Kent Countywide Model

Forecast Report

CLP4 | 0.2

14 May 2021

Kent County Council

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Executive Summary

Model Objectives

Canterbury City Council (CCC) commissioned Jacobs to develop a Local Canterbury Transport Model to inform spatial assessments for early decision making on the Canterbury Local Plan Review (LPR).

The objectives of the LP spatial assessments are to:

- Assess the quality and capacity of transport infrastructure across the District and its ability to meet forecast demands.
- Assess the cumulative impacts of the LPR development options on the District's transport network.
- Identify proposals and potential measures to mitigate the impacts of development to inform the infrastructure requirements associated with the LPR.
- Identification of potential measures to enable and achieve higher levels of sustainable transport mode share across the District.
- Identification of the potential barriers to the utilisation of sustainable transport modes across the District.
- Identification of potential intervention measures on the transport network.

Key Model Design Considerations

CCC / KCC requested that the Kent-wide transport model is used for the evidence base. The Kent Countywide Model has been developed in PTV's VISUM 2020 software platform for the highway model component. A local Canterbury base network model has been cordoned from the countywide model to cover Canterbury District and areas extending out to the M2 J7 / A299 Junction. The Canterbury local highway models represent an average 'neutral' 2019 weekday for the AM and PM peak hours.

The local model has been checked and enhanced using available data to ensure its appropriateness for developing Canterbury-specific LP forecast scenarios and undertaking spatial assessments. The local Canterbury model is considered to have a good standard of comparability of traffic flows with recent count locations, as well as a high comparability of journey times. It is therefore considered suitable for model forecasting of Local Plan scenarios for the spatial assessment of the highway impacts in Canterbury City Centre and the wider District.

Forecasting and Option Testing with the Canterbury Local Model

The forecast Baseline has been developed for a single forecast year of 2040, after the completion of the 2019 Base model development. The forecast Baseline scenario includes a full identification of committed developments and transport schemes, while the forecast assessment has been based on the 'Highway assignment' only. On completion of the Baseline scenario, the local VISUM Transport Model helped to create five LPR option testing scenarios to understand the likely distribution and assignment patterns of LPR development's traffic on the network. Precise details of these scenarios have been confirmed with CCC and are made up of the following:

- Option 1 - Existing Local Plan Strategy;
- Option 2 - Coast with improved public transport;
- Option 3 - City with SWECO only – regarding signalisation of Ring road junctions;
- Option 4 - City with SWECO and relief roads; and
- Option 5 - City with Ghent and relief roads – regarding pedestrian and bikers friendly plans with reduced speed limits.

CCC has declared a Climate Change emergency and has an AQMA covering Canterbury City Centre. One of the LP assessment objective is to achieve higher levels of sustainable transport mode share across the District. However, The Canterbury local model assumes that the level of car journeys remains fixed ('Highway Assignment' only), no matter how much easier it is to walk or cycle the volume of car journeys will not change. The greater the potential for modal shift from cars to active travel the more diluted the impacts on highway performance would be in reality i.e. modal shift takes cars off the road and therefore reduces congestion. The Public Transport and Active Mode accessibility assessments have been undertaken by using data output from TRACC software. Consideration has also been given to the likelihood of mode shift based on the scale of intervention planned.

LPR Option Comparisons

The results have shown varying levels of operational performance across all proposed LPR options, however there is no single stand out option that could be recommended for solving the existing local and strategic issues in the network.

Forecast Baseline: This scenario shows reasonably good balance between additional developments and new infrastructure (vs existing state). Infrastructure improvements might have been focused on solving existing issues (queuing on Wincheap, Old Dover Road, New Dover Road, Sturry Road), but they cooperate relatively well with areas planned to develop, in the south part of the City as well as in the north. New or redeveloped A2 Highway connections SW of Canterbury (new off-slip with Gyratory Route and Bridge Interchange) could limit existing flow issues, but due to intensity of developments, reduction of traffic is limited. Canterbury north connection with increasing flows (coast direction) is quite well supported by Sturry Link Road and Herne Bay Relief Road. Traffic on Ring Road remain very high. Long distance traffic, especially between Canterbury and Coast (Whistable, Herne Bay) is distributed reasonably well in comparison to the development growth in 2040. Overall impact on long distance traffic using A2 highway should also be considered as improvement, although limited by high local development traffic.

Option 1: Inclusion of the additional LPR developments both in North and SW of Canterbury result in slightly high traffic in City Centre and surrounding area compared to Forecast Baseline. Local changes in development intensity increase traffic on Strode Link (Herne Bay) and in SE Canterbury (Mountfield Park), especially in PM, but within local network capacity. Increased traffic from N/NW towards SW Canterbury and its pressure on Ring Road, cause limited rerouting in the wider network. There are no additional highway interventions, such as bypasses, in this scenario. In summary, it deteriorates the overall networkwide performance compared to Forecast Baseline. Likelihood of mode shift based on PT and Active Travel interventions ranked low to medium as no specific PT and Active Travel interventions planned in Option 1.

Option 2: Coast focused developments impact almost exclusively traffic within the Coast (Herne Bay, Whitstable) and A299, even impact on roads between Canterbury and Coast is quite limited. Local A299 junctions and roads (especially Chesterfield junction and link road) are impacted by increased traffic. Due to good placement of Whitstable P&R, the overall local traffic remains within capacity. New Chesterfield link also impacts slightly rerouting on north Thanet Way connection, but changes in traffic patterns are rather limited. Very slight increase occurs to the City Centre traffic, hence it shows limited impact in the City Centre network performance. Likelihood of mode shift based on PT and Active Travel interventions ranked medium, with Whitstable bus link and Whitstable Park and Ride planned in Option 2.

Option 3: Ring Road limitations (such as, Bus lane approaches scheme and CAZ) result in high decrease in traffic flows between St Peter's Roundabout and St George's Roundabout. This also results in a very high congestion and queuing on the ring road due to very high traffic leading to City Centre or near it. All Ring Road junctions experience very high delays and bad traffic conditions. Some other junctions close to City Centre are prone to queuing on Ring Road. New P&R locations around City Centre help to reduce traffic issues is limited due to very high existing traffic volumes. New infrastructure on A2 (Thanington 4th slip) helps to distribute the traffic widely without accessing the City, but its impact is local. Long-distance traffic rerouting is limited due to limited alternative highway interventions, such as bypasses. This results in increased traffic on the lower class rural roads and rat runs through the City. Likelihood of mode shift based on PT and Active Travel interventions ranked high, with all planned highway and PT interventions in Option 3.

Option 4: Ring Road limitations result in high decrease in traffic flows between St Peter's Roundabout and St George's Roundabout. Very high congestion on the Ring road, but noticeably less queuing than in Option 3 due to having alternative highway interventions (Western Bypass and Eastern Bypass) in the network. Slight improvement on parts of A28 NE of the City Centre. Bypass road allow for long-distance rerouting. Likelihood of mode shift based on PT and Active Travel interventions ranked medium, considering PT interventions and likely highway impact in Option 4.

<u>Option 5:</u> Limitations on the Ring Road (reduced vs Option 3&4) but supported by “blockers” and “shared space” scheme, result in high rerouting, affecting both City Centre access and wider Canterbury traffic. NE traffic from Centre in highly reduced due to blocker on the minor roads. Ring Road junctions (roundabouts) experience limited delays due to blockers and rerouting. Overall access to City Centre is challenging however traffic reductions improve the environment for active travel and reduce traffic flows and related air quality within the city centre. Likelihood of mode shift based on PT and Active Travel interventions ranked very high, considering PT interventions and likely highway impact due to additional city highway interventions included (shared streets and modal filters on short cuts) in Option 5.

Overall, the assessment of a ‘best’ or ‘better performing’ option is therefore complex, and dependent on what the priority is for the scheme. In terms of reducing traffic in City, Option 4 and Option 5 are the better performing options, due to having City and major infrastructure schemes in the network. In terms of accessing City by car, Option 1 and the Option 2 are the better performing options due to less restriction implemented in City. In terms of network wide performance, Option 2 and the Option 4 are the better performing options. Option 4 shows reduction in journey time along some wider routes in Canterbury. In terms of congestion hotspots, Option 1 and Option 2 are the better performing options. This is due to the proposed development location in these options and no city restriction implemented. In terms of Public Transport Accessibility Option 2 and Option 3 are the better performing option when comparing access by PT to Key Centres, however when considering access only to Canterbury City Centre, Option 4 and 5 are best performing options. In terms of Active Travel Accessibility, option 5 is the best performing (both for access to Key Centres and access to Canterbury City Centre Only).

<u>Next Step</u>

Travelling behaviour modelling in an ever-changing environment is a challenging task, involving some simplifications and present time traveling patterns. It should be considered for the preferred option to improve the existing model with additional analysis and modelling approaches, such as Variable demand modelling and sensitivity test incorporating the “Work from Home behaviour” by reducing “Commuting trips” based on the latest guidance .

Limitation Statement

The sole purpose of this technical report is to describe the processes by which the initial demand forecasts have been carried out using the Local Canterbury Model. These initial forecast scenarios have been developed in order to test the functionality of the Local Canterbury Model rather than to assess the impacts of any particular individual scheme or policy. 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 (Kent County Council) 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

Canterbury City Council (CCC) commissioned Jacobs to develop a Local Canterbury Transport Model to inform spatial assessments for early decision making on the Canterbury Local Plan Review (LPR). Canterbury City Council (CCC)'s Local Plan (LP) sets out the requirements for 16,000 new homes and 6,500 jobs by 2031 which have been included in the District Transport Strategy. The main aims of the District Transport Strategy are to improve travel choices within the area, reduce traffic congestion within the area, improve road safety, reduce travel demand, improve travel awareness, improve journey time reliability, and reduce greenhouse gas emissions as a result of traffic congestion. The focus will be on shifting the modes of transport used, promoting all possible transport choices including walking, cycling, the use of public transport and introduction of park and rides, and work on removing dependency on private car usage. This is also applicable to the Local Plan developments.

The objectives of the LP spatial assessments are to:

- Assess the quality and capacity of transport infrastructure across the District and its ability to meet forecast demands.
- Assess the cumulative impacts of the LPR development options on the District's transport network.
- Identify proposals and potential measures to mitigate the impacts of development to inform the infrastructure requirements associated with the LPR. 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.

Jacobs previously proposed three stages in which traffic modelling can be used to contribute towards the Local Plan Review evidence base:

d) Stage 1 (Initial Assessment): A review of existing (baseline) conditions to help identify current network "hotspots" (completed in January 2020).

e) Stage 2 (High-Level Spatial Assessment): High-level spatial option testing, which was initially planned to use the existing Canterbury traffic models. The base model (2008) has been updated to 2019, however the LPR options were not available by October 2020. So, at the request of CCC and Kent County Council (KCC), the further option testing couldn't progress for this stage using the existing Canterbury traffic models.

f) Stage 3 (Spatial Assessment): A spatial option assessment using the emerging Countywide Kent Traffic Model (only highway base models have been completed at the time of writing[1]).

CCC / KCC preferred to use the emerging Kent-wide transport model for the evidence base. This modelling architecture is still in the development stage (programmed to complete by end of March 2021[2]), but an early version of the highway assignment base model is now considered sufficiently ready for developing the local highway district models for the LP testing. A local Canterbury base network model has been cordoned from the countywide model to cover Canterbury District and areas extending out to the M2 J7 / A299 Junction.

The local model has been checked and enhanced using available data to ensure its appropriateness for developing Canterbury-specific LP forecast scenarios and undertaking spatial assessments. The local Canterbury model is considered to have a good standard of comparability of traffic flows with recent count locations, as well

[1] Completed end of August 2020 and LMVR completed in January 2021

[2] Currently estimated to complete by end of March 2021

as a high comparability of journey times. It is therefore considered suitable for model forecasting of Local Plan scenarios for the spatial assessment of the highway impacts in Canterbury City Centre and the wider District.

With the checks and updates described in the local model report[3], the Canterbury traffic model is considered suitable for spatial option testing, in combination with other analytical techniques, to provide an initial ranking and qualitative assessment of the highway impacts, challenges, and opportunities associated with various Local Plan options.

1.2 Purpose of this Document

This Forecast Report describes the principles, assumptions and methodology employed to develop the future year Baseline situation and allow for the testing of five spatial options using the Local Canterbury Model. The forecast Baseline has been developed for a single forecast year of 2040, after the completion of the 2019 Base model development. The forecast Baseline scenario includes a full identification of committed developments and transport schemes, while the forecast assessment has been based on the 'Highway assignment' only. On completion of the Baseline scenario, the local VISUM Transport Model helped to create five LPR option testing scenarios to understand the likely distribution and assignment patterns of LPR development's traffic on the network. Precise details of these scenarios have been confirmed with CCC and are made up of the following:

- Existing Local Plan Strategy;
- Coast with improved public transport;
- City with SWECO only – regarding signalisation of Ring road junctions;
- City with SWECO and relief roads; and
- City with Ghent and relief roads – regarding pedestrian and bikers friendly plans with reduced speed limits.

The Public Transport and Active Mode accessibility assessments have been undertaken by using data output from TRACC software. The intention is to use this work to help provide an evidence base and high-level rating assessment of the available options. This can then inform decision-making towards a preferred option.

1.3 Related Documents

This report is accompanied by related documents:

- Stage 3 Canterbury LP - Local Model Validation Report (Document Number CLP3); and
- Kent Countywide Model - Base Model Development and Validation Report (Document Number 3.1).

1.4 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 demand forecasting approach;
- **Chapter 4 –** discusses the development of the future year networks;
- **Chapter 5 –** describes the development of the forecast matrices for the future year scenarios;
- **Chapter 6 –** presents the forecast results for the future year scenarios;

[3] Stage 3 Canterbury LP - Local Model Validation Report (2 November 2020)

- **Chapter 7 –** describes the performance of LPR Options compared to the Forecast Baseline scenario using the highway assignment;
- **Chapter 8 –** presents the Public Transport (PT) and active travel accessibility for all scenarios;
- **Chapter 9 –** discusses the assessment of Likelihood of Mode Shift; and
- **Chapter 10 –** provides a summary and conclusions.

2. Proposed Use of the Model and Key Model Design Considerations

2.1 Study Area

The Kent Countywide VISUM model has been cordoned for the development of the Canterbury Local Model. Due to the large strategic nature of the Kent model, it was not expected to meet local validation aspirations in all areas. As is standard practice, should a model be required for a specific study within the detailed model area (such as the Canterbury Local Plan review), then a cordoned model may need to be created and it is likely that additional data may need to be collected to refine the validation in the local area.

The network of the Canterbury Local Model has therefore been developed based on the cordoned network from the Kent County Model with necessary updates to ensure that the local network replicates base conditions. Figure 2-1 shows the cordoned Canterbury local model study area:

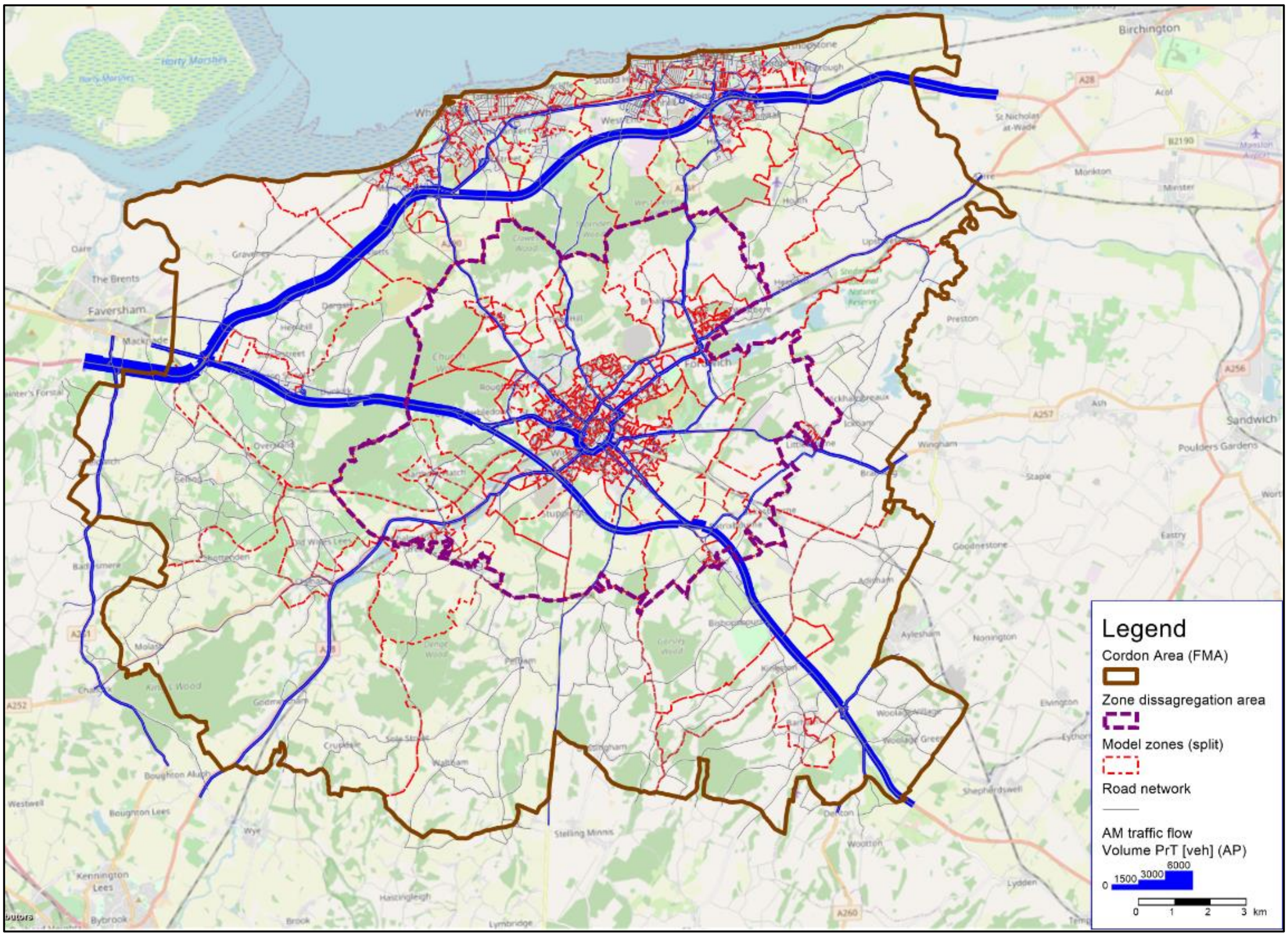


Figure 2-1 Canterbury Local Model Study Area

2.2 Proposed Use of the Model

The model has been developed for CCC to inform spatial assessments for early decision making on the Canterbury Local Plan Review (LPR). Relevant guidance has been followed as much as possible and as is feasible for model development of this type and scale.

2.3 Key Model Design Considerations

2.3.1 Software

PTV's VISUM2020 has been used as the software platform for the highway component of the model. This was also the same software used to develop the Kent Countywide Model. 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.

TRACC software has been used to analyse the public transport and active travel time for the public transport and active mode accessibility assessment. The software has been used to produce isochrones showing the distances achieved by selected mode up to 30 minutes from each key centre, 30 minutes being chosen as an acceptable length of journey for most local journey purposes.

2.3.2 Base Year and Time Periods

The Local Canterbury Model base year is 2019. This is because the Kent Countywide VISUM model has been cordoned for the development of the Local Canterbury Model and at the time of model development, it was the latest year for which required data was available with which to build the model.

There is a need to provide assessment and forecasting capability to reflect the impact that the schemes have during the busiest parts of the day. Therefore, a morning peak and evening peak model have been developed to allow policy makers to understand local issues/impacts of developments, infrastructure improvements, and policy measures. The highway transport assignment model therefore represents an average 2019 weekday in the following two modelled time periods:

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

The demand model, meanwhile, represents an average weekday in 2019 at the morning peak hour and evening peak hour level. The demand of the local model is also obtained from the Kent County Model. This considered cordoning initial demand (prior to matrix estimation matrix) from the countywide model and undertaking a matrix estimation process for the local model to produce highway peak hour vehicle matrices required for the assignment.

This approach is consistent with the guidance set out in TAG Unit M3.1 and was deemed most appropriate for a robust demand matrix generation for the Canterbury Local Plan Review.

2.3.3 Highway Assignment Modelled Responses

The Local Canterbury 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 of trips with one or both trip-ends within Canterbury 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. The public transport, cycle and walk modes are not modelled explicitly, however impact of these elements are captured through vehicle trip rates.

No variable demand model is associated with the Local Canterbury Model development, and therefore highway demand remains fixed.

3. Approach to Forecasting

3.1 Overview

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

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

A forecast year of 2040 has been modelled with the following demand growth assumption:

- Forecast Baseline (based on local growth assumptions);
- Forecast assessment was based on the 'Highway assignment' only. Multi modal demand model was not developed for this Stage 3 assessment. However, Public Transport (PT) and active elements (cycle and walk) were captured through trip rates and bus priority corridors were modelled in the network to replicate any additional delays due to this.

3.2 Forecast Modelling Scenarios

Forecast Baseline uses local growth assumptions based on committed developments while Option analysis contribute to possible updates to Local Plan. Forecast Baseline include committed schemes to be implemented on the transport network between the 2019 base year and 2040 future year. The Local Plan scenarios (Options) were then created additionally to the Forecast Baseline schemes.

Forecast Baseline and LPR Options assumptions are described in detail in section 4 and also in section 5. Each of the five scenarios redefines some of the dwellings and employment space locations, and focused on testing particular dwelling and employment allocations supported by road infrastructure updates:

- Option 1: Existing Local Plan Strategy;
- Option 2: Coast with improved public transport;
- Option 3: City with SWECO interventions;
- Option 4: City with SWECO interventions and relief roads; and
- Option 5: City with Ghent and relief roads.

The Forecast Baseline provides an estimate of the impact of demand growth on the base year network with only committed upgrades and a point of comparison for the LPR Option tests. The latter have been developed in order to test the functionality of the Local Canterbury Model to inform spatial assessments for early decision making on the Canterbury Local Plan Review (LPR).

3.3 Treatment of Growth

3.3.1 Highway Private Car

The general method for forecasting future year car travel uses factors constrained to TEMPro 7.2 growth to update origin/destination for each zone and for each purpose. These factors are applied to the Baseline AM and PM peak hour OD demand matrices through a furnessing process to obtain a forecast demand matrix.

In order to consider development growth of the Local Plan scenarios (Options), the TEMPro alternative assumptions functionality was used to constrain total modelled growth to the National Trip End Model (NTEM) at the district level. The National Trip End Model (NTEM) model forecasts the growth nationwide which take into account national projection of population, employment, housing, car ownership and trip rates.

The NTEM factors were calculated after discounting the specific development sites modelled explicitly (documented using an Uncertainty Log). Growth in Canterbury district was derived from the reduced background growth (i.e. NTEM growth after applying alternative planning assumptions) and site-specific developments were modelled. Growth in the remainder of the study area (i.e outside of Canterbury district) was derived entirely from the NTEM growth (i.e. with no specific developments modelled).

3.3.2 Heavy Goods Vehicles

Demand growth in Heavy Goods Vehicles have been produced by applying growth factors from the latest Road Traffic Forecasts (RTF) (2018) published by DfT. This growth was applied at an assignment (peak hour) matrix level.

4. Forecast Network Development

4.1 Overview

A 2040 future year network has been prepared for the purposes of initial Local Canterbury 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 Kent County Council (KCC) and Canterbury City Council (CCC), for inclusion in the transport networks.

4.2 Forecast Baseline Schemes

Following consultation with KCC and CCC, the network has been updated to accommodate the development growth. The table below summarises the schemes included in the Forecast Baseline network and their main parameters, due to their impact on traffic flows (also, scheme layouts are included in Appendix A). Figure 4-1 shows the Forecast Baseline scheme locations.

Baseline Scheme	Description
Roads/ Infrastructure main schemes in Baseline Forecast	
Wincheap Gyratory	Urban road with 30 mph speed; Layout confirmed in drawings
Herne relief road	Road S2 class with 60 mph speed limit; Layout confirmed in drawings
Sturry link road	Suburban road with 30-40 mph speed limit Layout confirmed in drawings included
Strode Junction / link road	A299 / A291 junction update and the layout confirmed in drawings Link road S3 class with 30 mph speed limit and link road scheme confirmed as a sketch
Howe Barracks A257-A28 link	Urban/suburban road with 30 mph speed limit; Layout confirmed in drawings
South Canterbury Bridge Interchange	A2 Highway junction (overbridge, new slip roads) Layout confirmed in drawings
Other minor schemes in Baseline Forecast	
South Canterbury ODR Access	A2050 Roman Road roundabout to priority junction, access roads to development areas Layout confirmed in drawings
South Canterbury Pilgrims Way	Pilgrims Way junctions' corrections, development access road Layout confirmed in drawings
South Canterbury Old Dover Road	Old Dover Road junctions' corrections Layout confirmed in drawings
South Canterbury Bifrons Hill	Bifrons Hill junction signalisation junction changes Layout confirmed in drawings
South Canterbury Brenley	Brenley Roundabout corrections and signalization changes Layout confirmed in drawings
South Canterbury fast bus link	Considered reduced City trip rates for the South Canterbury development
Thanington off-slip	A2 to A28 Thanington Road off-slip, development site access Layout confirmed in drawings
Broad Oak Roundabout	New junction (roundabout) on A291 Layout confirmed in drawings
Hoplands Farm	Hersden Hopland Farm junction corrections Layout confirmed in drawings
Cockering Farm	Cockering Farm access corrections Layout confirmed in drawings
HBGC Bullockstone Access	Herne Bay Golf Club access junction corrections Layout confirmed in drawings

Baseline Scheme	Description
Duncan Down	Duncan Down development access (new roundabout on Thanet Way) Layout confirmed in drawings
Greenhill (Lidl)	Pedestrian crossing, access road Layout confirmed in drawings
Grasmere Gardens	A299 Chestfield Thanet Way widening Layout confirmed in drawings
Station Road West Multi-storey	Replacement of existing field car park with multi-storey car park Layout confirmed in drawings

Table 4-1 Forecast Baseline Scheme description

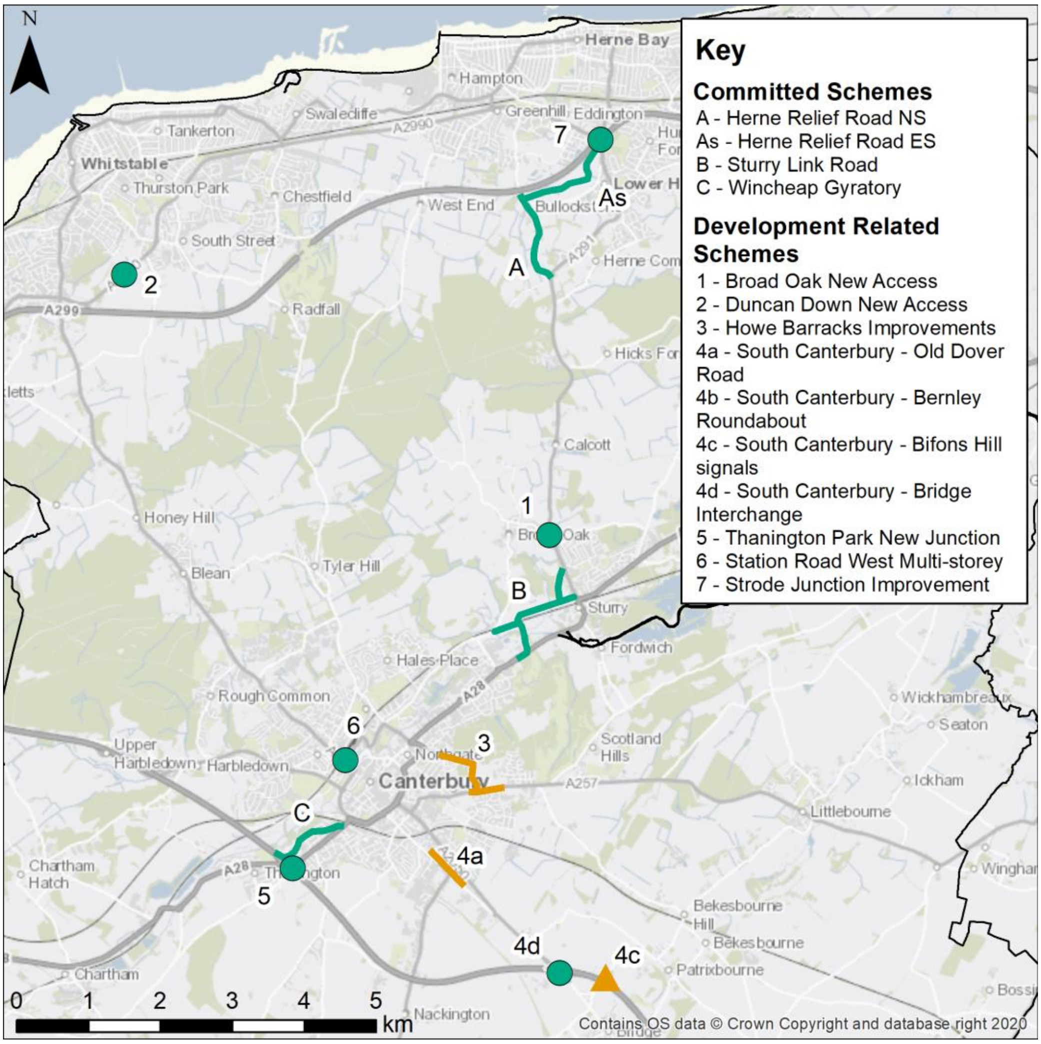


Figure 4-1 Forecast Baseline infrastructure schemes location

4.3 LPR Options Schemes

LPR Options' networks have been developed using the Forecast Baseline network with additional site-specific updates to accommodate the development growth and possible transportation policy changes. All network updates have been made in accordance with the consultation involving KCC and CCC. Tables below summarise the schemes included in the Local Plan Scenario networks (Options) due to their impact on traffic flows:

Local Plan Scenario Scheme	Description
Roads/ Infrastructure	
Eastern Bypass	Road A class with 40 mph speed limit Layout confirmed in drawings
Western Bypass	Road A class with 40 mph speed limit Layout confirmed in drawings included
Alternative Thanington 4th slip - with direct access to hospital	Suburban road with 30 mph speed limit A2 Coast Bound off slip relocated to access hospital and replaced with 4th A2 off slip within the site Link road access to Hospital
Chestfield link and junction	Road A class with 40 mph speed limit New interchange between A299 NTW and A2990 OTW Chestfield/Greenhill
Whitstable link (bus)	Bus route using existing services 4 and 5, through Duncan Down site
City centre	
"Shared streets" (1 veh lane)	From Wincheap to A28 Tourtel road, Speed limit is 20 mph and 1 veh lane in both directions - retain bus lanes
Signalized junctions on Ring road	Wincheap Roundabout, Riding Gate Roundabout, St. George's Roundabout converted to signalized junctions
Bus lane on all approaches	One veh lane converted to bus lane on A2050 between London Rd roundabout and St Peters
Clear Air Zone (charger/tolls)	Area within the current AQMA Daily charges £100: buses, coaches, HGV (Euro VI minimum standard) Daily charges £9: taxis, private hire vehicles, vans and minibus (Euro 6 (diesel) and Euro 4 (petrol)) and private cars are exempt from the CAZ charges
Modal filters on short cuts - "Blockers"	Within the inner ring road for all but service vehicles/busses at: Zealand Road, Longport railway line, River-Sturry, Salisbury Road (6 mph speed limit to simulate: reduced access for local residents only; to be monitored by ANPR camera)
School streets	School Streets programme – 12 mph speed limit to simulate: no vehicles except residents at school pick up/ drop off times
Parking and P&R	
Whitstable P&R	450 new spaces
Expanded Sturry P&R	600 existing and 200 new spaces
Expanded Wincheap P&R	600 existing and 300 new spaces
New Dover Road P&R	600 existing (relocated) and 300 new spaces
New Wincheap multi-storey	450 new spaces
New Harbledown P&R	750 new spaces

Table 4-2 Development Options Scheme description

The schemes described in Table 4-2 above can be classified as Road/ Infrastructure, City centre and Park and Ride schemes. Each of the categories are shown in Figure 4-2 to Figure 4-4. Also, scheme layouts are included in Appendix A and Appendix B.

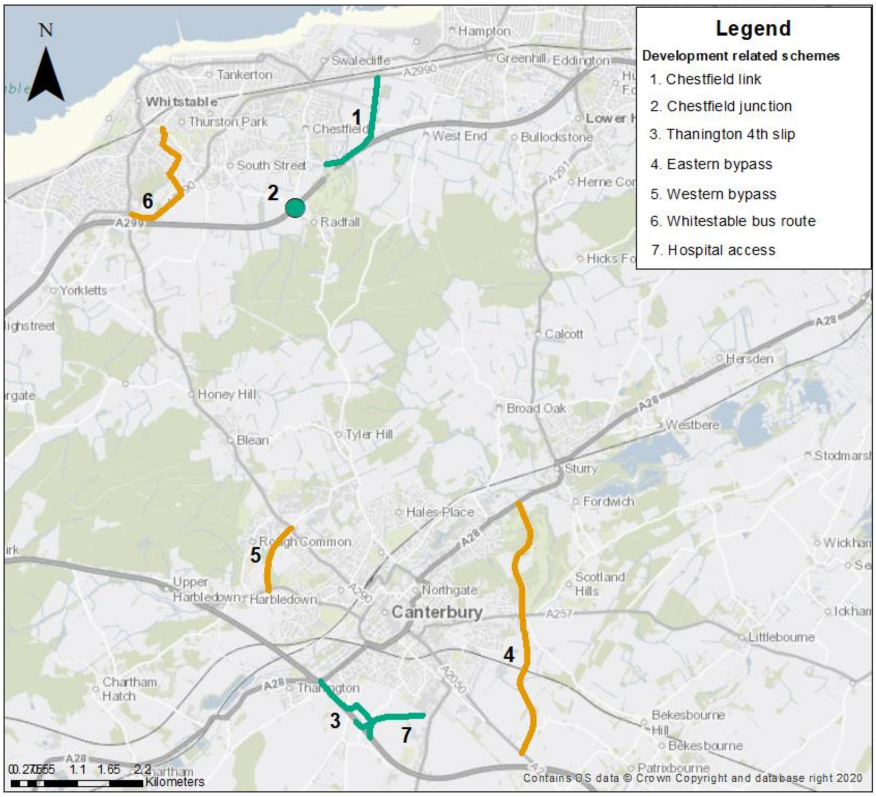


Figure 4-2 Road / Infrastructure schemes

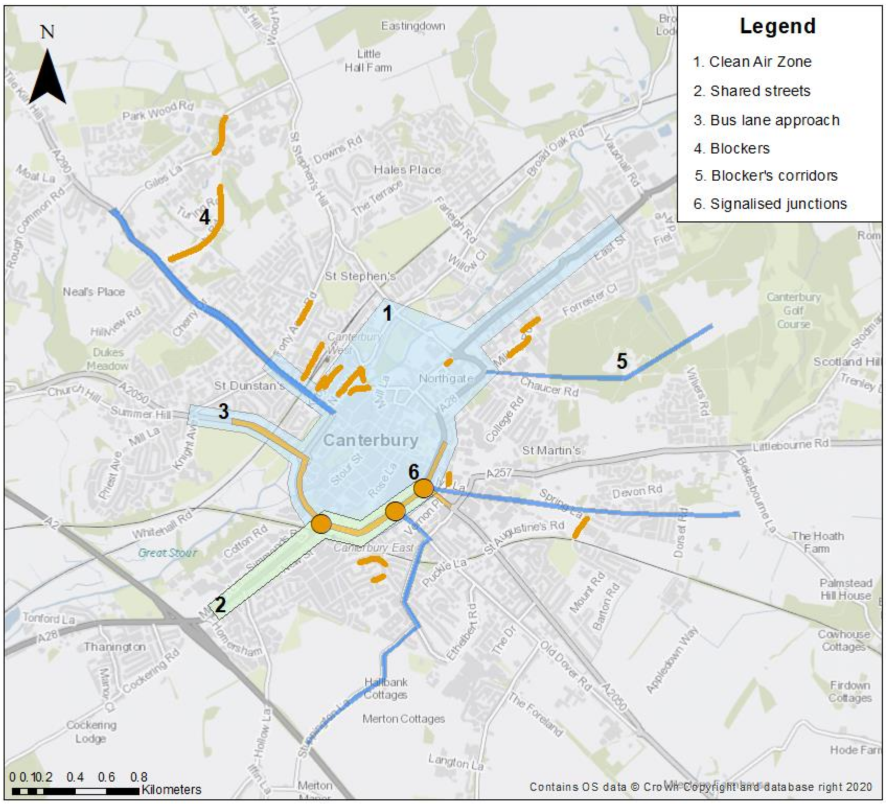


Figure 4-3 City centre schemes

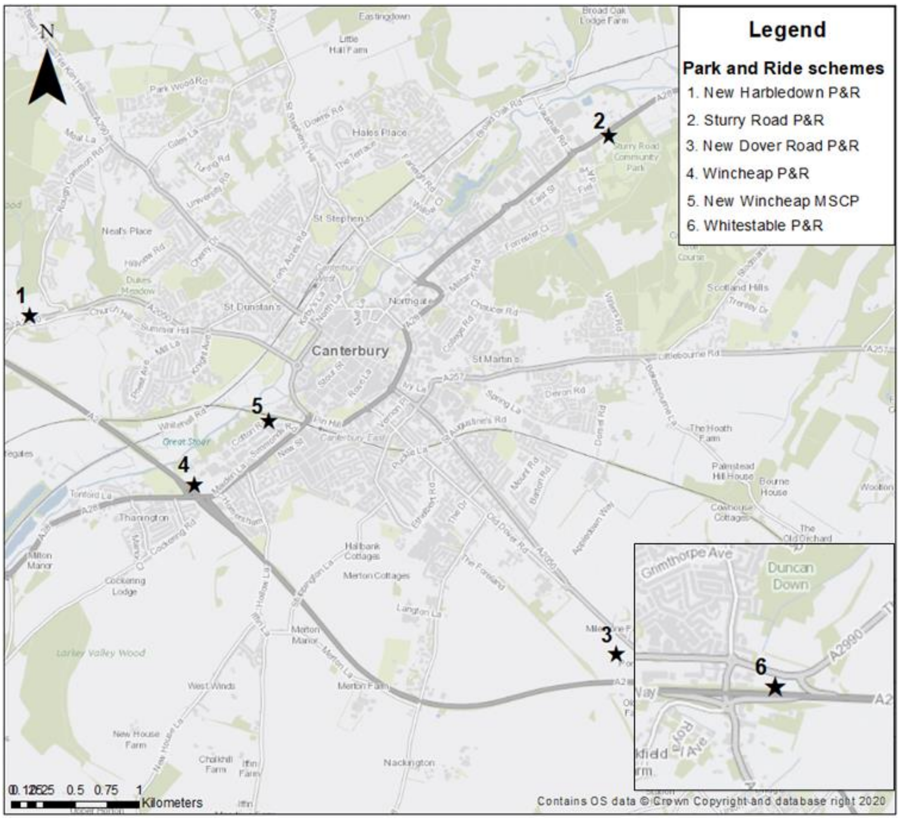


Figure 4-4 Park and Ride schemes

Schemes coded in each Local Plan scenario can be found in Table 4-3 and Figure 4-5 to Figure 4-8.

Development	Option 1	Option 2	Option 3	Option 4	Option 5
Growth					
Background growth 2500	x		x	x	x
Background growth 2500 (rural split)		x			
Planned growth 6500 (COAST)		x			
Planned growth 6500 (SWECO)			x		
Planned growth 11500				x	x
Coastal Secondary	x	x	x	x	x
New Primary Schools	x	x	x	x	x
Broad Oak Reservoir	x	x	x	x	x
Hospital			x	x	x
Roads/ Infrastructure					
Eastern Bypass				x	x
Western Bypass				x	x
Thanington 4th slip (Baseline)	x	x			
Alternative Thanington 4th slip with direct access to hospital			x	x	x

Development	Option 1	Option 2	Option 3	Option 4	Option 5
Chestfield link and junction		x			
Whitstable link (bus)		x	x		
"Shared streets" (1 veh lane)					x
Signalized junctions on Ring road			x	x	
Bus lane on all approaches			x	x	x
Clear Air Zone (charger/tolls)			x	x	
Modal filters on short cuts - "Blockers"					x
School streets			x	x	
Parking and P&R					
Whitstable P&R		x	x		
Expanded Sturry P&R	x	x	x	x	x
Expanded Wincheap P&R	x	x	x	x	x
New Dover Road P&R			x	x	x
New Wincheap multi-storey			x	x	x
New Harbledown P&R			x	x	x

Table 4-3 Local Plan scenarios - Scheme assumptions

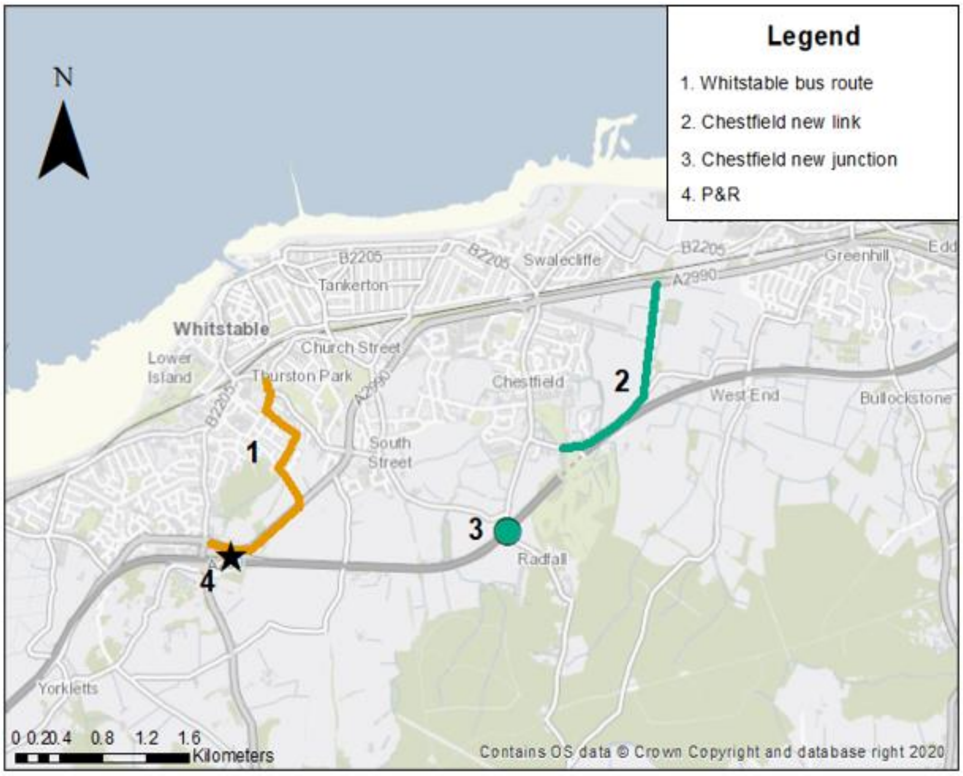


Figure 4-5 Option 2 based schemes

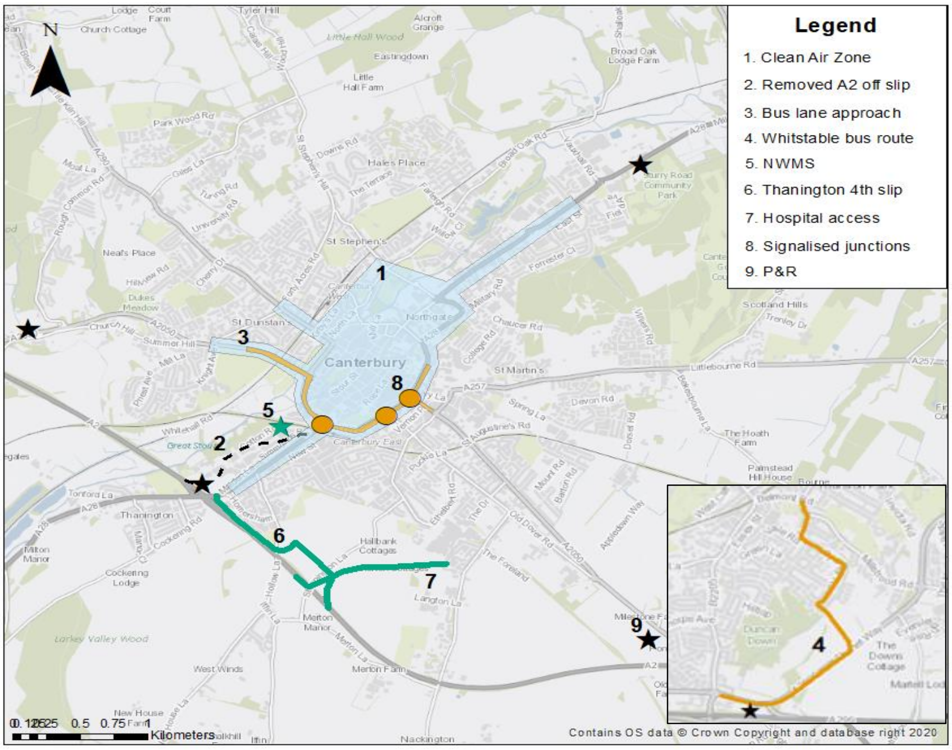


Figure 4-6 Option 3 based schemes

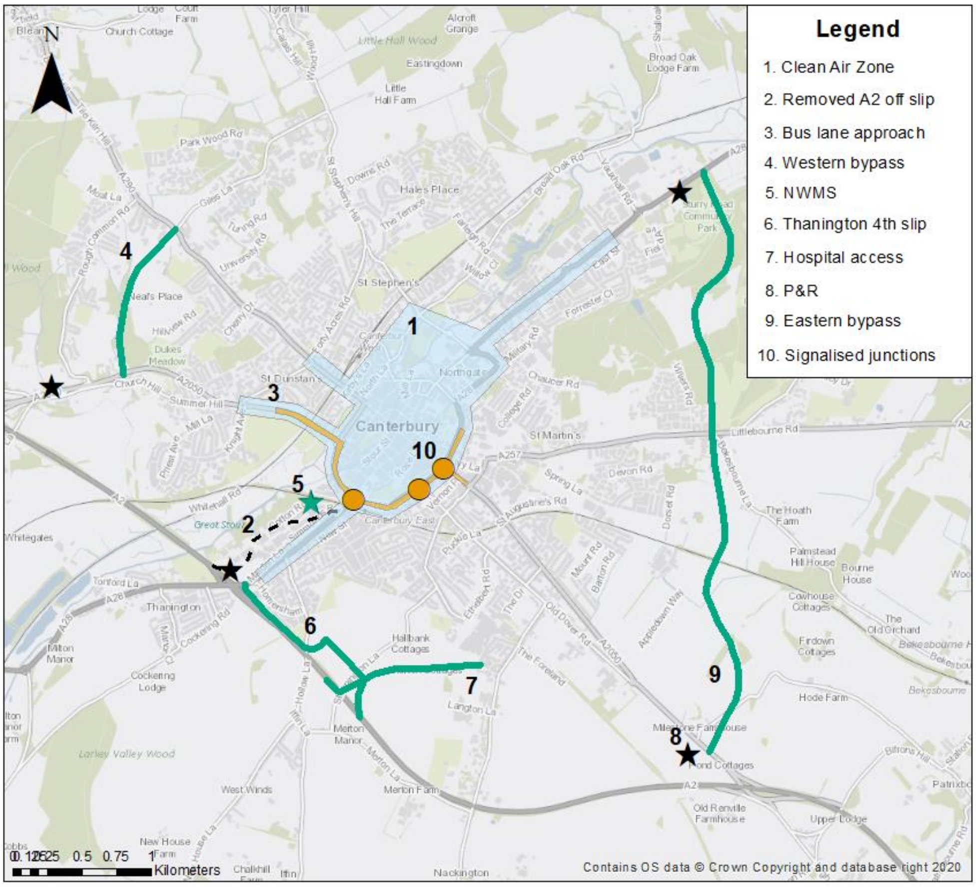


Figure 4-7 Option 4 based schemes

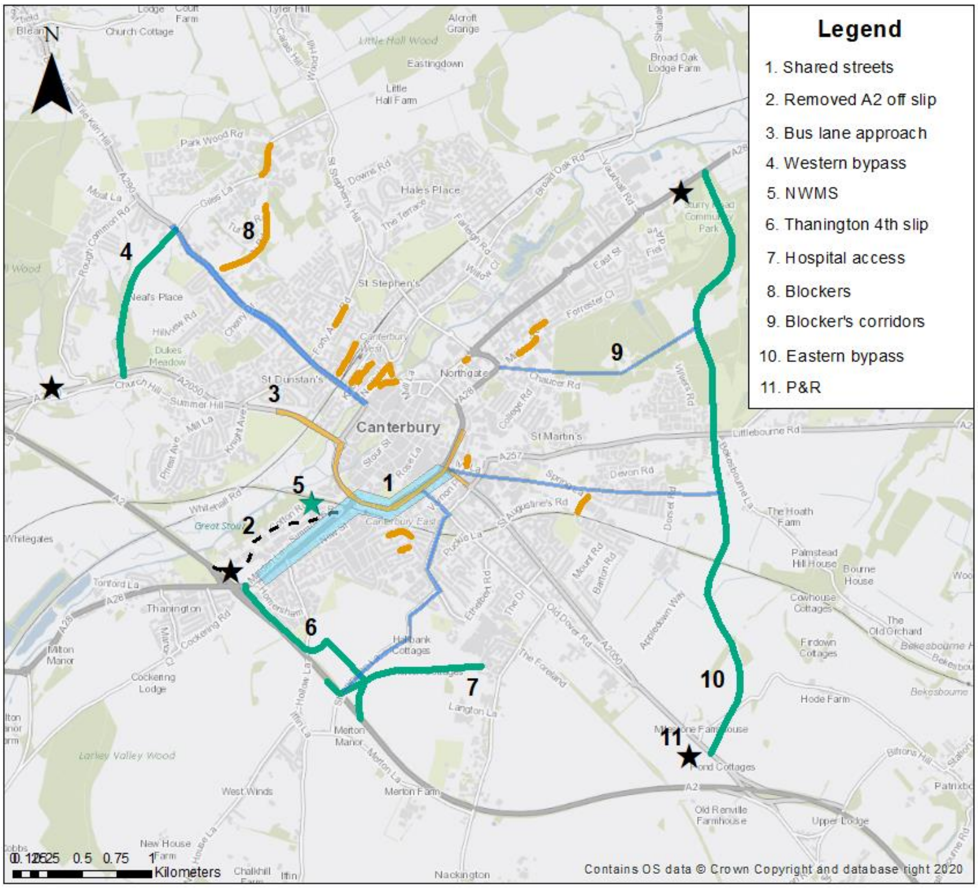


Figure 4-8 Option 5 based schemes

Some City Centre schemes were still in the process of development at the time of model production and therefore modelled using the designs available at the time of network building. It is important to note that these designs may be subject to change.

4.4 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 Local Canterbury Model highway assignment are based on the latest TAG Unit A1.3 guidance and Data Book available at the time of model development (May 2020 v1.13). 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 Local Canterbury Model are provided in Table 4-4.

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 Forecast Year TAG Databook Value		2040 Forecast Year VISUM Units		2040 Forecast Year Final VISUM Coefficients	
		VoT (ppm)	VOC (ppk)	VoT (pps)	VOC (ppmetre)	VoT	VOC
AM	UC1 Car Commute	43.79	9.10	0.7298	0.0091	1	0.0125
	UC2 Car Business	29.37	4.38	0.4894	0.0044	1	0.0089
	UC3 Car Other	20.26	4.38	0.3377	0.0044	1	0.0130
	LGV	31.74	13.11	0.5289	0.0131	1	0.0248
	HGV (doubled VoT)	63.21	45.19	1.0535	0.0452	1	0.0429
PM	UC1 Car Commute	44.42	9.19	0.7404	0.0092	1	0.0124
	UC2 Car Business	29.47	4.41	0.4911	0.0044	1	0.0090
	UC3 Car Other	21.22	4.41	0.3536	0.0044	1	0.0125
	LGV	31.74	13.17	0.5289	0.0132	1	0.0249
	HGV (doubled VoT)	63.21	45.60	1.0535	0.0456	1	0.0433

Table 4-4 – Highway Generalised Cost Parameters

5. Forecast Matrix Development

5.1 Overview

This section describes how future year matrices have been developed using fixed trip demand forecasting techniques. A forecast year of 2040 has been modelled with the TEMPro growth and local growth assumptions. No other growth scenarios have been considered in the demand forecasting.

5.2 Forecast Demand Development

The general method for forecasting future year car travel uses factors constrained to TEMPro growth to update origin/destination for each zone for each purpose. These factors are applied to the validated Base AM and PM peak hour OD demand matrices through a furnessing process to obtain a forecast demand matrix.

To consider development growth of the Forecast Baseline and Local Plan scenarios, the NTEM factors were calculated after discounting the specific development sites modelled explicitly (documented using an Uncertainty Log), using the TEMPro alternative assumptions functionality. Growth in Canterbury district was derived from the reduced background growth (i.e. NTEM growth after applying alternative planning assumptions) as well as site-specific developments modelled. Growth in the remainder of the study area (i.e outside of Canterbury district) was derived entirely from the NTEM growth (i.e. with no specific developments modelled).

Demand growth in LGV and HGV have been produced by applying growth factors from the latest Road Traffic Forecasts (RTF) (2018) published by DfT. This growth was applied at an assignment (peak hour) matrix level.

5.2.1 Forecast OD Matrices Development

The forecast OD demand matrices were developed using fixed trip demand forecasting techniques. The following steps were considered to derive the future matrices for 2040 as shown in Figure 5-1:

- Identification of planning data (Uncertainty log);
- TEMPro background growth calculation using alternative planning assumptions for car trips;
- Development trip matrices calculation in OD format;
- Combine background growthed matrices with development trip matrices, and then furnessing the car trip matrices;
- Calculate goods vehicle growth factors from the RTF18, and apply to the base goods vehicle matrices; and
- Creation of future year target trip ends by combining car trips and goods vehicles (LGVs and HGVs).

The above forecasting approach is consistent with TAG Unit M4 ‘Forecasting & Uncertainty’. Forecast demand for travel was generated by using national, regional and local data sets to inform the amount of travel growth that could be expected from the base year.

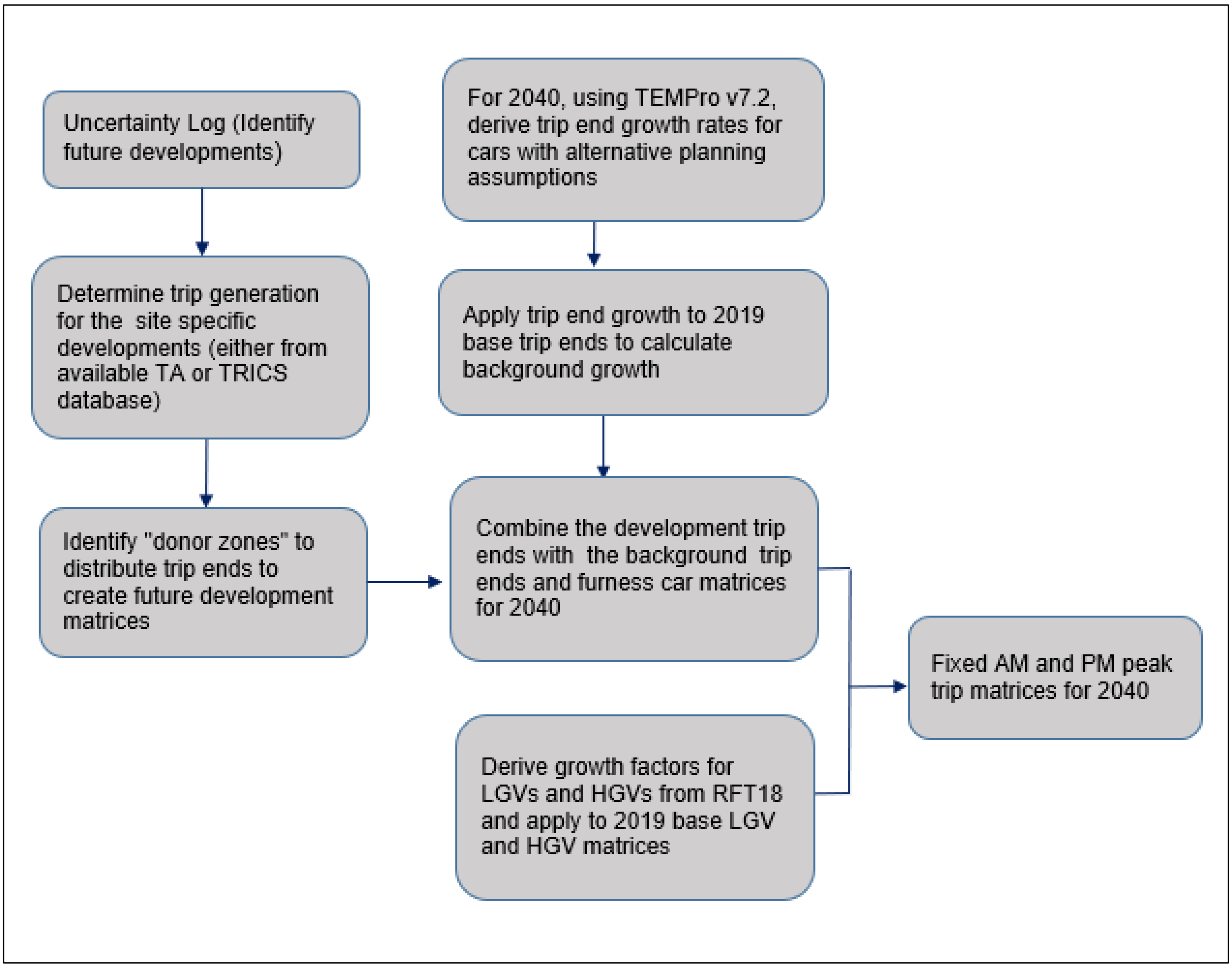


Figure 5-1 OD Matrices Development Flow Chart

5.2.2 Identification of Planning Data (Uncertainty Log Development)

The purpose of the uncertainty log is to identify a list of developments which are potentially included in the Forecast Baseline as well as Local plan scenarios. Planning data from local authority in the region was used to identify the locations of new development, and the size and type of development proposed. The likelihood of each development was identified and recorded in an uncertainty log. Where these development sites were considered to generate substantial demand trips then instead of being included as background development, they were within the model as specific developments. This was done to ensure that the model is sufficiently well detailed to be able to model the impacts that these developments have on the local road network.

