

AtkinsRéalis



# Local Plan Modelling Outputs Report

Bristol City Council

July 2024

# BRISTOL CITY COUNCIL – LOCAL PLAN TESTING



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# Executive Summary

AtkinsRéalis has been commissioned by Bristol City Council (BCC) to support the transport evidence base for the development of their New Local Plan<sup>1</sup>. The scope of work includes using the West of England Regional Transport Model (WERTM) to forecast the impact on the transport network of BCC's local plan development in 2042.

The DfT National Trip End Model (NTEM8.0) has been used to project housing, population, employment, car ownership and trip rates from 2019 to 2042 and hence used to forecast travel demand in the region.

<b>Bristol (only)</b>	<b>2019 Base</b>	<b>2042 NTEM8.0 (Do Minimum)</b>	<b>2042 Local Plan</b>
Dwellings	193,967 <sup>1</sup>	223,369 <sup>1</sup> (~1,300 per annum)	227,817 (+4,448 <sup>2</sup> , 1.9%) (~1,500 houses per annum)
Jobs	273,319 <sup>1</sup>	296,307 <sup>1</sup>	302,362 (+6,055 <sup>2</sup> , +2.0%)
Total Trips (All Modes, 24hr PA)	941,767 <sup>3</sup>	1,044,349 <sup>3</sup>	1,061,109 <sup>3</sup> (+3.9% vs DM)

1. NTEM8.0 considers local plans to forecast dwelling (using National Planning Policy Framework and assumptions on housing supply).
2. BCC Local Plan
3. WERTM

These growth assumptions are then input into the model which then calculates the changes in trips across various purposes and calculates mode shares which are then placed into the Highway Assignment model and Public Transport Assignment Models which provide us with the outputs as noted in the report.

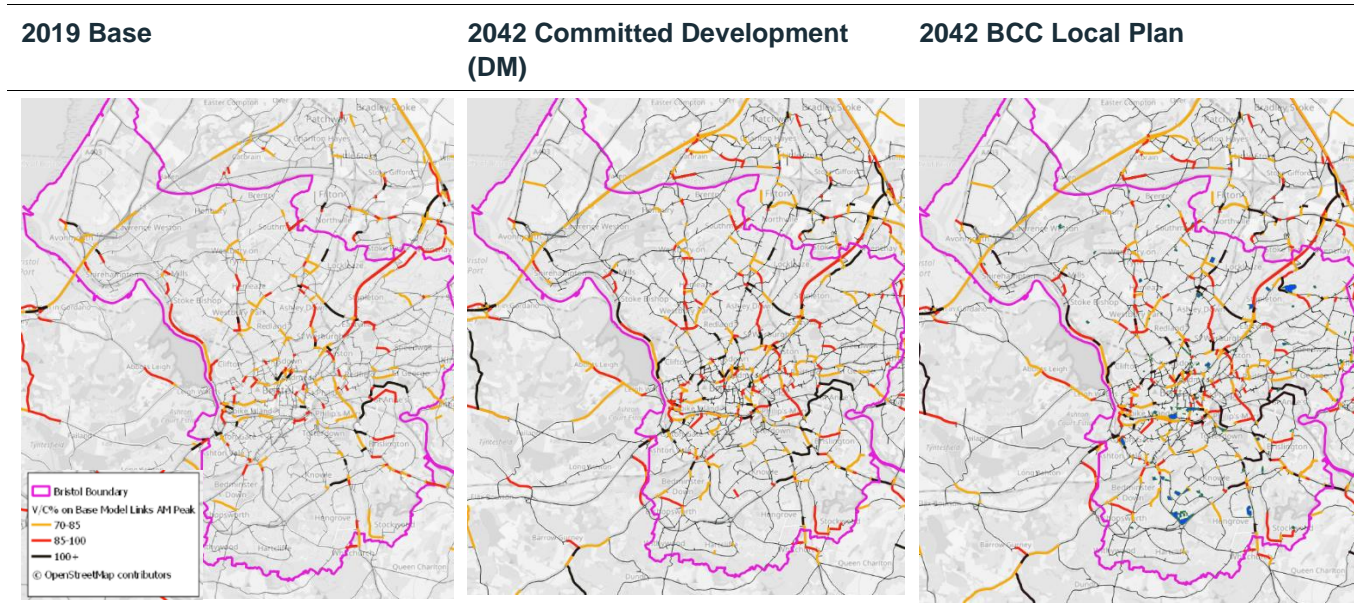
We recognise that this does not fully align with the Strategic Housing Land Availability Assessment (SHLAA)<sup>2</sup> that is outlined below, however the NTEM data source is a standard source that takes into account background growth and there is often a disconnect between the growth set out within it and local development policies/aspirations.

WERTM projects that the location and intensification of additional development (beyond the NTEM8.0 Core Do Minimum travel forecasts) will not lead to a proportionate increase in highway trips. This is due to several factors. By 2042, congestion levels, parking charges, and network capacity constraints resulting from existing and committed developments, along with the density of the Local Plan (LP) development, are expected to drive a greater increase in sustainable travel modes—particularly active travel. The model's capacity constraint projections (volume/capacity %) reveal the broadening and intensification of congested links. In other words, the network was constrained in 2019 and is projected to become more operationally stressed by 2042, regardless of the additional Local Plan development.

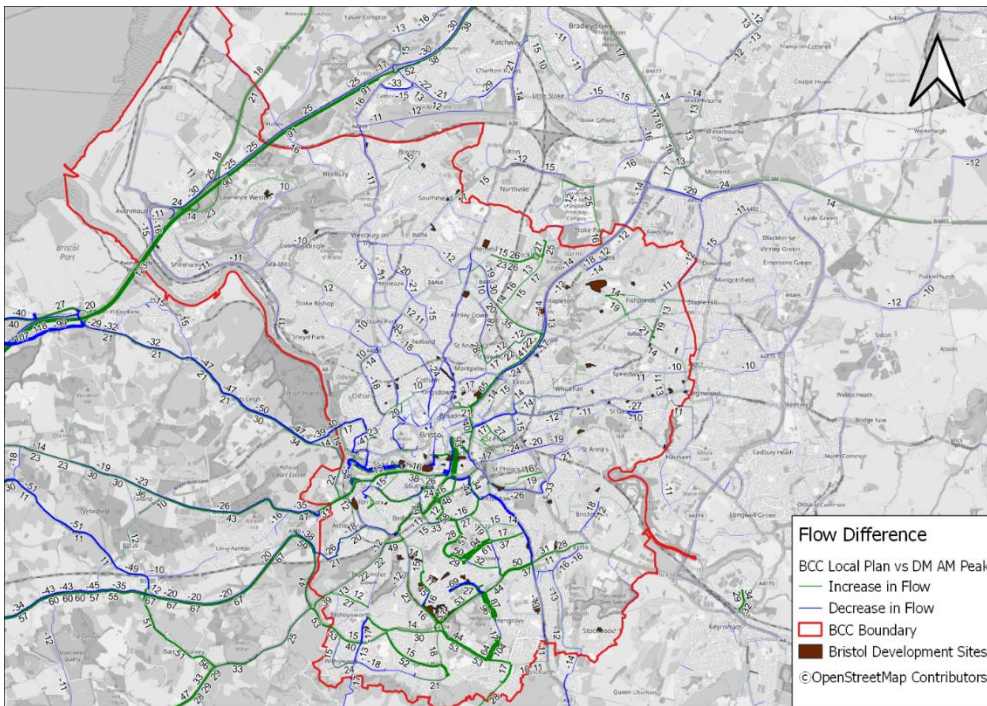
<sup>1</sup> <https://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/local-plan/local-plan-review>

<sup>2</sup> <https://www.bristol.gov.uk/files/documents/7636-eveh01-strategic-housing-land-availability-assessment-april-2024/file>

## Impact on capacity



## Traffic flow change (Local Plan vs Do-Minimum)



## WERTM Limitations

The primary message from this modelling exercise is that adding additional housing and jobs (associated with the local plan) does not lead to a proportionate increase in highway trips across the network; the majority of the extra trips are made using sustainable modes of transportation. While this is a positive finding in terms of policy aspirations, it's important to recognize the limitations of WERTM as a strategic tool. AtkinsRealis advises caution in assuming that additional development growth can be seamlessly accommodated without resulting in highway impacts. Thorough detailed checks and suitable mitigation measures are necessary to promote more sustainable travel.



# 1. Introduction

AtkinsRéalis has been commissioned by Bristol City Council (BCC) to support gathering the transport evidence base for the development of their New Local Plan<sup>3</sup>. The scope of work includes using the West of England Regional Transport Model (WERTM) suite consisting of Highway Assignment Model (HAM), Public Transport Assignment Model (PTAM) and Variable Demand Model (VDM) components to develop forecast year model scenarios for 2042 with BCC's local plan development changes. It is to be noted that AtkinsRéalis has used an update to 2019 base year WERTM HAM to better support the local plan testing, and this updated HAM is used for forecasting. The current scope includes testing the impacts of the Local Plan development allocations on the transport network.

This report presents the inputs considered for the local plan development and the respective model outcomes. One Do Something (DS) local plan development has been tested at this stage and the impacts on the transport network, measured against the Do Minimum (DM) is detailed below.

## 1.1 Report Structure

The report is structured as follows:

- Chapter 2 – provides an overview of the approach to Local Plan Testing;
- Chapter 3 – describes the travel demand development process;
- Chapter 4 – describes the network development for Do Minimum;
- Chapter 5 – provides the Do Minimum model outputs;
- Chapter 6 – outlines the local plan development scenario tested;
- Chapter 7 – provides a summary of the Local Plan Do Something test; and
- Chapter 8 – provides a summary of the document.

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<sup>3</sup> <https://www.bristol.gov.uk/residents/planning-and-building-regulations/planning-policy-and-guidance/local-plan/local-plan-review>

## 2. Local Plan Testing Overview

This chapter provides a high-level overview of the forecast model development to support the local plan testing. It also provides an overview of the base model. Forecast demand development is detailed in Chapter 3 and the supply changes are presented in Chapter 4.

### 2.1 Base Model Overview

AtkinsRéalis has recently undertaken a partial update to the 2019 West of England Regional Transport Model (WERTM) HAM to improve its accuracy in key areas that maybe impacted by the Bristol Local Plan. Details of the model development can be found in the associated Local Model Validation Report (LMVR)<sup>4</sup> of WERTM-SGC highway model.

Base year PTAM and VDM models are taken from WERTM and highway skims from the updated HAM model are used in the VDM run. No changes are made to the PTAM. Details of PTAM and VDM are found in the WERTM Model Development and Validation Report (MDVR)<sup>5</sup>.

Model features such as geographic coverage, zoning, modelled time periods for HAM, trip purposes, demand segments and assignment user classes are same as in WERTM.

### 2.2 Local Plan Modelling

As explained in Chapter 1, a “Do Minimum” (DM) scenario and a local plan development scenario (DS) have been modelled to test the impacts of new developments in the Bristol area on the forecast year transport network. The DM scenario is developed using the WERTM Foundation Case (FC) serving as a starting point, and the local plan development are built on the DM scenario. Only a single forecast year of 2042 has been modelled for both DM and the one local plan scenario as agreed with BCC.

#### 2.2.1 Forecasting Approach

- The structure of the model is identical to 2042 WERTM FC with updated input assumptions provided for the demand and supply components within Bristol City which reflects the growth estimates in NTEM v8.0, with “spatially neutral” growth assumptions;
- In line with WERTM FC, forecast year travel demand is derived in the form of ‘Person Trip Ends’, based on proposed land use supplied by BCC for the forecast year DM and DS scenario. The inputs include population, employment and other attraction factors such as school places;
- Car external to external trips (i.e., those passing through the model area), LGV and HGV trips are prepared externally, using DfT’s National Road Traffic Projections 2022;
- Network changes to Highway, PT and Active networks for the respective DM and DS are made; and
- Economic and behavioural assumptions (e.g., value of time, vehicle operating costs) also remain unchanged from WERTM FC, and are in line with the DfT TAG Databook v1.22.

The details of the overall model structure are presented in Chapter 2 of the WERTM Model Development and Validation Report<sup>6</sup>.

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<sup>4</sup> [5219624\\_WERTM\\_SGC\\_Update\\_LMVR\\_v5\\_issued.pdf](#)

<sup>5</sup> [WERTM\\_MDVR\\_v1\\_REV2\\_Issued.pdf](#)

<sup>6</sup> [WERTM\\_MDVR\\_v1\\_REV2\\_Issued.pdf](#)

# 3. Travel Demand Development

## 3.1 Introduction

Forecast changes in travel demand are required to understand the transport impacts of any changes due to land use and transport interventions in future years. Travel demand is a direct consequence of the predicted demographics of people living, working, and pursuing other recreational and business activities across the study area. To estimate future demand for travel, the likely levels and patterns of land use activities, which in turn leads to person trips are required. These land uses are then translated into trip ends for Local Plan forecasts (forecast year 2042) using the assumptions and methodology presented in Figure 3-1 and Figure 3-2. The methodology presented in Figure 3-1 is used to develop the forecast demand for DM scenario based on the SGC land use activities and the methodology presented in Figure 3-2 is used to update only the forecast demand for the Bristol district. The demand for the rest of the local authority districts (LADs) in the region remains same as the WERTM FC except that National Trip End Model (NTEM) v8 is used to constrain the trip ends.

Figure 3-1 – DM (NTEM8) Forecast Trip End Development

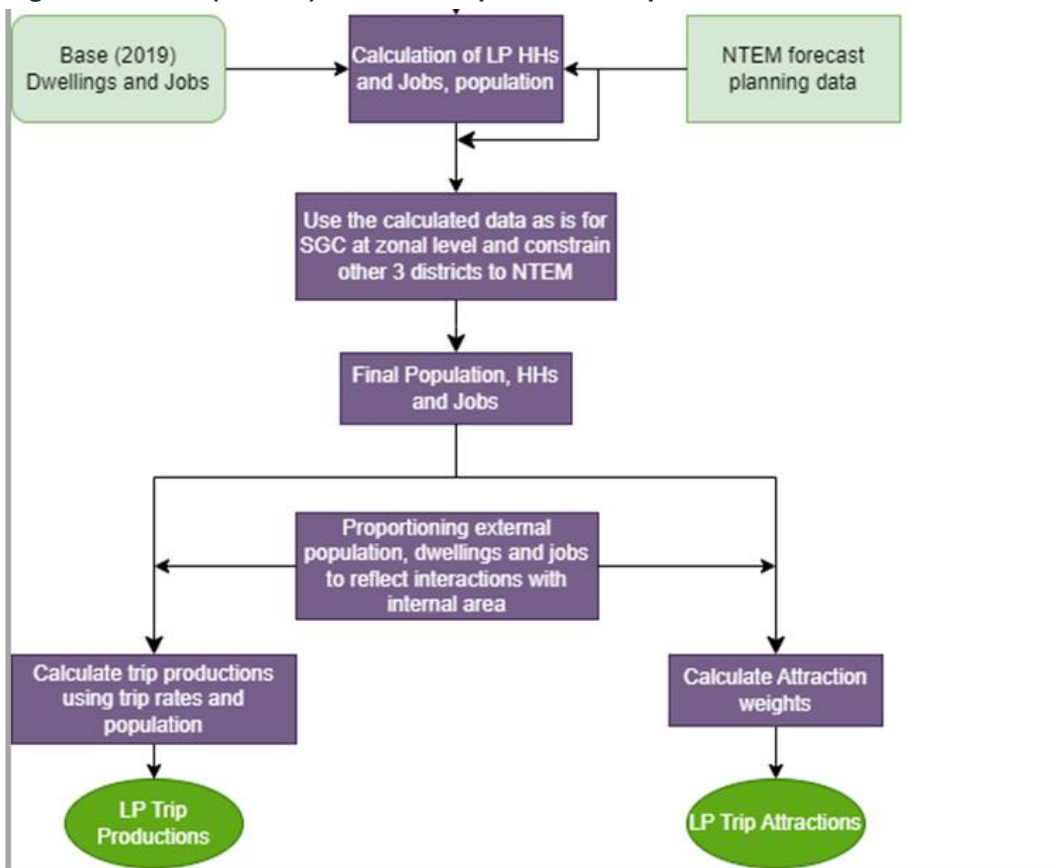
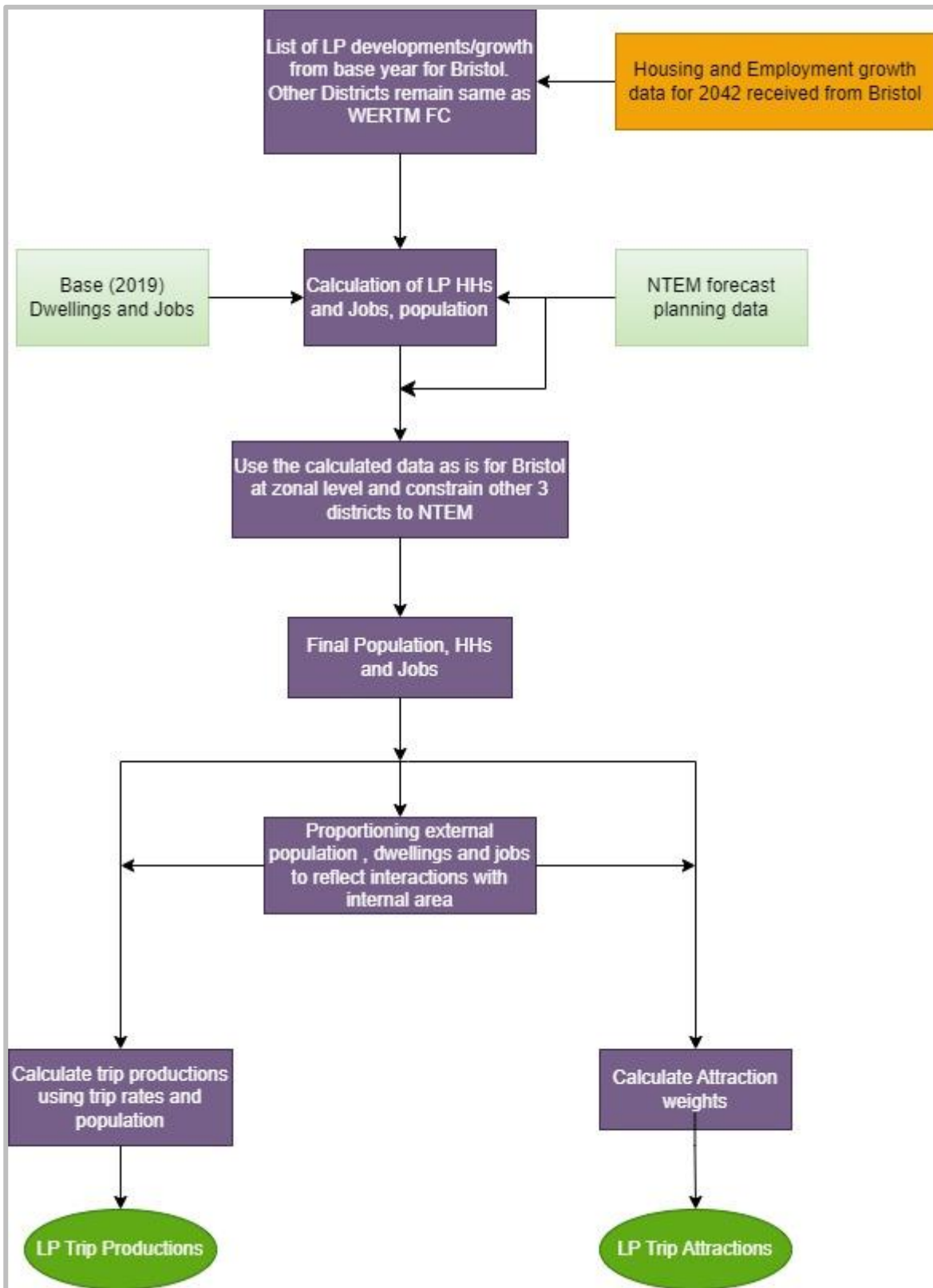


Figure 3-2 – BCC Local Plan Forecast Trip End Development



## 3.2 Development Assumptions

The development assumptions used to create the background growth in the Bristol City Council was to use the growth projections from NTEM v8.0 which was derived and allocated at a district level. Creation of additional zones was not considered necessary to represent the travel choices and transport impacts of the new development. Therefore, the growth has been added to existing zones, which also avoids unnecessary increases in model size and run time.

### 3.2.1 Derivation of dwellings and jobs

#### 3.2.1.1 Do Minimum

For housing developments, the number of expected dwellings were assumed to be in line with the projected growth in NTEM v8.0 as agreed with BCC. These were assumed to be equivalent to the number of households for the purpose of the Local Plan, though it should be noted that a proportion of dwellings normally remain vacant and therefore contain no household population. Since no exact locations of committed growth was provided, it has been assumed that the background NTEM growth has been distributed evenly for zones within the Bristol District.

For the employment developments, the number of expected jobs were assumed to be in line with the projected growth in NTEM v8.0 as agreed with BCC. These were assumed to be equivalent to the number of jobs for the purpose of the Local Plan. Since no exact locations of committed growth was provided, it has been assumed that the background NTEM growth has been distributed evenly for zones within the Bristol district.

#### 3.2.1.2 Do Something

For housing developments, the number of expected dwellings by site was provided by Bristol County Council. These were assumed to be equivalent to the number of households for the purpose of the Local Plan. These dwellings are then assigned to one or more model zones based on the location and extent of development site. In case the development extends over multiple zones dwellings are divided based on the proportion of site area falling in each zone.

