Basildon Town Centre Modelling

Forecast Report

November 2021

Safer, greener, healthier

Document Control Sheet

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1 Background

Introduction

As specialist consultant to Ringway Jacobs, the framework provider to Essex County Council (ECC), Jacobs developed the Basildon Town Centre VISSIM Model (BTCVM) in 2017 to assess the impact of proposed highway changes outlined in the Basildon Town Centre Masterplan (2016). In 2020, Jacobs also developed the Enhanced Essex Countywide Model (EECSM) to provide ECC with a tool to understand how people travel strategically within the region and how this might change with future growth and as major transport schemes are implemented. It has a base year of 2019 and covers the whole of the South Essex Region.

Jacobs has since been commissioned by ECC to develop four modelling forecast scenarios using the newly developed 2019 Basildon Town Centre (BTC) VISSIM Base Model and provide outputs thereon. This will help identify the impacts of proposed revisions to the highway network in Basildon Town Centre and the differences relating to two different levels of dwellings build out in the town centre. The modelling has been carried out against a backdrop of new development proposals and land use changes within the area and will help inform the wider urban capacity study of Basildon Town Centre.

Study Area

Basildon town centre is situated approximately one mile from the A127 Southend Arterial Road and A13 London Road - both routes are key connectors to London and the M25. The study area is primarily made up of the following key routes:

- A1321 Broadmayne
- A176 Nethermayne
- Southernhay
- Cherrydown East

Basildon rail station is situated to the south of the town centre, approximately five minutes on foot from Basildon bus station.

The extent of the BTCVM is illustrated in Figure 1.1.

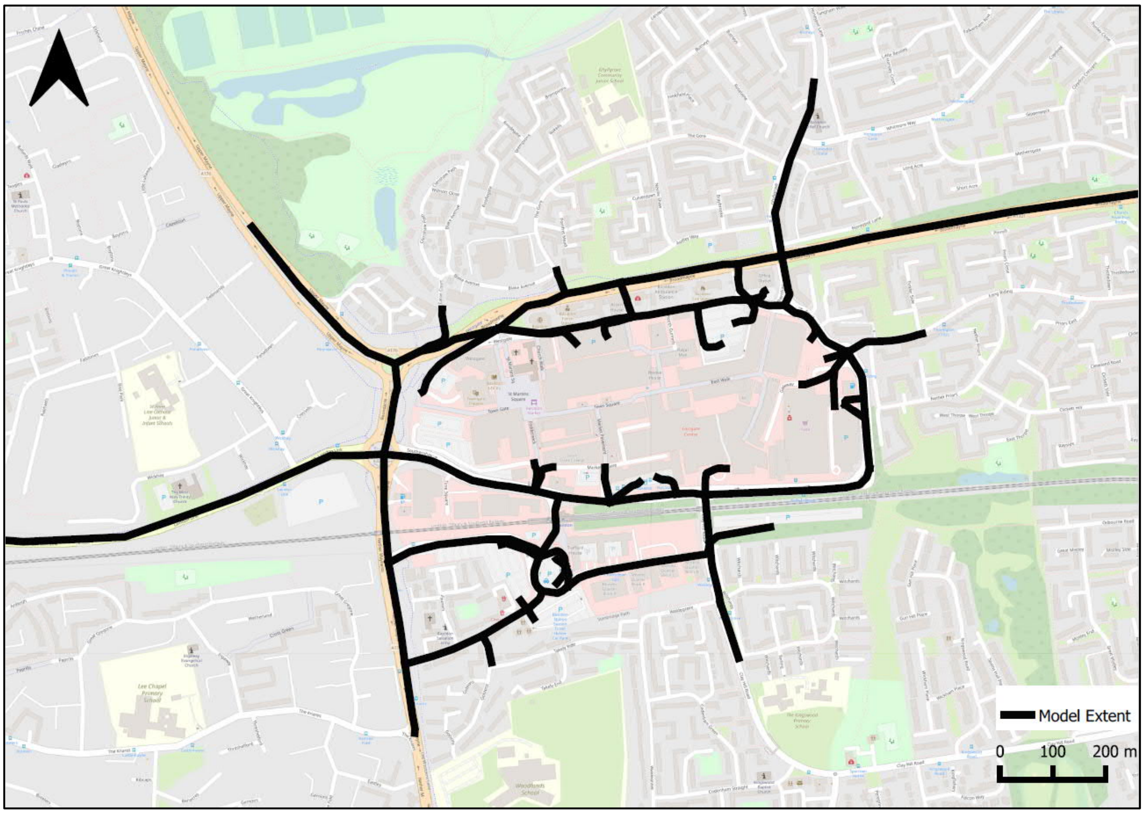


Figure 1.1: Model network extent

Base Model

The base model was developed to provide a robust representation of 2019 traffic flows, journey times, and delays around Basildon Town Centre, which could later be used with confidence to form future forecast models in order to help identify the impacts of proposed revisions to the highway network in Basildon Town Centre.

The model network was built in VISSIM version 2020 using the software's network object tools. Three models were produced to represent the busiest AM, PM and Saturday peak hours based on observed traffic data.

The model times were as follows:

- **AM** 08:00-09:00
- **PM** 17:00-18:00
- **Saturday** 12:00-13:00

The base model demand was developed for the network as a whole using one hourly matrix. This matrix was then separated in to four smaller 15-minute matrices for modelling purposes. They were developed using a number of data sets including Automatic Traffic Counts, Link Counts and Junction Turning Counts. Information on the production of the model can found in the BTCVM LMVR[1]. The traffic was assigned to the base model using dynamic assignment and vehicle demand inputted as matrices for each user class.

Dynamic assignment allows traffic to choose their preferred route at the time they enter the simulation, rather than have it dictated. The route choice of each vehicle is based on the comparative “cost” of all accessible options, with routes chosen to minimise travel cost. Distance and travel time are factors in determining option cost.

The BTC VISSIM base model was calibrated and validated in line with the Department for Transport’s Transport Analysis Guidance (TAG) and Transport for London’s Traffic Modelling guidelines (which provides a good standard to apply to microsimulation models, such as the BTCVM). The models were calibrated by comparing modelled turning flows against observed turning flows. The results demonstrated that turning movements in the AM and PM model passed the required calibration thresholds outlined in the above guidelines, and therefore ensured that the model was representative of observed travel patterns. The Saturday model could not be calibrated due to a lack of available observed turning flow data. More information on this point can be found in the BTCVM LMVR.

The model journey time was validated against Teletrac data, which comprises automatically collected data on car travel times; the data is collected from in-vehicle GPS-enabled devices . Modelled journey-time measurements were compared with observed journey times and were found to satisfy TAG guidelines, thus ensuring that the base model was representative of actual travel times and delays.

Based on the results of the validation process, it was concluded that the VISSIM base model was fit for purpose in providing a representation of existing conditions and could be used to develop future forecast models.

Report structure

The remaining sections in this report summarise the forecast modelling scenarios, network development, demand development and modelling results.

2. Forecast Assumptions and Modelling Approach – outlines the methodology used to carry out the modelling and a summary of the forecast scenarios for testing.

3. Forecast Network Development – provides details on the development of the forecast VISSIM network.

[1] Basildon Town Centre VISSIM Model Local Model Validation Report (2021)

4. Forecast Demand Development – details the process used to produce the demand for the forecast scenarios and provides a comparison of trips produced by each scenario.

5. Forecast Model Convergence – summarises the convergence performance of each modelling scenario.

5. Modelling Outputs – provides comparative analysis of the modelling outputs for each scenario.

6. Conclusion – Summarises the findings from the output analysis and suggestions to ease potential issues.

Appendix A – Concept drawings for committed transport schemes

Appendix B – Convergence Graphs

Appendix C – Journey Time Graphs

2 Forecast Assumptions and Modelling Approach

Forecast Year

The forecast models have been developed to be representative of a 2040 forecast year. This year was chosen as it was considered by Basildon Borough Council (BBC) to be sufficiently far into the future to allow sufficient time for the entirety of the town centre development to be completed.

Scenarios

To test the impact of proposed revisions to the highway network, a scenario based approach has been developed. That is, a number of different scenarios have been produced each representing a different version of the future, and by comparing these scenarios, the impacts of different elements can be isolated and identified.

Four forecast scenarios have been developed. These include two 'Do Minimum' (DM) and two 'Do Something' (DS) scenarios.

All four scenarios include committed developments (as defined by BBC), i.e. increased housing and employment land uses consistent with Local Plan assumptions within Basildon Borough, as they were understood at the time the model was developed. Outside of Basildon Borough, trip growth is derived from standard NTEM land uses.

All four scenarios also incorporate a number of committed network changes. These are:

- Junction and link changes to Southernhay, Station Way, Cherrydown East, and Clay Hill Road.
- Down grading of Southernhay to a single lane in both directions between Southernhay/Clay Hill Road Junction and Southernhay/Long Riding Roundabout.
- Removal of Southernhay Roundabout

The forecast scenarios are differentiated from each other in the following ways:

Do Minimum (DM)

The two DM scenarios have been created to assess impacts of town centre build out at two different levels:

- Level 0 (DM0): An increase of 7520 residential dwellings from current levels
- Level 1 (DM1): An increase of 5000 residential dwellings from current levels.

Do Something (DS)

The two DS scenarios test the impacts of different highway network improvements at the 5000 dwellings town centre build out level.

In addition to the network changes applied in the DM scenarios, the DS scenarios also included a set of proposed town centre highway changes including:

- DS1:
    - The downgrade of Great Oaks to a single lane; and
    - removal of the bus gate northbound on Ghyllgrove in order to allow all vehicles to make the left turn movement onto the A1235; and
- DS2:
    - All of the DS1 changes above; and
    - the pedestrianisation/removal of Little Oaks

Table 2.1 summarises the demand and network changes included the scenarios described above.

Table 2.1: Forecast Scenarios

Scenarios		DM0	DM 1	DS1	DS2
Demand	7520 Dwellings	✓			
	5000 Dwellings		✓	✓	✓
Network	Committed Transport Schemes	✓	✓	✓	✓
	Downgrading of Southernhay to single lane	✓	✓	✓	✓
	Removal of Southernhay Roundabout	✓	✓	✓	✓
	Downgrading of Great Oaks to single lane			✓	✓
	Removal of the bus gate northbound on Ghyllgrove			✓	✓
	Pedestrianisation/removal of Little Oaks				✓

Thus, by comparing the two DM scenarios (DM0 and DM1) the differential impact of the additional 2,520 dwellings in the town centre can be identified. By comparing DS1 with DM1, the impact of the Ghyllgrove bus gate and the downgrading of the Great Oaks can be identified. And finally, by comparing DS1 and DM1 with DS2, the effect of the removal of Little Oaks can be identified.

Initial Do Something Test

It should be noted that although not reported on in detail here, an initial DS scenario was developed. This scenario included the 7520 dwellings demand along with the down grading of Great Oaks to single lane and the removal of both Little Oaks and Link Way.

Data from that forecast model showed that the network was very congested with extensive traffic queuing. A meeting was held with ECC and BBC and it was agreed that this scenario was not a feasible option due to the extensive negative effects. Therefore, this scenario was abandoned and no further analysis was undertaken.

The revised approach described in this report, from which two new DS scenarios (DS1 & DS2) were developed, was in response to the initial assessment. This report only provides detailed analysis of the four scenarios outline in Table 2.1.

Modelling Approach

The forecast year VISSIM models incorporate growth in travel demand which was derived from the strategic Enhanced Essex Countywide Model (EECSM). EECSM is a strategic model covering a substantial part of South Essex, but lacking the network detail seen in the BTCVM. It is therefore a good estimator of large scale travel demand changes in the wider area and has been used to provide estimates of travel growth in areas outside of Basildon Town Centre which nonetheless have an impact within the town centre.

The required demand, traffic growth, and network assumptions have first been modelled in the EECSM (to the extent that that model was capable of representing the detail of the changes), and then the changes in demand from the EECSM base year model to the EECSM forecast scenario was identified. This change was then applied to the base year demand of the 2019 Basildon Town Centre VISSIM Model. This has been achieved using the following process illustrated in Figure 2.1.

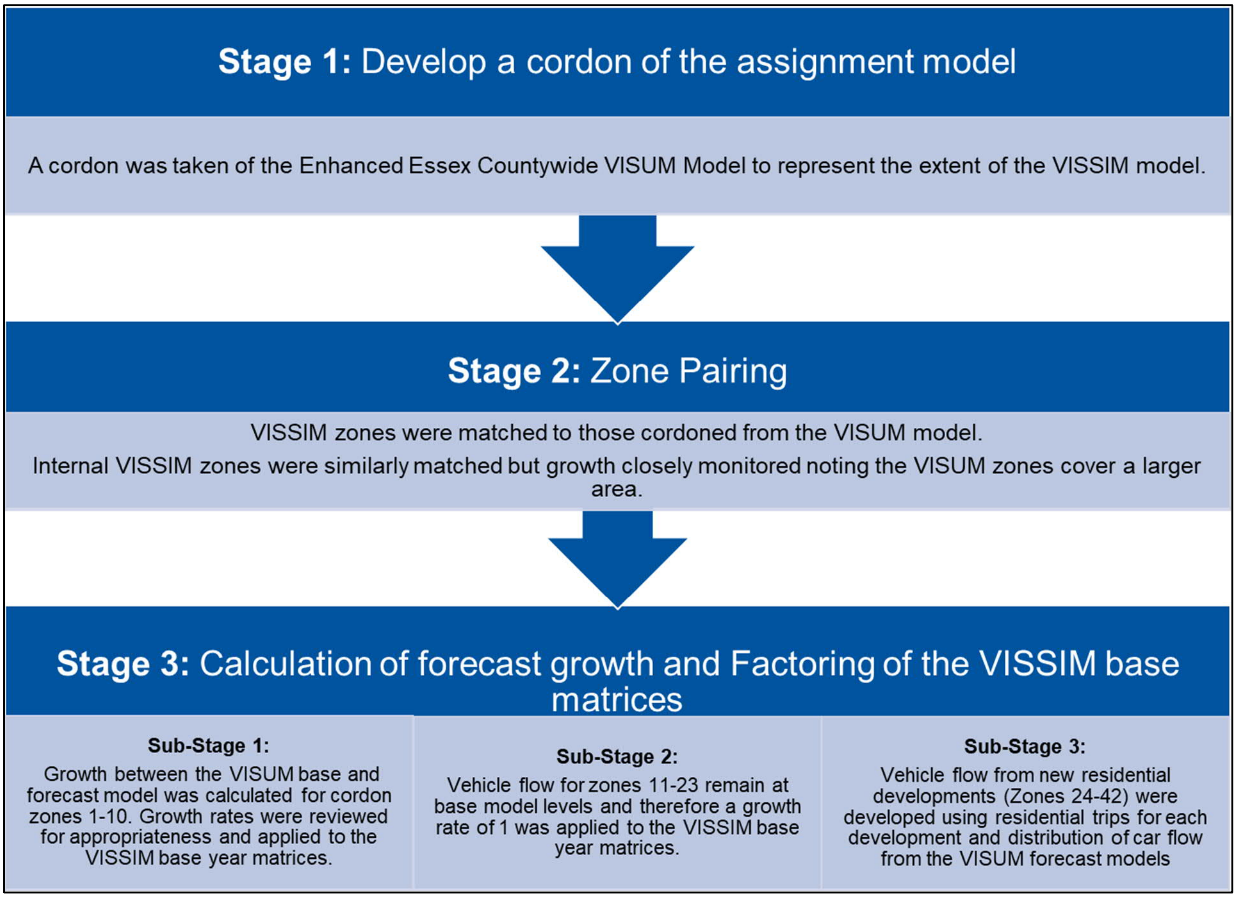


Figure 2.1: Demand Development Flow Diagram

In the above figure, zones 1-10 refers to points in the VISSIM model at which traffic from outside of the town centre loads on to the town centre network. Zones 11-23 represent points within the town centre at which existing land uses load trips onto the network, and zones 24-42 represent points within the town centre at which new land uses (i.e. the 5,000 or 7,520 dwellings) load trips on to the network.

This method ensured that growth in the BTCVM incorporated wider demand growth from developments beyond the town centre, as well as changes in wider trip routing effected by changes to the town centre network, and where relevant, the Ghyllgrove bus gate. The EECSM rerouted trips in response to the schemes according to the changes in travel times and delays that those schemes create.

The EECSM only covers the AM peak, PM peak, and weekday interpeak period. After a comparison of TEMPro trip rates with those gathered from transport assessments for proposed developments within Basildon Town Centre, it was concluded that the PM peak rates most closely matched Saturday trip rates and therefore the PM peak EECSM was used as a proxy for weekend growth. The development of the forecast demand is expanded upon in section 4.

Committed transport schemes within the town centre were coded into the revised BTCVM base network and EECSM using concept drawings, to create the DM scenarios. The DM network was then copied and updated with the Basildon town centre improvements outlined in Table 2.1 to create the DS scenarios. These updates were made with the information available at the time of modelling.

These network changes were made to all time peaks. Further information on the forecast networks is provided in section 3.

3 Forecast Network Development

The forecast DM VISSIM network was developed from the 2019 BTC VISSIM base model with modifications to incorporate committed transport schemes. As mentioned in section 2, a copy of the DM model was used to develop the DS1 and DS2 VISSIM networks which contained additional proposed revisions to the highway network implemented in the northern section of Basildon Town Centre.

The full scale of network changes carried out in order to model the committed transport schemes can be seen in the concept drawing provided by BBC as contained in Appendix A.

All network changes were made for all time peaks and forecast scenarios unless otherwise stated.

Link Structure

Do Minimum

In the DM scenario a number of changes were made to the link structure from that of the base year. These included junction improvements around Southernhay, Station Way, Cherrydown East, and Clay Hill Road to reflect the committed transport schemes in those areas as well as some addition changes to help with model running.

Between Market Pavement and Clay Hill Road eastbound, a bus gate was introduced, stopping vehicles making the straight movement along Southernhay. In response to this, Station Way was upgraded to a two-way road, causing the reversal of flows on Cherrydown East. All right turn movements around Station Road/ Cherrydown East were banned.

Cherrydown East and Clay Hill Road were upgraded to two-way with subsequent improvements made to pedestrian crossings.

Southernhay was downgraded to one lane in both directions between Market Pavement and the Long Riding Roundabout. The Southernhay Roundabout was removed, and adjustments made to one of the zone access points onto Southernhay. Additional pedestrian revisions were also included as per the drawings (e.g. pedestrian crossings).

To accommodate the changes to Southernhay, additional pedestrian crossings were added at various locations along Southernhay.

A number of additional zones were coded within the town centre area to provide a network entrance for vehicle trips from new developments. These were set up using the same process carried out to model zones in the base model.

Two of the new zones required access onto the network via the Laindon Link/ Great Knightleys junction. In the base model this junction was not modelled to its full extent and therefore additional detail was added to the junction in the forecast models in order to allow the zones to function properly. This junction is unlikely to have a significant impact on the network performance as it is located at the edge of the model.

Links used to model the A176 Upper Mayne were extend back to the previous junction in order to increase the amount of space available in the event of traffic queues building, and thereby allow a greater number of vehicles onto the network from the zone.

The figure below shows the new link structure of the DM model and the location of the adjustments.

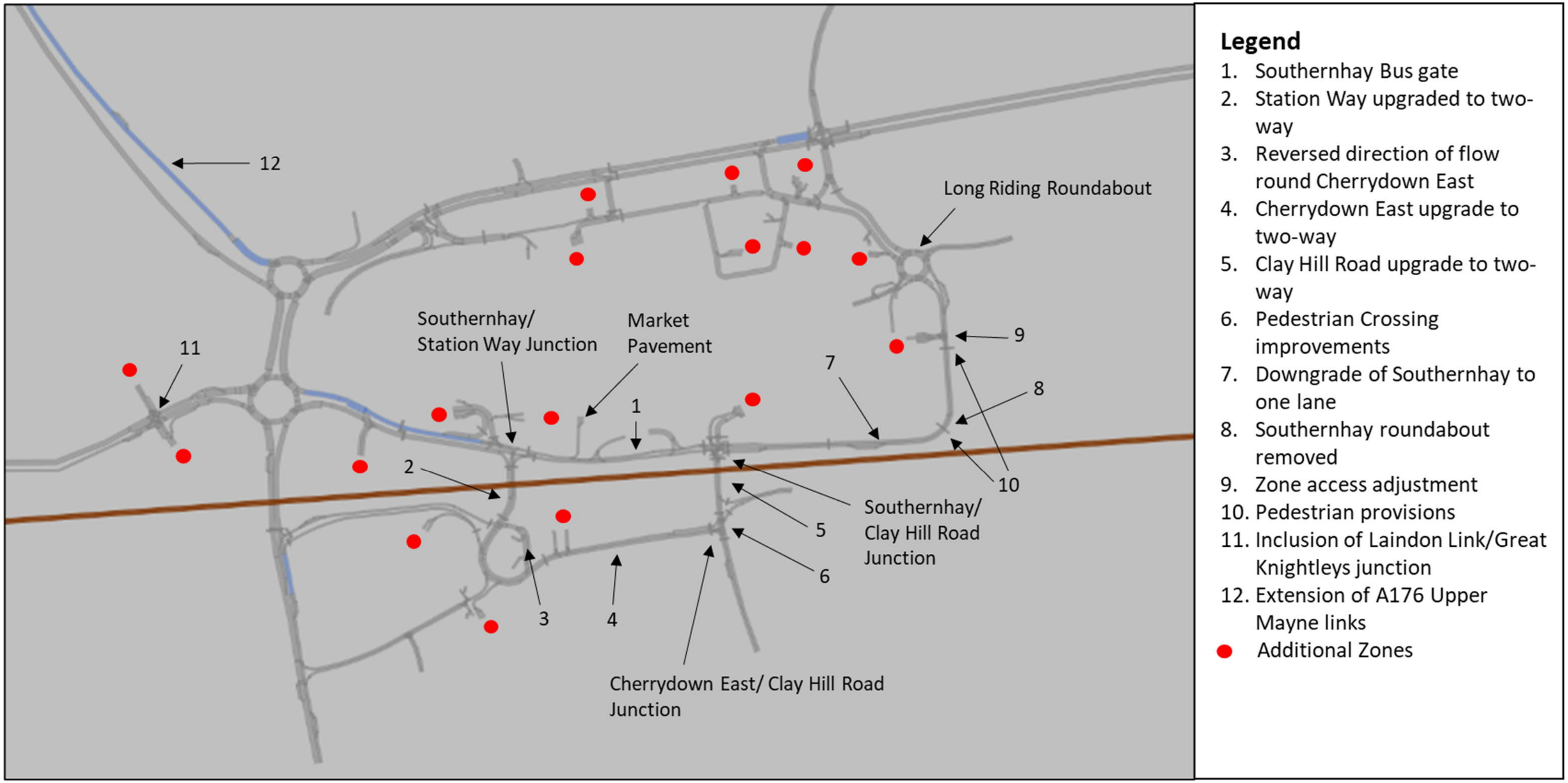


Figure 3.1: Do Minimum Network Link Structure

Do Something

A copy of the DM model network was used as a starting point for developing the DS networks, thus all the committed schemes described above were carried through to the DS models. In addition to this Great Oaks was also downgraded to a single lane in both DS models. In the DS2 model a further adjustment was made to the network by removing Little Oaks to represent pedestrianisation of the area.

The DS1 and DS2 link structures can be seen in Figure 3.2 and Figure 3.3 respectively and include the location of addition changes made in each scenario.

Figure 3.2: Do Something 1 (DS1) Network Link Structure

Figure 3.3 Do Something 2 (DS2) Network Link Structure

Reduced Speed Area and Desired Speed Decisions

As part of the junction upgrades included in the committed transport schemes, reduced speed areas have been applied to all new turning movements and sharp bends generated by the changes.

Desired speed decisions have been used to set vehicle's desired speeds on new entry points into the network, with most being set to 30mph.

Give Way Junctions

Priority rules have been added at the A1321/Great Oaks junction, A176/A1231 roundabout, Laindon Link/ Great Knightleys junction and Station Way/ Ashdown Way/ Cherrydown East junction in all time peaks and scenarios, where congestion causes blocking of junction and roundabout entrance and exits. The amount of congestion and blocking in the base year was much lower and thus it is only in the forecast model that these extra priority rules were required.

In certain locations, additional priority rules have been applied at entrances onto the network where congestion occurs on the main road, blocking access into and out of the side road. Again, these were not required in the base year and only introduced in the forecast because of the increasing levels of congestion.

Priority rules have also been added into the forecast networks where conflict areas give-way criteria are too strict to allow increased forecast traffic flows out of side-roads and onto the main network. Mainline and side road traffic flows were not substantial enough in the base model to necessitate such a measure hence they were only added into the forecast.

Signal Timings

New signal timings were developed for the following junctions at which changes were introduced by the committed schemes:

- Southernhay/ Station Way Junction
- Southernhay/ Clay Hill Road Junction
- Clay Hill Road/ Cherrydown East Junction
- Ashdown Way/ Station Way/ Cherrydown East Junction

As the committed transport schemes were still in development at the time of modelling, signal timings for these new junctions had not yet been developed and therefore not available to use in the modelling. Instead, new signal timings were estimated in order to best accommodate new and removed turning movements and for the Southernhay/ Station Way Junction, increased demand at certain junction arms. During the development of the new signal timings, where appropriate, the old signal timings were used as a reference point.

As signal timings could not be provided for the Laindon Link/ Great Knightleys junction, the fixed time signals from the base model were adjusted to accommodate turning movements from side roads and a new residential development.

Other Changes

A new vehicle driving behaviour, 'Urban Merge', has been defined within the forecast year models to encourage vehicles in congested sections of road to merge quicker.

Lane change and emergency stop distances were changed in certain locations in the model to reflect changes in driving behaviour that occur under congested conditions. Typically, where there are greater amounts of congestion, vehicles are likely to get into lane earlier. Therefore, by increasing the lane change distance, the vehicles are encouraged to find their correct lane sooner, replicating real life driver behaviour.

Bus Stops on the main carriage way between the Southernhay/Clay Hill Road Junction and Long Riding Roundabout have been removed. This section of road was reduced from two lanes in each direction to one lane, and keeping the on-carriageway bus stop would have made the carriageway impassable when buses stop. It's not known if this is the expected long term outcome for bus stops in this area, but since the impact on buses is not the subject of this work, for simplicity in the model assessment, the stops were removed and the assessment is silent on bus impacts.