5.2.2.1 Forecast Baseline

Forecast Baseline uses local growth assumptions and committed developments to be implemented on the transport network between the 2019 base year and 2040 future year. For residential and employment land use developments in the study area, any development that exceeded the following limits in Table 5-1 were considered in the Forecast Baseline scenario:

Land Use Type	Units	Size Threshold
Food Retail (A1)	Gross Floor Area (GFA)	> 800m2
Non-Food Retail (A2)	Gross Floor Area (GFA)	> 1,500 m2

Land Use Type	Units	Size Threshold
Financial and Professional Services (A2)	Gross Floor Area (GFA)	> 2,500 m2
Restaurants and Cafes (A3)	Gross Floor Area (GFA)	> 2,500 m2
Drinking Establishments (A4)	Gross Floor Area (GFA)	> 600 m2
Hot Food Takeaway (A5)	Gross Floor Area (GFA)	> 500 m2
Business (B1)	Gross Floor Area (GFA)	> 2,500 m2
General Industrial (B2)	Gross Floor Area (GFA)	> 4,000 m2
Storage of Distribution (B8)	Gross Floor Area (GFA)	> 5,000 m2
Hotels (C1)	Bedrooms	> 100 bedrooms
Residential Institutions – Hospitals, Nursing Homes (C2)	Beds	> 50 beds
Residential Institutions – Residential Education (C2)	Students	> 150 students
Residential Institutions – Institutional Hostels (C2)	Residents	> 400 residents
Dwelling Houses (C3)	Dwelling Units	> 80 units
Non-Residential Institutions (D1)	Gross Floor Area (GFA)	> 1,000 m2
Assembly and Leisure (D2)	Gross Floor Area (GFA)	> 1,500 m2

Table 5-1 – Uncertainty Log Developments Size Thresholds

Housing and employment within the Canterbury Administrative Area were based on planning data confirmed by Canterbury City Council (CCC) in summer 2020. The assumptions for 2040 Forecast Baseline scenarios are summarised in Table 5-2 and they are depicted in Figure 5-2.

Dev No	Development Name	Households	Jobs
1	Broad Oak	456	40
2	Cockering Farm	400	161
3	Duncan Down	400	0
4	Chestfield Lidl	0	175
5	Grassmere Gardens	300	179
6	Greenhill	450	0
7	Herne Bay Golf Club	600	173
8	Hoplands Farm, Hersden	250	263
9	Howe Barracks	500	0
10	South Canterbury	4000	1565
12	Sturry	650	0
13	Hillborough	1200	670
14	Thanington Park	750	205

Dev No	Development Name	Households	Jobs
15	Station Road West Multi-storey	0	129
16	Strode Farm	800	0

Table 5-2 Forecast Baseline Developments

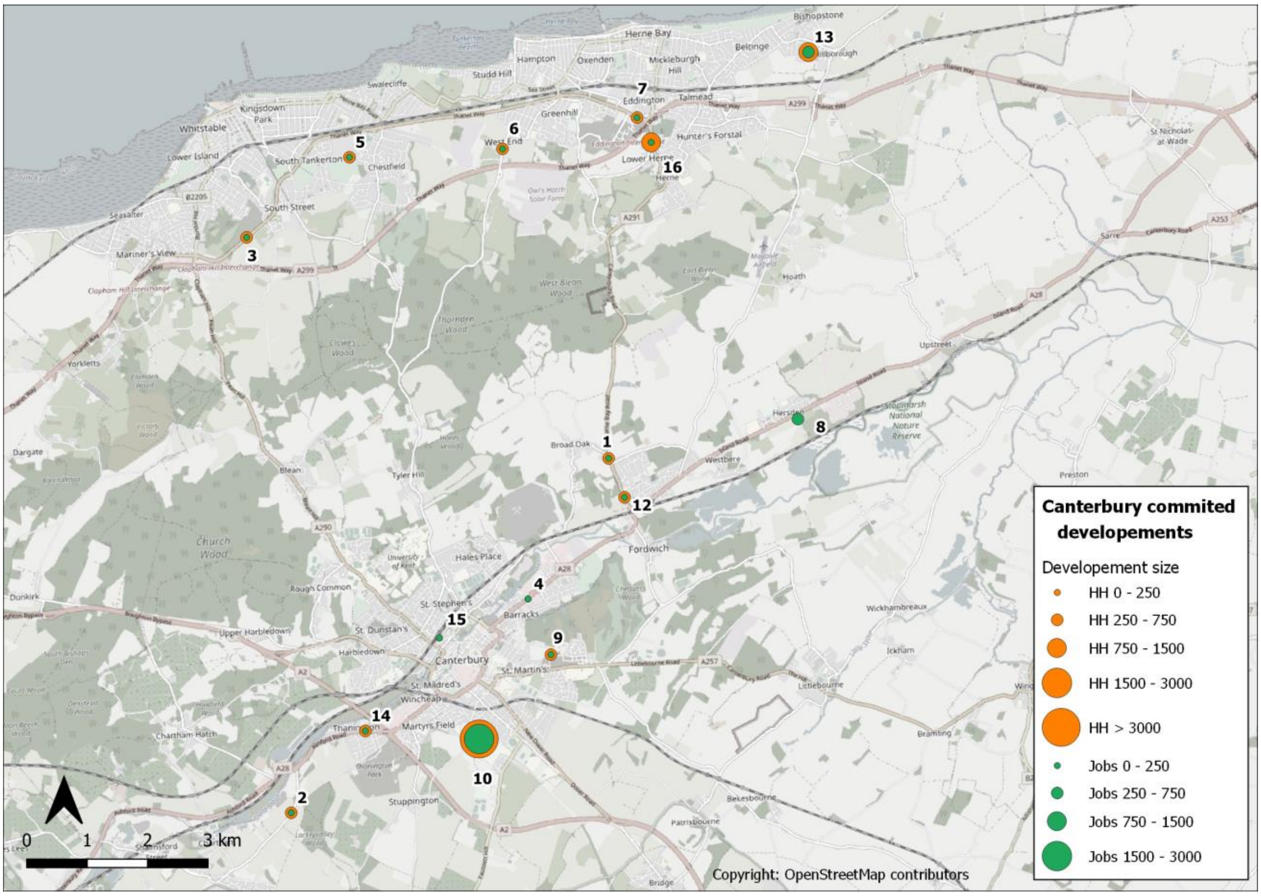


Figure 5-2 Forecast Baseline Developments Locations

5.2.2.2 Local Plan Scenarios

The Local Plan scenarios were then created in addition to the Forecast Baseline schemes. Each of the five scenarios add additional housing and employment developments on top of those in the 2040 Forecast Baseline model (total of 6,500 dwellings to 11,500 dwelling depending on the option criteria and 25,000 square metres of employment space). While Option 1 continues the existing pattern of planned growth, Option 2 focusses growth at the coast, and Options 3, 4 and 5 focus growth at Canterbury. In particular, Option 4 and Option 5 account for the most housing developments compared to other Local Plan options, proposed around the city centre.

The exact development location is unknown at this stage. Proposed development assumptions are considered over the best-known representative areas based on known constraints and natural barriers such as rivers or railways. The potential development locations were provided per area (as shown in Figure 5-3) which was assigned to the representative LSOA zones. Total number of dwellings was equally distributed across the defined LSOAs per area since no further assumptions are available.

The assumptions for the 2040 five local plan scenarios are summarised in Table 5-3 and Table 5-4 and they are depicted in Figure 5-3 to Figure 5-6. These sites were defined based on a minimum development size of 80 houses. The full list of developments' assumptions is provided in Appendix C. Core developments are presented by type size (Dwellings and Jobs).

Area	Location	Option 1	Option 2	Option 3	Option 4	Option 5
Canterbury	NW	1000	1000	1000	2000	2000
	S/SE	3000	1000	1000	7000	7000
Herne Bay		1500	2000	2000	1000	1000
Whitstable		500	2000	2000	1000	1000
Rural	Sturry	200	200	200	200	200
	Hersden	60	60	60	60	60
	Littlebourne	60	60	60	60	60
	Bridge	60	60	60	60	60
	Chartham	60	60	60	60	60
	Blean	60	60	60	60	60

Table 5-3 Local housing assumptions

Option	Location	Floor space (sqm) by Employment type		
		B1 a/b (24%)	B1c/B2 (32%)	B8 (44%)
Option 1	Herne Bay	3,000	4,0000	5,500
	Whitstable	3,000	4,0000	5,500
Option 2	Herne Bay	3,000	4,0000	5,500
	Whitstable	3,000	4,0000	5,500
Option 3	NW	3,000	4,0000	5,500
	S/SE	3,000	4,0000	5,500
Option 4	NW	3,000	4,0000	5,500
	S/SE	3,000	4,0000	5,500
Option 5	NW	3,000	4,0000	5,500
	S/SE	3,000	4,0000	5,500

Table 5-4 Local employment assumptions

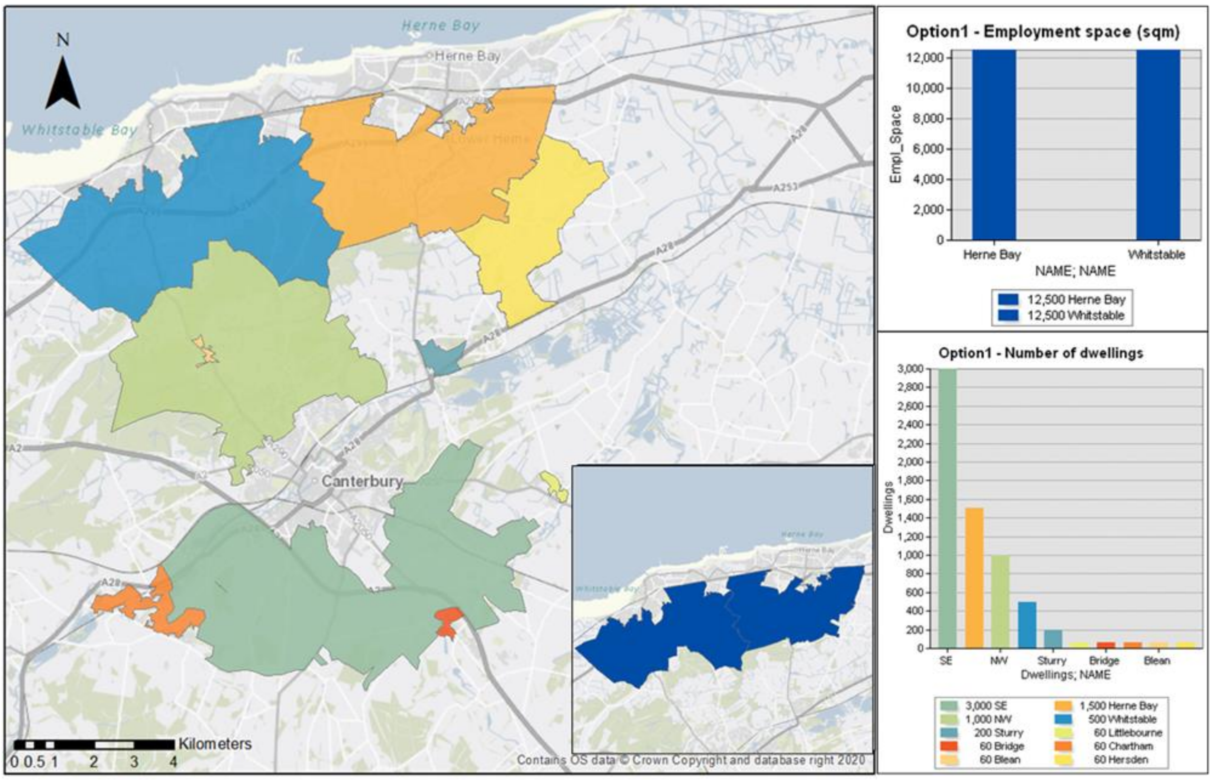


Figure 5-3 Local growth assumptions - Option 1

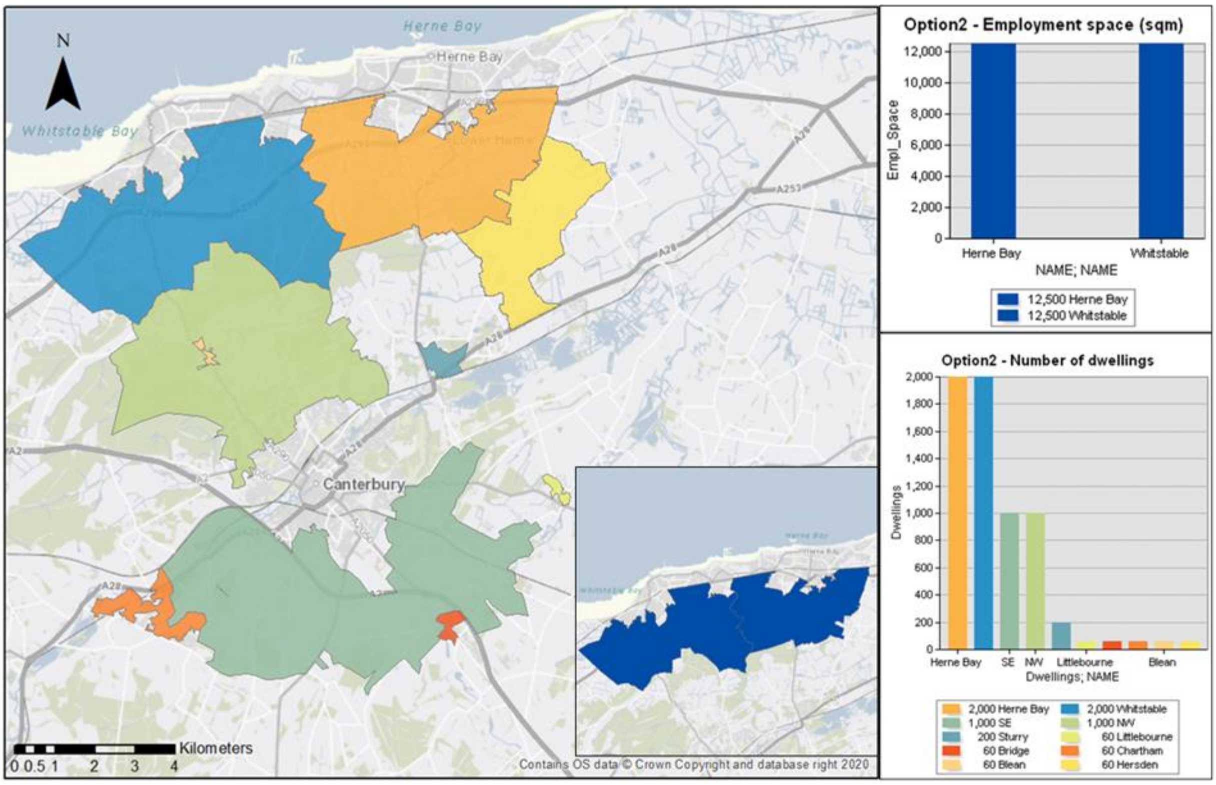


Figure 5-4 Local growth assumptions - Option 2

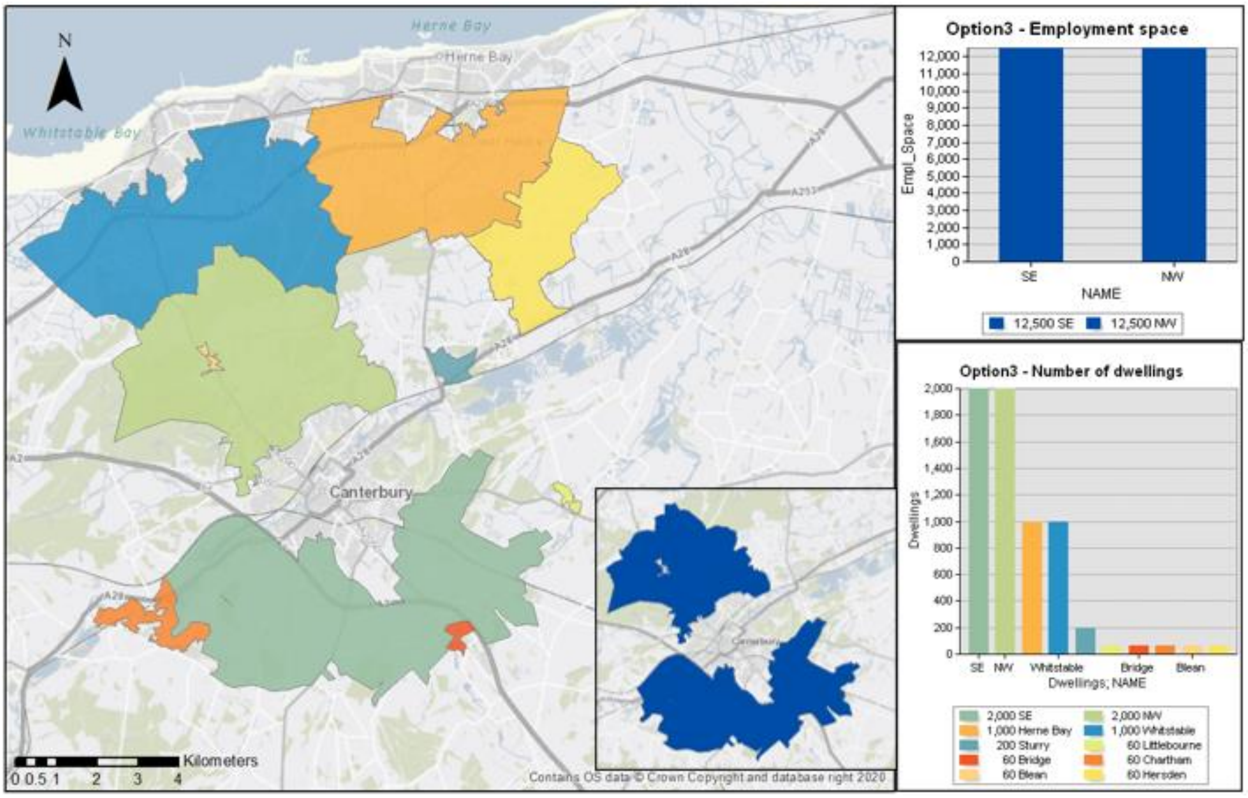


Figure 5-5 Local growth assumptions - Option 3

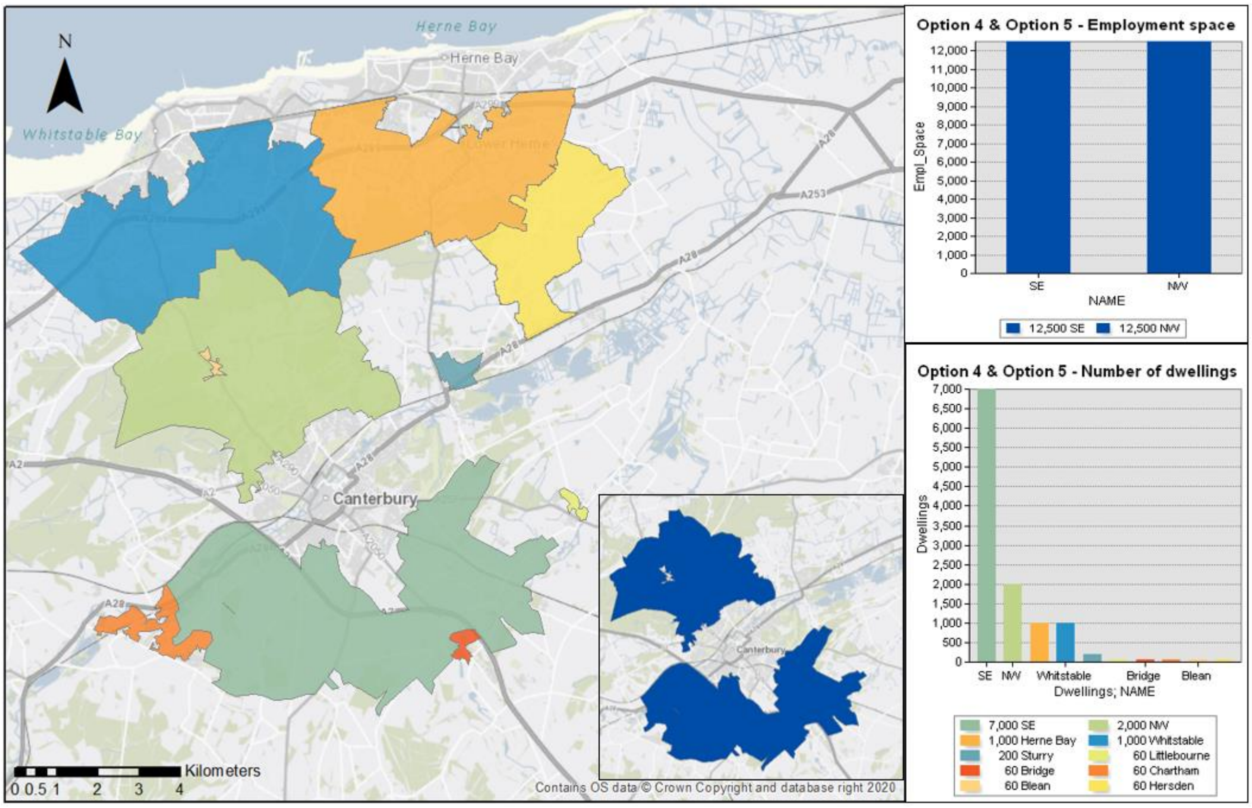


Figure 5-6 Local growth assumptions - Option 4 & Option 5

5.2.3 Treatment of Committed and Site-Specific Development with TEMPro and Background Growth Calculation

TEMPro v7.2 datasets were used to calculate the background growth for 2040 forecast year at MSOA level and, then, split out to the VISUM zone system. The number of households or jobs associated with specific developments 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.

Model demand data has been constrained with NTEM values up to year 2031: growth has been applied partially to specific sites locations and partially distributed evenly as background growth (see Figure 5-7 below). After year 2031 additional growth has been added based on local assumptions (see Figure 5-7, Figure 5-8 and Table 5-5 below). Growth after year 2031 has not been constrained with NTEM values, and it's at slightly higher rates than TEMPro for Households and lower for Employment. In the Forecast baseline scenario, additional growth after year 2031 has been distributed evenly across the district for both Households and Employment developments, but in LPR Options majority of the Household developments has been allocated to specific sites (6500 HH for Option 1-3 and 11500 HH for Options 4-5). All Options include a partial background household growth after year 2031 (around 2500 HH) which has been distributed evenly among the defined LSOAs.

Figure 5-7 visualises comparation between overall number of Households in Forecast Baseline and LPR Options, Figure 5-8 compares Employment. As shown on the figures, the housing growth is only slightly higher than TEMPro and on the same level for Forecast Baseline and Option 1, Option 2 & Option 3, while Option 4 and Option 5 include higher Housing growth. On the other hand, Employment growth is lower than TEMPro in all Options and Forecast Baseline, while Options include amount of jobs still slightly higher than Baseline.

Description	Year/Scenario	Households	Jobs
Default land uses (TEMPRO)	2019	68567	78594
	2040	86876	83824
New Developments	Forecast Baseline	10756	5500
	Option 1	17256	5603
	Option 2	17256	5603
	Option 3	17256	5603
	Option 4	22256	5603
	Option 5	22256	5603
Alternative land use (Background Growth)	Forecast Baseline	9399	-3166
	Option 1	2565	-3166
	Option 2	2565	-3166
	Option 3	2565	-3166
	Option 4	2565	-3166
	Option 5	2565	-3166
Total increase (Background and development)	Forecast Baseline	88722	80928
	Option 1	88388	81031
	Option 2	88388	81031

Description	Year/Scenario	Households	Jobs
	Option 3	88388	81031
	Option 4	93388	81031
	Option 5	93388	81031

Table 5-5: Base planning data (TEMPro) and planning data comparation between Forecast Baseline and LPR Options for years 2019-2040

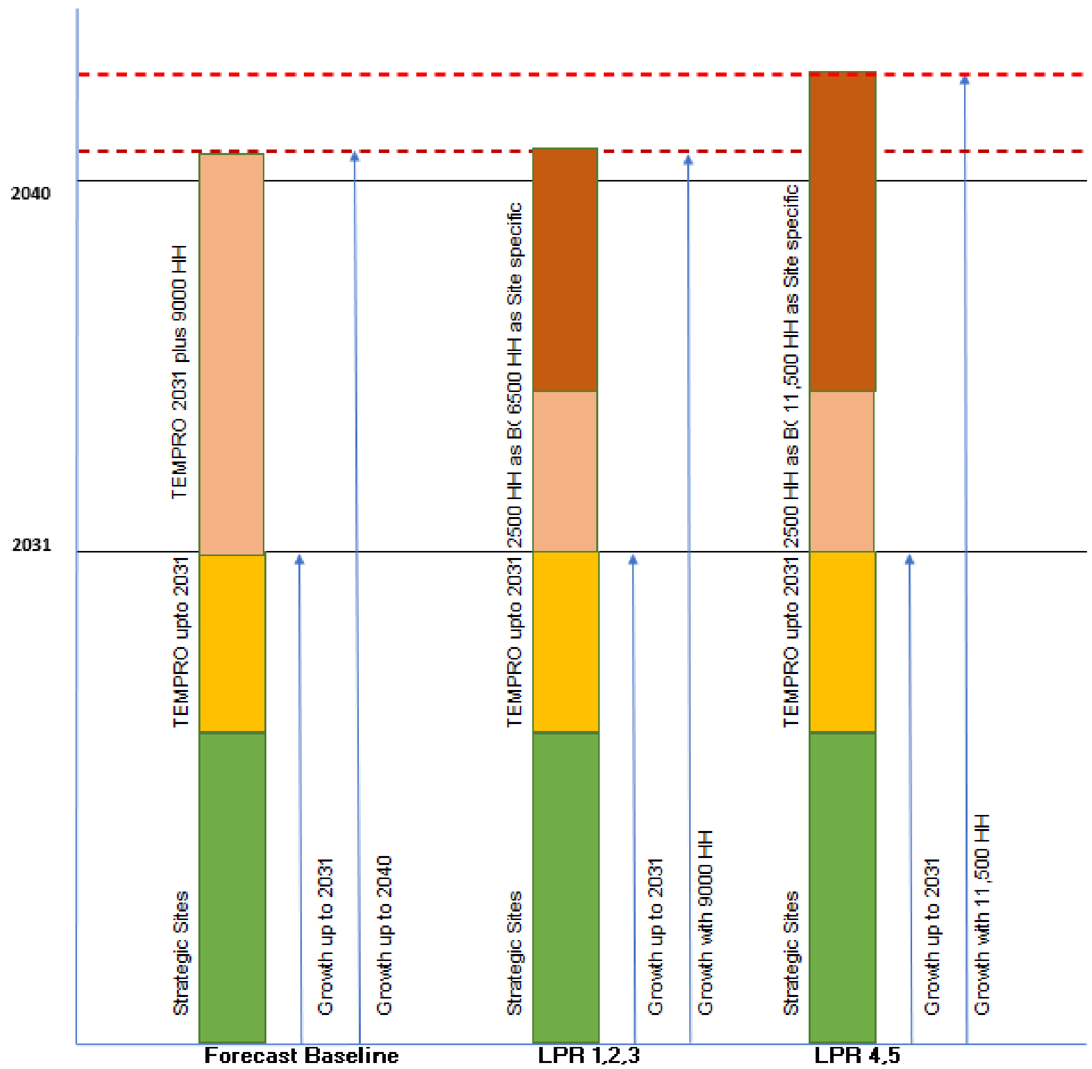


Figure 5-7 Land use comparation between Forecast Baseline and LPR Options – Housing

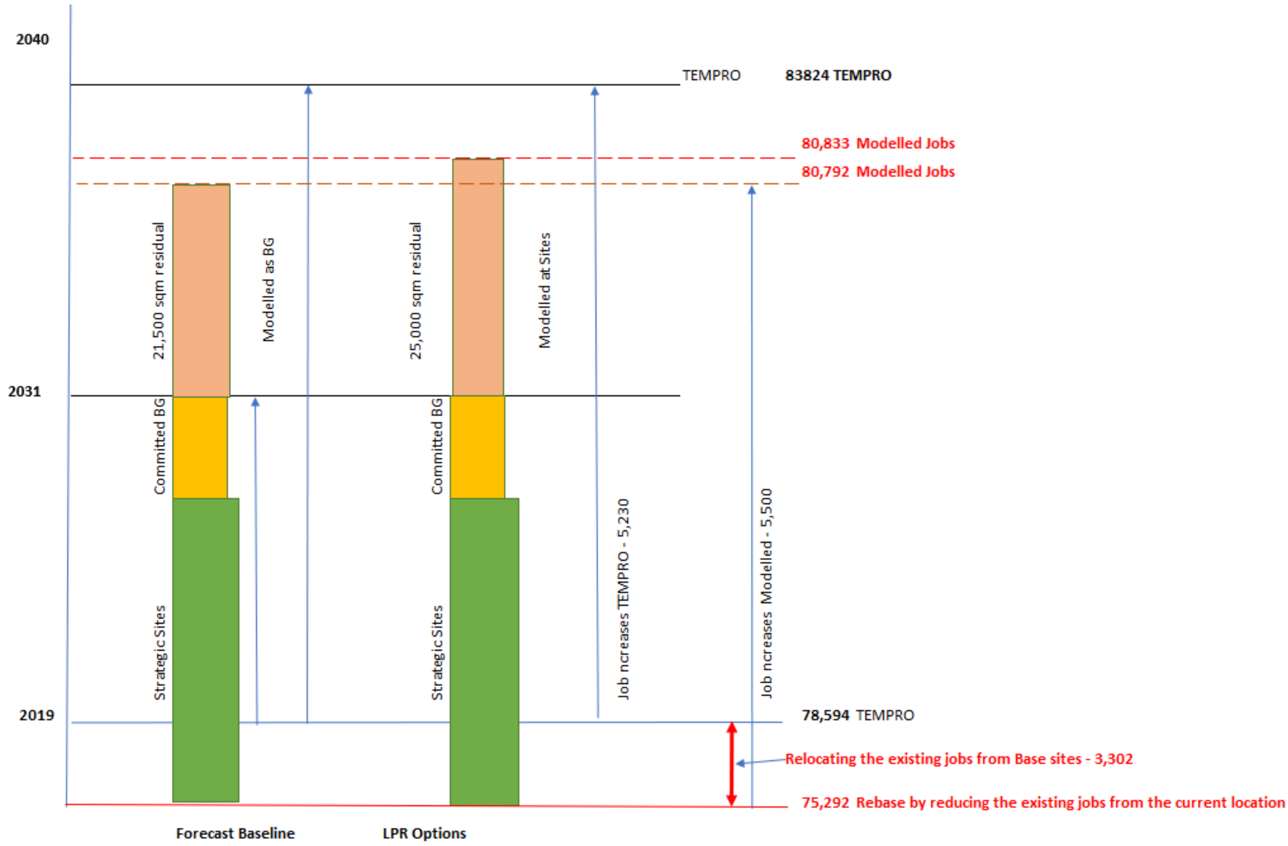


Figure 5-8 Land use comparation between Forecast Baseline and LPR Options – Employment

5.2.4 Site specific Development Trip Matrices

5.2.4.1 Development OD trip generation

Trip generation for the site-specific developments considered trip rates from the Transport Assessment (TA), where possible. For the developments where TA is not available, TRICS trip rates were used which were updated for each land use from a more recent version of the TRICS database (version 7.7.1). This includes surveys up to September 2019. For all trip calculations, only sites in England, Wales and Scotland were included. London sites were removed by default, as some areas in outer London may be considered representative. Only sites with surveys on weekdays were included. Unless otherwise stated, only sites with surveys post 1st January 2012 (the default 8 year cut off in TRICS) have been used.

Also, Canterbury specific trip rates were received for the residential developments based on their location (i.e, City or Outside City etc). “City” trip rates represent lower vehicular trip generation, whereas “Outside City” trip rates represent comparatively higher vehicular trip generation. Table 5-6 below summarises the updated trip rates used in the forecast demand modelling. Trip rates shown in Table 5-6 are for hourly AM and PM peak periods.

Type	Source	Unit	Arrivals		Departures	
			AM (8-9am)	PM (5-6pm)	AM (8-9am)	PM (5-6pm)
City						
C3: Residential - Mixed Private/Affordable Housing	KCC/CCC	Per Dwelling	0.081	0.210	0.185	0.119
B1a: Office	TRICS	Per 100sqm	0.553	0.079	0.096	0.510
B1a: Business Park	TRICS	Per 100sqm	0.907	0.090	0.118	0.741

Type	Source	Unit	Arrivals		Departures	
			AM (8-9am)	PM (5-6pm)	AM (8-9am)	PM (5-6pm)
Outside City						
C3: Residential - Mixed Private/Affordable Housing	KCC/CCC	Per Dwelling	0.101	0.298	0.376	0.164
B1a: Office	TRICS	Per 100sqm	0.553	0.079	0.096	0.510
B1a: Business Park	TRICS	Per 100sqm	0.907	0.090	0.118	0.741

Table 5-6: New forecasting TRICS Trip Rates per Time Period

5.2.4.2 Development Trip Distribution

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

5.2.5 Fuel-income adjustment

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 May 2020 TAG data book, published by DfT. The income adjustment factors for the base year 2019 and forecast year 2040 are given below in Table 5-7.

Factor	2019	2040
Fuel	1.0692356	1.1405772
Income	1.0184391	1.0691645
Overall fuel factor		1.0667220
Overall income factor		1.0498070
Growth adjustment		1.1198523

Table 5-7: Fuel and Income Adjustment Factors

5.2.6 Future Year Target Trip Ends

The final matrices combined the reduced background growth (after applying alternative planning assumptions) with specific developments through a furnessing process to obtain a forecast year demand matrix for the 2040 forecast year as presented in Table 5-8. As the matrix totals combining developments and growthed trips had been differing slightly between origins (O) and destinations (D), in AM the destinations and in PM origins were re-scaled to have the same total as before furnessing.

Description	Scenario	AM	PM
Base (2019)	**Base**	36,587	40,255
Base (2040 TEMPro)		43,246	47,776
New Developments	Forecast Baseline	2,498	1,275
	Option 1	3,849	4,006
	Option 2	4,019	4,081
	Option 3	3,877	3,976
	Option 4	4,282	4,465
	Option 5	4,282	4,465
Alternative land use (Background Growth)	Forecast Baseline	39,033	43,111
	Option 1	37,233	41,032
	Option 2	37,233	41,030
	Option 3	37,233	41,032
	Option 4	37,233	41,032
	Option 5	37,233	41,032
Matrices Total (After Furnessing)	Forecast Baseline	40,873	43,858
	Option 1	41,696	44,237
	Option 2	41,951	44,359
	Option 3	41,745	44,235
	Option 4	43,155	45,606
	Option 5	43,155	45,606

Table 5-8: 2040 Forecast Matrices After Furnessing

Checks were carried out to compare the trip totals in all scenarios between the 2019 base year and 2040 to ensure that overall growth was in line with the proposed developments. Table 5-9 and Table 5-10 provide a summary of matrix trip totals at the AM and PM peak hour level for each trip purpose for the full matrix and the percentage change between base and forecast scenarios totals.

Purpose		Base Year	Baseline Forecast	Option 1	Option 2	Option 3	Option 4	Option 5
AM	Commute	12,281	15,988	16,117	16,208	16,132	16,707	16,707
	Business	2,954	3,818	3,865	3,886	3,845	4,012	4,012
	Other	10,879	15,865	16,193	16,310	16,253	16,768	16,768
	LGV	2,981	4,065	4,348	4,363	4,338	4,481	4,481
	HGV	993	1,137	1,174	1,185	1,178	1,187	1,187
	Total	**30,089**	**40,873**	**41,696**	**41,951**	**41,745**	**43,155**	**43,155**
PM	Commute	11,354	14,518	14,538	14,553	14,542	15,008	15,008
	Business	2,966	3,805	3,863	3,871	3,876	4,003	4,003

Purpose		Base Year	Baseline Forecast	Option 1	Option 2	Option 3	Option 4	Option 5
	Other	15,375	21,518	21,576	21,657	21,568	22,268	22,268
	LGV	2,430	3,318	3,527	3,545	3,515	3,589	3,589
	HGV	609	699	732	733	735	738	738
	Total	**32,734**	**43,858**	**44,237**	**44,359**	**44,235**	**45,606**	**45,606**

Table 5-9: Base Matrix Totals Comparison with Forecast Matrices

Purpose		Baseline Forecast	Option 1	Option 2	Option 3	Option 4	Option 5
AM	Commute	1.30	1.31	1.32	1.31	1.36	1.36
	Business	1.29	1.31	1.32	1.30	1.36	1.36
	Other	1.46	1.49	1.50	1.49	1.54	1.54
	LGV	1.36	1.46	1.46	1.45	1.50	1.50
	HGV	1.14	1.18	1.19	1.19	1.20	1.20
	Total	**1.36**	**1.39**	**1.39**	**1.39**	**1.43**	**1.43**
PM	Commute	1.28	1.28	1.28	1.28	1.32	1.32
	Business	1.28	1.30	1.31	1.31	1.35	1.35
	Other	1.40	1.40	1.41	1.40	1.45	1.45
	LGV	1.37	1.45	1.46	1.45	1.48	1.48
	HGV	1.15	1.20	1.20	1.21	1.21	1.21
	Total	**1.34**	**1.35**	**1.36**	**1.35**	**1.39**	**1.39**

Table 5-10 : Forecast Matrix Growth Compared to Base Matrix

5.3 Goods Vehicle Growth

Growth in LGV and HGV demand has been produced by applying growth factors from the Road Traffic Forecasts (RTF) (2018) published by DfT. The RTF produces forecasts to a horizon year of 2040 in 5-year intervals. For the purposes of this work, the RTF Scenario 1 was adopted, namely the “central” macroeconomic assumption, a positive and declining income relationship, and using historic averages for trip rates.

The South East England 2040 RTF forecasts were extracted for LGV and HGV to obtain a growth factor for 2040 from 2019. The resulting growth rates were applied to the entire demand matrix. Table 5-11 shows the % changes calculated between base year and 2040 from the RTF data for goods vehicles for South East England:

Region/Area	Vehicle Class	2019 to 2040 Growth
South East England	LGV	1.29
	HGV	1.11

Table 5-11 : LGV and HGV Growth Factors

6. Forecast Results

6.1 Overview

This section describes the forecast results for the Forecast Baseline and Local Planning scenarios. A forecast year of 2040 has been modelled with the TEMPro growth assumptions in order to create the following assignment scenarios:

- Forecast Baseline – including committed schemes and developments to be included on the transport network between the 2019 base year and 2040 forecast year;
- Local Plan Scenarios – including local plan development and particular schemes to be included on the transport network between the 2019 base year and 2040 for each of the following options:
  - Option 1: Existing Local Plan Strategy;
  - Option 2: Coast with improved public transport;
  - Option 3: City with SWECO interventions plus;
  - Option 4: City with SWECO interventions plus and relief roads; and
  - Option 5: City with Ghent and relief roads.

The purpose of the Forecast Baseline was to be able to compare the impact of demand growth on the base year. The Local Plan Scenarios can then be compared to the Forecast Baseline. These initial forecast scenarios have been developed primarily to inform spatial assessments for early decision making on the Canterbury Local Plan Review (LPR).

A set of output plots have been produced to show flow difference, node level of service and change in travel time in order to help identify key areas of constraint arising from additional development in the LPR scenarios, compared to the Forecast Baseline.

6.1.1 Flow difference plots

Flow difference plots have been produced to show the difference in actual flows between each LPR Option and the Forecast Baseline (Reference Case) and will help aid analysis of the development allocations, network restrictions and sufficiency for local transport needs. Each flow difference plot is analysed below in the relevant LPR Option section. Also, each link flow plot is included in Appendix E and each flow difference plot is included in Appendix F.

6.1.2 Level of service plots

Level of service (LOS) plots provide a qualitative measure of how good the present traffic situation is on a given junction, from the driver's perspective. 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 Level of Service (LOS) based on the mean delay experienced by each vehicle. VISUM has the capability to calculate LOS for all types of junctions (all-way stops, 2-way stops, roundabouts and signalised junctions). In the case of an all-way stop junction an iterative calculation is used to ensure that the departure headway converges. For 2-way stop junctions, a priority rank is applied for major and minor turning movements. For junctions where mean delays experienced by each vehicle are in excess of 15 seconds, Table 6-1 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 manoeuvrability 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 6-1 : LOS Level Description

Most design or planning efforts typically use service flow rates at LOS C or D, to ensure an acceptable operating service for facility users. Each LOS plot is analysed below in the relevant Forecast Baseline and LPR Option section. Also, each LOS plot is included in Appendix G.

Strategic model route/traffic delay is based on link congestion delay (defined by Volume Delay Function VDF), junction turn delay (representing give-way waiting time) and possible over-capacity issues (represented by queues). For the practical reasons strategic model scheme comparations should be based on Journey Time as it combines all means of delays.

Canterbury Model show that in some cases traffic delays in different Options can be based on different attributes. For example, Wincheap Roundabout traffic delays are mostly based on very slow-moving traffic (congestion delay) or queuing on Wincheap road before the roundabout, that could be found on Journey Time graph or queue plots, but junction delay (LOS) on roundabout is limited.

6.2 Forecast Baseline results

The Forecast Baseline network was used in a comparison with the LPR scenarios. The actual flows, shown in vehicles per hour, and the Level of Service from the Forecast Baseline network are given in Figure 6-1 to Figure 6-4.

In the AM, the largest traffic flows are on the two major corridors and specifically north in the A299 Thanet Way and south in the A2 Dover Rd with 2600 (westbound direction) and 1800 (eastbound direction) vehicles per hour respectively. The City centre accumulates high traffic flows on the Ring Road in the region of 500 (St. Peter’s Pl road) to 1400 (Rheims Way) vehicles per hour on the southwest, as a result of the links between A299 Thanet Way and the City centre and A2 Dover Rd and the City centre. The traffic flows on the link roads vary with a maximum flow of 1300 vehicles per hour on Reihms Way followed by Littlebourne road and Wincheap road with almost 1100 and 1000 vehicles per hour respectively. Whitstable road and Broad Oak road resulted in traffic flows between 800 and 900 vehicles per hour while flows on St Stephen’s Hill, New Dover road and Sturry road are in the region of 600 to 700 vehicles per hour. New parallel Sturry link road creates alternative facilitating local transport. Smaller traffic flows are also visible on parallel roads and on the northern part of Ring Road. The traffic flows in the PM are similar to that of the AM.

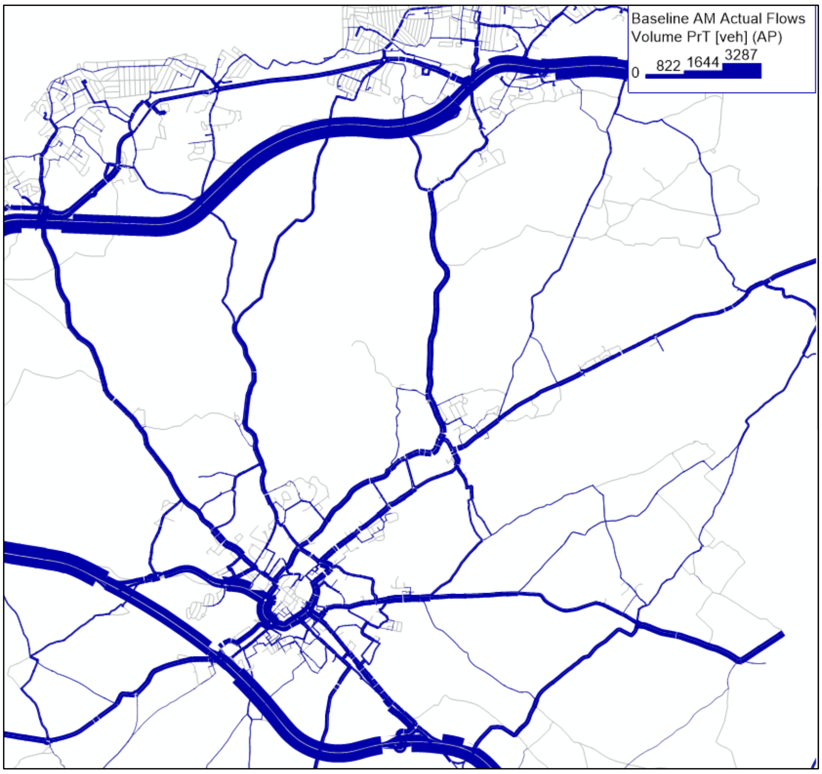


Figure 6-1 Forecast Baseline AM Flows

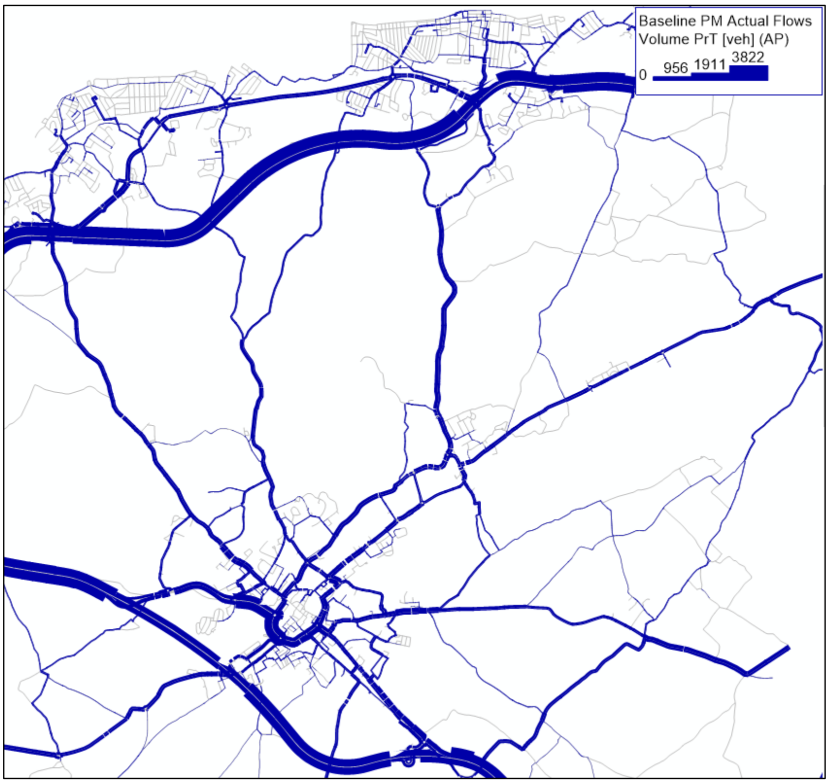


Figure 6-2 Forecast Baseline PM Flows

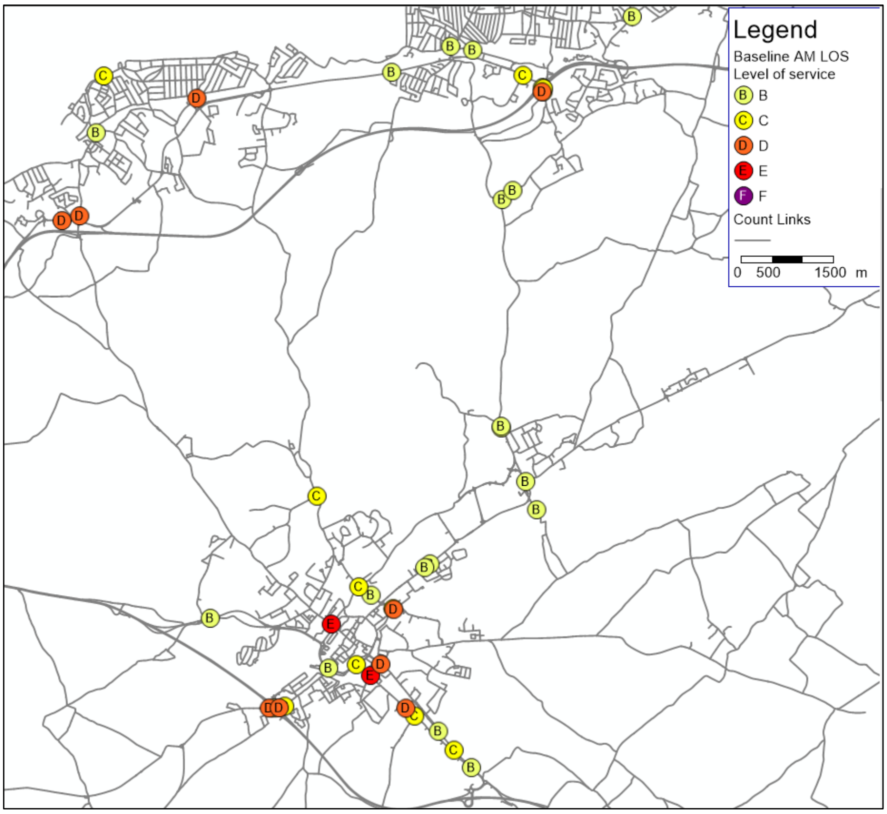


Figure 6-3 Forecast Baseline LOS AM

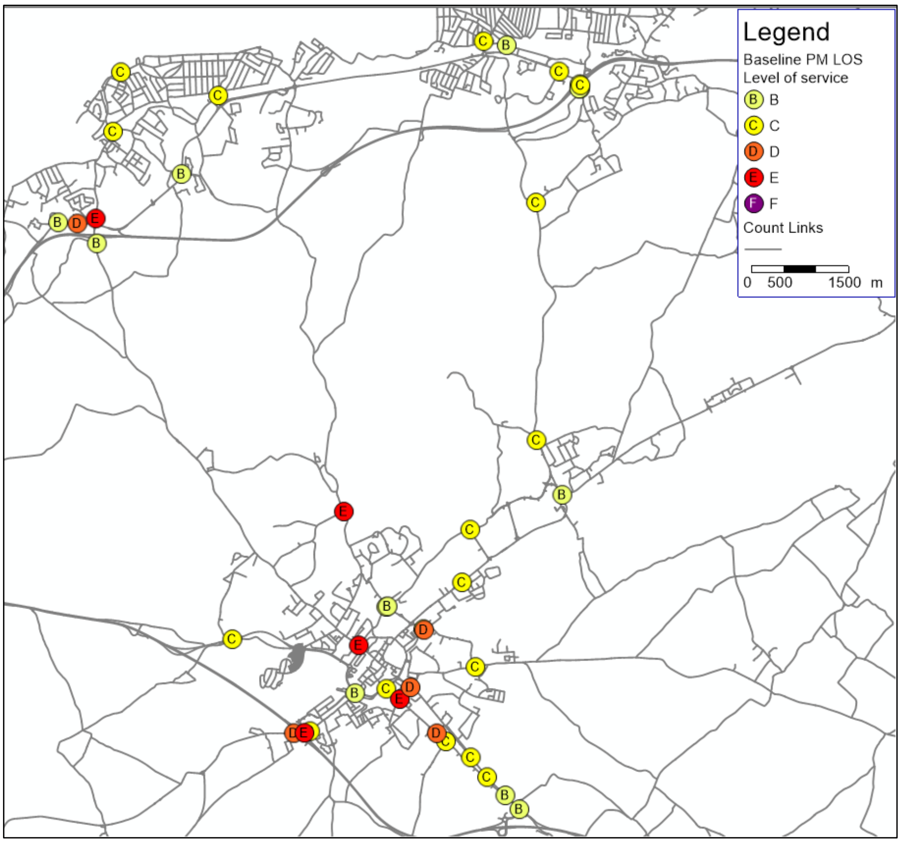


Figure 6-4 Forecast Baseline LOS PM

The level of service in the AM displayed severe delays on the northwest and southeast of the city centre with class E nodes. Class D nodes are observed on the coastal area and peripheral to the Ring road on the accesses to Canterbury centre, specifically, on the Military Rd roundabout, the New Dover Rd junction and the Wincheap Gyratory junction. Minor delays of class C and B are detected around the Ring road, while the later are also present in the coastal area and the northeast corridors. It should be highlighted that round abouts have not been modelled as main nodes rather they were assessed as single nodes. This results in individual nodes of class C located in Vauxhall, Stephen's Hill roundabout and Wincheap roundabout.

The level of service during the PM peak improves for the coastal area while delays around the city centre increase slightly.

6.3 LPR Option 1 - Existing Local Plan Strategy

LPR Option 1 has been developed to continue the pattern of the existing Local Plan Strategy[4] which aims to provide well-designed communities, good access to jobs and services and protect sensitive landscapes. Housing is planned to meet local housing need and support economic growth.

6.3.1 LPR Option 1 Flow Difference from Forecast Baseline

In the AM, traffic flows increase across the network compared to Forecast Baseline. Since Option 1 based schemes include committed and Forecast Baseline's schemes, the change in traffic flows is subject to the local level of development. Due to more housing allocated to Herne Bay and the outskirts of Canterbury, and employment space allocated equally across Herne Bay and Whitstable, the highest increases are mainly on the northern corridors.

A290 Whitstable Rd and A291 Herne Bay Rd accumulate high increases with the first channelling the traffic to the city centre. Minor increases in traffic flows are observed around Canterbury city in total as a result of the level of development around the centre.

In the PM peak, traffic flows reduce (very slightly) around the Ring Road, mainly on Wincheap road, due to rerouting based on increased congestion on the Ring Road (developments). The rest of the network presents similar to that of AM peak, and overall flow changes remain rather minor.