For the employment developments, floor area in square metres and floor space distribution was provided by Bristol County Council. The floor space is then converted to number of jobs per each category using the job density assumptions from chapter 4 of Employment Density Guide 2015<sup>7</sup> presented in Appendix B.1. Equal splits between use classes are considered for sites where data is not available. For any missing employment categories like use class E job density is taken from Inclusive Local Economy and Employment Policy<sup>8</sup> presented in Appendix B.2. If the job densities provided are in the form of range, then average is considered for the estimation of jobs i.e., job density for use class B1b is 40-60 per m<sup>2</sup>, this is considered as 50 jobs per m<sup>2</sup> for the estimation.

In addition to the jobs from employment floor space, service jobs are calculated as a proportion of number of dwellings. Service jobs refer to employment positions that primarily involve providing a service to individuals or businesses rather than producing tangible goods and it is expected that there will be growth in service jobs in proportion to growth in general population. The proportion is calculated based on the data of workforce jobs by industry from 2021 from Office for National Statistics (ONS) data. Retail, Accommodation & food, Health and Education (categories G, I, Q and P respectively) are considered as service jobs, and the proportion is calculated

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<sup>7</sup> [https://www.kirklees.gov.uk/beta/planning-policy/pdf/examination/national-evidence/NE48\\_employment\\_density\\_guide\\_3rd\\_edition.pdf](https://www.kirklees.gov.uk/beta/planning-policy/pdf/examination/national-evidence/NE48_employment_density_guide_3rd_edition.pdf)

<sup>8</sup> <https://www.westminster.gov.uk/media/document/inclusive-local-economy-and-employment-updated-november-2021>

at Bristol district level as a ratio of total service jobs to the total number of dwellings. This proportion is then used to calculate the service jobs for each zone and added to the actual jobs.

### 3.3 Derivation of school capacity

The housing developments in the forecast year generate various types of trips which include school trips by children below the age of 18. Additional school capacity to accommodate these trips has been created within the model, based on assumptions of pupils per dwelling.

School capacity for the forecast year is calculated based on the growth in housing developments i.e., dwellings. The assumptions to calculate the number of pupils per dwelling for each category of school are derived from experience in previous studies carried out by AtkinsRéalis. Table 3-1 below presents the assumptions. The threshold is considered at zone level i.e., a zone will be allocated additional school capacity only if the forecast dwellings in that zone are greater than the threshold.

**Table 3-1 - Forecast School Capacity assumptions**

Category	Pupil per dwelling	Dwelling threshold
Primary School	0.20	100
Secondary School	0.13	200
Sixth Form (Tertiary)	0.04	200

### 3.4 Goods vehicles and Car External-External trips

It is to be noted that the VDM does not predict changes in demand for external-to-external trips and goods trips, these must be input from external estimates. However, the model does determine routing for the vehicle trips and consider their influence on congestion.

The growth factors vary by region and are derived for South-West region of England, with appropriate growth rates being extracted for each movement based on the vehicle type and dominant road type. The growth rates are then applied to generate forecast in freight (LGV and HGV) and car external-external trips. The growth rates for WERTM foundation were derived from RTF 2018. However, for Bristol Local Plan, NRTP 22<sup>9</sup> is used as the basis for updating these growth rates for freight and Car external-external trips. Table 3-2 shows the growth rates derived by vehicle and road type from NRTP 22 forecasts. Detailed assumptions on how the growth factors are calculated and applied can be found in section 3.6 of the WERTM Forecasting Report.

**Table 3-2 – NRTP 22 Derived Growth Rates (2019 to 2042) by Road Type and Vehicle Type**

Vehicle Type	2019 to 2042 Growth factor		
	Minor Roads	Trunk A	Motorway
Car	1.15	1.28	1.33
LGV	1.31	1.32	1.31
HGV	1.02	1.07	1.12

<sup>9</sup> [National road traffic projections 2022 \(publishing.service.gov.uk\)](https://publishing.service.gov.uk)

# 4. Do Minimum Supply Development

## 4.1 Coding approach and assumptions

The committed schemes from the supply log are included in the Do Minimum (DM). Along with these, the schemes from WERTM Foundation Case (FC) are also included in the DM. All the schemes are assumed to have been completed by 2042. The details of the schemes such as design layouts were provided by the authorities directly taken from the FC HAM model.

The following approach was adopted for coding the highway network for the DM scenario:

- The coding assumptions (Speed Flow Curves, link capacities etc.) were adopted from the network coding manual used to develop the base model network;
- Numbering for new nodes is consistent with the base model, i.e., based on the local authority in which the node is located; and
- Wider signal timings are consistent with the base model, i.e., they have not been optimized to accommodate forecast changes. It was not considered proportionate for the development of the strategic DM for junction-by-junction re-optimization and localized checking of every signal junction.

The following approach was adopted for coding the Public Transport (PT) and active network for the DM scenario:

- The coding assumptions (link type, stop type, naming conventions for new stops and services, etc.) are consistent with the coding in the base model; and
- The user perception factors used for active network are consistent with the factors in the base model. For all public realm enhancement schemes, the existing walk and/or cycle link perception factor has been updated based on the scheme description, example – segregated cycle path, off-road cycle track.

### 4.1.1 Approach to update Public Transport services

It is unlikely that the public transport level of service (either route coverage or service frequency) will remain consistent between the model base year and forecast year. The impacts of travel restrictions during the Covid pandemic and the adoption of new travel behaviours has brought about significant changes to local buses services in the region. Bus and rail routes have been adjusted in the DM to reflect the 2023 timetables and services in SGC, with the assumption these are continued into the future. The changes in model were carried out only for the services that are completely internal to SGC or have any interaction with SGC i.e., originating/terminating in SGC.

#### 4.1.1.1 Bus Routes

2023 bus timetable data was sourced from Bus Open Data Service (BODS)<sup>10</sup> in GTFS format and was imported into the model. Checks were carried against the BODS data by comparing the routes from Travelwest journey planner<sup>11</sup>. Bus routes that are interacting with SGC were removed from the model and the routes from 2023 GTFS data were added. A new service along route Y2 serving North Yate is added, North and South Yate will have a 30-minute frequency but combined will provide a 15-minute frequency along the main A432 corridor.

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<sup>10</sup> <https://data.bus-data.dft.gov.uk/downloads/>

<sup>11</sup> [Routes & Timetables | Travelwest](#)

#### 4.1.1.2 Rail routes

Rail data for 2023 was downloaded from DataCutter<sup>12</sup>. Similar to bus routes, rail routes interacting with SGC were removed from the model and 2023 data was imported. In addition to this, updates to timetables were also made based on the calling pattern information for Charfield station received from SGC.

## 4.2 Highway Schemes

The DM scenario includes schemes from the WERTM FC (SGC variant). Appendix C presents the scheme drawings.

## 4.3 Active Travel Schemes

The DM scenario includes schemes from the WERTM FC, and schemes received from SGC.

## 4.4 PT Schemes

No further PT schemes are modelled in the DM in addition to the schemes from WERTM FC. However, there are changes in the services and PT timetables reflecting the 2023 scenario as explained in Section 4.1.1.

Details of highway, PT and active travel schemes from WERTM can be found in the WERTM Forecasting Report and the scheme drawings are presented in Appendix D

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<sup>12</sup> <https://datacutter.basemap.co.uk/DataCutter>

## 5. Do Minimum Forecasts

The assumptions and processes detailed in Chapter 3 result in trip ends for use in the Variable Demand Model (VDM) providing insights on how the changes in planning data reflects in changes in trip ends. When these are applied to the VDM, with the supply changes as described in Chapter 4, the output results in trip matrices split by purpose and mode. This chapter gives insights about convergence and stability and analyses the demand responses along with the highway (HAM) and public transport (PTAM) assignments in the DM model.

### 5.1 Demand Model Outputs

The VDM treats all four WECA districts of SGC, B&NES, BCC and NSC (for the purpose of WERTM, NSC is treated as a part of WECA) as internal, and the model provides demand responses accordingly. For the purpose of this study and reporting, these responses are evaluated at the Bristol level, treating Bristol as internal and all others as external. In other words, the VDM analysis covers internal-to-internal, internal-to-external, and external-to-internal trips for Bristol, and the same are presented in the following sections.

#### 5.1.1 Model Convergence

The VDM iterates to account for changes in highway costs (congestion) feeding back and influencing travellers' choices. Travel costs supplied from the highway assignment in each loop will alter the demand generated in the VDM until demand-supply equilibrium or convergence is reached. Having a converged model is crucial because it signifies stability in the model and reduces the model noise. The convergence criterion in WERTM is based on the nested demand gap values calculated for each choice model. The equation used to calculate the gap value as set out in TAG unit M2.1 Section 6.3.4 is presented below.

$$\text{Percentage Gap} = \frac{\sum_a - U_a |D_a^{new} - D_a^{old}|}{\sum_a - U_a D_a^{old}} \times 100$$

Where,

$U_a$  is the costs specified in referenced nested demand procedures (i.e., negative utility)

$D_a^{old}$  is the saved demand from last iteration

$D_a^{new}$  is the saved demand from current iteration

$a$  runs through all matrix entries, demand strata, modes and times of the day

The Do Minimum has converged with an overall gap value of 0.181 in 11 iterations, which is within the convergence GAP target of 0.2% as per TAG Unit M2.1. Table 5-1 presents gap statistics for each of the choice models by purpose. The outputs from the converged loops are used for reporting the results in the subsequent sections.

**Table 5-1 - % Gap values for Do Minimum**

Purpose	Mode & Destination choice	Car Sub-Mode	PT Sub-Mode
Home Based Work (HBW)	0.35%	0.42%	0.35%
Home Based Employer Business (HBEB)	0.35%	0.37%	0.62%
Home Based Education (HBEd)	0.17%	0.28%	0.13%
Home Based Shopping/Personal Business (HBSHOPPB)	0.08%	0.13%	0.02%
Home Based Recreation/Visiting Friends & Relatives (HBRecVFR)	0.09%	0.11%	0.12%
Non-Home Based Employer Business (NHBEb)	0.16%	0.18%	0.16%
Non-Home Based Others (NHBO)	0.12%	0.16%	0.04%

## 5.1.2 Demand Matrices

### 5.1.2.1 Change in trips by purpose

Table 5-2 below presents the final forecast demand at the 24-hour production / attraction level by mode and purpose across all the movements within, to and from Bristol. The table shows that there is a rise of approximately 11% in total number of trips from base year to the 2042 DM. A significant portion of this increase is in shopping, work, employer business, and education trips, which reflects the changes in production from base to DM. In terms of travel modes, the increase is mainly attributed to Car mode followed by walk and cycle.

**Table 5-2 – DM 24 hr P/A Trips by Purpose by Mode and comparison to base year**

Purpose	Base Year: 24hr P/A Trips					DM: 24hr P/A Trips					Percentage Diff to Base				
	Car	PT	Walk	Cycle	Total	Car	PT	Walk	Cycle	Total	Car	PT	Walk	Cycle	Total
HBW	122,046	27,907	34,052	15,766	199,770	131,824	31,105	37,608	17,471	218,008	8.0%	11.5%	10.4%	10.8%	9.1%
HBEB	23,610	3,640	1,123	608	28,982	26,397	4,156	1,298	685	32,535	11.8%	14.2%	15.5%	12.6%	12.3%
HBEd	33,588	20,268	44,271	5,103	103,230	42,150	20,690	46,971	5,362	115,173	25.5%	2.1%	6.1%	5.1%	11.6%
HBSHOPPB	136,012	35,963	58,131	8,767	238,872	164,002	37,523	61,858	9,218	272,600	20.6%	4.3%	6.4%	5.1%	14.1%
HBRecVFR	108,046	22,138	31,369	2,769	164,322	123,596	21,808	32,120	2,792	180,316	14.4%	-1.5%	2.4%	0.8%	9.7%
NHBEb	27,161	1,493	3,573	229	32,457	30,342	1,411	3,449	216	35,418	11.7%	-5.5%	-3.5%	-5.8%	9.1%
NHBO	115,022	10,812	48,118	181	174,134	131,796	10,817	47,508	177	190,298	14.6%	0.1%	-1.3%	-2.5%	9.3%
Total	565,485	122,221	220,637	33,424	941,767	650,108	127,510	230,811	35,920	1,044,349	15.0%	4.3%	4.6%	7.5%	10.9%

## 5.1.3 Mode Shares

### 5.1.3.1 Mode Shares by Purpose

Table 5-3 below presents the mode shares by purpose for DM. There is an increase in car shares in DM when compared to the base year for all purposes except commute and business. The car share increase is attributed to the rise in PT fares and the relative decrease in car operating costs due to fuel efficiency and increase in share of electric vehicles. In 2042, according to TAG v1.22 (consistent with the version used for model parameters), electric vehicles will account for 64% of vehicle kilometres travelled by cars, contributing to a reduction in car operating costs.

**Table 5-3 – DM Mode Shares by Purpose and comparison to base year**

Purpose	DM 24hr P/A Trips				Mode Share				Change in Mode Share			
	Car	PT	Walk	Cycle	Car	PT	Walk	Cycle	Car	PT	Walk	Cycle
HBW	131,824	31,105	37,608	17,471	60.5%	14.3%	17.3%	8.0%	0.6%	0.3%	0.2%	0.1%
HBEb	26,397	4,156	1,298	685	81.1%	12.8%	4.0%	2.1%	0.3%	0.2%	0.1%	0.0%
HBEd	42,150	20,690	46,971	5,362	36.6%	18.0%	40.8%	4.7%	4.1%	1.7%	2.1%	-0.3%
HBShopPB	164,002	37,523	61,858	9,218	60.2%	13.8%	22.7%	3.4%	3.2%	1.3%	1.6%	-0.3%
HBRecVFR	123,596	21,808	32,120	2,792	68.5%	12.1%	17.8%	1.5%	2.8%	1.4%	1.3%	-0.1%
NHBEb	30,342	1,411	3,449	216	85.7%	4.0%	9.7%	0.6%	2.0%	0.6%	1.3%	-0.1%
NHBO	131,796	10,817	47,508	177	69.3%	5.7%	25.0%	0.1%	3.2%	0.5%	2.7%	0.0%
<b>Total</b>	<b>650,108</b>	<b>127,510</b>	<b>230,811</b>	<b>35,920</b>	<b>62.3%</b>	<b>12.2%</b>	<b>22.1%</b>	<b>3.4%</b>	<b>2.2%</b>	<b>0.8%</b>	<b>1.3%</b>	<b>-0.1%</b>

### 5.1.3.2 Mode Shares by Sector

The change in car mode shares by production and attraction sectors for all purposes between DM and base is shown in Figure 5-1 and Figure 5-2. Car mode shares generally increases in DM. The sectors with large dwelling and jobs sites like Bristol City Centre, Bedminster, Knowle & Hengrove show an increase in car share as demonstrated in the above table.

**Figure 5-1 – Difference between DM and Base Year for Car Mode Shares - Productions, All Purposes**

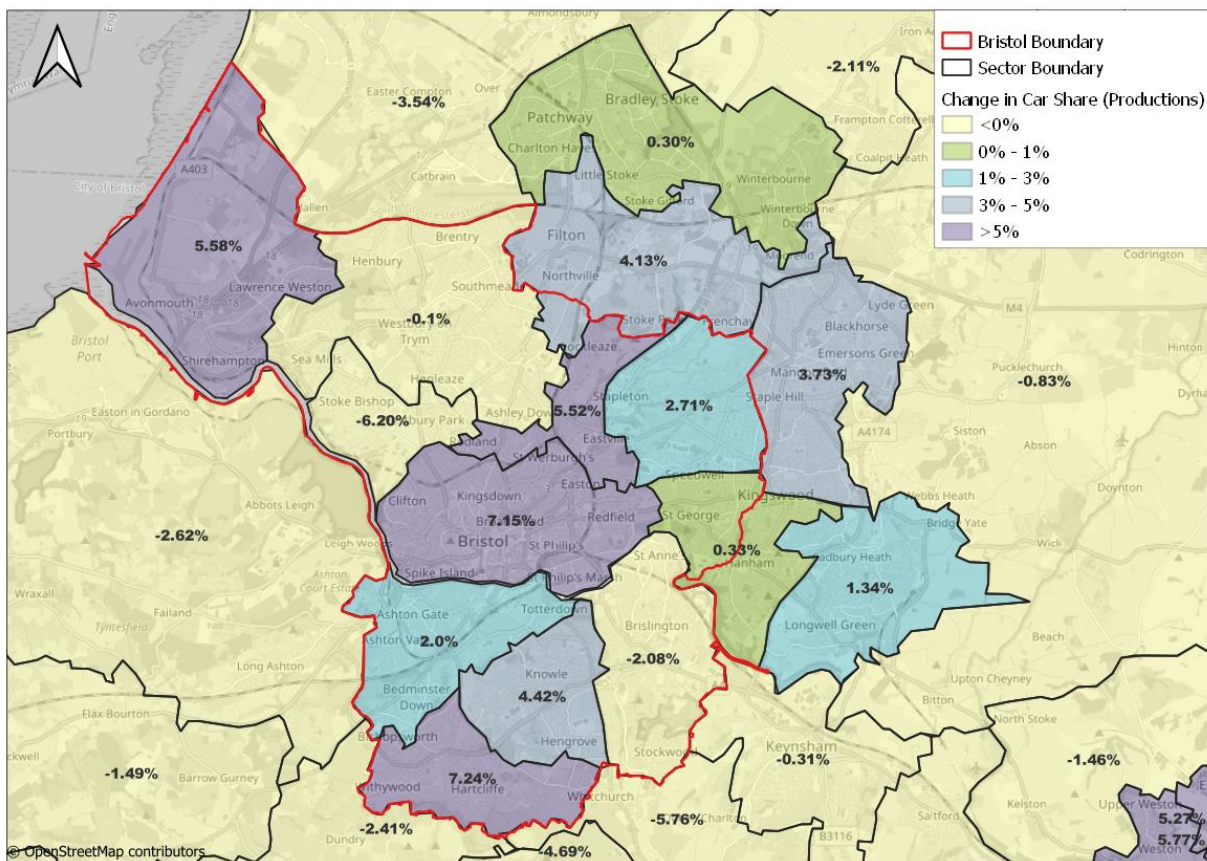
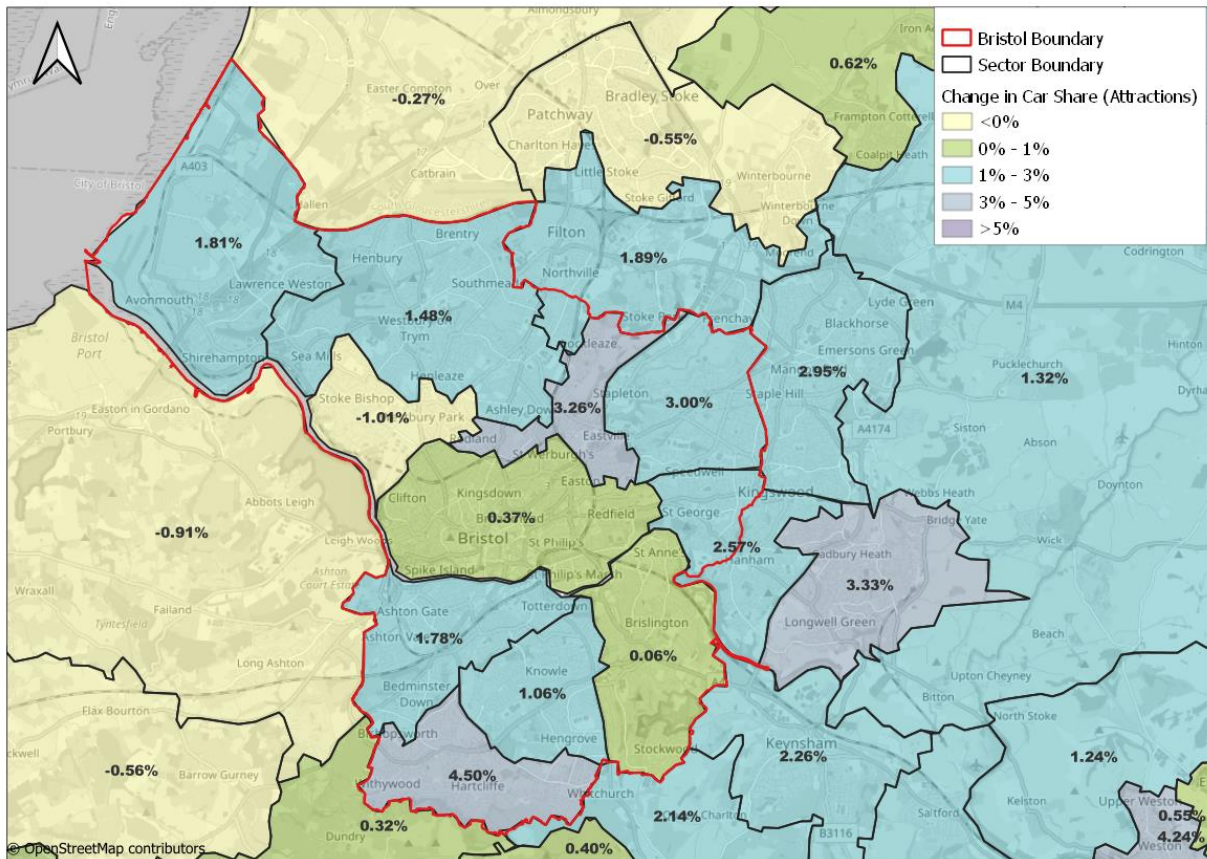


Figure 5-2 - Difference between DM and Base Year for Car Mode Shares - Attractions, All Purposes



### 5.1.4 Trip Lengths

Trip lengths at 24-hour production / attraction level are analysed for each purpose and mode to identify whether trips are becoming longer or shorter between the base and forecast year. Comparison of average trip length between DM and Base Year is presented in Table 5-4. Average trip lengths by Car have increased for education and non-home based purposes. This is primarily due to reduced vehicles operating costs. There is reduction in discretionary and shopping trips where there is a possible shift to walk for shorter distances. Long-distance rail trips in the model are driven by trips from the external area (the East and North sectors) to the WECA/SGC region. Bus journey lengths has shortened over time due to the increase in fares. Trip lengths for active modes are stable in the DM.