Enhanced Essex Countywide Model Network Updates

The Enhanced Essex Countywide Model (EECSM), which is used to provide forecast growth to the VISSIM base demand, was updated where possible (given the relatively lower level of detail in the strategic EECSM model) with the same committed transport schemes applied in the VISSIM forecast models (as described in earlier sections and in Appendix A). The model included the provision of the new residential development in the town centre, and this established the wider distribution and routing patterns of the new development.

A EECSM DM model was used to develop the DS model. The only additional network change applied to the DS network was the removal of the Ghyllgrove northbound bus gate. As this is outside Basildon Town Centre, this network update was not included in the Basildon Town Centre Vissim DS models (BTCVM), but due to its inclusion in the EECSM, the effects of it (i.e. reassignment of traffic to use the new bus gate) were able to be modelled in BTCVM.

It should be noted that the, the downgrading of Great Oaks and removal of Little Oaks, including in the BTCVM DS models, could not applied to the EECSM DS model as the network in that model is not detailed enough to include those roads (this is relatively common for strategic models).

4 Forecast Demand Development

Forecast demand matrices for the BTCVM model were developed for light vehicles and HGVs (these are the vehicle classes established for use in the base model) using the EECSM to provide the traffic growth from the base.

Two forecast demand scenarios have been created to help test the impact of additional dwellings on the network at two difference scales: 7,520 dwellings and 5000 dwellings. The 7,520 dwelling was developed first, known as the DM0 scenario, using the EECSM to provide traffic growth. The use of the EECSM in this context is unique to this project and not related to or shared with any transport work. The resulting BTCVM demand for DM0 was adjusted outside of the EECSM to derive the 5,000 dwelling demand for DM1. VISSIM DM0 Matrix development.

Stage 1

A forecast of the EECSM AM and PM models was developed, to be representative of the agreed level of committed development, and the maximum level of town centre residential development (at 7,520 dwelling). Because EECSM covers the whole of South Essex, it ensured that growth originating in areas beyond Basildon Town Centre, but which may travel through the town centre area, can be most accurately represented. The forecast models, as well as the EECSM base year model (representing current day traffic) were both ‘cordoned’ to the area of the BTCVM. That is, from the assigned EECSM, a section exactly matching the area covered by the BTCVM was ‘cut out’ from the wider network, including all the flows and demand data. This gave a representation of traffic demand through Basildon Town Centre, derived from consideration of wider strategic and local travel patterns, and the travel demand had the same structure as the BTCVM demand.

Note that there was a DM and DS version of the EECSM, and both were cordoned. The DS version had the bus gate at Ghyllgrove opened up to all traffic, thus the effects that that had on reassignment of wider traffic, could be included in the BTCVM.

Stage 2

The cordoned EECSM demand had zones corresponding with trip generators within the town centre, and also zones corresponding with locations on the edge of the cordon where trips from outside the town centre were loaded onto the town centre network. The cordoned network from the EECSM, along with the zones, is illustrated in Figure 4.1.

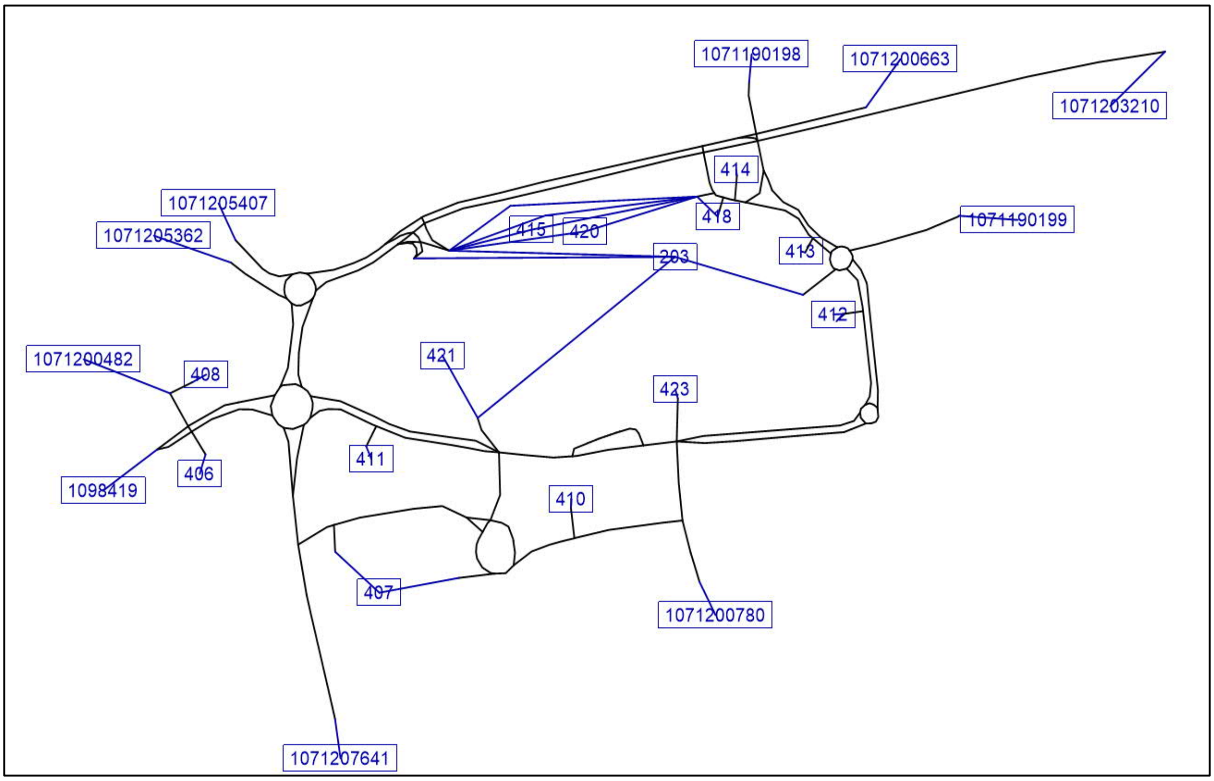


Figure 4.1: EECSM cordoned network and zone Locations

The EECSM zones were then matched up with the corresponding zones in the BTCVM zones. In some cases, because of the reduced level of network detail in the EECSM, there was not an equivalent EECSM zone to every BTCVM zone. Figure 4.2 shows the BTCVM network, with its zone system annotated.

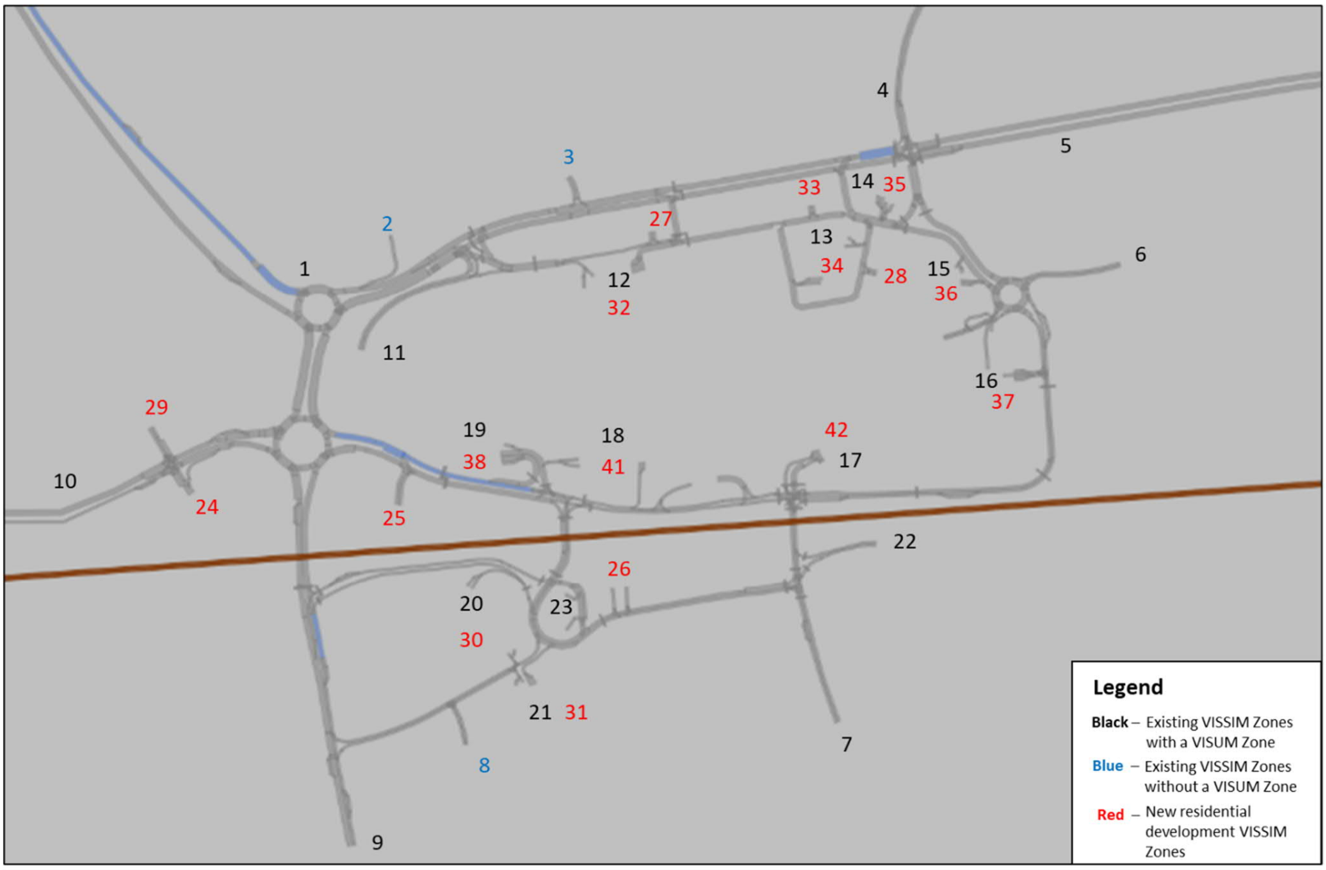


Figure 4.2: VISSIM Forecast Model Zone Locations

As noted in the figure, zones in blue are those for which there is a zone in the BTCVM but not an equivalent EECSM zone. For these zones, growth was based on a nearby EECSM zone. Zones in black are those for which there was a direct relationship between the EECSM and BTCVM zones, and growth was provided based on that simple correspondence. For zones in red, these represented new residential developments, which were included as zones in both the BTCVM and the EECSM, so there was a direct correspondence.

Table 4.1 lists the correspondence between EECSM and BTCVM zones.

Table 4.1: Zone Matching

VISSIM Zone	VISUM Zone
1	1071205362
2	1071190198
3	1071190198
4	1071190198
5	1071200663
6	1071190199
7	1071200780
8	1071207641
9	1071207641
10	1098419
11	Existing internal retail and commercial zones
12	
13	
14	
15	
16	
17	
18	
19	
20	
21	
22	
23	
24	406
25	411
26	410
27	416
28	418
29	408
30	407
31	419
32	415
33	417
34	415
35	414
36	413
37	412
38	421
41	409
42	423

Stage 3

Stage 3 is the process of calculating the forecast growth for each BTCVM zone by taking growth from the EECSM as appropriate. Figure 4.3 provides a schematic of the trip matrix, with origin zones (where trips start from) listed along the side and destination zones (where trips go to) along the top. Specific zone to zone movements were grouped into different categories in terms of how the forecast trips were calculated.

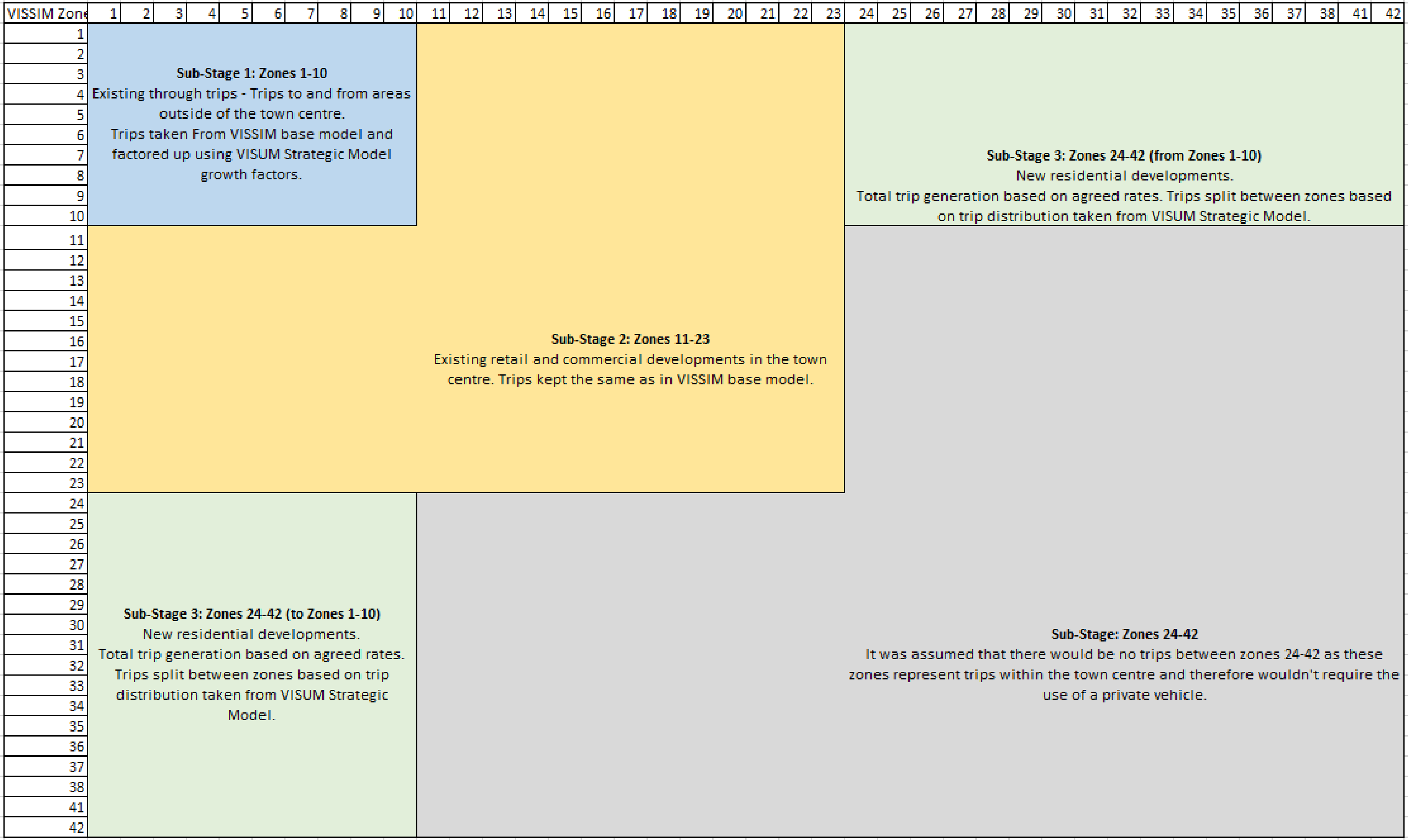


Figure 4.3: Matrix Development Methods

As the figure illustrates, trips were calculated according to one of three different methods, described as sub-stages 1 to 3 below.

Sub-Stage 1: Zones 1-10

Zones 1-10 are cordon zones representing locations at which trips enter the BTCVM network from outside, or leave the network to go to areas outside. Thus, trips between zones 1-10 are represent traffic travelling through, and not stopping within, the town centre.

Percentage growth rates were calculated between the cordoned EECSM base and forecast models for light vehicles for each zone to zone combination. For HGVs, given the relatively low trip volume and that not every zone to zone pair in the EECSM actually had a trip, a total growth rate was calculated for all movements between zones 1-10 as a whole.

These growth rates were reviewed for each scenario and time peak to ensure they were appropriate and aligned with changes made to the network. For movements where the growth rate was to be particularly large, but based on a relatively small number of trips (which is a result of the relative lack of network detail in the EECSM), the absolute change in vehicle flow between the base and forecast model was applied to the BTCVM base matrix. Otherwise, the percentage growth was applied.

For example, car trips from zone 7 to 5 significantly increased in the AM between the base and forecast EECSM models. The base trips were 2.4 and the forecast trips were 41, which produced a growth factor of 17.4, and an absolute difference of 38.7. The BTCVM base trips for the same movements were 42.7, which is much higher than EECSM base. If the growth factor was applied to the VISSIM base, the forecast VISSIM trips would have been 741.5, likely a gross overestimate. Therefore, the absolute difference of 38.7, was added to BTCVM Base number to derive the forecast demand for that movement.

Sub-Stage 2: Zones 11-23

In the EECSM base model, Zones 11-23 are located around the town centre, representing existing commercial and retail vehicle trips. Due to limited certainty in the effects of retail and commercial trip generation on the town centre (for example, levels of linked trips and non-primary trips were not easily calculable), it was agreed with BBC and ECC that it was likely that commercial and retail trip generation in the future was unlikely to change from present day levels. Therefore, the base year trips in the BTCVM for these zones was preserved. i.e. the growth rate for trips to/from zones 11-23 is 1.

Sub-Stage 3: Zones 24-42

Zones 24 - 42 in the BTCVM represent new residential developments (at 7,520 dwellings in DM0 and 5,000 in DM1). Light vehicle flow for these zones was developed by applying agreed trips rates to the anticipated level of residential development at each zone, to end up with a total trip generation as agreed with BBC.

The dwellings, their quanta, and trip generation in each DM scenario are detailed below:

Zone Number	Development description	Quantum (DM0)	Quantum (DM1)	Trip gen (AM peak hour two-way)		Trip gen (PM peak hour two-way)	
				DM0	DM1	DM0	DM1
24	Car Park 14	205	136	15	10	20	13
25	Time Square	409	272	31	21	39	26
30	Car Park 11	51	34	4	3	5	3
31	Car Park 12	205	136	15	10	20	13
26	Trafford House	196	131	15	10	19	13
41	Land at Market Square	503	335	33	22	44	29
32	Town Centre North (former M & S site)	547	364	41	28	53	35
32	Church Walk House	82	54	6	4	8	5
27	Acorn House Great Oaks	78	52	6	4	7	5
28	East Walk and Southernhay	162	107	12	8	16	10
33	Great Oaks (Fire, Police and Clinic) – spread over two locations	563	374	37	25	50	33
34	QD/ Post Office & Car Park 2	534	355	40	27	51	34
35	Great Oaks (former Carphone Warehouse)	324	216	21	14	23	15
36	Former Toys R Us	777	517	59	39	75	50
36	Eastgate	2864	1904	144	96	183	122
37	Former Youth Centre	20	13	2	1	2	1
Total		7520	5000	482	320	613	408

The trip distribution was derived from the distribution of the equivalent zone in the EESCM forecast cordoned model. As the new developments have limited parking provision, it was assumed that there would be zero HGV flows. Additionally, flows between these zones and the existing commercial and retail zones in the town centre were also set to 0 because it is anticipated that any movements between these would be done on foot rather than by car.

When combined, the outputs from Sub-Stages 1,2 & 3 produce an AM and PM VISSIM forecast demand matrix for both forecast scenarios (DM0 and DM1).

Saturday Peak Matrix Development

As there is no Saturday peak VISUM model, a comparison of AM, PM and weekend TEMPro trip rates for Basildon was carried out and identified that Saturday peak trip rates were most similar to PM trip rates. Therefore, EECSM growth rates from the PM peak models for Zones 1-10 were applied to the Saturday Base VISSIM matrix. For zones 11-23 vehicle trips were left as found in the Saturday base model.

Residential development trip information provided by BBC for zones 24-42 did not include Saturday or Weekend trip information. Using a residential TRICS trip rate, it was possible to generate a set of estimated Weekend origin and destination trips for each development. When the Weekend TRICS trip rates were compared with AM and PM TRICS trip rates, it was found that PM trip rate was most similar to the weekend Origin trip rate and AM trip rate most similar to the weekend Destination trip rate. Therefore, residential development trips (zones 24-42) were calculated for Saturday by using the ratio of weekend, AM and PM TRICS trip rates and a combination of residential PM trips for origin and AM trips for destination. Once the Saturday residential trip generation for zones 24-42 were calculated, their trip distribution was derived from the PM peak EECSM forecast.

Difference between DM and DS matrix

The BTCVM DM matrix was produced using the EECSM DM model and methodology outlined above. An initial DS matrix was also created using the same process as DM. However, rather than take the DS matrices generated by this process, it was used to inform the *changes* from the DM to the DS, which were actually then applied to the BTCVM DM matrix.

The difference in EECSM DM and DS networks in terms of an effect on wider trip patterns, was the removal of the Ghyllgrove northbound bus gate. Therefore, in order to create a DS matrix that reflected this network change, a set of manual adjustments informed by the initial DS matrix were undertaken. These are outlined in Table 4.2.

HGV trips in the DS matrices remained the same as the DM matrix as it was assumed that the opening of the bus gate northbound on Ghyllgrove wouldn’t cause a change in trips or re-routing of the HGVs.

Table 4.2: Do Something Matrix Adjustments

<table>
<tr><th>Zone Movements</th><th>Adjustment</th><th>Reason</th></tr>
<tr><td>3–1
4–1</td><td>Movements set to 0</td><td>Vehicles from zones 3 and 4 will use Ghyllgrove and the A1235 to access areas north east of the town centre. This means they will never appear on the town centre network.</td></tr>
<tr><td>3–5
4–5</td><td>60% decrease applied to flow</td><td>This represents the trips that use Ghyllgrove to access areas north east of the town centre and never enter the town centre network. The EECSM model indicated a reduction of 60%, rather than complete removal of trips, most likely because the Ghyllgrove entry is ‘left out’ so to travel to the east a roundabout U-turn is required, which is less attractive.</td></tr>
<tr><td>5–1</td><td>60% increase applied to flow</td><td>The reductions in flows 3-1 and 4-1 above described above effectively reduce westbound flow on Broadmayne. This induces some increased westbound through trips from other areas.</td></tr>
<tr><td>36–1
36–4
37–1
37–4</td><td>18% of total origin trip end removed from zone 1 and added to zone 4.</td><td rowspan="2">Small amount of reassignment of trips from zone 1 to zone 4 as the removed bus gate on Ghyllgrove offers a more attractive route choice than Upper Mayne for travelling north.</td></tr>
<tr><td>15–1
1–4
16–1
16–4</td><td>Movements to zone 1 were decreased by 40% and the absolute difference added on to movements from zone 15 & 16 to zone 4</td></tr>
</table>

Once the matrices for each time peak and scenario were finalised, the matrices were separated into 15-min intervals using the proportions used to split the base model matrices. This is summarised in the BTCVM LMVR.

Impact of new town centre build out

As can be seen in the table below, ~6-7% of total trips in the DM0 scenario are generated by the proposed residential dwellings and ~4-5% in the DM1 scenario. The overall total trip reduction between the two scenarios is therefore around 2% of all vehicles in the town centre area. Trips originating from the proposed residential dwellings in the DM1 scenario are ~30% lower than in the DM0 scenario. This decrease is quite small, but it should be noted that the trip generation from the residential developments in the 7,520 dwelling scenario was already relatively low, due to limited parking provided within the town centre. Therefore a decrease of 2,520 dwellings is a small proportion (around one third) of an already relatively small number, thus the overall impact on total trips in the town centre area is not significant.

It is noted that the 5,000 dwellings scenario is itself an uplift compared to previous local plan assumptions of 2,128 dwellings; whilst an assessment of the 2,128 dwelling scenario is not within the scope of work, it may be inferred from the relative change of 2,520 dwellings (i.e. between 7,250 and 5,000) noted here, that all else being equal, the step down from 5,000 to 2,128 dwellings would have a similarly small effect on total trips through the town centre. However, modelling would be required in order to confirm this inference.

Table 4.3 Trip Comparison

Dwelling scenario	AM Peak			PM Peak			Saturday Peak		
	Total Trips	..of which from resi. devs	Proportion of trips from new resi. (%)	Total Trips	..of which from resi. devs	Proportion of trips from new resi. (%)	Total Trips	..of which from resi. devs	Proportion of trips from new resi. (%)
7520 Dwellings	8973	489	5.5	8841	622	7.0	8809	482	5.5
5000 Dwellings	8809	325	3.7	8633	414	4.8	8648	320	3.7
Abs Diff.	164	164		208	208		162	162	
% Diff.	1.8%	34%		2.4	33%		1.8	34%	

5 Forecast Model Convergence

The BTCVM model uses dynamic trip routing, i.e. the model allows individual travellers to choose their best route in an iterative process. Convergence is determined by the level of stability of the model whereby trip routing does not change significantly between iterations of the same model. A good level of convergence is required in order to ensure that any impacts noted in the DS scenario is a result of the changes in the DS network, rather than due to 'noise' in the model due to instability and random effects.

Before any results from the Basildon Town Centre Forecast models were extracted, confirmation that each of the models had reached an acceptable level of convergence (and therefore stability) was required.

According to Transport for London (TfL) Traffic Modelling Guidelines on VISSIM modelling, convergence is be deemed to have been satisfactorily achieved when the following criteria have been met over the modelled peak hour:

- 95% of all path traffic volumes change by less than 5% for at least four consecutive iterations; and
- 95% of travel times on all paths change by less than 20% for at least four consecutive iterations.

The convergence performance of the 12 models can be seen in Appendix B, and illustrates that a good level of stability is achieved in the model runs.

6 Modelling Outputs

This section compares the model outputs from the VISSIM DM and DS forecast models. In order to provide context, base model outputs have also been provided. The scenarios tested were detailed in section 2 and are repeated below for ease of reference:

Table 6.1 Forecast Scenarios

Scenarios		DM0	DM1	DS1	DS2
Demand	7520 Dwellings	✓			
	5000 Dwellings		✓	✓	✓
Network	Committed Transport Schemes	✓	✓	✓	✓
	Downgrading of Southernhay to single lane	✓	✓	✓	✓
	Removal of Southernhay Roundabout	✓	✓	✓	✓
	Downgrading of Great Oaks to single lane			✓	✓
	Removal of the bus gate northbound on Ghyllgrove			✓	✓
	Pedestrianisation/removal of Little Oaks				✓

The analysis undertaken in the following sections aims to illustrate the impact of the demand and highway network changes described in the table above, with a view to answering the following questions:

1. What is the effect of a lower level of residential development (5,000 dwellings instead of 7,520) in the do minimum scenario?
2. Against a background of 5,000 dwellings, how does the downgrading of Great Oaks and removal of Ghyllgrove bus gate affect network performance.
3. How does the additional removal of Little Oaks affect network performance.

Three types of output were used for forecast scenario analysis: relative delay heat maps, journey times and network statistics.