[4] Canterbury District Local Plan (July 2017)

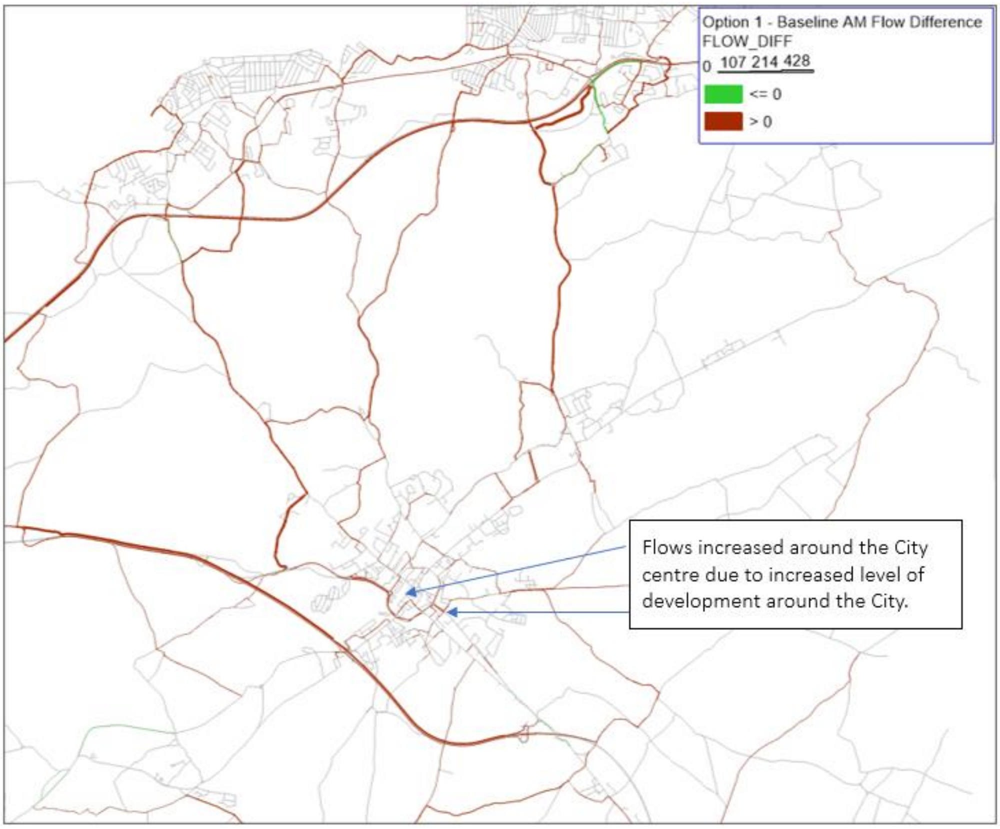


Figure 6-5 LPR Option 1 Compared to Forecast Baseline Traffic Flows AM

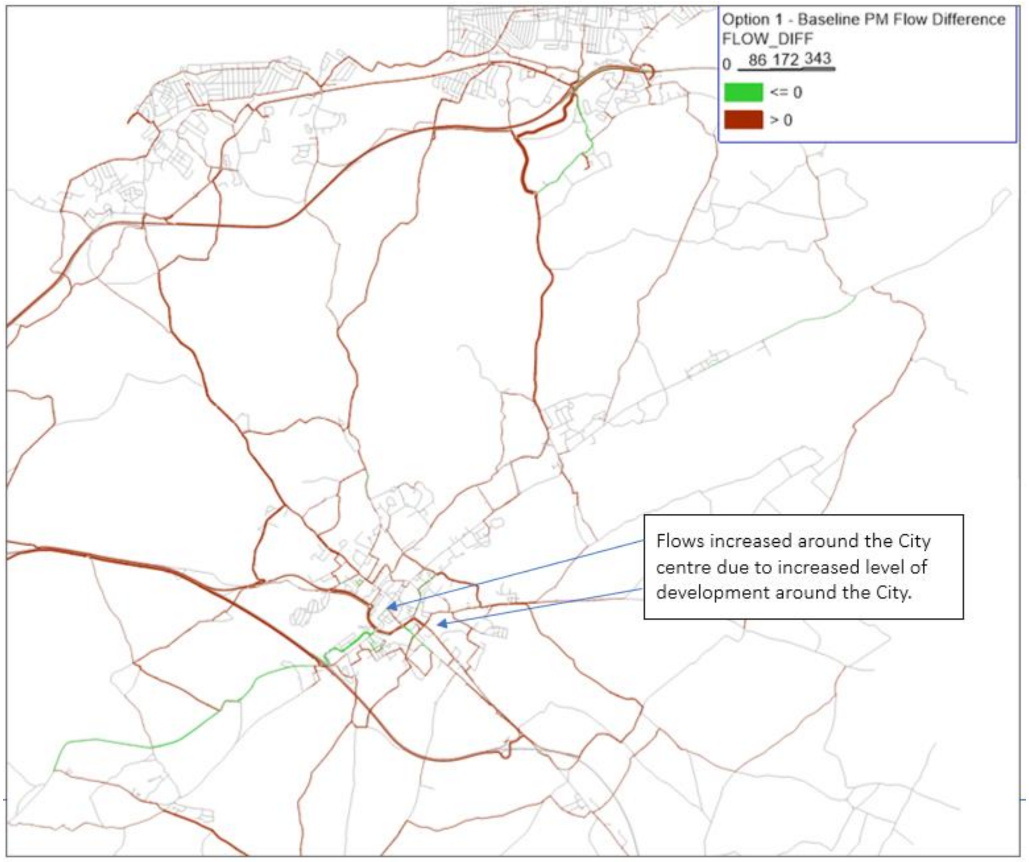


Figure 6-6 LPR Option 1 Compared to Forecast Baseline Traffic Flows PM

6.3.2 Level of service

The level of service is similar to that of Forecast Baseline due to the absence of development related schemes introduced for Option 1. The change in traffic flows and as a result the change in junction delays derived from the allocation of developments. Therefore, the northern corridors and their junctions resulted in slightly increased delays.

The level of service overall decreases in PM compared to AM. Nodes of class E and F increased around the city centre.

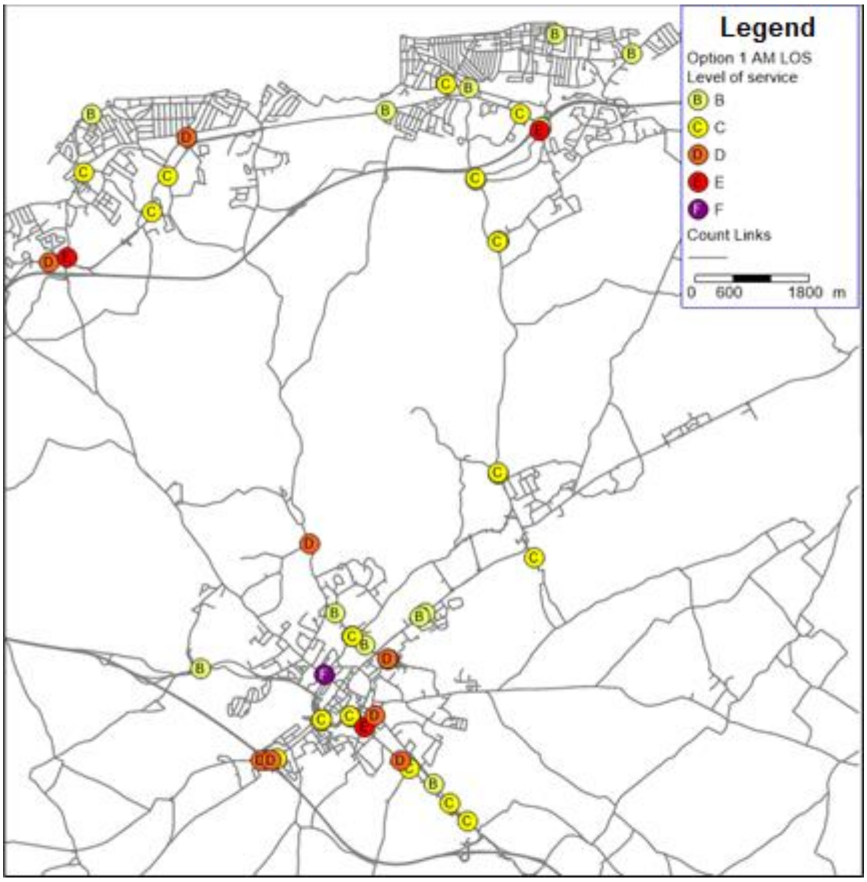


Figure 6-7 LPR Option 1 LOS AM

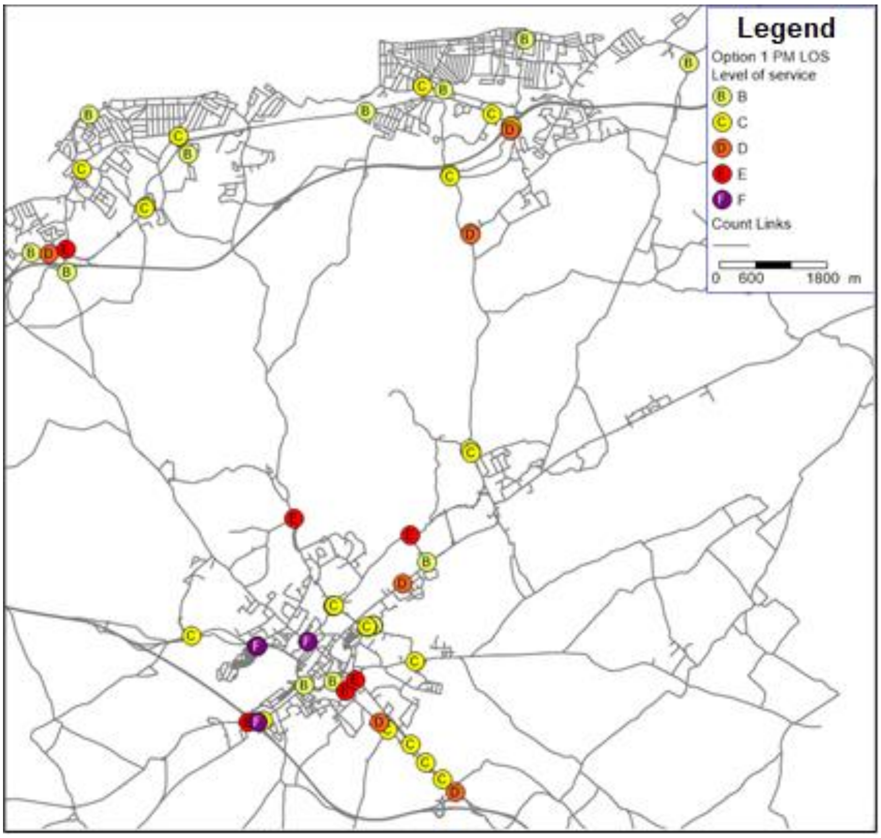


Figure 6-8 LPR Option 1 LOS PM

6.4 LPR Option 2 - Coast with improved public transport

In summary, the LPR Option 2 has been developed to test the impacts on the connectivity of coastal area. The Whitstable bus link and P&R and the Chestfield link and New junction provide alternative links between the coastal area and the A299 Thanet Way.

6.4.1 LPR Option 2 Flow Difference from Forecast Baseline

In the AM, the largest reduction in traffic flows are on the outer of Canterbury city and specifically on the A2990 Thanet Way. The decrease in traffic flows on this road is around 600 vehicles per hour. There are further reductions on the coastal area and minor reductions around the city centre.

The Option 2 based schemes provide improvement for the coastal area's connectivity, increasing traffic flows locally and towards the city centre. The highest traffic flow increase is observed on links using the new Chestfield junction with a maximum increase of over 420 vehicles per hour, compared to the Forecast Baseline. Traffic flows increase around Canterbury city in total as a result of the Chestfield link and new junction. This additional highway junction and link creates alternative routes within coastal area, rerouting results in traffic reductions on local coastal roads.

The differences in traffic flows in the PM are similar to that of the AM.

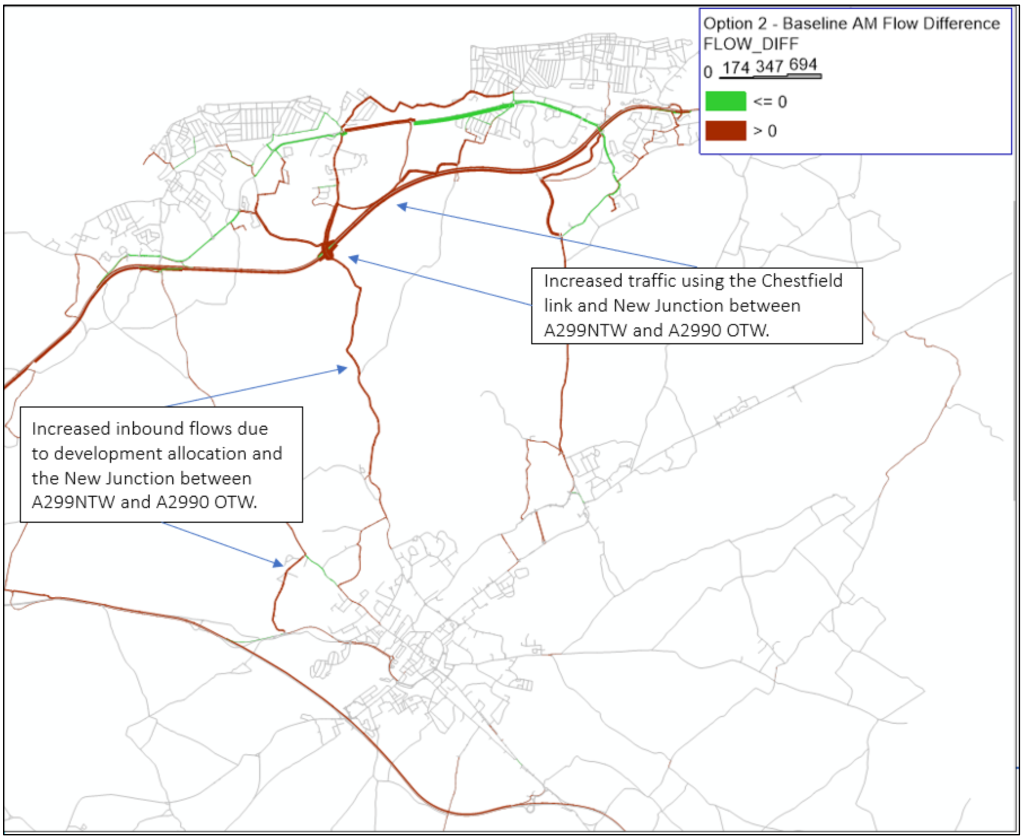


Figure 6-9 LPR Option 2 Compared to Forecast Baseline Traffic Flows AM

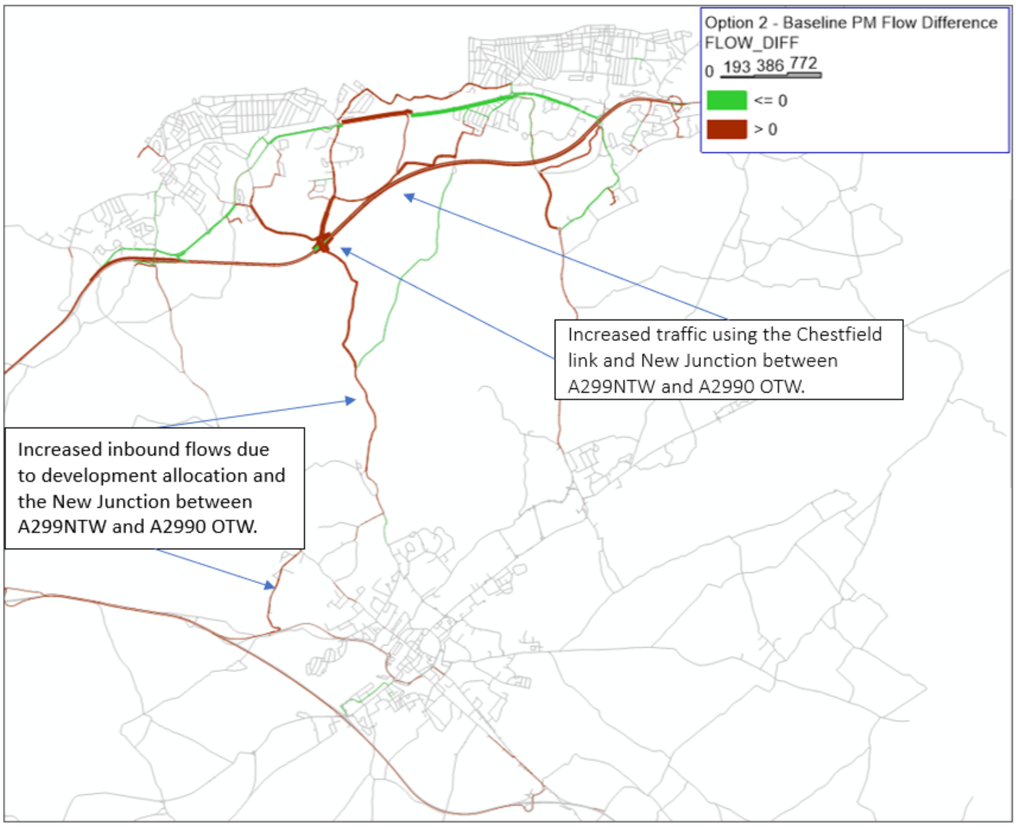


Figure 6-10 LPR Option 2 Compared to Forecast Baseline Traffic Flows PM

6.4.2 Level of service

In the AM, the more impaired nodes are located just beyond the Ring road on the north and south of the city centre and on the eastern of the coastal area (class E and F respectively), indicating severe delays and unpredictable travel times. Class D nodes are observed around the city centre, while central junctions indicate stable flows (class C). Peripheral nodes resulted in B and C level of service classes indicating stable flows and moderate delays. Overall, the level of service is similar to that of Forecast Baseline due to non-particular schemes introduced for the city centre in Option 2. Coastal schemes and particularly the Chestfield link and new junction discharge the A2990 Thanet Way, decreasing junction delay (class C comparing to class D in Baseline scenario).

In the PM peak, the north part of the city centre experiences higher delays to this of AM peak while the east of coastal area is slightly improved on the A299 Thanet. The rest of the network presents similar delays to the AM peak.

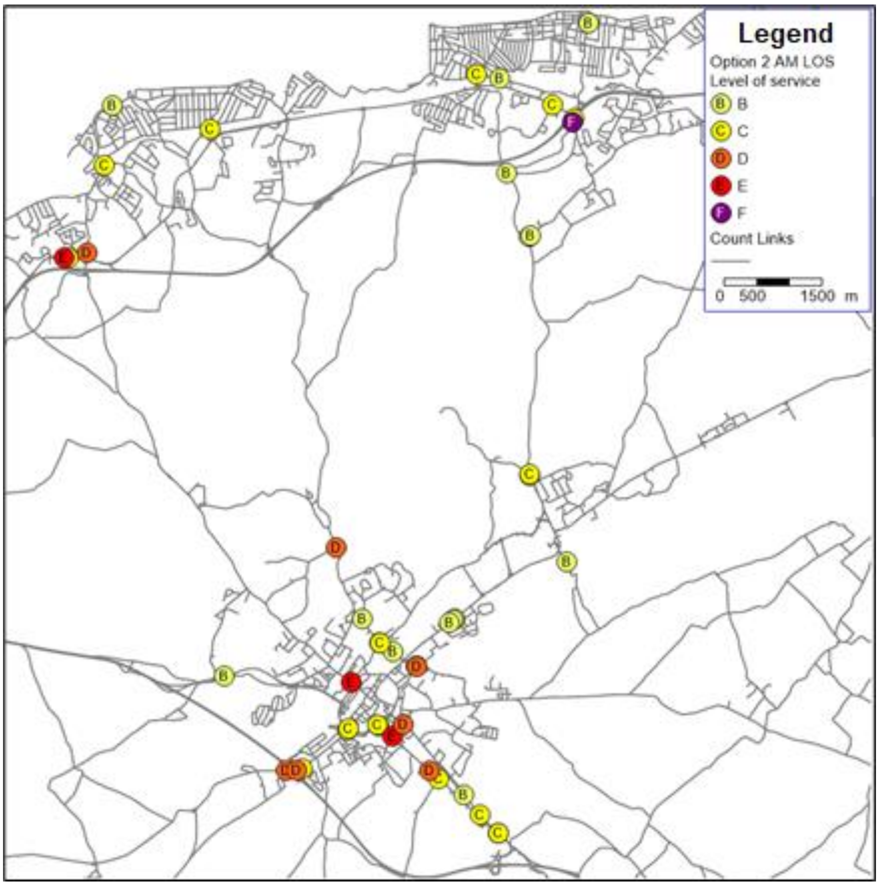


Figure 6-11 LPR Option 2 LOS AM

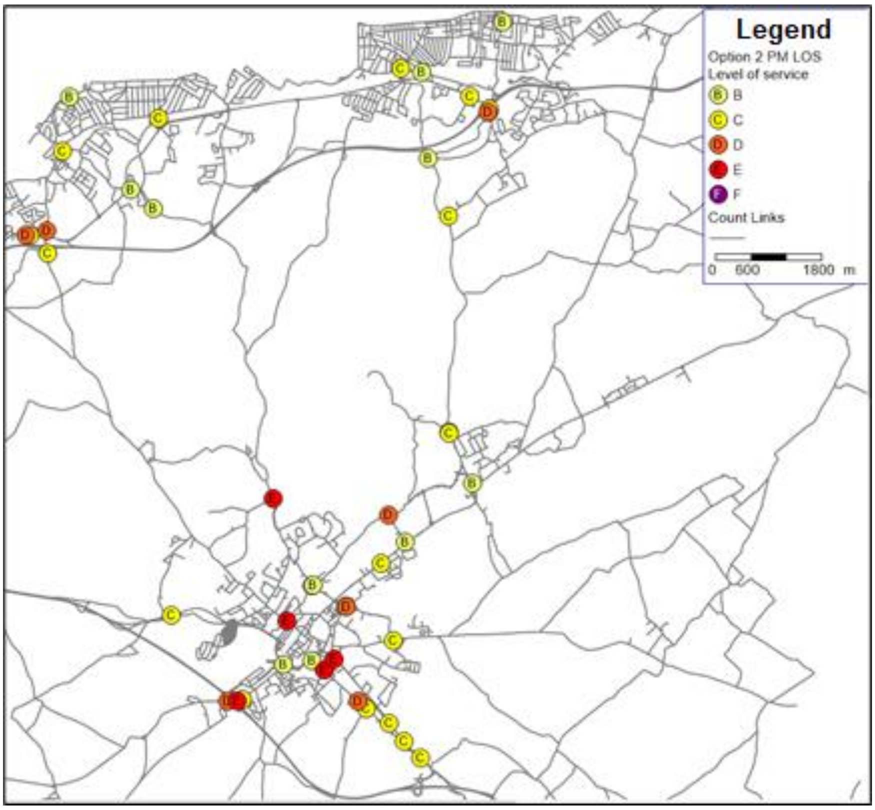


Figure 6-12 LPR Option 2 LOS PM

6.5 LPR Option 3 - City with SWECO interventions plus

In summary, the LPR Option 3 has been developed to test the impacts on the connectivity of coastal area and the road network within the city centre. The Whitstable bus link and P&R provide an alternative link to the coastal area. The Thanington 4th slip allows a connection between the Hospital and the A2 Dover road avoiding the city centre. In addition, local traffic in the city centre is controlled by signalised junctions on the Ring road while Clean Air Zone, Bus lane approach and Park and Ride facilities improve air quality and mobility respectively.

6.5.1 LPR Option 3 Flow Difference from Forecast Baseline

In the AM, the largest reduction in traffic flows are in the western and south-eastern part of the Ring Road from Rheims Way, Pin Hill road up to St George's roundabout. The decrease in traffic flows on these roads are in the region of 470 to 900 vehicles per hour. This is due to reduced capacity, resulting in increased travel time and rerouting of traffic having alternative travel route. It is observed that St Stephen's road between St Stephen's roundabout and Station Rd W roundabout display almost zero flow difference compared to Forecast Baseline. This is a result of the total flow from North Lane and Station road (558 vehicles per hour in Option 3 and 576 vehicles per hour in Forecast Baseline) that is almost equal in the two scenarios compared.

The Option 3 based schemes mainly focus on the City centre discouraging car trips on the Ring road. The absence of alternative routes to the city centre results in less rerouting options and hence peripheral traffic flow increase. In particular, "artificial bypasses" are observed as alternative routes through local residential roads. For the western artificial bypass Tyler Hill road, Whitstable road and Rough Common are considered, while on the east the "artificial bypass" is the link between Fordwich and Littlebourne road passing south to Spring Lane and residential roads. The flow impact of the "artificial bypasses" is analysed in Section 7.3.3. In addition, on the alternative A2 4th slip is observed increased traffic flow around 500 vehicles per hour. The differences in traffic flows in the PM are similar to that of the AM.

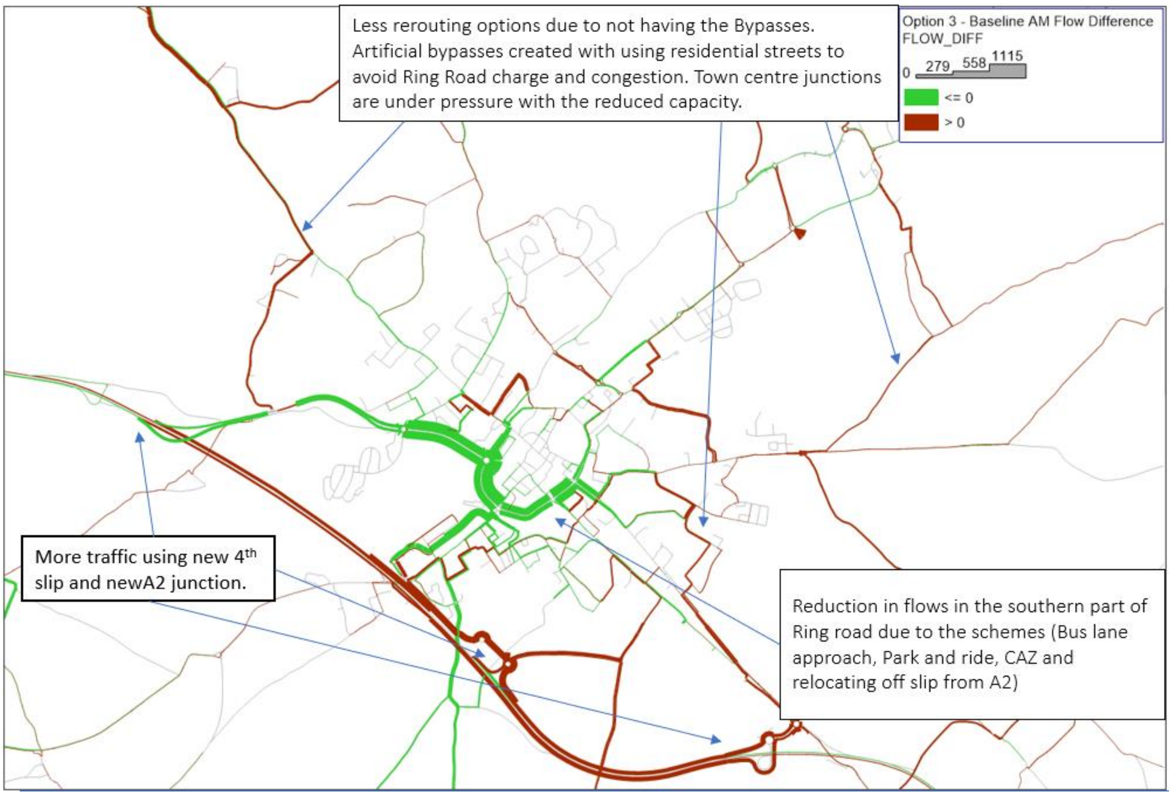


Figure 6-13 LPR Option 3 Compared to Forecast Baseline Traffic Flows AM

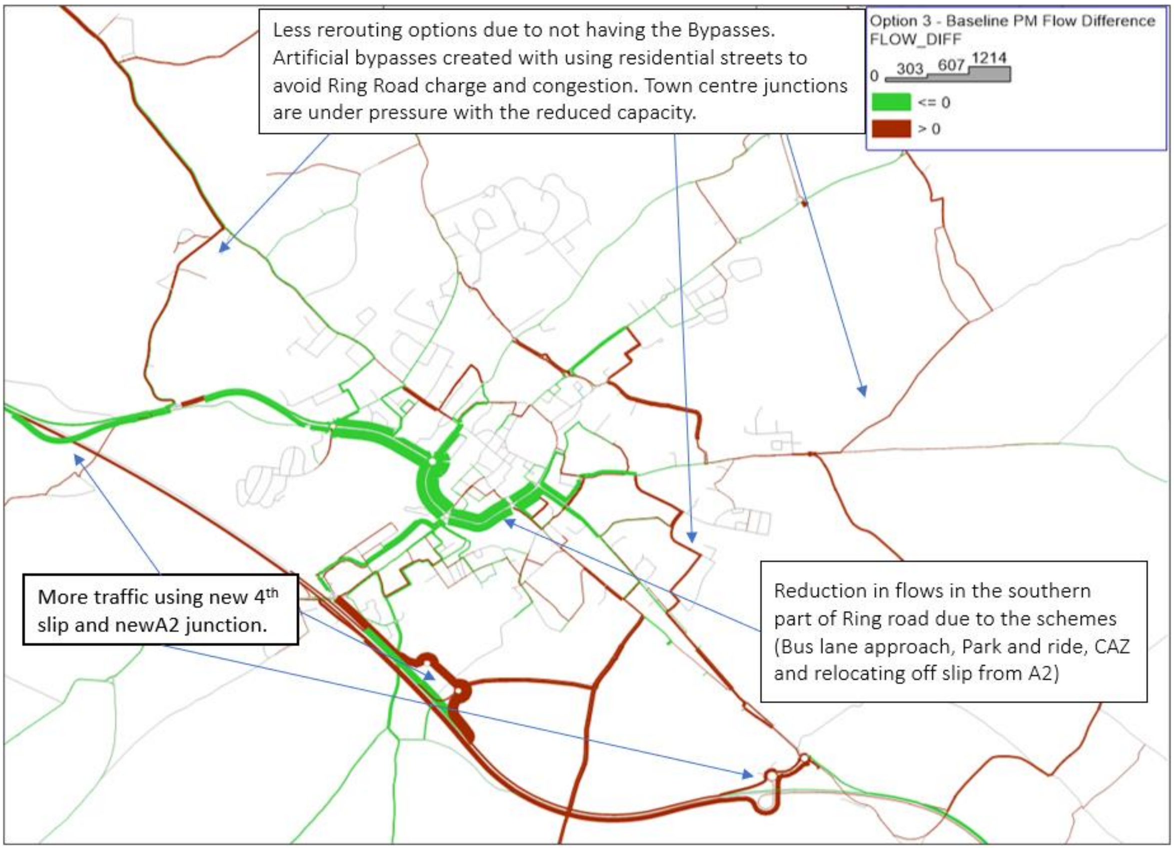


Figure 6-14 LPR Option 3 Compared to Forecast Baseline Traffic Flows PM

6.5.2 Level of service

In the AM, the more impaired nodes are located on the south and southeast of the Ring road (class E and F), indicating severe delays and unpredictable travel times. Class D nodes are observed peripheral of the City centre and particularly on the south, while better quality flows of class B and C respectively are observed on the north and northeast distanced form the city centre. Overall, the level of service decreased on the Ring road and the parallel roads on the south as a result of the local traffic restrictions and the decreased car space (such as, bus lane approach). Junctions outside the Ring road on the south and southeast display higher delays. A clear increase in junction delay is observed on the north, outer of the city centre where there are no alternative routes to accommodate flows.

The level of service overall decreases in the PM. Delays increased around the City centre with class F nodes, while distanced corridors on the northeast presented similar delays to these of AM peak.

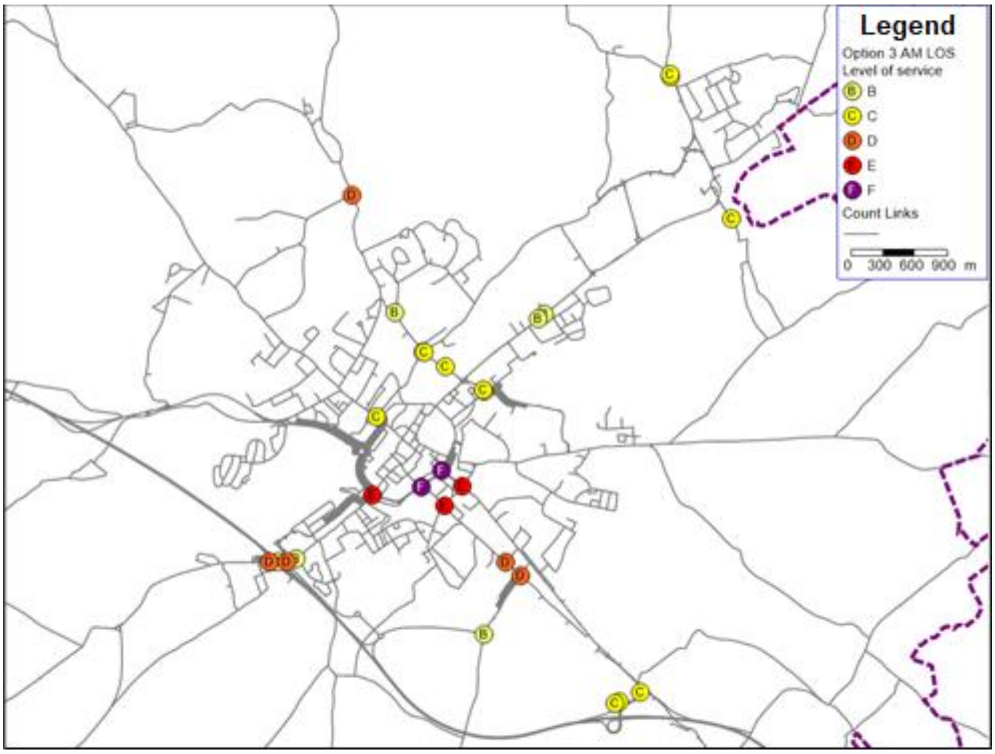


Figure 6-15 LPR Option 3 LOS AM

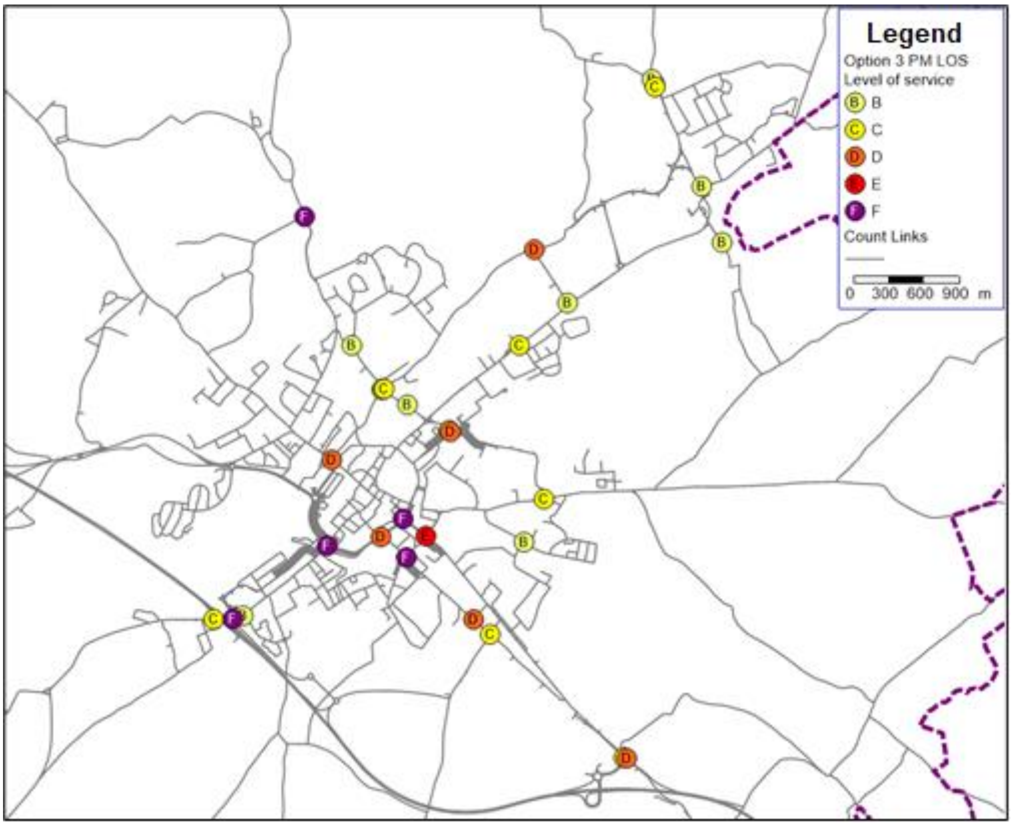


Figure 6-16 LPR Option 3 LOS PM

6.6 LPR Option 4 - City with SWECO interventions plus and relief roads

In summary, the LPR Option 4 has been developed to test the impacts on the road network within and around the city centre. Major infrastructure schemes such as the Western bypass, the Eastern bypass and the Thanington 4th slip accommodate traffic flows peripheral to the city centre. In addition, local traffic is controlled by signalised junctions on the Ring road while Clean Air Zone, Bus lane approach and Park and Ride facilities improve air quality and mobility respectively.

6.6.1 LPR Option 4 Flow Difference from Forecast Baseline

In the AM, the largest reduction in traffic flows are in the south-western part of the Ring road from London Rd roundabout, St Peter's roundabout and Rheims Way up to Wincheap roundabout. The decrease in traffic flows on these roads are in the region of 440 to 910 vehicles per hour. The Option 4 based schemes re-route traffic from these roads to the Western and Eastern bypasses avoiding saturation in the city centre. The flows on the two new bypass links are between 550 and 1150 vehicles respectively. There are further reductions on the northern and eastern part of the Ring road as well as on the parallel roads. These are, as a result of the Bus lane approach and the Clean Air Zone (Figure 4-7), restrictions to exclusively local traffic. Minor increases on A257 St Martin's Hill and Chaucer Rd are present due to traffic seeking alternative routes to travel towards the city centre.

The differences in traffic flows in the PM are similar to that of the AM.

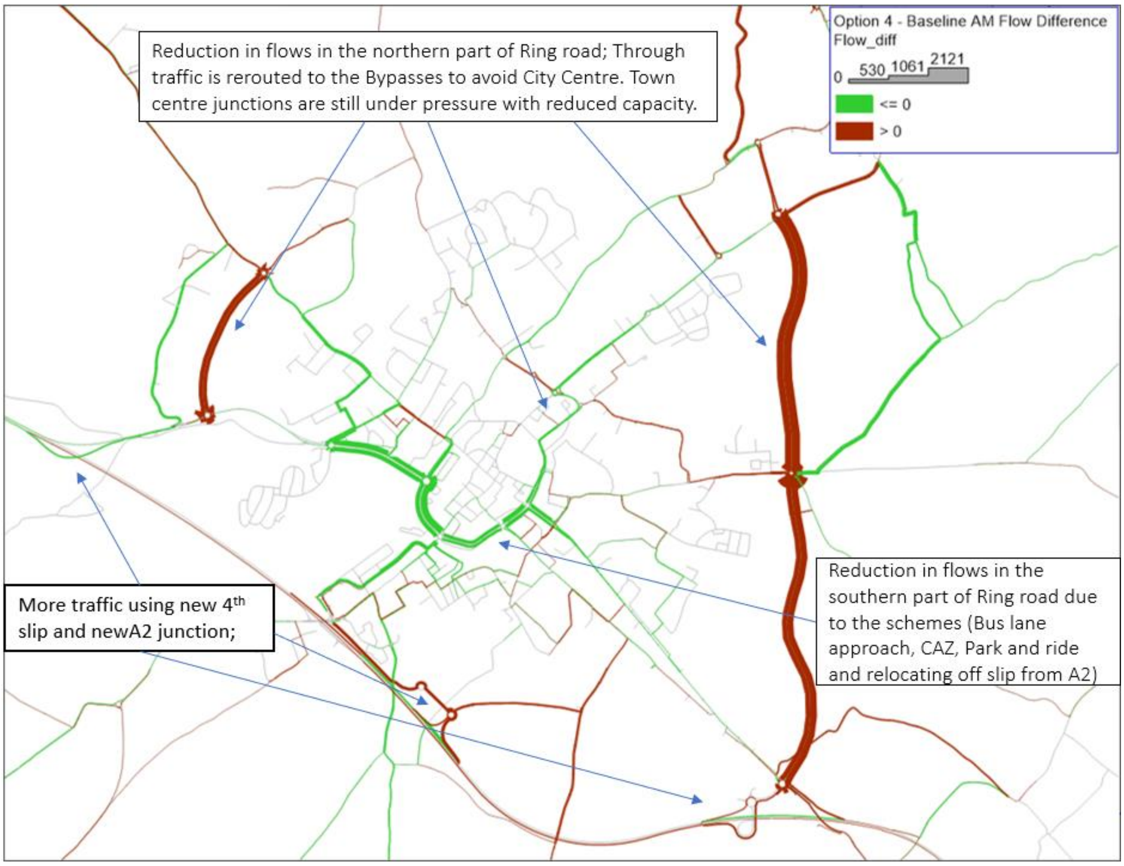


Figure 6-17 LPR Option 4 Compared to Forecast Baseline Traffic Flows AM

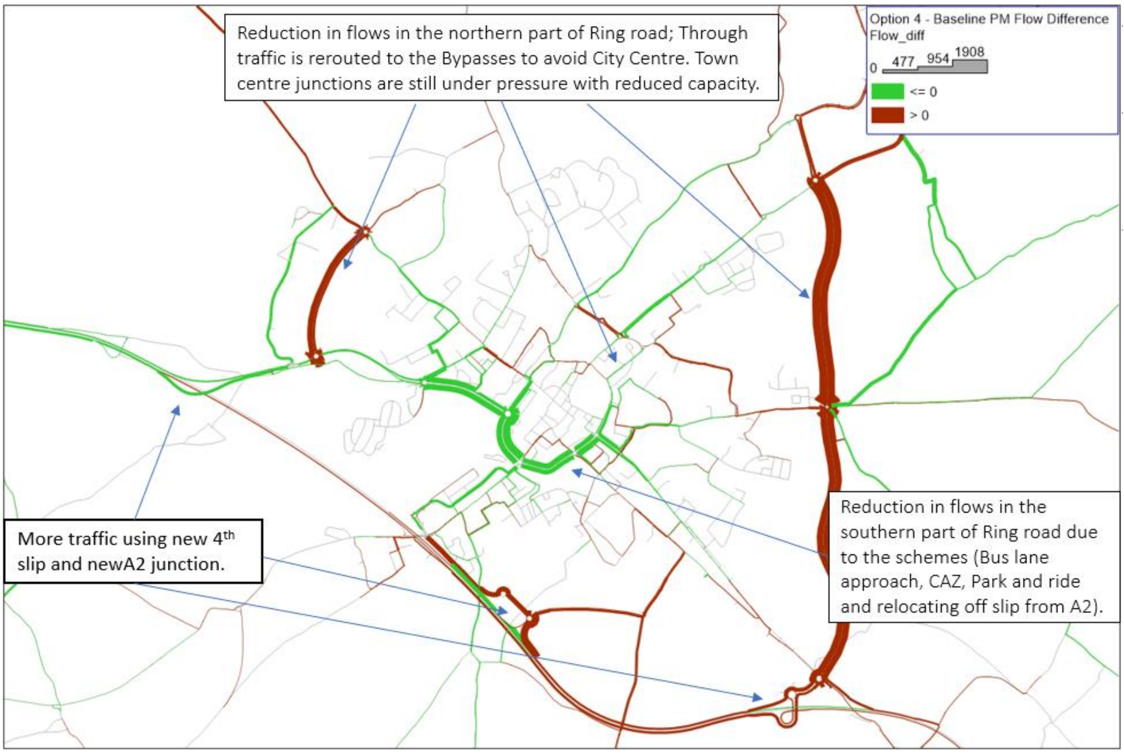


Figure 6-18 LPR Option 4 Compared to Forecast Baseline Traffic Flows PM

6.6.2 Level of service

In the AM, the more impaired nodes are located on the Ring road, the New Dover and the Old Dover road (class E and F) indicating severe delays and unpredictable travel times. Similar quality is the junction on the northeast corridor. Class D nodes are observed on the St Stephen's Hill road, the northern part of the Ring road and the A2 access to the City centre, while junction delays decrease peripheral to the City centre (Dover road, Broad Oak road and eastern bypass). Overall, as a result of the City centre schemes, the level of service decreased on the Ring road increasing delays (Signalised junctions, Bus lane approach and Clean Air Zone). The new Eastern and Western bypasses and the Hospital access result in decreased junction delays in and around the city as traffic flows are rerouted to alternative links.

The level of service in the PM decreased compared to that of AM. While the central area junctions experience higher delays compared to AM, there is a clear improvement outer of the City centre on the eastern and north-eastern part.

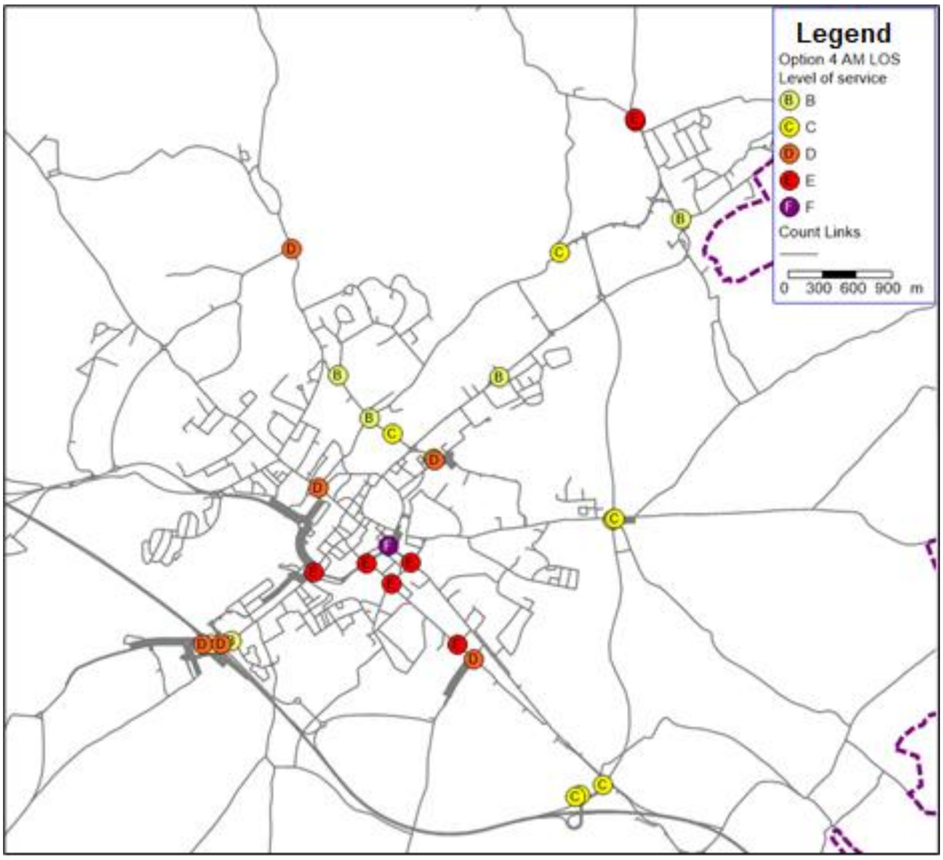


Figure 6-19 LPR Option 4 LOS AM

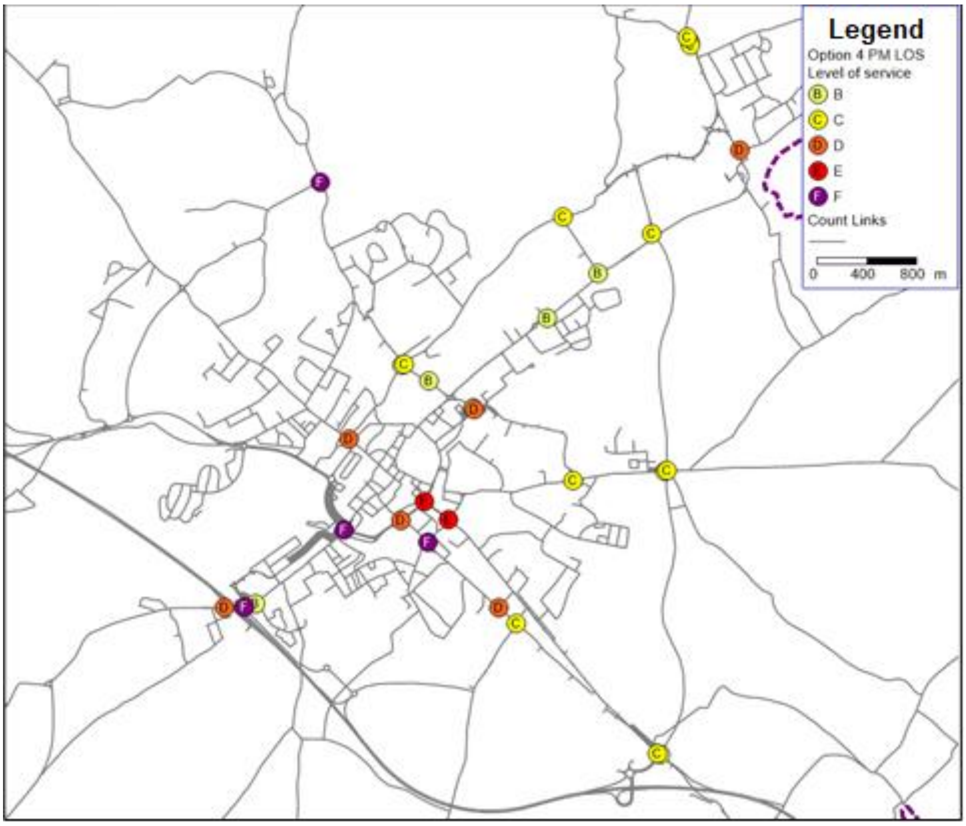


Figure 6-20 LPR Option 4 LOS PM

6.7 LPR Option 5 - City with Ghent and relief roads

In summary, the LPR Option 5 has been developed to test the impacts on the road network within and around the City centre. Major infrastructure schemes such as the Western bypass, the Eastern bypass and the Thanington 4th slip accommodate traffic flows peripheral to the city centre. In addition, local traffic is restricted by modal filters or Blockers while Shared streets, Bus lane approach and Park and Ride facilities improve mobility in the city centre.

6.7.1 LPR Option 5 Flow Difference from Forecast Baseline

In the AM, the largest reduction in traffic flows are on the north the Ring road from St Stephen's road and Military road. The decrease in traffic flows on these roads are in the region of 500 to 900 vehicles per hour. The Option 5 based schemes re-route traffic from these roads to the Western and Eastern bypasses avoiding saturation in the city centre. The increase in flows on the two new bypass links are between 680 and 1280 vehicles respectively. The case of Western bypass introduces further increase on Whitstable road (north of bypass) and Tyler Hill road as connecting links to bypass.

Further reductions occur on the northern and eastern part of the Ring road as well as on residential roads due to the introduction of Blockers and Shared streets restrictions. These restrictions permit local residents to use these roads but doesn't allow 'through' traffic usage without consequences (e.g. fines). Minor increases on A257 St Martin's Hill and Chaucer Rd are present due to traffic seeking alternative routes to travel towards the City centre. Major increase on Tyler Hill Road is due to the limited access to City from St. Stephens Hill and traffic is seeking alternatives other than Giles Ln and University Rd (with blockers scheme in place).

The differences in traffic flows in the PM are similar to that of the AM.

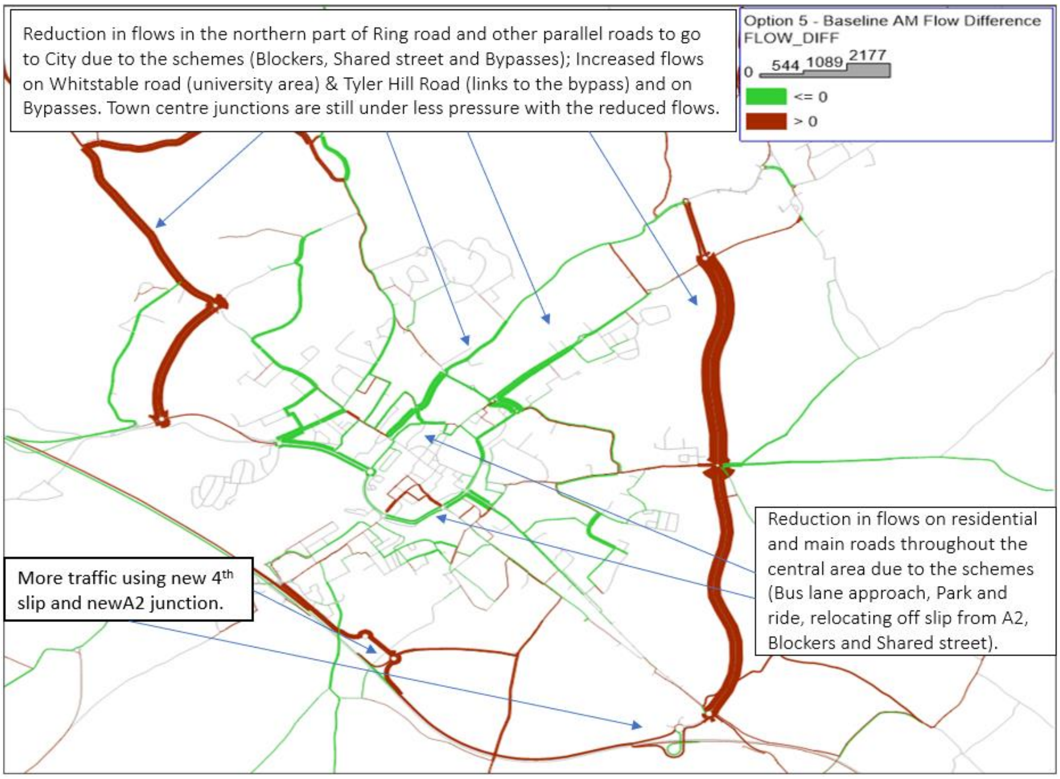


Figure 6-21 LPR Option 5 Compared to Forecast Baseline Traffic Flows AM

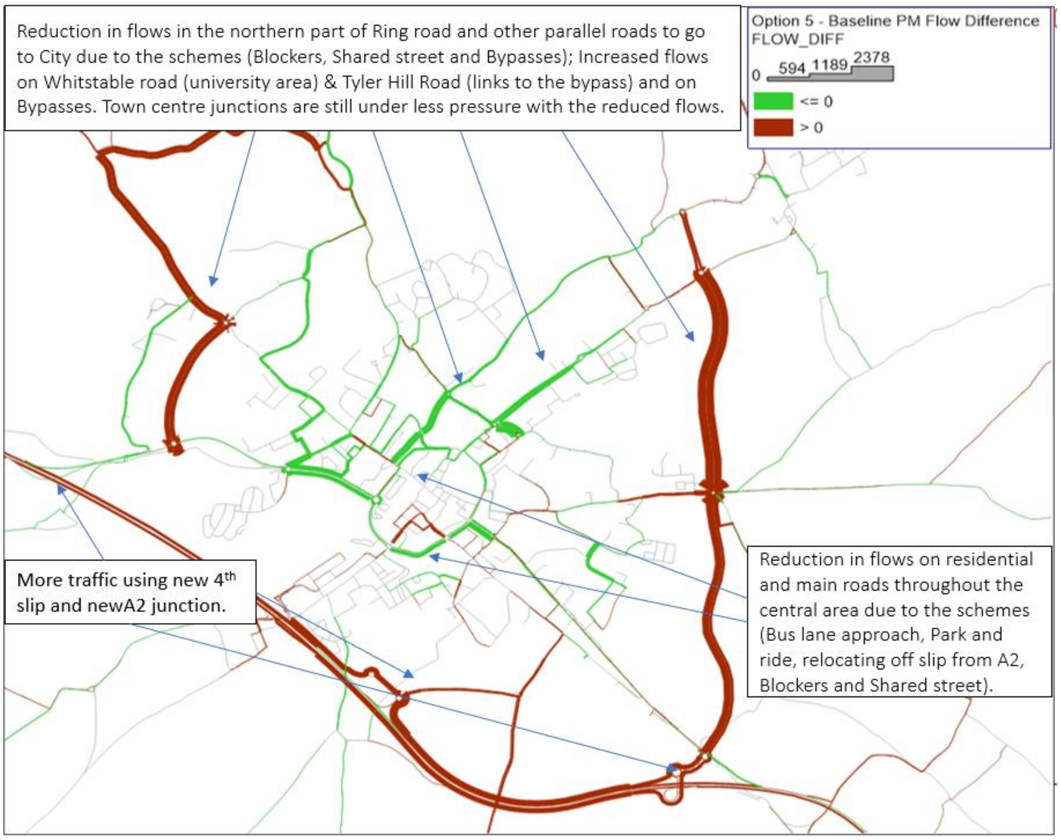


Figure 6-22 LPR Option 5 Compared to Forecast Baseline Traffic Flows PM

6.7.2 Level of service

In the AM, the more impaired nodes are located on the north and southeast of the city (class E) indicating severe delays. Class D nodes are on the south peripheral to the Hospital accesses on A2 and Old Dover road. The junction delays on the Ring road decrease compared to the Forecast Baseline scenario, resulting in class C nodes. Junctions on the north and northeast peripheral to the Ring road shared similar improvement. In addition, nodes created to accommodate traffic flows through the Western and Eastern bypasses display a good traffic quality with B and C class level of service. Overall, the level of service improves for the Ring road and the parallel roads on the north as a result of the local traffic restrictions (Blockers) and the decreased car space (Shared streets and Bus lane approach). Junctions outside the Ring road on the south and southeast either display similar delays or resulted in higher delays respectively. A clear increase in junction delay are observed on the north, outer of the city centre, while new bypasses achieved stable flows with moderate delays as alternative routes to the city centre.

The level of service in the PM is similar to that of AM. While A2 junctions experience higher delays compared to AM, there is a clear improvement on the Hospital accesses.