Table 5-4 – DM Average Trip Length by Purpose by Mode, Comparison to Base Year

Purpose	Car		Bus		Rail		Cycle		Walk	
	DM	Diff from Base	DM	Diff from Base	DM	Diff from Base	DM	Diff from Base	DM	Diff from Base
HBW	16.8	▼ -0.1	7.4	▬ 0.0	109.3	▼ -28.3	6.3	▲ 0.1	1.9	▲ 0.1
HBEB	18.4	▬ 0.0	5.0	▼ -0.5	65.8	▼ -17.5	4.5	▬ 0.0	0.9	▬ 0.0
HBEd	6.3	▲ 0.5	9.2	▼ -1.2	15.0	▲ 1.1	4.0	▬ 0.0	1.7	▬ 0.0
HBSshopPB	15.4	▼ -1.7	8.5	▼ -3.4	46.0	▼ -14.5	4.9	▬ 0.0	1.6	▬ 0.0
HBRecVFR	14.1	▼ -2.3	7.8	▼ -3.5	45.7	▼ -17.8	6.2	▬ 0.0	2.1	▲ 0.1
NHBEB	14.4	▲ 0.7	6.4	▼ -0.8	84.0	▼ -31.1	4.3	▲ 0.1	0.9	▬ 0.0
NHBO	14.2	▲ 0.1	9.6	▼ -1.0	73.7	▲ 45.3	4.4	▬ 0.0	1.5	▲ 0.1
<b>Grand Total</b>	<b>14.7</b>	<b>▼ -0.8</b>	<b>8.4</b>	<b>▼ -2.2</b>	<b>82.7</b>	<b>▼ -25.2</b>	<b>5.5</b>	<b>▲ 0.1</b>	<b>1.7</b>	<b>▲ 0.1</b>

## 5.2 Highway Assignment outputs

The advice on model convergence is set out in TAG Unit M3.1 and is discussed in Section 20.4.6 in MDVR. The HAM model convergence for DM is summarized in Table 5-5 presenting the gap statistics and percentage of links passing the flow criteria for the last four iterations.

**Table 5-5 – DM SATURN Highway Assignment Convergence Summary**

Scenario	Time Period	Number of iterations	%Flow	%Delay	%GAP
DM	AM Peak	64	99.1	99.4	0.0230
		657	99.2	99.4	0.0230
		668	99.4	99.5	0.0250
		679	99.4	99.5	0.0280
	Inter Peak	37	99.0	99.7	0.010
		38	99.2	99.8	0.0084
		39	99.3	99.8	0.0011
		40	99.3	99.8	0.0011
	PM Peak	97	98.7	99.3	0.030
		98	99.2	99.3	0.0390
		99	99.0	99.2	0.0300
		100	99.2	99.3	0.0340

### 5.2.1 Overall network statistics

Table 5-6 below presents the network statistics for the DM and base year for all time periods. Average speeds have reduced in the DM and average trip lengths did not have any significant change. Overall trip totals, travel time and distance, delay/vehicle has increased in the DM.

**Table 5-6 – DM Overall highway network statistics (whole UK model)**

Time Period	Scenario	Base Year	DM	% Diff with Base
AM Peak	Matrix Totals (pcu/hr)	183,134	219,951	20.10%
	Total Travel Times (pcu-hrs)	109,473	142,217	29.91%
	Travel Distance (pcu-kms)	6,595,465	7,959,581	20.68%
	Average Speed (km/h)	60.20	56.0	-6.98%
	Total Delay / Vehicle (mins/pcu)	6.08	8.52	40.13%
	Average Trip Length (pcu.km)	36.01	36.19	0.50%
Inter Peak	Matrix Totals (pcu/hr)	151,695	182,714	20.45%
	Total Travel Times (pcu-hrs)	81,878	101,616	24.11%
	Travel Distance (pcu-kms)	5,561,242	6,780,747	21.93%
	Average Speed (km/h)	67.90	66.70	-1.77%

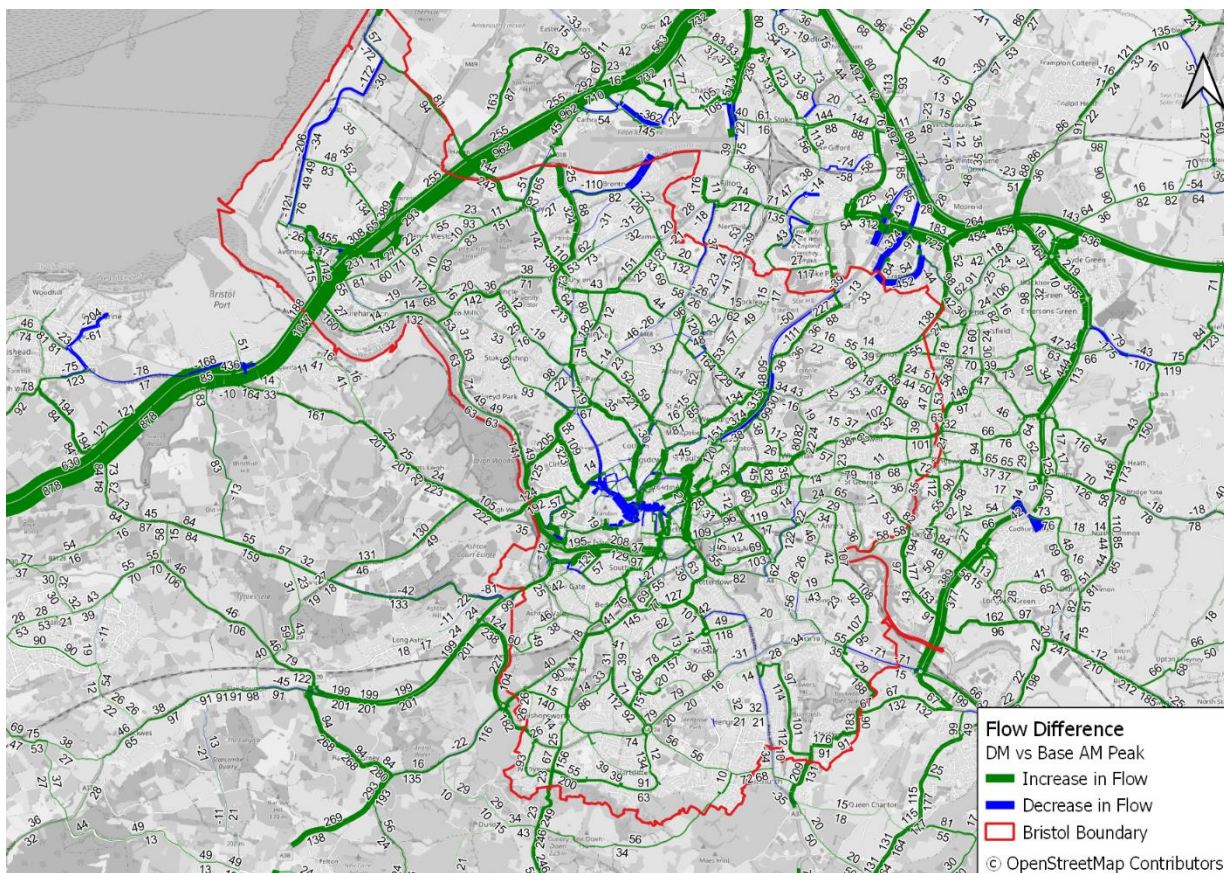
Time Period	Scenario	Base Year	DM	% Diff with Base
	Total Delay / Vehicle (mins/pcu)	3.31	3.81	15.11%
	Average Trip Length (pcu.km)	36.66	37.11	1.23%
PM Peak	Matrix Totals (pcu/hr)	184,099	219,047	18.98%
	Total Travel Times (pcu-hrs)	108,247	139,281	28.67%
	Travel Distance (pcu-kms)	6,498,046	7,847,617	20.77%
	Average Speed (km/h)	60.00	56.30	-6.17%
	Total Delay / Vehicle (mins/pcu)	6.18	8.34	34.95%
	Average Trip Length (pcu.km)	35.30	35.83	1.50%

## 5.2.2 Impact on Network

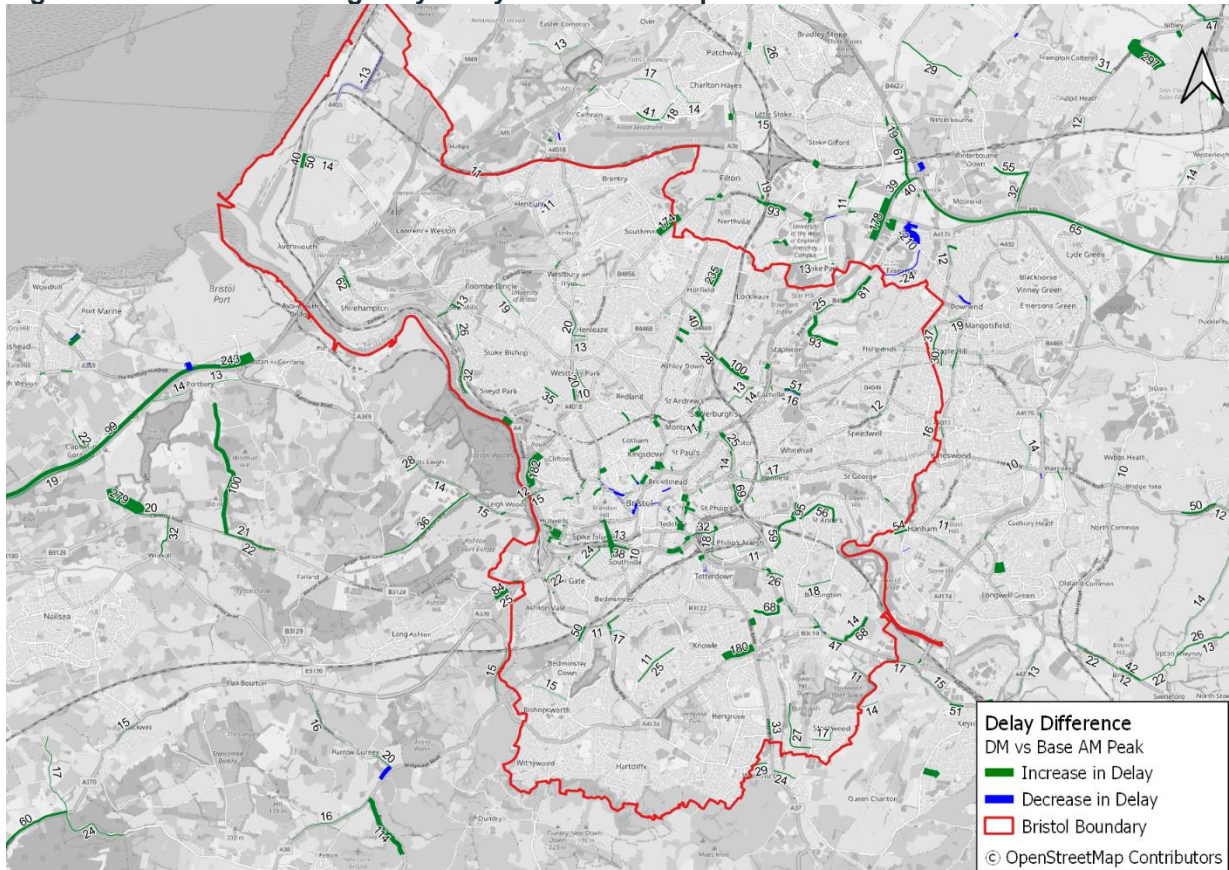
Model flows from the DM have been compared with the base year to demonstrate how traffic flows are expected to change in future year due to the network and land use changes.

Figure 5-3 and Figure 5-4 below presents the flow difference and delay difference respectively between the DM and base in AM Peak, Figure 5-5 and Figure 5-6 presents the same for PM peak. Green indicates an increase and blue indicates a decrease in the plots presented.

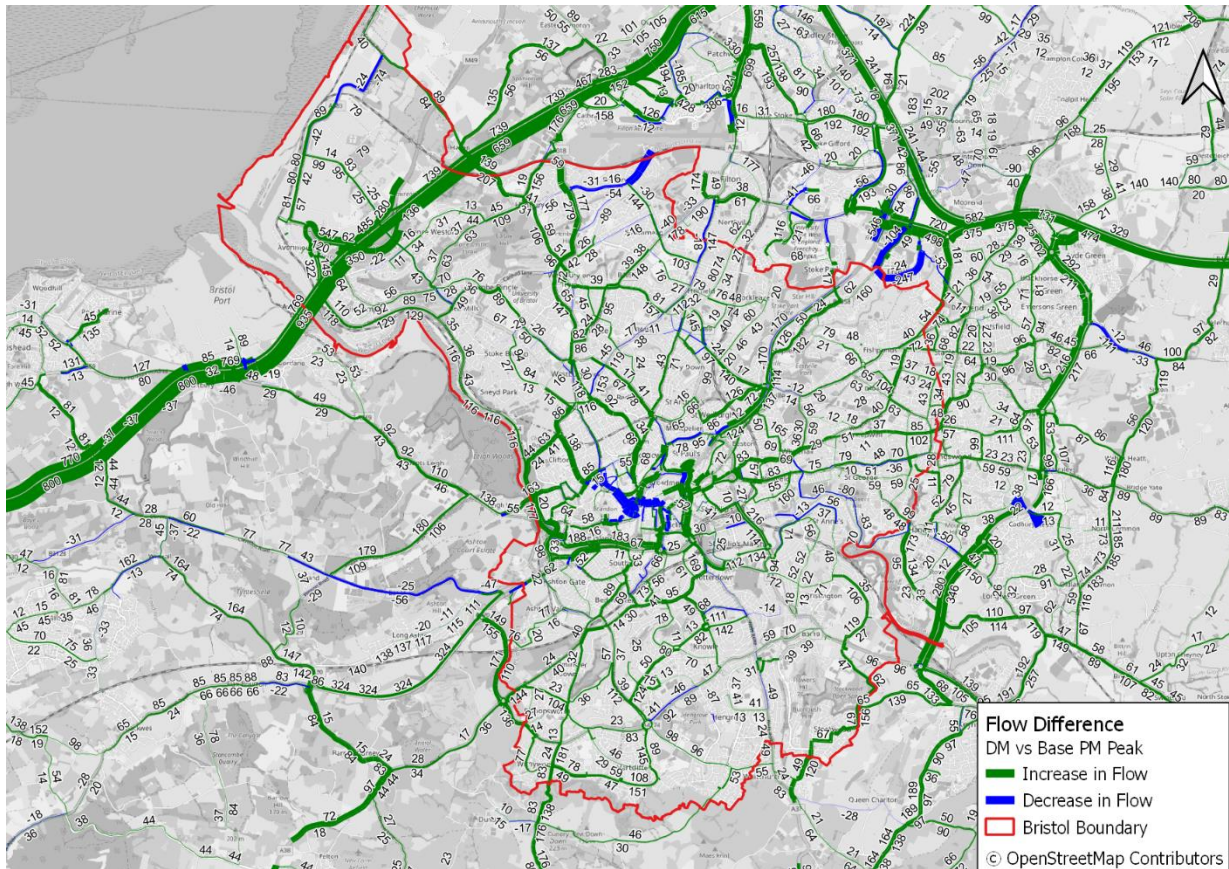
**Figure 5-3 – DM vs Base Highway Flow difference AM peak**



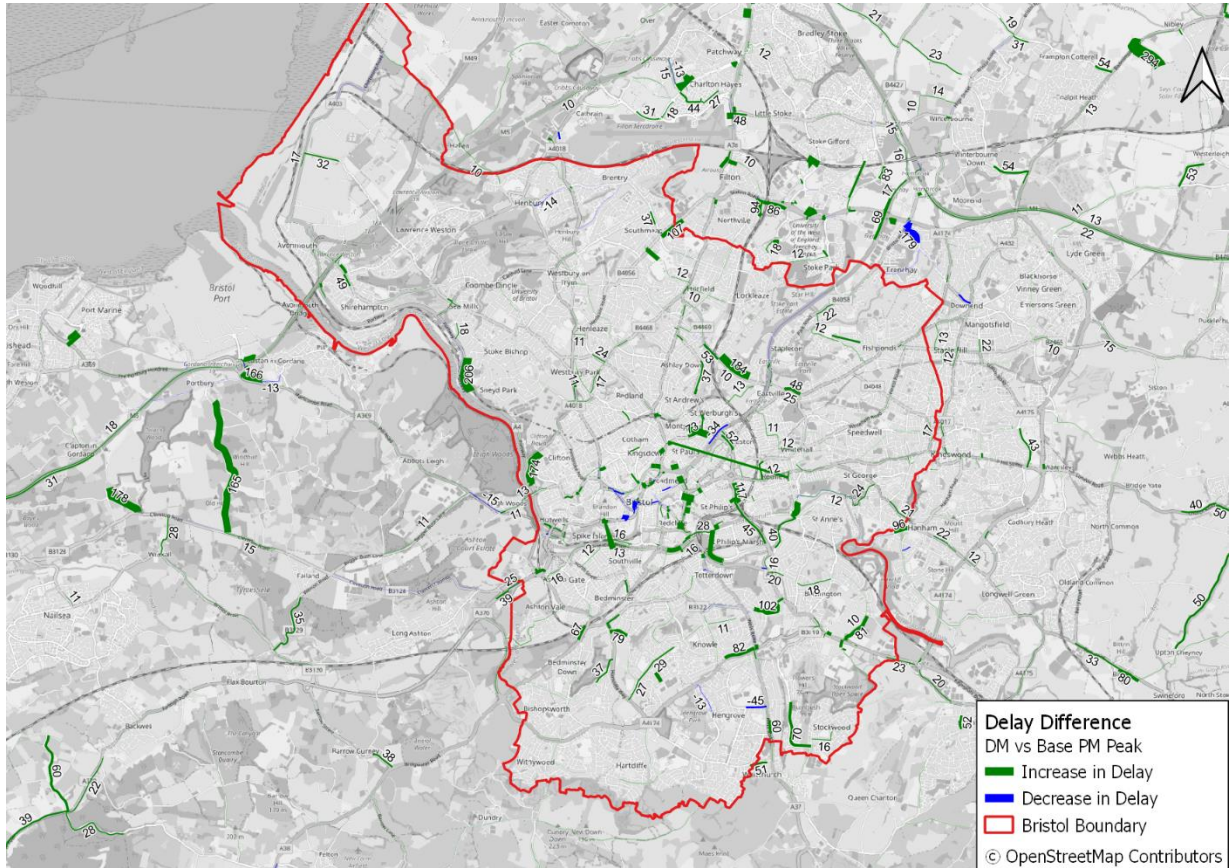
**Figure 5-4 – DM vs Base Highway Delay difference AM peak**



**Figure 5-5 – DM vs Base Highway Flow difference PM peak**



**Figure 5-6 – DM vs Base Highway Delay difference PM peak**



## 5.3 PT Assignment outputs

### 5.3.1 Bus patronage changes

Figure 5-7 and Figure 5-8 presents the bus flow difference between the 2042 DM and base year for AM peak and the same for PM peak. An increase in flow is observed along the M32 corridor through to Filton and extending onto A38 and A432 corridors. The majority of the increase on the M32 and Filton Avenue is a result of the increase in bus demand between Bristol and Patchway, Filton sectors. There is also a similar increase in patronage on the A38/Bradley Stoke Way corridor, and Lyde Green to Bristol. Bus flows are observed on the new link built through former Filton Airfield. Similar trend is observed in the PM peak but with an increase in patronage in the Northbound direction.