Relative Delay Heat Maps

Relative delay heat maps have been created to show model performance for each forecast scenario. They also facilitate identification of key areas within the network experiencing higher levels of delay. Relative delay is presented as a percentage and is calculated as the total delay divided by total travel time of all vehicles in this link segment for the modelled hour. When at 0% delay vehicles can travel freely along each link without hinderance whereas at maximum delay (95%-100%) vehicles are travelling at a speed which is close to, 0. In the 50% delay band (41-50%) vehicles experience some congestion but will still make progress along the link. In the heat maps, links are coloured from green (no congestion) through to red (high congestion) and black (maximum congestion)

Network Statistics

A number of average network statistics have been extracted for each modelled scenario to provide a high level snapshot of the overall model performance. The network statistics extracted for each scenario are listed in Table 6.2 with a description of how they are calculated.

Table 6.2: Network Statistics Summary

Network Statistic	Summary
Average Delay	The Average Network Delay statistic records the network's average delay per vehicle in seconds. It is calculated as '*Total delay / (Number of vehicles in the network + number of vehicles that have arrived)*' and is provided for each scenario as an average of 10 runs.
Average Number of Stops	The average number of stops per vehicle in the network. In this case a 'stop' describes when a vehicle is stationary due to queuing. Calculated as '*Total number of stops / (Number of vehicles in network + number of vehicles that*
Total Distance Travelled	Total distance travelled by all vehicles in the network or by those that have already exited it. Measured in metres.
Total Travel Time	Total travel time of vehicles traveling within the network or that have already left the network. Measured in seconds
Average Speed	The average speed of vehicles in the network in mph. It is calculated as '*Total Distance Travelled/ Total travel time*'. It is calculated as a weighted average of the speed of all vehicles. The weight is the respective travel time of the vehicles. This means that vehicles that have only a short travel time have less influence on the value of this result attribute than vehicles that have been in the network for a long time.
Average distance travelled	The average distance travelled per vehicle measured in meters. Calculated as '*Total Distance travelled/(Vehicles Active + Vehicles Arrived)*'. Vehicles active are defined as the 'Total number of vehicles in the network at the end of the simulation' and Vehicles Arrived are defined as 'Total number of vehicles which have already reached their destination and have been removed from the network before the end of the simulation'.

Average Travel Time	The average travel time per vehicle measured in minutes. Calculated as '*Total Travel Time/(Vehicles Active + Vehicles Arrived)*'.

Journey Time

Journey time results for each scenario and forecast year have been extracted for key routes in the network, to allow the identification of impacts to vehicle travel times associated with implementation of committed traffic schemes and proposed town centre improvements. Results were extracted for the key journey time routes seen in Figure 6.1. Graphs visualising the journey time profile of each route are provided in Appendix C.

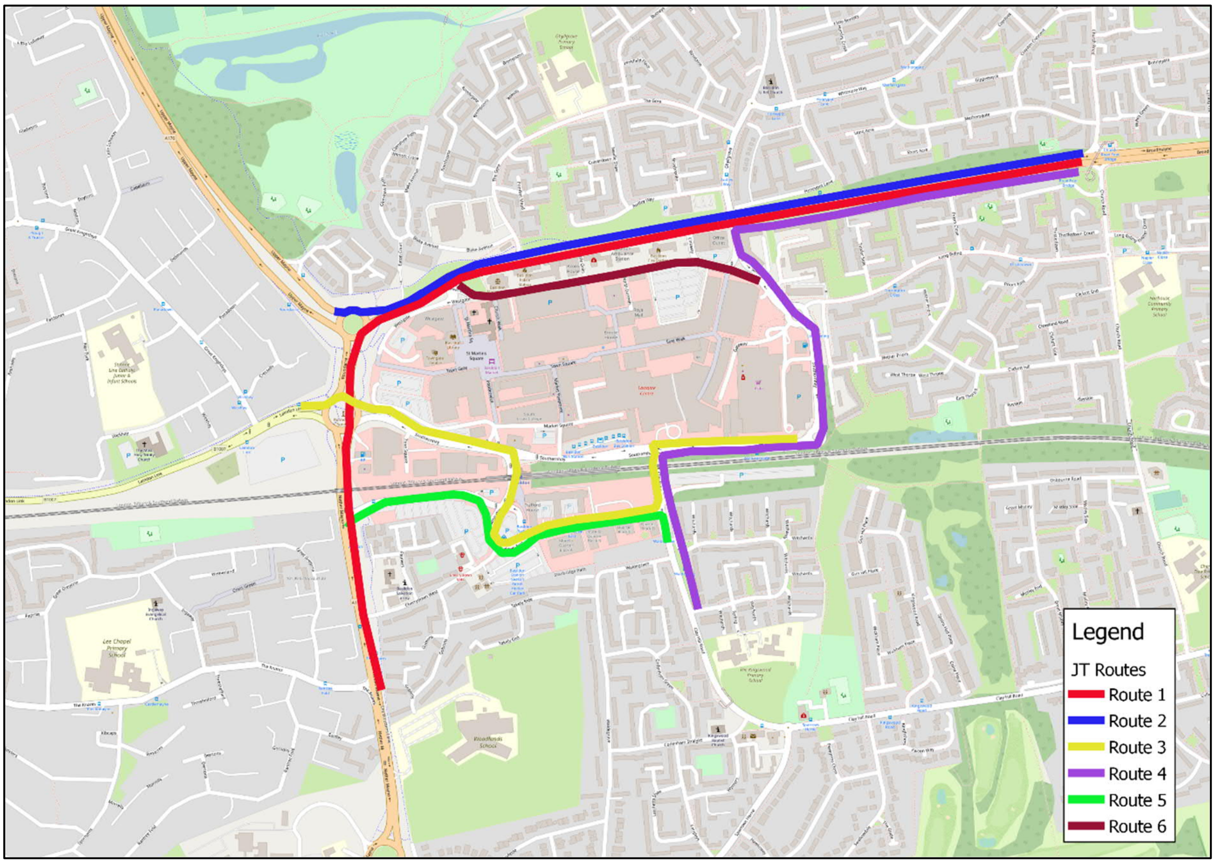


Figure 6.1: Forecast Model Journey Time Routes

Comparison of DM0 and DM1 scenarios

This section provides a comparison of the DM0 and DM1 scenarios and highlights the impacts associated with different levels of town centre build out, in order to answer the question "What is the effect of a lower level of residential development (5,000 dwellings instead of 7,520) in the do minimum scenario?".

Results are also provided for the base year model as an indication of how much greater congestion will be in the future compared to current conditions. This is provided for context although though with the inevitability of traffic growth, it is almost impossible for present day conditions to be maintained.

Relative Delay Heat Maps

The figures below demonstrate the level of congestion based on the delays that exist in different areas of the Basildon Town Centre for the Base and the Do Minimum scenarios.

AM

In the AM peak there are no significant differences between the two Do Minimum scenarios. In both scenarios, the area with the highest delay is Roundacre roundabout, while some delays can also be noted at the Ghyllgrove and Broadmayne junction.

The only notable difference between the two DMs (although relatively minor) can be seen northbound on Southernhay between Long Riding roundabout and Great Oaks/ Southernhay junction. At this location, DM0 has higher level of congestion compared to DM1.

Figure 6.2: Relative Delay Heat Map Base AM

Figure 6.3: Relative Delay Heat Map DM0 AM

Figure 6.4: Relative Delay Heat Map DM1 AM

PM

In the PM peak, there are significantly fewer delays at Roundacre roundabout in both DMs compared to the AM peak. However, there are high levels of delay for the southbound direction of A176 Upper Mayne and Ghyllgrove, and the eastbound direction of A1321 Broadmayne in both DM scenarios.

Similar to the AM peak, DM0 has a higher level of congestion than DM1 on the northbound Southernhay between Long Riding roundabout and Great Oaks/ Southernhay junction.

Figure 6.5: Relative Delay Heat Map Base PM

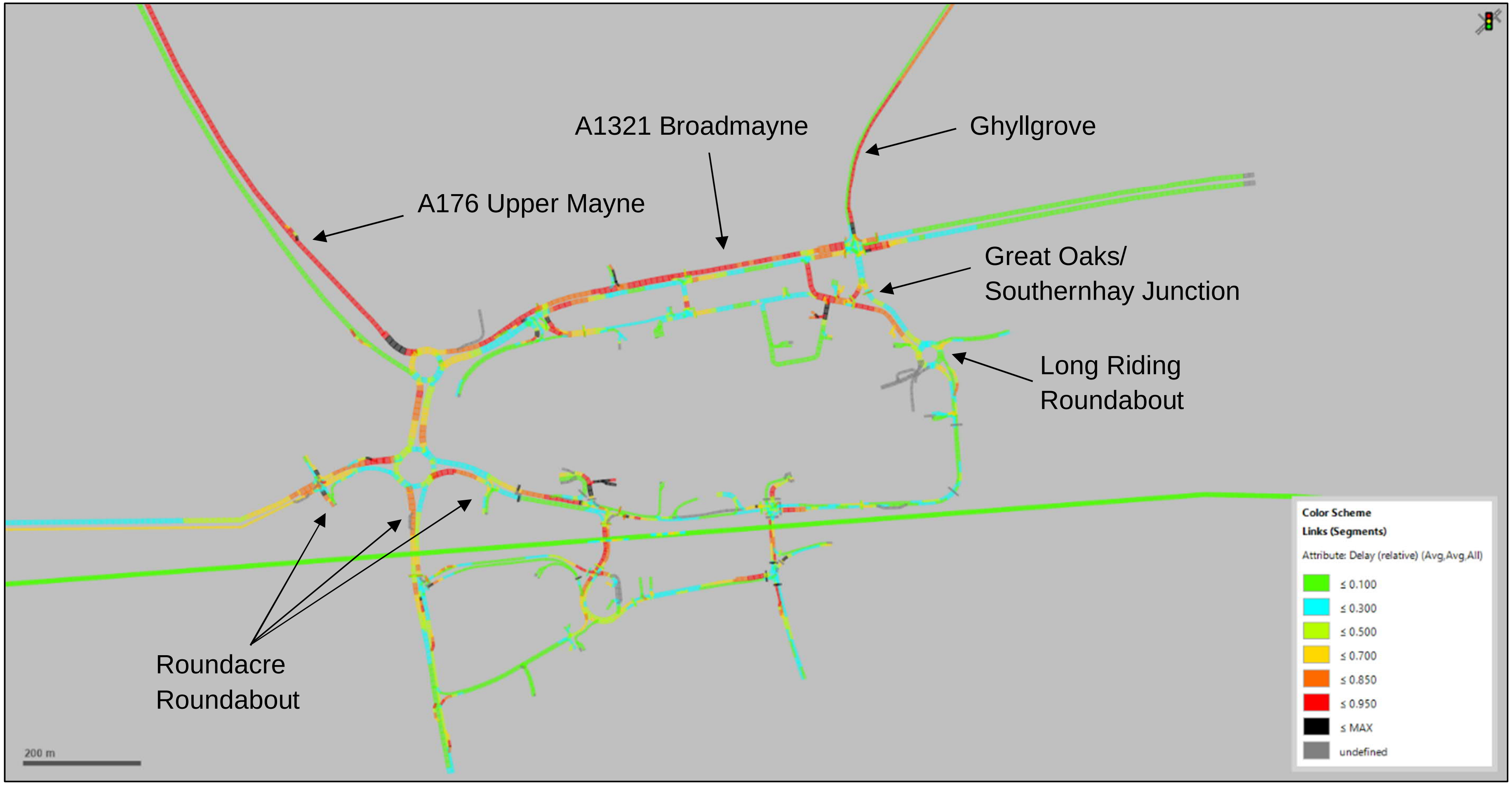


Figure 6.6: Relative Delay Heat Map DM0 PM

Figure 6.7: Relative Delay Heat Map DM1 PM

Saturday

In the Saturday peak, the relative delay of the two DM scenarios shows a similar pattern in the southern area of the model.

In the northern area of the model there are some small changes in congestion between the two scenarios. In the DM1 scenario there is slightly increased congestion on the A176 Upper Mayne southbound. There is also a slight decrease in congestion eastbound on Laindon Link. This appears the only evidence of a change due to the reduced number of dwellings in the town centre. The reductions at Laindon Link are due to a small decrease in opposing flows at the roundabout, making it easier for traffic to exit the link. However, this results in slightly more traffic going to the roundabout with Upper Mayne, increasing the opposing flow and causing the increase in congestion on Upper Mayne southbound. Nonetheless, these changes are relatively small within the wider context of the town centre area.

Figure 6.8: Relative Delay Heat Map Base SAT

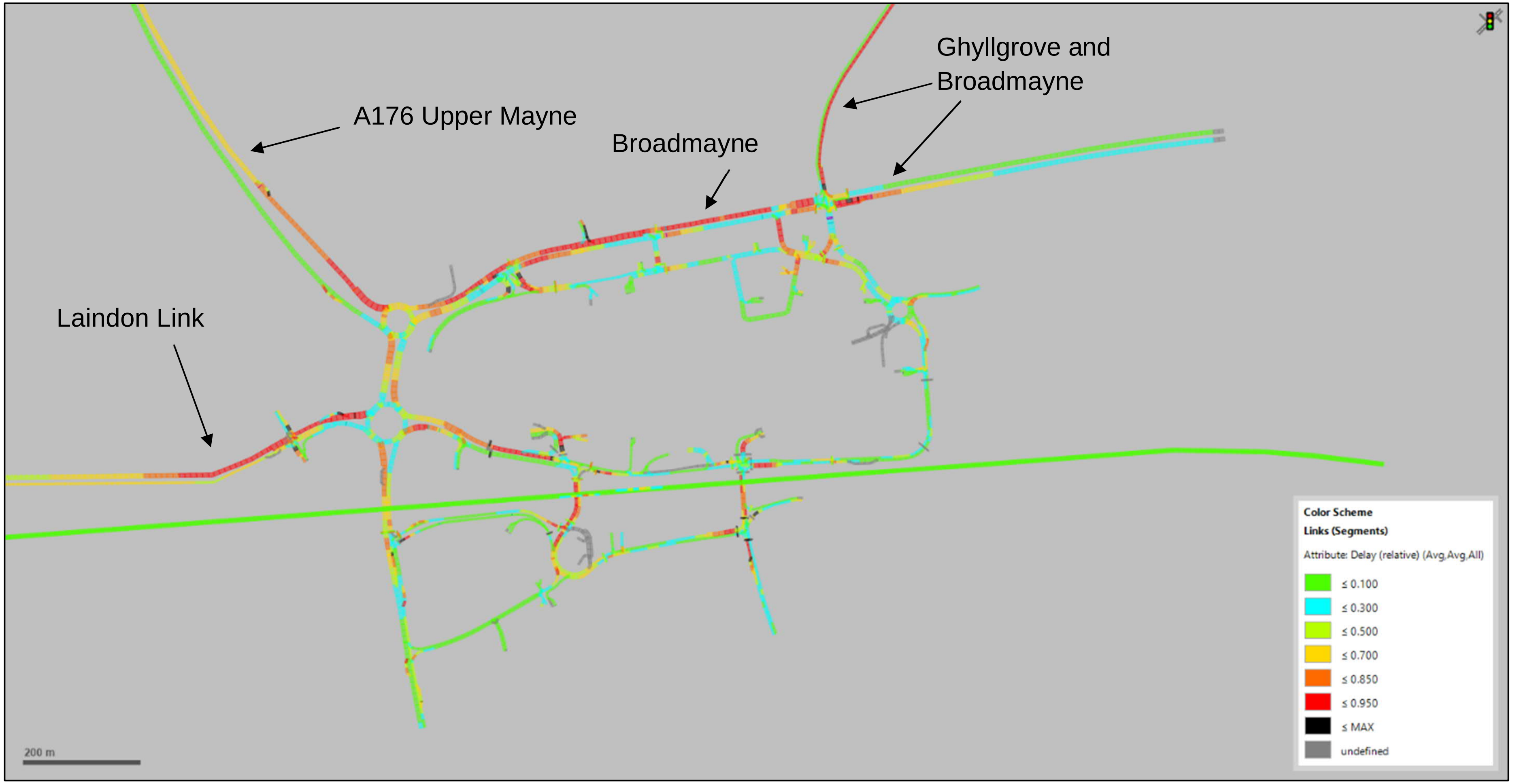


Figure 6.9: Relative Delay Heat Map DM0 SAT

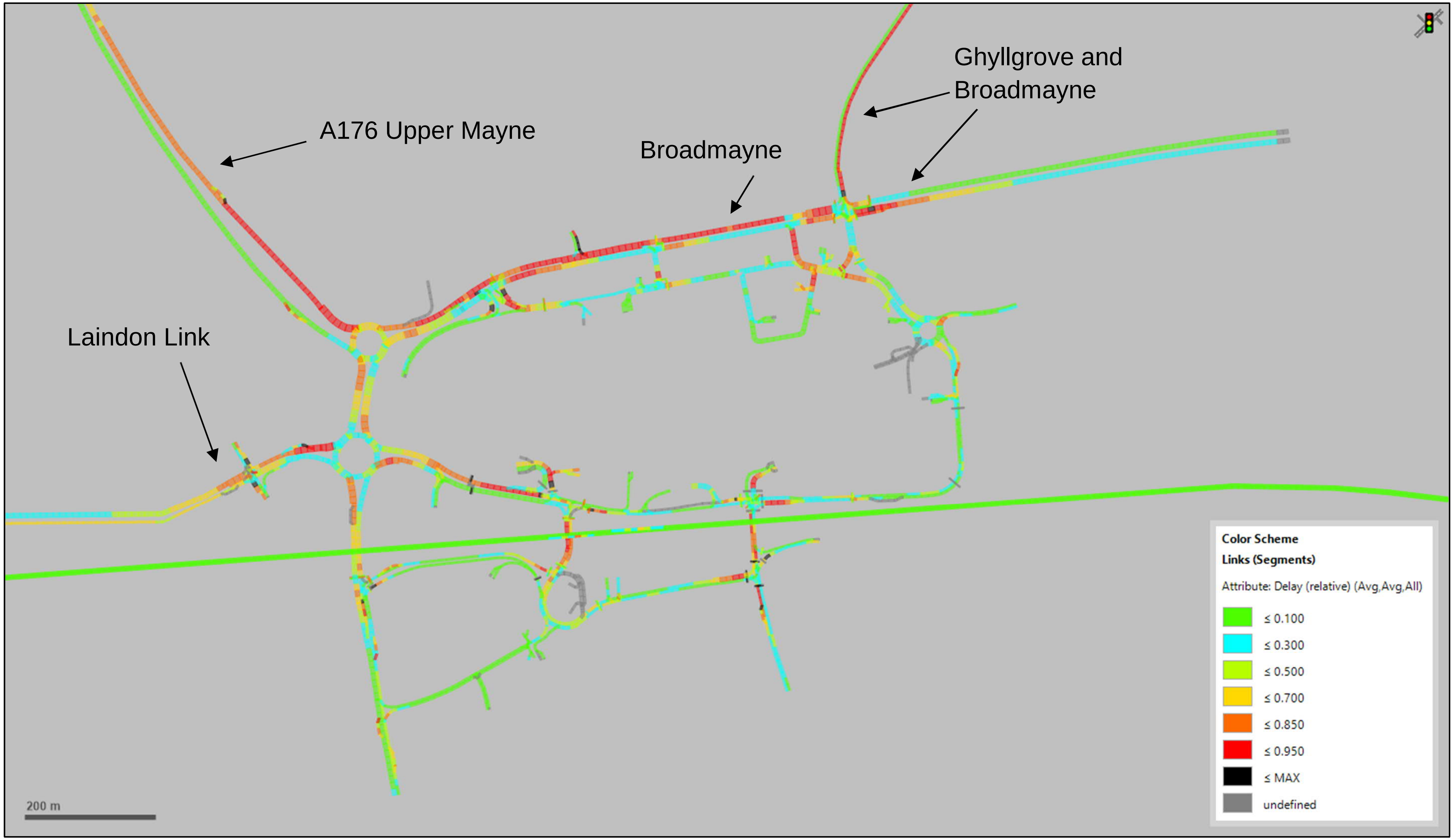


Figure 6.10: Relative Delay Heat Map DM1 SAT

Overall, any differences between the DM scenarios are relatively minor, such that there are not any significant delay differences. In effect, the difference in the number of residential dwellings in the town centre (7,520 v 5,000) is not really apparent in the road network.

Network Statistics

The table below details the overall network statistics.

Table 6.3: DM0 – DM1 Network Statistics Comparison

Network Statistics	AM			PM			SAT		
	Base	DM0	DM1	Base	DM0	DM1	Base	DM0	DM1
Average Delay per Vehicle (Min)	01:39	04:35	04:35	01:28	04:36	04:16	01:10	04:28	04:15
Average Number of Stops per Vehicle	3.36	9.16	9.33	3.03	11.48	10.54	2.43	8.87	8.22
Average Speed of Vehicles in Network (mph)	14.61	8.03	8.07	15.88	8.11	8.63	16.67	7.89	8.21
Average Distance Travelled per Vehicle (m)	1.32	1.39	1.40	1.35	1.40	1.42	1.25	1.32	1.33
Average Travel Time per Vehicle (Min)	3.36	6.47	6.49	3.16	6.45	6.15	2.79	6.25	6.06
Total Distance Travelled by All Vehicles (m)	12068	14399	14230	12378	13831	13974	11994	14328	14194
Total Travel Time for all Vehicles (Hours)	514.11	1114.56	1097.64	485.28	1059.79	1006.18	447.03	1129.90	1075.07

The data confirms the conclusions of the heatmaps. The two DM scenarios have very similar network statistics in almost every category. The average delay per vehicle in the AM peak is identical (04:35), while in the PM peak and in the Saturday peak there is slightly less delay in the DM1 scenario, although the differences are small enough to be barely discernible (04:36 down to 04:16 and 04:28 down to 04:15 respectively). The same pattern occurs for the average speed, as it slightly improves in the DM1 scenario, but only by fractions of a mile per hour. The DM1 scenario has the lower level of residential development, and the statistics again emphasise that although there is an improvement in network conditions, the level of improvement is tiny. The effect of reduced development is very small.

It is noteworthy that compared to the base year, network conditions worsen considerably. This reflects the general level of traffic growth attributable to the EECSM model forecasts, which in turn rely on local plan data and TEMPro growth. It's considered that these are function of general conditions rather than anything directly attributable to impacts from town centre development. As noted previously, the base data is intended to give some comparison to current conditions, but an assessment of future conditions compared to the base is not within this scope of work.

Journey Time

Given the above, it is expected that the two Do Minimum scenarios will have similar journey times across the model.

As shown in the outputs summarised in Table 6.4, these two scenarios record similar journey times across all three peak periods. The largest journey time difference is noted for Route 3 in the Saturday peak hour and is less than one minute (59 seconds). Generally, the journey times in the DM1 are slightly lower than the DM0 scenario.

Table 6.4: DM0 – DM1 Journey Time Comparison

Route	Direction	AM (min:sec)				PM (min:sec)				SAT (min:sec)			
		Base	DM0	DM1	Difference (DM1-DM0)	Base	DM0	DM1	Difference (DM1-DM0)	Base	DM0	DM1	Difference (DM1-DM0)
1	SB	05:13	09:36	08:56	- 00:40	05:08	05:06	05:09	+ 00:03	04:47	06:25	06:23	- 00:02
1	NB	04:31	10:13	10:04	- 00:08	04:49	08:17	07:48	- 00:29	04:35	09:41	09:43	+ 00:02
2	EB	02:31	03:45	03:42	- 00:03	02:50	06:03	05:42	- 00:21	02:39	07:14	07:30	+ 00:16
2	WB	03:13	07:26	06:45	- 00:42	03:00	03:24	03:23	- 00:01	03:10	04:42	04:40	- 00:02
3	EB	00:00	03:24	03:23	- 00:01	00:00	04:37	04:58	+ 00:21	00:00	05:48	05:28	- 00:20
3	WB	02:55	08:33	08:34	+ 00:01	03:29	04:56	04:41	- 00:15	02:44	05:10	04:11	- 00:59
4	SB	02:58	06:49	06:11	- 00:38	02:56	03:51	03:48	- 00:03	03:02	04:34	04:31	- 00:03
5	WB	02:27	02:28	02:32	+ 00:04	02:05	01:49	01:57	+ 00:07	01:42	02:20	01:54	- 00:26
6	WB	01:12	01:31	01:27	- 00:04	01:23	01:23	01:21	- 00:02	01:16	01:22	01:23	- 00:00

Comparison of DM1, DS1 & DS2

This comparison aims to identify the impact of different highway network improvements and answer the two questions posed: 1. Against a background of 5,000 dwellings, how does the downgrading of Great Oaks and removal of Ghyllgrove bus gate affect network performance? And 2. How does the additional removal of Little Oaks affect network performance?

Relative Delay Heat Maps

Figure 6.11 to Figure 6.19 demonstrate the levels of relative delay that exist in the Basildon Town Centre for the DS1 and DS2 scenarios compared to the DM1 scenario.

AM

In the AM peak, there is reduced congestion southbound on Ghyllgrove in the DS1 and DS2 scenarios compared to the DM1 scenario. However there is increased congestion westbound on Broadmayne. These differences are caused by traffic re-routing due to the removal of the bus gate on Ghyllgrove in the DS scenarios. The impact of the changes to the demand described in Table 4.2 effectively reduced traffic flows southbound on Ghyllgrove and increase them westbound on Broadmayne. Aside from these changes, there is no other great difference between the levels of congestion in DS1 and DM.

It is also clear from the heatmaps that the north part of the network in the DS2 scenario has higher delays compared to the DM1 and the DS1 scenarios. In particular, there is a significant increase in congestion eastbound along the A176 Upper Mayne and Broadmayne. This happens due to the removal of Little Oaks in DS2, which is forcing all vehicles wanting to access Great Oaks from Broadmayne to travel through the Ghyllgrove/Broadmayne junction. Thus this junction experiences a notable increase in trips, and this causes a long queue extending back to the A176 Upper Mayne/Broadmayne roundabout.

However, one positive side-effect of this is that the DS2 experiences a decrease in congestion westbound on Roundacre due to conflicting flow at the roundabout with the A176 reducing as a result of being held up in queues at the A176 Upper Mayne/Broadmayne roundabout and not being able to get through.