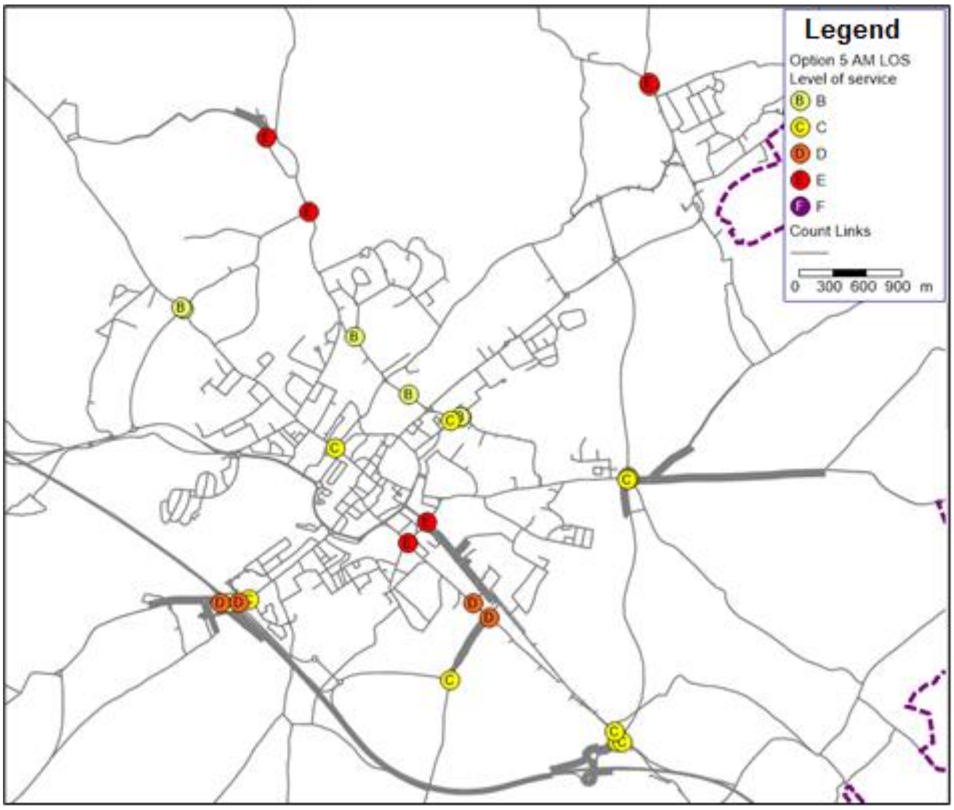


Figure 6-23 LPR Option 5 LOS AM

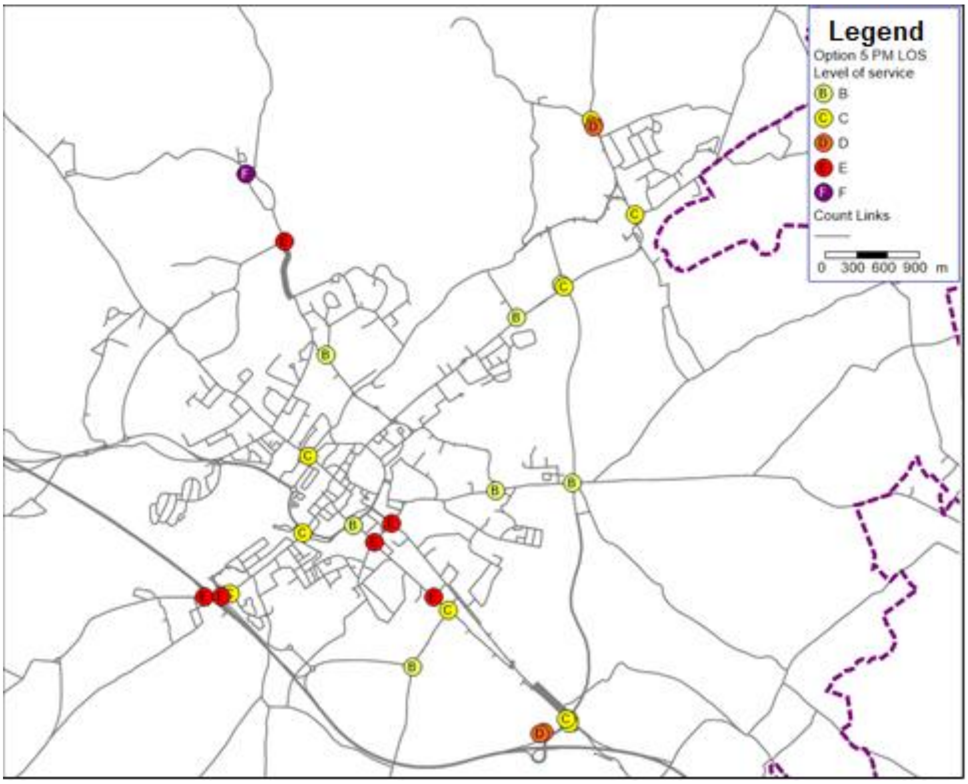


Figure 6-24 LPR Option 5 LOS PM

7. LPR Option comparison

7.1 Overview

In this section journey times, junction LOS (level of service), queue length and flow data from the VISUM models were used to compare LPR Options with the Forecast Baseline scenario both in City centre and network wide view.

7.2 City Centre Journey time and queue length

Seven key routes were considered for journey time comparison between the modelled LPR Option outputs and the Forecast Baseline.

7.2.1 Journey times

The locations of journey time routes are shown in Figure 7-1. These journey time routes were chosen for comparison as they were validated in the Base Model validation process.

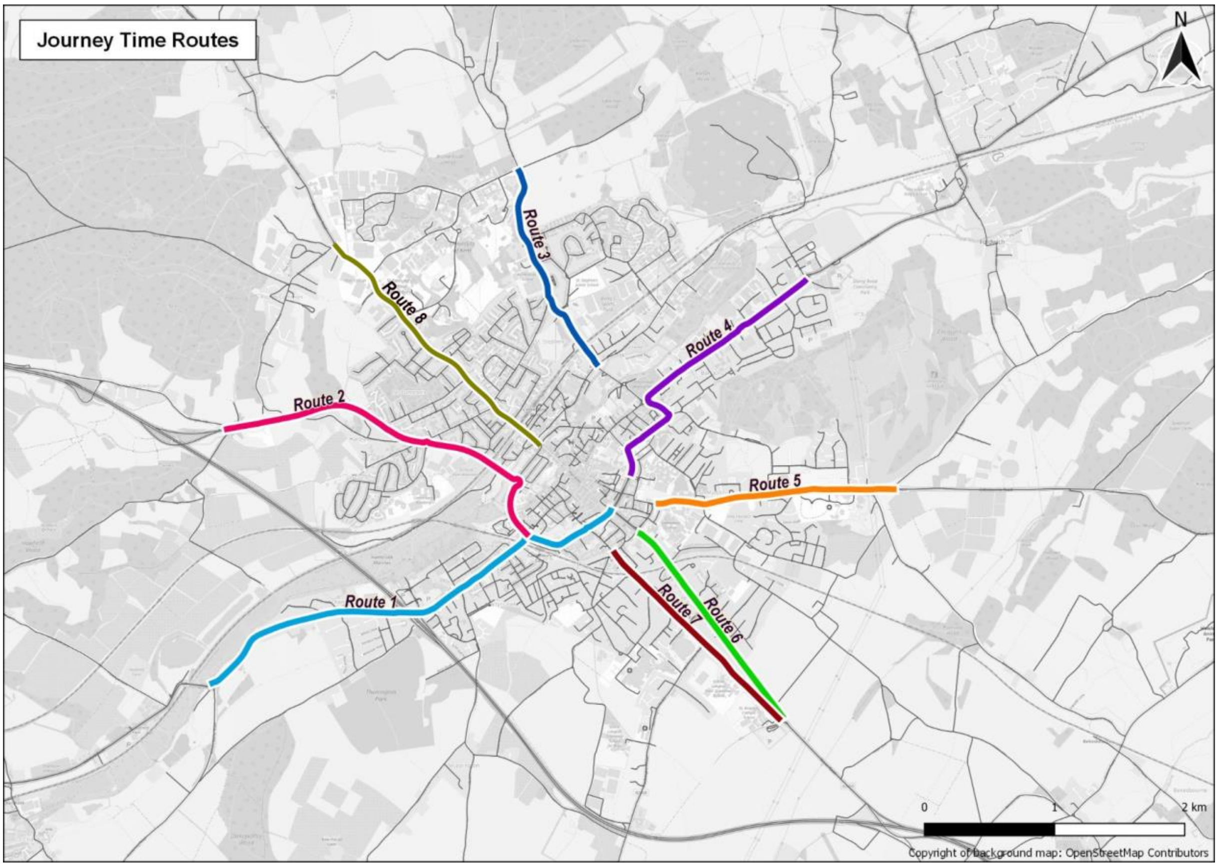


Figure 7-1 Journey Time Routes

The modelled journey times (to City Centre) per route per option are presented in Table 7-1 and Figure 7-2 and Figure 7-3.

Route	Forecast Baseline (mm:ss)		Option 1 (mm:ss)		Option 2 (mm:ss)		Option 3 (mm:ss)		Option 4 (mm:ss)		Option 5 (mm:ss)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Route 1	14:09	12:26	16:03	15:48	17:11	15:36	21:30	21:16	23:26	21:23	25:16	17:48
Route 2	05:26	04:07	05:41	04:10	06:45	04:12	13:22	11:19	11:59	09:58	05:59	04:22
Route 3	05:33	04:07	05:57	05:19	07:37	05:52	07:00	04:45	06:11	04:31	06:46	07:05
Route 4	12:32	08:16	14:34	08:02	13:04	09:16	13:38	08:41	09:21	06:12	23:31	14:32
Route 5	05:42	03:09	06:25	03:24	06:28	03:13	06:54	03:20	07:43	03:37	08:04	04:03
Route 6	04:42	03:48	04:54	03:56	05:09	04:56	07:44	05:27	04:08	03:02	10:26	03:54
Route 7	05:57	05:12	05:53	05:46	05:54	05:54	07:44	08:04	07:58	06:21	08:08	06:12
Route 8	05:40	04:37	07:07	05:35	06:29	04:47	07:58	05:09	06:03	04:27	06:06	04:12

Table 7-1 Modelled Journey Times

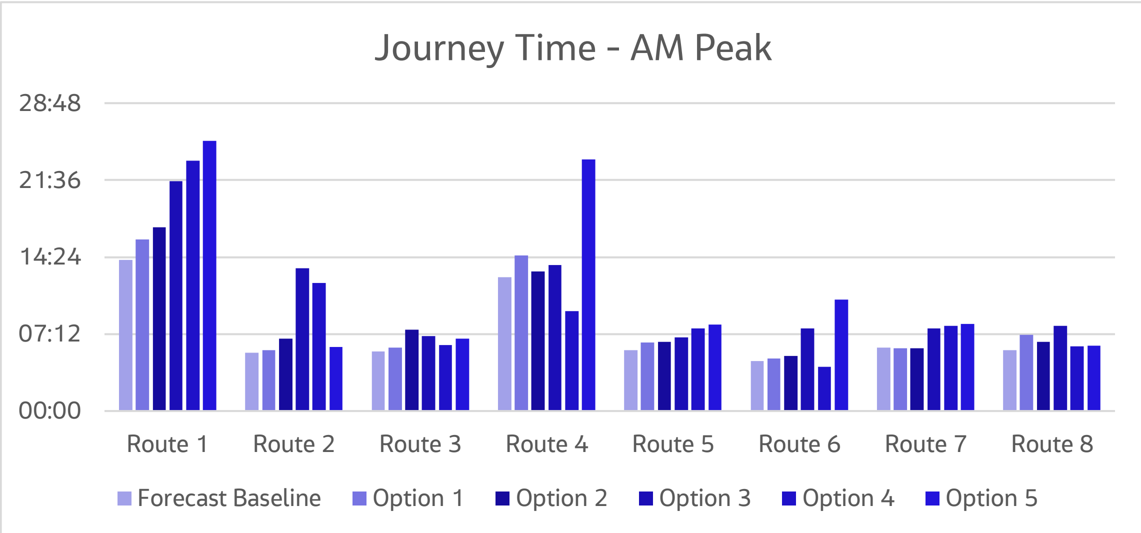


Figure 7-2 Modelled Journey Times AM

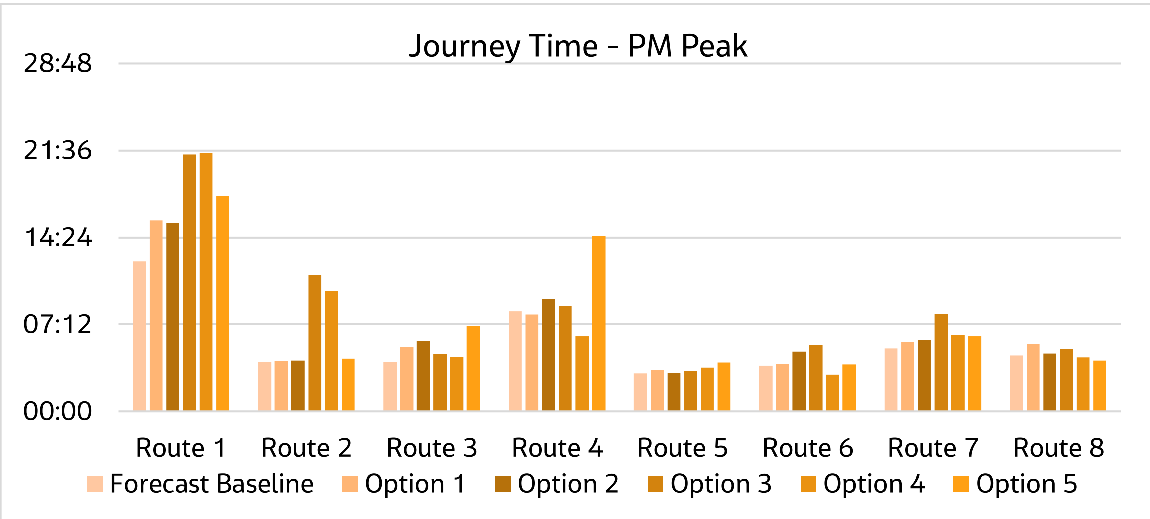


Figure 7-3 Modelled Journey Times PM

As seen in Figure 7-2 and Figure 7-3 above, Route 1, Route 2 and Route 4 are mostly affected among various options. Option 1 & 2 show moderate increases in journey times compared to Forecast Baseline, by around 5%-10%. This increase derives from the planned development allocation since no City schemes are introduced for Option 1 and Option2. The rest options that include City centre schemes presented more significant change in journey times. In particular, Option 4 shows significant increases, compared to Forecast Baseline by around 30%, while Option 3 & Option 5 result in severely affected journey times around the City centre with an 50% increase. This heightened increase in journey times is a result of less route choice options and more city restrictions introduced for Option 3 and Option 5 respectively. In Option 4, Route 4 and Route 7 journey time decrease, due to alternative routes provided, Eastern bypass in particular. Despite being far from City Centre, it creates a new connection between south and east of Canterbury allowing to remove some through traffic from the City.

The journey time differences between the LPR Options and the Forecast Baseline scenario for the AM and PM peaks are presented in Table 7-2.

Route	Option 1 (mm:ss)		Option 2 (mm:ss)		Option 3 (mm:ss)		Option 4 (mm:ss)		Option 5 (mm:ss)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Route 1	01:54	03:22	03:02	03:10	07:21	08:50	09:17	08:57	11:07	05:22
Route 2	00:15	00:03	01:19	00:05	07:56	07:12	06:33	05:51	00:33	00:15
Route 3	00:24	01:12	02:04	01:45	01:27	00:38	00:38	00:24	01:13	02:58
Route 4	02:02	-00:14	00:32	01:00	01:06	00:25	-03:11	-02:04	10:59	06:16
Route 5	00:43	00:15	00:46	00:04	01:12	00:11	02:01	00:28	02:22	00:54
Route 6	00:12	00:08	00:27	01:08	03:02	01:39	-00:34	-00:46	05:44	00:06
Route 7	-00:04	00:34	-00:03	00:42	01:47	02:52	02:01	01:09	02:11	01:00
Route 8	01:27	00:58	00:49	00:10	02:18	00:32	00:23	-00:10	00:26	-00:25
Average	00:49		01:04		03:02		01:56		03:11	

Table 7-2 Change in Journey Times Compared to Forecast Baseline (in min:ss)

7.2.2 Queue length

Journey time is probably most reliable statistic to compare the LPR options since it includes reduces speed along links, junctions' delays (shown by Level of Service) and queue delays. So, queue delays show only a part of possible network capacity issues.

Measuring queue length in the strategic models is not advisable since this cannot depict the delays associated with junction geometries. More sophisticated tools at micro level, such as micro-simulation and junction modelling software are considered to use in this respect. Queue in VISUM-based models represents vehicles that are unable to pass a link or junction within its demand period (peak hour),and could be considered as "left for later" (over capacity). It should be noted that some very slow links "are still moving" within model and queue is not noticed there as traffic volume is within link/junction capacity, however very high congestion might still be perceived by drivers.

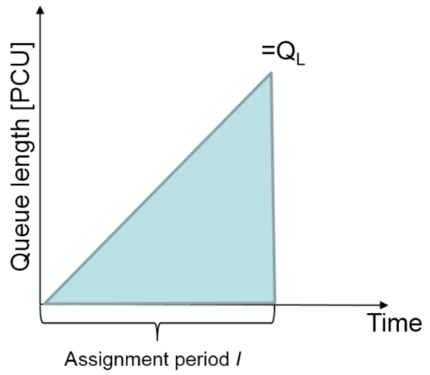
Queuing effect is a part of sophisticated blocking back model (calculated in iterations), in case of the Canterbury Model using excess congestion factor for turns and links.

For a single link L, the excess congestion factor $\sigma_{Link}(L)$ is given by:

$$\sigma_{Link}(L) = \frac{VolDem(L)}{Cap(L)}$$

Here, $VolDem(L)$ is the link volume resulting from assignment, $Cap(L)$ is the PrT capacity of the link. Analogously, for turns T, excess congestion factors $\sigma_{Turn}(T)$ is defined.

The percentage of traffic corresponding to the reciprocal of this number can pass through the network without any congestion. If σ ⩽ 1, the procedure is not carried out. In this case, the corrected volumes (Vol) equal the volumes calculated in the assignment (*VolDem*), thus no congestion occurs, otherwise there is no more free capacity available, the procedure terminates, and the wait time *W(L)* is calculated.



This is expressed by the following formula:

$$W(L) = I * \frac{Q(L)}{2}$$

Where I is the assignment time (3600 seconds in Canterbury Model for both AM and PM). The wait time is determined based on the assignment time and the queue length, reducing speed (increasing time) on the traveling paths passing though the link or turn, thus affecting rerouting in the following iteration. Within blocking back model average space required for car unit: 7m is used and the stocking capacity of links is calculated, if the queue length exceeds link length it's extended to other link(s).

Queuing in peaks along journey time routes in Canterbury City is summarized in Table 7-3 and Table 7-4 below.

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Total AM	Compared to Baseline
Forecast Baseline	11	0	0	0	0	0	0	11	-
Option 1	20	77	0	6	0	0	0	103	92
Option 2	19	38	0	0	0	0	0	58	46
Option 3	162	268	0	0	0	0	0	430	419
Option 4	215	211	0	0	24	10	0	460	449
Option 5	88	0	0	0	23	39	0	150	138

Table 7-3 AM queue lengths in vehicles

	Route 1	Route 2	Route 3	Route 4	Route 5	Route 6	Route 7	Total PM	Compared to Baseline
Forecast Baseline	54	0	0	0	0	0	0	54	-
Option 1	93	0	0	0	0	0	12	104	51
Option 2	84	0	0	0	0	0	9	94	40
Option 3	148	156	0	0	0	39	29	371	318
Option 4	142	120	0	0	0	5	8	275	222
Option 5	2	0	0	0	0	9	0	11	-42

Table 7-4 PM queue lengths in vehicles

Queue lengths in Canterbury LPR schemes are highly related to number of new developments proposed near City. Options 3, 4 and 5 share highest overall queue lengths (Option 3 being the highest), while developments near coast in Option 2 show limited queuing compared to the Baseline Forecast.

It is worth to note that on Route 1 queue builds up in every scenario (all Options and Baseline). Another congested route is Route 2, especially in Option 3 (due to concentrated developments near City with limited travel alternatives) and in Option 4 (with bypass roads but with concentrated developments near City). In Option 5 includes similar level of development allocation and bypass alternatives as in Option 4, however this gives different pattern of queuing on Route 2 and Route 6 due to the inclusion of Blockers scheme.

The relative queue length plot is included in Appendix H for each Option. Relative queue length is a link length percentage taken by the queue.

7.2.3 Summary of City Centre Journey time and queue length

Overall, the changes in City centre journey times vary depending on the proposed schemes per option. In addition to this and where no proposed schemes are considered, journey time change is affected by the housing allocation around the City centre. Table 7-5 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1 and Option 2	Option 3 & Option 4	Option 5
City Centre Journey Time	Increase by around 40 sec to 50 sec	Increase by around 3 min 10 sec to 3 min 15 sec	Increase by over 3 min 40 sec
Queue length	< 150 vehicles	Over 500 vehicles	around 150 vehicles
Comments	**Ranked 1st** Option 1 & Option 2 show slight increases in City Centre journey times compared to Forecast Baseline, by around 5%-10%. This slight change is as a result of household increase planned around the City centre and coastal area as well as the absence of schemes included in City Centre.	**Ranked 3rd** Option 3 & Option 4 show moderate increases in City Centre journey times compared to Forecast Baseline, by around 30%. This is as a result of the reduced capacity in the city centre due to local traffic restrictions. In addition to this, the increased number of planned households near the City centre lead to greater journey time increase.	**Ranked 2nd** Option 5 show significant increases in City Centre journey times compared to Forecast Baseline, by around 50%. Similar to Option 3 and Option 4, this is as a results of local traffic restrictions that reduce capacity in the city centre. In addition, there are more restrictions on the parallel roads around the city centre.

Table 7-5 City Centre Journey Time Change – Summary

7.3 City Centre inbound flows

7.3.1 Inner cordon

The routes presented in Figure 7-4 were used to analyse and compare inbound Inner cordon City centre flows between the modelled LPR Options and the Forecast Baseline scenario. The modelled flows per option are presented in Table 7-6.

	Forecast Baseline	Option 1	Option 2	Option 3	Option 4	Option 5
Inbound flows						
AM	7079	7627	7307	5925	5977	5522
PM	6028	6369	6127	4934	4732	4774
Percentage change to Baseline						
AM	-	8%	3%	-16%	-16%	-22%

	Forecast Baseline	Option 1	Option 2	Option 3	Option 4	Option 5
PM	-	6%	2%	-18%	-22%	-21%

Table 7-6 Inner cordon: Inbound City Centre Flows

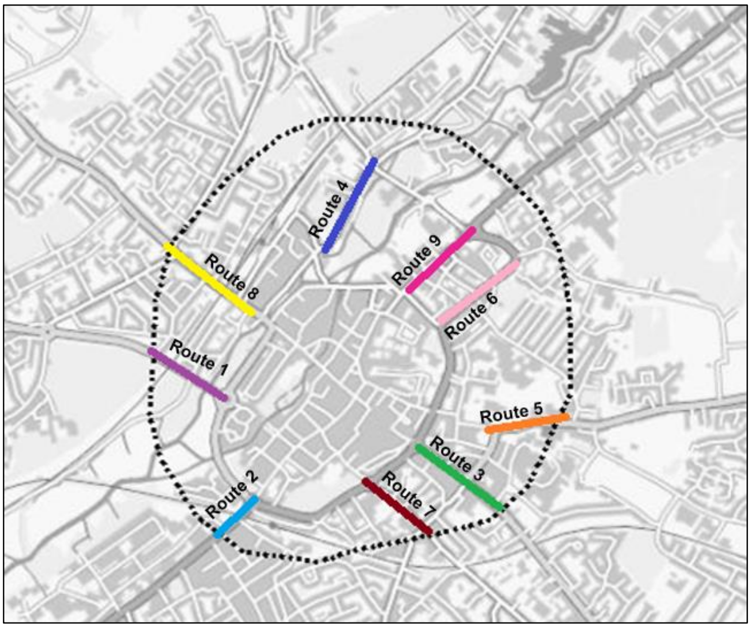


Figure 7-4 Inner cordon: City Centre Inbound Flow Locations

For the inner cordon, Inbound City centre flows of Option 1 and Option 2 resulted in moderate and minor increase respectively, compared to the Forecast Baseline scenario. This increase does not exceed 10% for Option 1 and 5% for Option 2. Higher in Option 1 is a result of the development location close to the city centre. The rest of options resulted in decreased inbound flows compared to the Forecast Baseline for both peak periods. Option 3 showed an average decrease of 17% compared to the Forecast Baseline, whereas Option 4 and Option 5 resulted in an average of 19% and 22% decrease respectively. Despite Option 4 and Option 5 share similar level of development and major schemes, inbound flows vary depending on the city centre proposed traffic restrictions. With city centre restrictions in place, traffic uses the local minor roads to access the city in Option 4. On the contrary, Option 5 with "blockers", prohibits city access through the minor local roads which forces traffic to use the main corridors (shown in Figure 7-4). The results are summarised in Figure 7-5 and Figure 7-6 below.

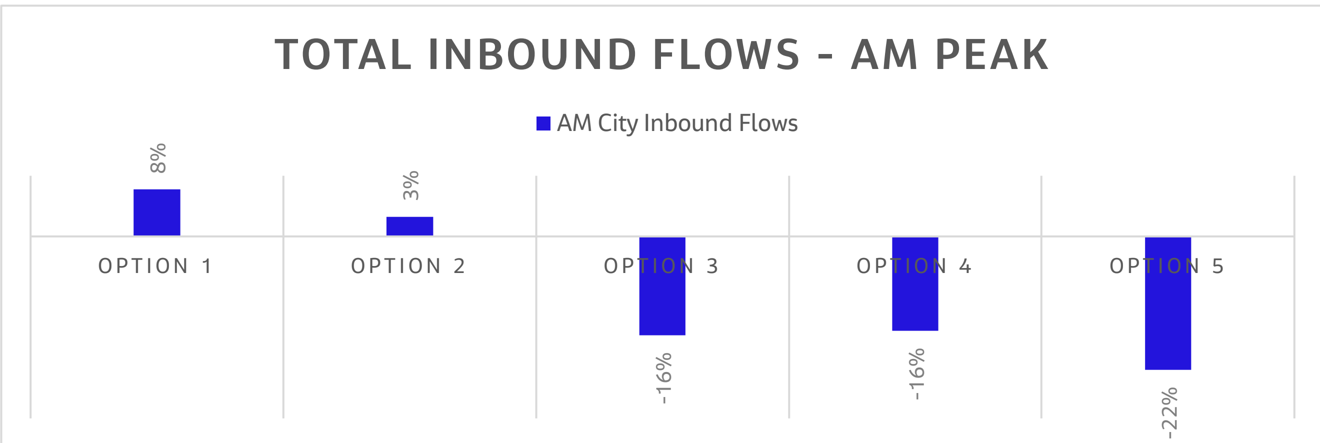


Figure 7-5 Inner cordon: Inbound AM flows % Change Compared to Forecast Baseline

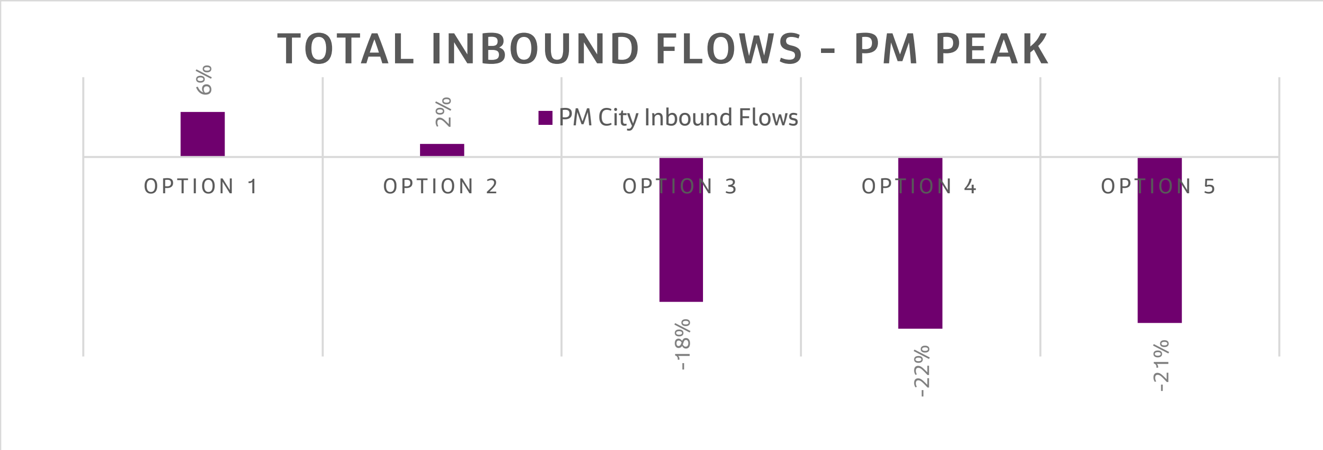


Figure 7-6 Inner cordon: Inbound PM flows % Change Compared to Forecast Baseline

7.3.2 Outer cordon

An outer cordon was created to assess inbound flows on the edges of the city centre. The routes considered in this analysis are presented in Figure 7-7 and allow the comparison between the modelled LPR Options and the Forecast Baseline inbound flows. The modelled flows per option are presented in Table 7-7.

For the outer cordon inbound flows, the percentage changes displayed similar to that of the inner cordon. Option 1 and Option 2 suggest increased inbound flows, compared to the Forecast Baseline, of an average of 10%. Option 3 showed an average reduction in inbound flows of 7%, while Option 4 and 5 resulted in average 9% and 6% decrease respectively, compared to the Forecast Baseline. Overall, the reduction in inbound flows for the outer cordon is comparatively less than inner cordon as it is not constrained for the traffic to get through these locations that form the outer cordon. The results are summarised in Figure 7-8 and Figure 7-9 below.

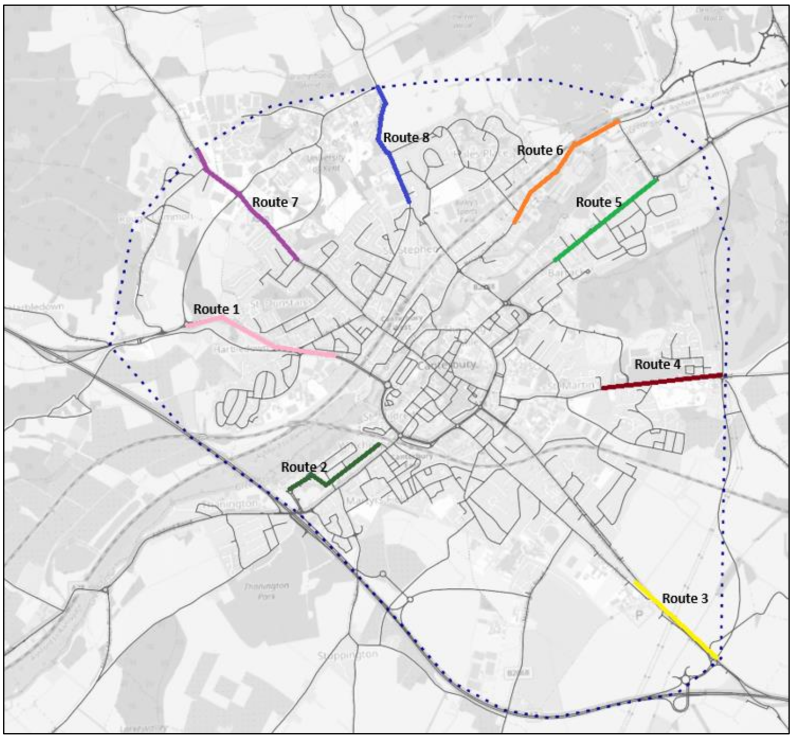


Figure 7-7 Outer cordon: City Centre Inbound Flow Locations

	Forecast Baseline	Option 1	Option 2	Option 3	Option 4	Option 5
Inbound flows						
AM	7412	7643	7585	7025	6873	6711
PM	5103	5523	5123	4710	4548	4987
Percentage change to Baseline						
AM	-	3%	2%	-5%	-7%	-9%
PM	-	8%	0%	-8%	-11%	-2%

Table 7-7 Outer cordon: Inbound City Centre Flows

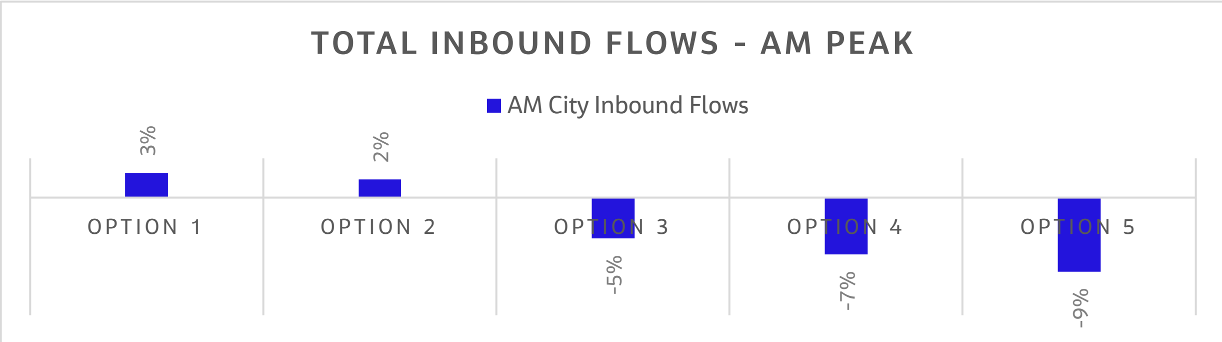


Figure 7-8 Outer cordon: Inbound AM flows % Change Compared to Forecast Baseline

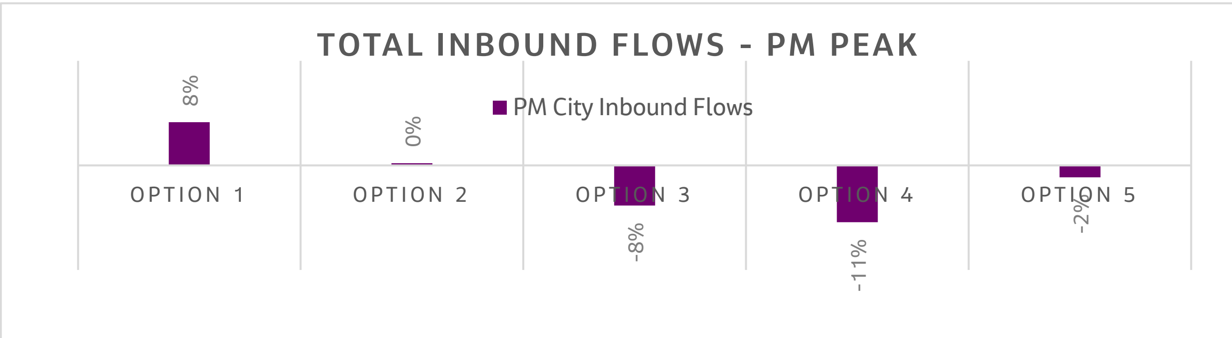


Figure 7-9 Outer cordon: Inbound PM flows % Change Compared to Forecast Baseline

7.3.3 Summary of City Centre inbound flows

Overall, the changes in flows towards the City centre depend on the proposed schemes per option. In addition to this, housing allocation around the city centre affects inbound traffic flows. Table 7-8 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1 and Option 2	Option 3	Option 4	Option 5
Average % Change - Inner Cordon	Increase: < 10%	Decrease < 20%	Decrease < 20%	Decrease > 20%

	Option 1 and Option 2	Option 3	Option 4	Option 5
Average % Change - Outer Cordon	Increase: < 10%	Decrease: ~ 7%	Decrease: ~9%	Decrease: ~ 6%
Comments	**Ranked 4th** Option 1 and Option 2 share similar trends with Option 1 having almost double the effect of Option 2. The absence of City Centre traffic restrictions and the allocation of planned developments close to the city resulted in increased flows.	**Ranked 3rd** Option 3 introduces local schemes that reduce capacity in the City centre (Bus lane approach, Signalised junctions etc). This option's schemes discourage inbound City centre flows that resulted in almost 10% reduction compared to Forecast Baseline.	**Ranked 2nd** Option 4 showed substantial decrease in inbound flows, compared to Forecast Baseline that was close to 15%.	**Ranked 1st** Option 5 showed a decrease of around 13% compared to Forecast Baseline. Due to Blockers on minor roads around the City Centre, traffic is forced to use main corridors discouraging inbound flows.

Table 7-8 City Centre Inbound Flows Change – Summary

7.4 City Centre Dispatched traffic

7.4.1 Dispatched traffic analysis

Major infrastructure schemes proposed for the Local Plan scenarios (for Option 4 and Option 5) regard the construction of alternative routes on the east and west of the city. This allows for traffic diversion for Option 4 and Option 5 while rest options have restricted route alternatives. This results in so called "artificial bypasses" as presented in Figure 7-10 towards the city centre, using residential local roads.

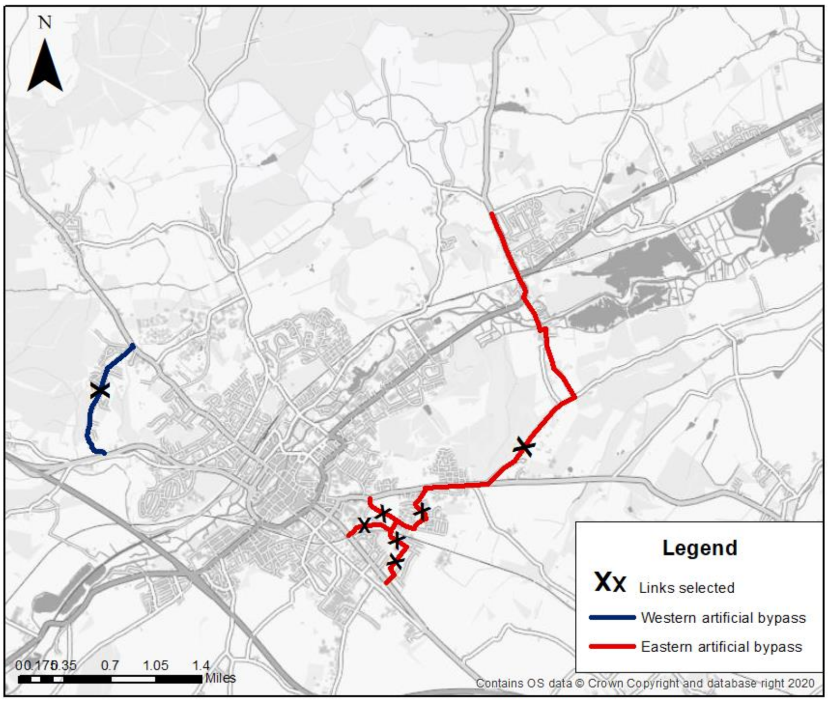


Figure 7-10 Dispatched traffic - Artificial bypasses

Table 7-9 allows for the analysis of dispatched flows per option compared to the Forecast Baseline, in order to further assess option performance. Table results are summarised in Figure 7-11 and Figure 7-12. In this case, traffic from main corridors is dispatched to minor roads with increased traffic flows. A straightforward example derives from the comparison of Option 3 with Option 5, with the first lacking alternative routes allowing for residential road usage and the second providing bypass options and restricting local road traffic. Indicative flow bundles in Figure 7-13 and Figure 7-14 visualise dispatched traffic to either residential roads or suggested bypasses.

	Baseline	Option 1	Option 2	Option 3	Option 4	Option 5
Absolute flows						
AM	1724	2214	1918	2489	1474	815
PM	2542	3116	2778	3241	1992	1592
Flow difference vs Baseline						
AM	-	28%	11%	44%	-14%	-53%
PM	-	23%	9%	28%	-22%	-37%

Table 7-9 Dispatched traffic - Inbound Flows

Flows in artificial by passes depended on the level of development around the city centre and the alternative route options. This resulted in increase in traffic flows for Option 1 to Option 3 that do not include major infrastructure schemes, while Option 4 and Option 5 resulted in decreased flows due to proposed bypasses. In particular, Option 3 experienced the highest flow increase on the "artificial bypasses" of almost 36% on average, for both peaks. This follows the level of development around the city centre and the city centre schemes to reduce traffic. Hence, flows are accommodated through peripheral residential roads. Option 1 experienced an increase of 26% on average due to development allocation around the city centre. Option 2 saw a moderate increase in flows of 10%. After incorporating the Western and Eastern bypass and despite the fact that Option 4 and Option 5 regarded the highest level of development, dispatched flows decreased almost 20% and 45% respectively. It is clear that city centre traffic restrictions for Option 5 had a severe impact on dispatched flows due to the "blockers".

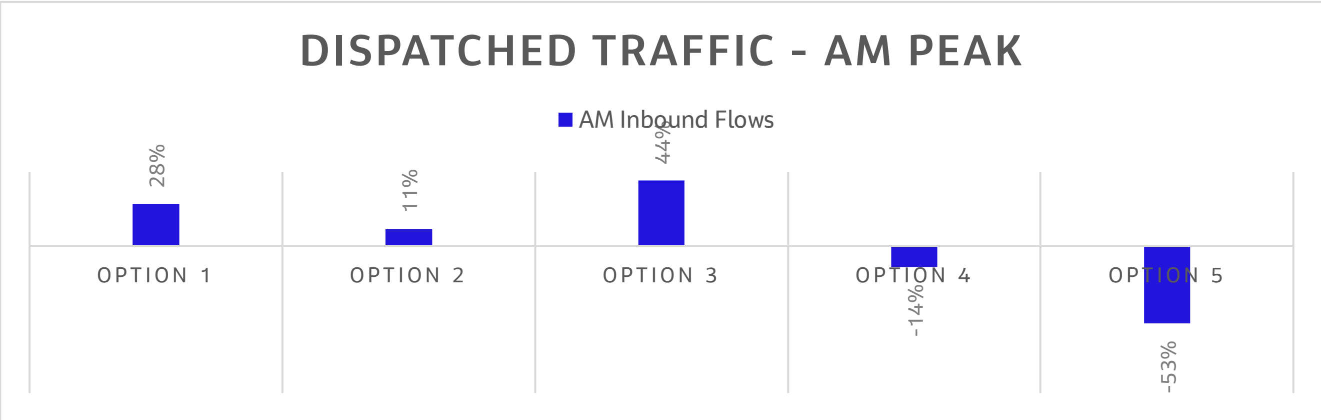


Figure 7-11 Dispatched traffic: Inbound AM flows % Change Compared to Forecast Baseline

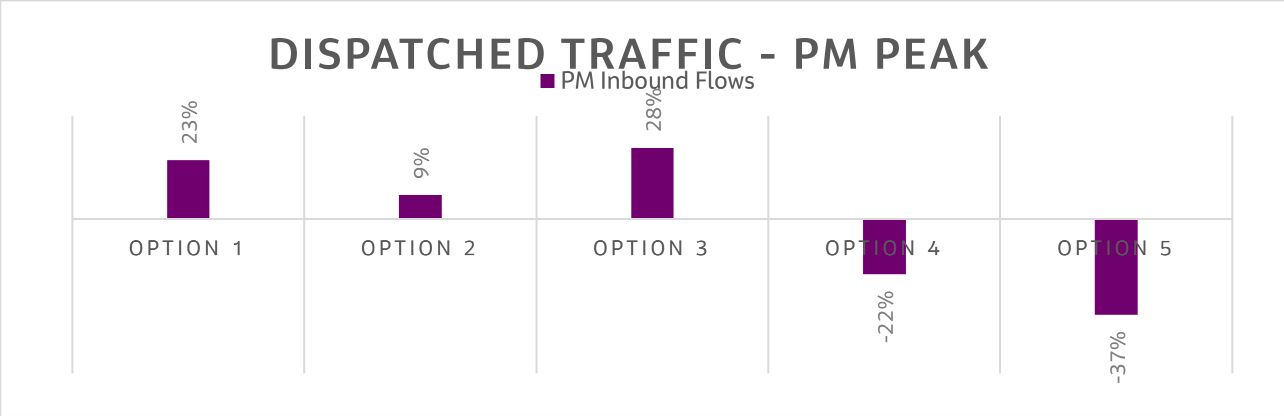


Figure 7-12 Dispatched traffic: Inbound PM flows % Change Compared to Forecast Baseline

Figure 7-13 Dispatched traffic - Western bypass

Left side of Figure 7-13 illustrates how traffic flow is routed in Option 3 and right side represents Option 5. On the left the “artificial western bypass” accommodates traffic through local roads while on the right and Option 5 traffic is restricted in main corridors. Similarly, in Figure 7-14, Option 3 is shown on the left side dispatching traffic through Fordwich. On the contrary, flows on Option 5 (right side) are routed towards the Eastern bypass, Littlebourne road and Dover roads.

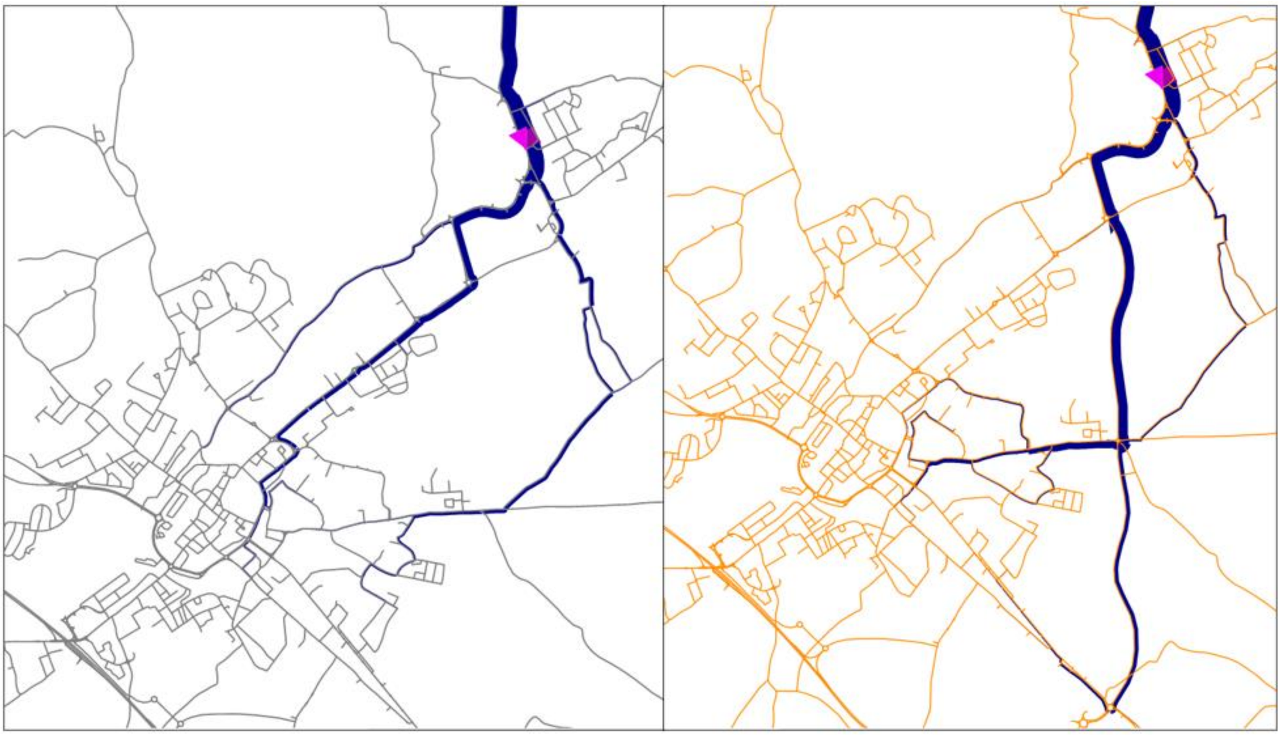


Figure 7-14 Dispatched traffic - Eastern bypass

7.4.2 Summary of City Centre dispatched traffic

Overall, the changes in dispatched traffic towards the City centre depend on the proposed schemes per option. In addition to this, housing allocation around the city centre affects inbound traffic flows. Table 7-10 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1 and Option 2	Option 3	Option 4	Option 5
Dispatched traffic % change	Increase: < 30%	Increase: 36%	Decrease: ~ 20%	Decrease: 45%
Comments	**Ranked 3rd** Option 1 and Option 2 share similar trends with Option 1 having almost double the effect of Option 2. The absence of City Centre traffic restrictions and the allocation of planned developments close to the city resulted in increased flows. Journey time on dispatched routes increased.	**Ranked 4th** Option 3 introduces local schemes that reduce capacity in the City centre (Bus lane approach, Signalised junctions etc). This option's schemes discourage inbound City centre flows. However, residential roads are stretched with over 35% increase in flows and some noticeable increase in travel time of dispatched routes.	**Ranked 2nd** This option's schemes discourage inbound flows and reroutes traffic to the bypasses resulting in 20% in dispatched traffic. Notable significant decrease in travel time on dispatched routes ~ 25%	**Ranked 1st** Due to Blockers on minor roads around the City Centre, traffic is forced to use main corridors discouraging inbound flows and displaying a substantial 45% decrease in dispatched traffic. Travel time on dispatched roads is decreased slightly.

Table 7-10 City Centre Dispatched traffic change – Summary

7.5 Junction Performance (LOS)

In order to draw conclusion on the City centre traffic conditions, the LPR Options were compared with the Forecast Baseline scenario regarding the local LOS. The most impaired junctions of class D to class F, in both AM and PM peak period, were considered in this analysis creating congestion hotspots.

The congestion hotspots as modelled for the Forecast Baseline are presented in Figure 7-15 below. There is a total of twenty-three congestion hotspots, where ten hotspots are located on the approach to Canterbury city Centre (including three class F). Five of those are in close proximity to the Ring road (including two class F). There are two hotspots on the A2 interchange and another on the wider approach to the City Centre. Herne Bay has one hotspot, in and three hotspots in close proximity to Whitstable are situated on the A299 and the A2990 (including one class E). Overall, most congestion hotspots are located in the City centre, while the coastal area also presents impaired junctions (on approach to Whitstable).

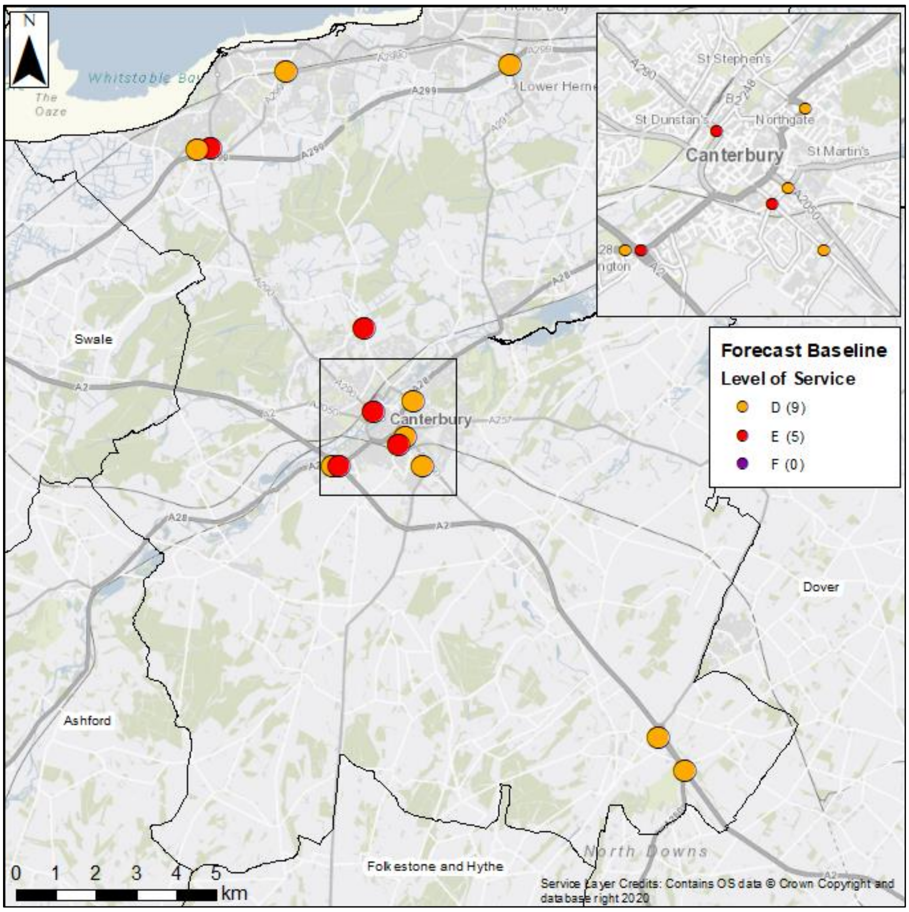


Figure 7-15 Congestion hotspots Forecast Baseline

Table 7-11 presents the congestion hotspots change in each option compared to Forecast Baseline.

Scenario	D	E	F	Hotspot Score (D=1,E=2,F=3)	Difference from Forecast Baseline Score
Forecast Baseline	9	5	0	19	
Option 1	8	7	3	31	+12
Option 2	7	6	1	22	+3

Scenario	D	E	F	Hotspot Score (D=1,E=2,F=3)	Difference from Forecast Baseline Score
Option 3	12	2	6	34	+15
Option 4	8	8	6	42	+23
Option 5	10	10	2	36	+17

Table 7-11 Congestion Hotspots Change

Option 1 shows an increase in Hotspot score from the Forecast Baseline of 12 points, where level D is scored 1, level E is scored 2 and level F is scored 3. Option 1 includes three level F hotspots located at A2/A28 Wincheap Junction, A2050 London Road Roundabout and St Dunstans Street/North Lane.

Option 2 has a hotspot score just 3 points more than the Forecast Baseline. Option 2 only has one level F hotspot (A299/A2990 Thanet Way junction).

Option 3 shows an increase in Hotspot score of 15 points. There are six locations in Option 3 with level F hotspots (A2/A28 Wincheap Junction and five on or close to Canterbury Ring Road).

Option 4 has the highest increase in Hotspot score of 23 points. These include six level F hotspots (A2/A28 Wincheap Junction, four on or close to Canterbury Ring Road and one at Canterbury Hill/Giles Lane roundabout north of Canterbury).

Despite only two level F hotspots (one on Canterbury Hill and one close to the B2068 south of Canterbury), Option 5 has the second highest increase in Hotspot score of 17 points due to the higher number of level D and E hotspots.

7.5.1 Summary of junction performance (LOS)

Overall, the changes in junction performance, between the LPR Options and the Forecast Baseline, are captured through the congestion hotspots monitoring junction of D, E and F class for both the AM and PM peak. Table 7-12 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1 and Option 2	Option 3 and Option 5	Option 4
Change in Congestion Hotspot Score	< 15 points	5 to 20 points	>20 points
Comments	**Ranked 1st** Option 1 & Option 2 show slight increase in congestion hotspot score to Forecast Baseline, by less than 15 points	**Ranked 2nd** Option 3 and Option 4 show moderate increases in congestion hotspot score to Forecast Baseline that do not exceed 20 points.	**Ranked 3rd** Option 4 shows significant increases in congestion hotspot score to Forecast Baseline resulting to 23 points.

Table 7-12 Congestion hotspots - Summary

7.6 Wider Area Network Performance

7.6.1 Wide Area Network Journey time

Five key routes have been considered for journey time comparison between the modelled LPR Option outputs and the Forecast Baseline. The routes for journey time comparison have been selected based on highest Ward-to-ward movements and trips outside of City Centre. The journey time analysis is based on shortest (quickest) path route between estimated centre of transport activity for each Ward. The simplified locations of journey time routes for wider area are shown in Figure 7-16.

Wider area routes include:

- Route 1: Sturry to Barton;
- Route 2: Herne & Broomfield to Barton;
- Route 3: Heron to Barton;
- Route 4: Gorrell to Blean Forest; and
- Route 5: St Stephens to Blean Forest.

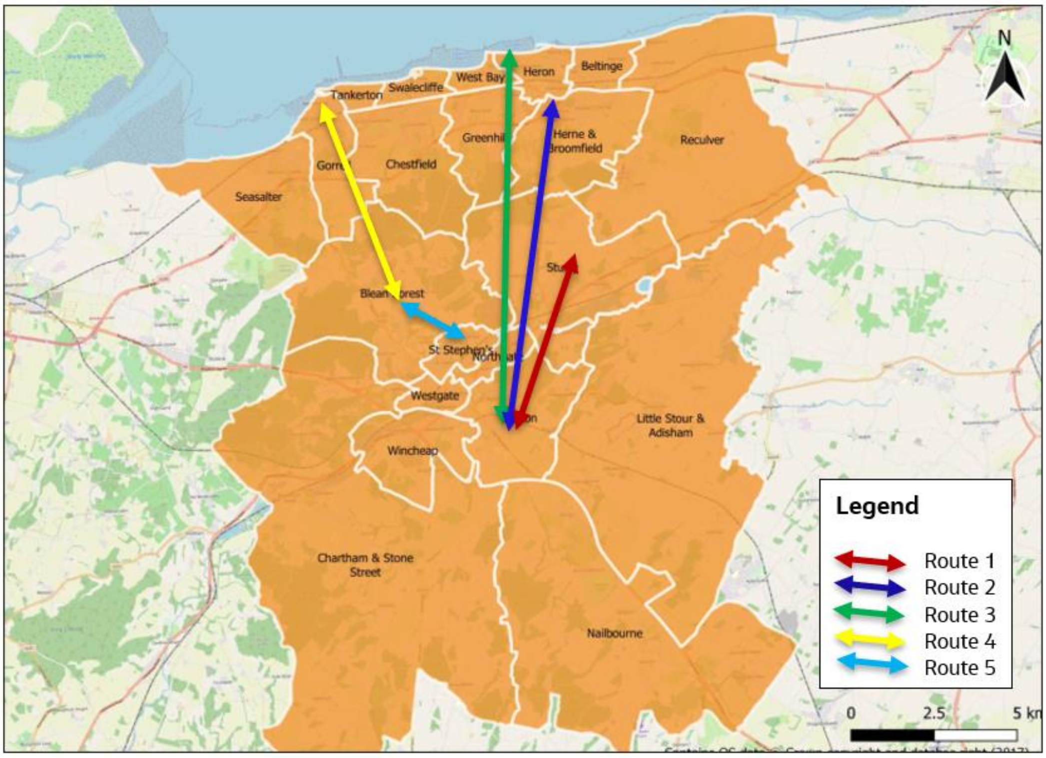


Figure 7-16 Journey Time – Wider network routes

The modelled wider area journey times per route per option are presented in (Table 7-13 and) Figure 7-17 and Figure 7-18.