Figure 5-7 - Bus AM Flow Difference (persons) - DM minus Base

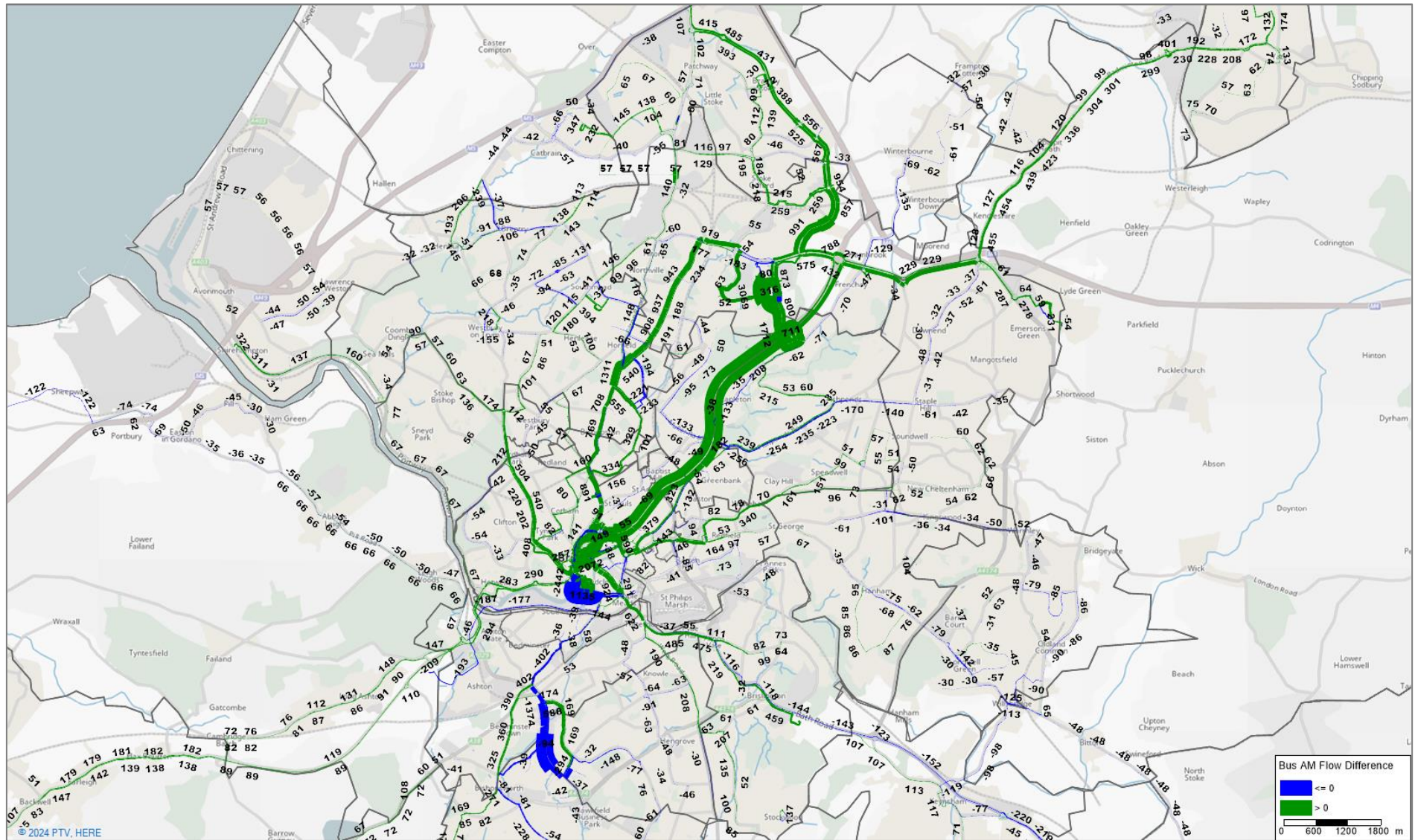
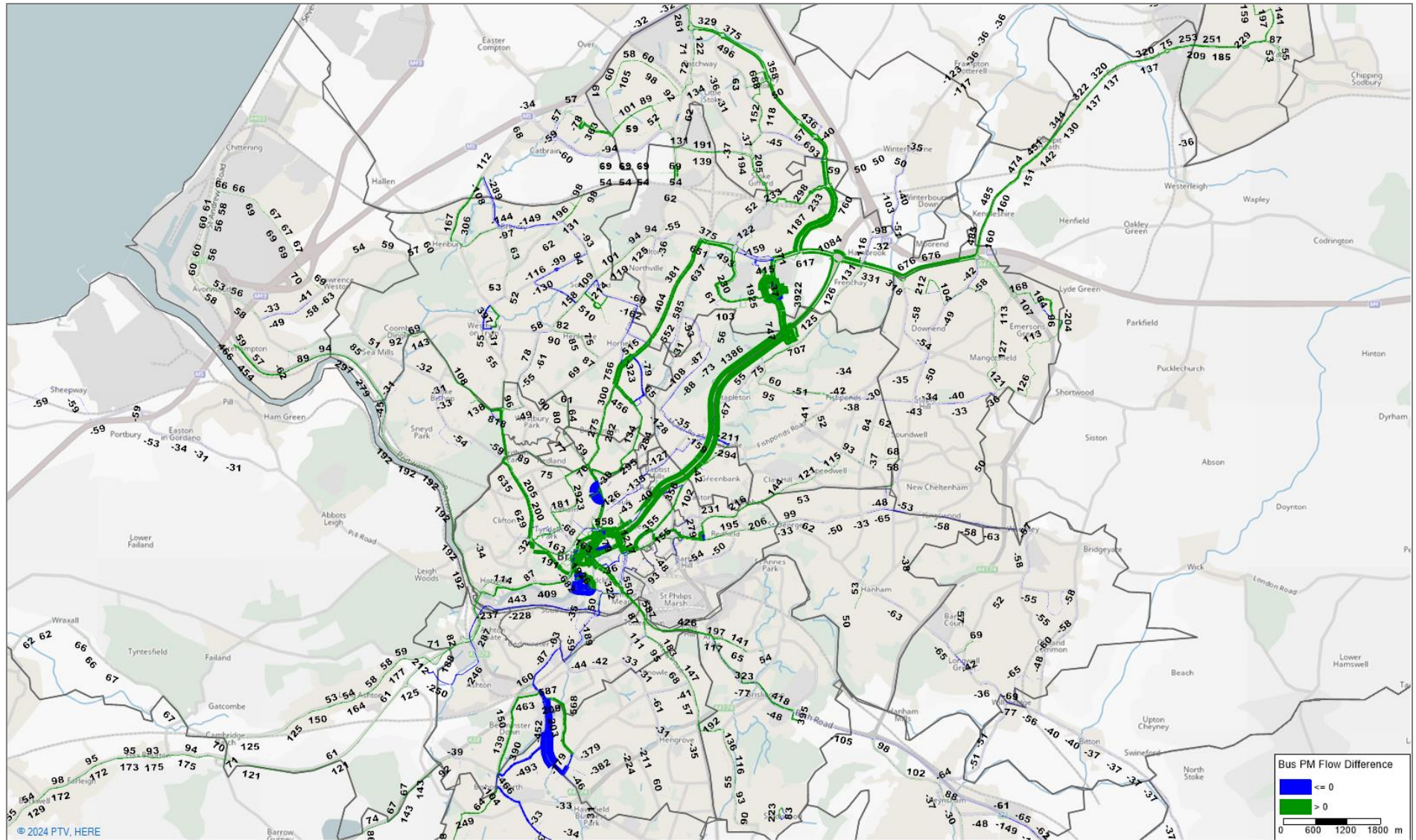


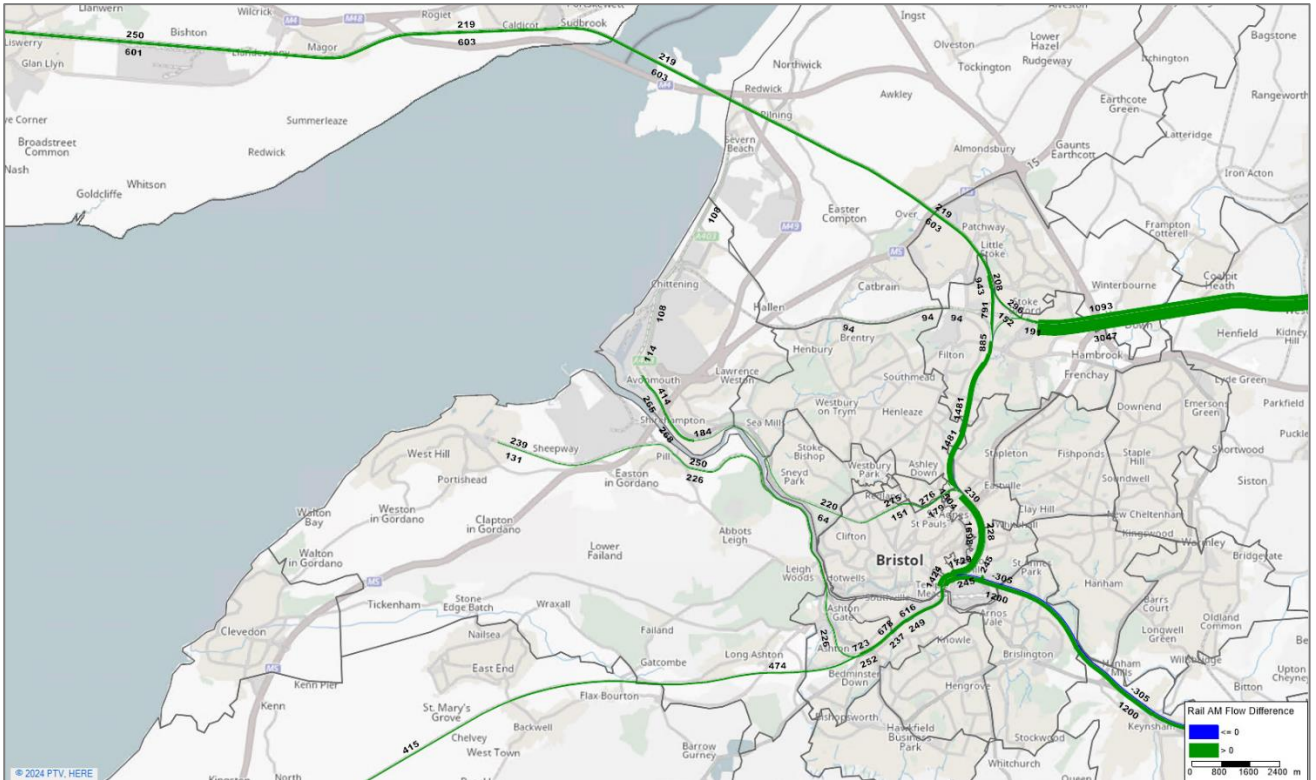
Figure 5-8 - Bus PM Flow Difference (persons) - DM minus Base



### 5.3.2 Rail Patronage changes

Figure 5-9 and Figure 5-10 presents the rail flow differences between the 2042 DM and base year for the AM peak and PM peak respectively. Rail patronage has generally increased from base to forecast years. Within Bristol increase in flows is observed on the new Henbury line. There is an increase in trips from the sectors of North External and East External to Filton and Severn Beach sectors resulting from the new developments in the DM. As a result, a shift in trips is observed between the Bristol Parkway - East External sector (towards London) corridor and Bristol-Bath- East External sector suggesting there is a rerouting happening and also a change in destination choice with Filton having a higher number of developments in DM from the committed developments.

**Figure 5-9 - Rail AM Flow Difference (persons) - DM minus Base**





# 6. Development Bristol Local Plan

Development locations for Bristol Local Plan were shared by BCC along with quantum of dwellings and proposed landuse.

The developments and their impact on the model outputs are presented in the subsequent chapters.

## 6.1 Demand Development

Assumptions laid out in Chapter 3 are followed for demand development for DS local plan testing as well. Dwellings and jobs are calculated separately similar to DM. The developments are assigned to a model zone based on the geographical location, and the resulting dwellings and jobs from these developments are modelled in addition to the developments from DM. In addition to the dwellings and jobs, school capacity is also calculated based on the assumptions mentioned in chapter 3. Table 6-1 below presents the summary of the total number of dwellings and jobs considered for Bristol local plan. The column 'Scenario' presents the dwellings/jobs as part of that particular scenario and column 'Total' presents the growth from base (2019) to forecast year for each scenario.

**Table 6-1 -Summary of Land Use Developments, growth above 2019 Base Year**

Model Scenario	Dwellings			Jobs		
	Scenario	Total	% Additional Growth above DM	Scenario	Total	% Additional Growth above DM
DM	25,763	25,763	-	24,658	24,658	-
Bristol Local Plan	+4,448	30,211	+17.27%	+6,055	30,713	+24.56%

## 6.2 Supply development

The purpose of this testing is to identify the impact of new developments on the transport network in the absence of specific mitigation measures or schemes. Consequently, there are no new schemes incorporated within the development lens during this stage. However, additional connectors are added in the HAM and PTAM for zones where more than 150 dwellings were proposed. Additional connectors were coded for zones where new dwellings had existing alternate access on ground or proposed access arrangements. For zones where no alternate access was available, the capacity of the connectors was increased to infinite to ensure the trips could load onto the network.

# 7. Bristol Local Plan Testing

## 7.1 Introduction

Figure 7-1 below presents the location of developments under Bristol Local Plan. Developments are mostly located in city centre areas towards southern part of BCC.

**Figure 7-1 – Bristol Development Sites**

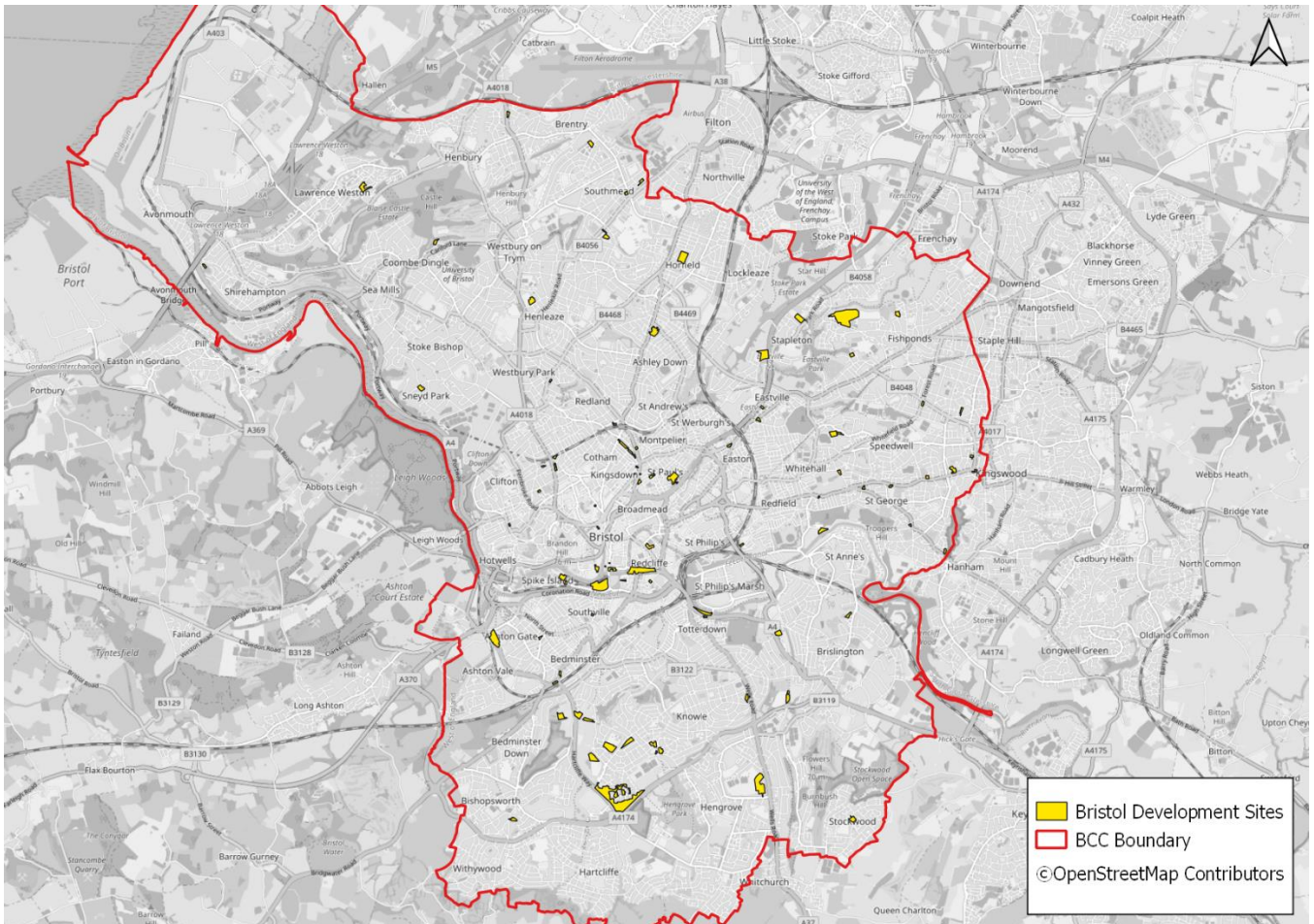
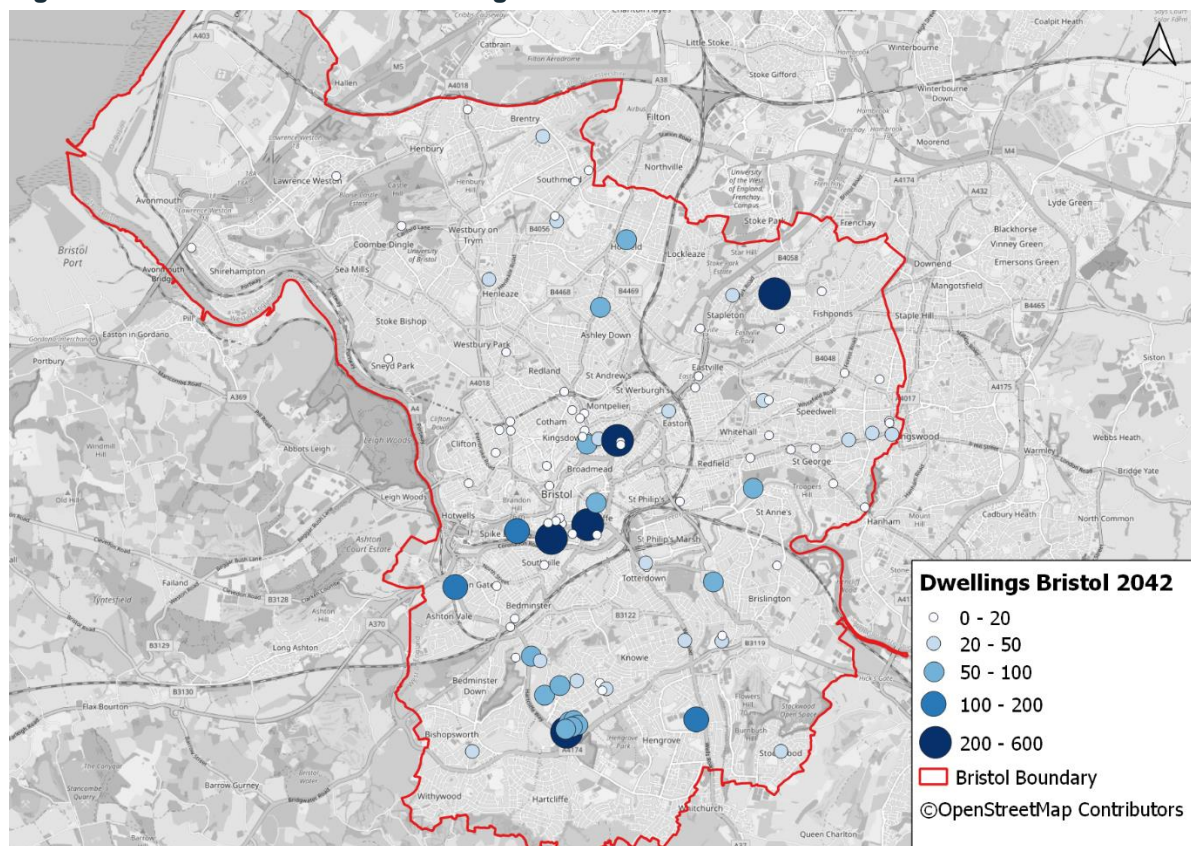


Table 7-1 presents the number of dwellings and jobs resulting from the above developments along with the sector wise percentages contributing to the total. Growth in number of jobs is higher than housing which will result in lesser out-commuting i.e., fewer people travelling outside study area for work. Figure 7-2 and Figure 7-3 presents the density of dwellings and jobs considered for Bristol Local Plan.

**Table 7-1 – Housing and Jobs in Bristol**

Sector	Dwellings	Jobs	% of Total Dwellings	% of Total Jobs
Bristol City Centre	1,860	2,608	41.82%	43.07%
Stoke Bishop & Westbury Park	32	13	0.72%	0.22%
Sea Mills, Westbury on Trym & Ashley Down	320	605	7.20%	9.99%
Montpelier & Lockleaze	53	58	1.19%	0.96%
Fishponds	472	579	10.61%	9.57%
Kingswood	173	341	3.89%	5.63%
Brislington	182	76	4.08%	1.25%
Knowle & Hengrove	1,048	884	23.55%	14.60%
Bedminster	254	795	5.70%	13.13%
Bishopsworth, Hartcliffe & Whitchurch	25	83	0.56%	1.37%
Sevenside	30	12	0.67%	0.21%
<b>BCC Total</b>	<b>4,448</b>	<b>6,055</b>	<b>100%</b>	<b>100%</b>

**Figure 7-2 – Bristol Local Plan Dwellings**



**Figure 7-3 – Bristol Local Plan Jobs**



## 7.2 Demand Model outputs

### 7.2.1 Model Convergence

The Bristol Local Plan model converged with an overall gap value of value of 0.181% in twelve iterations, which is within the convergence GAP target of 0.2% as per TAG Unit M2.1. The outputs from the converged loops are used for reporting the results in the subsequent sections.

### 7.2.2 Demand Matrices

#### 7.2.2.1 Change in trips by purpose

Table 7-2 below presents the final forecast demand for Bristol Local Plan at the 24-hour production / attraction level by mode and purpose across all the movements that involves BCC. There is an increase of approximately 4% in total trips across modes and purposes from DM to Bristol Local Plan resulting from the new developments. The majority of new trips are occurring by walk, primarily due to the location of new developments. There has been an overall increase in trips for all purposes, with a majority attributed to home-based work and employee business trips in terms of percentage increase. This is expected with the increase in population and jobs.

**Table 7-2 – Bristol Local Plan 24 hr P/A Trips by Purpose by Mode and comparison to DM**

Purpose	DM: 24hr P/A Trips					Bristol Local Plan: 24hr P/A Trips					Percentage Diff to Previous Version				
	Car	PT	Walk	Cycle	Total	Car	PT	Walk	Cycle	Total	Car	PT	Walk	Cycle	Total
HBW	131,824	31,105	37,608	17,471	218,008	132,482	31,528	39,352	17,893	221,256	0.5%	1.4%	4.6%	2.4%	4.7%
HBEB	26,397	4,156	1,298	685	32,535	26,683	4,238	1,378	707	33,007	1.1%	2.0%	6.2%	3.3%	5.2%
HBEd	42,150	20,690	46,971	5,362	115,173	42,390	21,044	48,170	5,482	117,086	0.6%	1.7%	2.6%	2.2%	4.5%
HBShopPB	164,002	37,523	61,858	9,218	272,600	164,497	37,974	63,892	9,399	275,763	0.3%	1.2%	3.3%	2.0%	3.2%
HBRecVFR	123,596	21,808	32,120	2,792	180,316	123,154	24,214	34,483	3,009	184,861	-0.4%	11.0%	7.4%	7.8%	3.8%
NHBEB	30,342	1,411	3,449	216	35,418	30,730	1,441	3,542	222	35,935	1.3%	2.1%	2.7%	2.6%	4.7%
NHBO	131,796	10,817	47,508	177	190,298	132,337	10,962	49,720	182	193,202	0.4%	1.3%	4.7%	3.0%	3.5%
<b>Total</b>	<b>650,108</b>	<b>127,510</b>	<b>230,811</b>	<b>35,920</b>	<b>1,044,349</b>	<b>652,274</b>	<b>131,402</b>	<b>240,539</b>	<b>36,895</b>	<b>1,061,109</b>	<b>0.3%</b>	<b>3.1%</b>	<b>4.2%</b>	<b>2.7%</b>	<b>3.9%</b>

## 7.2.3 Mode Shares

### 7.2.3.1 Mode Shares by Purpose

Table 7-3 below presents the mode shares by purpose for Bristol Local Plan and comparison with DM. Though the changes are minor there is an increase in walk mode share with reduction in Car. These shifts align with the increase in walk trips as shown in Table 7-2. The most significant change is observed in recreation and visiting trips.