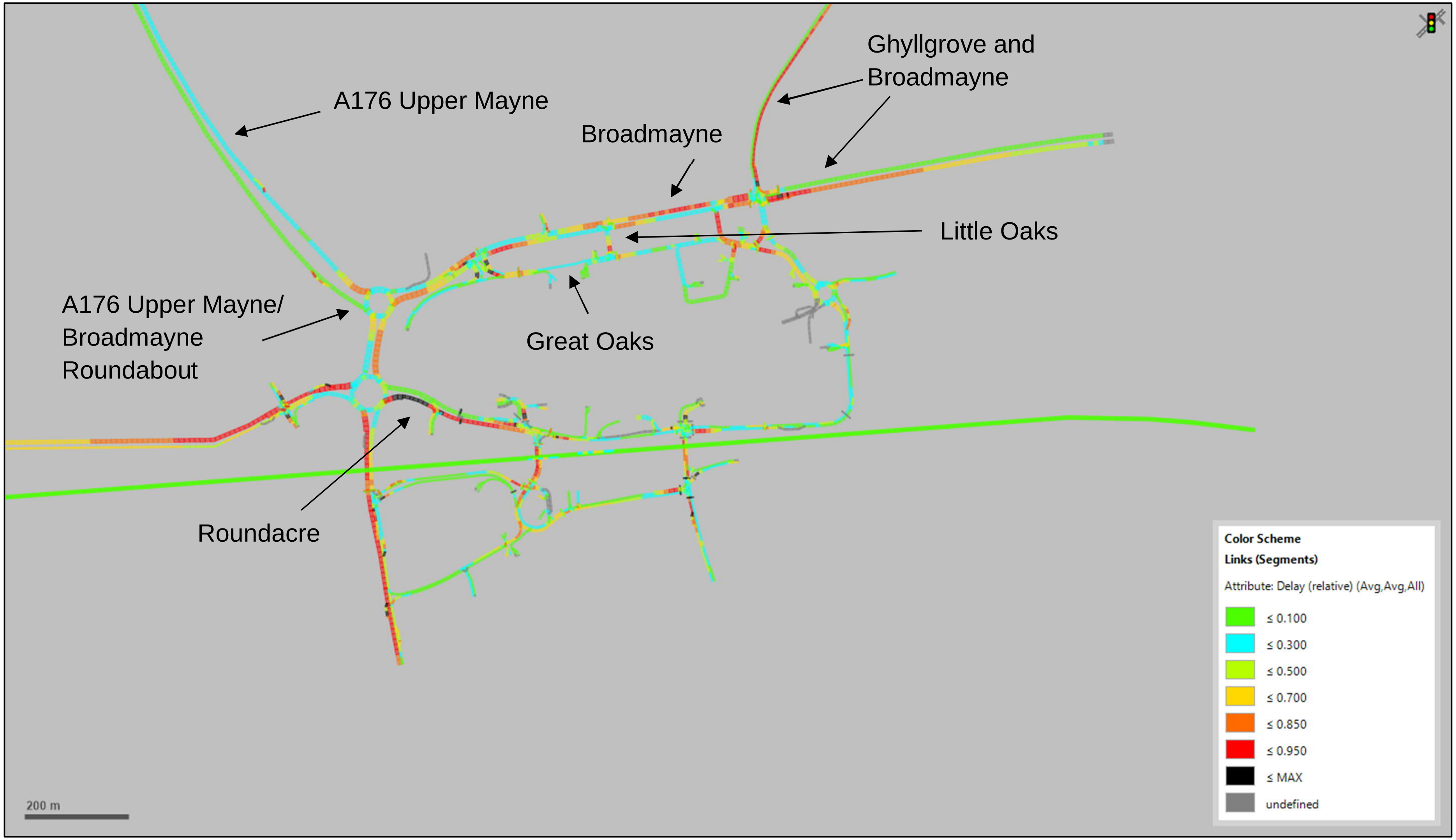


Figure 6.11: Relative Delay Heat Map DM1 AM

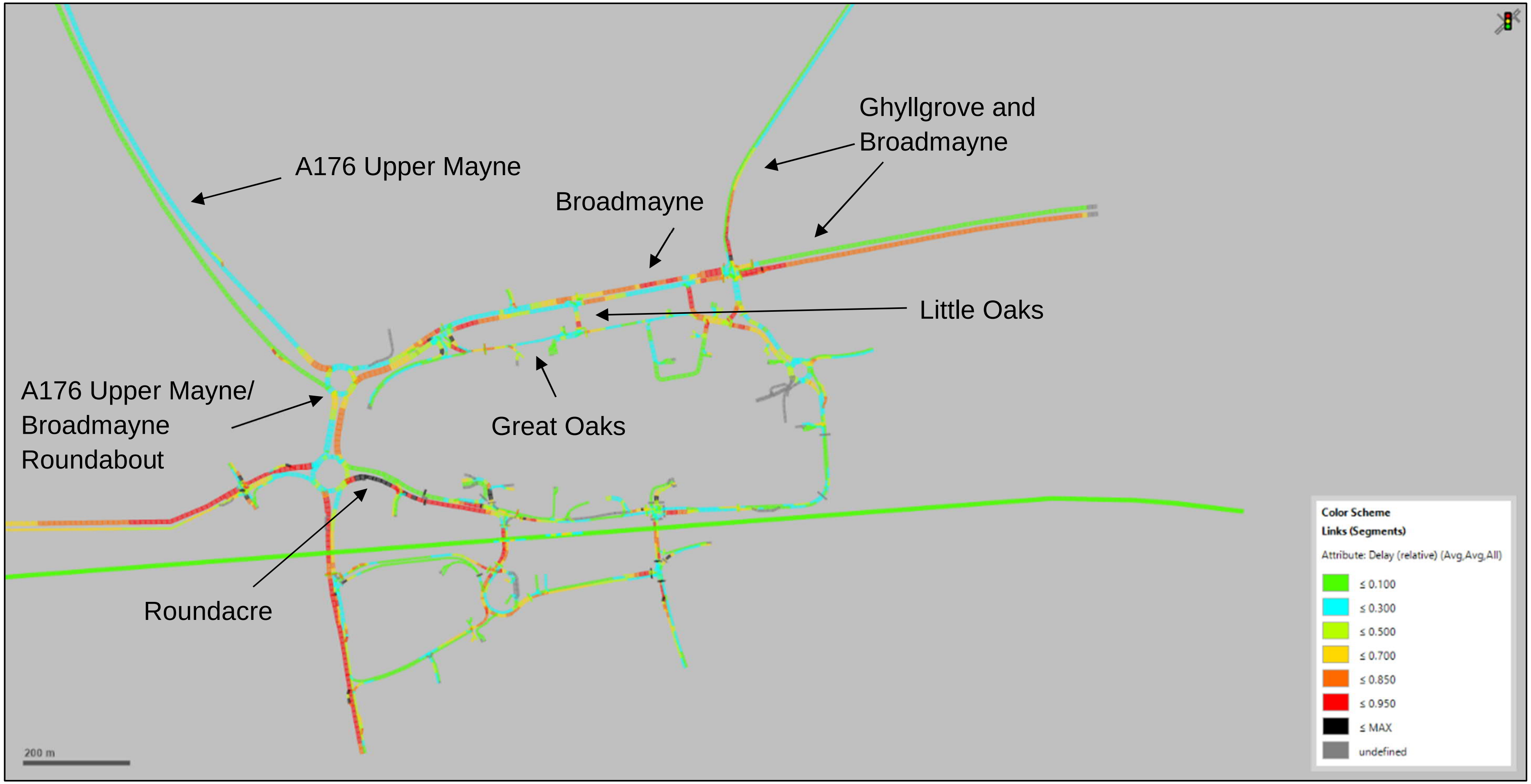


Figure 6.12: Relative Delay Heat Map DS1 AM

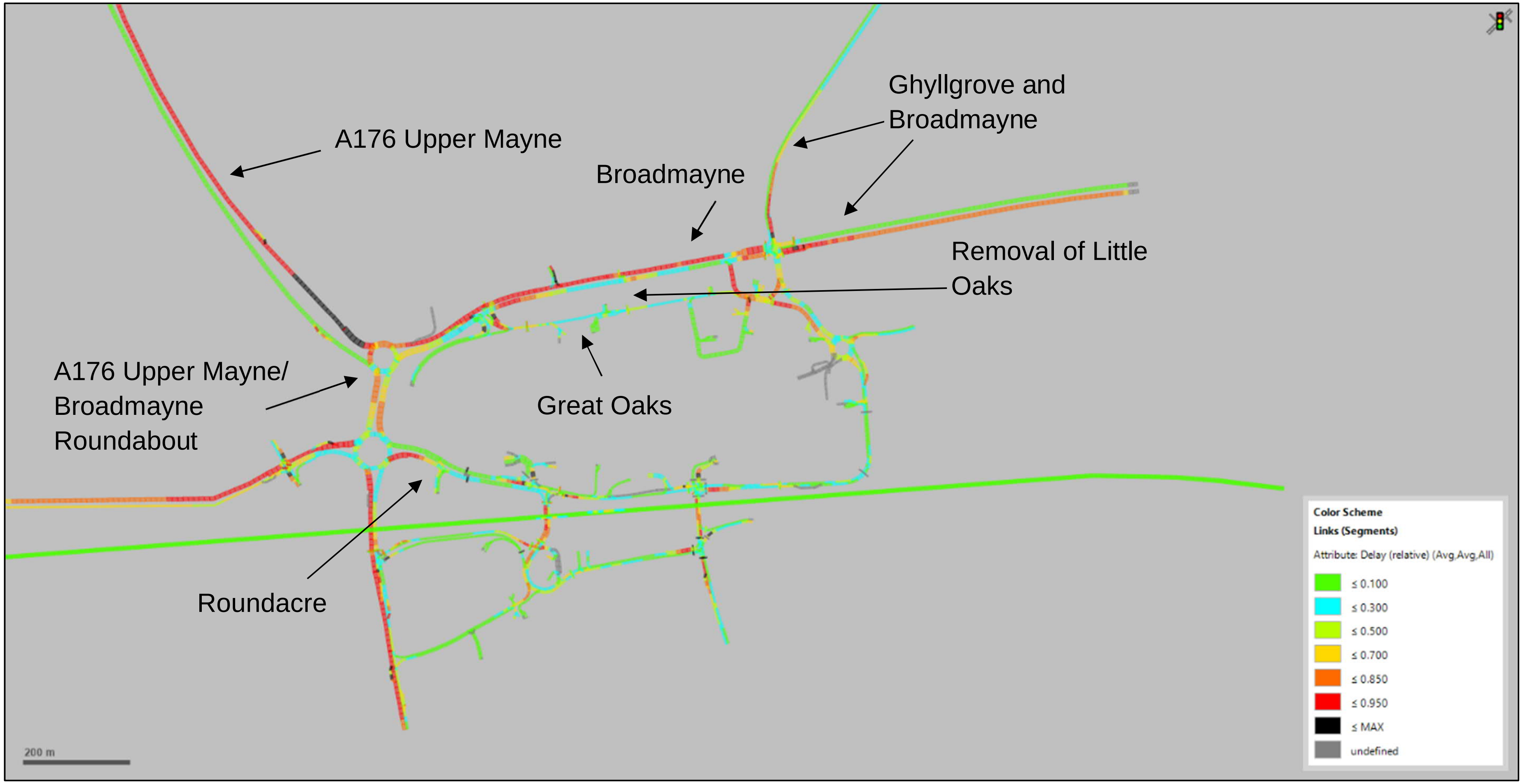


Figure 6.13: Relative Delay Heat Map DS2 AM

PM

In the PM peak, the removal of the bus gate in the DS scenarios causes reduced congestion southbound on Ghyllgrove compared to the DM, which is similar to what was noted in the AM peak. However, in the PM peak, unlike the AM peak, there is no subsequent increase of delay for vehicles moving westbound on Broadmayne as that arm of the junction is less congested to start with so not as sensitive to the relatively small increase in traffic that occurs on that arm.

There is a small increase in congestion northbound on Southernhay between the Long Riding Roundabout and the Southernhay/Great Oaks junction. This is due to the reassignment of a small number of trips attracted to the opened bus gate who are using Southernhay to then access Ghyllgrove.

Aside from the above, there are no other differences in congestion, indicating that the downgrading of Great oaks does not have an effect on travel conditions.

However, in DS2 with the removal of Little Oaks, the same patterns as noted in the AM peak occur. That is, increased eastbound queuing on Broadmayne with knock-on effects to Upper Mayne, as a result of increased funnelling of traffic displaced from Little Oaks.

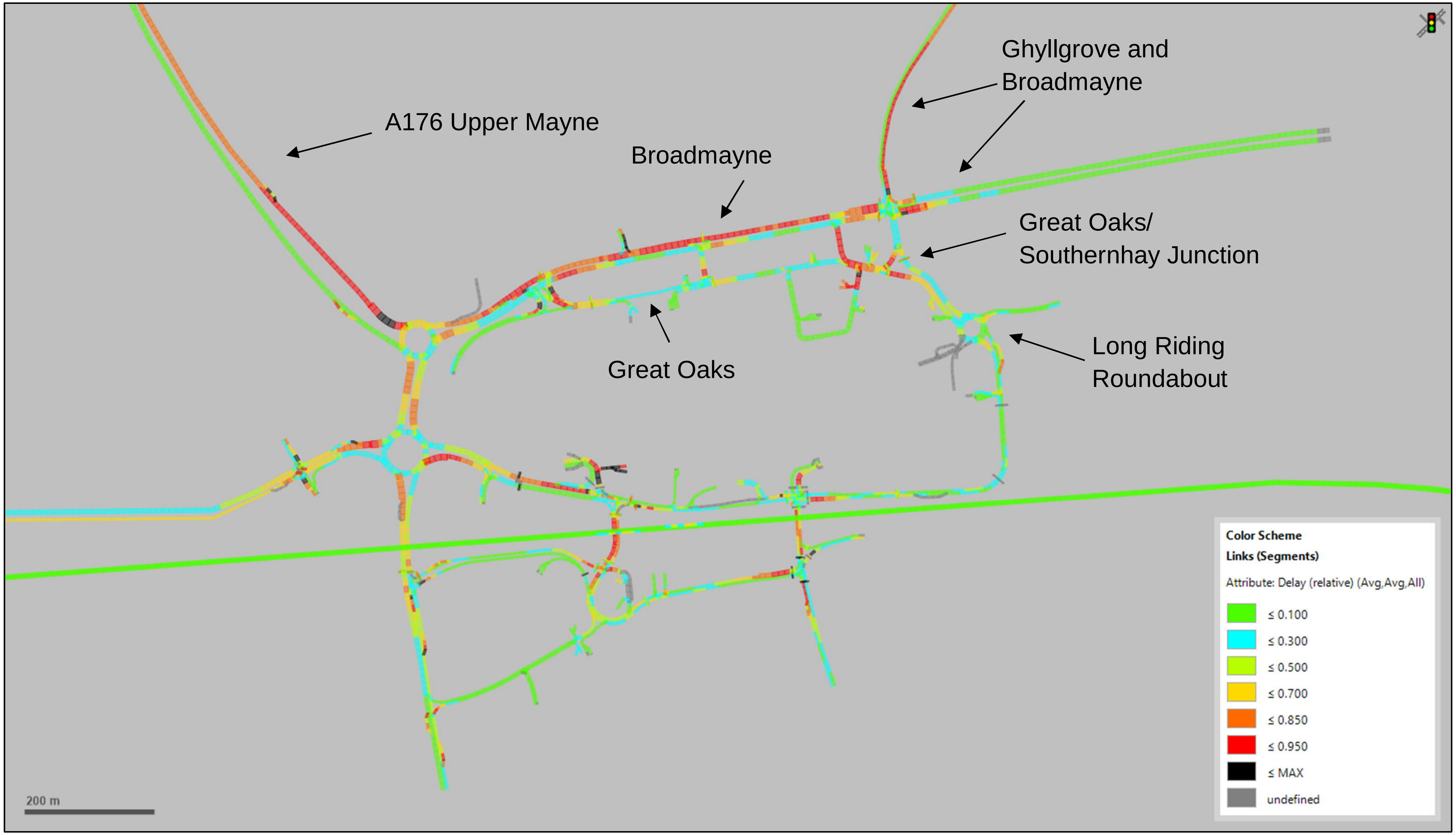


Figure 6.14: Relative Delay Heat Map DM1 PM

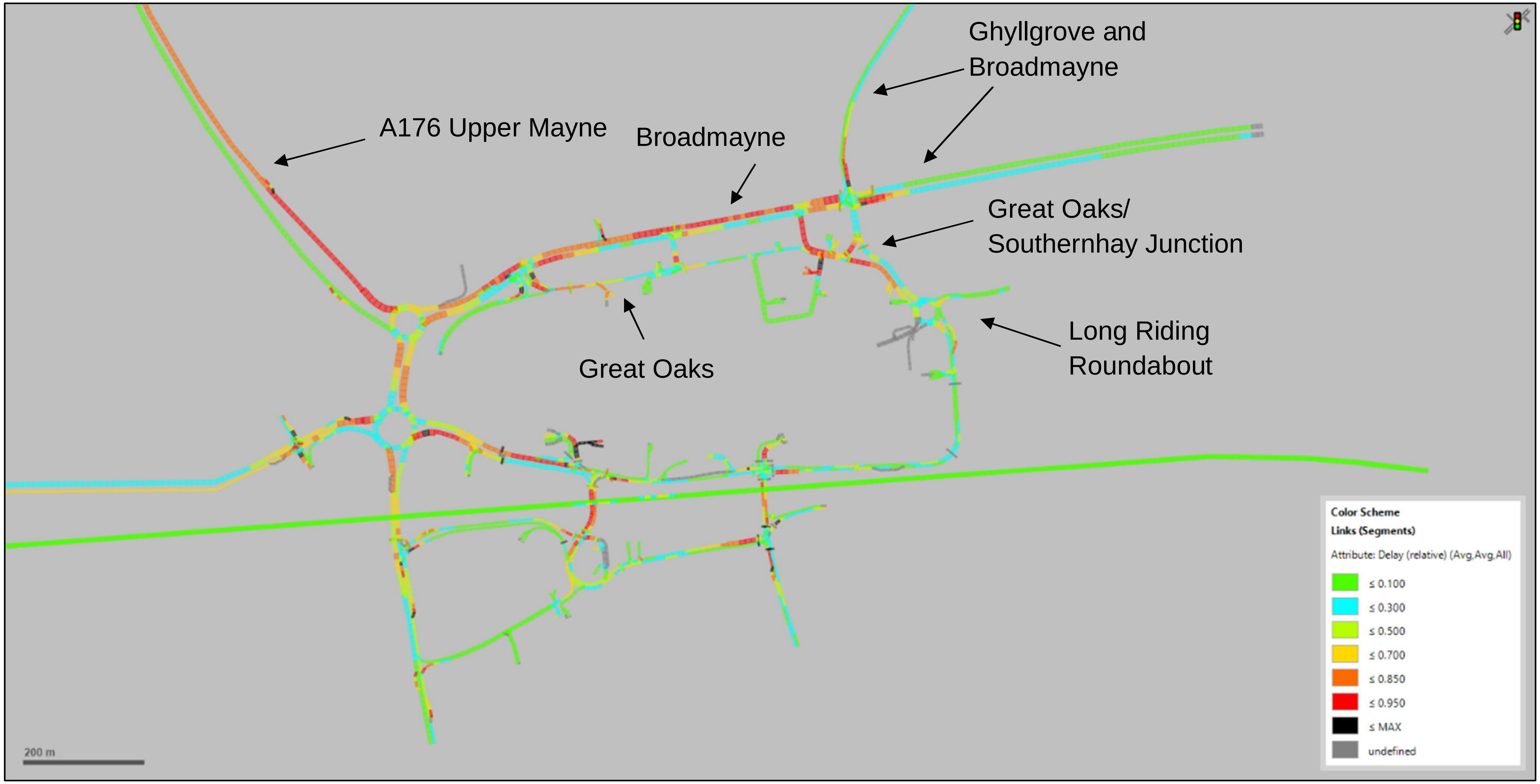


Figure 6.15: Relative Delay Heat Map DS1 PM

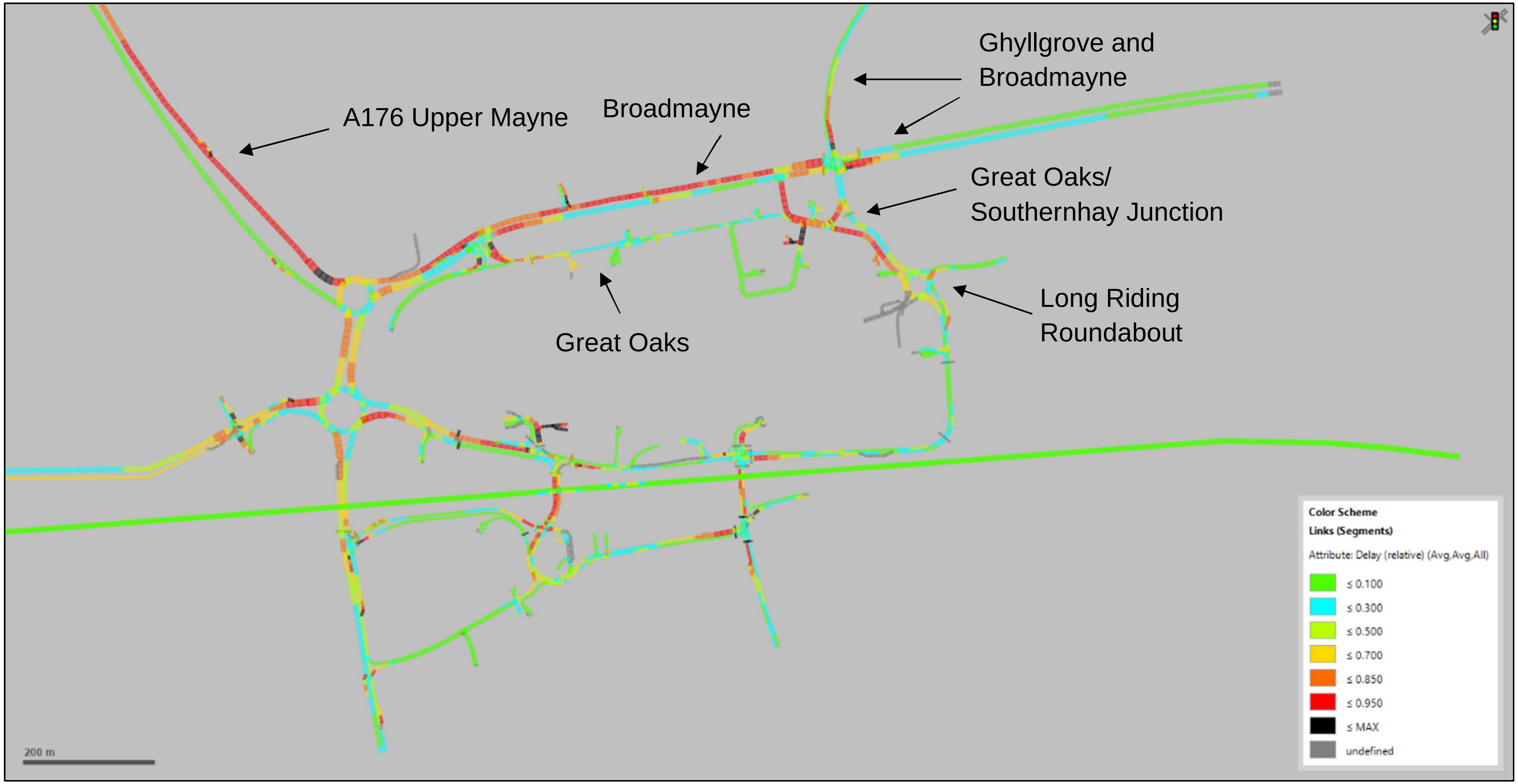


Figure 6.16: Relative Delay Heat Map DS2 PM

Saturday

Compared to the DM1, DS1 shows no significant delay changes in the southern half of the network. There are some changes in the northern half, however. The highest changes occur at Ghyllgrove, Broadmayne and A176 Upper Mayne. All these changes are associated with the removal of the bus gate on Ghyllgrove as traffic rerouting leads to the decrease of flow southbound on Ghyllgrove and the increase of flow westbound on Broadmayne. There are no other discernible impacts which suggests that the downgrading of Great Oaks has a relatively small impact on the network.

For the DS2 scenario, in comparison to DS1, there is an increase in congestion along Broadmayne eastbound. As with the other time periods, this occurs due to the removal of Little Oaks meaning that extra traffic is funnelled to the Broadmayne/ Southernhay junction, and that results in increased queuing back along the eastbound carriageway of Broadmayne. Additionally, there is a notable delay increase along the A176 Upper Mayne southbound, as well as a slight increase in congestion recorded on Laindon Link eastbound and the A176. This is also due to the closure of Little Oaks, as the additional queueing described on Broadmayne Eastbound blocks back to affect those other links.