Route	Forecast Baseline (mm:ss)		Option 1 (mm:ss)		Option 2 (mm:ss)		Option 3 (mm:ss)		Option 4 (mm:ss)		Option 5 (mm:ss)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Route 1	19:50	14:32	26:10	16:04	23:18	14:59	23:55	15:54	18:07	12:22	24:03	15:07
Route 2	27:27	21:30	34:18	23:17	31:37	21:57	32:09	23:03	27:05	19:50	33:06	22:41
Route 3	29:17	23:39	36:16	25:59	32:59	24:07	34:46	25:51	29:42	22:45	35:45	25:34
Route 4	15:41	13:55	18:39	14:32	17:09	14:12	15:46	14:08	15:44	14:10	17:10	14:58
Route 5	07:34	08:15	08:09	09:43	07:48	08:59	07:31	08:43	07:31	08:09	13:39	13:58

Table 7-13 Wider Area Routes Travel Time

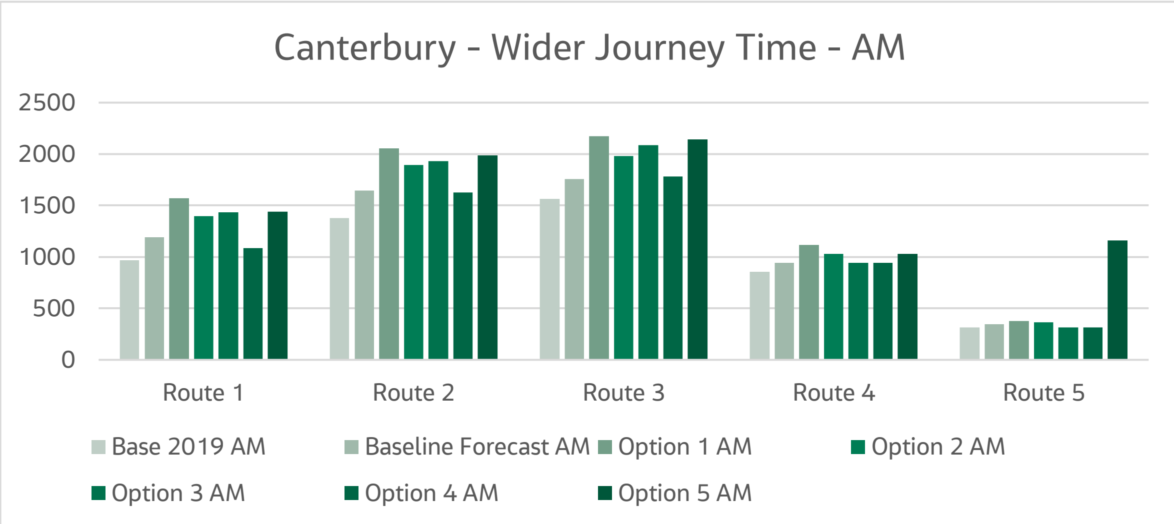


Figure 7-17 AM Journey Time – Wider Network Routes

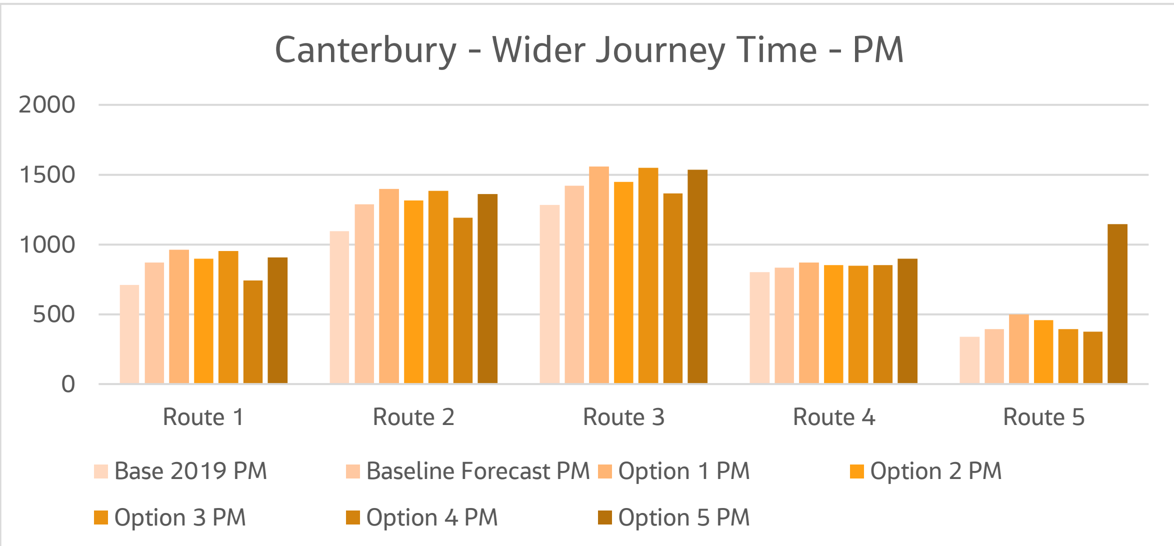


Figure 7-18 PM Journey Time – Wider Network Routes

As seen in Figure 7-17 and Figure 7-18 above, Route 1, Route 2 and Route 3 are mostly affected among various options. Blean Forest area (University), included in route 4 and 5, are highly affected by limited access alternatives in Option 5 due to blockers scheme, but overall changes for those routes are limited.

Option 1 shows moderate increases in journey times compared to Forecast Baseline, by around 20% in AM and 15% in PM. This increase derives from the planned development allocation across Canterbury County with limited mid-to-long distance route alternatives. The Option 5 blockers scheme restricts not only City Centre area, but also roads crossing existing developments, affecting the journey times the most; around 50% in AM, and around 40% in PM. Option 2&3 show slight increases in journey times compared to Forecast Baseline, by around 10% in AM and 5% in PM.

Option 4 in wider area represents balanced effect of City-related restriction schemes, supported by road network improvement scheme. Overall route journey times change for Option 4 versus Baseline Forecast, from 2% to -15%, averaging at -5% overall time decrease.

The journey time differences between the LPR Options and the Forecast Baseline scenario for the AM and PM peaks are presented in Table 7-14.

Route	Option 1 (mm: ss)		Option 2 (mm: ss)		Option 3 (mm: ss)		Option 4 (mm: ss)		Option 5 (mm: ss)	
	AM	PM	AM	PM	AM	PM	AM	PM	AM	PM
Route 1	06:20	01:32	03:28	00:27	04:05	01:22	-01:43	-02:10	04:13	00:35
Route 2	06:51	01:47	04:10	00:27	04:42	01:33	-00:22	-01:40	05:39	01:11
Route 3	06:59	02:20	03:42	00:28	05:29	02:12	00:25	-00:54	06:28	01:55
Route 4	02:58	00:37	01:28	00:17	00:05	00:13	00:03	00:15	01:29	01:03
Route 5	00:35	01:28	00:14	00:44	-00:03	00:28	-00:03	-00:06	06:05	05:43
Average	03:09		01:32		02:01		-00:37		03:26	

Table 7-14 Change in wider area journey times compared to Forecast Baseline (in min:ss)

7.6.2 Summary of Wider Area Journey time

Overall, the changes in Wider Area journey times vary depending on the proposed schemes per option. In addition to this and where no proposed schemes are considered, journey time change is highly affected by the housing allocation in areas surrounding Canterbury as well as City Centre. Table 7-15 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1 & Option 5	Option 2	Option 3	Option 4
Average	Over 3 min	1 min 30 sec	2 min	- 40 sec
Comments	**Ranked 4th** Option 1 and Option 5 displayed the highest increase in wider area journey times compared to the Forecast Baseline.	**Ranked 2nd** Option 2 resulted in limited increase in wider area journey times.	**Ranked 3rd** Option 3 displayed a slight difference in wider area journey times compared to Forecast Baseline.	**Ranked 1st** Option 4 resulted in 40 seconds time decrease compared to Forecast Baseline.

Table 7-15 Change in Wider Area Journey Times Compared to Forecast Baseline (in min:ss)

8. PT and Active Travel Accessibility

8.1 Introduction

This chapter provides high level analysis of Public Transport (PT) and Active Travel accessibility across the Canterbury City Council district for a series of five spatial options described previously in this report. A consideration of Sustainable Travel interventions is included in the Section 9.

Each option contains different housing allocations across district. The dwellings allocated to each area of search are shown in Figure 8-1.

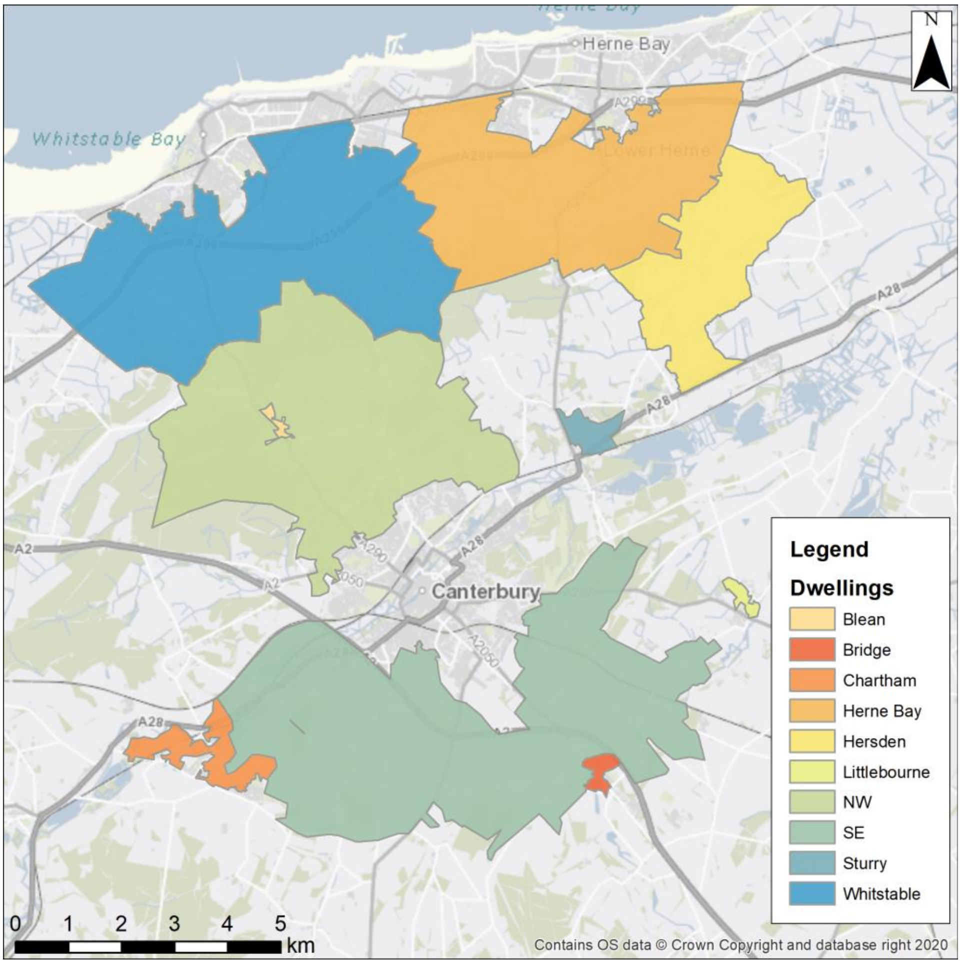


Figure 8-1 Canterbury Local Plan areas of search

Table 8-1 in next page, shows the location of housing allocations in each area of search per option.

Area of Search	Housing			
	Option 1	Option 2	Option 3	Option 4/5
SE	3000	1000	2000	7000
Whitstable	500	2000	1000	1000
NW	1000	1000	2000	2000
Herne Bay	1500	2000	1000	1000
Hersden	60	60	60	60
Chartham	60	60	60	60
Sturry	200	200	200	200
Bridge	60	60	60	60
Littlebourne	60	60	60	60
Blean	60	60	60	60
Total	**6500**	**6500**	**6500**	**11500**

Table 8-1 Housing Allocation in each dwelling by option

8.2 Methodology

The PT and Active Mode accessibility assessments were undertaken by using data output from TRACC software, used to analyse public transport and active travel time. This works by calculating journey times by mode to destinations, in this case to the key settlements of Canterbury; Herne Bay and Whitstable, for PT journeys this includes both the journey time and the time to walk to the bus stop or rail station. The software has been used to produce isochrones showing the distances achieved by selected mode up to 30 minutes from each key centre, 30 minutes being chosen as an acceptable length of journey for most local journey purposes.

With regard to PT, large developments are likely to support the introduction of new routes, but the most likely to be financially sustainable are those expanding on the current network. It is therefore assumed future PT networks would build on existing PT routes and therefore existing PT networks are considered a good proxy for future opportunities.

The data is used in conjunction with housing settlement data to compare each Spatial Option. The area of housing settlements that is overlapped by the TRACC output is used to calculate the percentage of the housing settlement area within a 30 minute travel time to a key centre. An average is calculated by weighting results by household numbers.

8.3 Public Transport Access to Key Centres

This section provides an analysis on the access by public transport to the areas of search identified in Figure 8-1. Figure 8-2 shows the areas of search against the aforementioned isochrones that show the public transport access to key centres within a 30 minute journey time. The analysis is based on Figure 8-2.

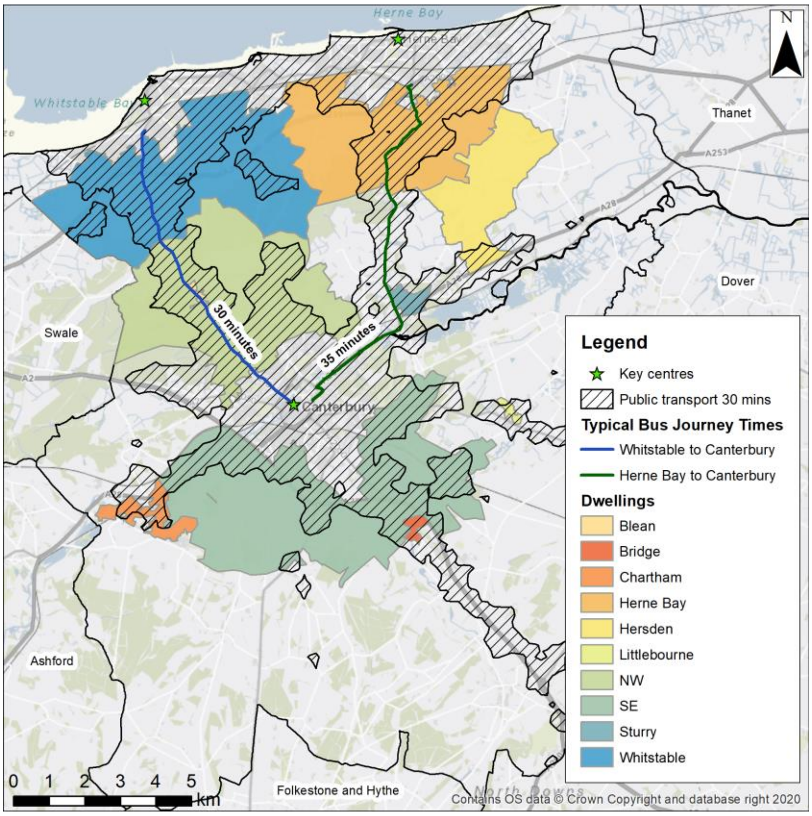


Figure 8-2 Canterbury district areas of search and public transport access within 30 minutes of key centres

Typical bus journey times have been added to the Figure above to illustrate that whilst many areas are within 30 minutes of one of the three key centres. Locations to the north of the district are not within 30 minutes of Canterbury City Centre, with bus journey times alone being at least 30 minutes.

An additional analysis has been undertaken in Section 8.4 to investigate PT accessibility to Canterbury City Centre only.

8.3.1 Option 1 Public Transport (Key Centres)

In summary, the South Canterbury has the greatest number of housing in Option 1 (Table 8-2), but only a 42% coverage of access by current public transport within a 30 minute journey time. Herne Bay and the North Canterbury have relatively large public transport coverages, both with over 50% access by public transport. Whitstable has fewer housing but has over 50% public transport coverage. 98% of Sturry is within public transport access to key centres. Option 1 shows a weighted average of 49.2% of access by public transport.

Area of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	3000	42.0%
Herne Bay	1500	51.9%
North Canterbury	1000	50.7%
Whitstable	500	51.7%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**49.2%**

Table 8-2 Option 1: Access to key centres

8.3.2 Option 2 Public Transport (Key Centres)

In summary, Whitstable and Herne Bay, which include the largest numbers of housing for Option 2 (Table 8-3), show over 50% of access by public transport within a 30 minute journey time. This high coverage is due to proximity to key centres and bus routes on main roads (A299, A290, and Herne Bay Road). The South Canterbury has a lower current public transport coverage. The North Canterbury also has over 50% coverage of public transport, and this follows from the area's proximity to the A290 and St Stephen's Hill, between Whitstable and Canterbury key centres. The majority of Sturry is within public transport access to key centres. Option 2 shows a weighted average of 52.2% of access by public transport.

Housing	Area of Search	% of access to area by public transport within 30 minutes
Whitstable	2000	51.7%
Herne Bay	2000	51.9%
South Canterbury	1000	42.0%
North Canterbury	1000	50.7%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**52.2%**

Table 8-3 Option 2: Access to key centres

8.3.3 Option 3 Public Transport (Key Centres)

In summary, the North Canterbury and South Canterbury areas, with the largest numbers of housing for Option 3 (Table 8-4), have reasonable public transport access with 50.7% and 42%, respectively. The South Canterbury has less coverage of public transport due to the relatively large rural area of the dwelling, and the dispersal of main roads, including the A2050 and the A28. Herne Bay and Whitstable areas both have a similar public transport coverage, and this is due to the proximity to key centres and the bus services between the three centres. Similarly to Option 1 and 2, the majority of Sturry is within public transport access to key centres. Option 3 shows a weighted average of 50.5% of access by public transport.

Area of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	2000	42.0%
North Canterbury	2000	50.7%
Whitstable	1000	51.7%
Herne Bay	1000	51.9%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**50.5%**

Table 8-4 Option 3: Access to key centres

8.3.4 Option 4/5 Public Transport (Key Centres)

In summary, the South Canterbury area has the largest number of housing for Option 4 and Option 5 (Table 8-5) with 7000 homes, however a relatively low coverage of public transport access within a 30 minute journey time. The North Canterbury area has a public transport access coverage of 50.7%, mainly due to the proximity of the A290 and St Stephen's Hill, between the Whitstable and Canterbury key centres. As with option 3, Herne Bay and Whitstable areas both have a similar public transport coverage, with the same number of housing. Sturry is also within public transport access to key centres. Options 4/5 shows a weighted average of 46.8% of access by public transport.

Areas of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	7000	42.0%
North Canterbury	2000	50.7%
Whitstable	1000	51.7%
Herne Bay	1000	51.9%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**46.8%**

Table 8-5 Option 4 and Option 5: Access to key centres

8.3.5 Summary of Weighted Averages Public Transport (Key Centres)

	Option 1	Option 2	Option 3	Option 4/5
Weighted Average	49.2%	52.2%	50.5%	46.8%
Comments	**Ranked 3rd** South Canterbury area of search has the highest number of housing with less than average public transport coverage Herne Bay and North Canterbury have higher than the average coverage of public transport access	**Ranked 1st** Whitstable and Herne Bay with highest number of housing have the greatest relative public transport coverage North Canterbury also has good coverage South Canterbury has a low relative public transport coverage	**Ranked 2nd** South Canterbury area with the highest number of housing has low relative public transport coverage North Canterbury, Herne Bay and Whitstable have relatively good public transport access	**Ranked 4th** South Canterbury area with highest number of housing has low relative public transport coverage North Canterbury, Herne Bay and Whitstable have relatively good public transport access

Table 8-6 Access to key centres - Summary

8.4 Public Transport Access to Canterbury City Centre Only

Figure 8-3 shows the areas of search against the aforementioned isochrones that show the public transport access to Canterbury city centre within a 30 minute journey time.

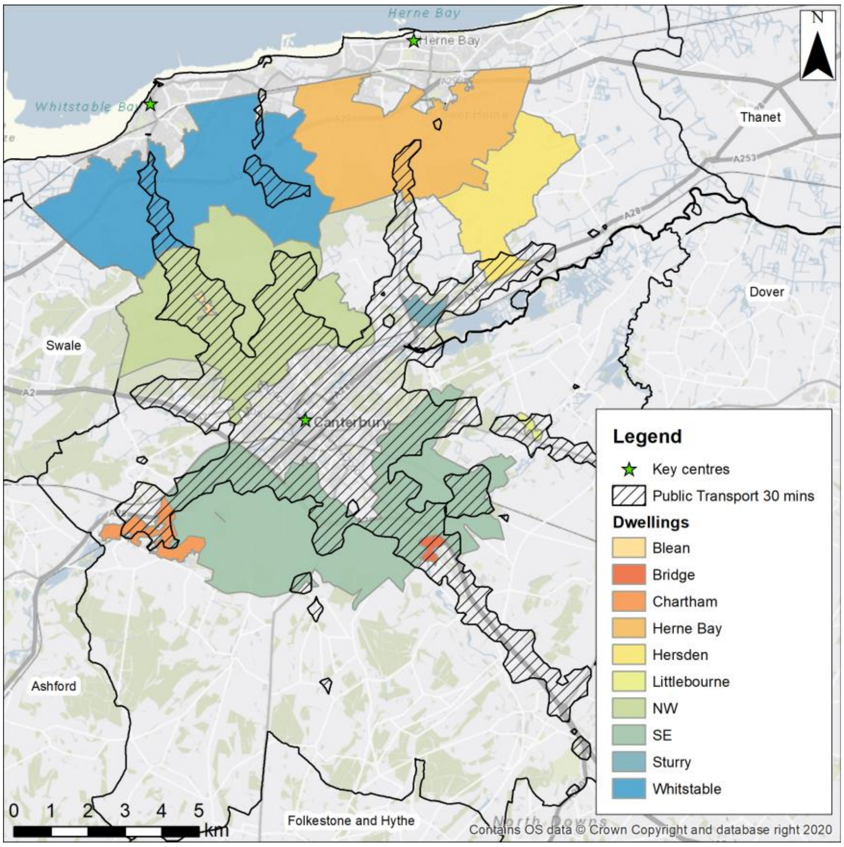


Figure 8-3 Canterbury district areas of search and public transport access within 30 minutes of Canterbury city centre

8.4.1 Option 1 Public Transport (Canterbury City Centre)

In summary, the South Canterbury area of search still has a 42% coverage of access by current public transport within a 30 minute journey time (Table 8-7). However, compared to when three key centres were considered, Herne Bay now has very low public transport access with 4.5%, whilst the North Canterbury area has a relatively large public transport with 48.4% coverage. Whitstable has fewer housing, and also low coverage of public transport access with 11.1%. 97.8% of Sturry is within public transport access to Canterbury. Option 1 shows a weighted average of 34.8% of access by public transport.

Areas of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	3000	42.0%
Herne Bay	1500	4.5%
North Canterbury	1000	48.4%
Whitstable	500	11.1%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**34.8%**

Table 8-7 Option 1: Access to the City centre

8.4.2 Option 2 Public Transport (Canterbury City Centre)

In summary, Whitstable and Herne Bay, with the two largest numbers of housing for Option 2 (Table 8-8), now show very low public transport coverage within a 30 minute journey time, due to the distance from Canterbury city centre. The South Canterbury and North Canterbury areas have higher public transport coverage, with over 40% access, and closer proximity to Canterbury city centre in comparison to Whitstable and Herne Bay. The majority of the Sturry is within public transport access to Canterbury city centre. Option 2 shows a weighted average of 24.8% of access by public transport.

Areas of Search	Housing	% of access to area by public transport within 30 minutes
Whitstable	2000	11.1%
Herne Bay	2000	4.5%
South Canterbury	1000	42.0%
North Canterbury	1000	48.4%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**24.8%**

Table 8-8 Option 2: Access to the City centre

8.4.3 Option 3 Public Transport (Canterbury City Centre)

In summary, the North Canterbury and South Canterbury areas of search, with the largest numbers of housing (Table 8-9), have reasonable public transport access with 48.4% and 42%, respectively. Herne Bay and Whitstable both have low public transport coverage, and this is due to the proximity to Canterbury city centre. Similarly to option 1 and 2, the majority of Sturry is within public transport access to Canterbury city centre. Option 3 shows a weighted average of 36.3% of access by public transport.

Areas of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	2000	42.0%
North Canterbury	2000	48.4%
Whitstable	1000	11.1%
Herne Bay	1000	4.5%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**36.3%**

Table 8-9 Option 3: Access to the City centre

8.4.4 Option 4/5 Public Transport (Canterbury City Centre)

In summary, South Canterbury area of search has the highest number of housing for Option 4 and Option 5 (Table 8-10) with 7000 homes, and a reasonable coverage of public transport access within a 30 minute journey time with 42%. The North Canterbury area has a public transport access coverage of 48.4%. Similar to option 3, Herne Bay and Whitstable both have a similar low public transport coverage, with the same numbers of housing. Sturry is also within public transport access to Canterbury city centre. Options 4/5 shows a weighted average of 38.7% of access by public transport.

Areas of Search	Housing	% of access to area by public transport within 30 minutes
South Canterbury	7000	42.0%
North Canterbury	2000	48.4%
Whitstable	1000	11.1%
Herne Bay	1000	4.5%
Sturry	200	97.8%
Hersden	60	8.2%
Chartham	60	46.6%
Bridge	60	100.0%
Littlebourne	60	76.3%
Blean	60	100.0%
	Weighted Average	**38.7%**

Table 8-10 Option 4 and Option 5: Access to the City centre

8.4.5 Summary of Weighted Averages Public Transport (Canterbury City Centre)

	Option 1	Option 2	Option 3	Option 4/5
Weighted Average	34.8%	24.8%	36.3%	38.7%
Comments	**Ranked 3rd** South Canterbury area of search with highest number of housing has the same public transport coverage as for three key centres. North Canterbury and Sturry also have good public transport coverage Herne Bay and Whitstable now have low coverage	**Ranked 4th** Herne Bay and Whitstable locations have with highest numbers of housing, but now low public transport coverage South Canterbury and North Canterbury locations have reasonable public transport access	**Ranked 2nd** South Canterbury and North Canterbury areas with highest number of housing have greatest relative public transport access coverage Herne Bay and Whitstable areas now have low public transport coverage	**Ranked 1st** South Canterbury area with highest number of housing has the same public transport access coverage as for three key centres. North Canterbury area also has good coverage Herne Bay and Whitstable now have low coverage

Table 8-11 Access to the City centre - Summary

8.5 Active Travel to Key Centres

This section provides an analysis on the access by active travel modes to the areas of search identified in Figure 8-1 Figure 8-4 shows the areas of search against the aforementioned isochrones that show the active travel modes access to key centres within a 30 minute journey time.

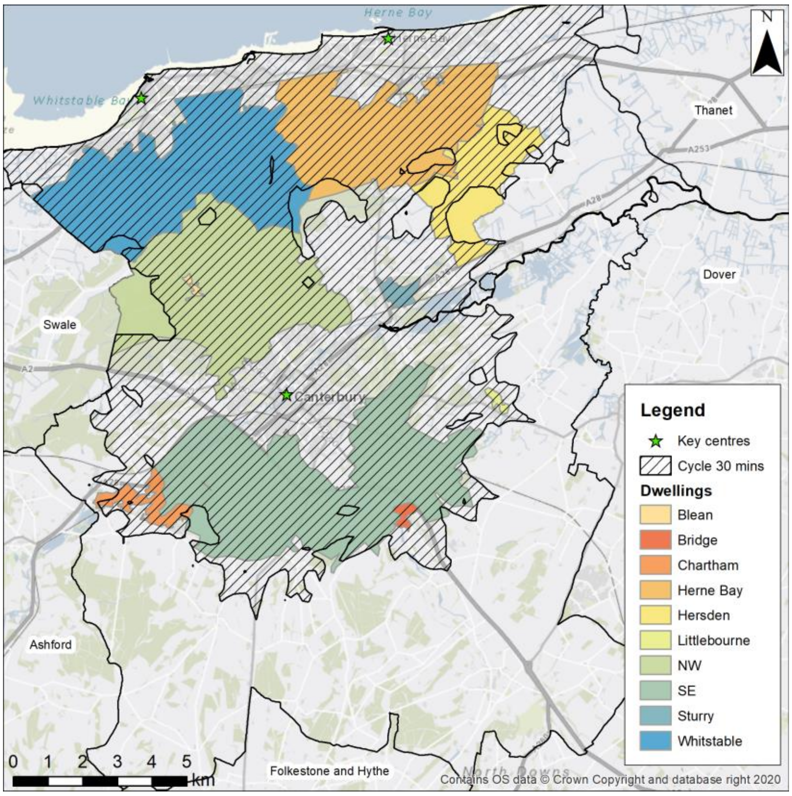


Figure 8-4 Canterbury district areas of search and active travel modes access within 30 minutes of key centres

8.5.1 Option 1 Active Travel (Key Centres)

In summary, the South Canterbury areas of search with 3000 homes show high coverage of access to key centres by active travel modes within a 30 minute journey time, with 95.2% (Table 8-12). Herne Bay with the next highest number of housing also has a relatively high active travel accessibility with 93.9%. The North Canterbury area has a slightly lower average coverage with 87.6%. Whitstable has the highest active travel mode accessibility with 95.7%. Sturry is fully accessible by active travel modes. Option 1 shows a weighted average of 93.7% of access by active travel modes.

Areas of Search	Housing	% of access to area by active modes within 30 minutes
South Canterbury	3000	95.2%
Herne Bay	1500	93.9%
North Canterbury	1000	87.6%
Whitstable	500	95.7%
Sturry	200	100.0%
Hersden	60	65.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**93.7%**

Table 8-12 Option 1: Active travel to key centres

8.5.2 Option 2 Active Travel (Key Centres)

In summary, Whitstable and Herne Bay, with the two largest numbers of housing (2000 homes assigned as shown in Table 8-13) show over 90% of access by active travel modes within a 30 minute journey time. The South Canterbury and North Canterbury areas also have a high portion of active travel coverage with 95.2% and 87.6% respectively. Similar to public transport coverage, Sturry is fully accessible by active travel modes. Similar to option 1, option 2 shows a weighted average of 93.7% of access by active travel modes.

Areas of Search	Housing	% of access to area by active modes within 30 minutes
Whitstable	2000	95.7%
Herne Bay	2000	93.9%
South Canterbury	1000	95.2%
North Canterbury	1000	87.6%
Sturry	200	100.0%
Hersden	60	65.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**93.7%**

Table 8-13 Option 2: Active travel to key centres

8.5.3 Option 3 Active Travel (Key Centres)

In summary, the South Canterbury and North Canterbury areas of search (both with 2000 homes as shown in Table 8-14), show high coverage of access to key centres by active travel modes within a 30 minute journey time, with 95.2% and 87.6% respectively. Whitstable and Herne Bay also have a high portion of active travel coverage, each over 90%. Sturry is fully accessible by active travel modes. Option 3 shows a slightly lower weighted average than option 2, with 92.7% of access by active travel modes

Areas of Search	Housing	% of access to area by active modes within 30 minutes
South Canterbury	2000	95.2%
North Canterbury	2000	87.6%
Whitstable	1000	95.7%
Herne Bay	1000	93.9%
Sturry	200	100.0%
Hersden	60	65.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**92.7%**

Table 8-14 Option 3: Active travel to key centres

8.5.4 Option 4 and Option 5 Active Travel (Key Centres)

In summary, the South Canterbury area of search with 7000 homes show high coverage of access to key centres by active travel modes within a 30 minute journey time, with 95.2%. The North Canterbury area has a slightly lower average coverage with 87.6%. Whitstable and Herne Bay also have a high portion of active travel coverage, each over 90%. Sturry is fully accessible by active travel modes. Option 4 and Option 5 show the highest weighted average for active travel across the options, with 93.8% of access by active travel modes (Table 8-15).

Areas of Search	Housing	% of access to area by active modes within 30 minutes
South Canterbury	7000	95.2%
North Canterbury	2000	87.6%
Whitstable	1000	95.7%
Herne Bay	1000	93.9%
Sturry	200	100.0%
Hersden	60	65.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**93.8%**

Table 8-15 Option 4 and Option 5: Active travel to key centres

8.5.5 Summary of Weighted Averages Active Travel (Key Centres)

Table 8-16 summarises modelled differences per option compared to Forecast Baseline scenario.

	Option 1	Option 2	Option 3	Option 4/5
Weighted Average	93.7%	93.7%	92.7%	93.8%
Comments	**Ranked joint 2nd** South Canterbury area of search with highest number of housing has greatest relative active travel coverage Herne Bay and North Canterbury also have good active travel coverage	**Ranked joint 2nd** Herne Bay and Whitstable areas with the highest number of housing have the greatest relative active travel coverage All areas have good active travel coverage	**Ranked 3rd** South Canterbury area with highest number of housing has greatest relative active travel coverage All areas have good active travel coverage	**Ranked 1st** South Canterbury area with highest number of housing has greatest relative active travel coverage All areas have good active travel coverage

Table 8-16 Active travel to key centres - Summary

8.6 Active Travel to Canterbury City Centre Only

Figure 8-5 shows the areas of search against the aforementioned isochrones that show the Active Travel access to Canterbury city centre within a 30 minute journey time.

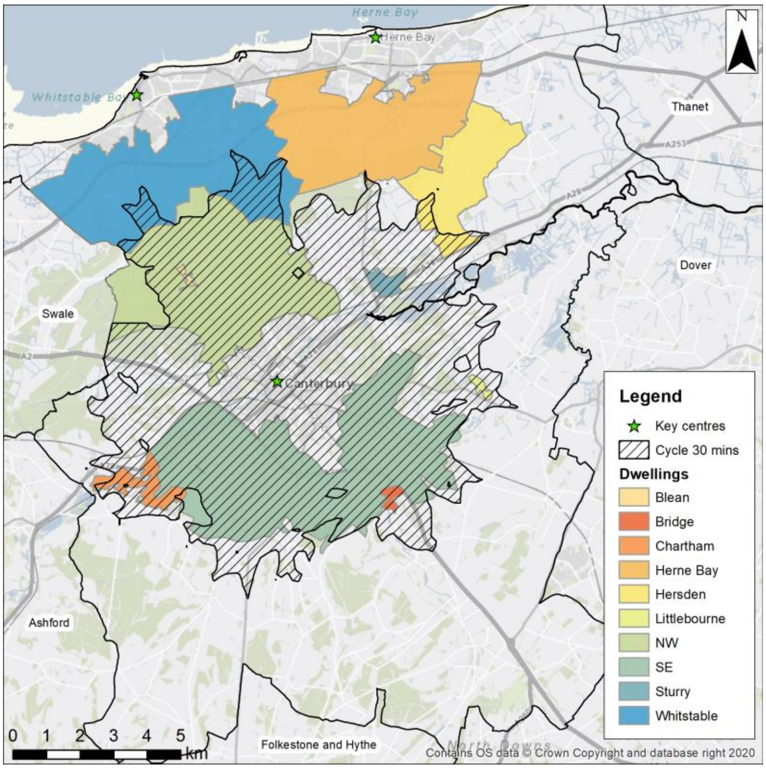


Figure 8-5 Canterbury district areas of search and active travel modes access within 30 minutes of Canterbury city centre

8.6.1 Option 1 Active Travel (Canterbury City Centre)

In summary, the SE area of search with 3000 homes shows high coverage of access to Canterbury city centre by active travel modes within a 30 minute journey time, with 95.2% (Table 8-17). Herne Bay with the next highest housing allocations now has a very low active travel accessibility with 0.2%, due to its distance from Canterbury. The NW area also has a high coverage with 85.1%. Whitstable has a low active travel mode accessibility, with 15.9%. Sturry is fully accessible by active travel modes. Option 1 shows a weighted average of 65.1% of access by active travel modes.

Areas of Search	Housing	% of access to area by active modes within 30 minutes
SE	3000	95.2%
Herne Bay	1500	0.2%
NW	1000	85.1%
Whitstable	500	15.9%
Sturry	200	100.0%
Hersden	60	14.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**65.1%**

Table 8-17 Option 1: Active travel to the City centre

8.6.2 Option 2 Active Travel (Canterbury City Centre)

In summary, Whitstable and Herne Bay, with the two largest number of housing (2000 homes as shown in Table 8-18) now show the lowest access to Canterbury by active travel modes within a 30 minute journey time, both under 20% accessibility. The SE, NW and Sturry areas all have a high portion of active travel coverage with over 85% each. Option 2 shows a weighted average of 39.5% of access by active travel modes.

Areas of Search	Housing	% of access to area by active modes within 30 minutes
Whitstable	2000	15.9%
Herne Bay	2000	0.2%
SE	1000	95.2%
NW	1000	85.1%
Sturry	200	100.0%
Hersden	60	14.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**39.5%**

Table 8-18 Option 2: Active travel to the City centre

8.6.3 Option 3 Active Travel (Canterbury City Centre)

In summary, the SE and NW areas, with 2000 homes (Table 8-19) show high coverage of access to Canterbury city centre by active travel modes within a 30 minute journey time, with 95.2% and 85.1% respectively. Whitstable (15.9%) and Herne Bay (0.2%) both now have a low active travel coverage. Sturry is fully accessible by active travel modes. Option 3 shows a weighted average of 64.8% of access by active travel modes.

Areas of Search	Housing	% of access to area by active modes within 30 minutes
SE	2000	95.2%
NW	2000	85.1%
Whitstable	1000	15.9%
Herne Bay	1000	0.2%
Sturry	200	100.0%
Hersden	60	14.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**64.8%**

Table 8-19 Option 3: Active travel to the City centre

8.6.4 Option 4 and Option 5 Active Travel (Canterbury City Centre)

In summary, the SE area with 7000 homes shows the high coverage of access to Canterbury city centre by active travel modes within a 30 minute journey time, with 95.2%. The NW area has a slightly lower average coverage with 85.1%. Whitstable and Herne Bay now have a low portion of active travel coverage, each below 20%. Sturry is fully accessible by active travel modes. Option 4 and Option 5 show the highest weighted average for active travel across the options, with 78% of access to the dwellings by active travel modes (Table 8-20).

Location	Housing Allocation	% of access to area by active modes within 30 minutes
SE	7000	95.2%
NW	2000	85.1%
Whitstable	1000	15.9%
Herne Bay	1000	0.2%
Sturry	200	100.0%
Hersden	60	14.0%
Chartham	60	87.6%
Bridge	60	100.0%
Littlebourne	60	100.0%
Blean	60	100.0%
	Weighted Average	**78.0%**

Table 8-20 Option 4 and Option 5: Active travel to the City centre

8.6.5 Summary of Weighted Averages Active Travel (Canterbury City Centre)

Table 8-21 summarises modelled differences per option compared to Forecast Baseline scenario.

		Option 2	Option 3	Option 4/5
Weighted Average	65.1%	39.5%	64.8%	78%
Comments	**Ranked 2nd** SE area of search with highest number of housing has greatest relative active travel coverage Herne Bay now has very low coverage NW also has good active travel coverage	**Ranked 4th** Herne Bay and Whitstable areas with the highest numbers of housing now have low active travel coverage SE, NW and Sturry have high active travel accessibility	**Ranked 3rd** SE area with number of housing has greatest relative active travel coverage The NW area also has a high coverage Whitstable and Herne Bay now have low accessibility	**Ranked 1st** SE area with highest number of housing has greatest relative active travel coverage The NW area also has a high coverage Whitstable and Herne Bay now have low accessibility

Table 8-21 Active travel to the City centre – Summary

8.7 Comparison of Assessments

Table 8-22 provides a summary of all four assessments. These results complement the analysis undertaken in the rest of this report.

	Public Transport Access to key centres	Public Transport Access to Canterbury only	Active Travel Access to key centres	Active Travel Access to Canterbury only
Option 1	**Ranked 3rd** (49.2%) SE has the highest number of housing with less than average public transport coverage Herne Bay and NW locations have higher than the average coverage of public transport access	**Ranked 3rd** (34.8%) SE with highest number of housing has high relative public transport coverage NW and Sturry also have good public transport coverage Herne Bay and Whitstable have low coverage (when assessed against Canterbury City Centre Only)	**Ranked joint 2nd** (93.7%) SE with highest number of housing has greatest relative active travel coverage Herne Bay and NW also have good active travel coverage	**Ranked 2nd** (65.1%) SE with highest number of housing has greatest relative active travel coverage Herne Bay has very low coverage (when assessed against Canterbury City Centre Only) NW also has good active travel coverage
Option 2	**Ranked 1st** (52.2%) Whitstable and Herne Bay with highest number of housing have the greatest relative public transport coverage NW also has good coverage SE has a low relative public transport coverage	**Ranked 4th** (24.8%) Herne Bay and Whitstable areas have with highest number of housing, but now low public transport coverage SE and NW locations have reasonable public transport access	**Ranked joint 2nd** (93.7%) Herne Bay and Whitstable areas have with highest numbers of housing have the greatest relative active travel coverage All areas have good active travel coverage	**Ranked 4th** (39.5%) Herne Bay and Whitstable areas with the highest number of housing now have low active travel coverage SE, NW and Sturry have high active travel accessibility
Option 3	**Ranked 2nd** (50.5%) SE areas with highest number of housing has low relative public transport coverage NW, Herne Bay and Whitstable have relatively good public transport access	**Ranked 2nd** (36.3%) SE and NW areas with highest number of housing have greatest relative public transport access coverage Herne Bay and Whitstable locations now have low public transport coverage	**Ranked 3rd** (92.7%) SE area with highest number of housing has greatest relative active travel coverage All areas have good active travel coverage	**Ranked 3rd** (64.8%) SE area with highest number of housing has greatest relative active travel coverage The NW location also has a high coverage Whitstable and Herne Bay now have low accessibility
Option 4/5	**Ranked 4th** (46.8%) SE area with highest number of housing has low relative public transport coverage NW, Herne Bay and Whitstable have relatively good public transport access	**Ranked 1st** (38.7%) SE area with highest number of housing has a high public transport access coverage NW location also has good coverage Herne Bay and Whitstable now have low coverage	**Ranked 1st** (93.8%) SE area with highest number of housing has greatest relative active travel coverage All areas have good active travel coverage	**Ranked 1st** (78%) SE area with highest number of housing has greatest relative active travel coverage The NW location also has a high coverage Whitstable and Herne Bay now have low accessibility

Table 8-22 Public transport accessibility assessment - Summary

9. Likelihood of Mode Shift

9.1 Assessment of Likelihood of Mode Shift

The model used in this project is highway based only and therefore cannot be used in its present form to quantify mode shift from car to sustainable modes. However, where there is a PT Intervention (such as Park and Ride) a reduced car trip rate has been applied so the results of the Highway Model Assessment do reflect the some of the positive impact of planned interventions.

The model assumes that the level of car journeys remains fixed, no matter how much easier it is to walk or cycle the volume of car journeys will not change. Also, journey time analysis is by car only whereas it is known that most trips in Canterbury made by car are short trips which could be made by walking or cycling with sustainable transport options in place. So, the car journey time presented in the earlier section would represent the worst case.

Canterbury City Council has declared a Climate Change emergency and has an AQMA covering Canterbury City Centre. Also, active travel has significant health benefits and supports improvements to air quality travel. The greater the potential for modal shift from cars to active travel the more diluted the impacts on highway performance stated in previous sections would be in reality i.e. modal shift takes cars off the road and therefore reduces congestion.

The TRACC analysis in the previous section ranked Options on the proportion of the Area of Search within 30 minutes of either three key centres or Canterbury City Centre. As more information becomes available narrowing down future areas of growth this analysis will be able to better compare the attractiveness of Options, in terms of access by PT and Active Travel Modes (for example safety and attractiveness of cycling routes). In the meantime, a consideration of likelihood of mode shift has been made based on the scale of intervention planned.In the table below the results from the TRACC analysis are compared against a Likelihood of Mode Shift, based on the scale of intervention planned in each option, with commentary provided on each Option in Table 9-1.

Option 1 does not include any PT and Active travel related interventions, and so it shows a low likelihood of modal shift by road network users, it also not ranked highest on either the PT or Active Travel assessments.

Option 2 presents various PT and Active travel related interventions in the vicinity to Whitstable, with the transport access rankings showing a greater access to all key centres compared to other options, but the lowest access to Canterbury city centre. This option is considered to have a medium likelihood of modal shift away from car.

Option 3 assumes a number of PT and Active travel related interventions Canterbury city centre and Whitstable, including five expanded or new Park and Ride services into Canterbury, Bus Lanes on all approaches and a Clean Air Zone. This option is considered to have a high likelihood of modal shift away from car.

Option 4 incorporates the Eastern and Western bypasses on top of the Option 3 interventions. The two new relief roads provide alternative routes to/from Canterbury routing traffic peripheral to the city centre. This option is therefore considered to have a high likelihood of modal shift away from car. It is also ranked first in PT (Canterbury Only) and Active Travel assessments.

Option 5 has the greatest number of interventions and includes Shared Streets and Modal Filters on top of Option 4 interventions. This option is considered to have a very high likelihood of modal shift away from car. It is also ranked first in PT (Canterbury Only) and Active Travel assessments (similar to Option 4 which assumes the same number of housing in the same areas of search).

Option	Rank				PT and Active Travel Interventions	Likelihood of mode shift, based on PT and Active Travel Interventions
	Public Transport Access to key centres	Public Transport Access to Canterbury only	Active Travel Access to key centres	Active Travel Access to Canterbury only		
Option 1	3rd	3rd	2nd	2nd	N/A	Low
Option 2	1st	4th	2nd	4th	Whitstable bus link Whitstable Park and Ride	Medium
Option 3	2nd	2nd	3rd	3rd	Whitstable bus link Signalised junctions on Ring road Bus lane on all approaches Clean Air Zones Whitstable Park and Ride Five Expanded/New Park and Rides for Canterbury	High
Option 4	4th	1st	1st	1st	Relief roads - bypasses Signalised junctions on Ring road Bus lane on all approaches Clean Air Zones Five Expanded/New Park and Rides for Canterbury	High
Option5	4th	1st	1st	1st	Relief roads - bypasses Shared streets Bus lane on all approaches Modal filters on short cuts Five Expanded/New Park and Rides for Canterbury	Very High

Table 9-1: Likelihood of Mode Shift, based on PT and Active Travel Interventions

9.2 Assessment of Likely Highway Impact

An assessment has been made of likely highway impact taking into account the assessments from the highway model and scale of interventions effecting the highway shown in Table 9-2. The detail highway assessments are included in the Section 6.

	City Centre JT	City Centre Flows	Dispatched flows	Hotspots	Network wide JT	Overall	Rank	Highway Interventions	Likely Highway Impact
Option 1	1	4	3	1	4	13	**3rd**	Same as in Forecast Baseline	**High**
Option 2	1	4	3	1	2	11	**2nd**	Chestfield link and junction	**Medium**
Option 3	3	3	4	2	3	15	**4th**	Signalised junctions on Ring Road, Bus lane on all approaches, Thanington 4th slip	**Very High**
Option 4	3	2	2	3	1	11	**2nd**	Signalised junctions on Ring Road, Bus lane on all approaches, Thanington 4th slip,	**Medium**

	City Centre JT	City Centre Flows	Dispatched flows	Hotspots	Network wide JT	Overall	Rank	Highway Interventions	Likely Highway Impact
								Eastern Bypass, Western Bypass	
Option 5	2	1	1	2	4	10	**1st**	Shared streets, Bus lane on all approaches, Modal filters on short cuts, Eastern Bypass, Western Bypass, Thanington 4th slip	**Low**

Table 9-2: Likely Overall Highway Impact

9.3 Overall Likelihood of Mode Shift

To ascertain the overall likelihood of mode shift from car to sustainable modes, the Table 9-3 considers both the Likelihood of mode shift, based on the scale of PT and Active Travel interventions, and the Likely Highway Impact.

	Likelihood of mode shift, based on PT and Active Travel Interventions	Likely Highway Impact	Overall Likelihood of mode shift
Option 1	Low	High	**Low to Medium**
Option 2	Medium	Medium	**Medium**
Option 3	High	High	**High**
Option 4	High	Low	**Medium**
Option 5	Very High	Very High	**Very High**

Table 9-3: Likely Overall Likelihood of mode shift

Option 1 would be expected to have a low likelihood of mode shift based solely on PT and Active Travel interventions, but there may be some mode shift away from due to the high impact of this Option on the performance of the Highway network. Therefore, the overall rating for this option is Low/Medium.

Option 2 would be expected to have a medium likelihood of mode shift based solely on PT and Active Travel interventions and the Highway network performance. So, overall likelihood of mode shift is rated Medium.

Option 3 is rated High for likelihood of mode shift based on PT and Active Travel interventions and High for likely highway impact. The overall likelihood of mode shift is therefore also rated High.

The comparison shows that whilst Option 4 scores most favourably when considering Highway impacts, it is not expected to have the highest mode shift to sustainable modes (the highest mode shift is expected with Option 5, rated Very High). Option 4 is rated Medium whereas Option 5 is rated Very High.

10. Cross boundary trips

The network of the Canterbury Local Model has been developed based on the cordoned network from the Kent County Model with the necessary updates. Therefore, the local Canterbury model cannot assess the variability of trips outside of the local model boundary due to any additional network scheme in Canterbury. So, the 'cross boundary trips' analysis has been considered to carry out for any network scheme that might attract traffic outside the Canterbury district. Initially, it was agreed only "Eastern Bypass" (non-committed scheme) is considered for this analysis. Also, the analysis of these trips is based on the Kent County wide area model, focused on trips associated with the neighbouring authorities, using the highway network.

Analysis has been performed on the 2037 Kent Reference Case model, using six selected highway data collection points shown in Figure 10-1. The Kent Reference Case model only include Canterbury committed schemes (similar to Canterbury Baseline Forecast). So, an additional scenario has been considered to include the Eastern Bypass. Therefore, the following scenarios are considered for this analysis:

- 2037 Kent Reference Case model; and
- 2037 Kent Reference Case model with Eastern Bypass.

Main analysis focus has been given to potential changes of "outside district traffic" stimulated or rerouted by this road investment, Eastern Bypass. The analysis collection points, located around the Canterbury District borders, are illustrated on the plan provided below.

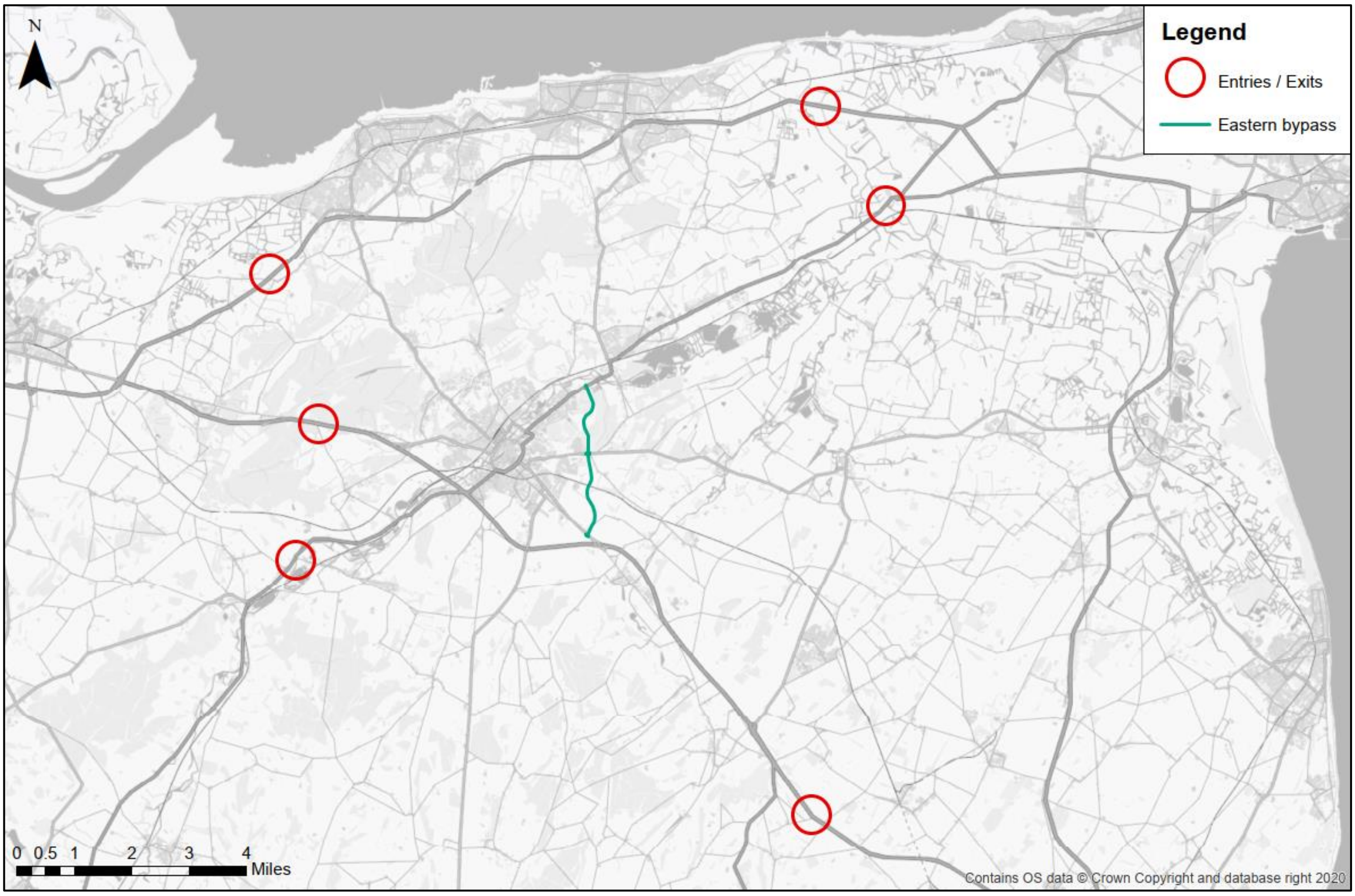


Figure 10-1 Cross boundary trips collection points

Road section	2037 Kent Reference Case AM Peak	2037 Kent Reference Case with Eastern Bypass AM Peak	Change
A299 West	5420	5386	-0.63%
A299 East	4627	4600	-0.58%
A28 East	1391	1408	1.22%
A28 West	1218	1240	1.81%
A2 West	4603	4562	-0.89%
A2 South	2854	2902	1.68%

Table 10-1 AM Cross boundary traffic changes due to Eastern Bypass scheme

Road section	2037 Kent Reference Case PM Peak	2037 Kent Reference Case with Eastern Bypass PM Peak	Change
A299 West	6456	6426	-0.46%
A299 East	5117	5108	-0.18%
A28 East	1417	1435	1.27%
A28 West	1246	1254	0.64%
A2 West	4614	4573	-0.89%
A2 South	2728	2764	1.32%

Table 10-2 PM Cross boundary traffic changes due to Eastern Bypass scheme

Eastern Bypass can very slightly reduce traffic between London direction (north-east) and areas west of Canterbury around by -0.5% on A299 and -1% on A2 west of Canterbury in both peaks, while also increase traffic on A28 East, A28 West and A2 South by around 0.5%-2%.

Although this analysis shows that the impact on cross-boundary travel is not of high significance, results in the earlier chapters demonstrate the significant impacts that the Eastern Bypass would have on traffic flows and congestion around Canterbury city centre, including journeys which originate outside of the district.

11. Conclusions and Recommendations

11.1 Summary

In conclusion, there are varying levels of operational performance across all proposed LPR options, however there is no single stand out option that could be recommended for solving the existing local and strategic issues in the network. It should be noted that based on the analysis presented in the previous sections, it has been identified that often, when one issue in the network is resolved by implementing one measure, it would consequently free up some suppressed traffic that in turn causes other problems elsewhere in the network. For example, restrictions around the City in the Option 5 reduces capacity for trips trying to go to the centre and improves the City Centre Ring road junctions, however this additional vehicular distance increases the expected journey time in the other area of Canterbury.

The assessment of a 'best' or 'better performing' option is therefore complex, and dependent on what the priority is for the scheme. In terms of reducing traffic in City, Option 4 and Option 5 are the better performing options, due to having City and major infrastructure schemes in the network. In terms of accessing City by car, Option 1 and the Option 2 are the better performing options due to less restriction implemented in City. In terms of network wide performance, Option 2 and the Option 4 are the better performing options. Option 4 shows reduction in journey time along some wider routes in Canterbury. In terms of congestion hotspots, Option 1 and Option 2 are the better performing options. This is due to the proposed development location in these options and no city restriction implemented. In terms of Public Transport Accessibility Option 2 and Option 3 are the better performing option when comparing access by PT to Key Centres, however when considering access only to Canterbury City Centre, Option 4 and 5 are better performing options. In terms of Active Travel Accessibility, option 5 is the best performing (both for access to Key Centres and access to Canterbury City Centre Only).

A summary table explaining a qualitative assessment of the options based on the results provided earlier in this report has been produced for each option to provide a description of its predicted local and possible wider impacts. It is important to note that the table highlights the general overall condition in the models in a qualitative sense and only considering the highway assignment modelling.