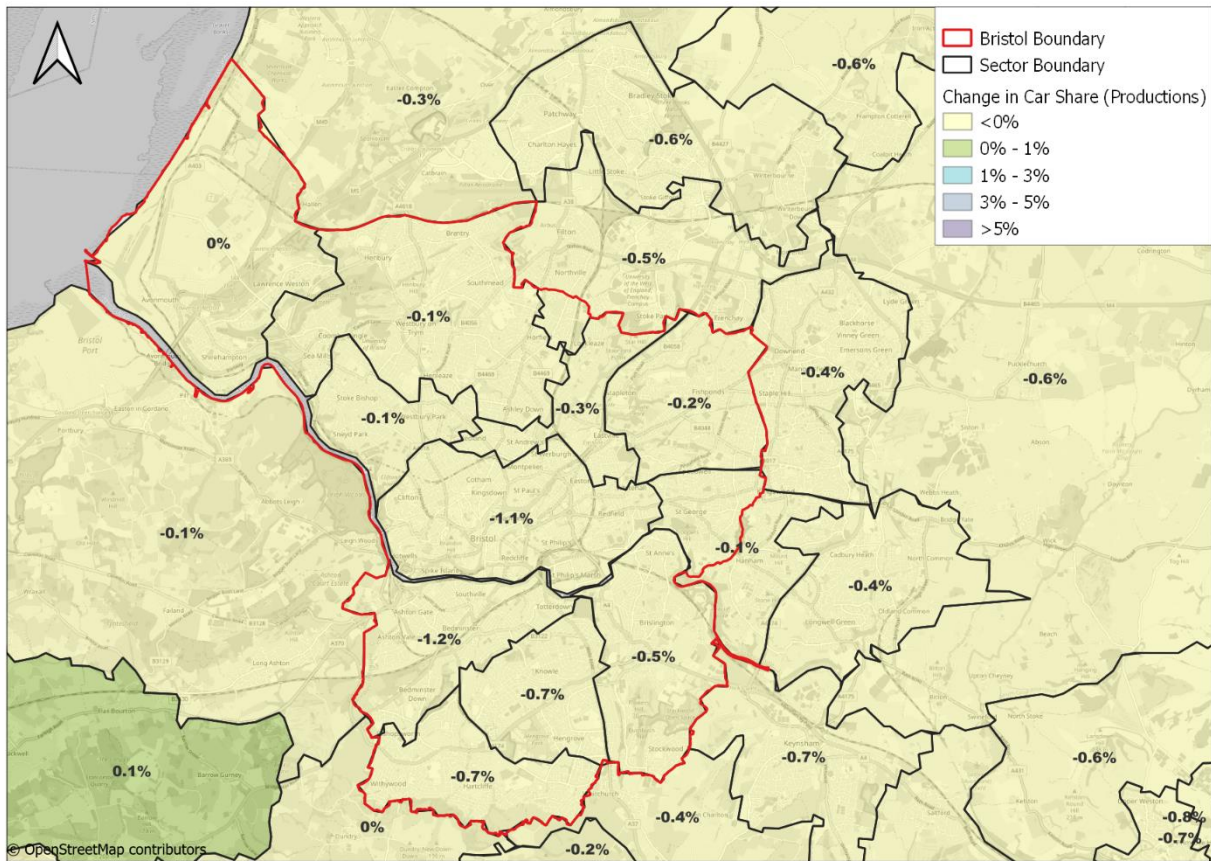
**Table 7-3 – Mode Shares by Purpose (vs DM)**

Purpose	BCC:24hr P/A Trips				Mode Share				Change in Mode Share			
	Car	PT	Walk	Cycle	Car	PT	Walk	Cycle	Car	PT	Walk	Cycle
HBW	132,482	31,528	39,352	17,893	59.9%	14.2%	17.8%	8.1%	-0.6%	0.0%	0.5%	0.1%
HBEB	26,683	4,238	1,378	707	80.8%	12.8%	4.2%	2.1%	-0.3%	0.1%	0.2%	0.0%
HBEd	42,390	21,044	48,170	5,482	36.2%	18.0%	41.1%	4.7%	-0.4%	0.0%	0.4%	0.0%
HBShopPB	164,497	37,974	63,892	9,399	59.7%	13.8%	23.2%	3.4%	-0.5%	0.0%	0.5%	0.0%
HBRecVFR	123,154	24,214	34,483	3,009	66.6%	13.1%	18.7%	1.6%	-1.9%	1.0%	0.8%	0.1%
NHBEB	30,730	1,441	3,542	222	85.5%	4.0%	9.9%	0.6%	-0.2%	0.0%	0.1%	0.0%
NHBO	132,337	10,962	49,720	182	68.5%	5.7%	25.7%	0.1%	-0.8%	0.0%	0.8%	0.0%
<b>Total</b>	<b>652,274</b>	<b>131,402</b>	<b>240,539</b>	<b>36,895</b>	<b>61.5%</b>	<b>12.4%</b>	<b>22.7%</b>	<b>3.5%</b>	<b>-0.8%</b>	<b>0.2%</b>	<b>0.6%</b>	<b>0.0%</b>

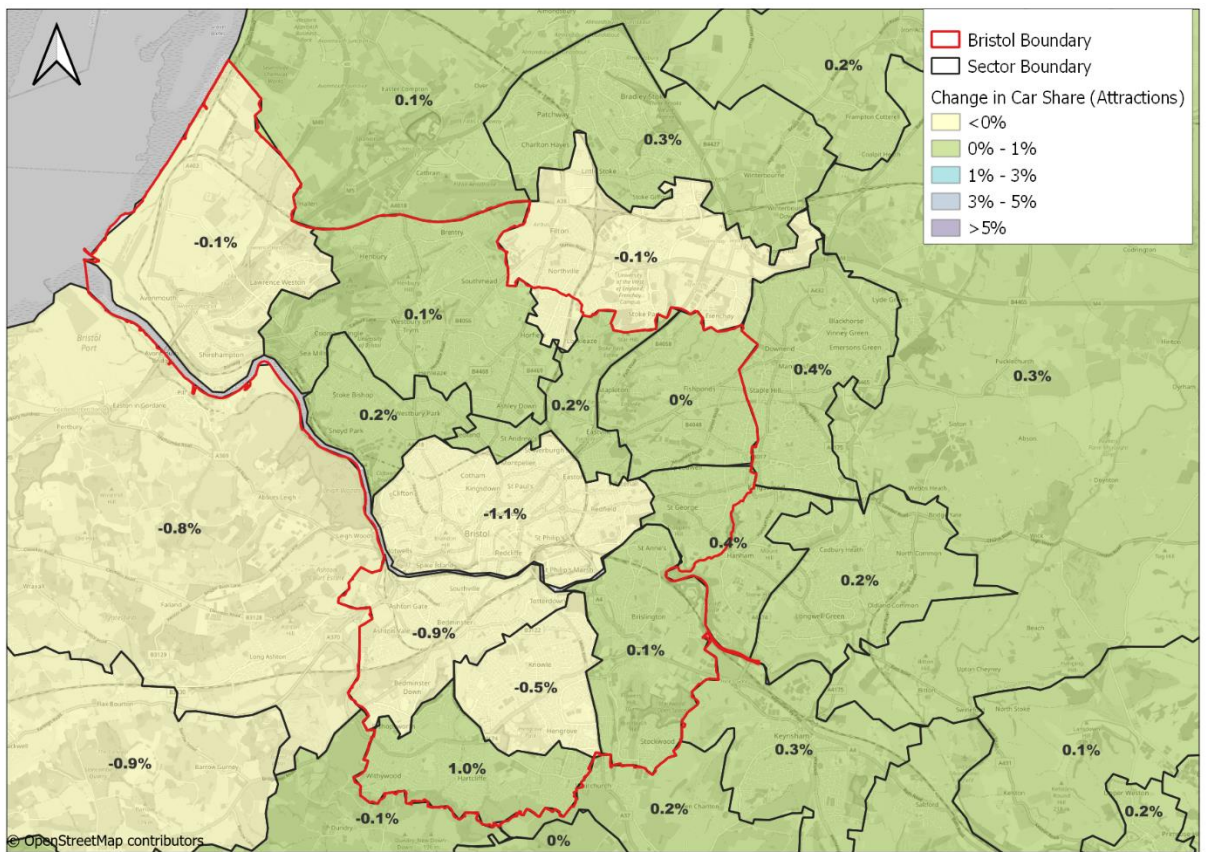
### 7.2.3.2 Mode Shares by Sector

Figure 7-4 and Figure 7-5 presents the change in car mode shares by production and attraction sectors for all purposes between Bristol Local Plan and DM. Car mode shares have decreased as seen in the above table. Notably, Bristol City Centre sector contributing 42% and 43% of dwellings and jobs shows the highest reduction in production car shares, particularly in Recreation and Visiting trips. The mode shares suggest a shift from car to walk, possibly due to concentration of more dwellings and jobs near the city centre. Similar trend is observed in Bristol City Centre for attraction shares where reduction of 1.1% is observed in car mode share. Bishopsworth, Hartcliffe & Whitchurch which has the least number of new dwellings added shows increase of 1% in attraction car mode shares.

**Figure 7-4 –Car Mode Shares (LP vs DM) Productions, All Purposes**



**Figure 7-5 - Car Mode Shares (LP vs DM) Attractions, All Purposes**



## 7.2.4 Trip Lengths

Average trip lengths (measured in Kilometres) in Bristol Local Plan and comparison with DM is presented in Table 7-4. Average trip lengths by Car have minor decrease for all purposes except for Education and Non home based other. Bus journeys see a minor decrease for work, employer business and shopping and non home based other. Rail journeys have increased for work, education and non home based other. Walk and Cycle trip lengths have remained stable.

The decrease in car journeys for shorter trips is due to location of new developments wherein more than 40% of dwellings and jobs are concentrated in Bristol City Centre. Due to this high concentration of jobs and congestion on the network people are preferring PT and Walk as mode of choice for trips within the sector.

**Table 7-4 – Bristol Local Plan Average Trip Length by Purpose by Mode, Comparison to DM**

Purpose	Bristol Local Plan Average Trip Lengths					Absolute Diff to DM				
	Car	Bus	Rail	Cycle	Walk	Car	Bus	Rail	Cycle	Walk
HBW	16.8	7.3	109.4	6.2	1.9	▼ -0.1	▼ -0.1	▲ 0.1	▬ 0.0	▬ 0.0
HBEB	18.3	4.9	65.7	4.4	0.9	▼ -0.1	▼ -0.1	▼ -0.1	▬ 0.0	▬ 0.0
HBEEd	6.3	9.2	15.5	3.9	1.7	▬ 0.0	▬ 0.0	▲ 0.6	▬ 0.0	▬ 0.0
HBSShopPB	15.3	8.5	46.0	4.9	1.5	▼ -0.1	▼ -0.1	▬ 0.0	▬ 0.0	▬ 0.0
HBRecVFR	14.1	7.8	45.3	6.2	2.1	▼ -0.1	▬ 0.0	▼ -0.4	▬ 0.0	▬ 0.0
NHBEB	14.3	6.3	83.8	4.3	0.9	▼ -0.1	▬ 0.0	▼ -0.2	▬ 0.0	▬ 0.0
NHBO	14.2	9.5	74.0	4.4	1.5	▬ 0.0	▼ -0.1	▲ 0.3	▼ -0.1	▬ 0.0
<b>Grand Total</b>	14.6	8.4	82.0	5.5	1.7	▼ -0.1	▬ 0.0	▼ -0.7	▬ 0.0	▬ 0.0

## 7.3 Highway Assignment Outputs

The HAM model convergence for Bristol Local Plan is summarized in Table 7-5 presenting the gap statistics and percentage of links passing the flow criteria for the last four loops. The highway assignment model has converged for all three peaks.

**Table 7-5 – Bristol Local Plan Highway Assignment Convergence Summary**

Scenario	Time Period	Number of iterations	%Flow	%Delay	%GAP
BCC Local Plan	AM Peak	84	99.0	99.2	0.0243
		85	99.3	99.3	0.023
		86	99.2	99.2	0.027
		87	99.0	99.4	0.019
	Inter Peak	40	99.3	99.8	0.015
		41	99.1	99.7	0.0085
		42	99.4	99.8	0.011
		43	99.2	99.8	0.0074
	PM Peak	92	99.0	99.4	0.0270
		93	99.1	99.4	0.0240
		94	99.1	99.5	0.0280
		95	99.2	99.4	0.0240

## 7.3.1 Overall Network Statistics

Table 7-6 below presents the network statistics for Bristol Local Plan and DM for all time periods. There is no significant change between Bristol Local Plan and DM across the peaks.

**Table 7-6 – Bristol Local Plan Overall highway network statistics (whole UK model)**

Time Period	Scenario	DM	Bristol Local Plan	% Diff with DM
AM Peak	Matrix Totals (pcu/hr)	219,951	221,058.4	0.50%
	Total Travel Times (pcu-hrs)	142,217	141,305.2	-0.64%
	Travel Distance (pcu-kms)	7,959,581	7,989,306	0.37%
	Average Speed (km/h)	56	56.50	0.89%
	Total Delay / Vehicle (mins/pcu)	8.52	8.12	-4.69%
	Average Trip Length (pcu.km)	36.19	36.14	-0.14%
Inter Peak	Matrix Totals (pcu/hr)	182,714	184,200.85	0.81%
	Total Travel Times (pcu-hrs)	101,616	102,323.8	0.70%
	Travel Distance (pcu-kms)	6,780,747	6,821,320	0.60%
	Average Speed (km/h)	66.7	66.70	0.00%
	Total Delay / Vehicle (mins/pcu)	3.81	3.83	0.52%
	Average Trip Length (pcu.km)	37.11	37.03	-0.22%
PM Peak	Matrix Totals (pcu/hr)	219,047	221,060.4	0.92%
	Total Travel Times (pcu-hrs)	139,281	140,838.1	1.12%
	Travel Distance (pcu-kms)	7,847,617	7,905,199	0.73%
	Average Speed (km/h)	56.3	56.10	-0.36%
	Total Delay / Vehicle (mins/pcu)	8.34	8.48	1.68%
	Average Trip Length (pcu.km)	35.83	35.76	-0.20%

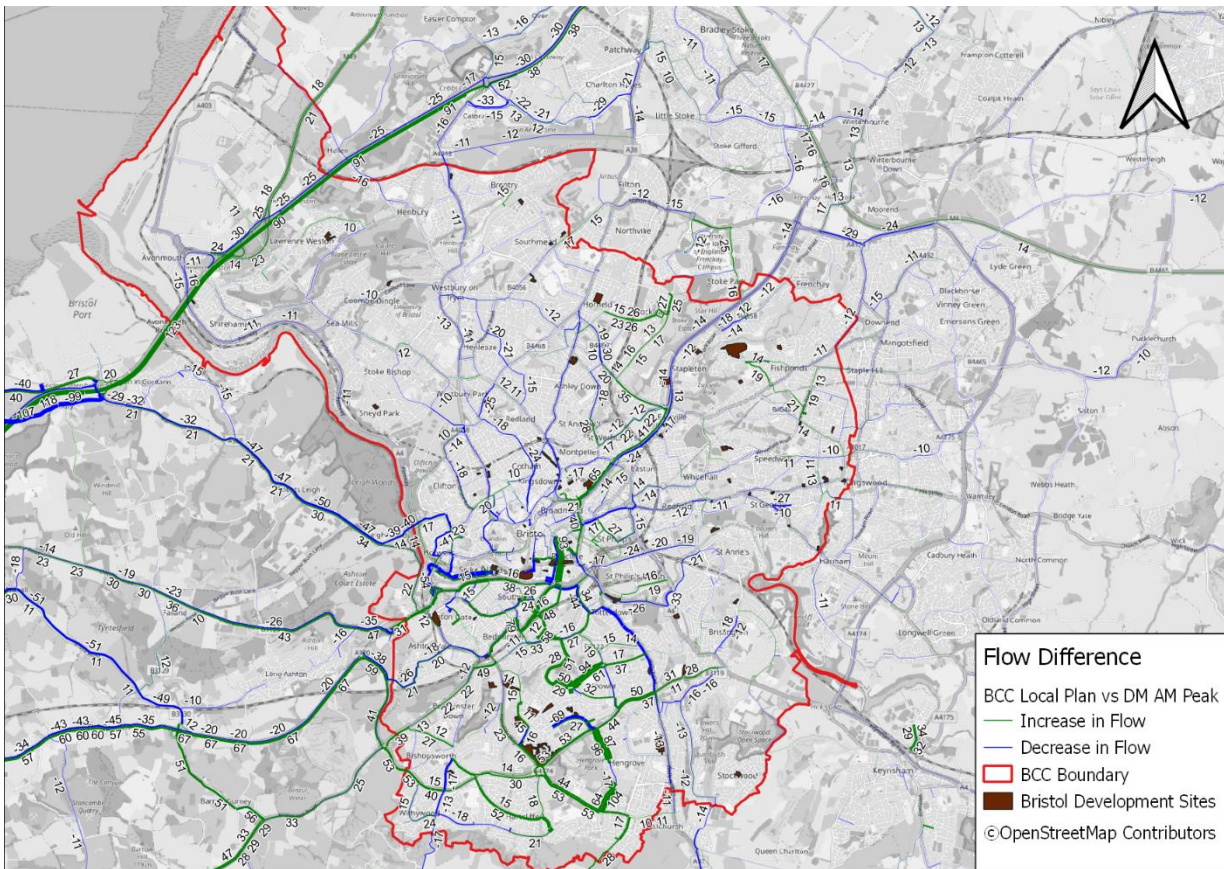
## 7.3.2 Impact on Network

Figure 7-6 and Figure 7-7 below presents the flow and delay difference respectively between Bristol Local Plan and DM in AM Peak, Figure 7-8 and Figure 7-9 presents the same for PM peak. These differences are primarily a result of increased land utilization in the area. During the AM Peak, there is a noticeable increase in traffic flow along Coronation Road and Redcliff Street, as well as on the M5. These increases are attributed mainly to the developments in the Bristol City Centre and Sea Mills, Westbury on Trym & Ashley Down sectors. The rise in traffic at M5 is of the magnitude of 123 pcu/hr and 176 pcu/hr on Redcliff Street respectively, and 68 pcu/hr on the Coronation Road in AM peak. Due to this increase in traffic, there are significant delays observed on Albert Road, A4044 and Victoria Street in the vicinity. It is important to note that the decreases in traffic flow seen are due to rerouting caused by the introduction of new zone connectors.

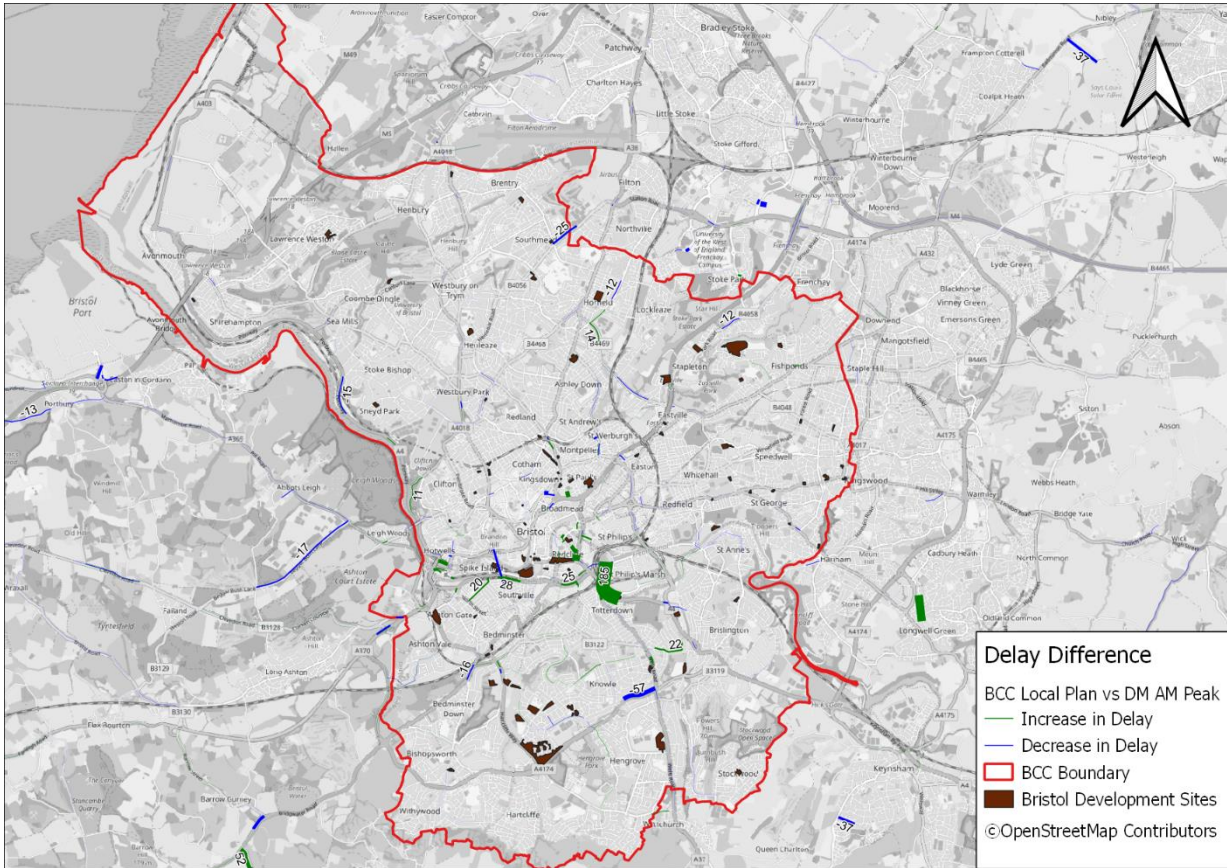
Like the AM peak there is an increase in traffic on Coronation Road, Redcliff Street, M5 as well as on Colston Avenue in the PM peak. Furthermore, we have observed a significant increase in flows on a few local roads like Bamfield, Hengrove Way, Hareclive Road and Whitechurch Lane. Delays are observed on many local roads in

Bristol City Centre, Bedminster as well as Knowle and Hengrove sectors. The reason for these might be additional housing and jobs proposed in these sectors for the local plan.