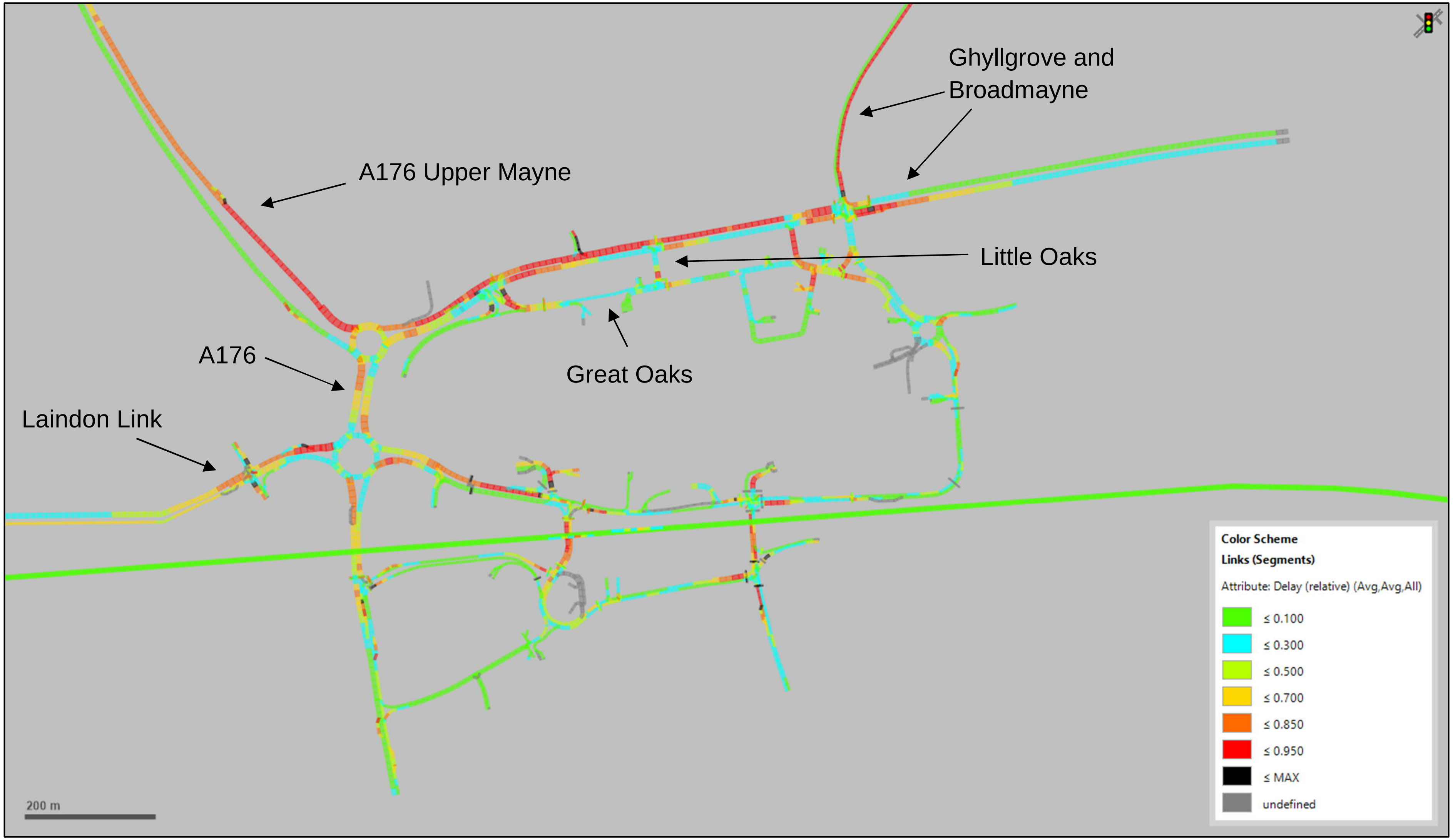


Figure 6.17: Relative Delay Heat Map DM1 SAT

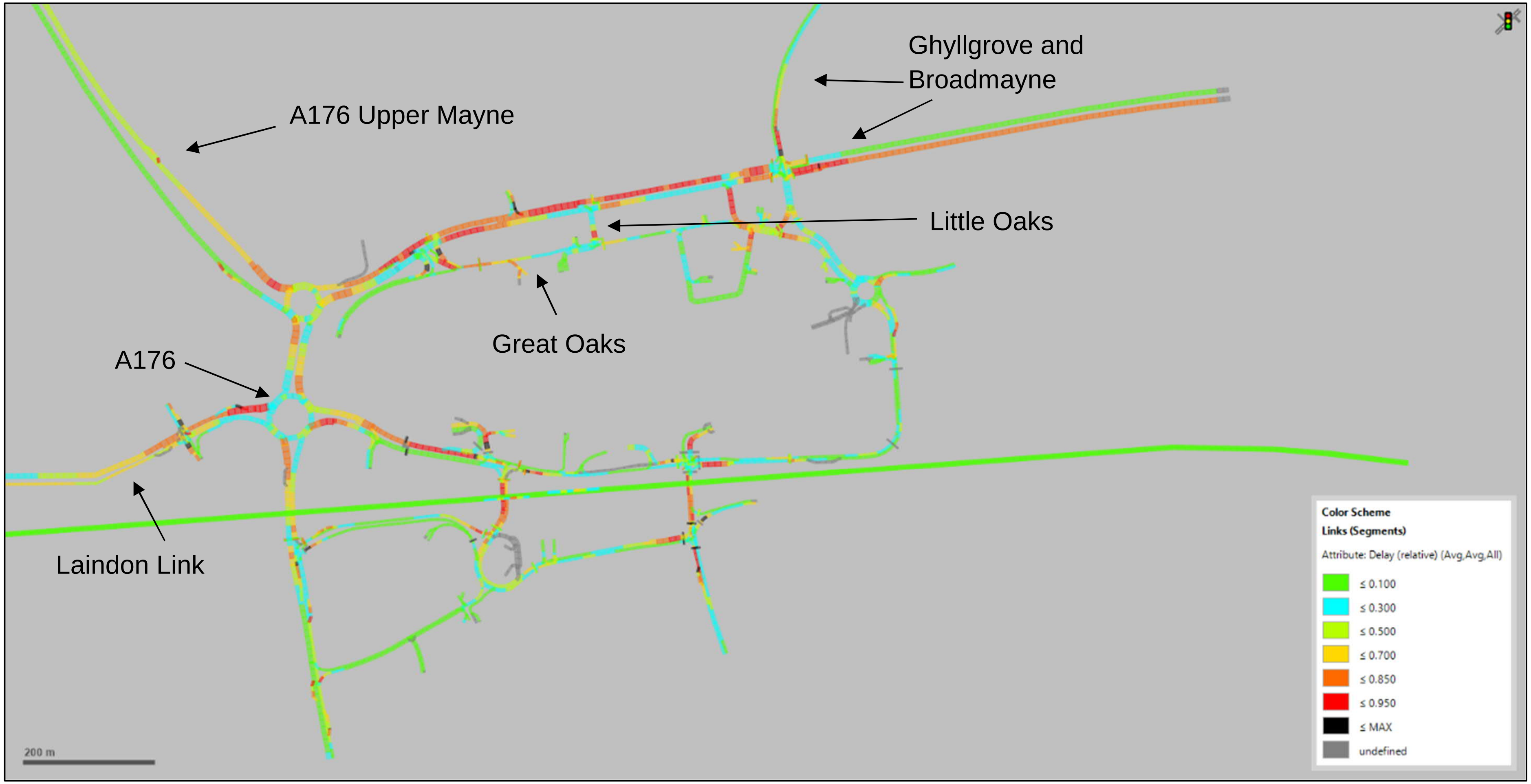


Figure 6.18: Relative Delay Heat Map DS1 SAT

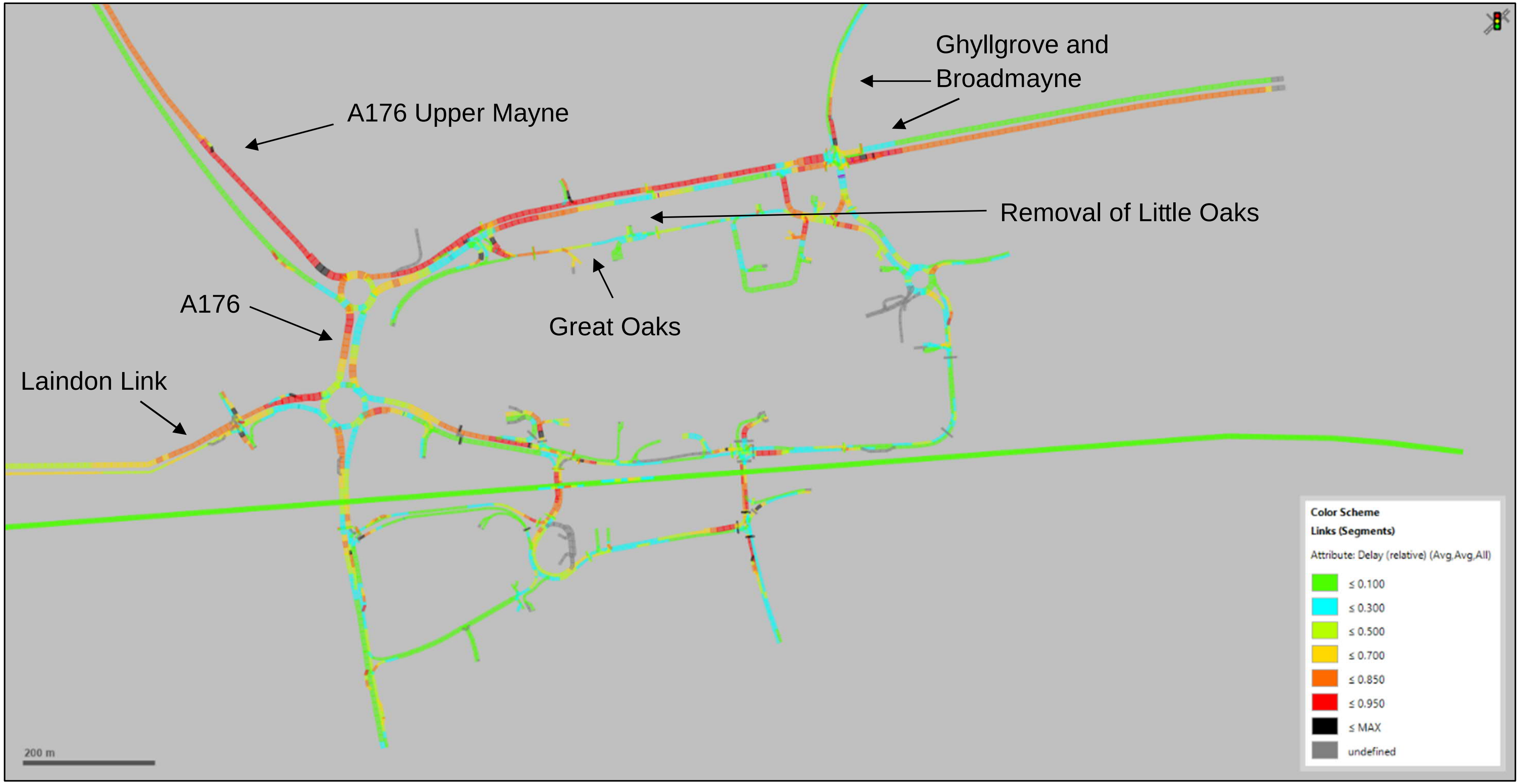


Figure 6.19: Relative Delay Heat Map DS2 SAT

Overall, the downgrading of Great Oaks to a single lane doesn't appear to have any significant negative impact on network performance across any of the peaks. The removal of the Ghyllgrove bus gate seems to have a slightly more significant impact but it is also considered minor.

On the other hand, the removal of Little Oaks in the DS2 scenario is causing significant problems as it is funnels excessive traffic to the Broadmayne/ Southernhay junction causing a backlog along Broadmayne, which is stretching back to A176 Upper Mayne.

Network Statistics

The severe congestion problems noted above for the DS2 scenario along Upper Mayne are reflected in the network statistics table. The average delay per vehicle for the DS2 scenario is the highest, across all three time periods, of all the. This stands out in particular in the AM peak where there are 2 minutes of extra delay per vehicle on average compared to the other options and average speeds drop considerably.

A similar pattern occurs for the PM peak and Saturday peak, although not as acutely.

The statistics in the table below also demonstrate that the DS1 scenario records lower delays, lower travel times and higher speeds across all three time periods compared to the DM scenario, despite the downgrading of Great Oaks, albeit these improvements are very slight. This is due to the net effect of the opening of the bus gate. However, these improvements are considered to be too slight to represent a significant effect, thus the net effect of the bus gate should be considered as broadly neutral.

Table 6.5: DM1 - DS1 – DS2 Network Statistics Comparison

Network Statistics	AM			PM			SAT		
	DM1	DS1	DS2	DM1	DS1	DS2	DM1	DS1	DS2
Average Delay per Vehicle (Min)	04:35	04:30	06:39	04:16	03:52	04:20	04:15	03:49	04:56
Average Number of Stops per Vehicle	9.33	9.21	15.98	10.54	9.24	10.71	8.22	5.90	9.98
Average Speed of Vehicles in Network (mph)	8.07	8.18	5.89	8.63	9.33	8.56	8.21	8.96	7.31
Average Distance Travelled per Vehicle (m)	1.40	1.41	1.34	1.42	1.45	1.43	1.33	1.36	1.32
Average Travel Time per Vehicle (Min)	6.49	6.42	8.49	6.15	5.77	6.22	6.06	5.67	6.73
Total Distance Travelled by All Vehicles (m)	14230	14138	12698	13974	14278	13714	14194	14401	13679
Total Travel Time for all Vehicles (Hours)	1097.64	1074.52	1340.27	1006.18	950.80	995.97	1075.07	999.74	1163.79

Journey Time

In the AM peak there are significant differences between the journey times along the six routes. In particular, in the DS2 scenario, the journey times of Route 1 NB and Route 2 EB increase by almost 7 minutes and 6 minutes respectively compared to the DS1 scenario. This is due to congestion along the Upper Mayne and Broadmayne which is caused by the removal of Little Oaks, as previously mentioned. Meanwhile, Route 3 WB observes a decrease in journey time in DS2 as there is less opposing traffic for vehicles moving westbound on Roundacre roundabout, due to its being held up at the Upper Mayne/Broadmayne roundabout.

For the DS1 scenario, the journey times for Route 1 SB, Route 2 WB and Route 4 SB increase by around 1 minute and 20 seconds compared to the DM1 scenario in the AM peak. This is due to congestion westbound along Broadmayne caused by changes made at the Ghyllgrove bus gate. This congestion tends not to occur in the PM peak and therefore the journey time changes are much smaller.

In the PM peak, the journey time differences between DS2 and DS1 follow the same pattern as in the AM peak, albeit the effect is less acute. Due to the removal of Little Oaks, the journey times of Route 1 NB and Route 2 EB increase by approximately 1 minute in the DS2 scenario compared to DS1. At the same time, the removal of the bus gate at Ghyllgrove in the DS1 scenario leads to an approximately 30 seconds journey time increase for Routes 1 SB & 2 WB compared to the DM1 scenario.

In the Saturday peak hour, the journey times of Route 1 NB and Route 2 EB increase by more than 2 minutes in the DS2 scenario compared to the DS1 scenario due again to the removal of Little Oaks. Also, the journey times of Route 1 SB, Route 2 WB and Route 4 SB increase by more than 4 minutes in the two DS scenarios compared to the DM1 scenario. This is caused by a significant increase in congestion on Broadmayne westbound approaching the Ghyllgrove/Broadmayne junction due to re-routing associated with the removal of the Ghyllgrove bus gate. However, it’s notable that despite these increases, the network statistics for the same time period show no significant change overall. This is again further evidence that removing the bus gate has benefits for some and disbenefits for others, but the net effect is that there is no real change in general delay levels.

Table 6.6: DM1, DS1 & DS2 Journey Times

Route	Direction	AM (min:sec)			PM (min:sec)			SAT (min:sec)		
		DM1	DS1	DS2	DM1	DS1	DS2	DM1	DS1	DS2
1	SB	08:56	10:15	10:16	05:09	05:37	05:17	06:23	10:41	10:22
1	NB	10:04	09:41	16:30	07:48	07:06	08:08	09:43	08:08	10:34
2	EB	03:42	03:25	09:19	05:42	05:04	05:52	07:30	06:10	08:15
2	WB	06:45	08:05	08:24	03:23	03:40	03:32	04:40	08:58	08:46
3	EB	03:23	03:25	03:15	04:58	05:12	04:54	05:28	05:42	05:10
3	WB	08:34	09:28	04:31	04:41	05:27	05:04	04:11	04:10	04:03
4	SB	06:11	07:36	08:18	03:48	03:51	03:53	04:31	08:40	08:26
5	WB	02:32	02:40	02:05	01:57	02:03	02:13	01:54	01:58	01:59
6	WB	01:27	01:30	01:20	01:21	01:33	01:23	01:23	01:31	01:32

Table 6.7: DM1, DS1 & DS2 Journey Time Comparison

Route	Direction	AM (min:sec)		PM (min:sec)		SAT (min:sec)	
		Difference (DS1-DM1)	Difference (DS2-DS1)	Difference (DS1-DM1)	Difference (DS2-DS1)	Difference (DS1-DM1)	Difference (DS2-DS1)
1	SB	+ 01:19	+ 00:01	+ 00:28	- 00:19	+ 04:18	- 00:19
1	NB	- 00:23	+ 06:49	- 00:42	+ 01:01	- 01:35	+ 02:26
2	EB	- 00:17	+ 05:54	- 00:38	+ 00:48	- 01:20	+ 02:05
2	WB	+ 01:20	+ 00:19	+ 00:17	- 00:09	+ 04:18	- 00:12
3	EB	+ 00:02	- 00:10	+ 00:14	- 00:17	+ 00:14	- 00:32
3	WB	- 00:54	- 04:57	+ 00:46	- 00:23	- 00:01	- 00:07
4	SB	+ 01:25	+ 00:42	+ 00:03	+ 00:02	+ 04:09	- 00:14
5	WB	+ 00:08	- 00:35	+ 00:06	+ 00:10	+ 00:04	+ 00:01
6	WB	+ 00:03	- 00:11	+ 00:12	- 00:10	+ 00:08	- 00:00

7 Conclusion

The purpose of this forecast report was to identify the potential impacts of proposed revisions to the highway network in Basildon Town Centre as well as identify the difference in impacts relating to two town-centre build out options.

Analysis of the model outputs has concluded the following:

Level of residential development in the town centre

- Modelling findings indicate that a reduction in dwellings doesn't lead to any strong improvements in traffic conditions (or looked at another way, an increase in dwellings doesn't necessarily translate to a significant adverse impact in traffic conditions). This is largely due to residential trip generation being relatively small, thus any proportional changes to the number of dwellings will have a limited effect on total trip generation around the town centre.

Downgrading Great Oaks (and removing Ghyllgrove Bus gate)

- Decrease in congestion on Ghyllgrove heading southbound to the junction with Broadmayne. Caused by some trips in the area reassigning through the now opened bus gate, as an alternative route.
- Increase in congestion on Broadmayne westbound, heading towards the junction with Ghyllgrove. This is a secondary effect of the bus gate in which reduction of trips from Ghyllgrove onto Broadmayne frees up some capacity downstream of the junction, and in turn induces more traffic from the east to take up the spare capacity.
- In the Saturday peak only, there is a decrease in congestion on Upper Mayne southbound. This is again a function of the bus gate opening.
- Aside from the above mentioned impacts, there are no other significant effects; i.e. downgrading Great Oaks has a negligible impact on network performance.
- In conclusion, the downgrading of Great Oaks does not do any harm to the performance of the town centre network. The opening of the bus gate at Ghyllgrove has a net neutral effect, but has some small positive impacts and some small negative impacts, depending on location.

Removing Little Oaks

- Removal of Little Oaks funnels all traffic using that road to access Great Oaks and the town centre to the Broadmayne/Southernhay/Ghyllgrove junction. In the AM peak, this is equivalent to around 400 vehicles added to the existing flows at that junction. The increase in traffic here has a significant adverse effect, as the junction becomes (even more) overcapacity, and causing

upstream effects, with congestion increasing along the eastbound Broadmayne, and causing blocking back to Upper Mayne and even Laindon Link in some cases.
- This is the main cause of the general worsening of traffic conditions in the town centre.
- In conclusion, the removal of Little Oaks is not recommended unless either some form of improvement at the Broadmayne/Southernhay junction can be effected, which will increase capacity in order to accommodate the increased flows displaced from Little Oaks, or, traffic levels across the town centre in general are reduced.

Further Recommendations

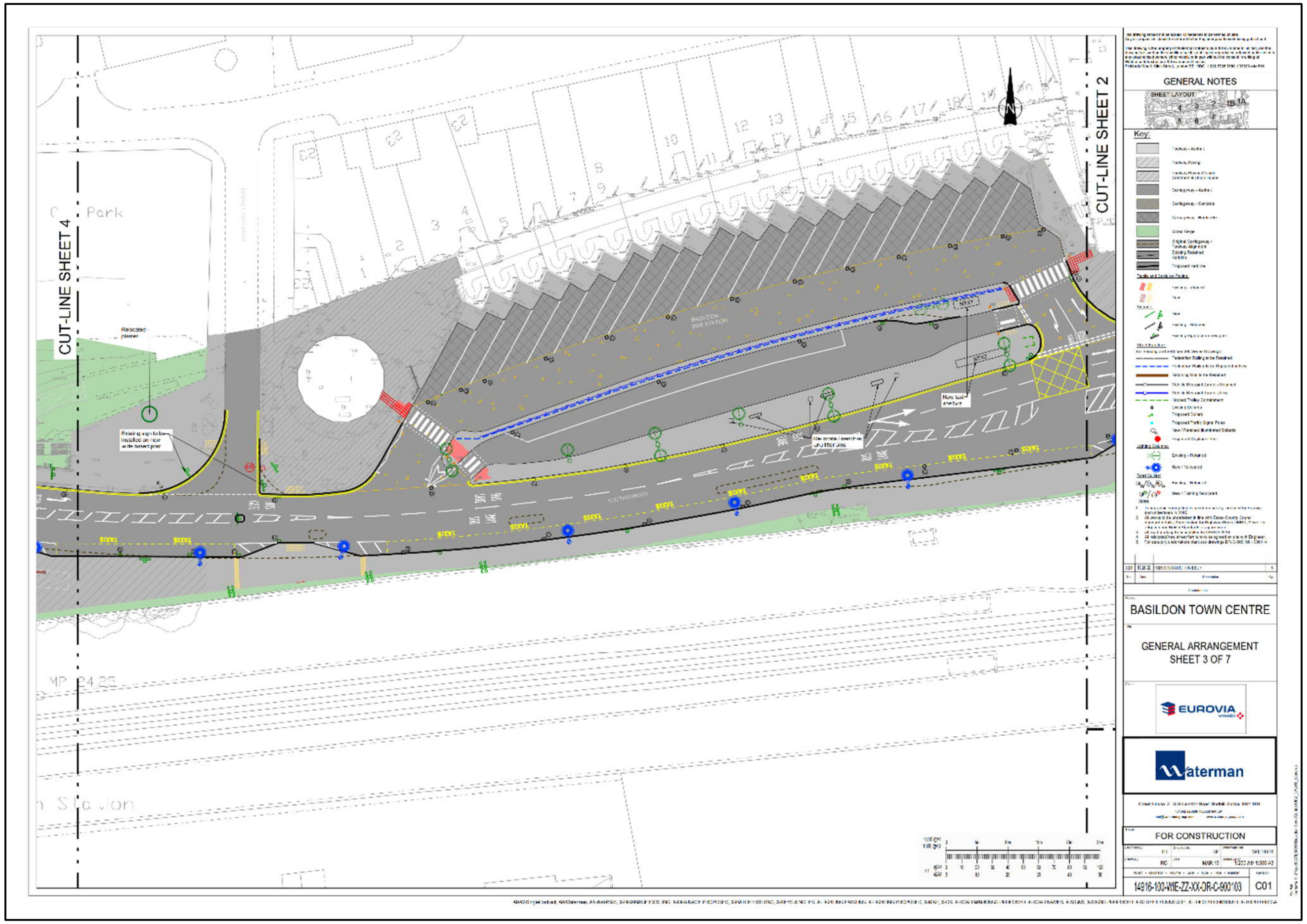
Noting the conclusions above, it is considered, based on the modelling evidence, that there are only two ways to make the removal of Little Oaks viable. These are:

- Introduce some form of capacity improvement at the Broadmayne/ Southernhay/ Ghyllgrove junction.
- Reduce traffic levels across the town centre generally. This would reduce flows across all junctions and may free up enough capacity at the Broadmayne/ Southernhay junction to allow it to accommodate the traffic displaced from Little Oaks

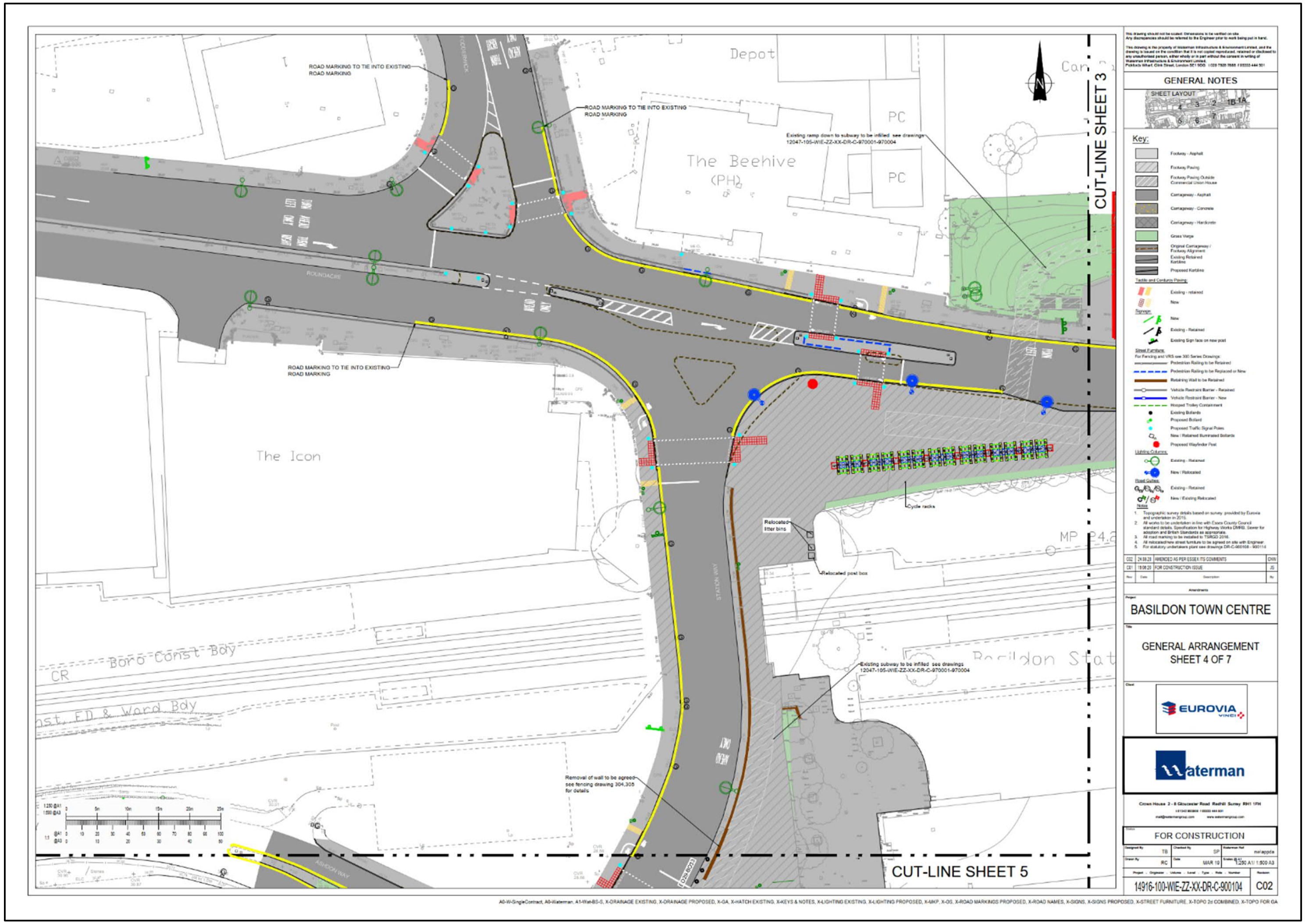
Therefore, if the removal of Little Oaks remains an aspiration, then either (or both) of the above listed measures should be examined in more detail.