Scenario	Overall Performance	Local Impact	Wider Impact
Forecast Baseline (Reference Case):	Reasonably good balance between additional developments and new infrastructure (vs existing state). Infrastructure improvements might have been focused on solving existing issues (queuing on Wincheap, Old Dover Road, New Dover Road, Sturry Road), but they cooperate relatively well with areas planned to develop, in the south part of the City as well as in the north.	New or redeveloped A2 Highway connections SW of Canterbury (new off-slip with Gyratory Route and Bridge Interchange) could limit existing flow issues, but due to intensity of developments, reduction of traffic is limited. Increased traffic / queuing could be expected on Dover Road access to Mountfield Park, as well as on Gyratory Route (due to increased traffic coming from Thanington off-slip directed to Wincheap Gyratory route) Canterbury north connection with increasing flows (coast direction) is quite well supported by Sturry Link Road and Herne Bay Relief Road. Traffic on Ring Road remain very high, with possible higher flows (increased journey time, possible queuing)	Long distance traffic, especially between Canterbury and Coast (Whistable, Herne Bay) is distributed reasonably well in comparison to the development growth in 2040. Overall impact on long distance traffic using A2 highway should also be considered as improvement, although limited by high local development traffic.

Scenario	Overall Performance	Local Impact	Wider Impact
		especially on Sturry Road-Tourtel Road-Military Road corridor.	
Option 1	Inclusion of the additional LPR developments both in N and SW of Canterbury result in slightly high traffic in City Centre and surrounding area compared to Forecast Baseline. In terms of PT and Active Travel Access to Key Centres Option 1 ranks 3rd and 2nd respectively. (Also 3rd and 2nd respectively with regard to Access to Canterbury only).	Ring Road traffic is increased due to more developments N/NW from the City resulting in there being is quite significant impact at further junctions leading to City Centre. Local changes in development intensity increase traffic on Strode Link (Herne Bay) and in SE Canterbury (Mountfield Park), especially in PM, but within local network capacity.	Increased traffic from N/NW towards SW Canterbury and its pressure on Ring Road, cause limited rerouting in the wider network. There are no additional highway interventions, such as bypasses, in this scenario. In summary, it deteriorates the overall networkwide performance. Likelihood of mode shift based on PT and Active Travel interventions ranked low to medium as no specific PT and Active Travel interventions planned in Option 1.
Option 2 **(Coast)**	Coast focused developments impact almost exclusively traffic within the Coast (Herne Bay, Whitstable) and A299, even impact on roads between Canterbury and Coast is quite limited. City Centre traffic remain similar to Forecast Baseline. In terms of PT and Active Travel Access to Key Centres Option 2 ranks 1st and 2nd respectively. (This changes to 4th and 4th respectively with regard to Access to Canterbury only).	Local A299 junctions and roads (especially Chesterfield junction and link road) are impacted by increased traffic. Due to good placement of Whitstable P&R, the overall local traffic remains within capacity. New Chesterfield link also impacts slightly rerouting on north Thanet Way connection, but changes in traffic patterns are rather limited. Very slight increase occurs to the City Centre traffic; hence it shows limited impact in the City Centre network performance.	Coast developments result in increase of long-distance traffic (probably mainly London direction), rerouting has rather local character, based on new junctions and roads. Likelihood of mode shift based on PT and Active Travel interventions ranked medium, with Whitstable bus link and Whitstable Park and Ride planned in Option 2.

Scenario	Overall Performance	Local Impact	Wider Impact
Option 3 **(SWECO)**	Limitations in City Centre allow for severe reduction of traffic. This may be as a result of increased congestion or length of queues. New P&R locations around City Centre help to reduce traffic issues is limited – due to very high existing traffic volumes. New infrastructure on A2 (Thanington 4th slip) helps to distribute the traffic widely without accessing the City, but its impact is local. In terms of PT and Active Travel Access to Key Centres Option 3 ranks 2nd and 3rd respectively. (Also 2nd and 3rd respectively with regard to Access to Canterbury only).	Ring Road limitations (such as, Bus lane approaches scheme and CAZ) result in high decrease in traffic flows between St Peter's Rbt and St George's Rbt. This also results in a very high congestion and queuing on the ring road due to very high traffic leading to City Centre or near it. All Ring Road junctions experience very high delays and bad traffic conditions. Some other junctions close to City Centre are prone to queuing on Ring Road and blocking back effect.	Long-distance traffic rerouting is limited due to limited alternative highway interventions, such as bypasses. This results in increased traffic on the lower class rural roads and rat runs through the City. Likelihood of mode shift based on PT and Active Travel interventions ranked high, with all planned highway and PT interventions in Option 3.
Option 4	Limitations on the Ring Road similar to Option 3, supported by additional road interventions (Western Bypass and Eastern Bypass) performs comparatively better networkwide. Both Bypass roads attract all traffic that does not need to go near or to City Centre, comparatively limiting impact on local roads. New P&R locations around City Centre help to reduce traffic issues but should be considered limited due to very high existing City Centre flows. In terms of PT and Active Travel Access to Key Centres Option 4 ranks 4th and 1st respectively. (This changes to 1st and 1s respectively with regard to Access to Canterbury only).	Ring Road limitations result in high decrease in traffic flows between St Peter's Rbt and St George's Rbt. Very high congestion on the Ring road, but noticeably less queuing than in Option 3 due to having alternative highway interventions in the network. Slight improvement on parts of A28 NE of the City Centre.	Bypass road allow for long-distance rerouting, providing non-City Centre alternatives for A2-East Canterbury traffic and for North to Canterbury traffic. Likelihood of mode shift based on PT and Active Travel interventions ranked medium, considering PT interventions and likely highway impact in Option 4.
Option 5	Limitations on the Ring Road (reduced vs Option 3&4) but supported by "blockers" and "shared apace" scheme, result in high rerouting, affecting	Due to "blockers" and "shared space" in place, lots of local City Centre related traffic tries to find other possible routes. Ring Road traffic shows decrease compared to Forecast Baseline but slightly	Similar to Option 4, intensive longer distance traffic rerouting occurs based on new bypass roads, also increasing

Scenario	Overall Performance	Local Impact	Wider Impact
	both City Centre access and wider Canterbury traffic. New P&R locations around City Centre help to reduce traffic issues and should be considered limited due to very high existing City Centre flows. Similar to Option 4, in terms of PT and Active Travel Access to Key Centres Option 5 ranks 4th and 1st respectively. (This changes to 1st and 1s respectively with regard to Access to Canterbury only).	increase vs Option 3&4 (less limitations). NE traffic from Centre in highly reduced due to blocker on the minor roads. Ring Road junctions (roundabouts) experience limited delays due to blockers and rerouting, but delays are spread across other junctions and roads near City Centre. Overall access to City Centre is challenging however traffic reductions improve the environment for active travel and reduce traffic flows and related air quality within the city centre. Overall vehicular access to the city involves greater travel distances however journey times are offset by the benefits of air quality and active travel as well as the significant benefit of traffic reductions on residential streets.	slightly A2 traffic "around" Canterbury. Likelihood of mode shift based on PT and Active Travel interventions ranked very high, considering PT interventions and likely highway impact due to additional city highway interventions included (shared streets and modal filters on short cuts) in Option 5.

Table 11-1: Overall Qualitative Impact of Forecast Scenarios

11.2 Next steps

Travelling behaviour modelling in ever-changing environment is a challenging task, involving some simplifications and present time traveling patterns. It should be considered for future to improve the existing model with additional analysis and modelling approaches for the preferred LP option.

11.2.1 VDM for preferred option

Canterbury model is Origin-Destination model type, based on existing traveling patterns factors. This kind of approach is considered good enough for most purposes, but in case of "demanded" change of transport mode (private transport to public transport) Variable Demand Modelling (VDM) should be considered. This kind of modelling reduces simplifications and reflects better possible changes in traffic behaviour as well as mode shift in highly congested areas and/or areas with traffic restrictions implementation. This kind of modelling would also improve model quality in terms of Public Transport improvements impact on congestion reductions.

It is suggester to perform full VDM model run for preferred LPR development option using updated (planned) Public Transport network and frequencies.

11.2.2 COVID impact

COVID-19 pandemics and lockdowns changed the travelling behaviour around the world. Some of the changes were considered temporary: due to limited time traveling restrictions by law. Some of the companies and their employees, especially office based, changed their at least partially their working patterns to “Work from Home behaviour” and that change is considered permanent.

It is recommended for future considerations to perform sensitivity test incorporating the “Work from Home behaviour” using the preferred option.

Suggested sensitivity modelling approach:

- Reduction by around 30% car trips from new B1 office related developments (factor based on Kent or Canterbury local data); and
- Monitor overall car trip reduction for “Commuting trips”. Based on DfT data is expected about 10%-13% car trip reduction roughly (local data to be used if available).