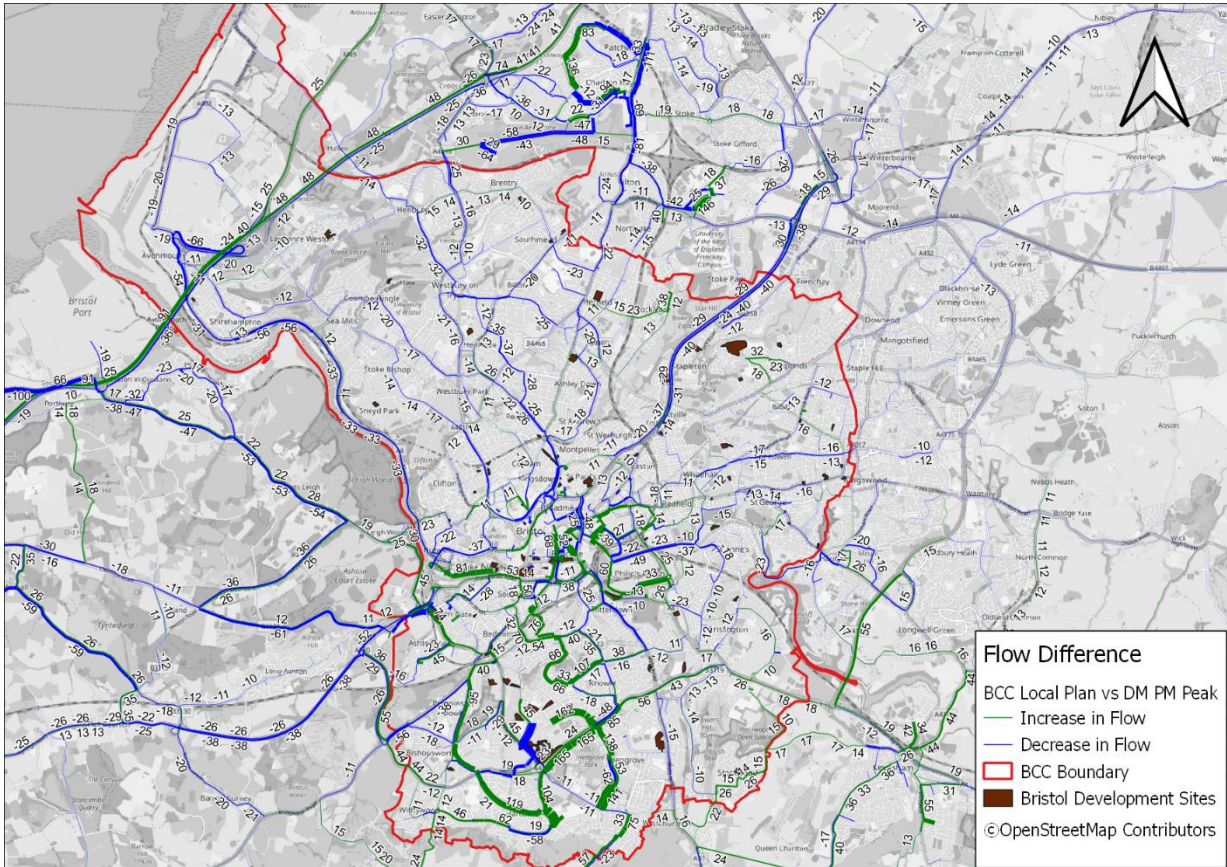
**Figure 7-6 – Bristol Local Plan vs DM Highway Flow difference AM peak**



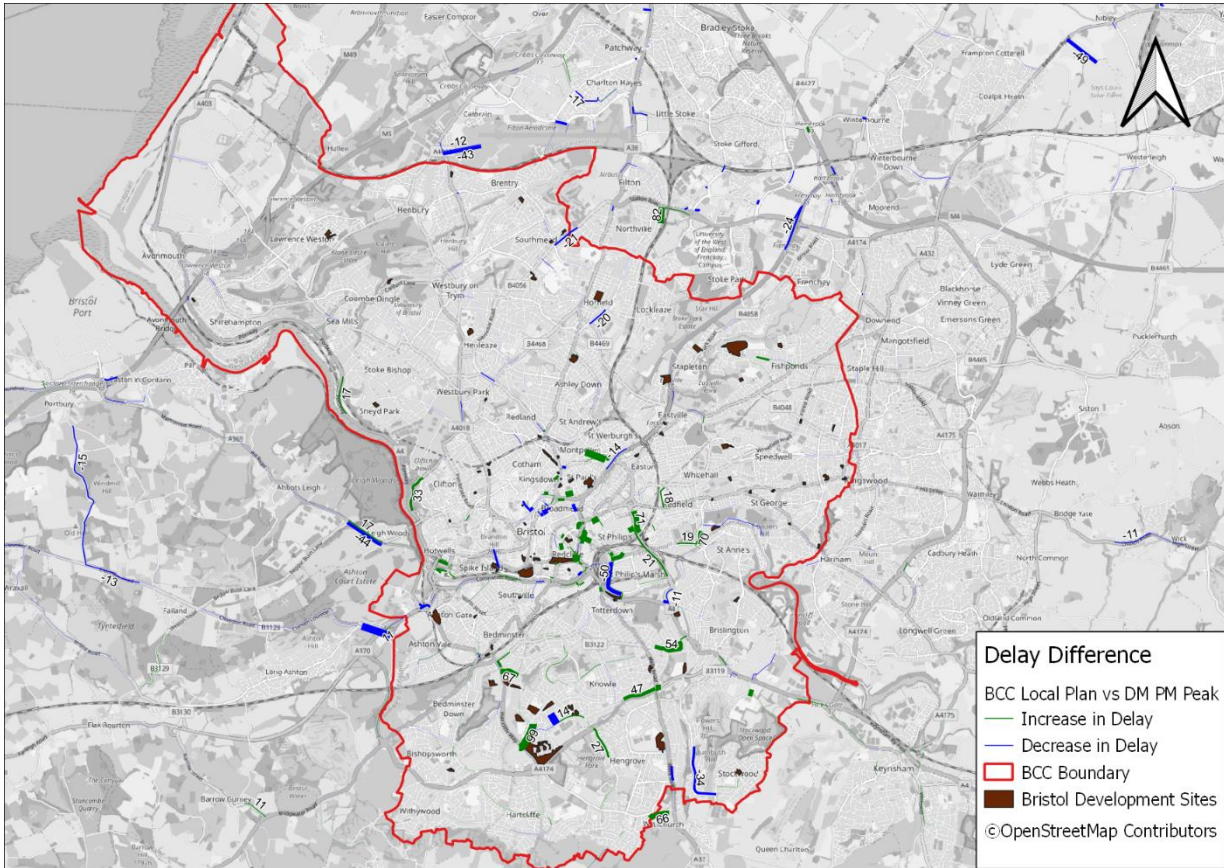
**Figure 7-7 – Bristol Local Plan vs DM Highway Delay difference AM peak**



**Figure 7-8 – Bristol Local Plan vs DM Highway Flow difference PM peak**



**Figure 7-9 – Bristol Local Plan vs DM Highway Delay difference PM peak**



## 7.4 PT Assignment Outputs

### 7.4.1 Bus patronage changes

Figure 7-10 and Figure 7-11 presents the bus flow differences between Bristol Local Plan and DM for AM peak and PM peak respectively. There are minor increases in bus flow along the Hartcliffe Way and Wells Road towards Hengrove serving the new developments. Increase in Bus flows is observed from Hambrook to Bristol near Redcliffe in AM peak. A similar trend is observed in PM peak however directionality is reversed in the PM peak with increase in flow from Bristol to Hambrook and Bristol to Hengrove. These increases are attributed to presence of additional dwellings and jobs in the Bristol City Centre, Bedminster and Knowle & Hengrove sectors.

Figure 7-10 - Bus AM Flow Difference (persons) – Bristol Local Plan vs DM

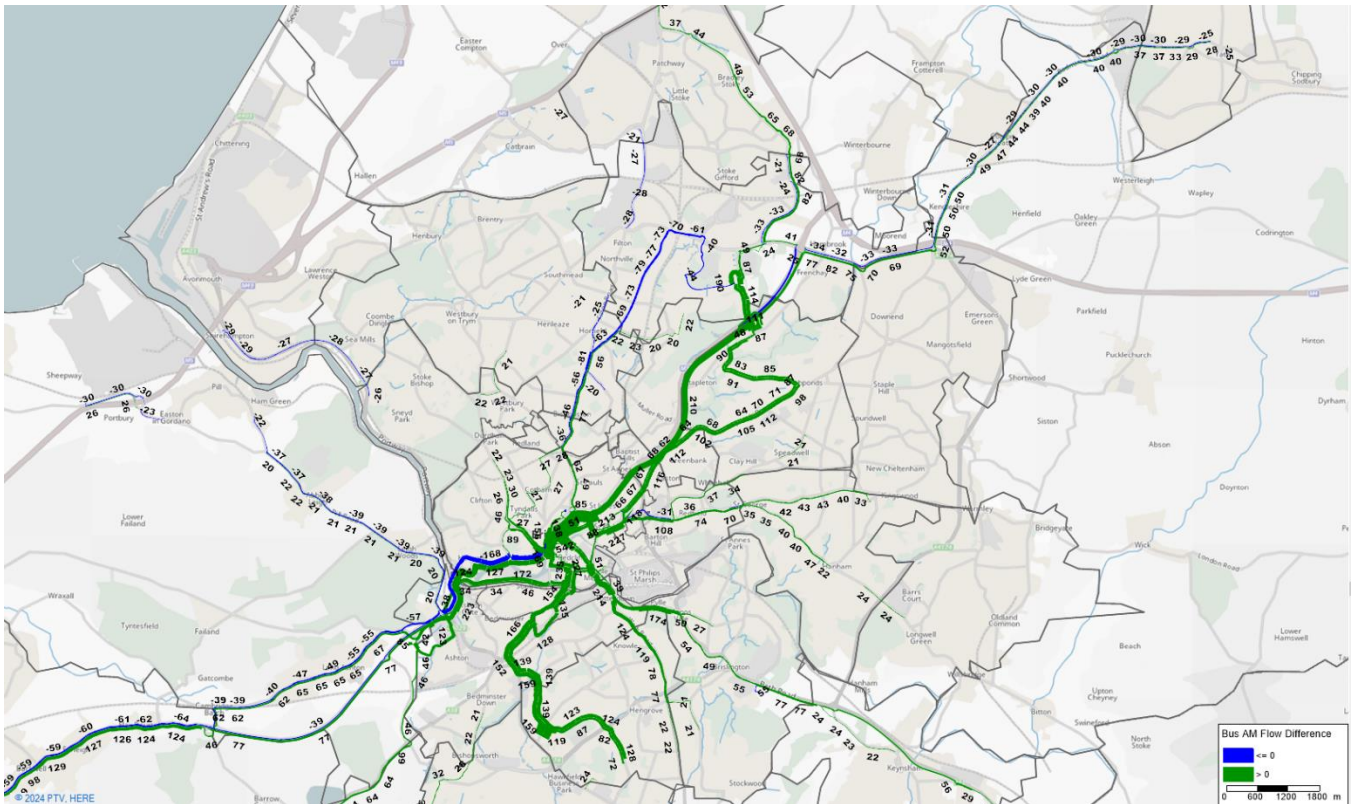
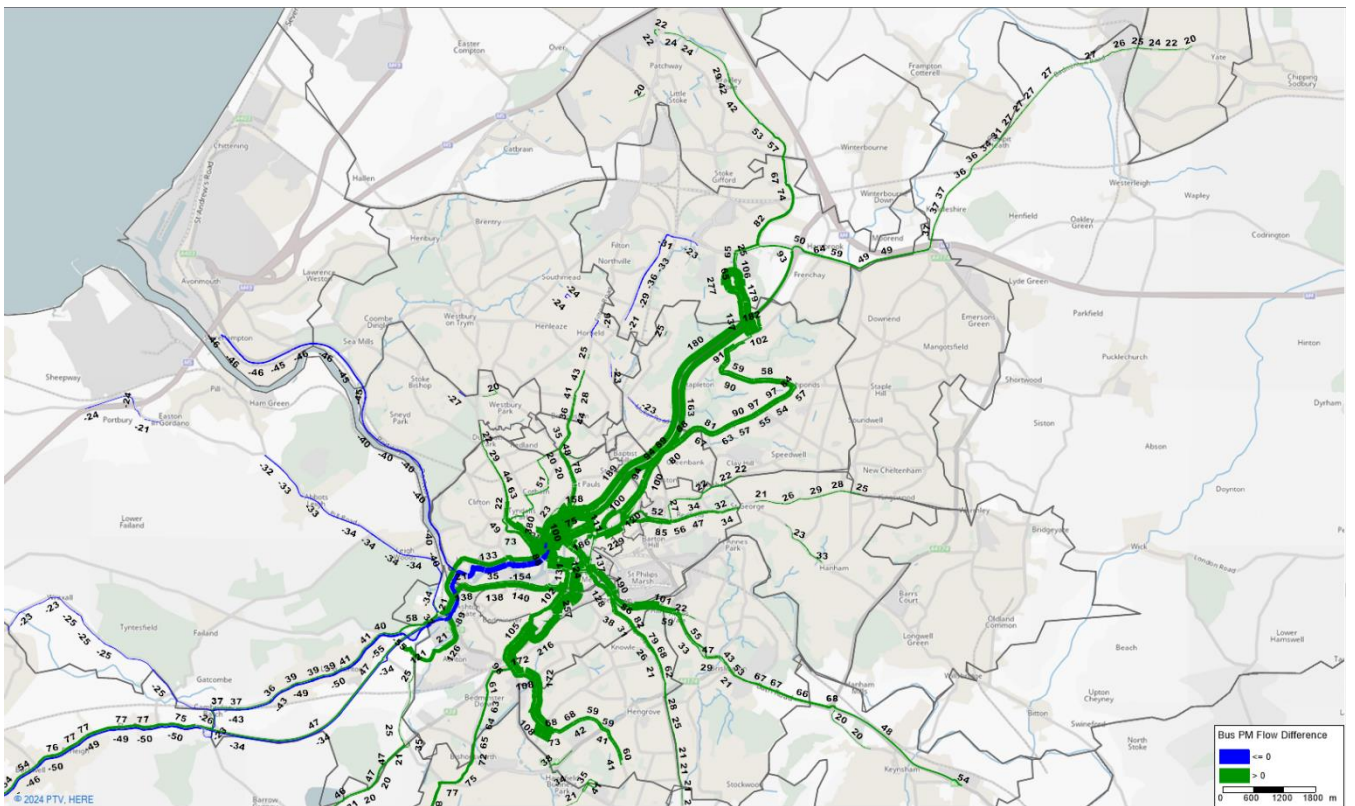


Figure 7-11 - Bus PM Flow Difference (persons) – Bristol Local Plan vs DM



## 7.4.2 Rail patronage changes

Figure 7-12 and Figure 7-13 presents the rail flow differences between Bristol Local Plan and DM for AM and PM peak respectively. An increase in flow from Yate towards Bristol and Keynsham towards Bristol in AM peak due to new developments. The directionality is reversed in PM along with minor increase from Weston village to Bristol.

**Figure 7-12 - Rail AM Flow Difference (persons) – Bristol Local Plan vs DM**

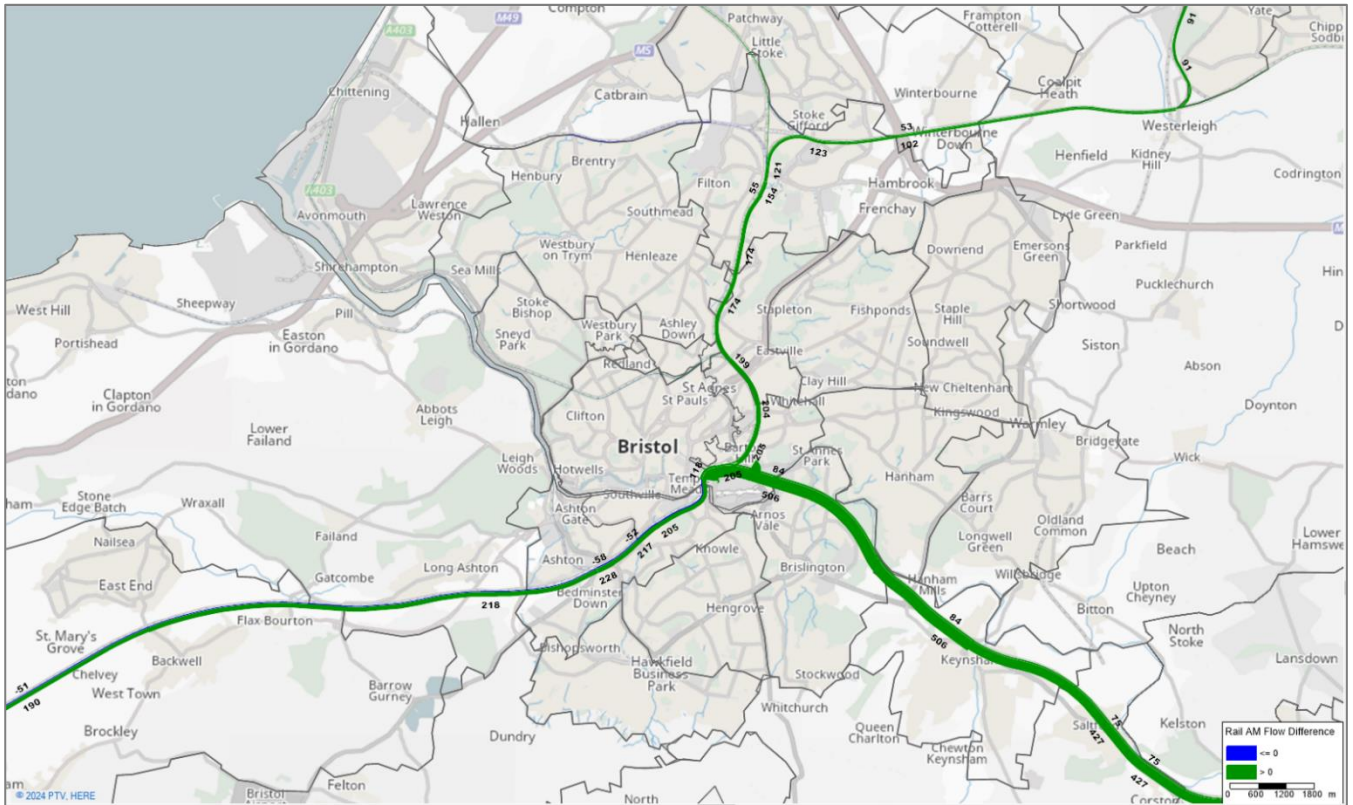
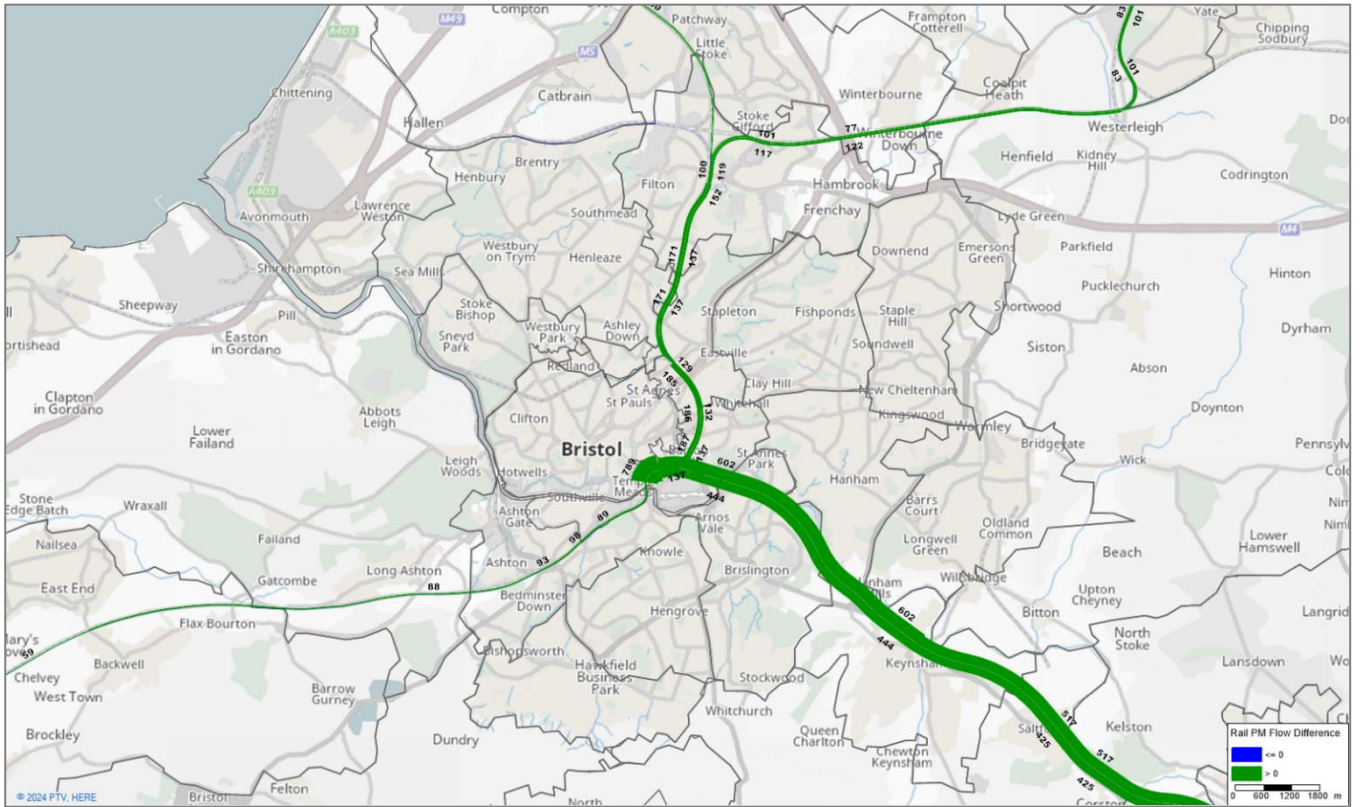


Figure 7-13 - Rail PM Flow Difference (persons) – Bristol Local Plan vs DM



# 8. Summary

## 8.1 Summary of Approach and Assumptions

This report has described the process followed in preparing the Do Minimum and Bristol Local Plan and has outlined the results of those tests. The WERTM model (with a Base Year update to the HAM in SGC) was used for this study and demand and supply changes (derived from a development log) applied as inputs to arrive at a forecast demand. A summary of assumptions during the Do Minimum model development is below:

- WERTM Foundation Case has been used as a building block to develop the local plan forecasts.
- Growth in housing (dwellings) and jobs (including service jobs) are calculated based on the developments. The HCA Employment Density Guide (2015) was used to calculate the number of jobs. Additional school capacity is added in the forecast year based on the growth in housing development i.e., growth in school age children. These growth numbers are then converted to 24-hour Production/Attraction trip ends with the changes in demographics, car ownership and expected travel behaviour controlled to NTEMv8 trip end projections. Freight traffic has been forecast based on National Road Traffic Forecasts 2022.