Appendix A: Concept drawings for committed transport schemes

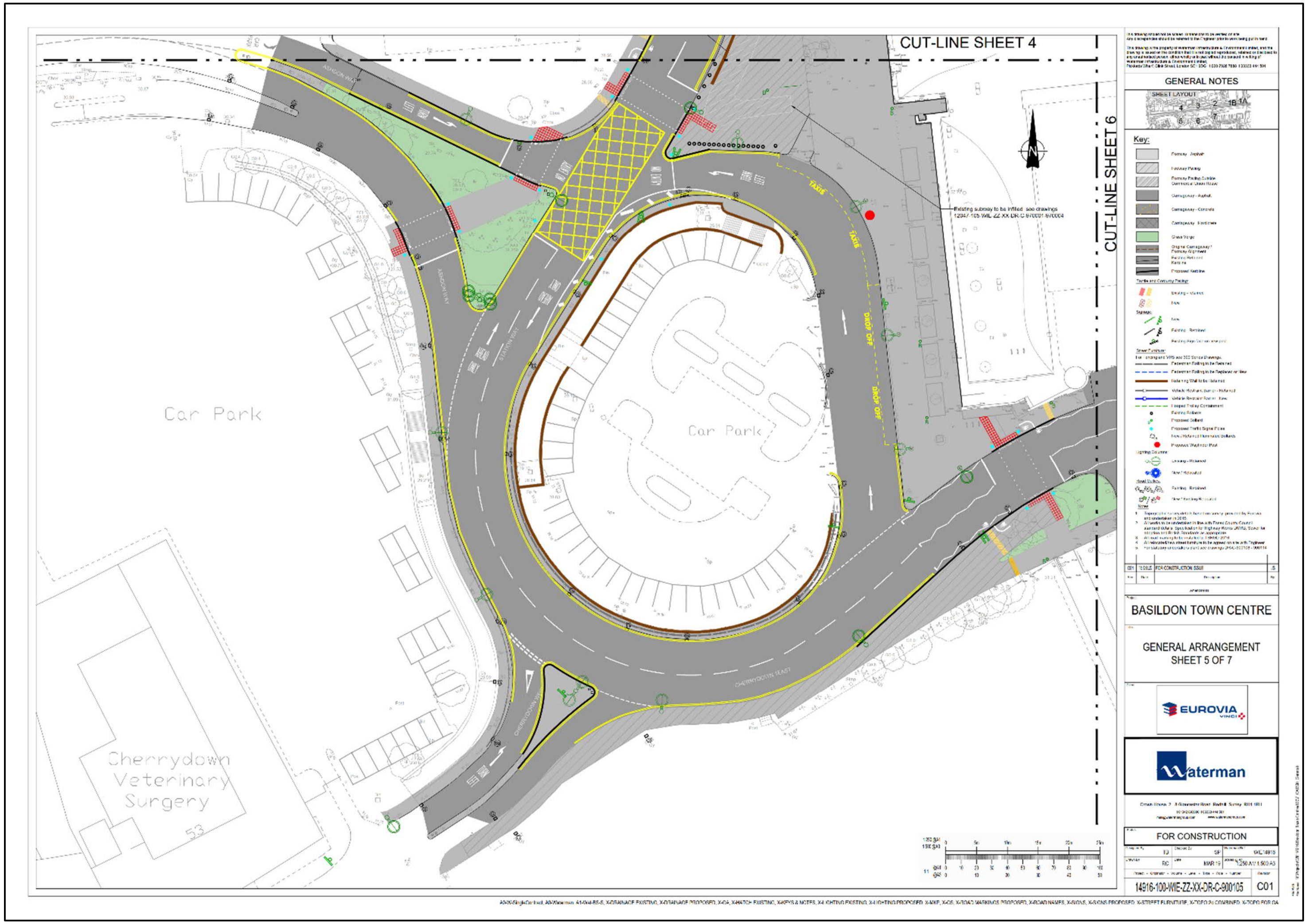
Bus Stop Design



Roundacre/Southernhay/ Station Road Junction Design

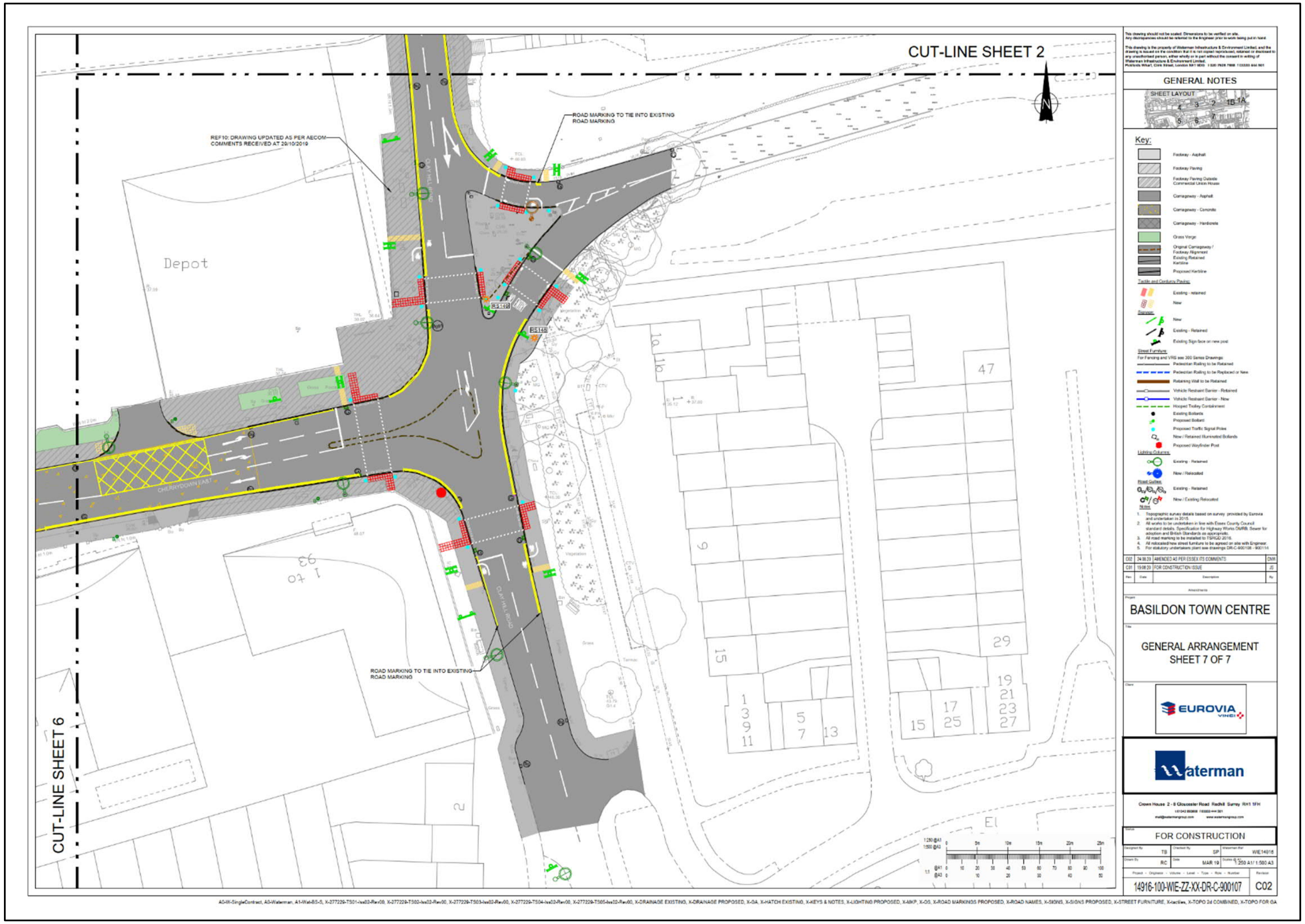


Cherrydown East/ Station Road junction Design

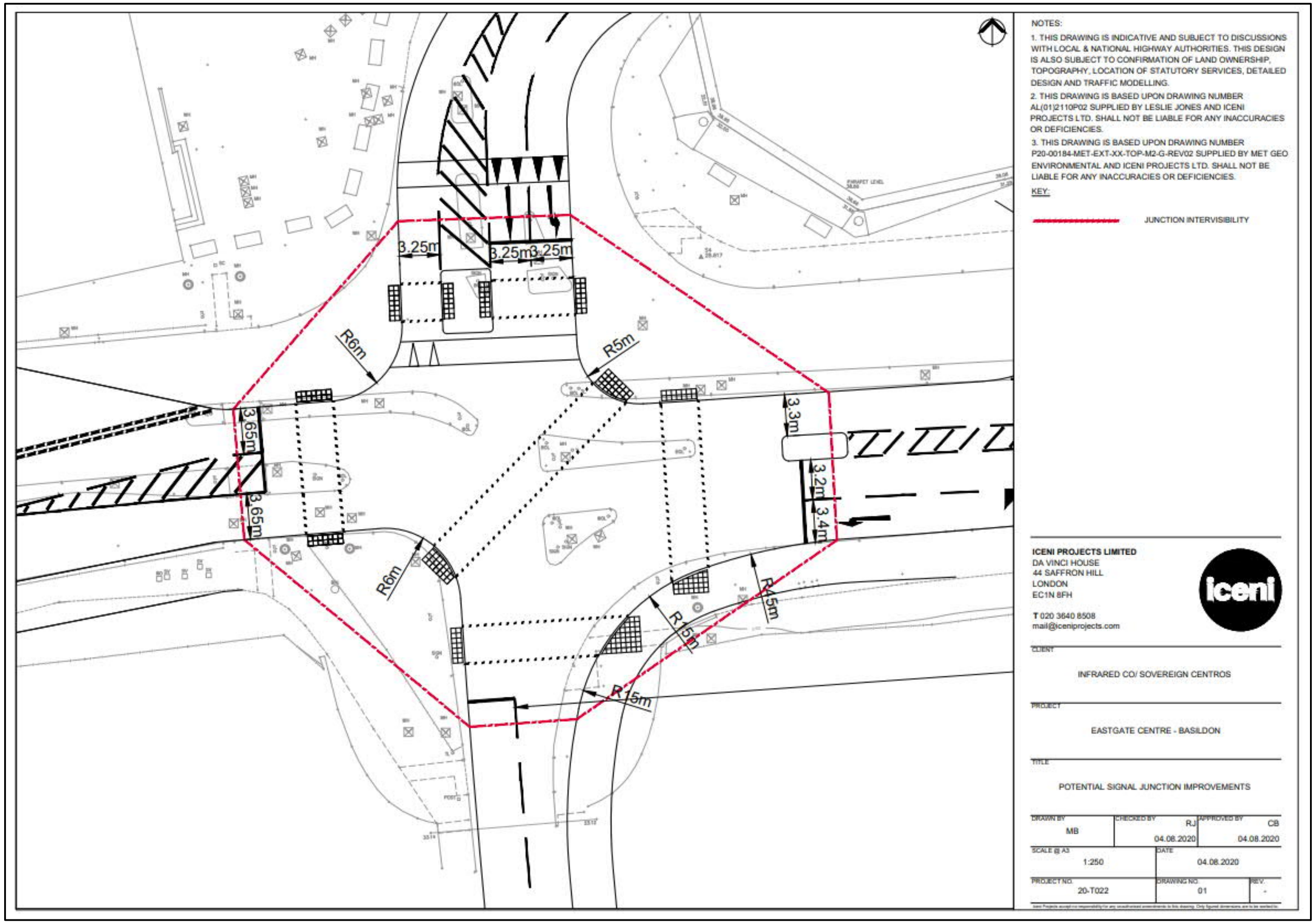


Cherrydown East Road Design

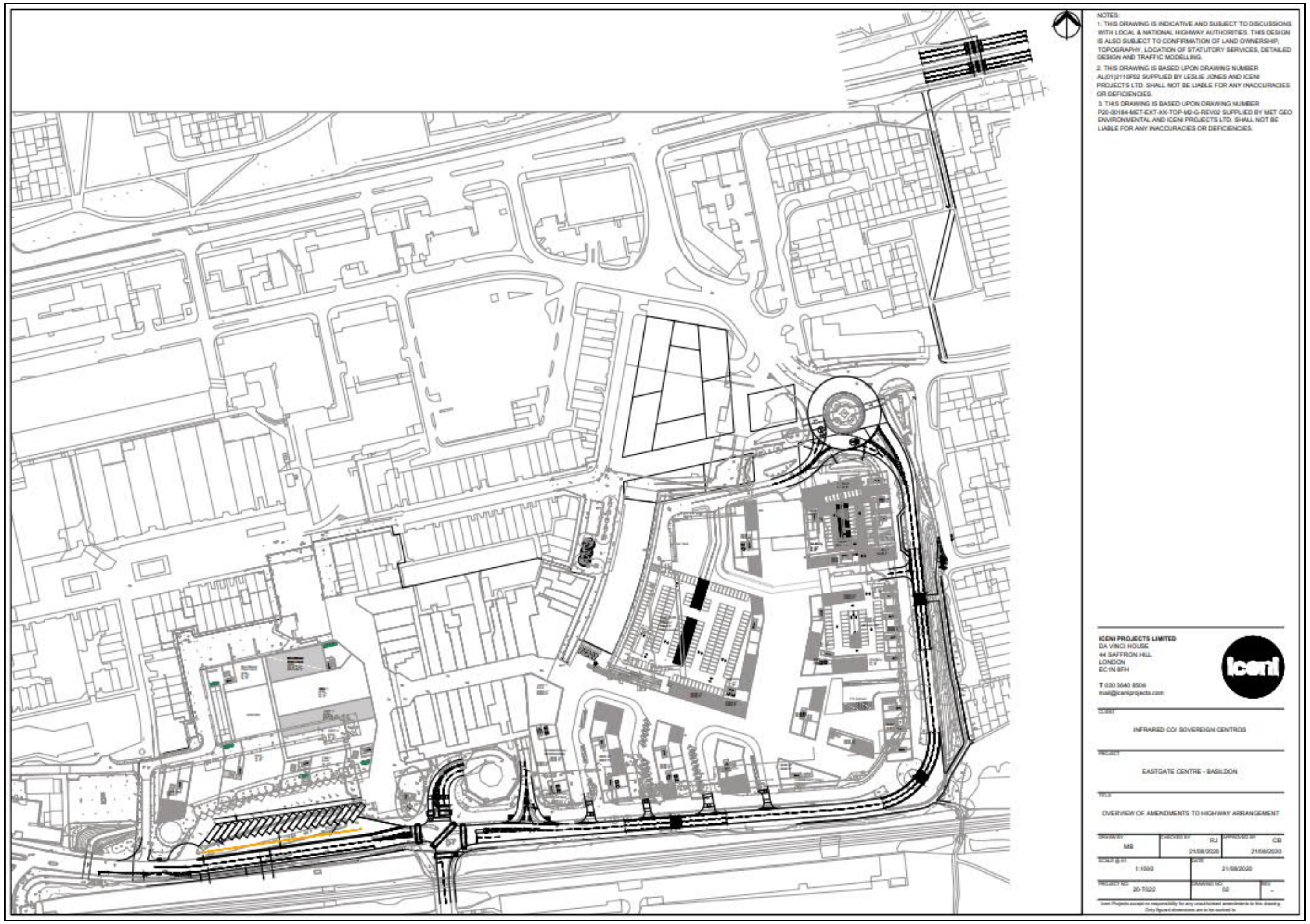
Cherrydown East/ Clay Hill Road Junction Design



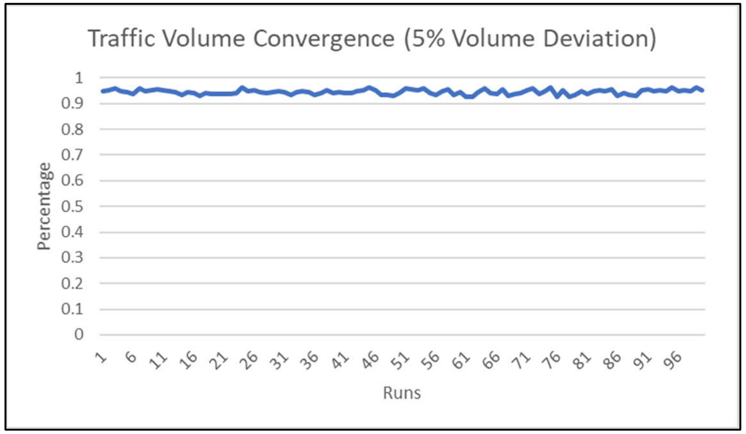
Southernhay/ Clay Hill Road Junction Design

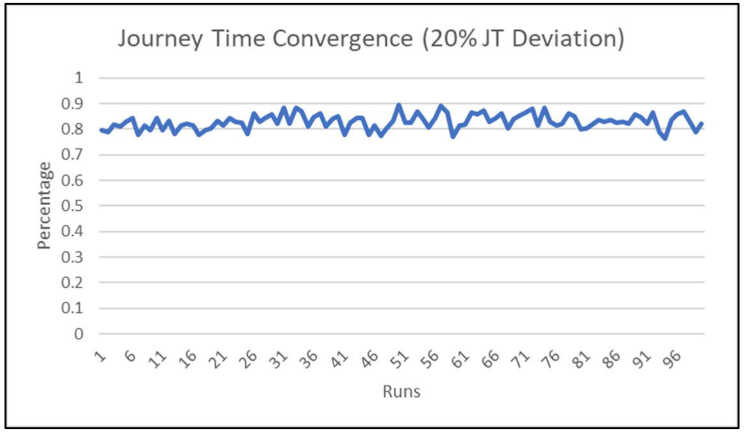


Southernhay Road Design

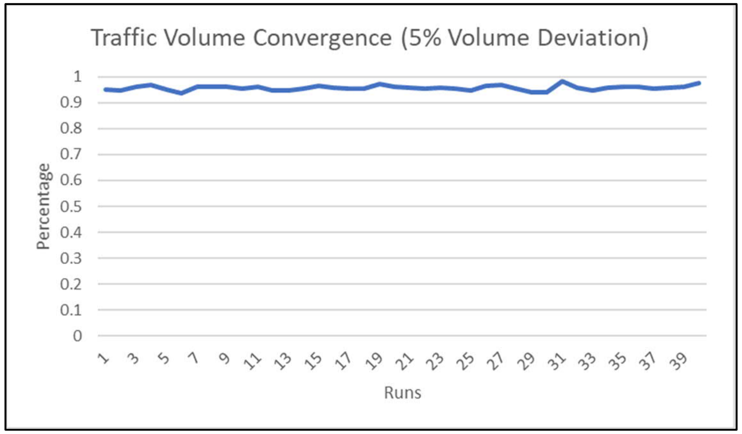


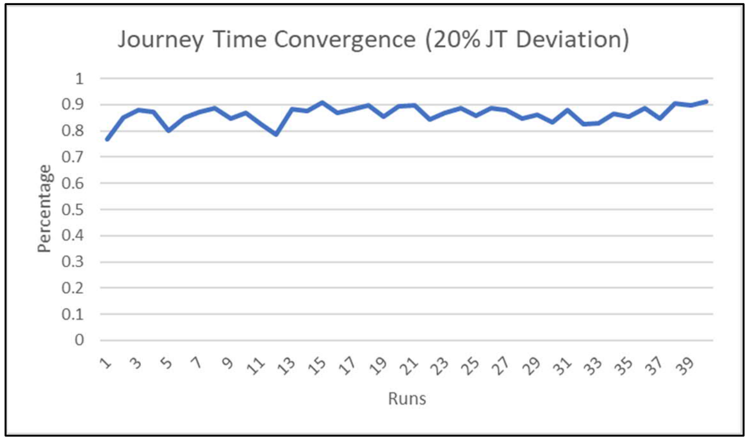
Appendix B: Convergence Graphs





AM 2040 DM0 Model Convergence





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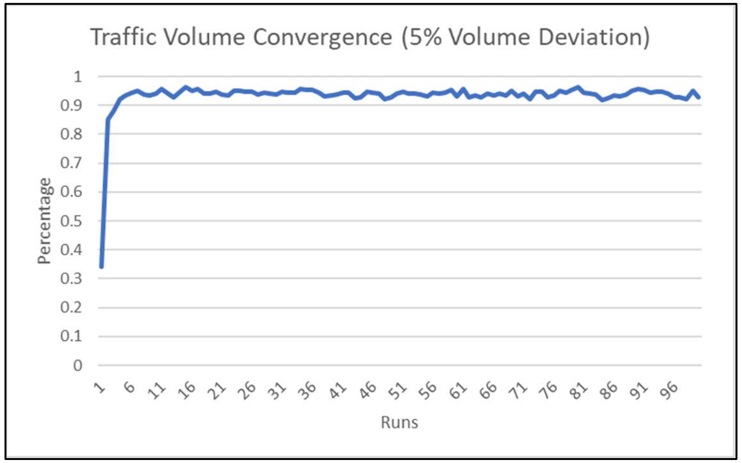

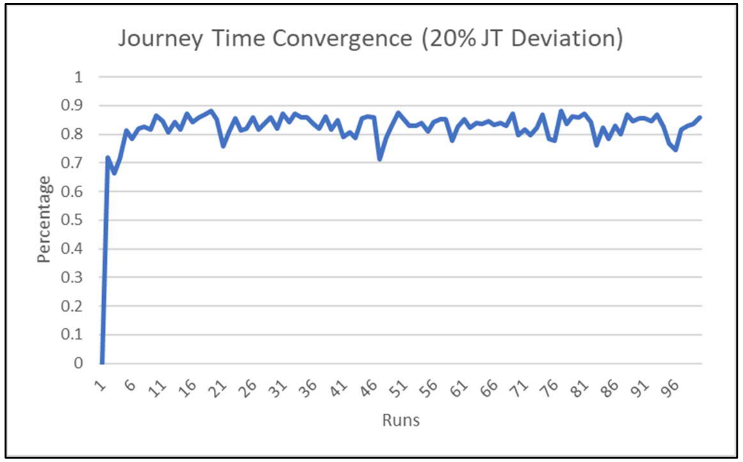

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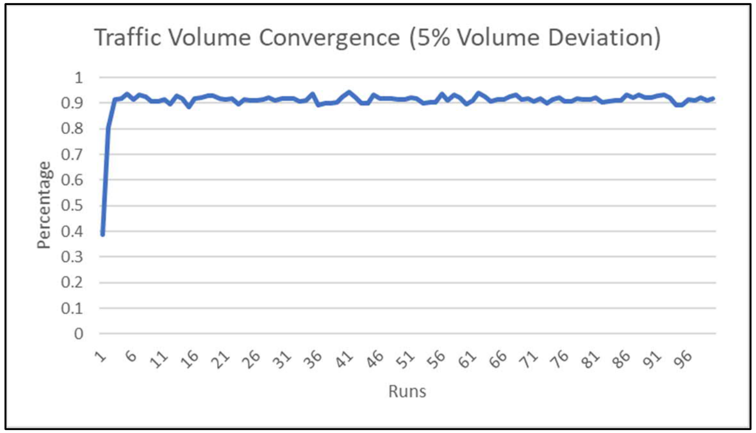

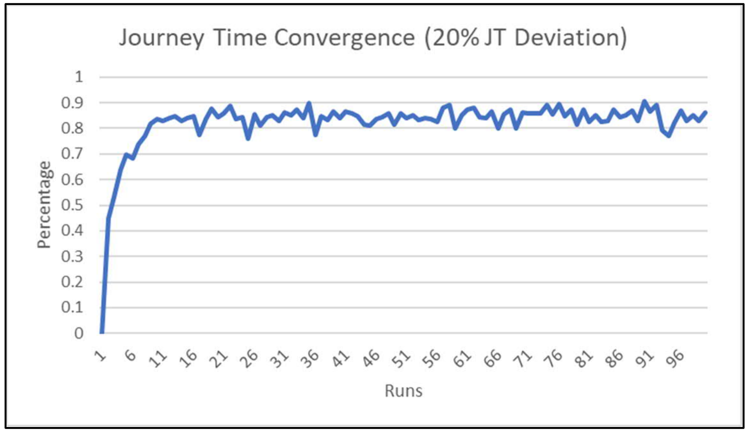

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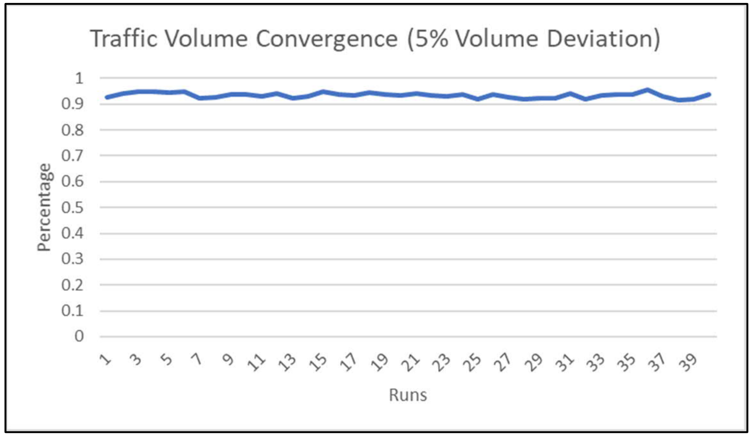

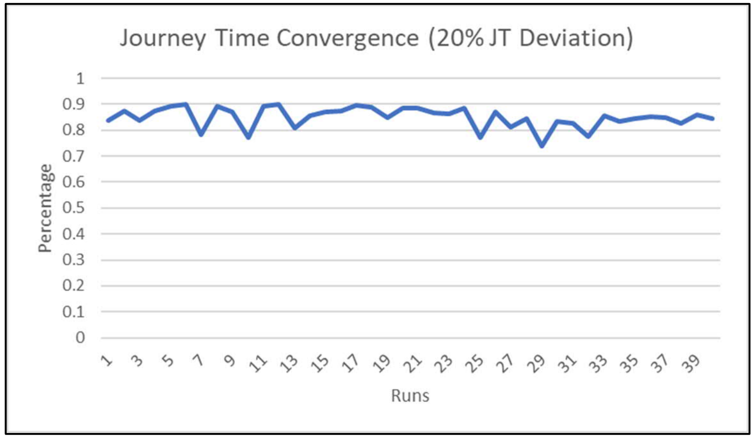

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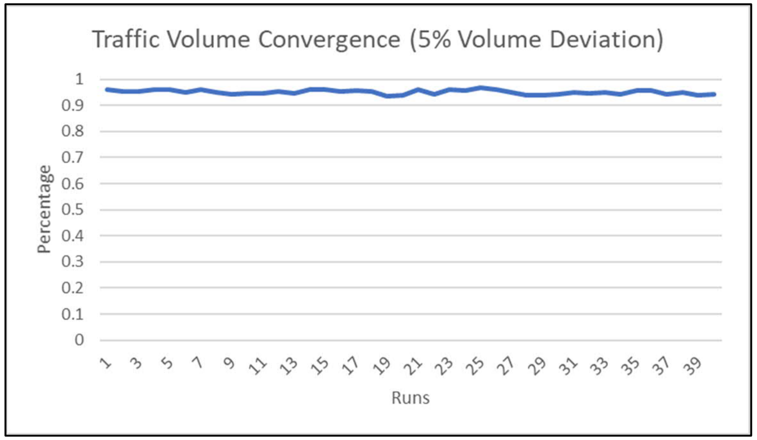