1. Appendix A - Scheme Designs

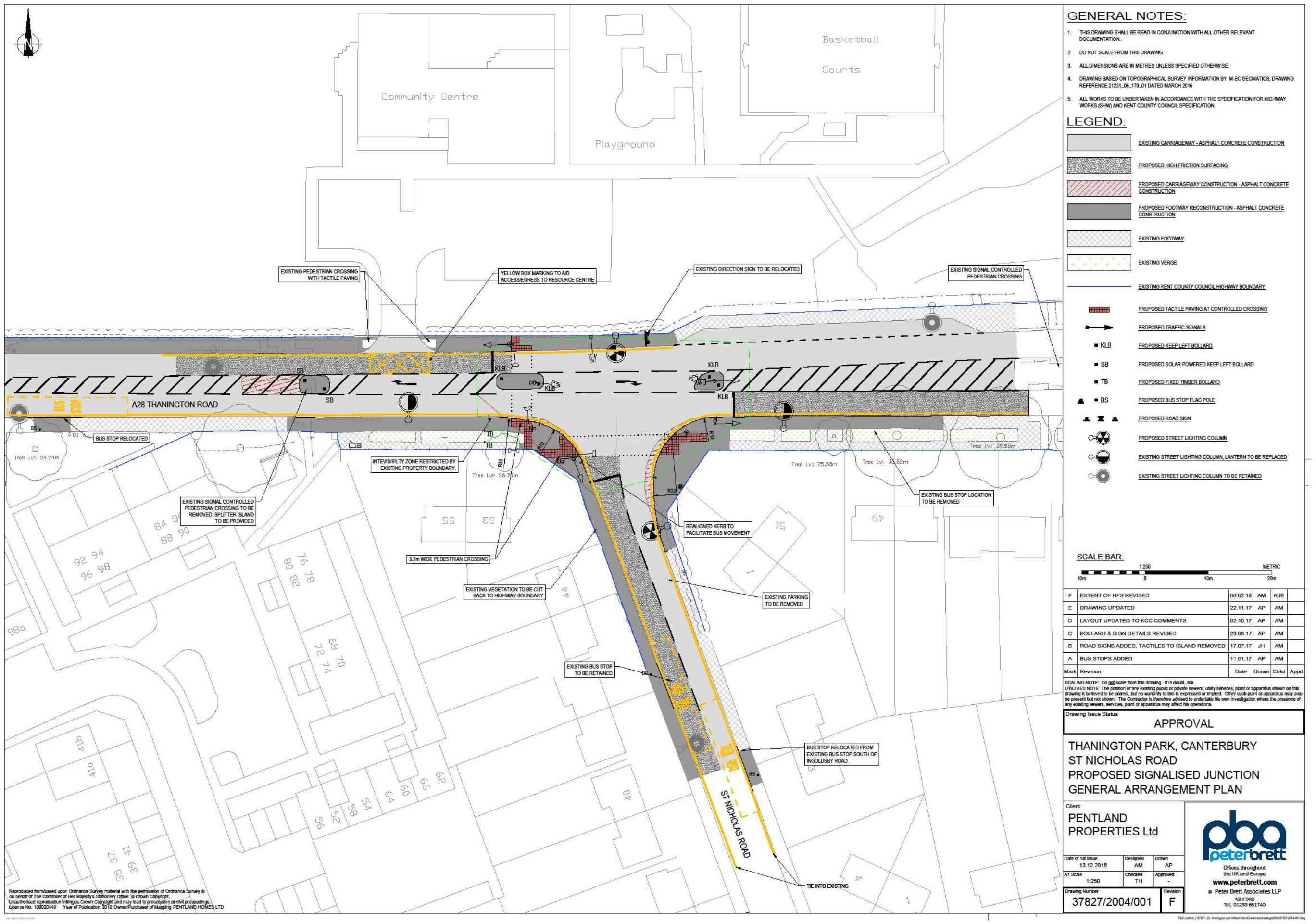


Figure 1.1: St Nicholas Road Proposed Signalised Junction

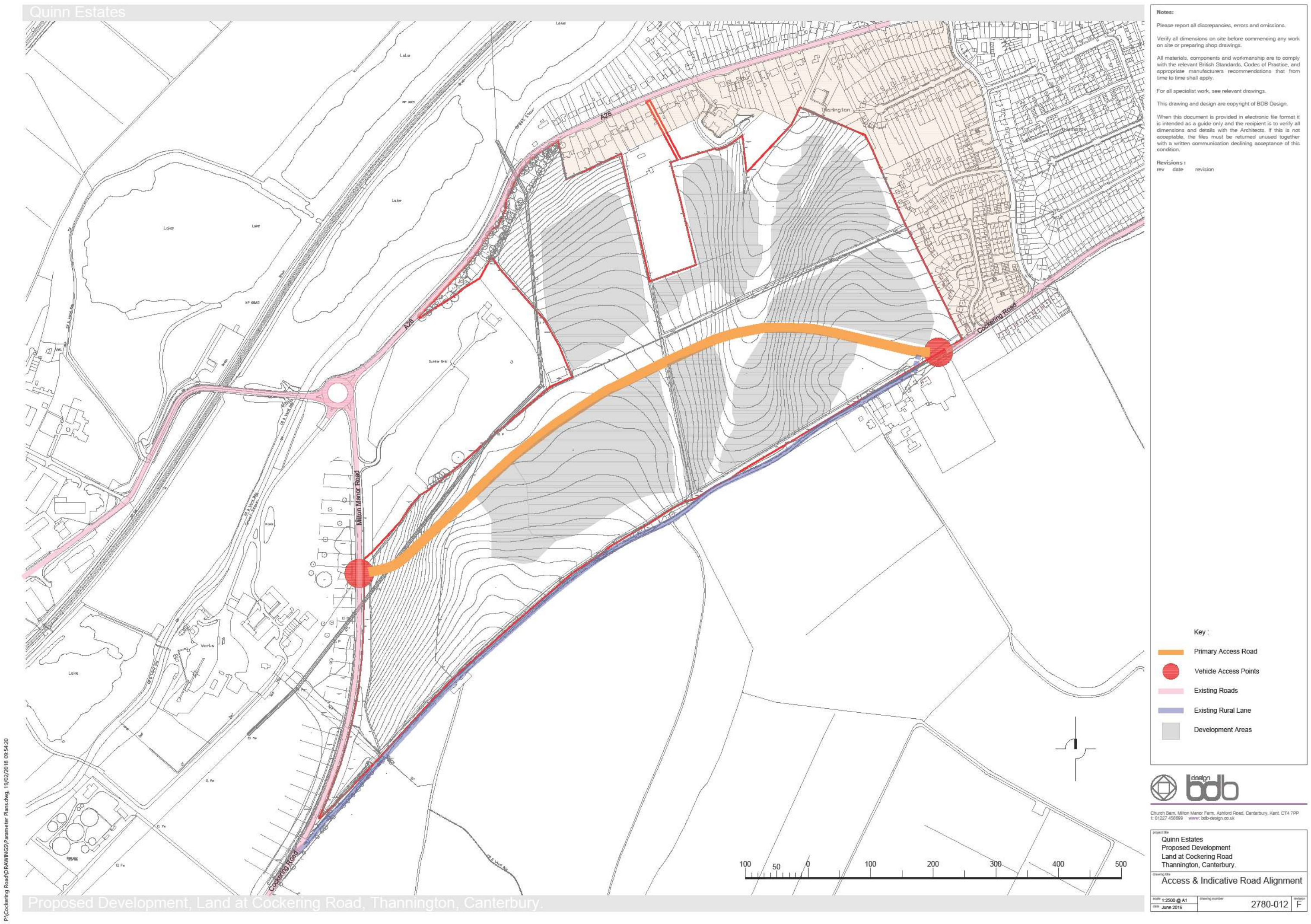


Figure 1.2: Land at Cockering Farm Access

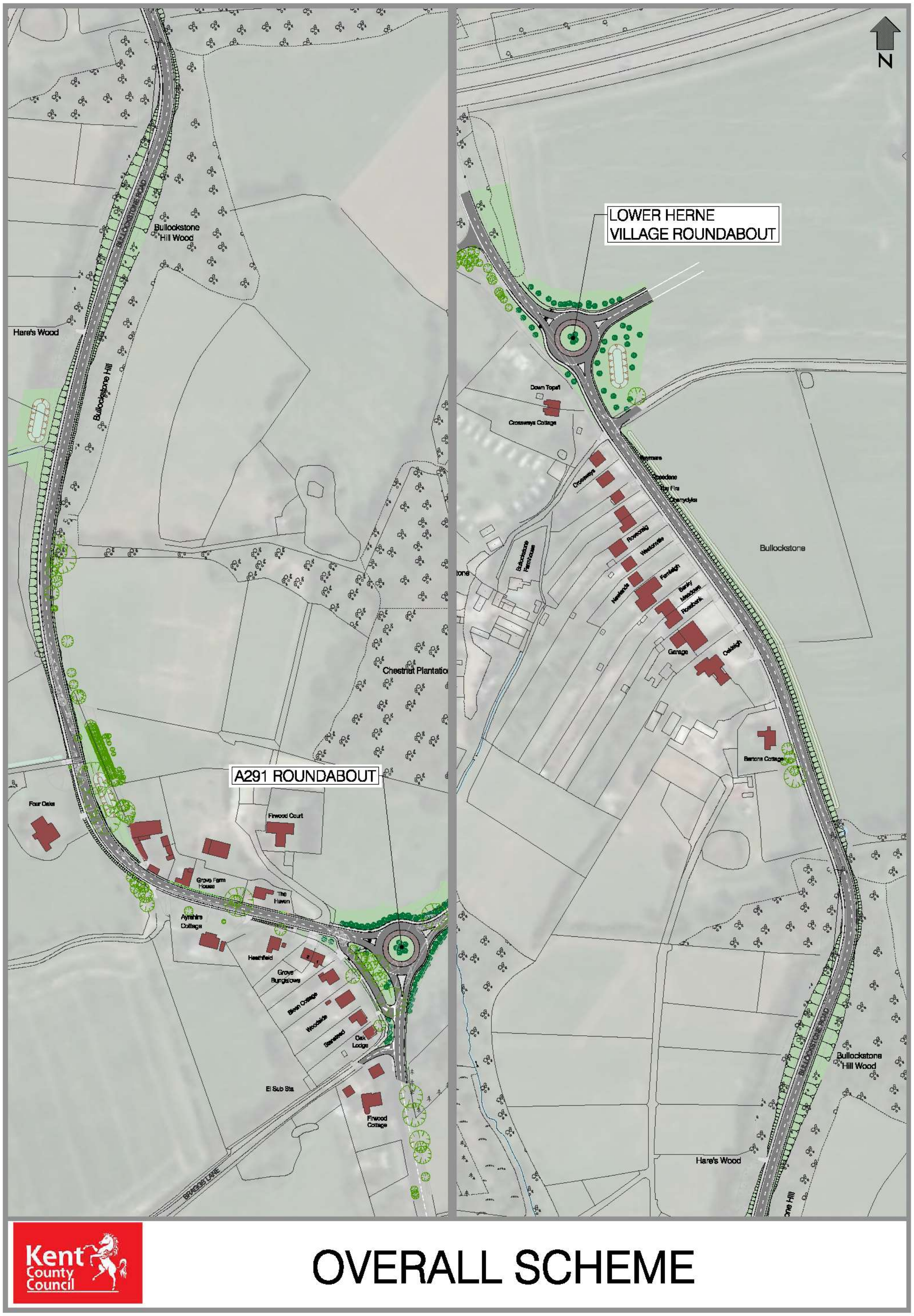


Figure 1.3: Herne Relief Road

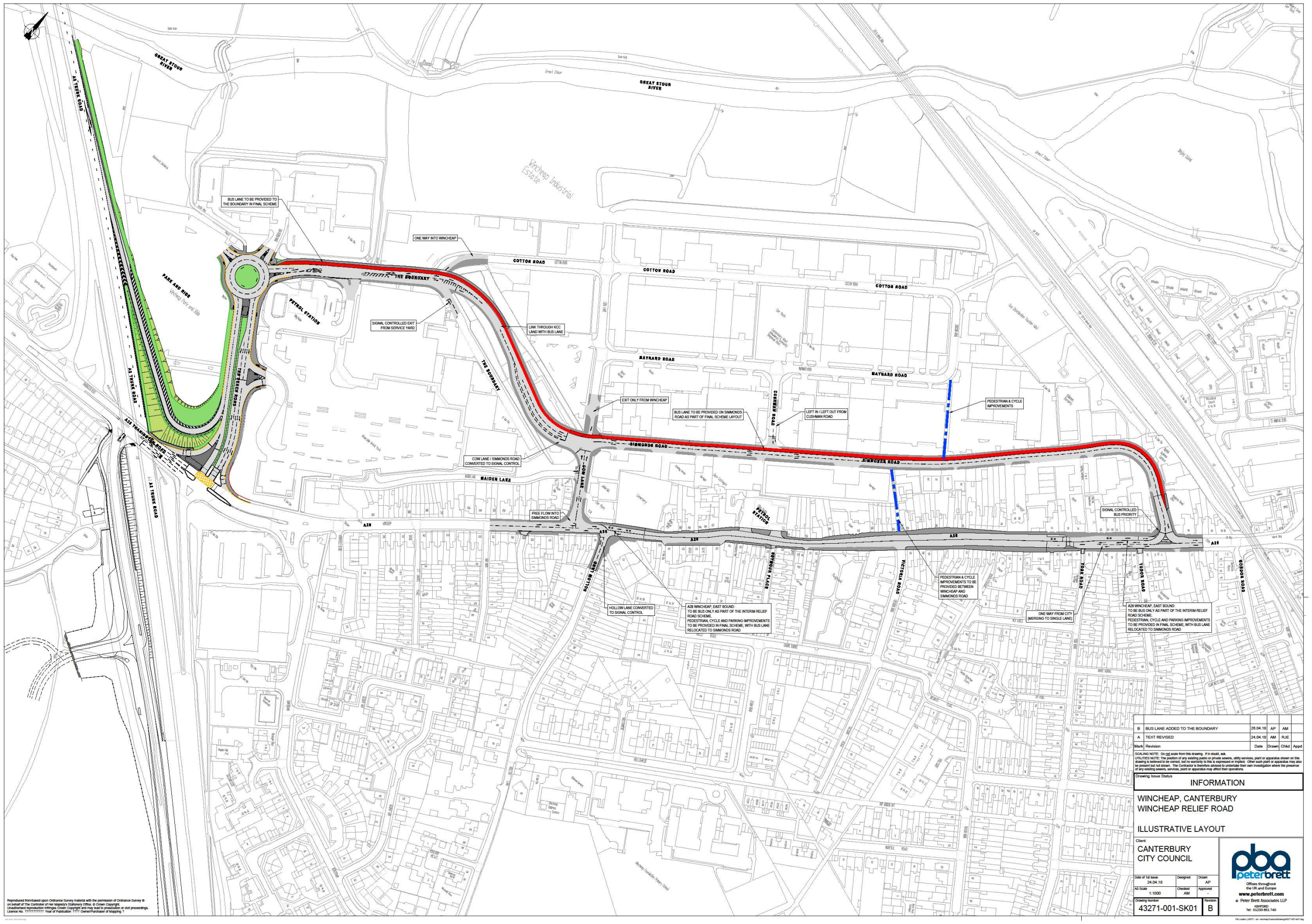


Figure 1.4: Wincheap Relief Road

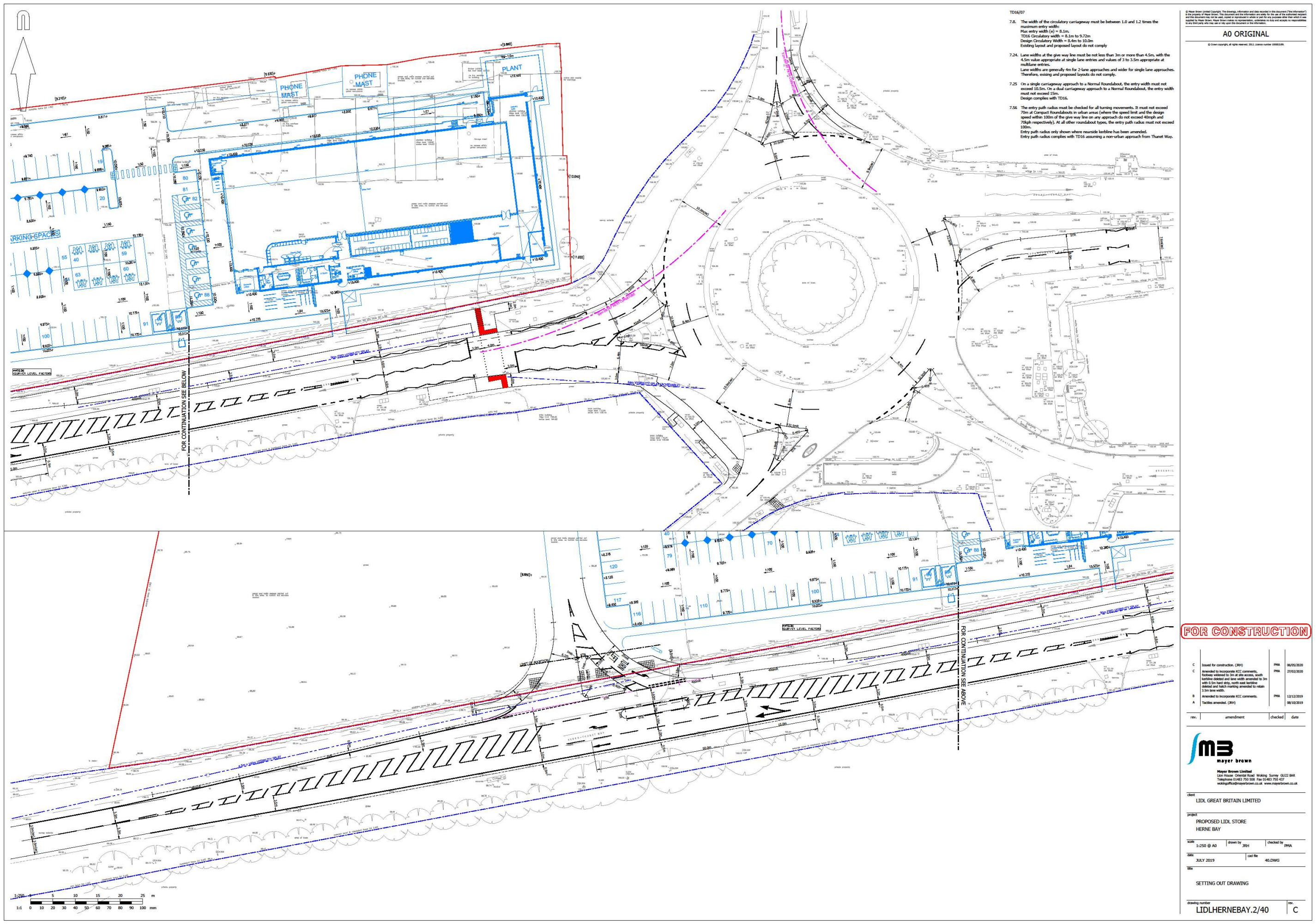


Figure 1.5: Lidl Greenhill

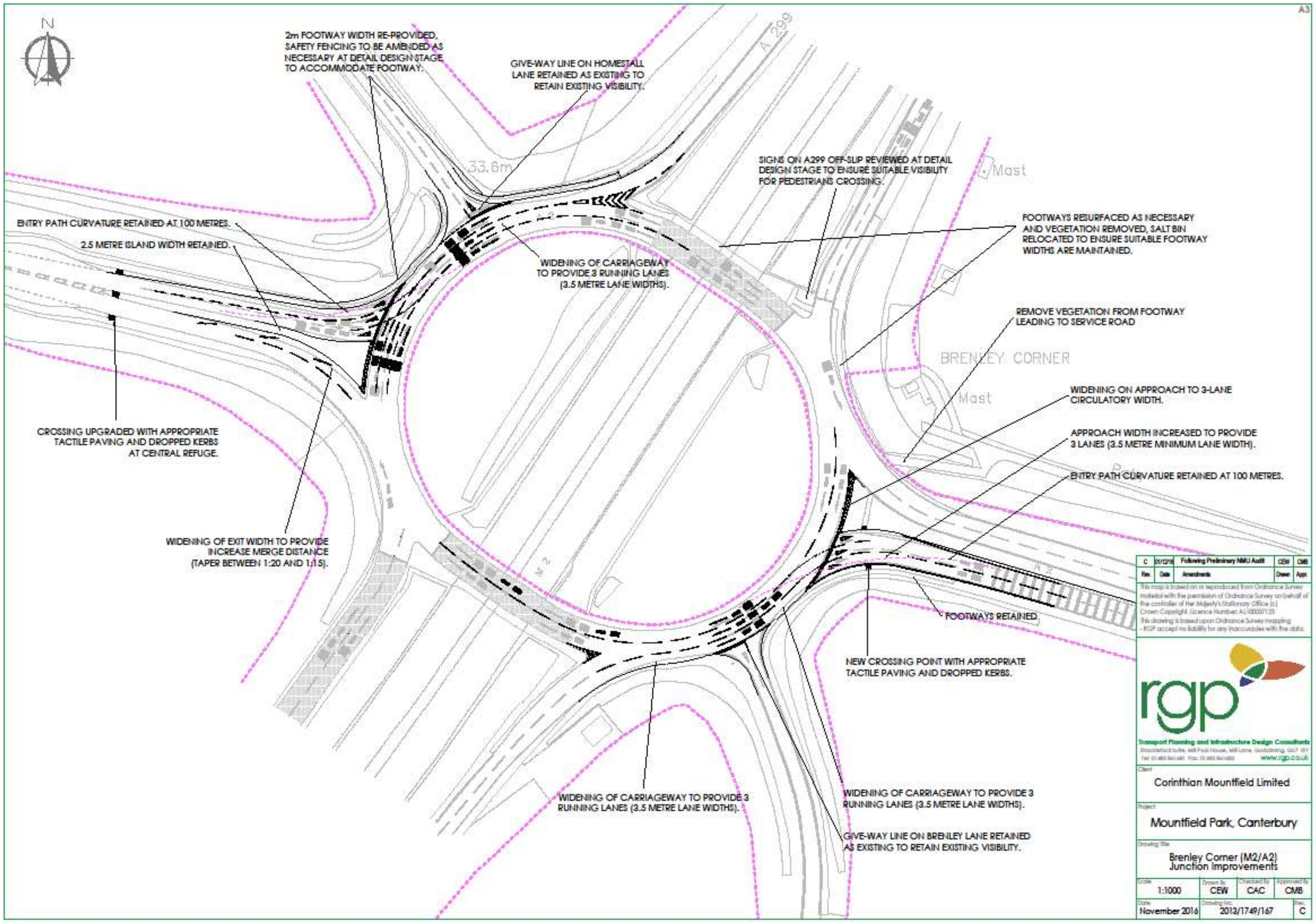


Figure 1.6: Brenley Corner Junction Improvements

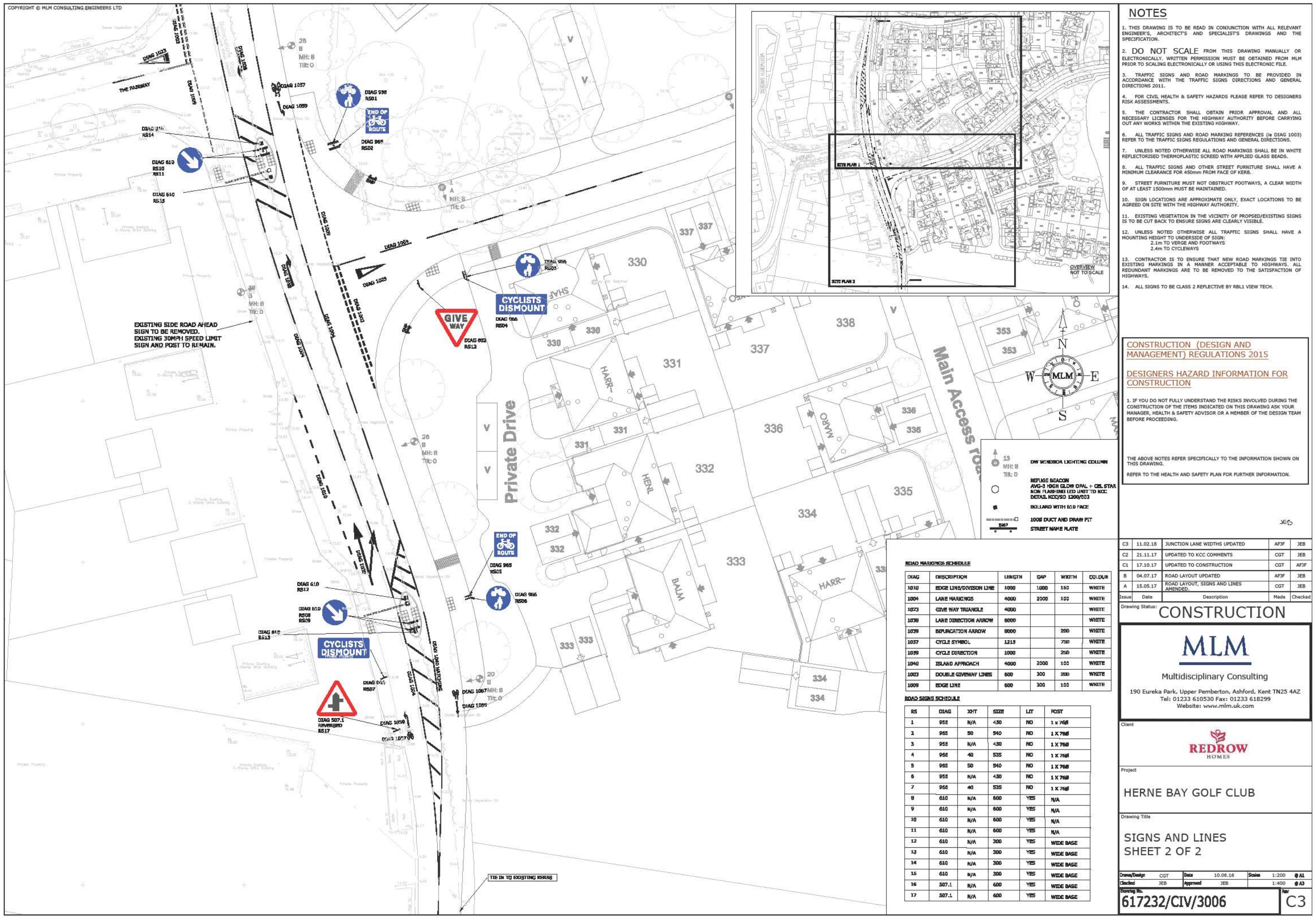


Figure 1.7: Herne Bay Golf Club

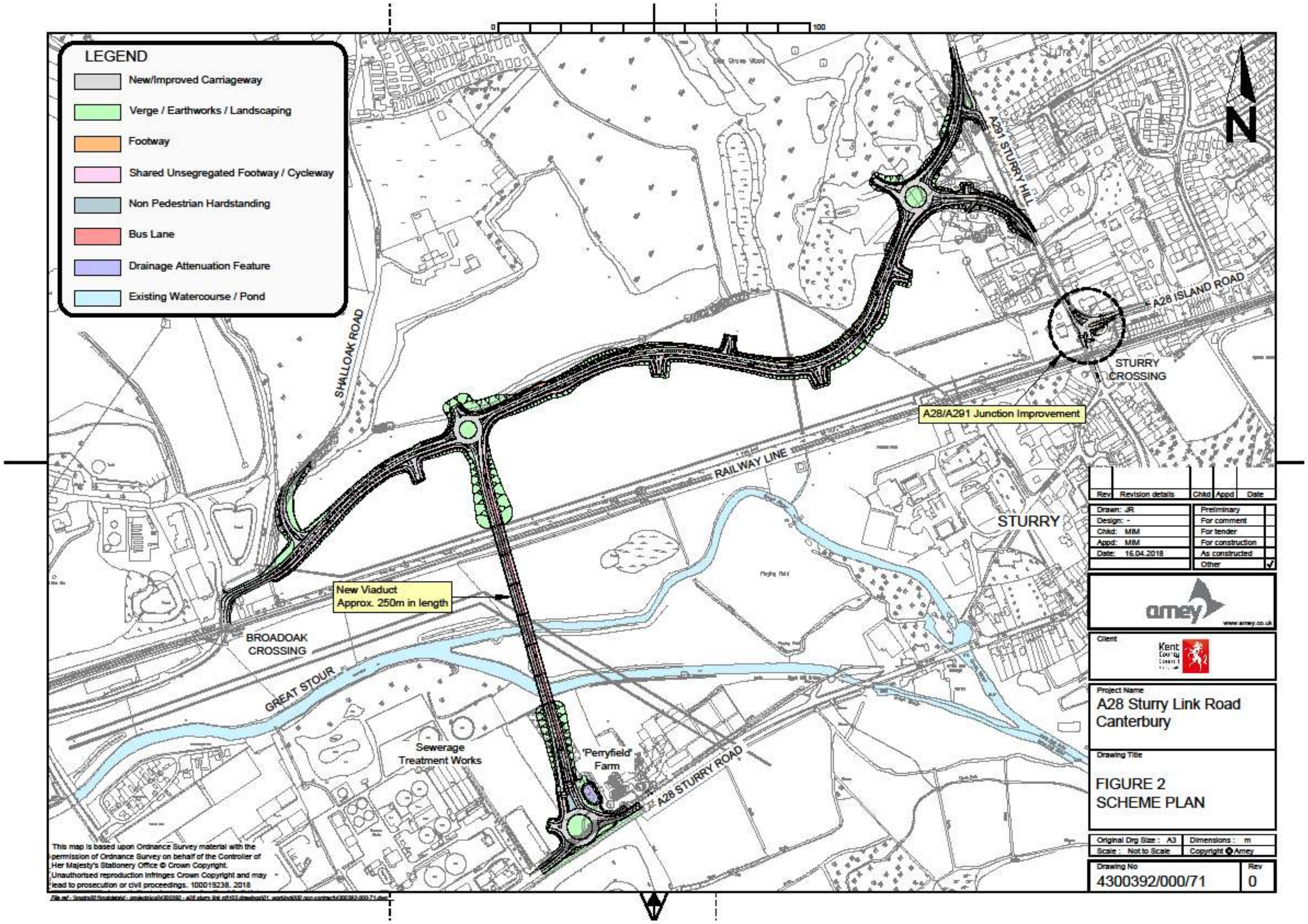


Figure 1.8: Sturry Link Road

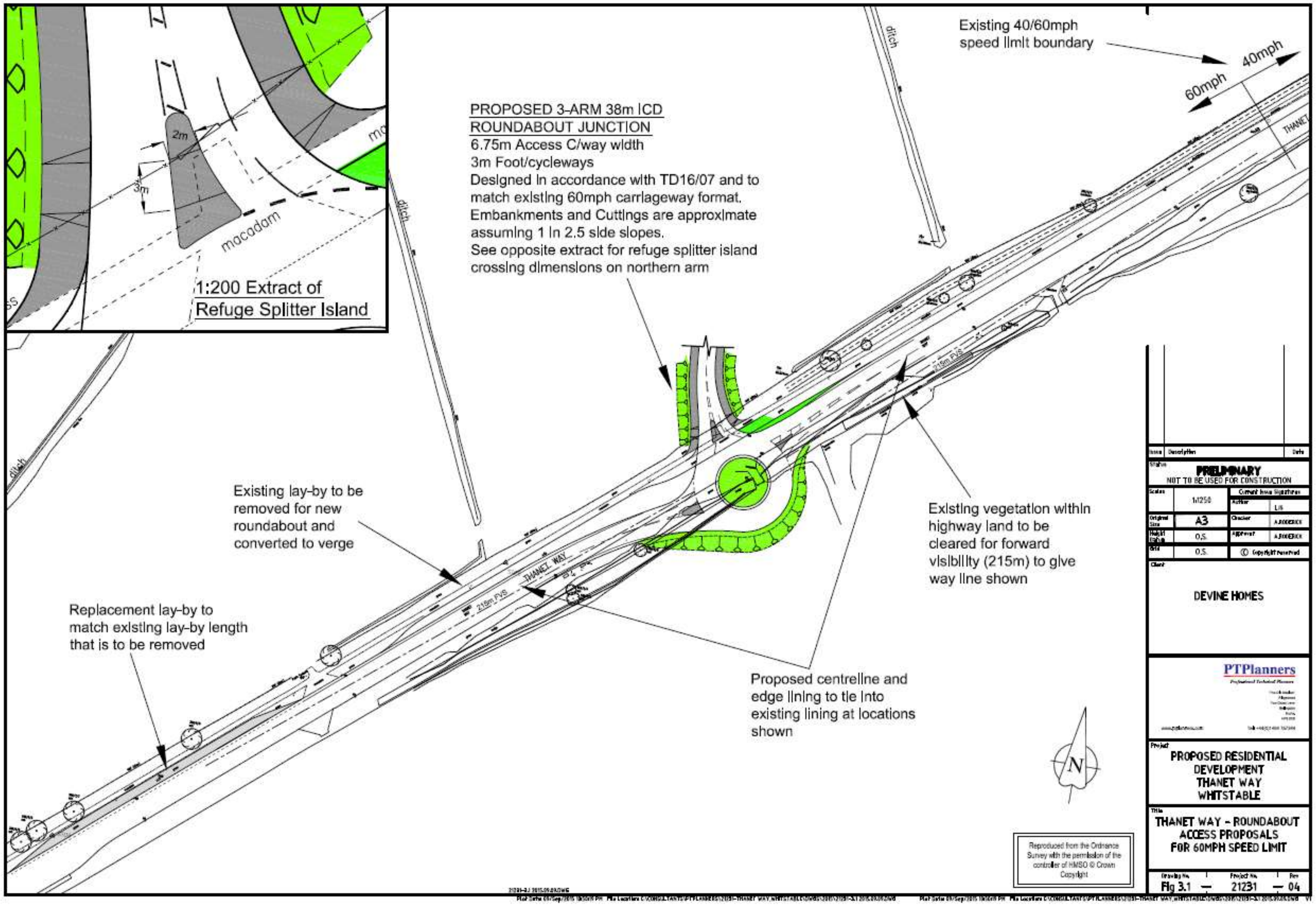


Figure 1.9: Thanet Way Roundabout Access Proposals

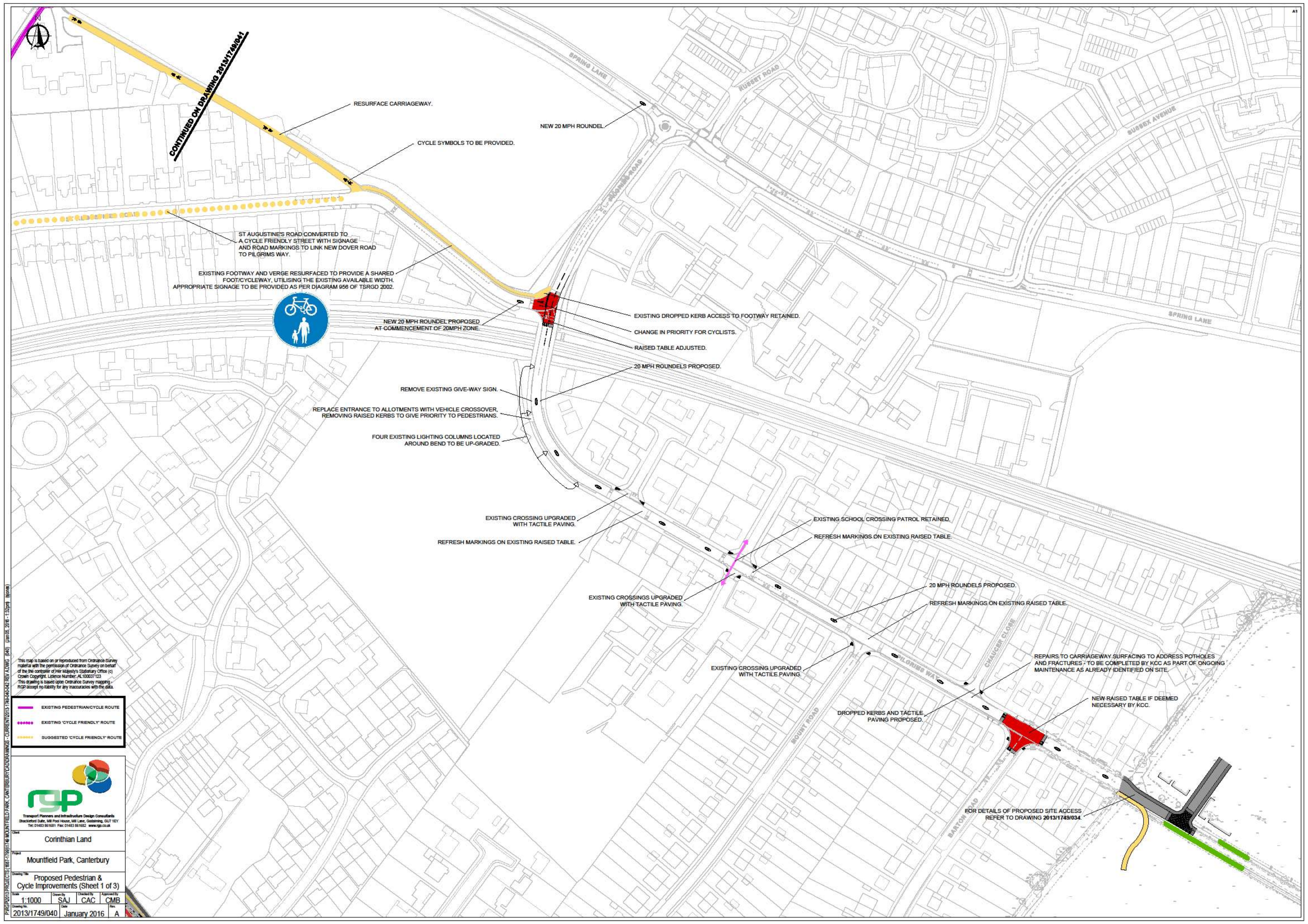


Figure 1.10: Mountfield Park Improvements

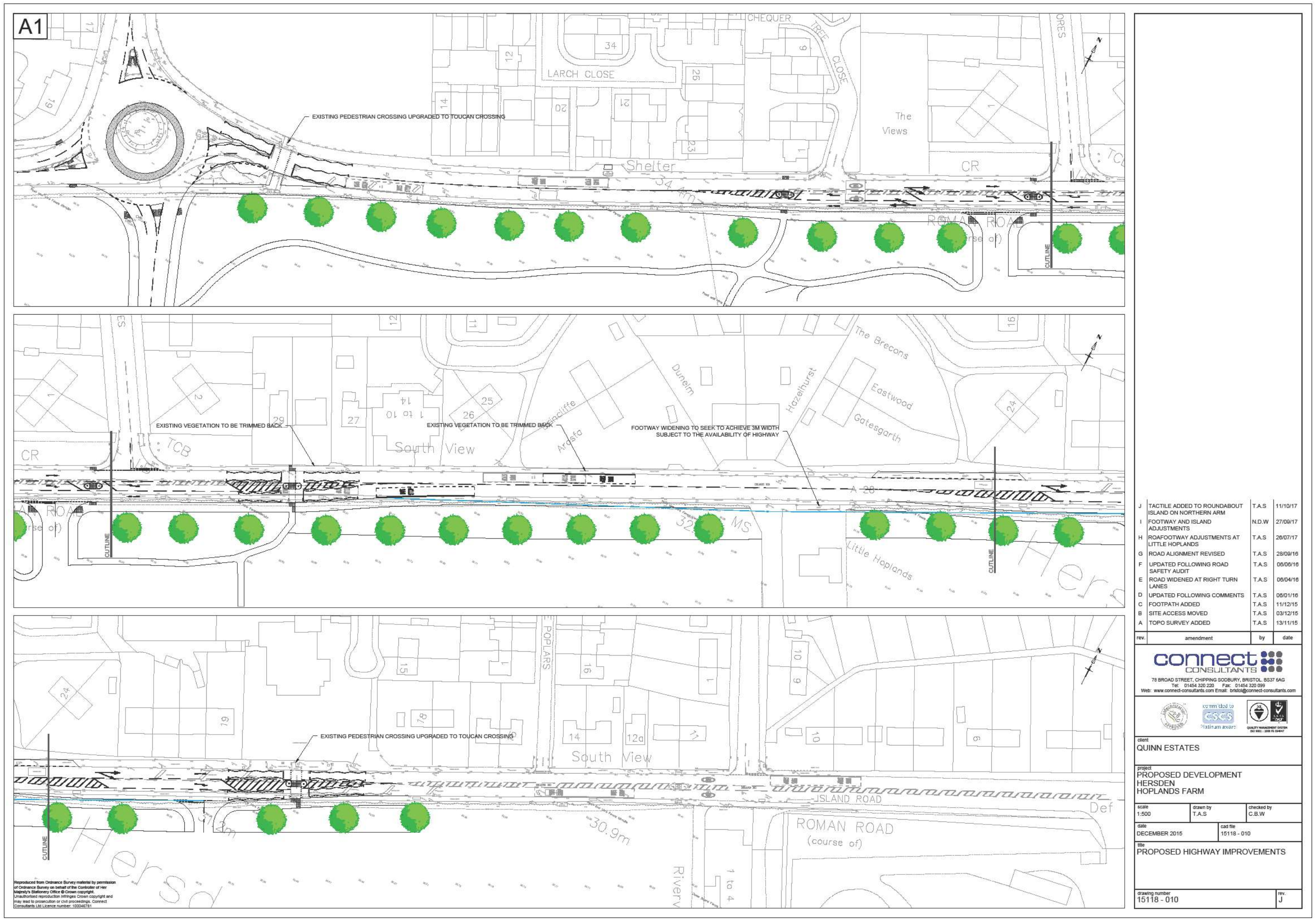


Figure 1.11: Hoplands Farm Proposed Highway Improvements

Figure 1.12: Station Way West Multistorey

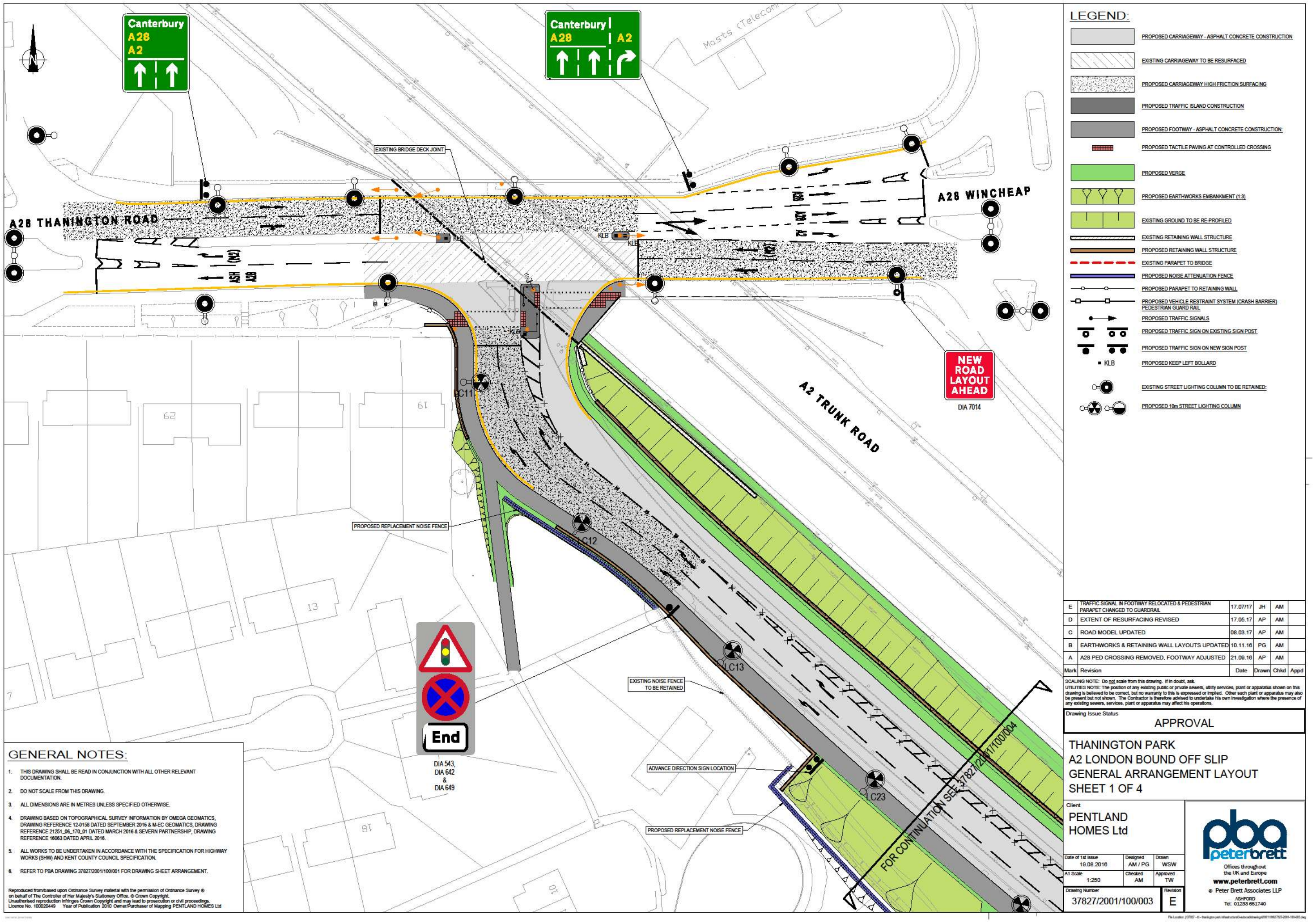


Figure 1.13: Thannington Park Off Slip

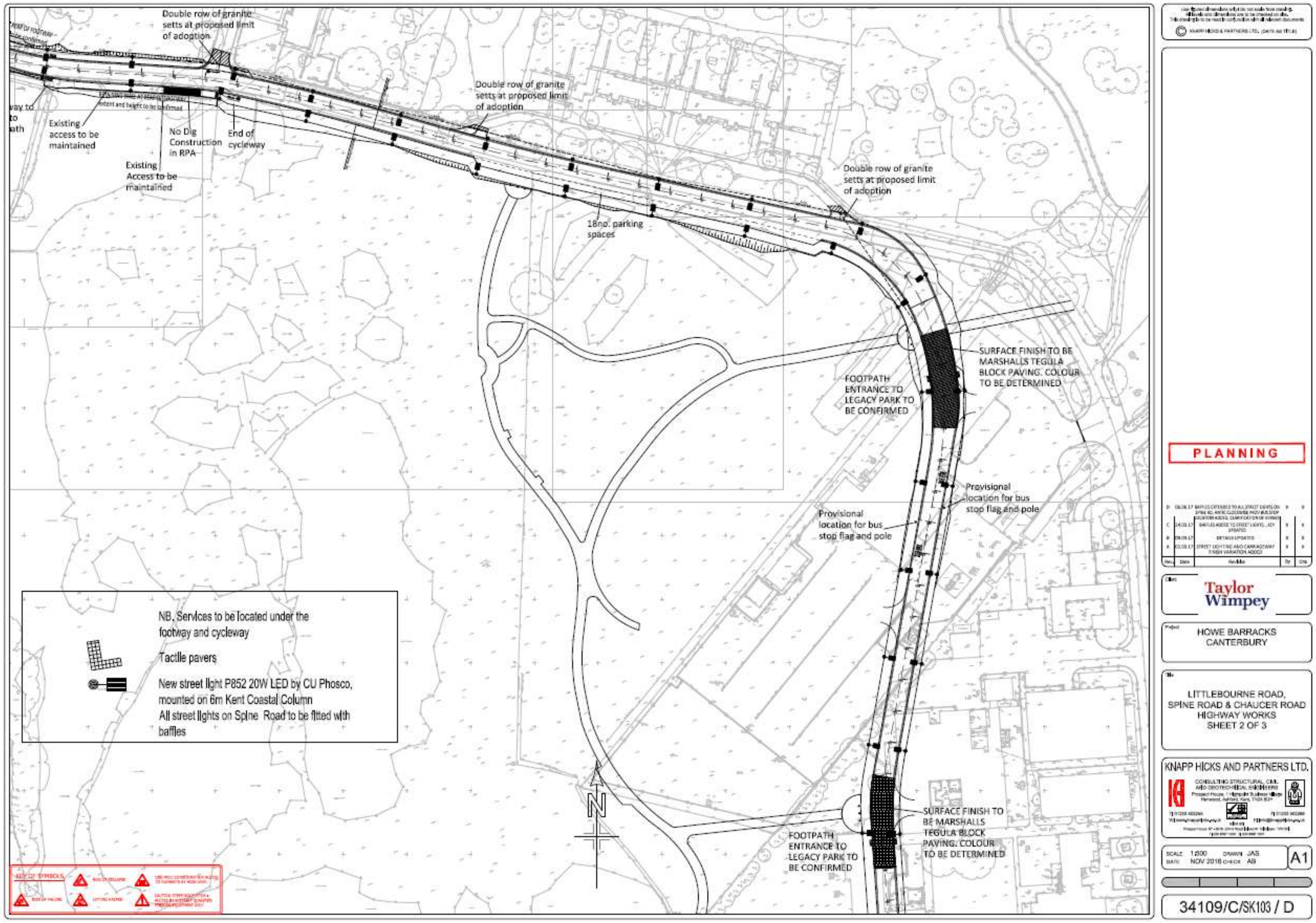


Figure 1.14: Littlebourne Road Highway Works

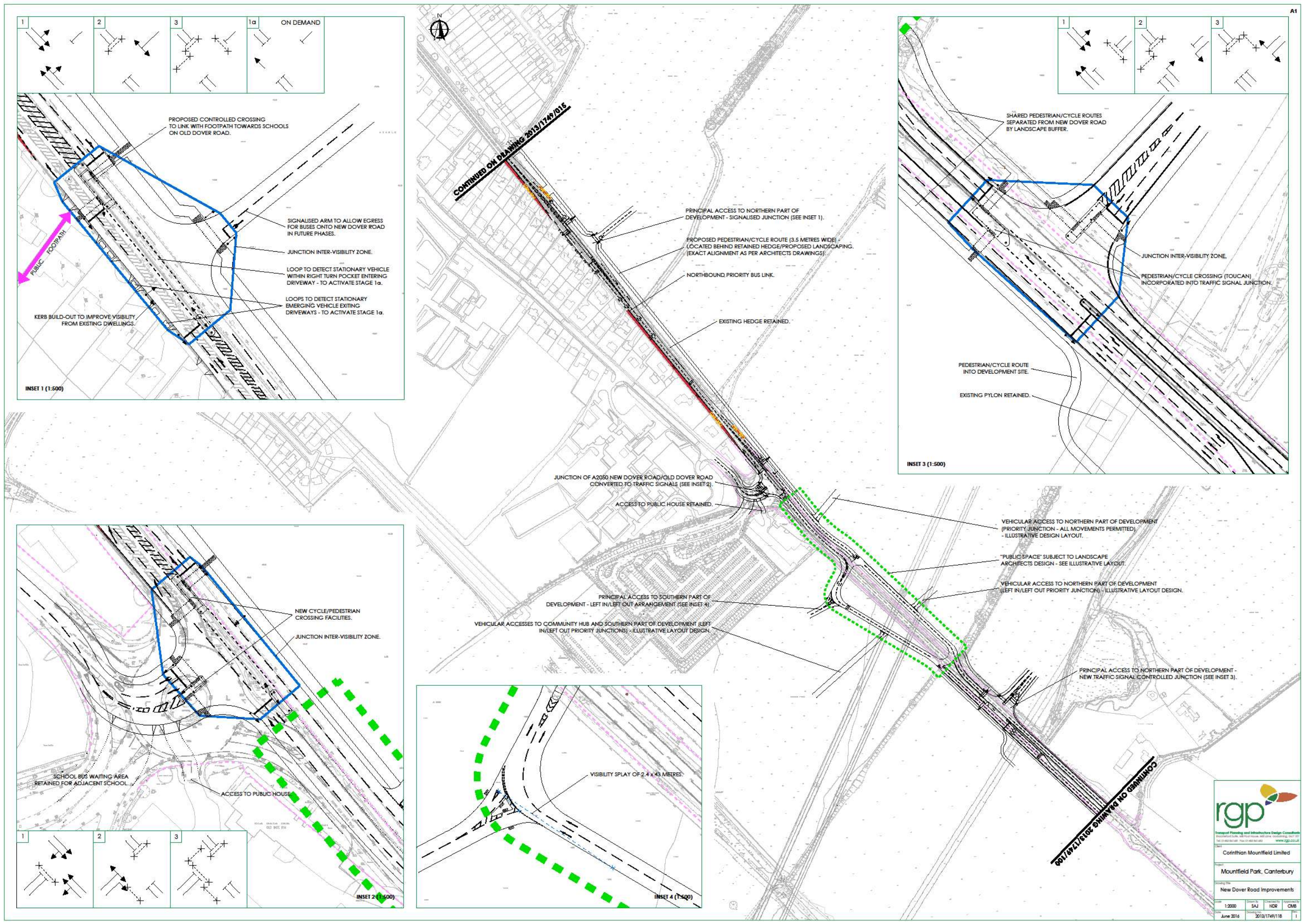


Figure 1.15: New Dover Road Improvements

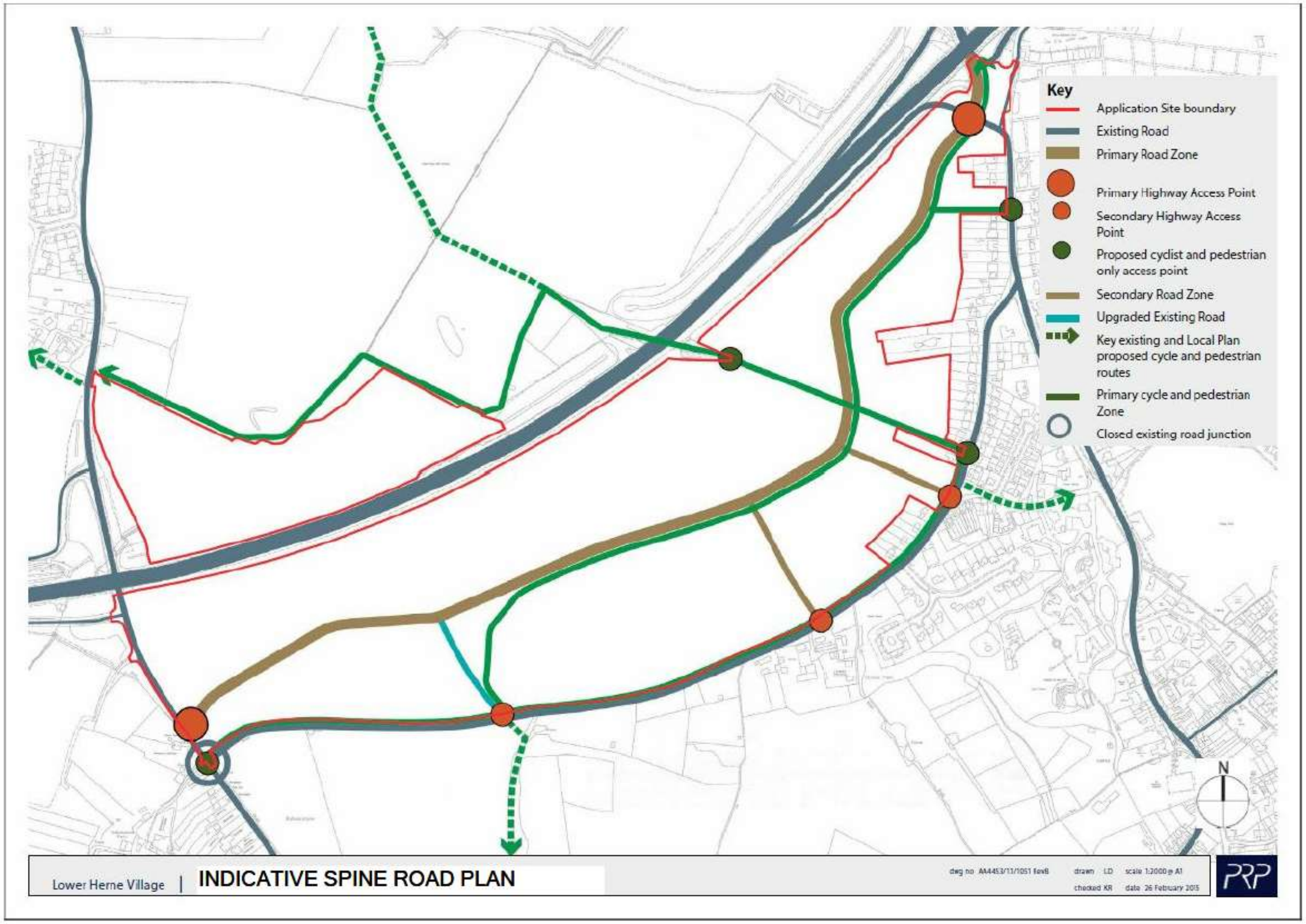


Figure 1.16: Indicative Spline Road Plan

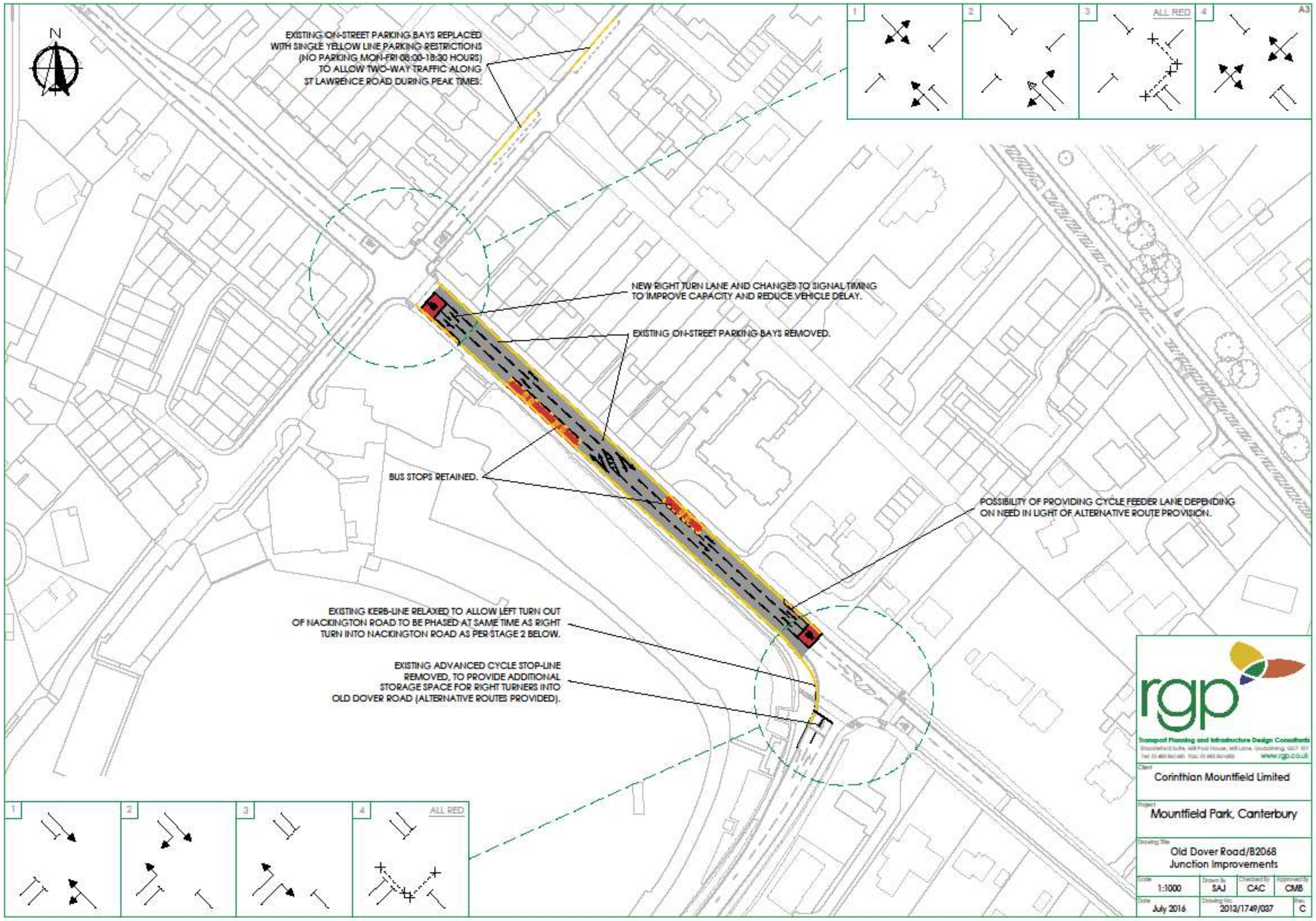


Figure 1.17: Old Dover Road Junction Improvements

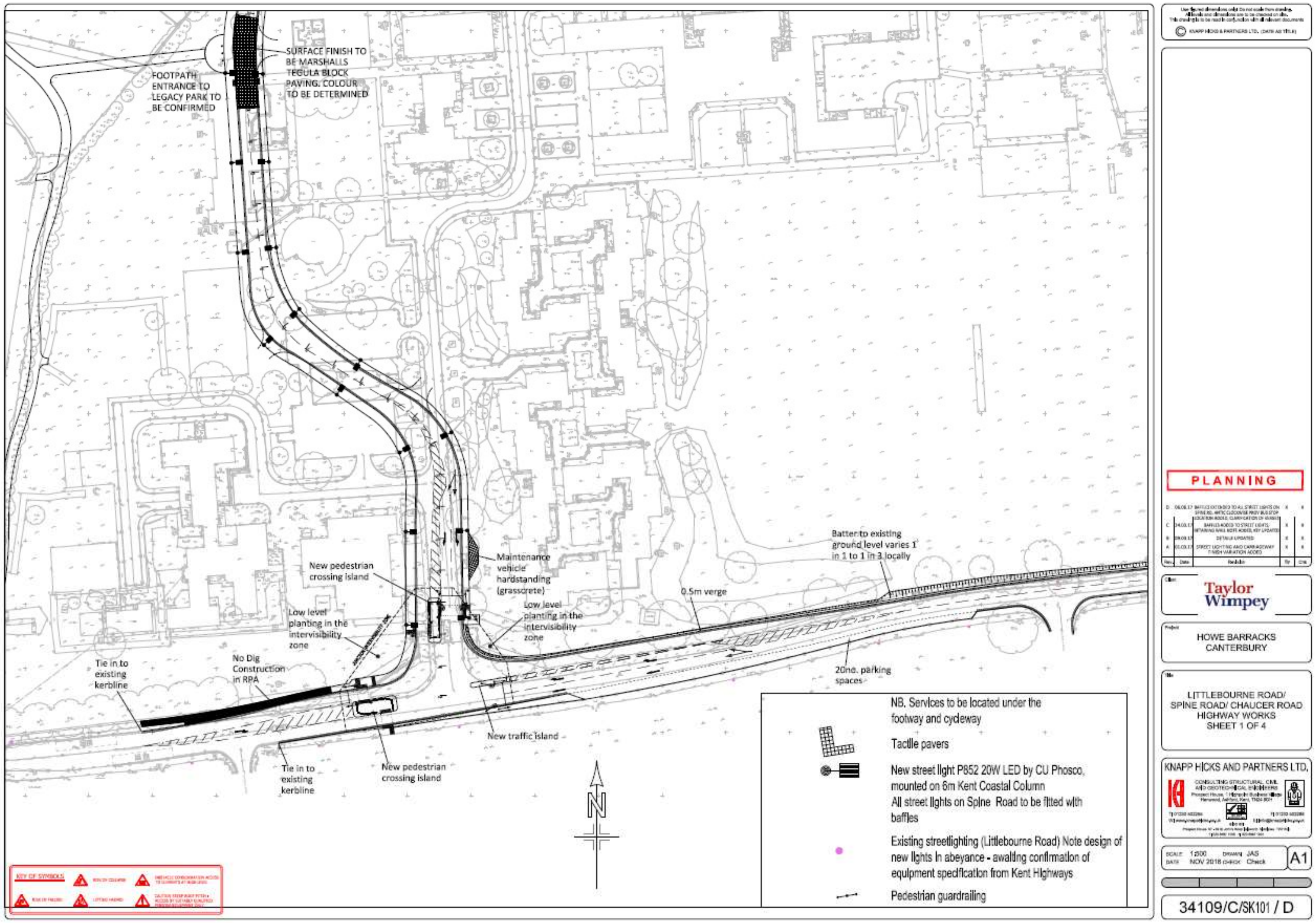


Figure 1.18: Littlebourne Road Highway Works

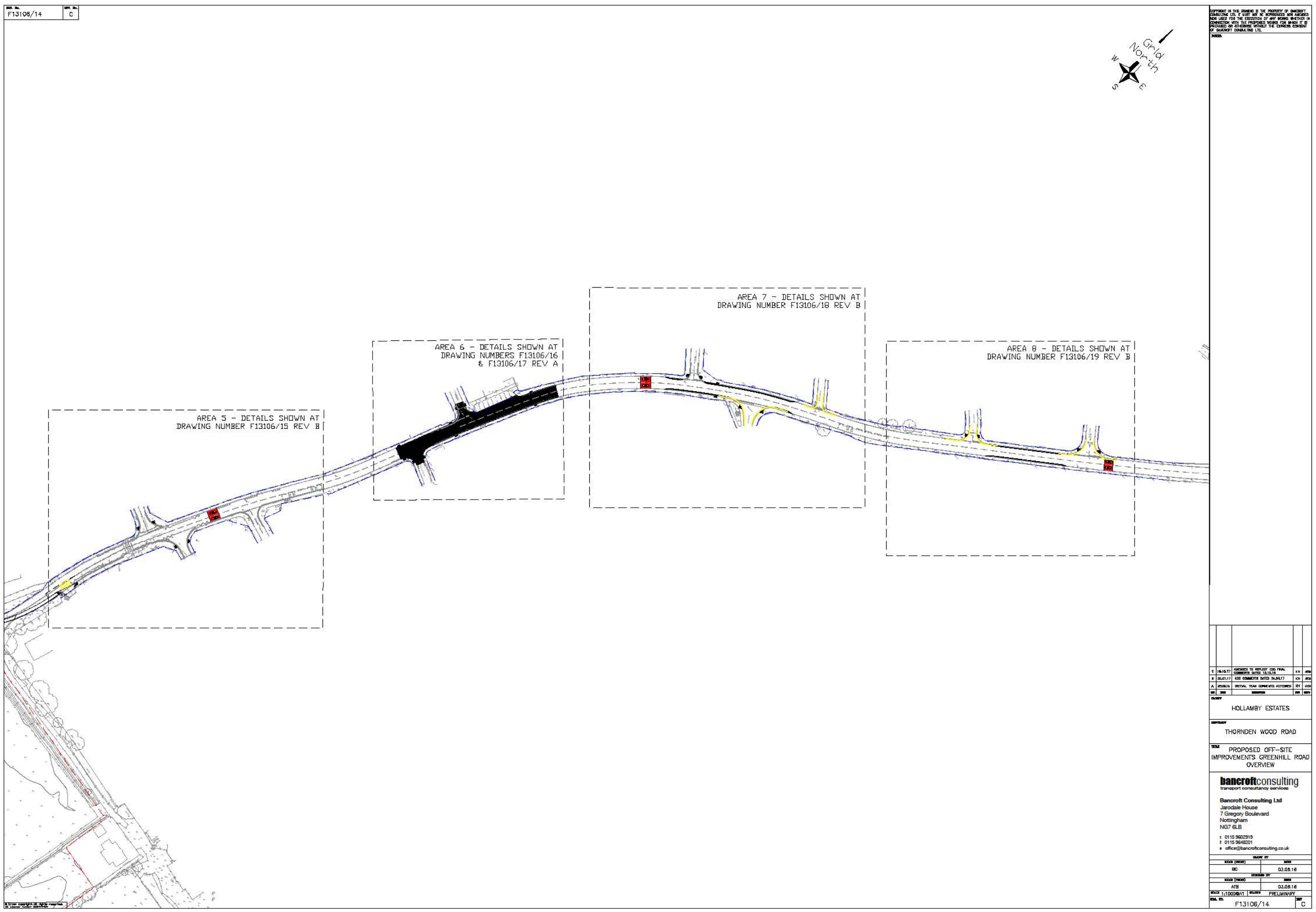


Figure 1.19: Greenhill Road Off-Site Improvements

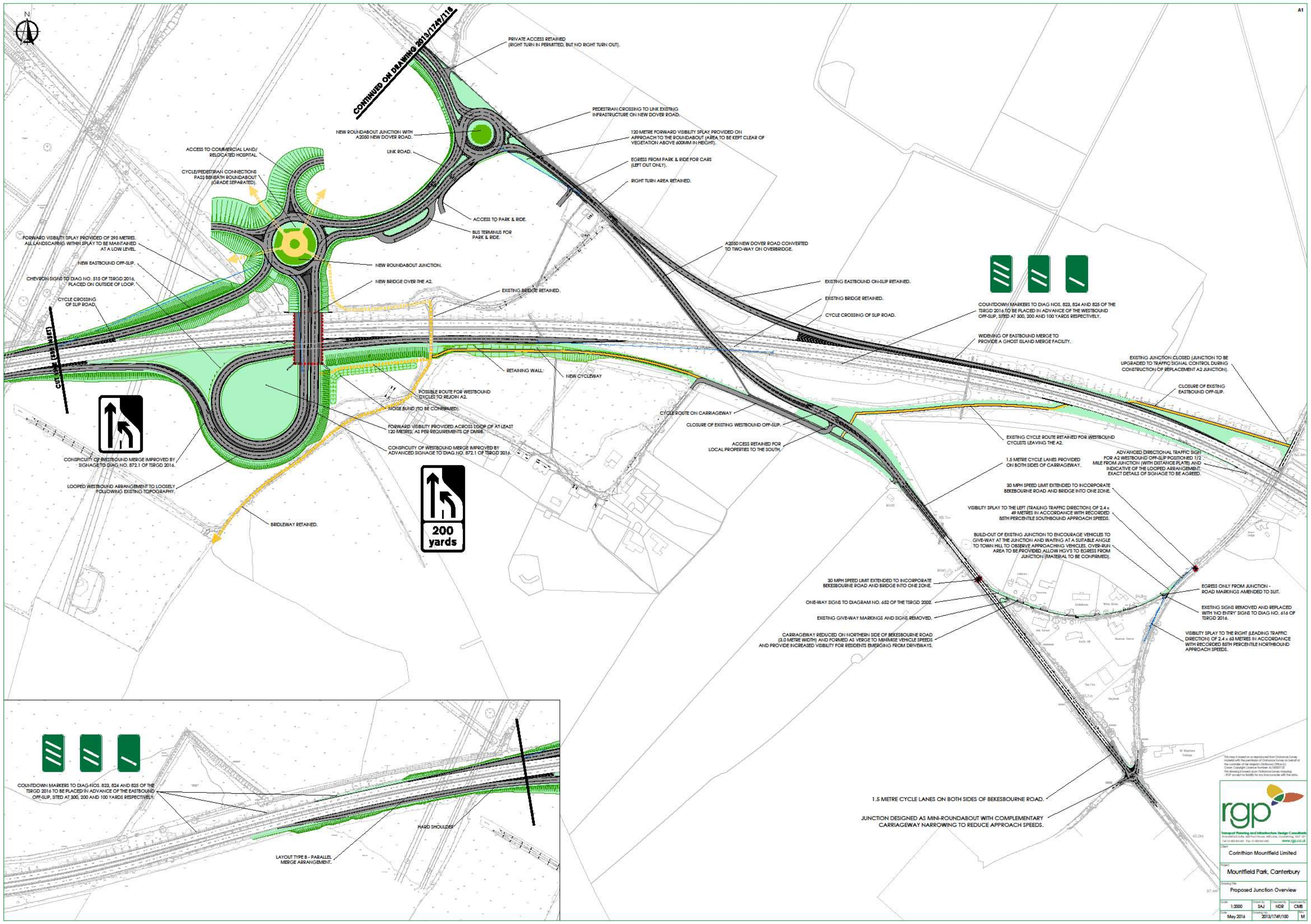


Figure 1.20: Mountfield Park Proposed Junction

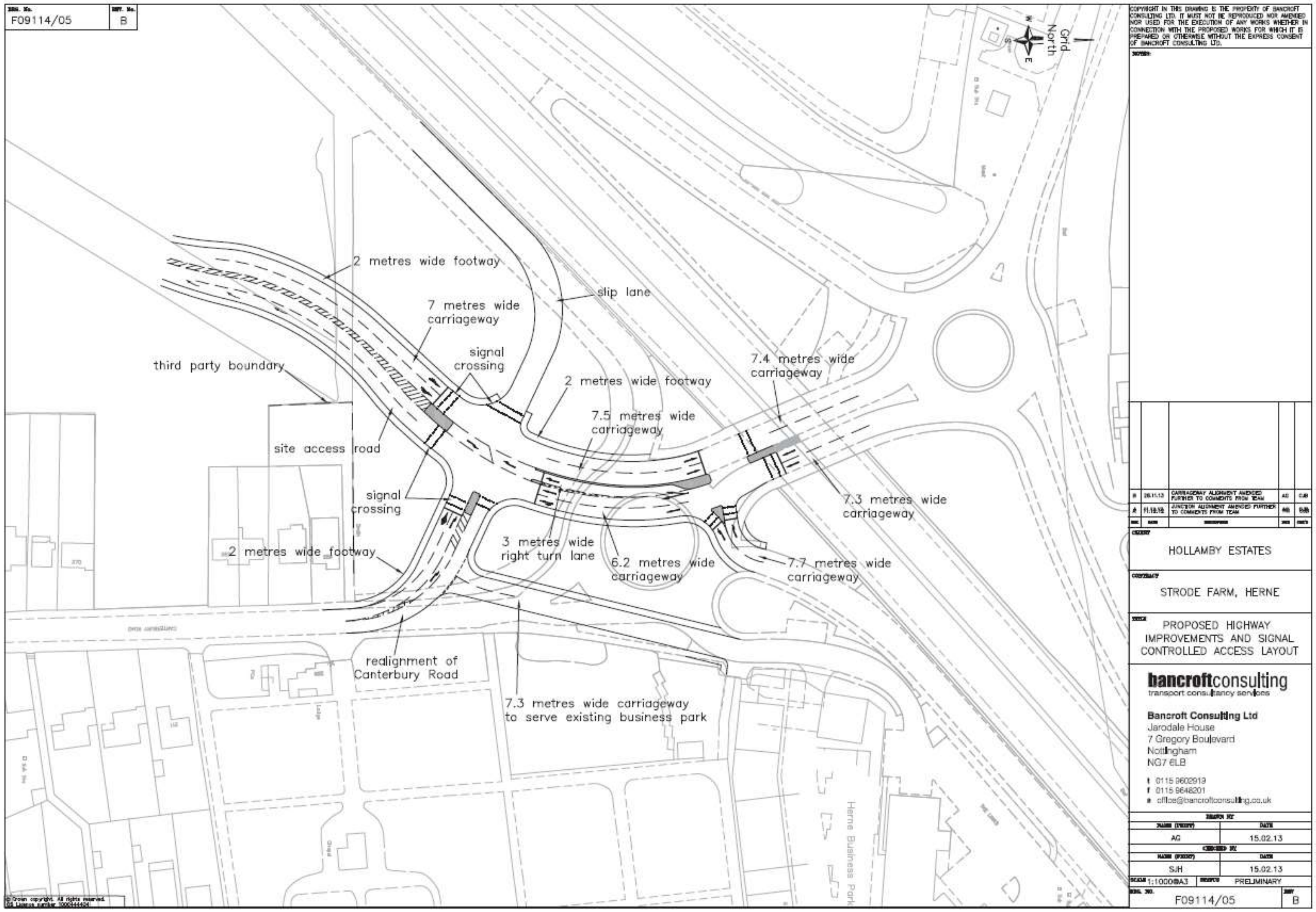


Figure 1.21: Strode Farm Proposed Highway Improvements

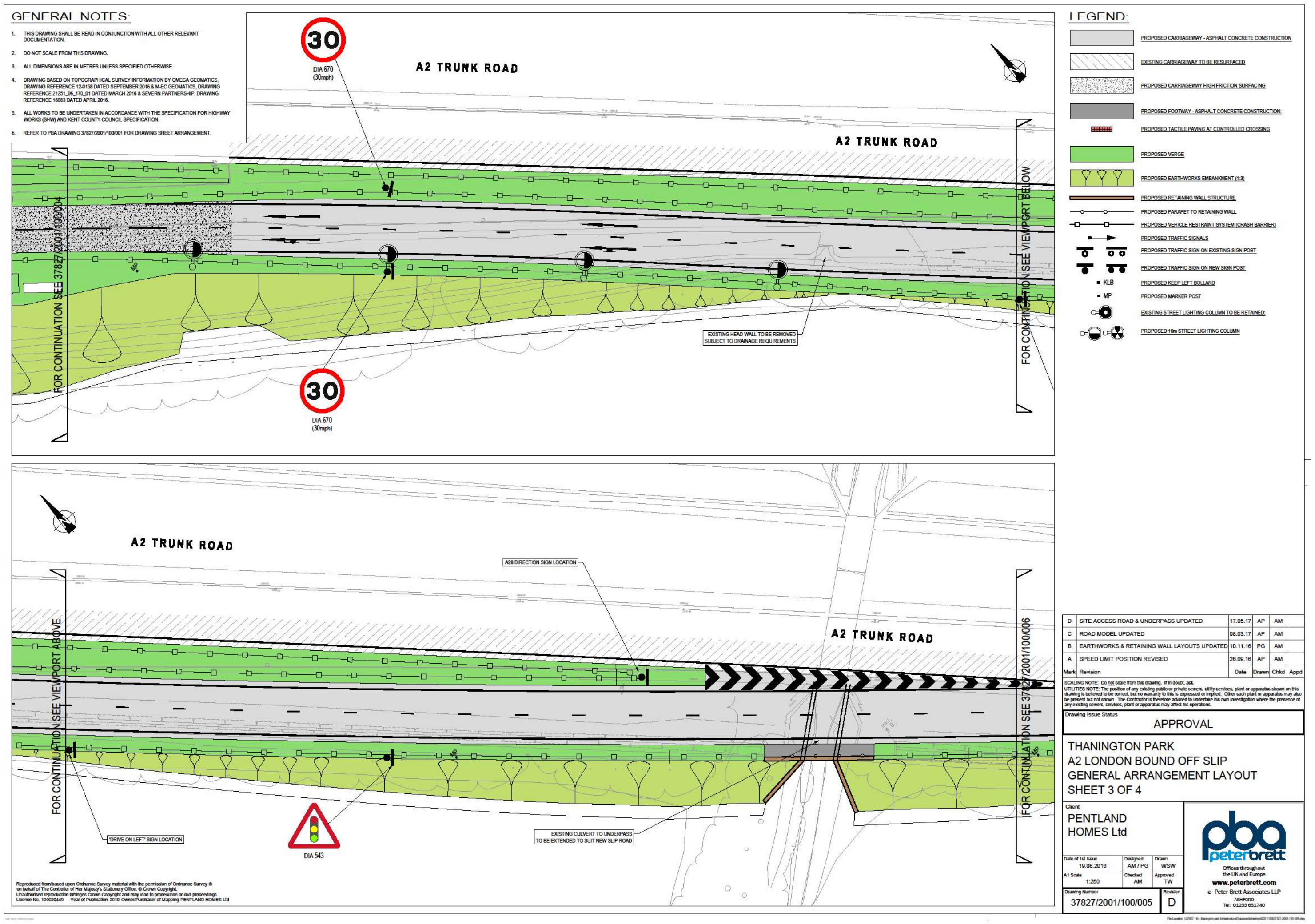


Figure 1.22: Thannington Park Off Slip General Arrangement Layout

Jacobs

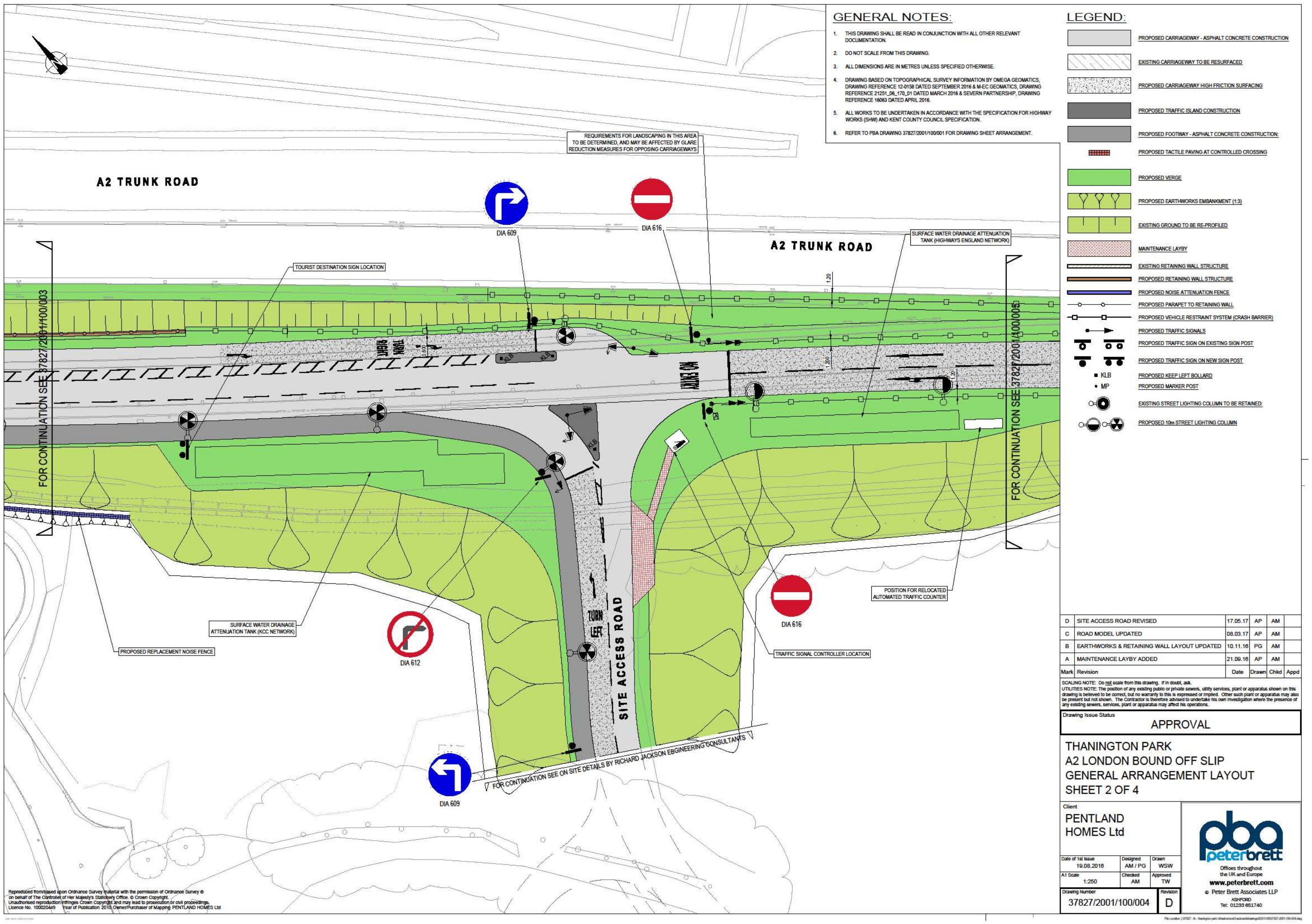


Figure 1.23: Thannington Park General Arrangement Layout 2

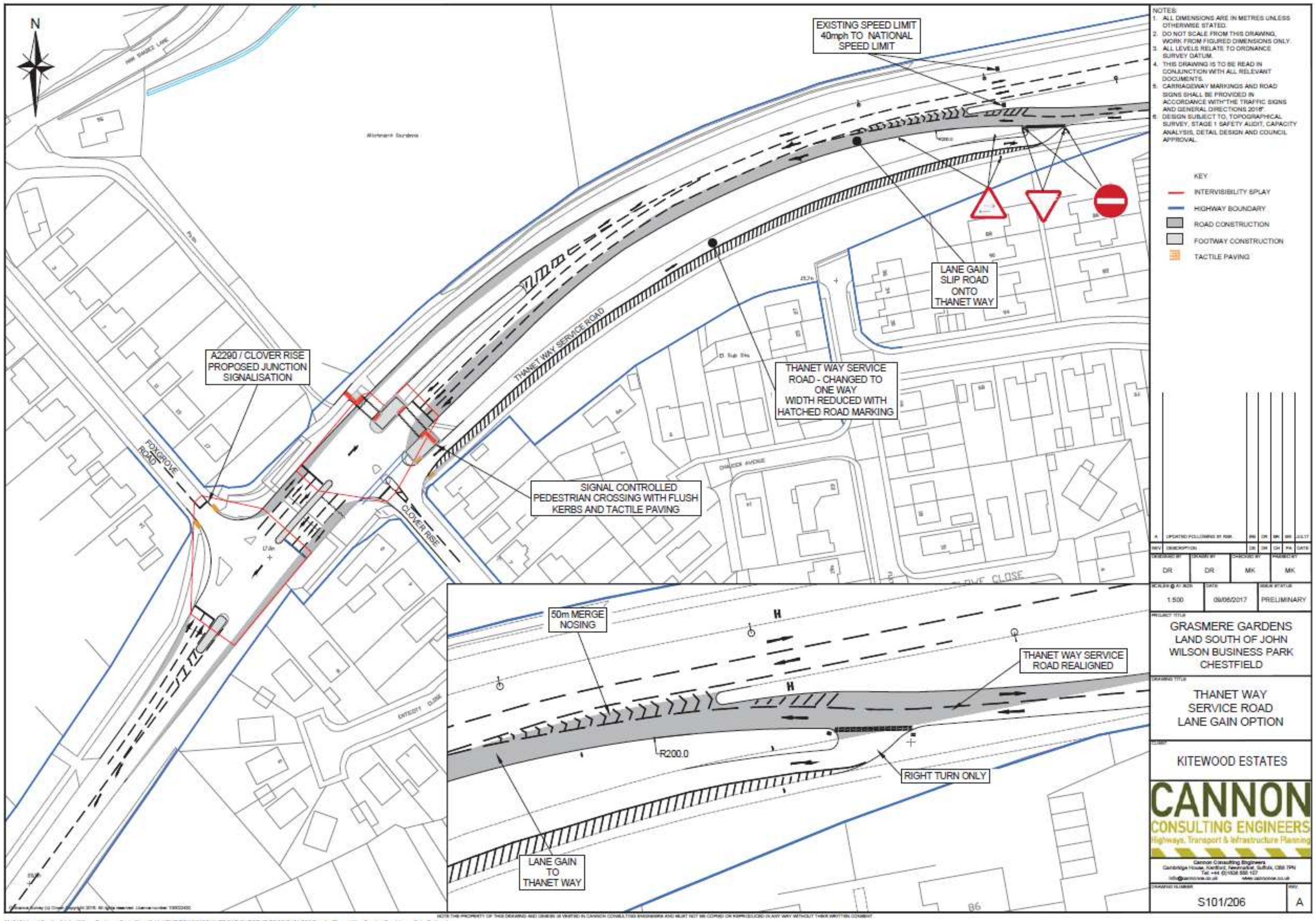


Figure 1.24: Thanet Way Service Road Lane Gain Option

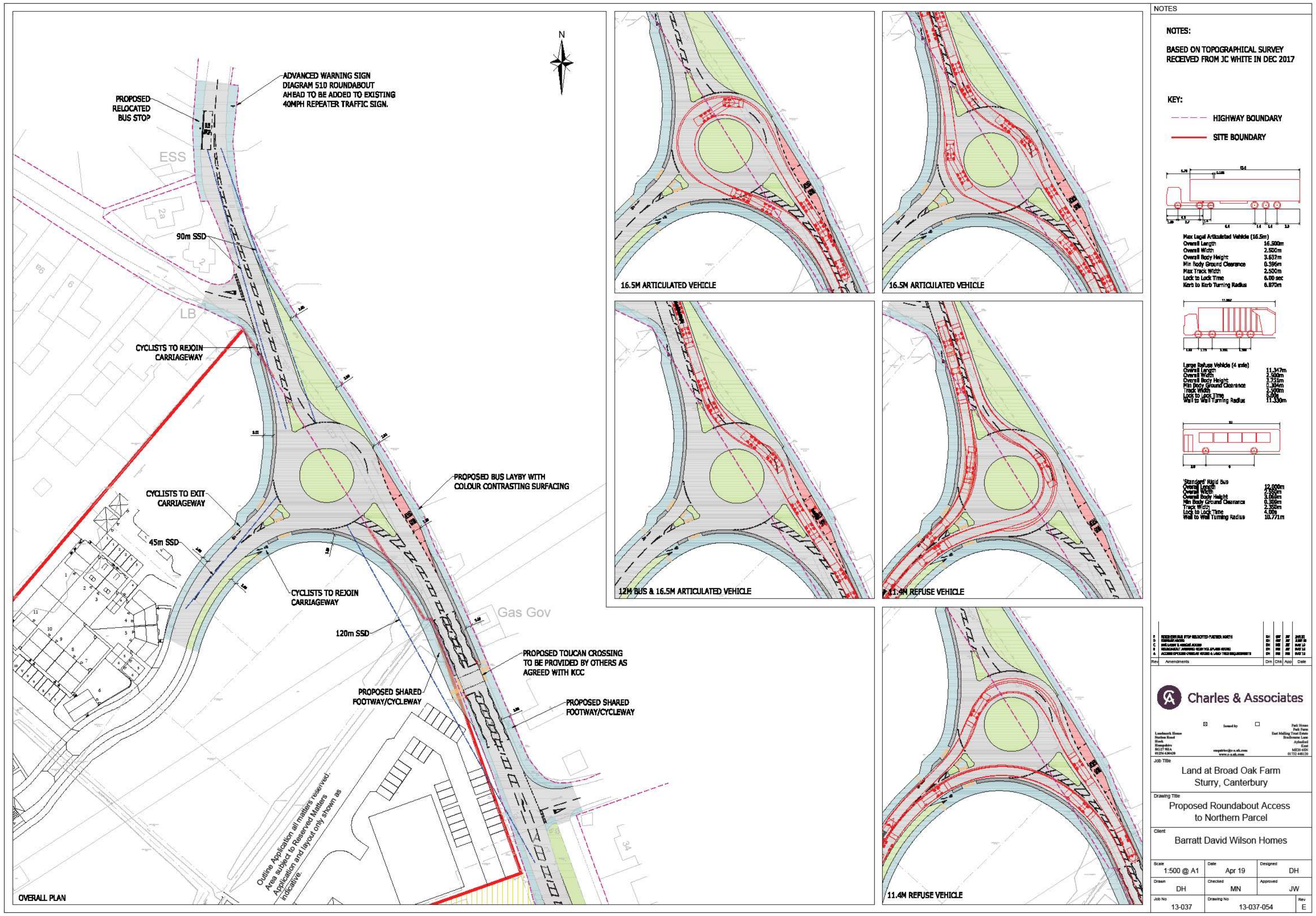


Figure 1.25: Broad Oak Farm Proposed Roundabout Access

Figure 1.26: Broad Oak Farm Proposed Site Access

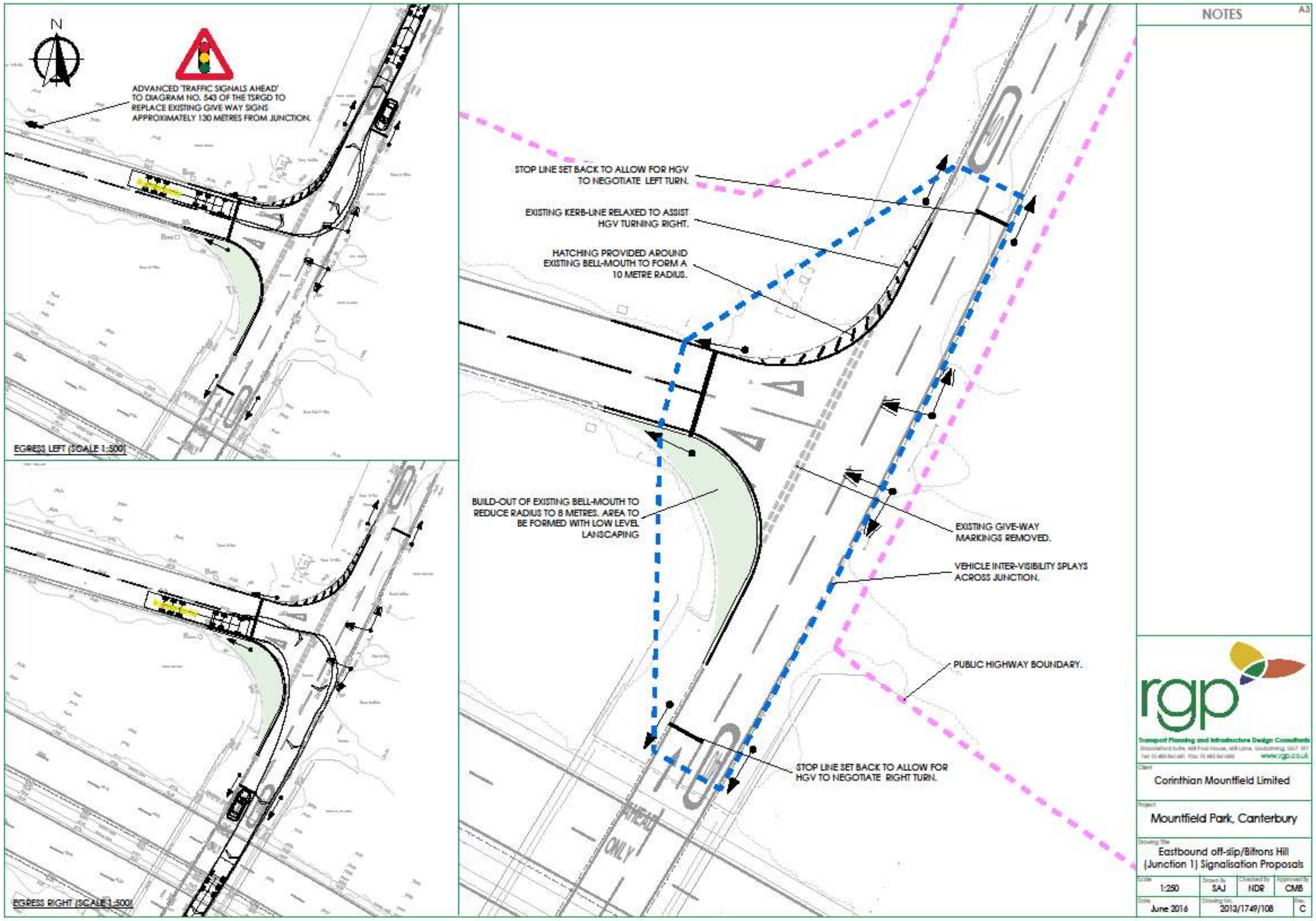


Figure 1.27: Mountfield Park Eastbound Off-Slip Signalisation Proposal

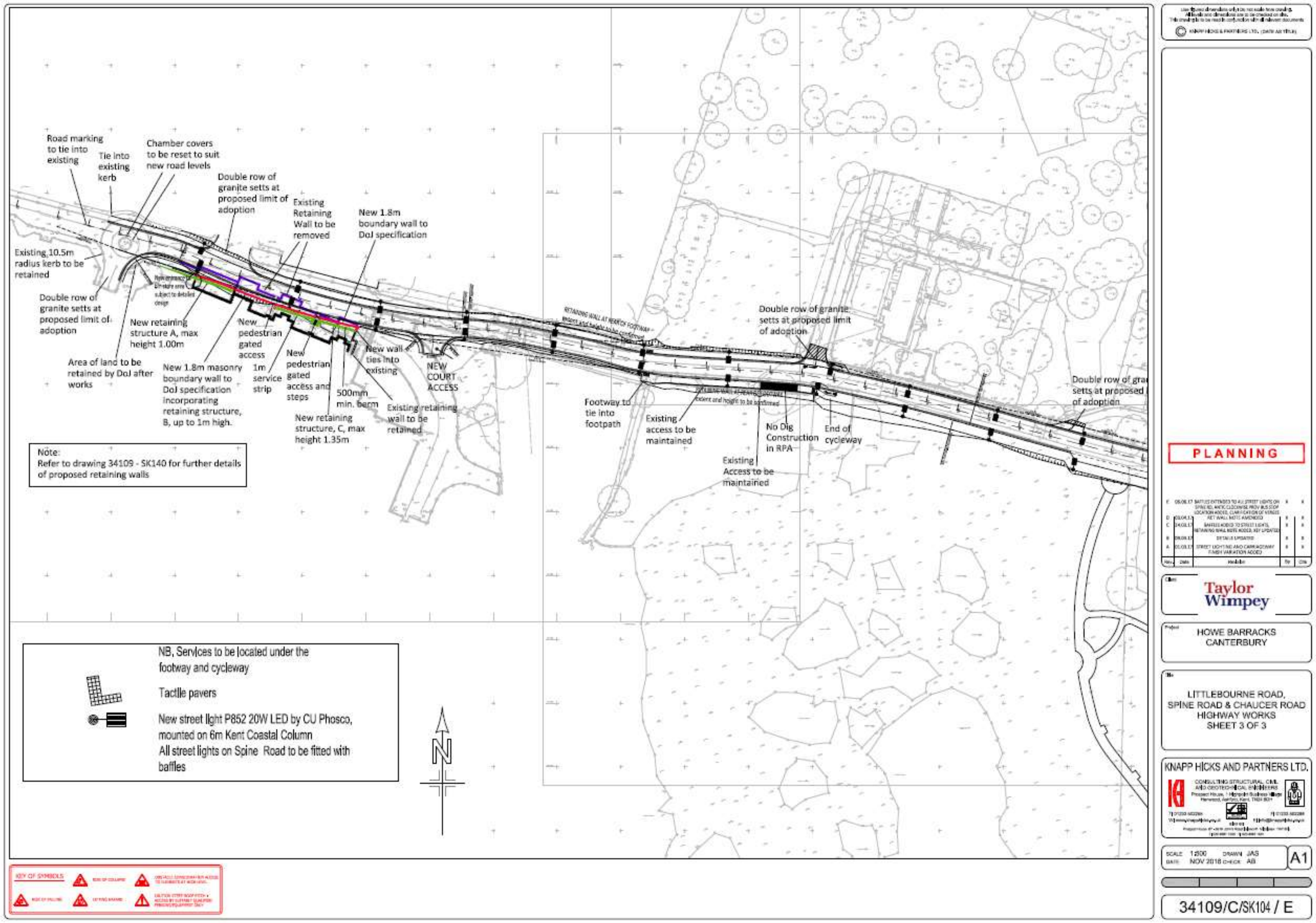


Figure 1.28: Littlebourne Road Highway Works

2. Appendix B – City Centre Option schemes

Due to limited details in general scheme assumptions some of the schemes required additional clarification. Figures below include Canterbury City Centre clarification for Option 3, 4 and 5, describing in detail number of lanes and overall traffic organization on the Ring Road and approaches.