Along with the demand and supply assumptions, limitations on the inputs mentioned in section 7.1.3 of WERTM Forecasting Report related to economic, political, social/environmental, technological and availability of information are also still valid and should be monitored regularly for any policy changes during the future application of the model. TAG Databook v1.22 is used for the local plan testing.

A 2042 Do Minimum model has been developed with demand and supply inputs from the committed developments and schemes, and the model reached an acceptable level of demand-supply convergence, meeting the convergence requirement laid out by TAG. There is an increase in trips from base year due to increased land use and the model predicts an increase in the use of cars in forecast year, which becomes relatively cheaper, more widely available and provide shorter journey times for the majority of trips. Local and strategic network sees an increase in traffic and delay increases are in line with the flow changes.

The Bristol Local Plan scenario has been developed with new developments in addition to DM amounting to 4%, increase in overall trips respectively in comparison to DM. The modelled scenario for the Bristol Local Plan reached an acceptable level of demand-supply convergence, meeting the convergence requirement laid out by TAG. Model shows an increase in overall trips catering the new developments with preference in usage of active travel modes. The absolute and percentage demand growth by various modes and the mode share for Bristol Local Plan are presented below.

**Table 8-1 – Overall Summary of Change in Demand by Mode.**

Main Mode	Car	PT	Walk	Cycle	Total
<b>Additional Trips for Bristol</b>	2,166	3,892	9,728	974	16,760
<b>Percentage Growth</b>	0.3%	3.1%	4.2%	2.7%	3.9%
<b>Mode Share</b>	61.5%	12.4%	22.7%	3.5%	100.0%
<b>Percentage Mode Share Change</b>	-0.8%	0.2%	0.6%	0.0%	

The model outputs in terms of mode shift align with expectations given the nature and scale of development for Bristol Local Plan. As can be seen from the table above, Bristol Local Plan produces rise in trips overall and for

each mode. The Bristol Local Plan exhibits the smallest rise in car mode share, and also signs of an increase in walk and cycle mode share.

By calculating the proportion of additional trips by each mode, the pattern is clearer. For Bristol Local Plan the proportion of new trips by car is 61.5%. This can clearly be related to the greater density of dwellings and jobs near the city centre and ability to reach destinations with shorter trips, which increases the propensity to walk and cycle.

The main message from this modelling - adding additional housing and jobs (associated with the local plan) does not result in a proportionate increase in highway trips and most of the extra trips are by sustainable modes. Whilst this is a positive message, in terms of policy aspirations, the limitations of WERTM, as a strategic tool, means that AtkinsRealis would urge caution in assuming that additional development growth can be accommodated and won't result in highway impact without more thorough detailed checks and suitable mitigation to adopt more sustainable travel.





# APPENDICES

The background of the page is an abstract composition of overlapping, curved bands. The colors transition from a bright magenta at the top left to a deep blue at the bottom right. The bands are semi-transparent, creating a layered, wavy effect that resembles a stylized landscape or a series of concentric, curved lines.

# Appendix A. Development Log

[Appendix A BCC Uncertainty Log v0.3.xlsm](#)



# Appendix B. Employment Assumptions

## B.1 Employment Density Guide

### 4. Employment density matrix

Use Class	Sub-Category	Sub-Sector	Density (sqm)	Notes
<b>B1a Offices</b>	General Office	Corporate	13	NIA
		Professional Services	12	NIA
		Public Sector	12	NIA
		TMT	11	NIA
		Finance & Insurance	10	NIA
	Call Centres		8	NIA
<b>B1b</b>	R&D Space		40-60	NIA lower densities will be achieved in units with higher provision of shared or communal spaces
<b>B1c</b>	Light Industrial		47	NIA
<b>B2</b>	Industrial & Manufacturing		36	GIA
<b>B8</b>	Storage & Distribution	National Distribution Centre	95	GEA
		Regional Distribution Centre	77	GEA
		'Final Mile' Distribution Centre	70	GEA
<b>Mixed B Class</b>	Small Business Workspace	Incubator	30-60	B1a, B1b – the density will relate to balance between spaces, as the share of B1a increases so too will employment densities.
		Maker Spaces	15-40	B1c, B2, B8 - Difference between 'planned space' density and utilisation due to membership model
		Studio	20-40	B1c, B8
		Co-Working	10-15	B1a - Difference between 'planned space' density and utilisation due to membership model
		Managed Workspace	12-47	B1a, b, c
<b>B8 / Sul Generis</b>	Data Centres	Wholesale	200-950	
		Wholesale Dark Site	440-1,400	
		Co-location Facility	180-540	
<b>A1</b>	Retail	High Street	15-20	NIA
		Foodstore	15-20	NIA
		Retail Warehouse	90	NIA
<b>A2</b>	Finance & Professional Services		16	NIA
<b>A3</b>	Restaurants & Cafes		15-20	NIA
<b>C1</b>	Hotels	Limited Service / Budget	1 per 5 beds	FTE per bed
		Mid-scale	1 per 3 beds	FTE per bed
		Upscale	1 per 2 beds	FTE per bed
		Luxury	1 per 1 bed	FTE per bed
<b>D2</b>	Fitness Centres	Budget	100	GIA
		Mid Market	65	GIA – both types tend to generate between 40-50 jobs per gym
		Family		
	Cinema		200	GIA
	Visitor & Cultural Attractions		30-300	The diversity of the cultural attraction sector means a very wide range exists
	Amusement & Entertainment Centres		70	Potential range of 20-100sqm

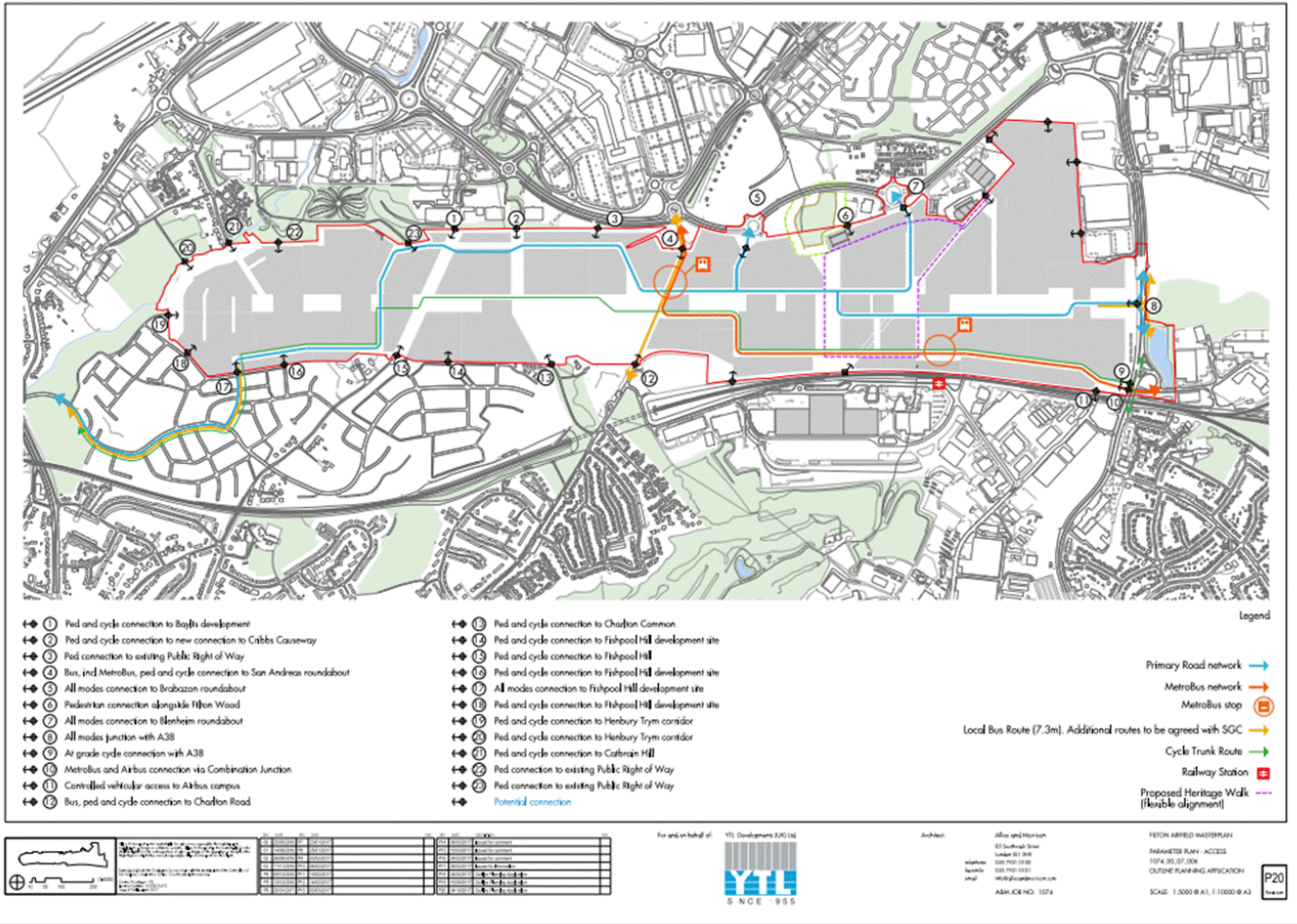
## B.2 Class E Job density

Occupancy levels will vary depending on what type of E Class floorspace is proposed. The following average jobs densities will therefore be used to calculate the occupancy level of different types of E Class floorspace. These are based on the ranges contained with HCA Employment density guide, 3<sup>rd</sup> edition, 2015 and the London Office Policy Review, 2017.

Proposed use	Job density
Class E (a/ b) – shop / café/ restaurant	1 job per 17.5sqm
Class E (c) – financial and professional	1 job per 16sqm
Class E (d) – gymnasiums/ fitness centres	1 job per 65sqm
Class E (g) - offices	1 job per 11.3sqm

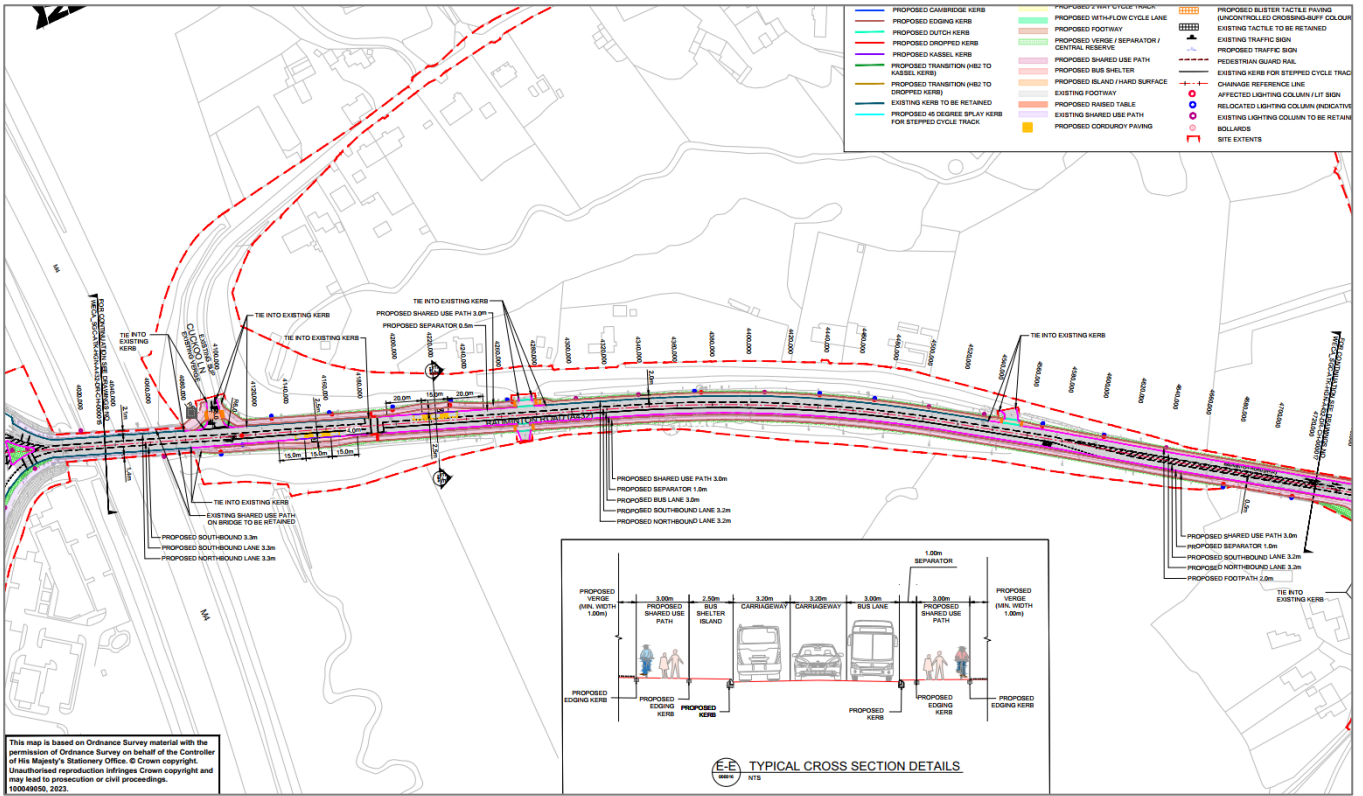
# Appendix C. DM Scheme Drawings

## C.1 Filton Airfield Development Proposed Infrastructure

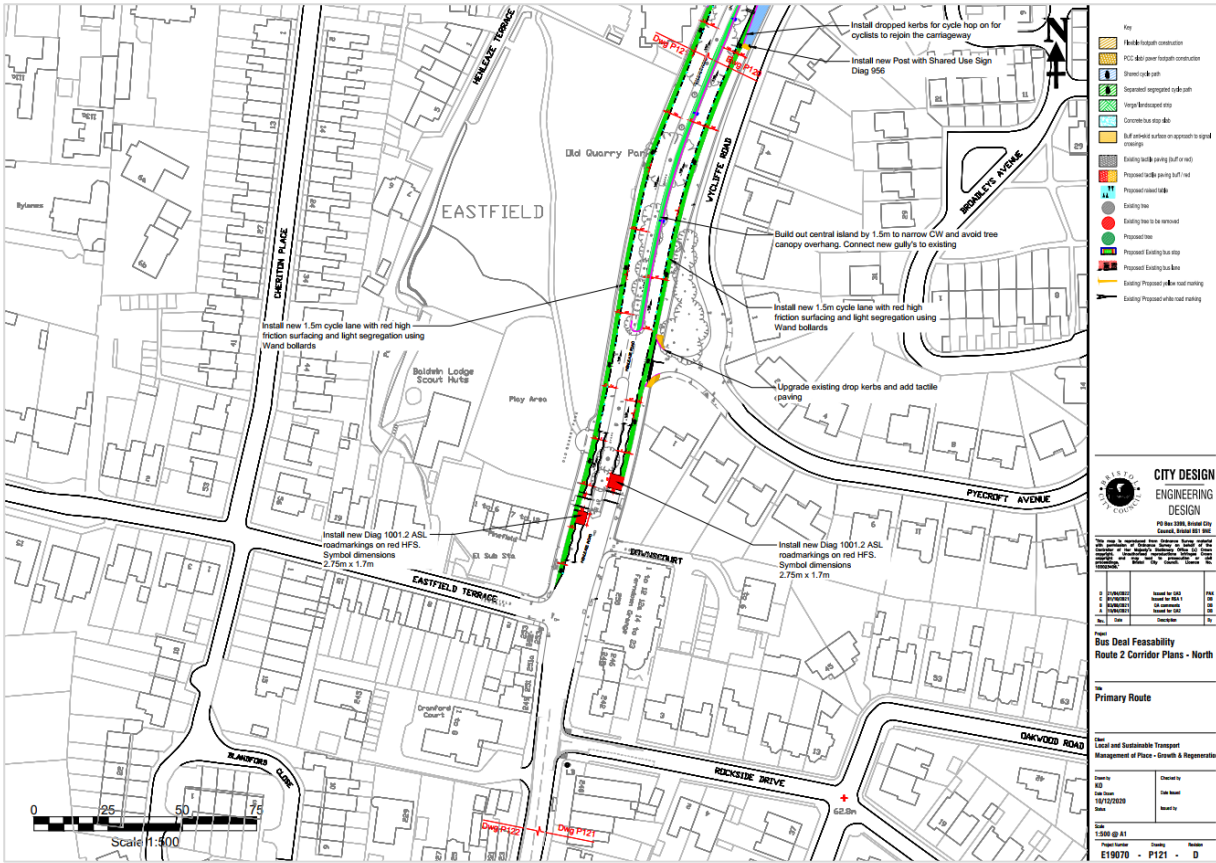




# C.4 A432







- Key
- 1.5m Inbound construction
  - PCC 400 cover bus stop construction
  - Shared cycle path
  - Segregated segregated cycle path
  - Large kerbside stop
  - Concrete bus stop 400
  - Buff kerbside surface on approach to cycle crossings
  - Existing kerb paving (buff or red)
  - Proposed kerb paving (buff or red)
  - Proposed kerbside
  - Existing tree
  - Existing tree to be removed
  - Proposed tree
  - Proposed kerbside for stop
  - Existing kerbside for bus
  - Existing Proposed ASL road marking
  - Existing Proposed white road marking

**CITY DESIGN ENGINEERING DESIGN**

FOR THE 10th Bristol City Council, Bristol BS1 9BE

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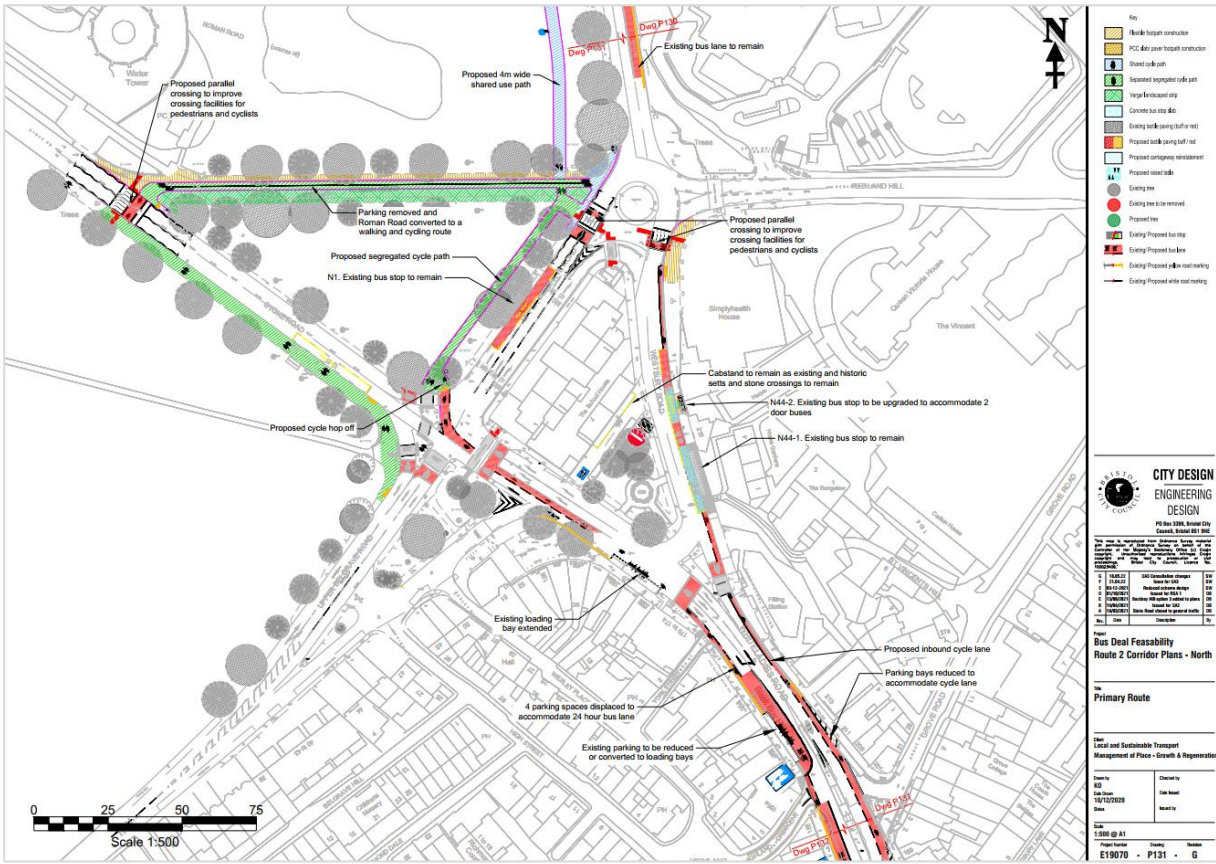
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- Key
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  - Existing kerbside for bus
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  - Existing Proposed white road marking