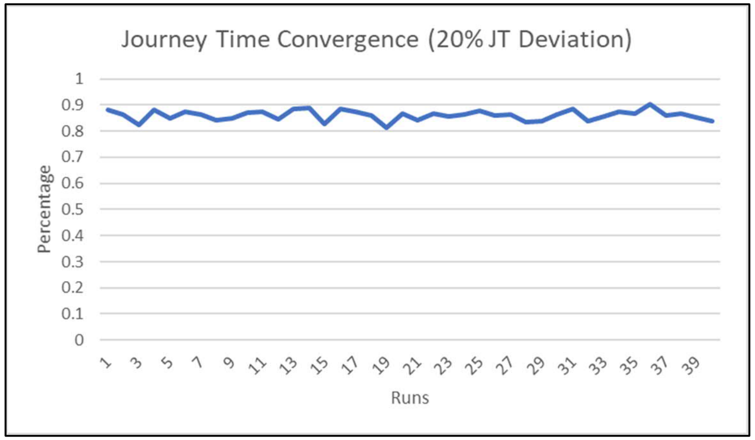

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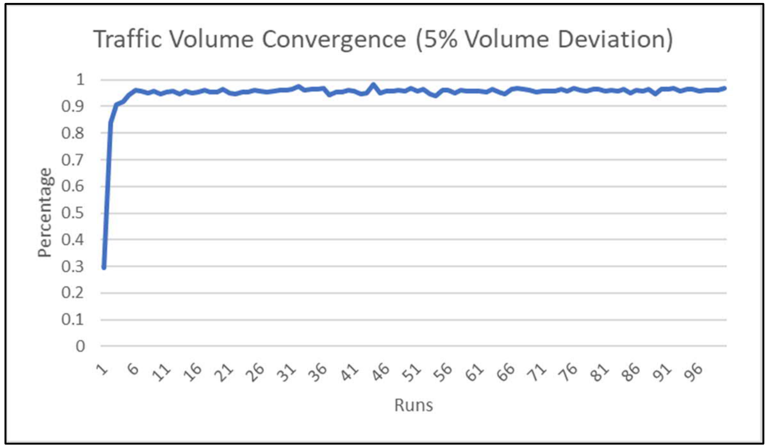

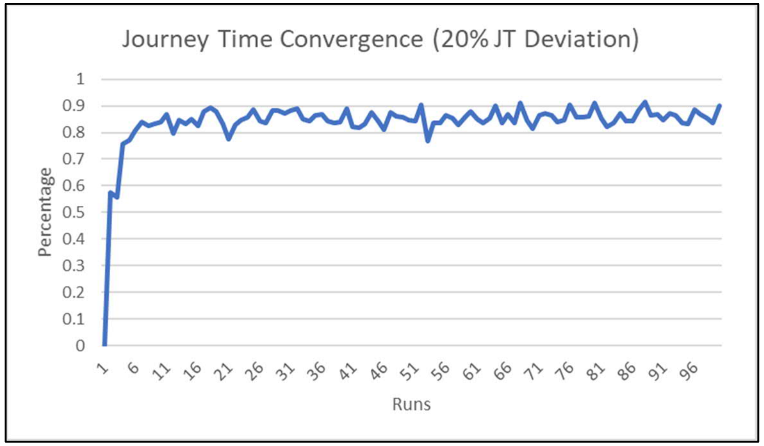

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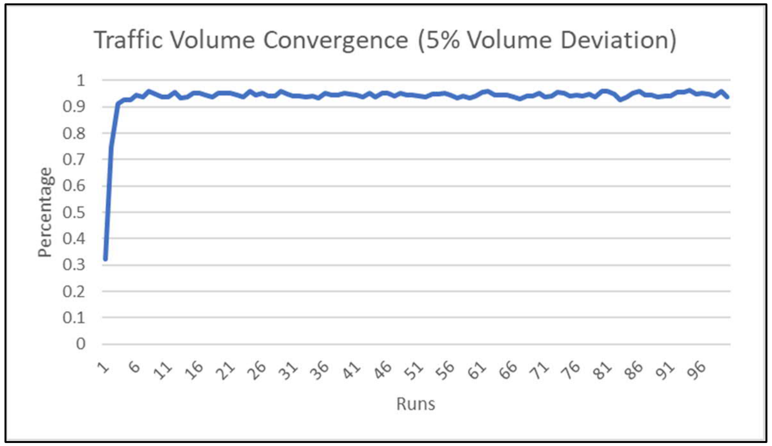

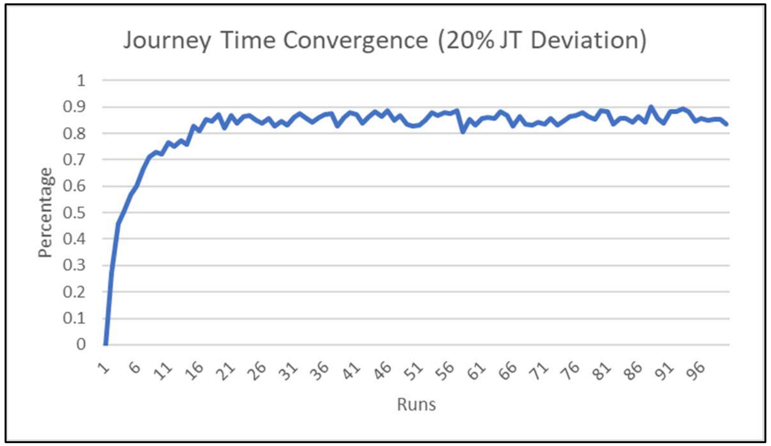

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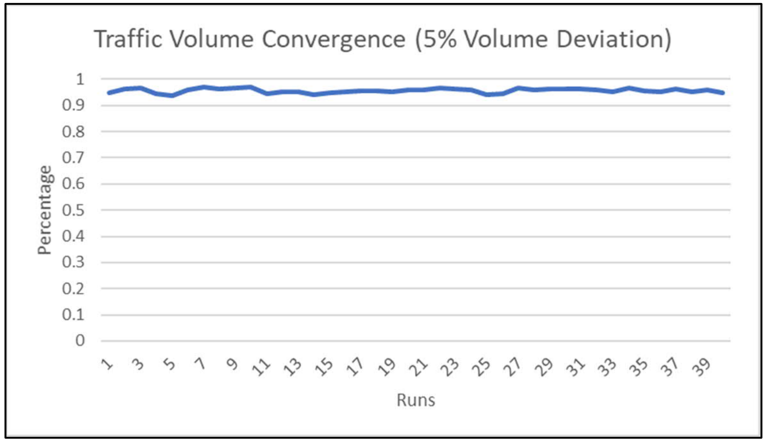
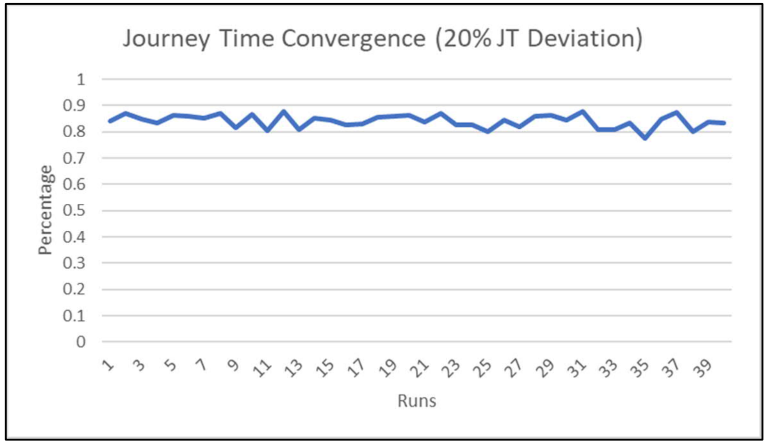
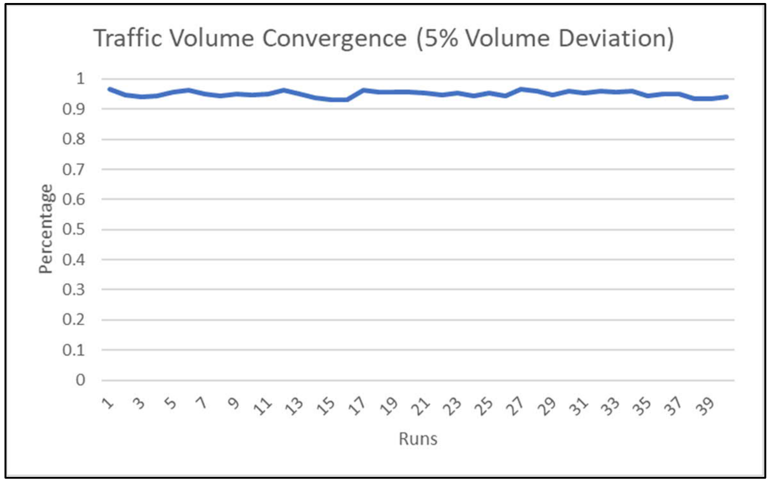
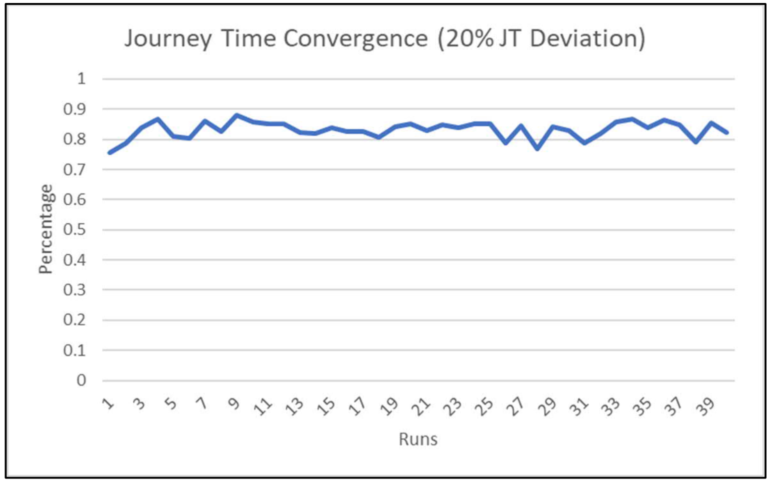




Saturday 2040 DM0 Model Convergence





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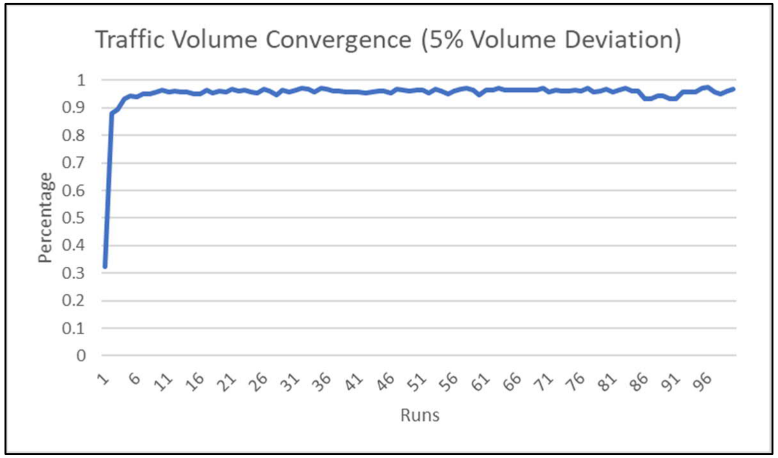

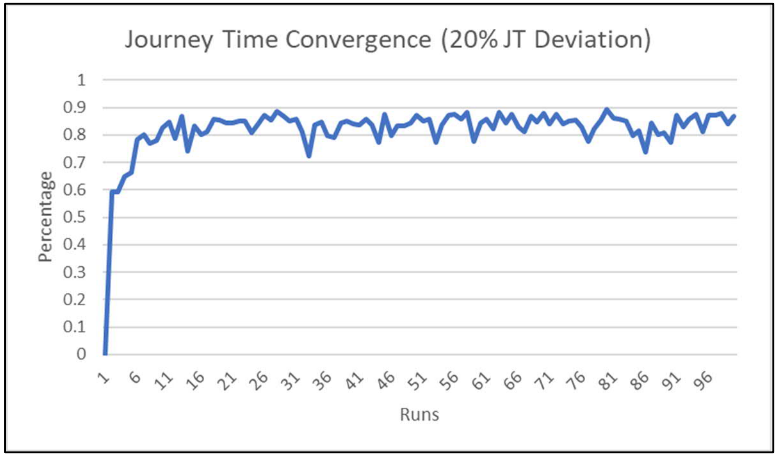

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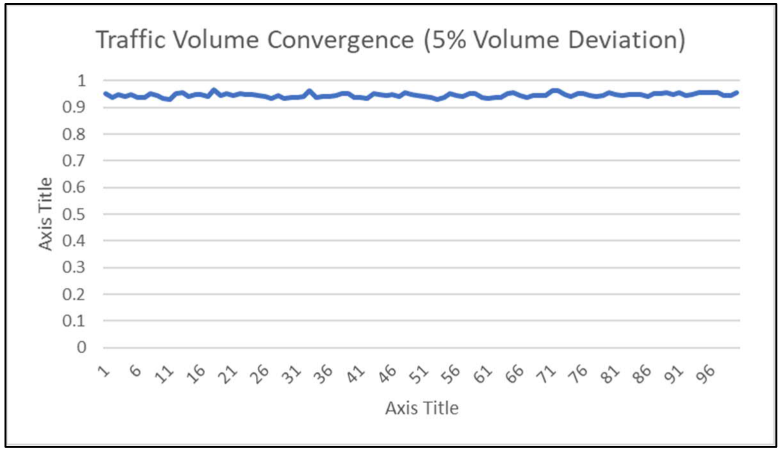
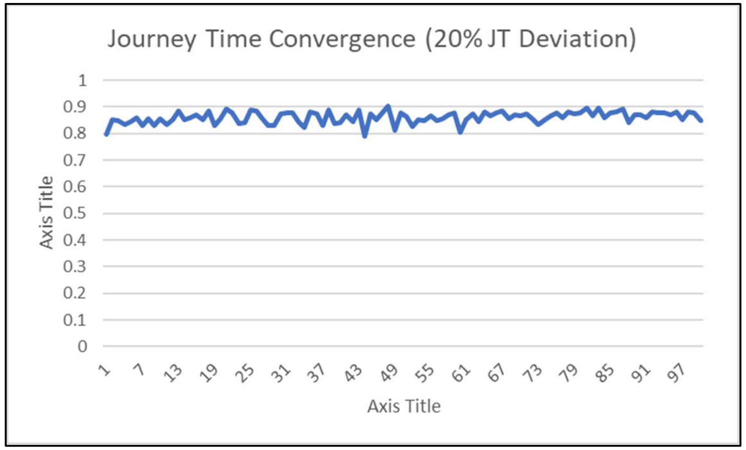
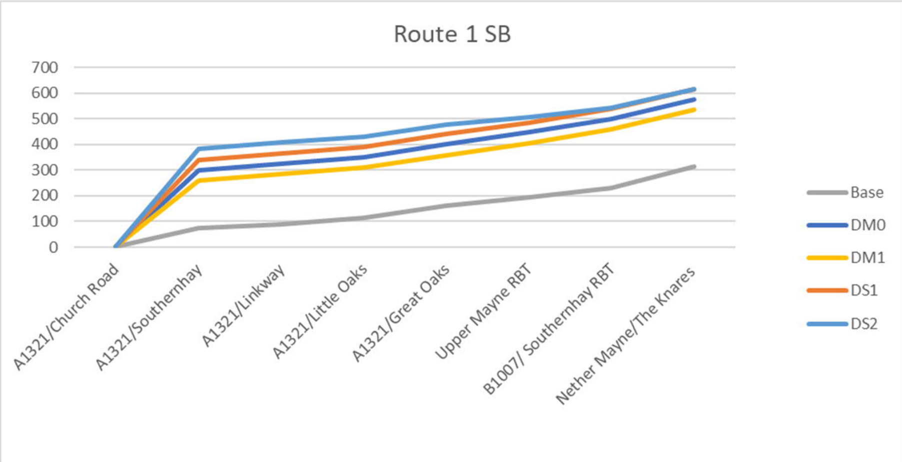


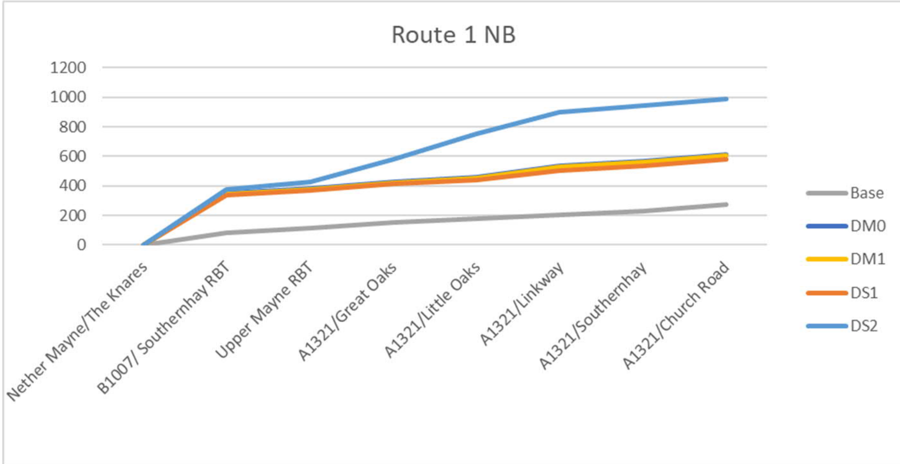


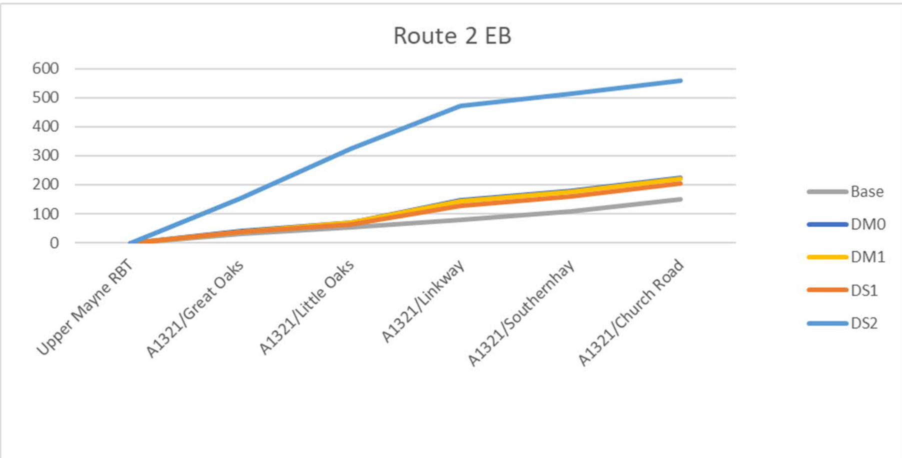
Saturday 2040 DS2 Model Convergence

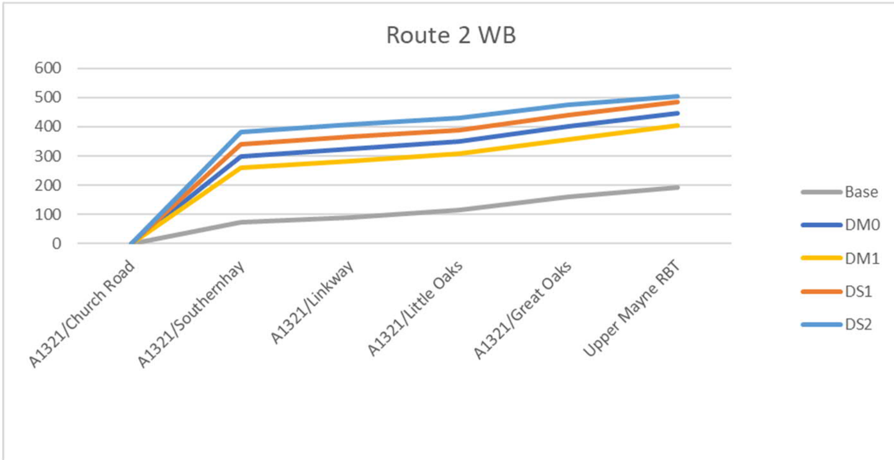
Appendix C: Journey Time Graphs

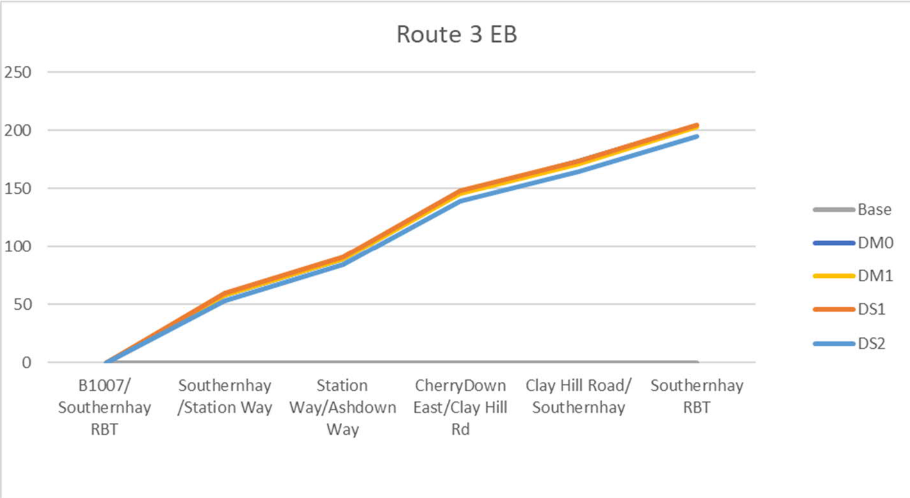
AM Peak



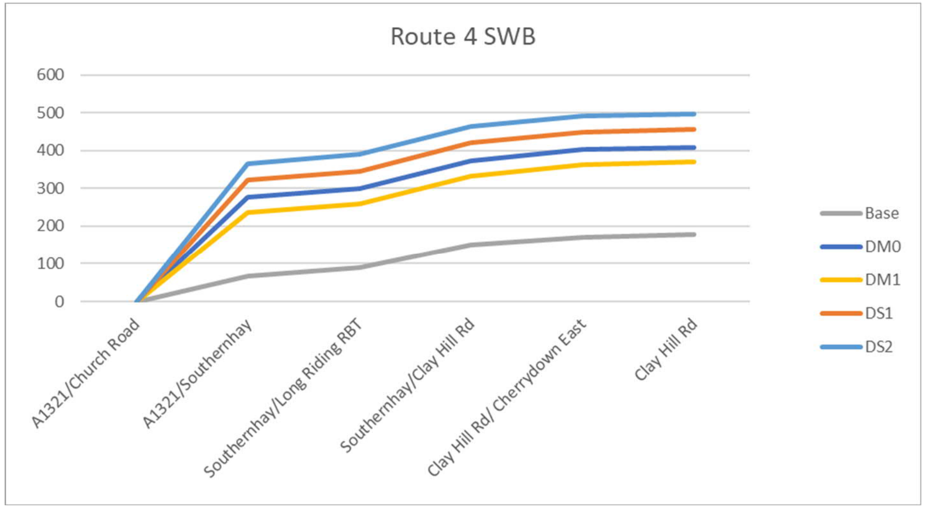







Route 3 EB
250
200
150
100
50
0
B1007/ Southernhay RBT
Southernhay /Station Way
Station Way/Ashdown Way
CherryDown East/Clay Hill Rd
Clay Hill Road/ Southernhay
Southernhay RBT
Base
DM0
DM1
DS1
DS2


Route 3 WB
600
500
400
300
200
100
0
Southernhay RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/Cherrydown East
Station Way/Ashdown Way
Southernhay/Station Way
B1007/ Southernhay RBT
Base
DM0
DM1
DS1
DS2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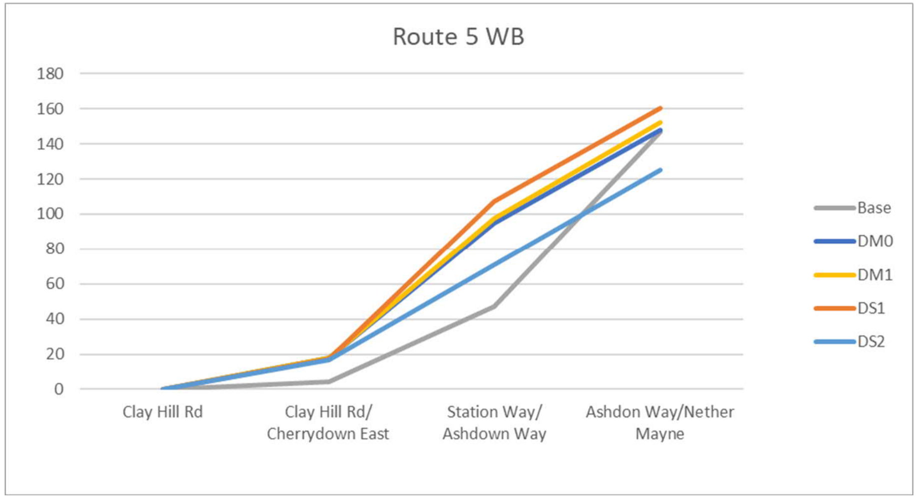
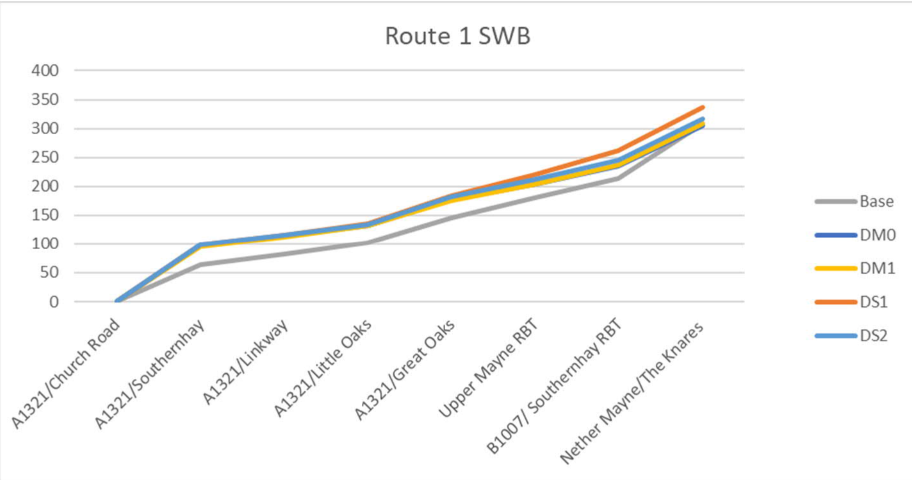
500
400
300
200
100
0
A1321/Church Road
A1321/Southernhay
Southernhay/Long Riding RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Clay Hill Rd
Base
DM0
DM1
DS1
DS2