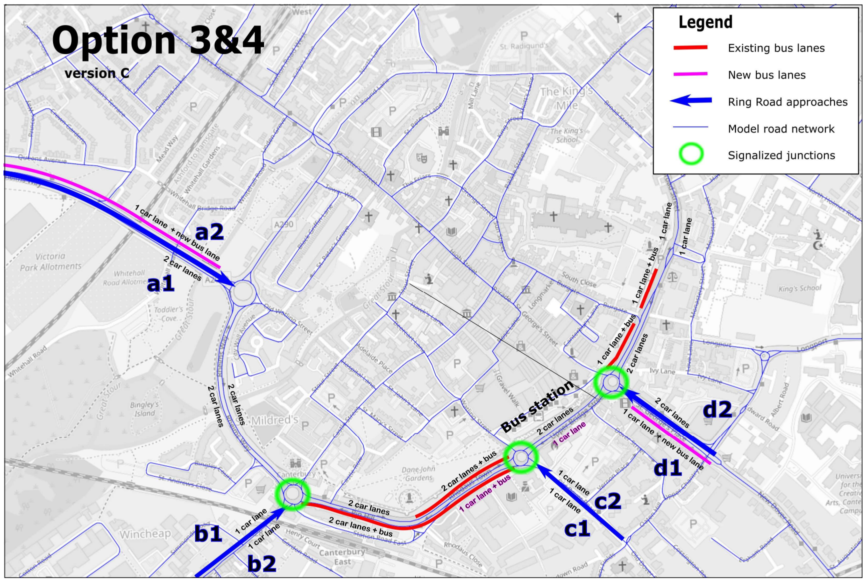


Figure 2-1 Option 3 & 4 City Centre lane/approach schemes sketch

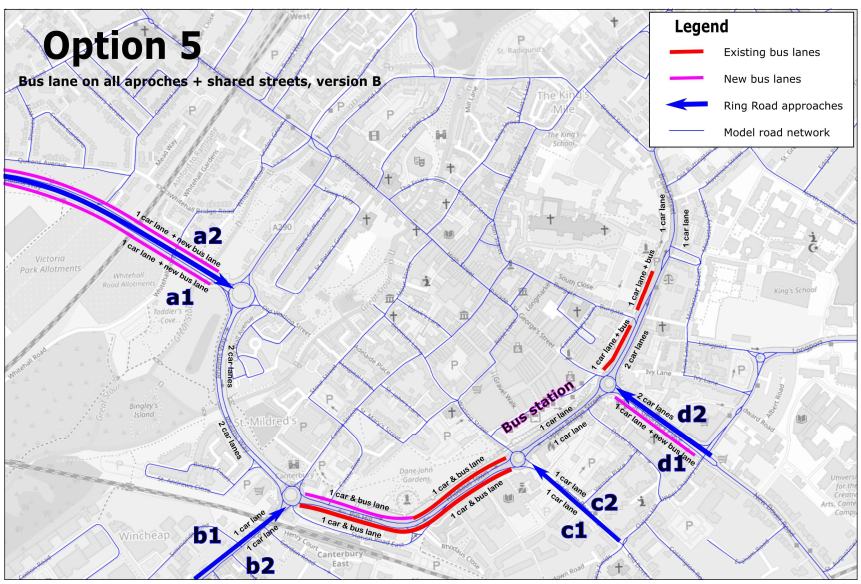


Figure 2-2 Option 5 City Centre lane and approaches sketch ("shared streets" and "bus lane on all approaches")

3. Appendix C - Uncertainty Logs

Development Assumptions

ID	Development Name	Description	Land Use	Size		Uncertainty Status	Completion Year	Model Zone	Access Arrangements	Transport Assessment Available?	KCC Comments
				Housing	Employment						
1	Broad Oak	18/00868 456 homes + 593 sqm Employment	A1/B1/C3	456	40	More than likely	2026	102050	2 accesses; Roundabout + RT	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGFEAID875&activeTab=summary	Drawing submitted
2	Cockering Farm	17/00519 400 homes + 3716 sqm Employment	B1/D1/D2/C3	400	161	Near certain	2026	102074	New Rt ghost + Spine Road	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGKEAID120&activeTab=summary	Drawing submitted
3	Duncan Down	15/01296 400 homes	C3	400	0	Near certain	2024	102031	New Roundabout	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGQEAID794&activeTab=summary	Drawing submitted
4	Chestfield Lidl	Discount supermarket	Retail	0	175	Near certain	2020	102065	RT Ghost lane	No	Drawing submitted
5	Grasmere Gardens	17/00469 300 homes + 3500sqm Employment	B1a/C3	300	179	Near certain	2024	102022		https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGKEAID191&activeTab=summary	Drawings submitted
6	Greenhill	17/02907 450 homes	C3	450	0	Near certain	2024	102016	Realignment of Thornden Wood Road	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGGEAID899&activeTab=summary	Drawings submitted
7	Herne Bay Golf Club	15/00844 600 homes + 4,800sqm Employment	C2/D1/A4/C3	600	173	Near certain	2022	102029	2 accesses	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGREAID450&activeTab=summary	
8	Hoplands Farm, Hersden	16/00404 250 homes + 5,500sqm Employment	A1/B1/D1/D2/C3	250	263	Near certain	2023	102048	2 accesses	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGOEAID223&activeTab=summary	Drawings submitted
9	Howe Barracks	14/01230 500 homes	C3	500	0	Near certain	2022	102063	Multiple works	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGUEAID683&activeTab=summary	Drawings submitted
10	South Canterbury	16/0060 4000 homes + 2 primary Schools+ 70,000sqm employment	Residential and Employment	4000	1565	Near certain	2036	102072			Drawings submitted
11	Sturry	17/01383 650 homes	C3	650	0	More than likely	2030	102053		https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGJEAID667&activeTab=summary	

ID	Development Name	Description	Land Use	Size		Uncertainty Status	Completion Year	Model Zone	Access Arrangements	Transport Assessment Available?	KCC Comments
				Housing	Employment						
12	Hillborough	1200 homes + 20,000sqm employment	Residential and Employment	1200	670	More than likely	2030	102006			
13	Thanington Park	750 homes +5000sqm Emplyment	Residential and Employment	750	205	Near certain	2020	102076	Multiple works		Drawings submitted
14	Station Road West Multi-storey	3 storey multi storey car park		0	129	Near certain	2020	102084	Access arrangements	yes	Drawings submitted
15	Strode Farm	15/01317 800 homes	C3	800	0	Near certain	2025	102025	Access and spine road	https://pa.canterbury.gov.uk/online-applications/applicationDetails.do?keyVal=ZZZXGQEAID737&activeTab=summary	Drawings submitted

Table 3.1: Canterbury Development Assumptions

Infrastructure Assumptions

ID	Scheme Name	Description	Uncertainty Status	Completion Year	Drawing Available?	KCC Comments
1	Sturry Link Road	Part LGF funded scheme. New viaduct and relief road.	Reasonably foreseeable	2025	Attached	Some uncertainty with funding but a strategic priority.
2	Herne Relief Road	Linked to Strode Farm application and link road	Near certain	2022	Attached	
3	Wincheap Gyratory	Linked to the Thanington applications	Near certain	2022	Attached	
4	ST Nicholas Signal	Linked to the Thanington applications	Near certain		Attached	Sent through email on 04/12/20

Table 3.2: Canterbury Infrastructure Assumptions

4. Appendix D - Donor Zones

Development zone	Description	Donor zone
200001	Broad Oak	119069
200002	Cockering Farm	119167
200003	Duncan Down	102035
200004	Chestfield Lidl	118984
200005	Grassmere Gardens	102022
200006	Greenhill	102011
200007	Herne Bay Golf Club	102025
200008	Hoplands Farm, Hersden	102047
200009	Howe Barracks	118771
200010	South Canterbury	118765
200011	Sturry	119080
200012	Hillborough	102006
200013	Thanington Park	119162
200014	Station Road West Multi-storey	119014
200015	Strode Farm	102026
200101	Broad Oak (added jobs)	119065
200108	Hersden (added jobs)	102047
200110	Mountfield Park (SC added jobs)	118767
200112	Hillborough (added jobs)	102006
200210	SC Schools	118761
310001	NW 1	118773
310002	NW 2	118774
310003	NW 3	118775
310004	NW 4	118776
310005	NW 5	118778
310006	NW 6	118779
310007	NW 7	118859
310008	NW 8	118861
310009	NW 9	118862
310010	NW 10	118863
310011	NW 11	119119
310012	NW 12	162941
320001	S/SE 1	118768
320002	S/SE 2	118786
320003	S/SE 3	118790
320004	S/SE 4	118942
320005	S/SE 5	118960
320006	S/SE 6	118961
320007	S/SE 7	118966
320008	S/SE 8	119153
320009	S/SE 9	119162
320010	S/SE 10	119163

320011	S/SE 11	119164
320012	S/SE 12	119165
320013	S/SE 13	119166
320014	S/SE 14	119167
320015	S/SE 15	119168
320016	S/SE 16	119169
330001	HB 1	102016
330002	HB 2	102026
330003	HB 3	102027
330004	HB 4	102028
330005	HB 5	102029
340000	Whitstable	102037
340001	SecSchool	102010
340002	Whitstable 2	102022
340003	Whitstable 3	102030
340004	Whitstable 4	102040
340005	Whitstable 5	102042
340006	Whitstable 6	102044
350000	Sturry	119070
360000	Hersden	102047
370001	Little 1	118945
370002	Little 2	118948
380001	Bridge 1	118965
380002	Bridge 2	118967
390001	Chart 1	118780
390002	Chart 2	118781
390003	Chart 3	118785
390004	Chart 4	118787
400000	Blean	118777
500000	Broad Oak Reservoir	119065
550001	Whitestable P&R	102040
550002	Expanded Sturry P&R	118981
550003	Expanded Wincheap P&R	119151
550004	New Dover Road P&R	118767
550005	New Wincheap multi-storey	119143
550006	New Harbledown P&R	118863
600000	KCC Hospital	118766

Table 4.1: Development zones with Donor Zones List

5. Appendix E – Link Flows

Baseline Flow AM

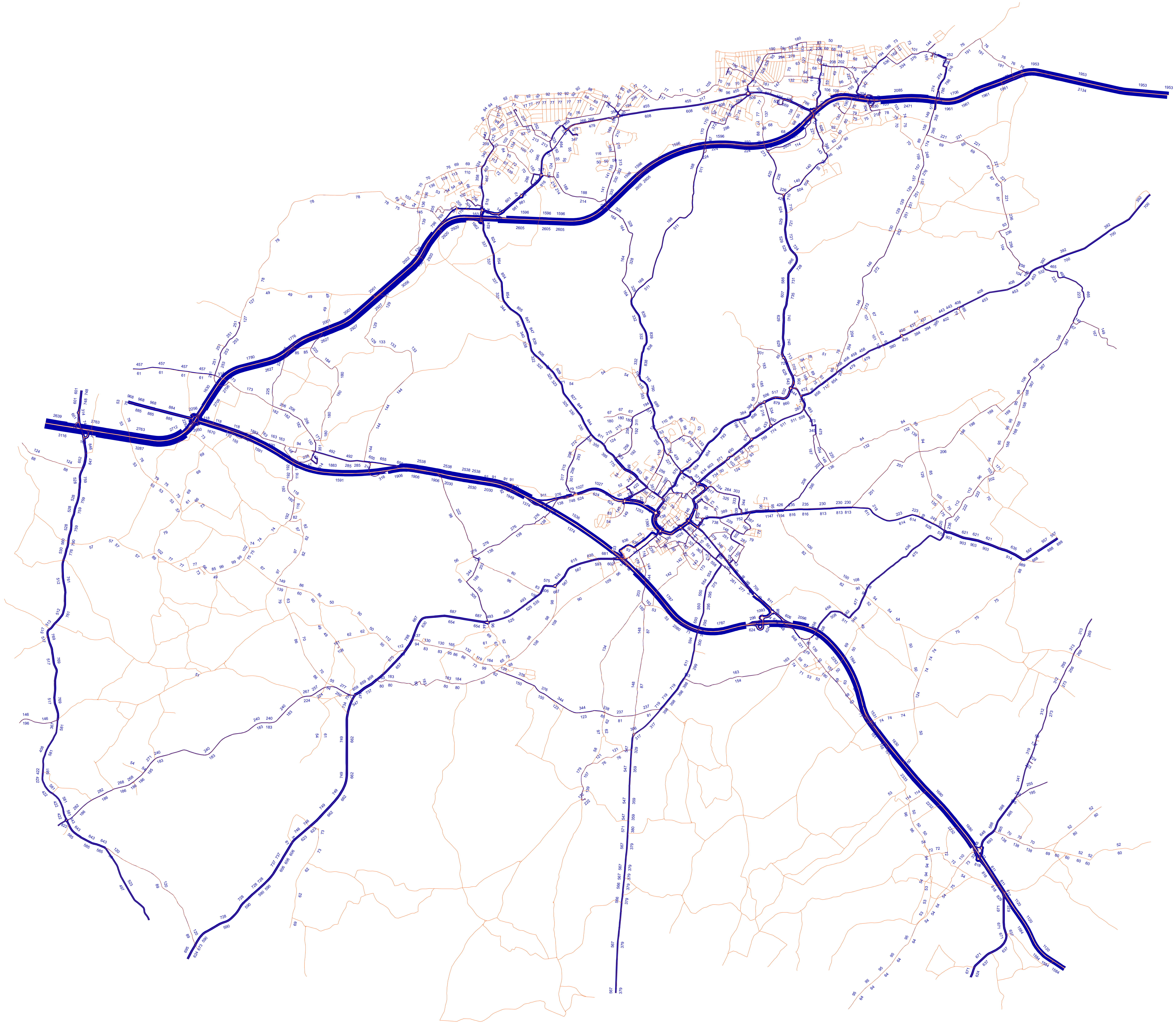
Legend

Volume PrT [veh] (AP)

0 822 1644 3287

Links

0 900 1500 m



Baseline Flow PM

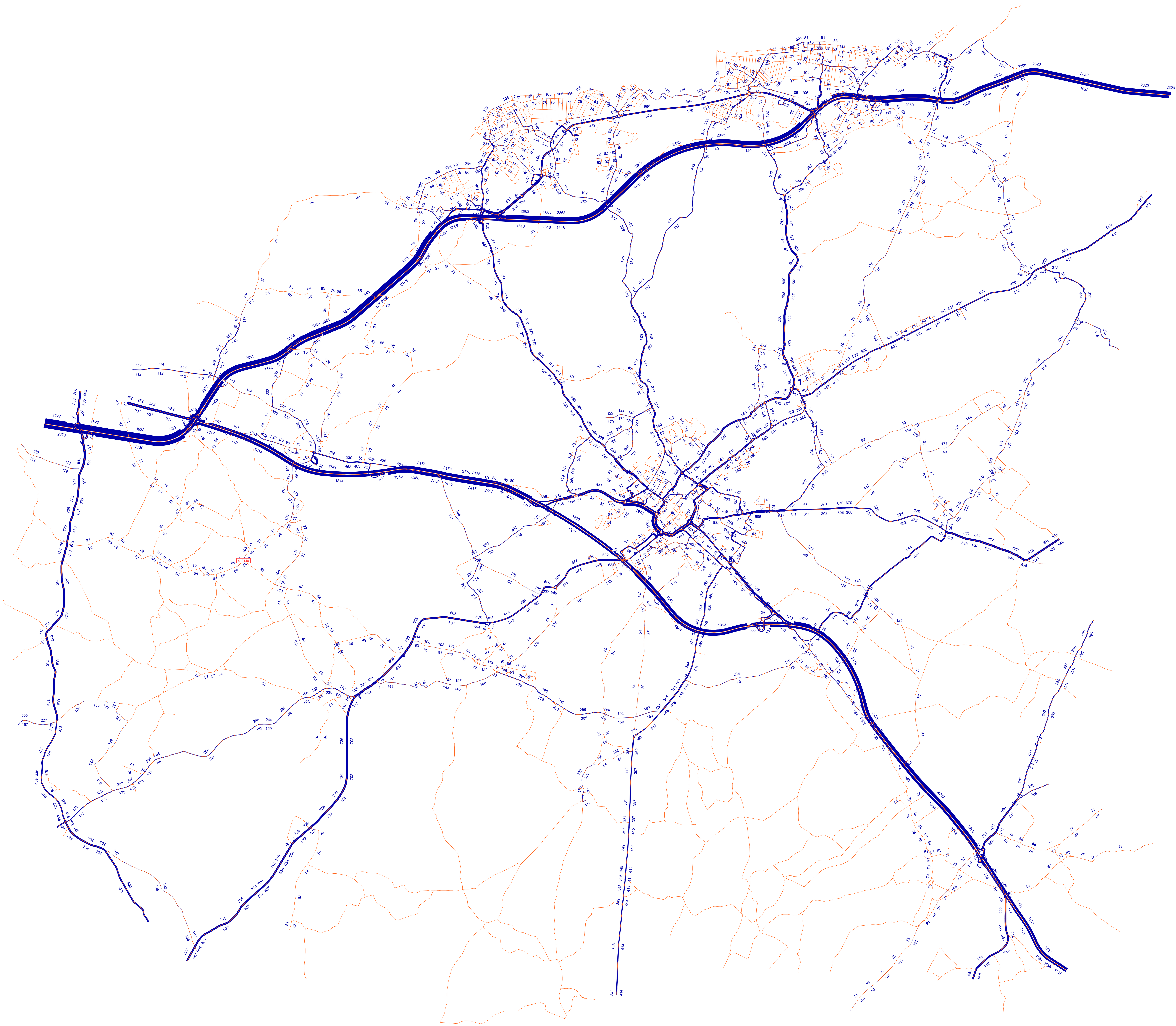
Legend

Volume PrT [veh] (AP)

0 956 1911 3822

Links

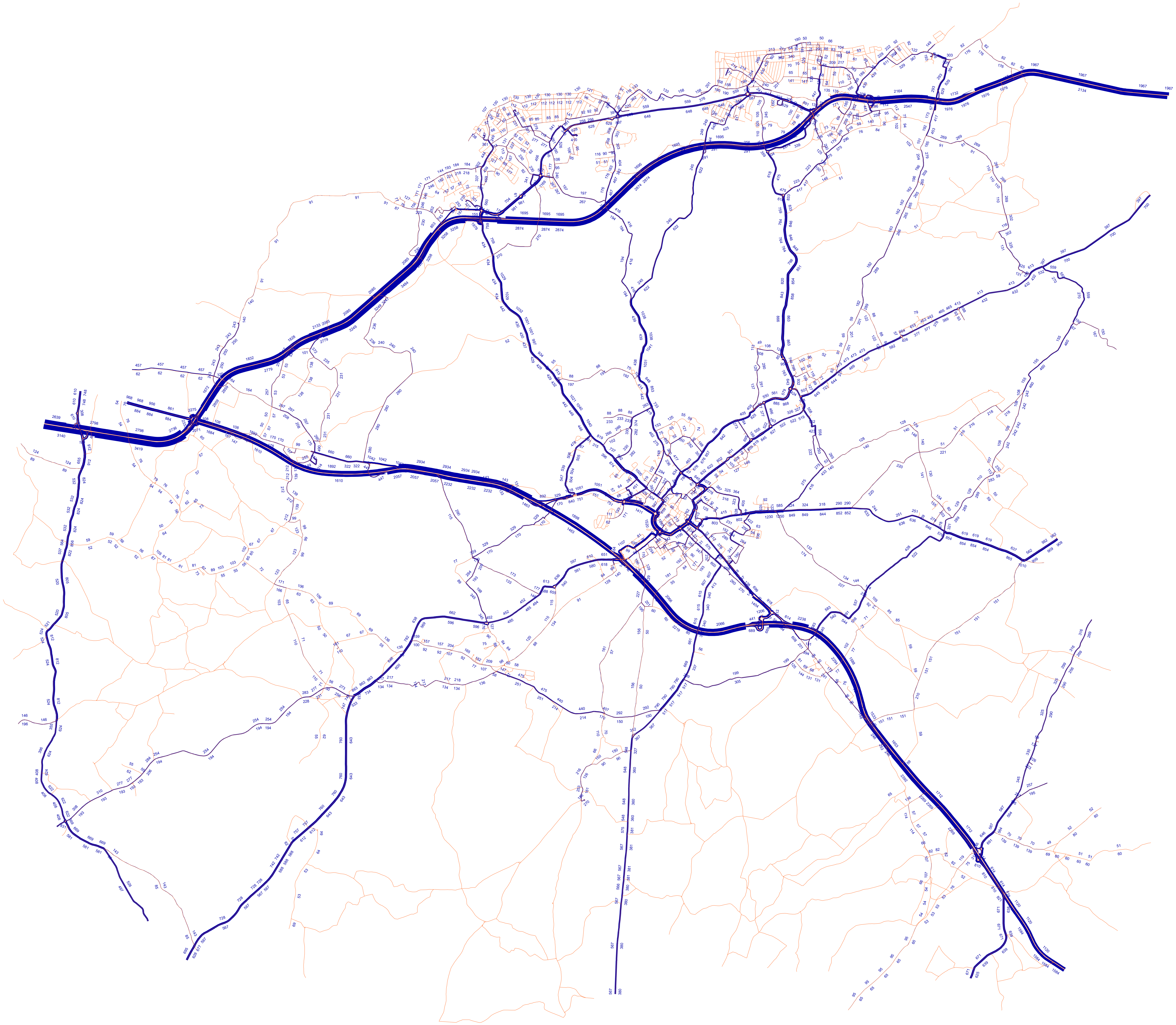
0 900 1500 m



Option 1 Flow AM

Legend
Volume PrT [veh] (AP)
0 871 1742 3484
Links

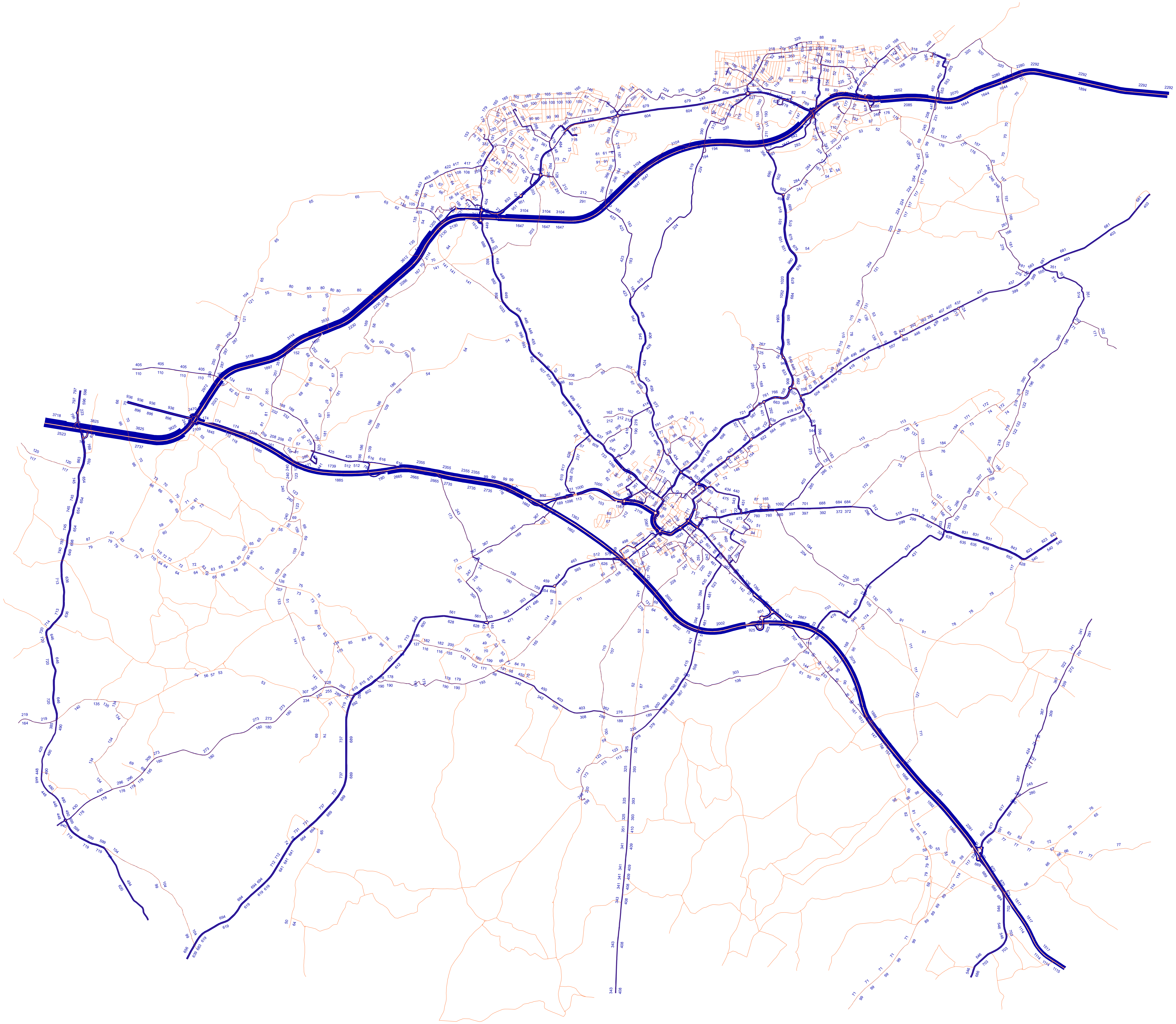
0 900 1500 m



Option 1 Flow PM

Legend
Volume PrT [veh] (AP)
0 956 1912 3825
Links

0 900 1500 m



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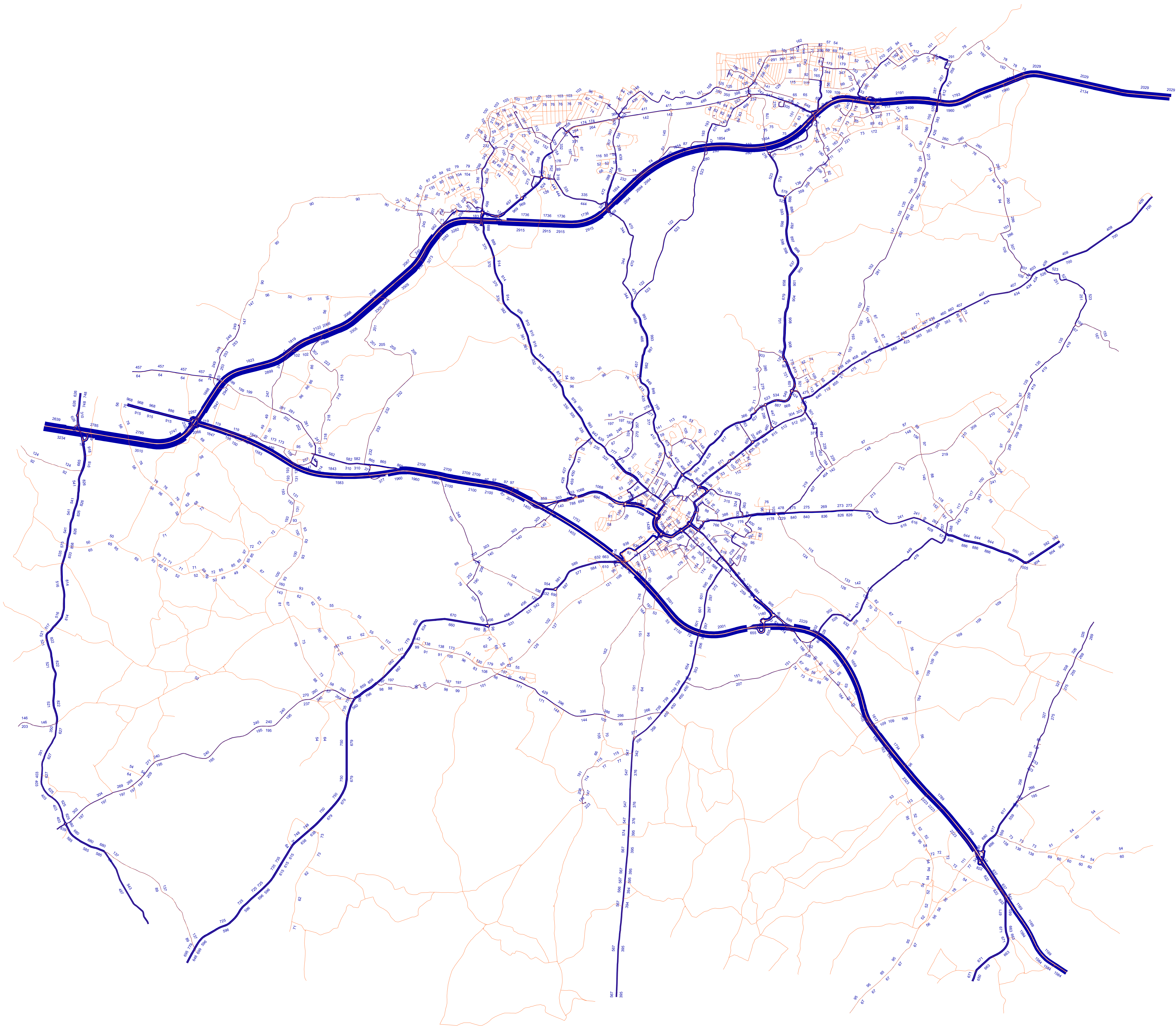
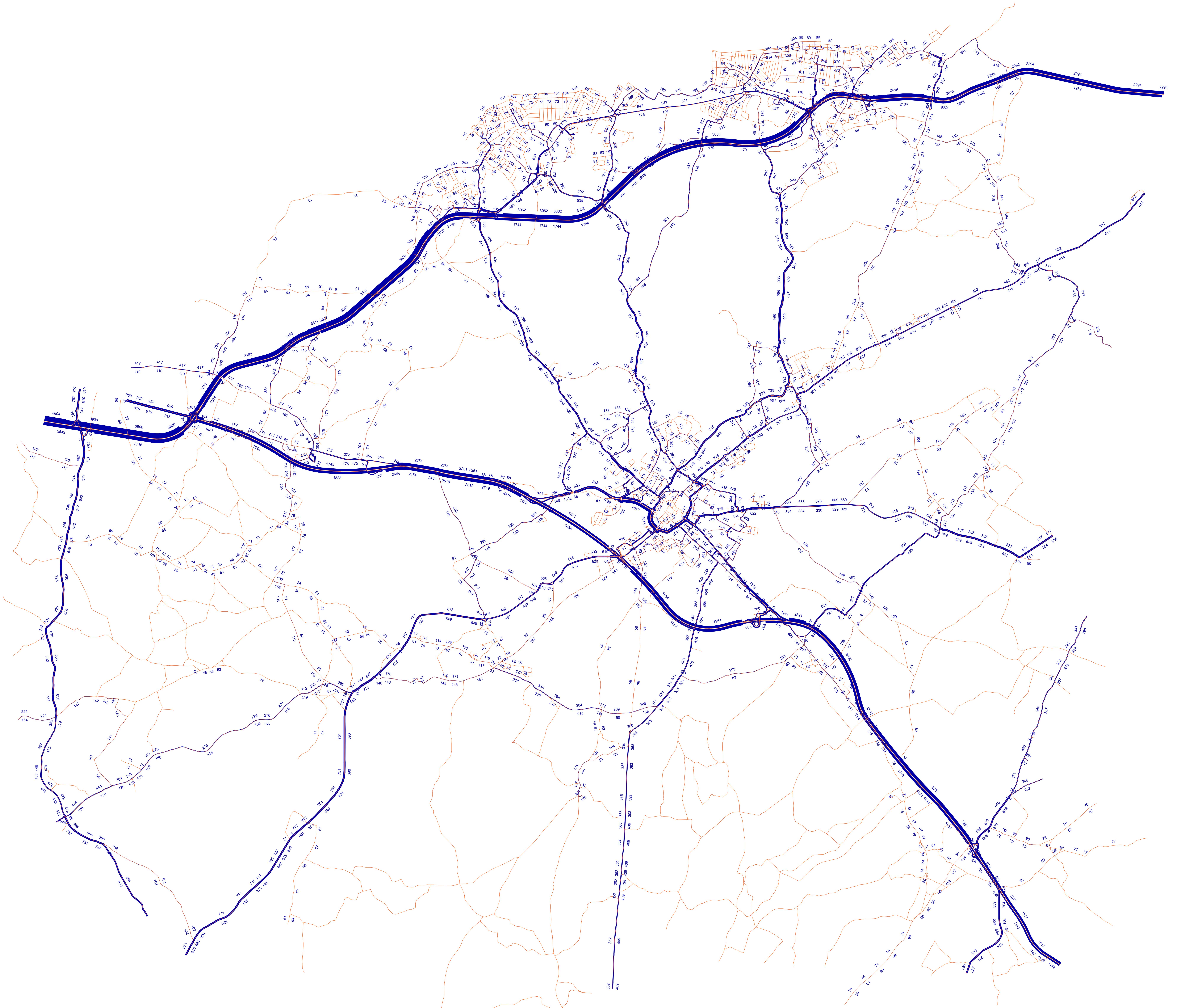
Option 2 Flow AM



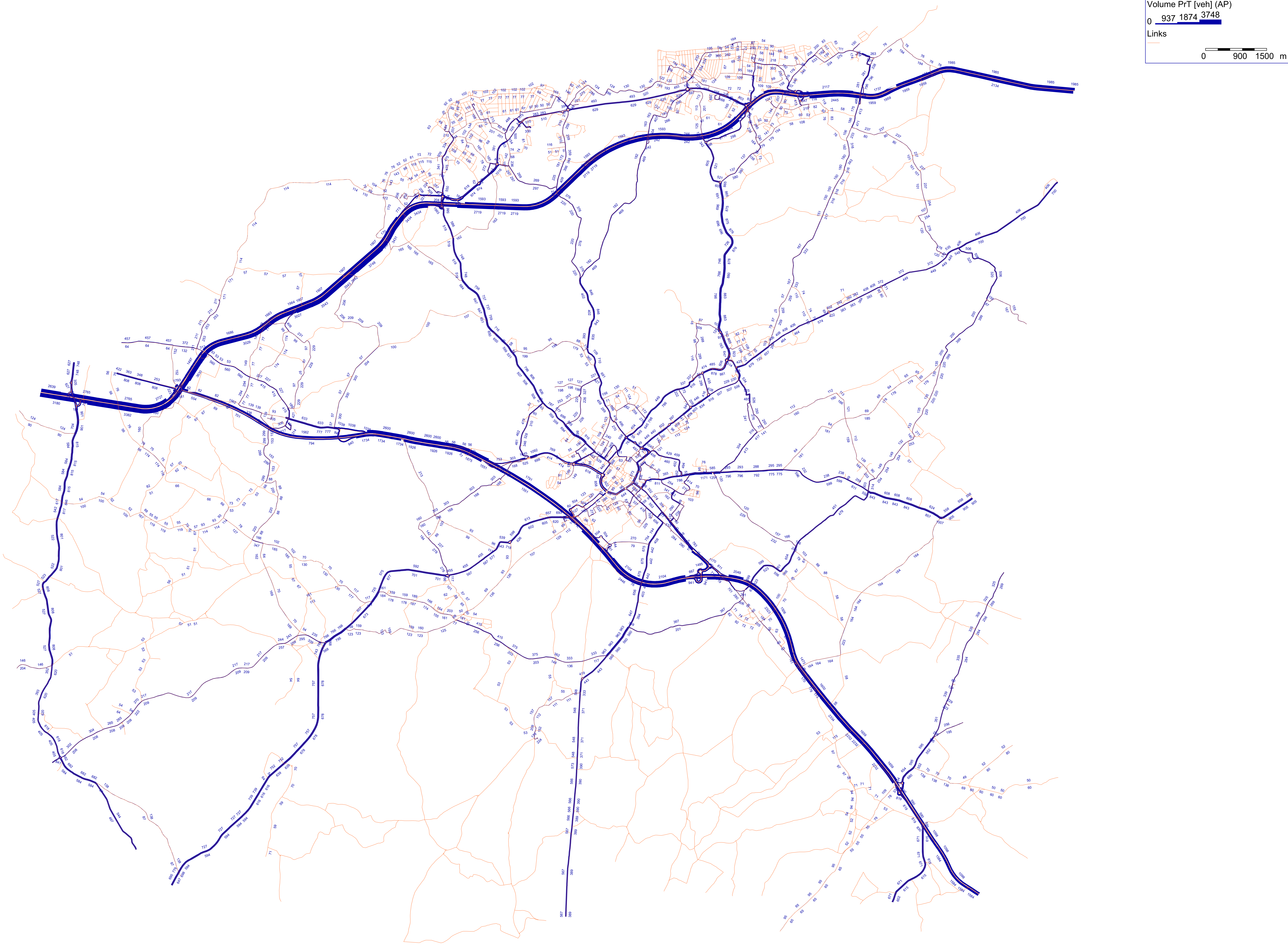
Option 2 Flow PM

Legend
Volume PrT [veh] (AP)
0 975 1950 3900
Links

0 400 1200 2000 m



Option 3 Flow AM

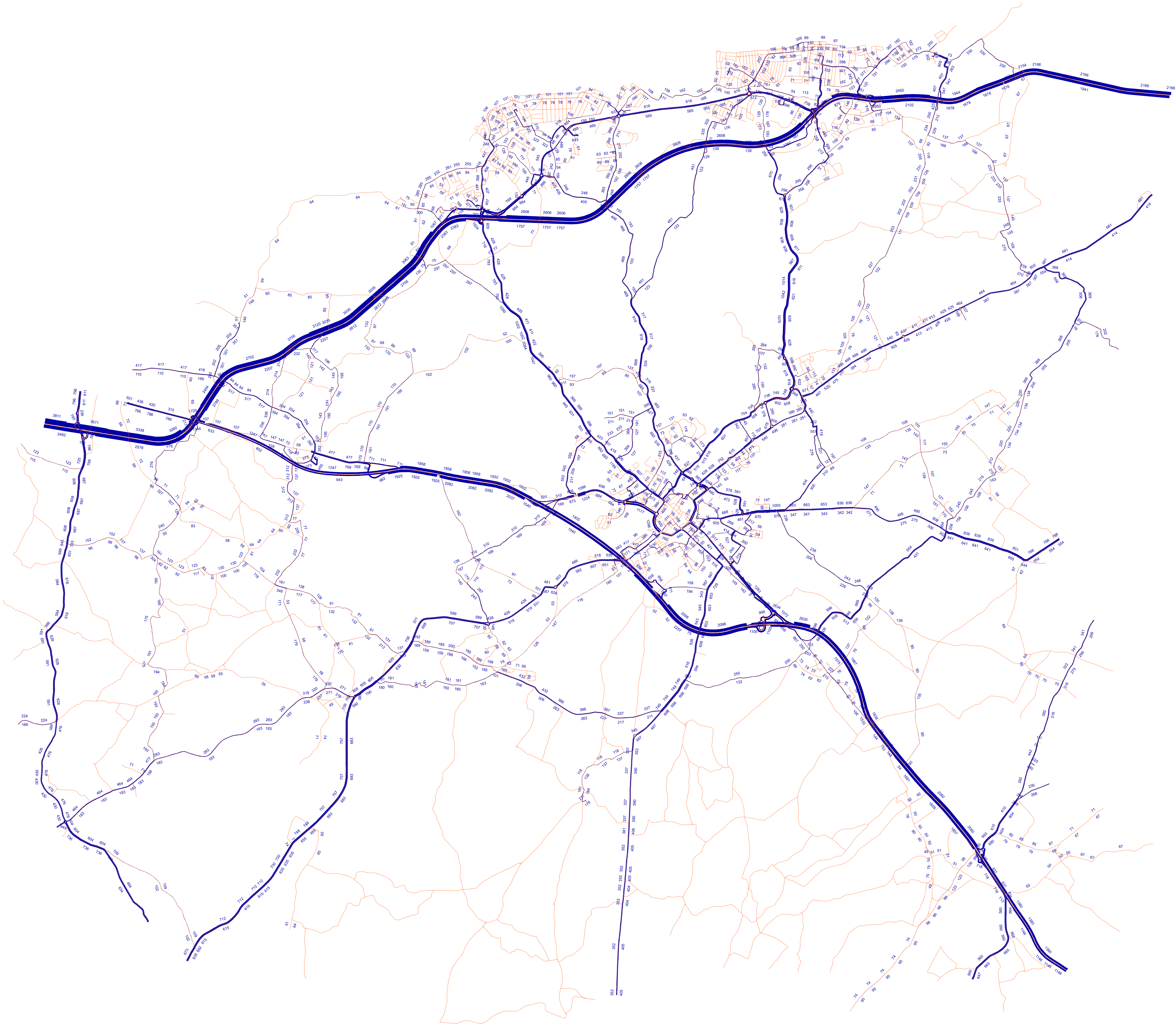


Option 3 Flow PM

Legend
Volume PrT [veh] (AP)
0 953 1906 3811

Links

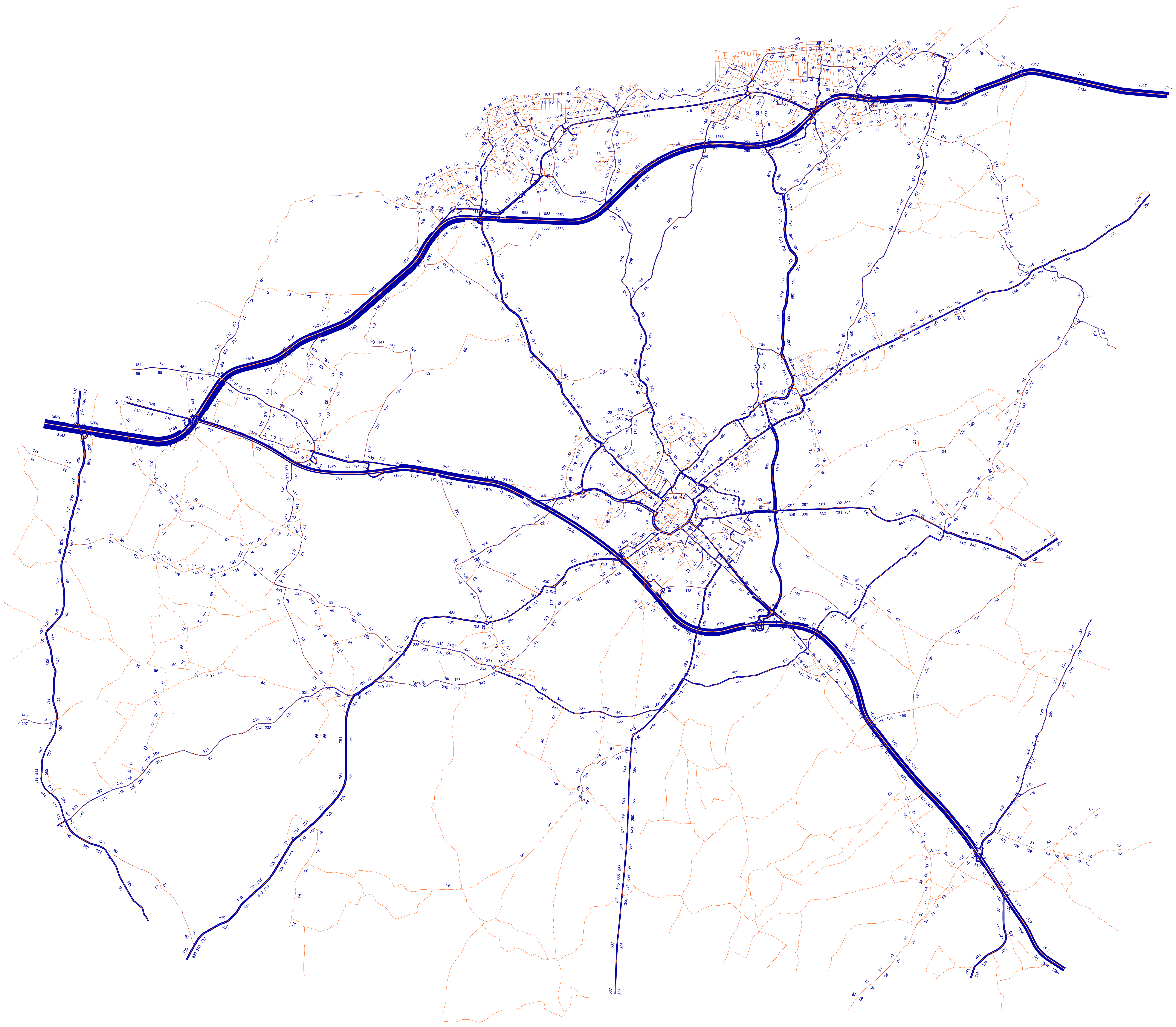
0 900 1500 m



Option 4 Flow AM

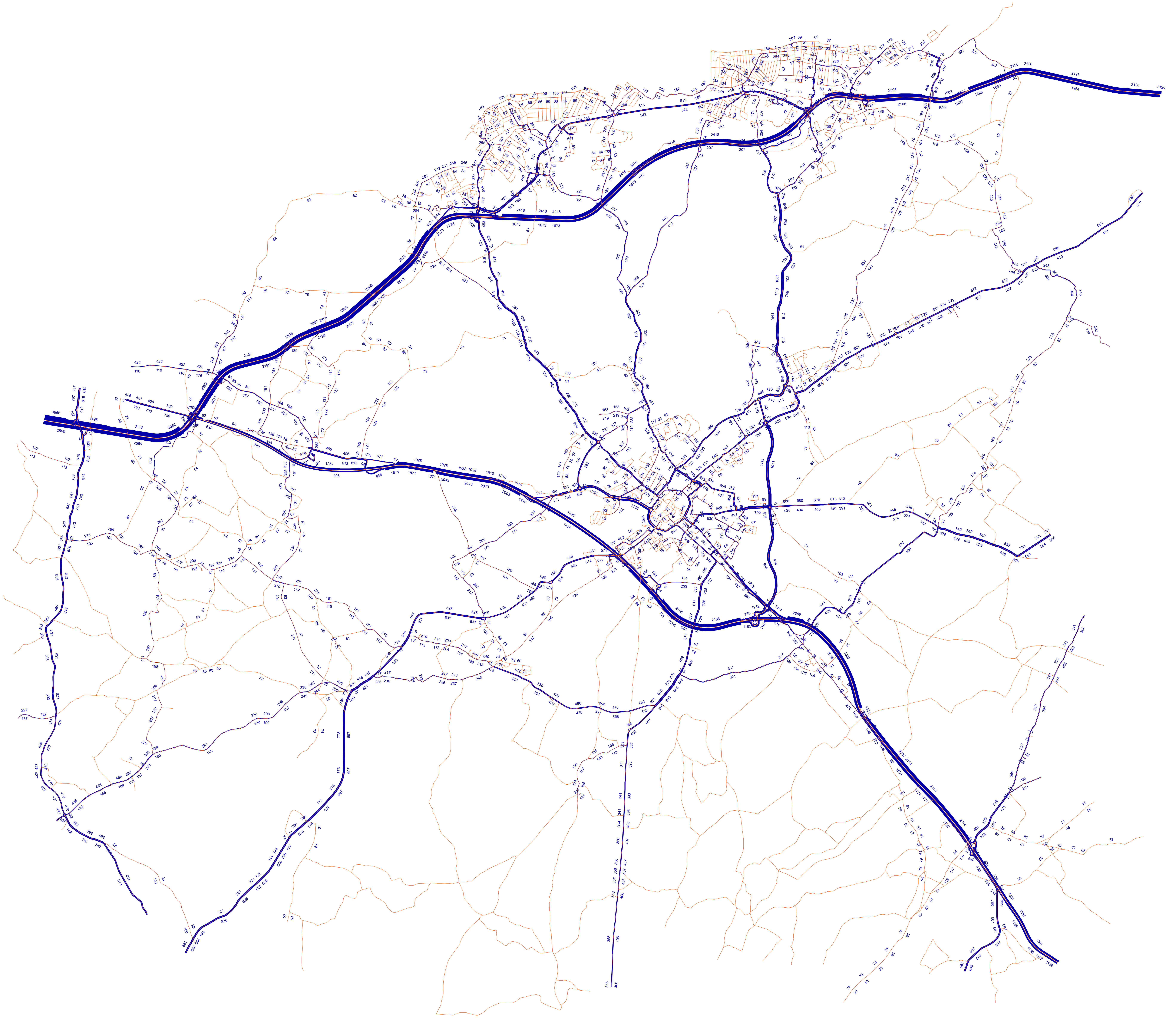
Legend
Volume PrT [veh] (AP)
0 909 1818 3635
Links

0 900 1500 m



Option 4 Flow PM

Legend
Volume PrT [veh] (AP)
0 964 1928 3856
Links
0 900 1500 m



Option 5 Flow AM

Option 5 Flow PM

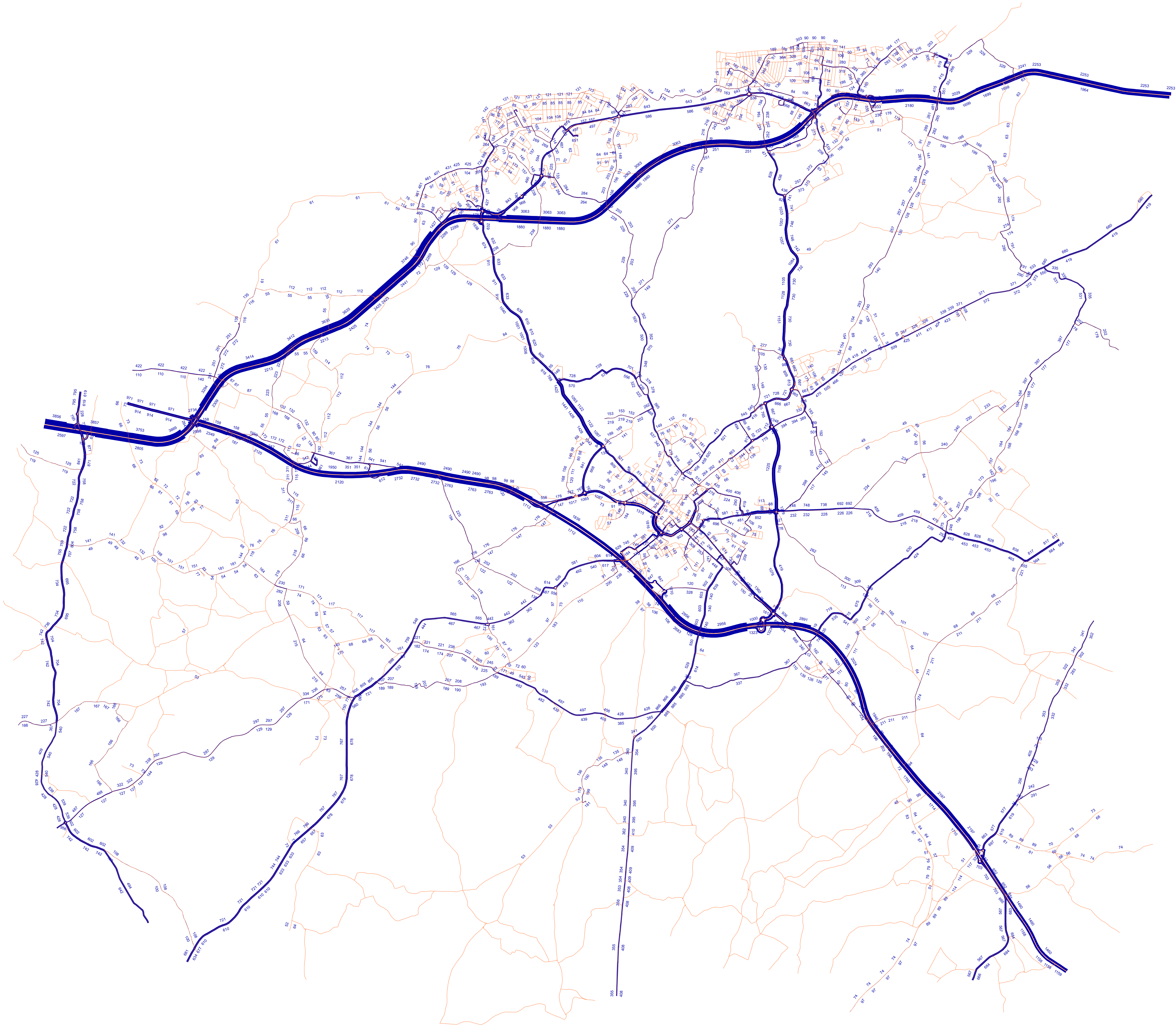
Legend

Volume PrT [veh] (AP)

0 964 1928 3857

Links

0 900 1500 m



6. Appendix F – Flow Difference Plots

Option 1 - 2040 Baseline AM Flow Difference
FLOW_DIFF

0 107 214 428

<= 0

> 0

Option 1 - 2040 Baseline PM Flow Difference
FLOW_DIFF

0 86 172 343

<= 0

> 0

Option 2 - 2040 Baseline AM Flow Difference
FLOW_DIFF

Option 2 - 2040 Baseline PM Flow Difference
FLOW_DIFF

0 193 386 772

<= 0

> 0

Option 3 - 2040 Baseline AM Flow Difference
FLOW_DIFF
0 279 558 1115
<= 0
> 0

Option 3 - 2040 Baseline PM Flow Difference
FLOW_DIFF

0 303 607 1214

<= 0

> 0

Option 4 - 2040 Baseline AM Flow Difference
FLOW_DIFF
0 540 1079 2159
<= 0
> 0

Option 4 - 2040 Baseline PM Flow Difference
FLOW_DIFF
0 497 994 1989
<= 0
> 0

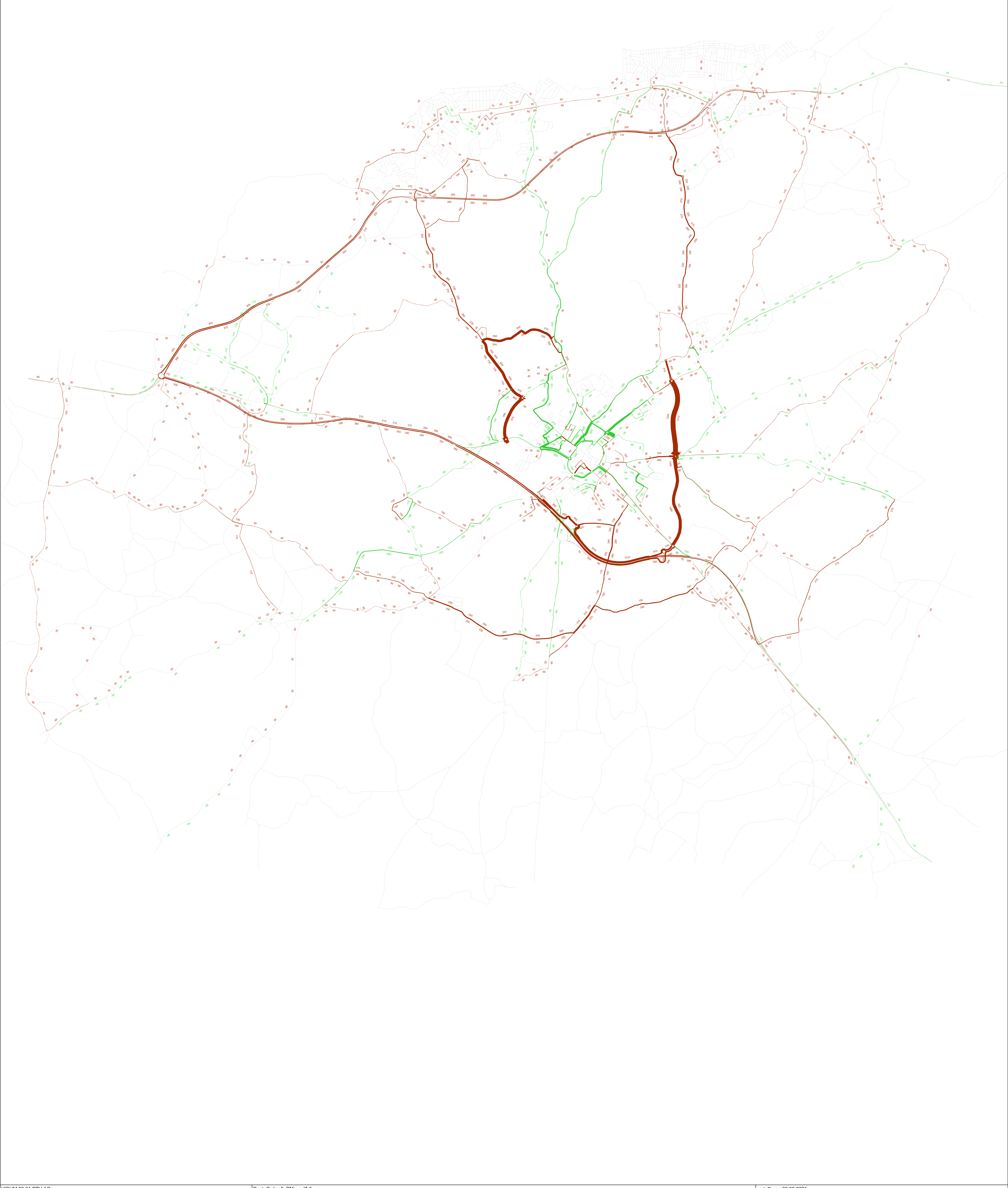

Option 5 - 2040 Baseline AM Flow Difference
FLOW_DIFF
0 544 1089 2177
<= 0
> 0

Option 5 - 2040 Baseline PM Flow Difference
FLOW_DIFF

0 594 1189 2378

<= 0

> 0



7. Appendix G – Level of Service (LOS)

Legend
Baseline AM LOS
Level of service
B
C
D
E
F
Count Links
0
400
800
m


Legend
Baseline PM LOS
Level of service
B
C
D
E
F
Count Links
0 400 800 m


Legend
Option 1 AM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m


Legend
Option 1 PM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m


Legend
Option 2 AM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m


Legend
Option 2 PM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m

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Legend
Option 3 PM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m

Legend
Option 4 AM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m

VISUM 20.01 PTV AG	Cant_Option4_PM_upd7.ver	erstellt am: 21.03.2021


Legend
Option 5 AM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m


Legend
Option 5 PM LOS
Level of service
B
C
D
E
F
Count Links
0 200 400 600 m

8. Appendix H – Relative Queue Length

Relative queue length is a link length percentage taken by the queue.

In strategic model relative length queue is only a supporting traffic attribute as route/traffic delay is based on link congestion delay, defined by Volume Delay Function (VDF), junction turn delay and possible over-capacity issues represented by queues. Model queue lengths should not be considered “actual” or “real” as strategic model does not represent actual geometry of the junctions, road lanes, turns etc. Practical (real) queue length and traffic driver behaviours should be modelled using micro-simulation software.

Baseline AM

Baseline PM

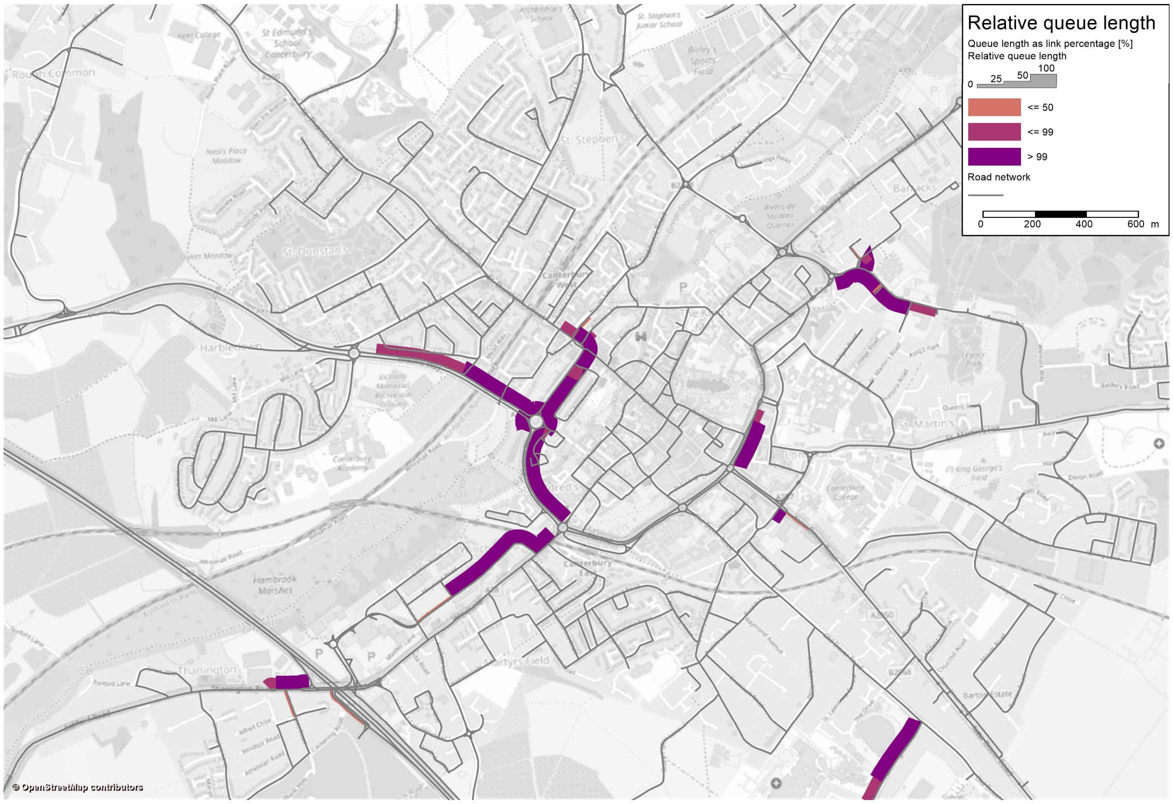
Option 1 AM

Option 1 PM

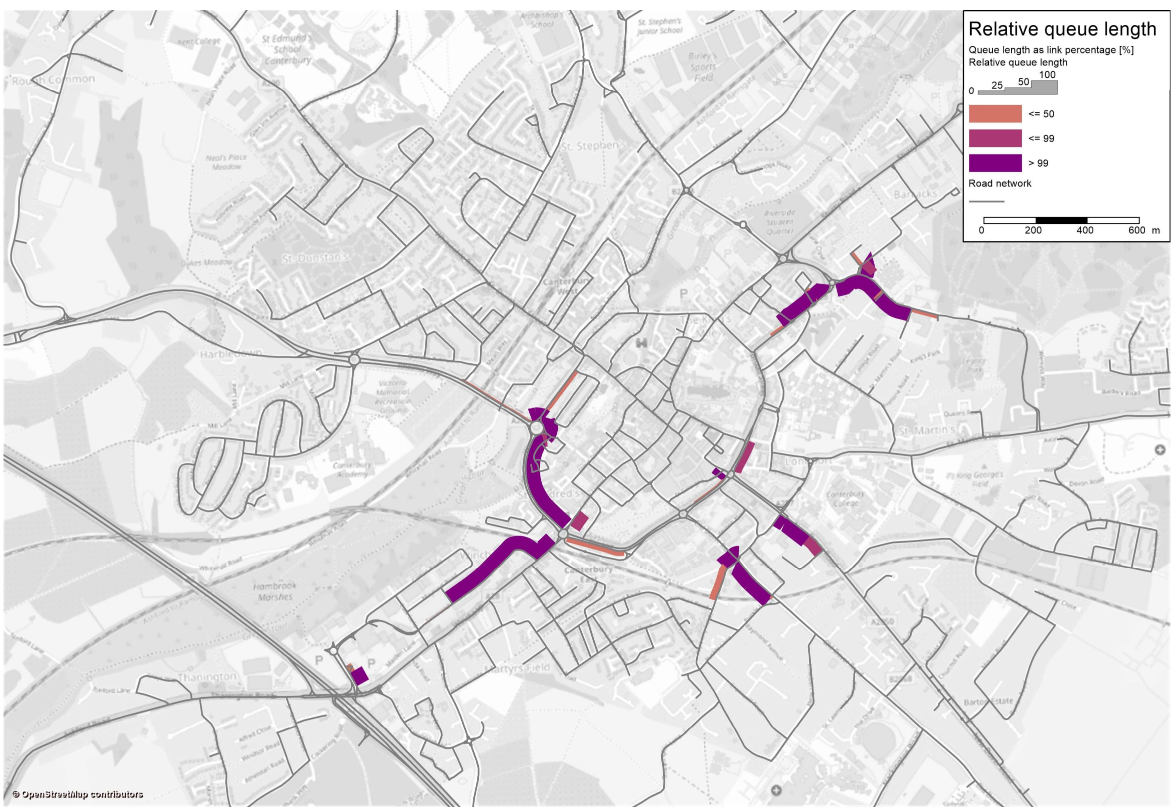
Option 2 AM

Option 2 PM

Option 3 AM



Option 3 PM



Option 4 AM

Option 4 PM

Option 5 AM

Option 5 PM