Route 5 WB
180
160
140
120
100
80
60
40
20
0
Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Station Way/ Ashdown Way
Ashdon Way/Nether Mayne
Base
DM0
DM1
DS1
DS2


Route 6 WB
100
90
80
70
60
50
40
30
20
10
0
Great Oaks
Great Oaks to Great Oaks/Broadmayne
Base
DM0
DM1
DS1
DS2

PM Peak


Route 1 SWB
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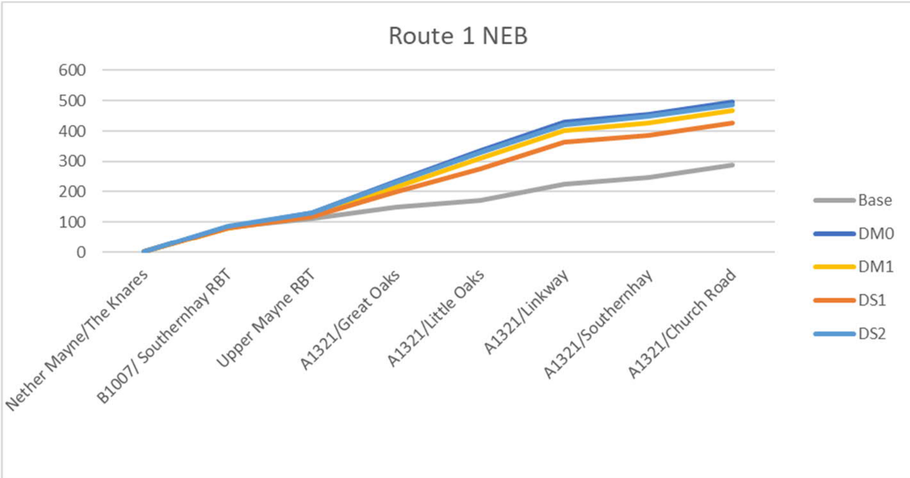
300
250
200
150
100
50
0
A1321/Church Road
A1321/Southernhay
A1321/Linkway
A1321/Little Oaks
A1321/Great Oaks
Upper Mayne RBT
B1007/ Southernhay RBT
Nether Mayne/The Knares
Base
DM0
DM1
DS1
DS2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100
0
Nether Mayne/The Knares
B1007/ Southernhay RBT
Upper Mayne RBT
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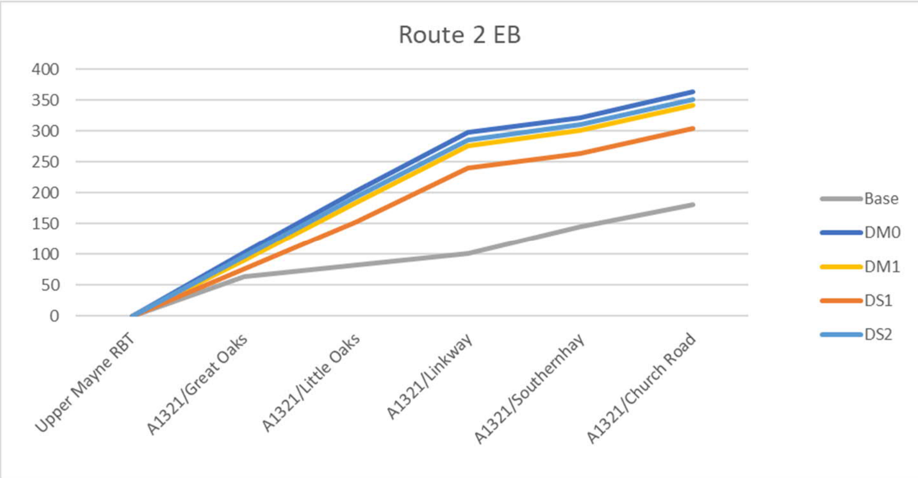
DM0
DM1
DS1
DS2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300
250
200
150
100
50
0
Upper Mayne RBT
A1321/Great Oaks
A1321/Little Oaks
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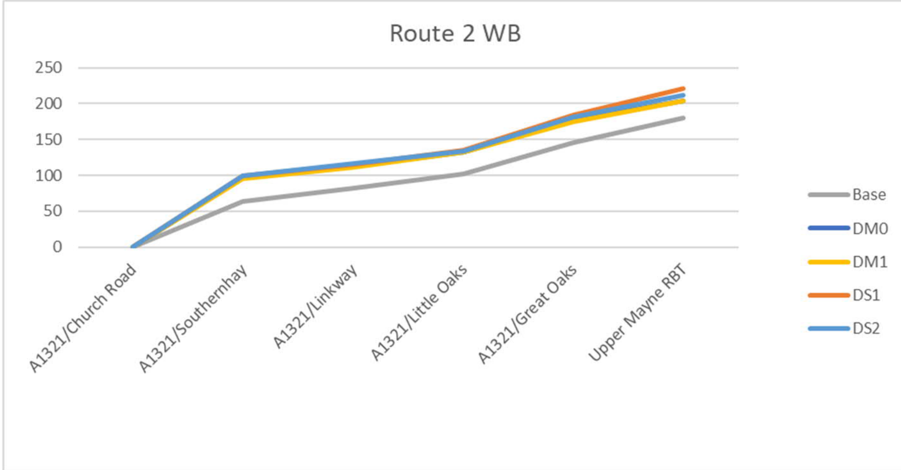
A1321/Southernhay
A1321/Church Road
Base
DM0
DM1
DS1
DS2


Route 2 WB
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200
150
100
50
0
A1321/Church Road
A1321/Southernhay
A1321/Linkway
A1321/Little Oaks
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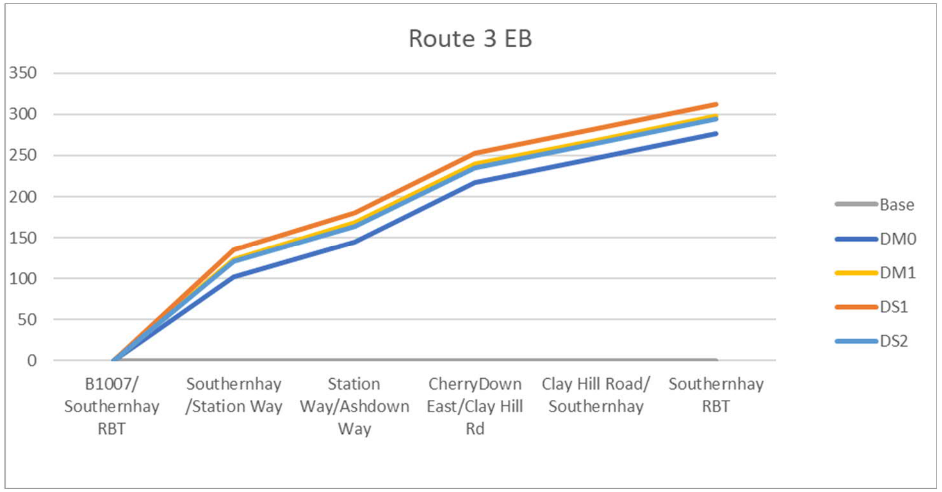
DM0
DM1
DS1
DS2


Route 3 EB
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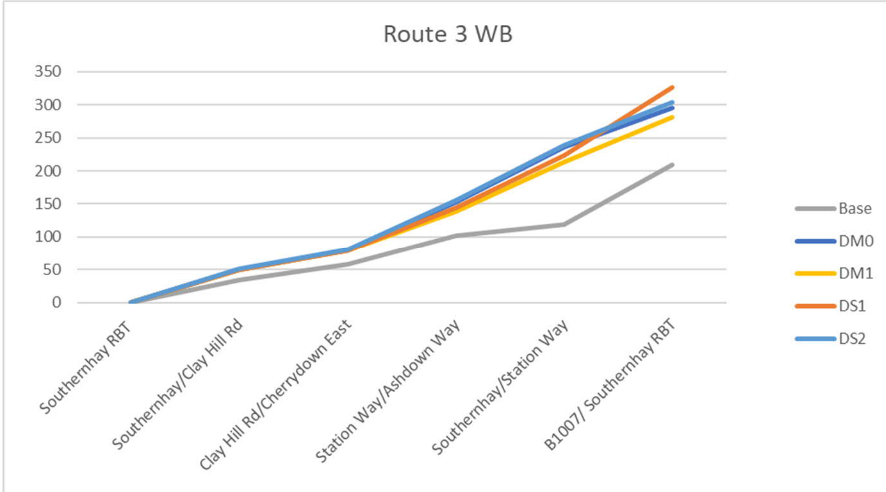
300
250
200
150
100
50
0
B1007/ Southernhay RBT
Southernhay /Station Way
Station Way/Ashdown Way
CherryDown East/Clay Hill Rd
Clay Hill Road/ Southernhay
Southernhay RBT
Base
DM0
DM1
DS1
DS2


Route 3 WB
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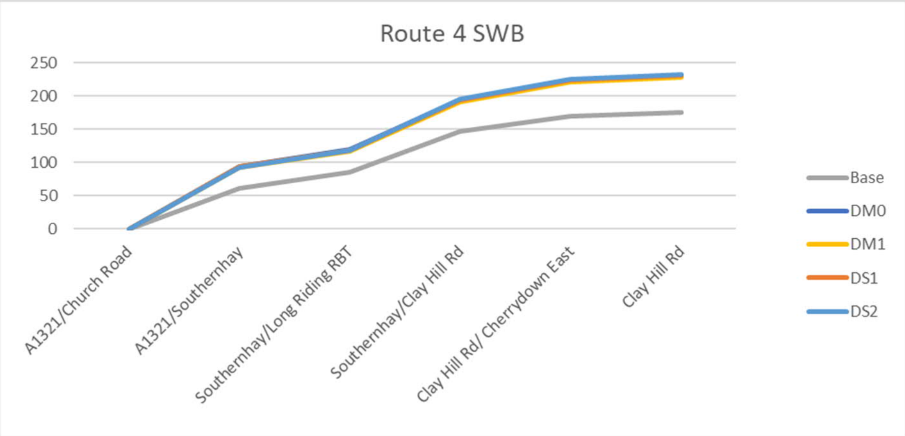
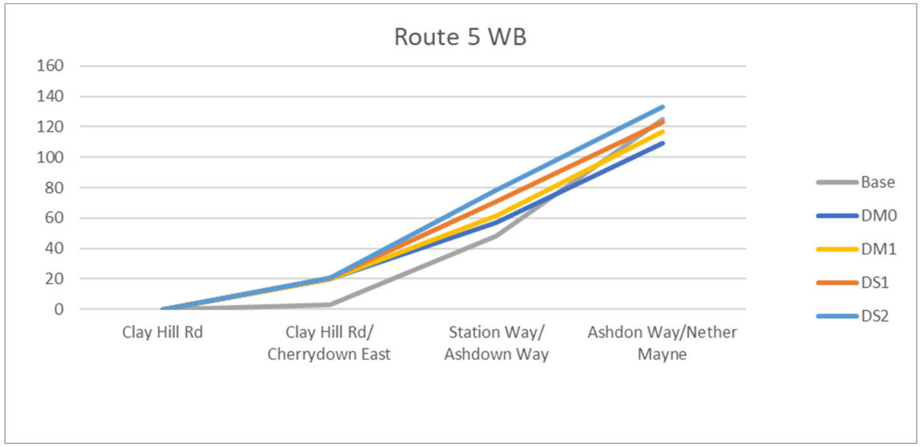
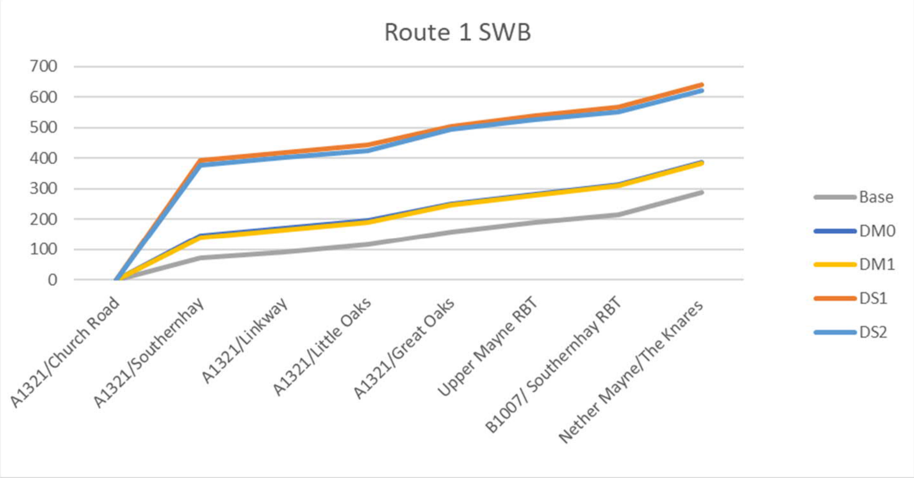
300
250
200
150
100
50
0
Southernhay RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/Cherrydown East
Station Way/Ashdown Way
Southernhay/Station Way
B1007/ Southernhay RBT
Base
DM0
DM1
DS1
DS2

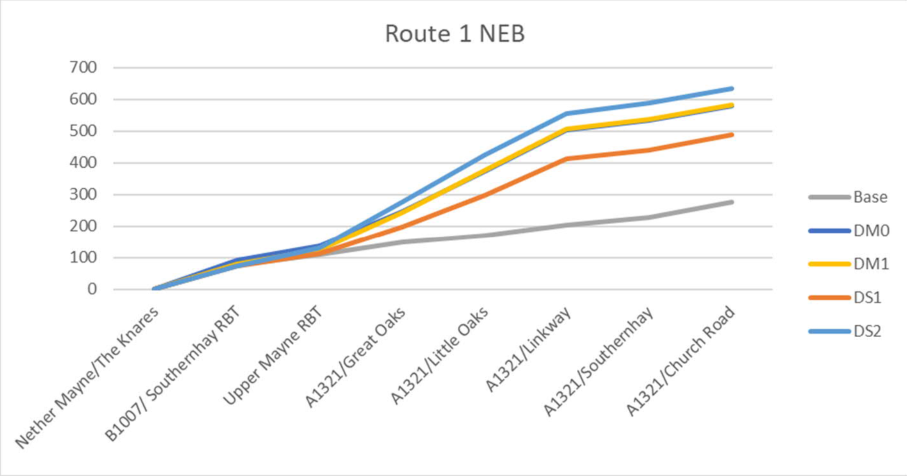

Route 4 SWB
250
200
150
100
50
0
A1321/Church Road
A1321/Southernhay
Southernhay/Long Riding RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Clay Hill Rd
Base
DM0
DM1
DS1
DS2

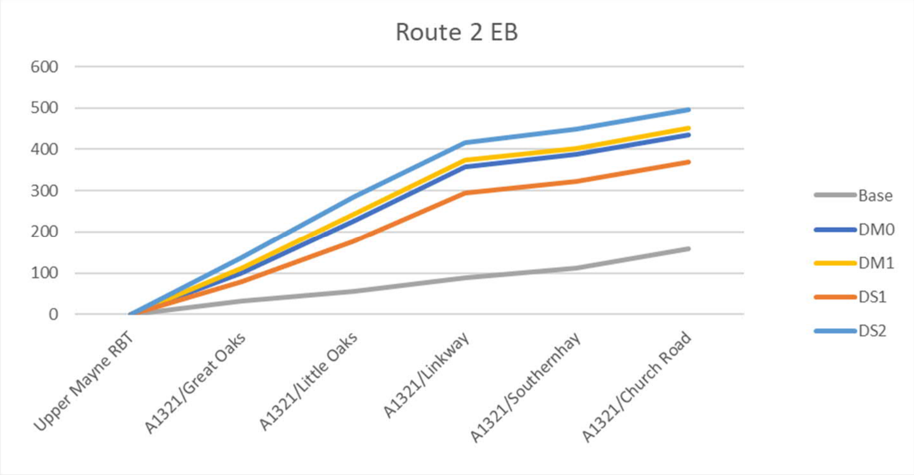

Route 5 WB
160
140
120
100
80
60
40
20
0
Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Station Way/ Ashdown Way
Ashdon Way/Nether Mayne
Base
DM0
DM1
DS1
DS2

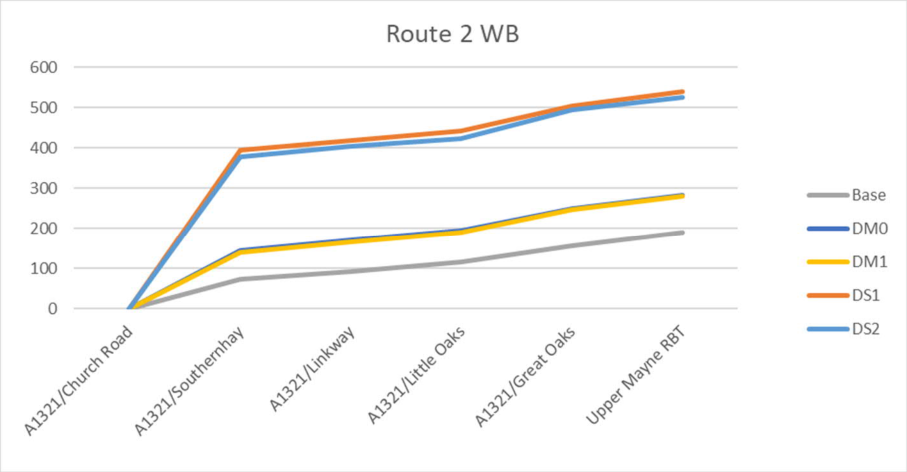

Route 6 WB
100
90
80
70
60
50
40
30
20
10
0
Great Oaks
Great Oaks to Great Oaks/Broadmayne
Base
DM0
DM1
DS1
DS2

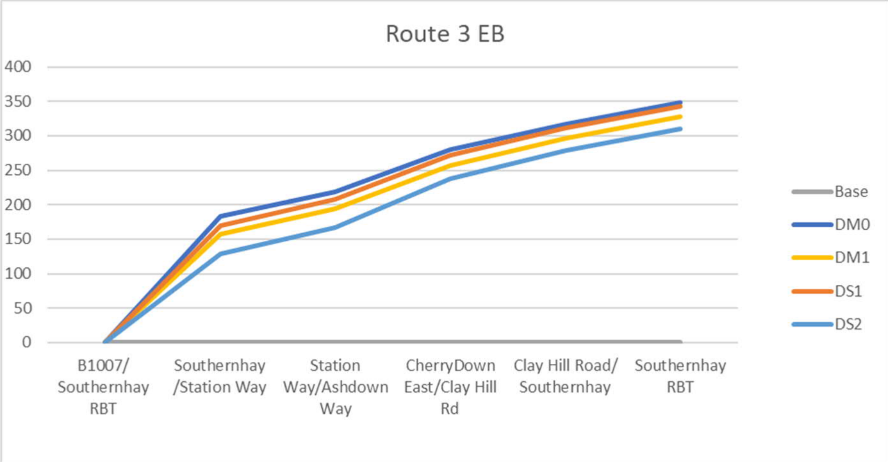
Saturday Peak

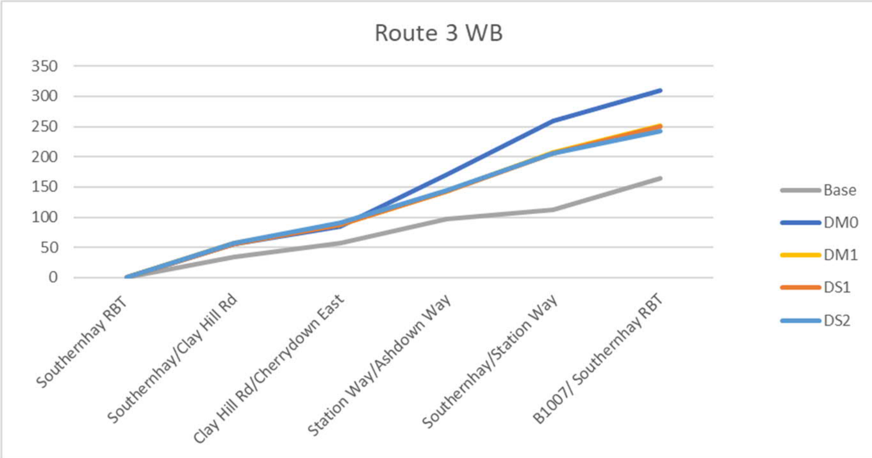


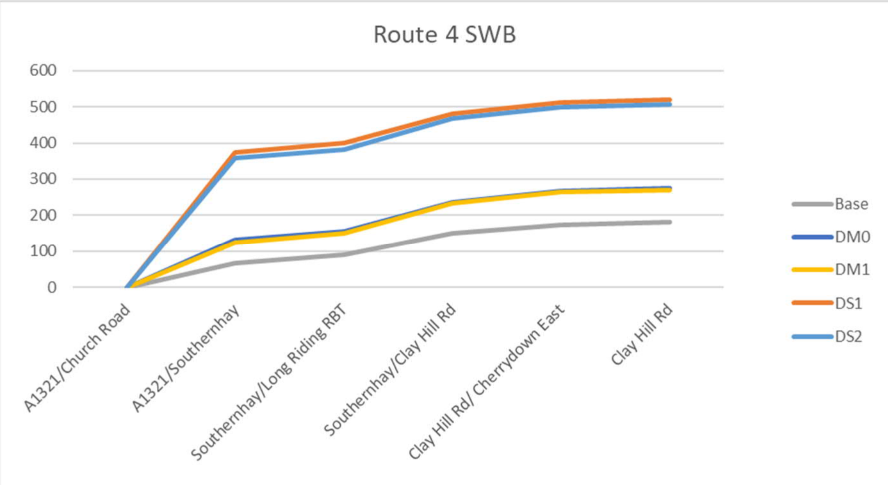


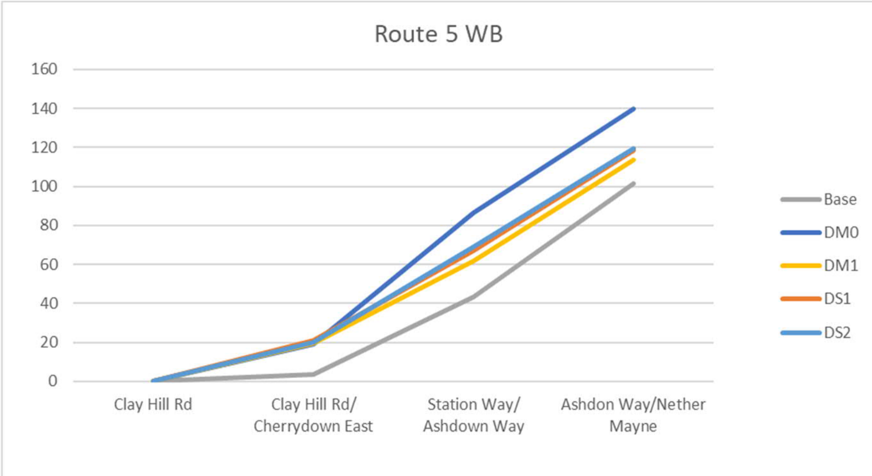


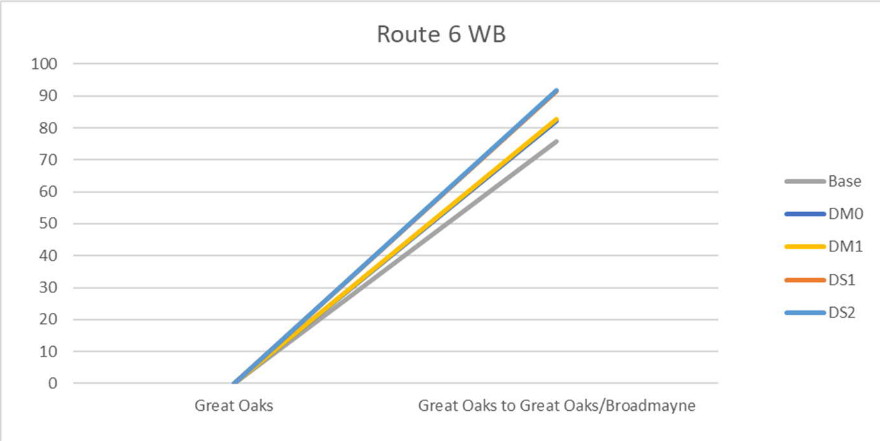



Route 3 EB
400
350
300
250
200
150
100
50
0
B1007/ Southernhay RBT
Southernhay /Station Way
Station Way/Ashdown Way
CherryDown East/Clay Hill Rd
Clay Hill Road/ Southernhay
Southernhay RBT
Base
DM0
DM1
DS1
DS2


Route 3 WB
350
300
250
200
150
100
50
0
Southernhay RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/Cherrydown East
Station Way/Ashdown Way
Southernhay/Station Way
B1007/ Southernhay RBT
Base
DM0
DM1
DS1
DS2


Route 4 SWB
600
500
400
300
200
100
0
A1321/Church Road
A1321/Southernhay
Southernhay/Long Riding RBT
Southernhay/Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Clay Hill Rd
Base
DM0
DM1
DS1
DS2


Route 5 WB
160
140
120
100
80
60
40
20
0
Clay Hill Rd
Clay Hill Rd/ Cherrydown East
Station Way/ Ashdown Way
Ashdon Way/Nether Mayne
Base
DM0
DM1
DS1
DS2


Route 6 WB
100
90
80
70
60
50
40
30
20
10
0
Great Oaks
Great Oaks to Great Oaks/Broadmayne
Base
DM0
DM1
DS1
DS2