**CITY DESIGN ENGINEERING DESIGN**

FOR THE 10th Bristol City Council, Bristol BS1 9BE

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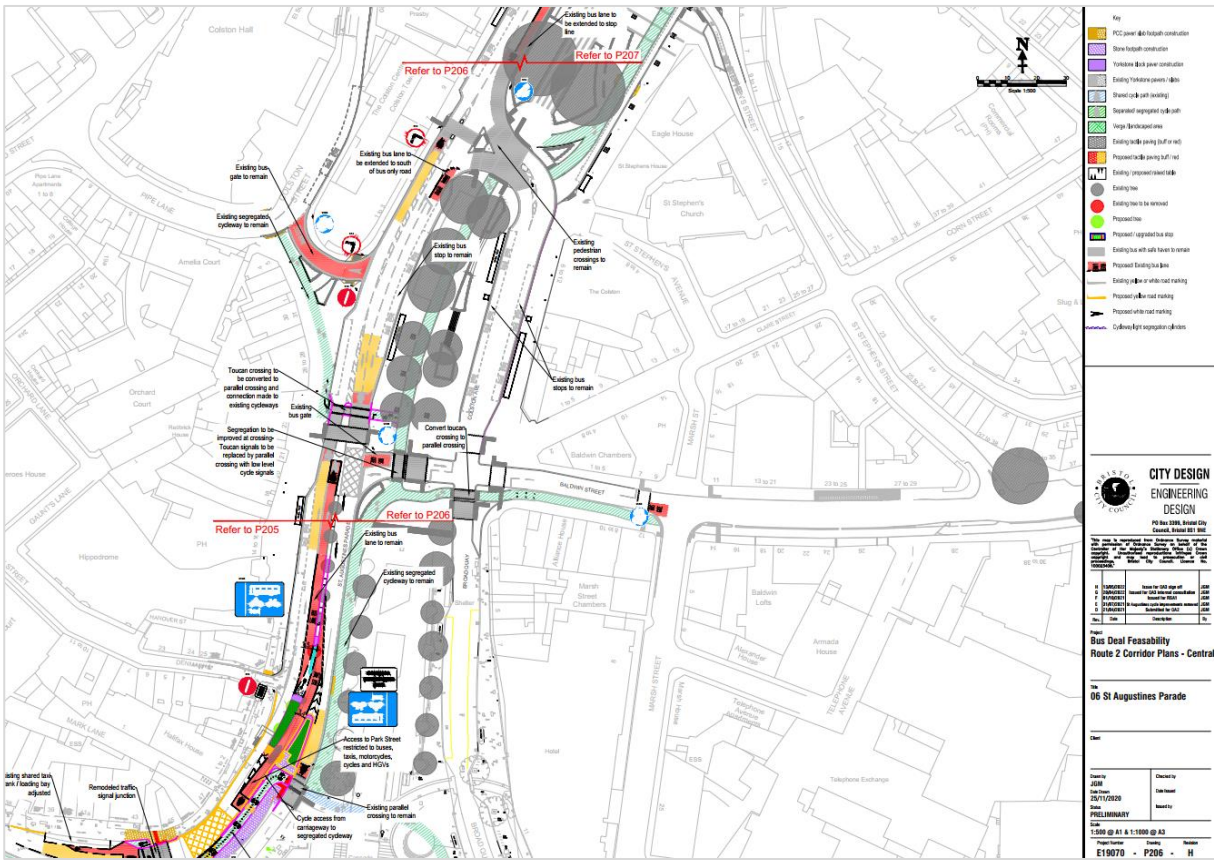
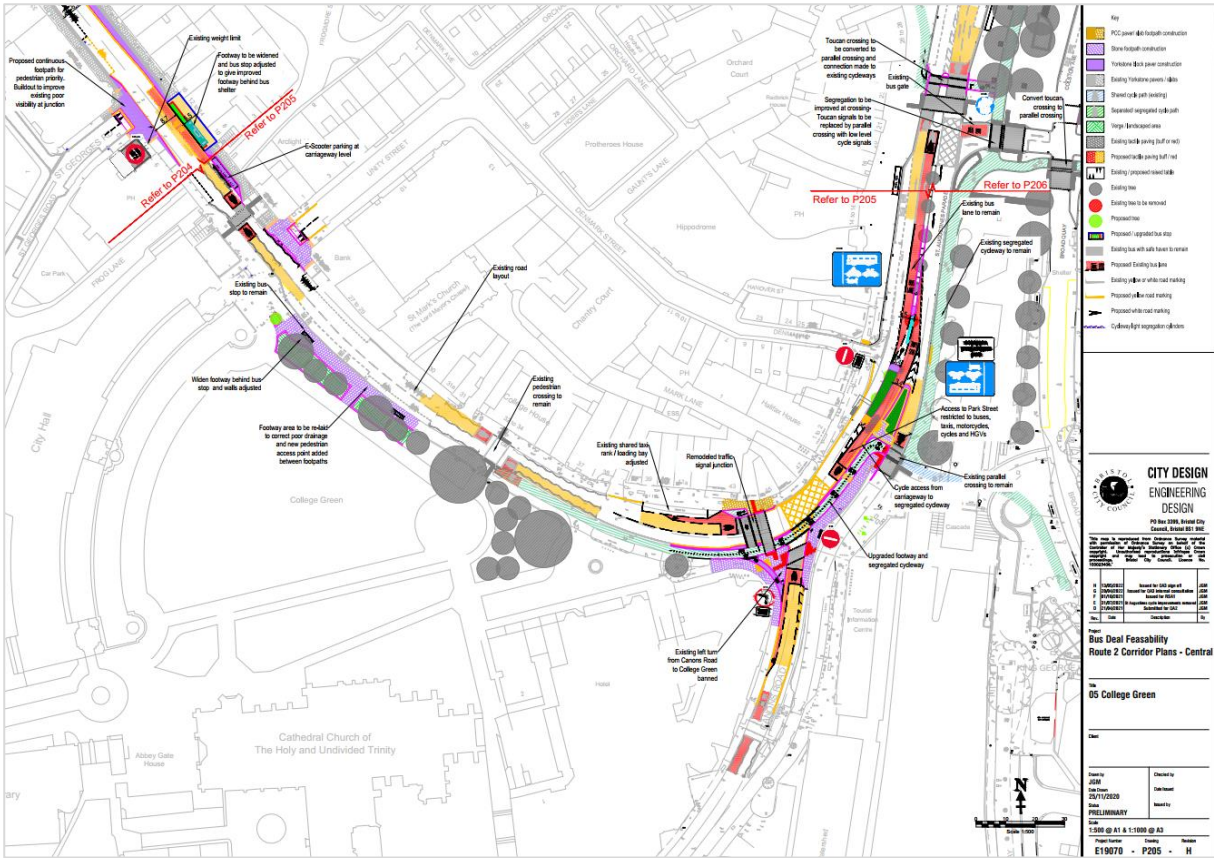
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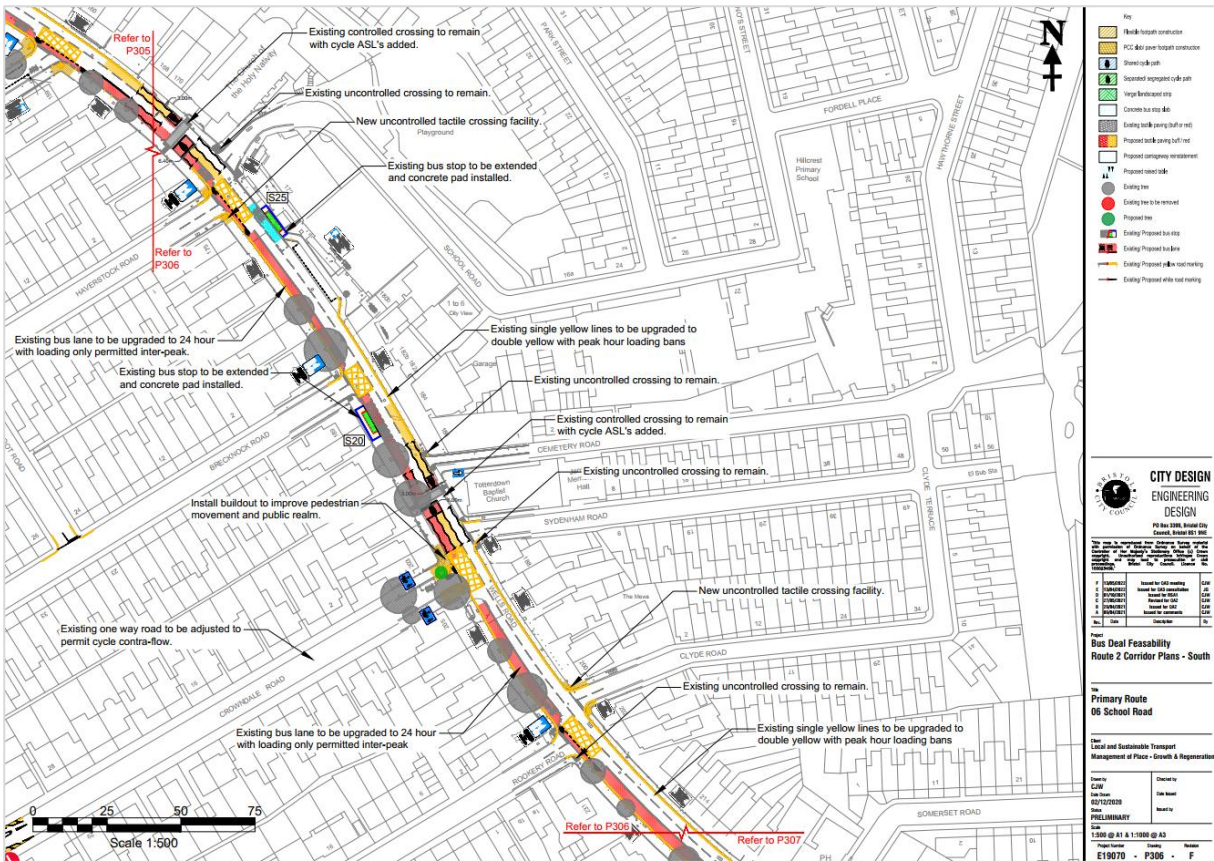
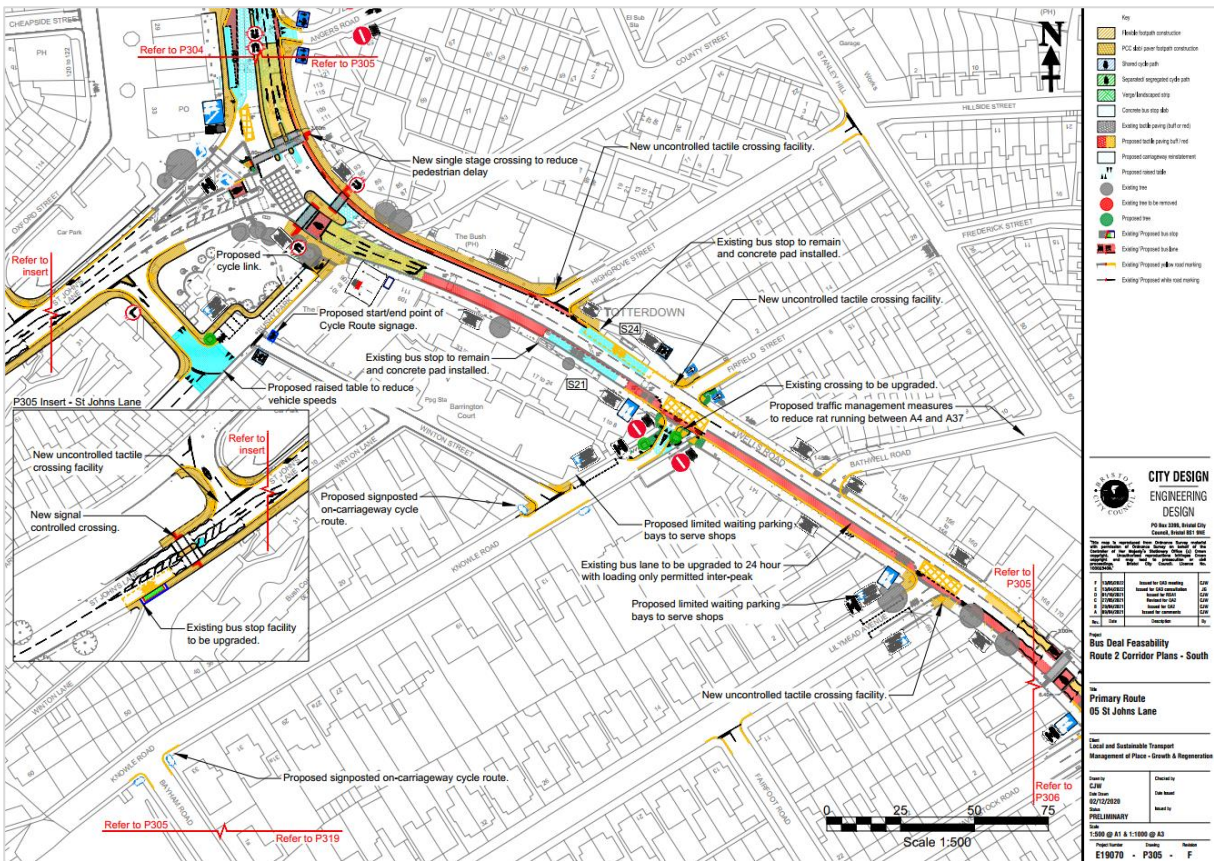
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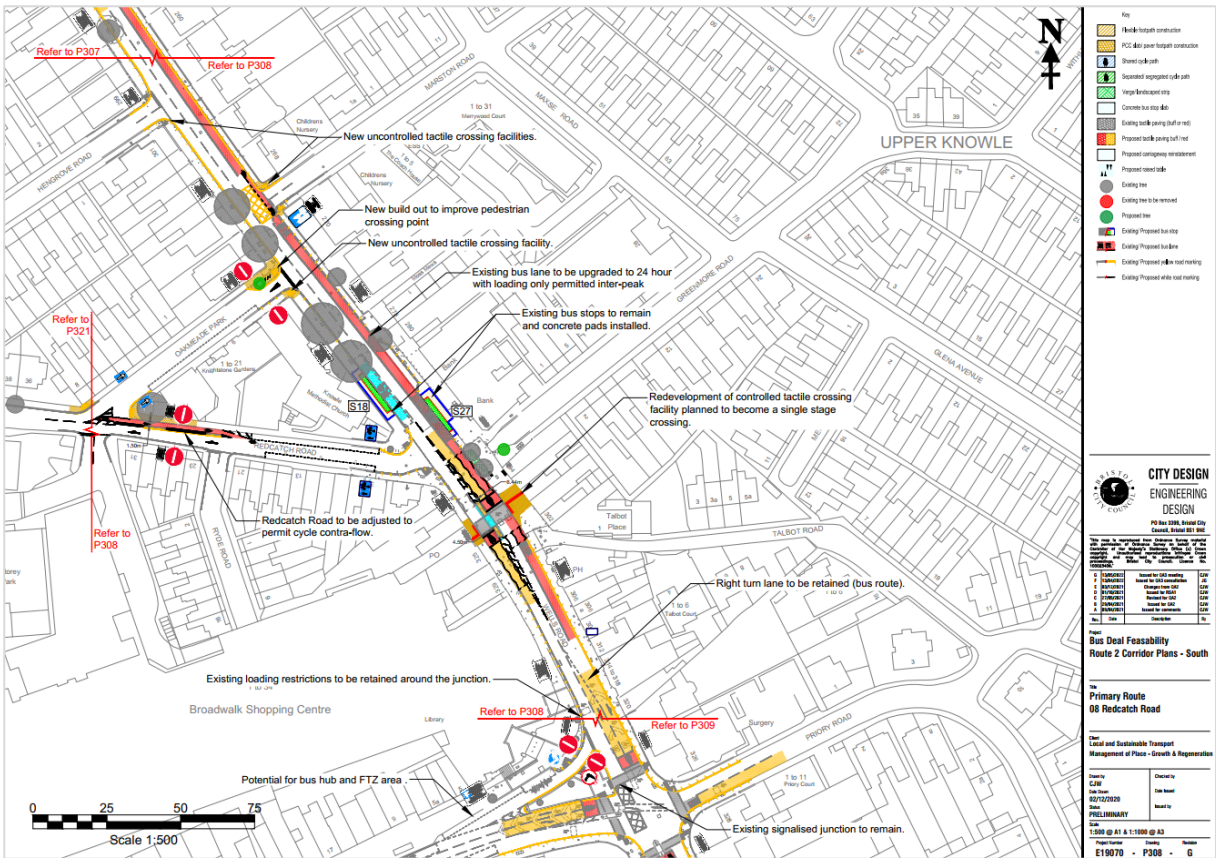
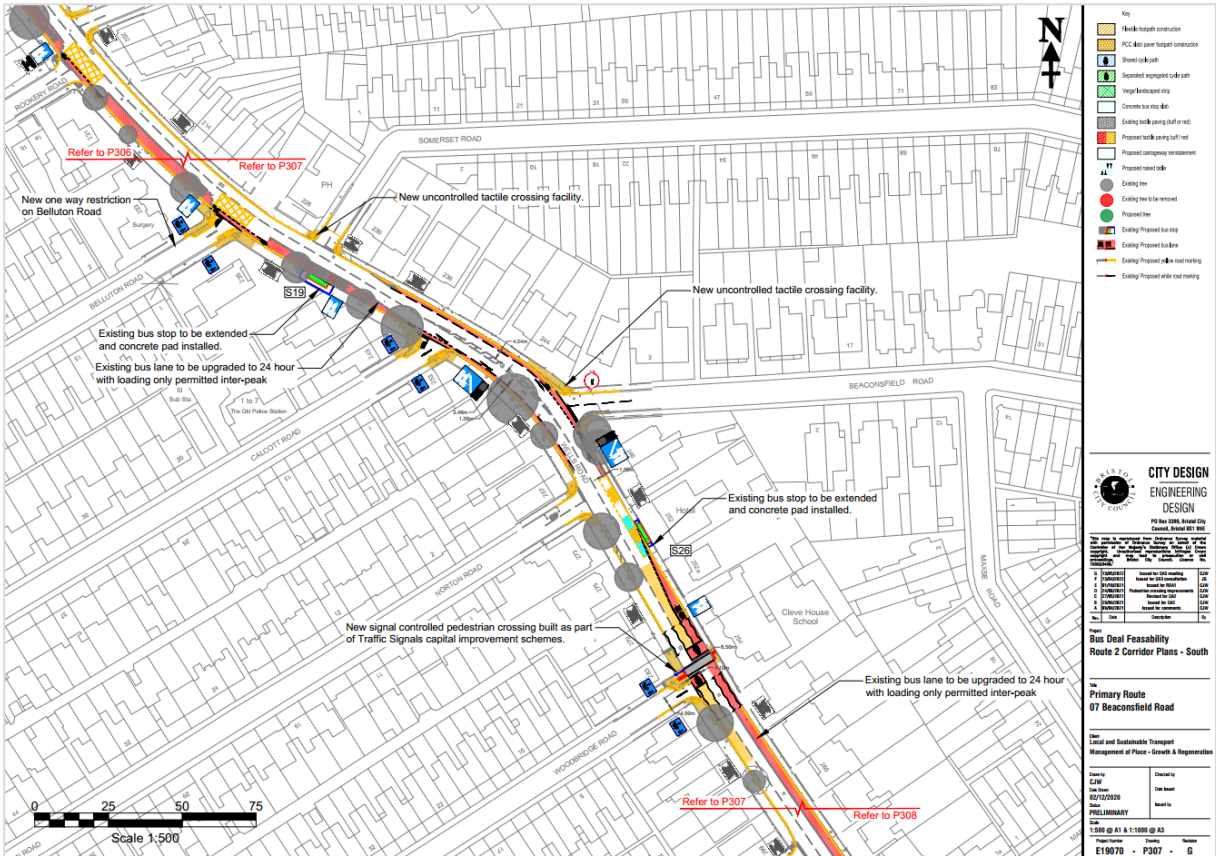


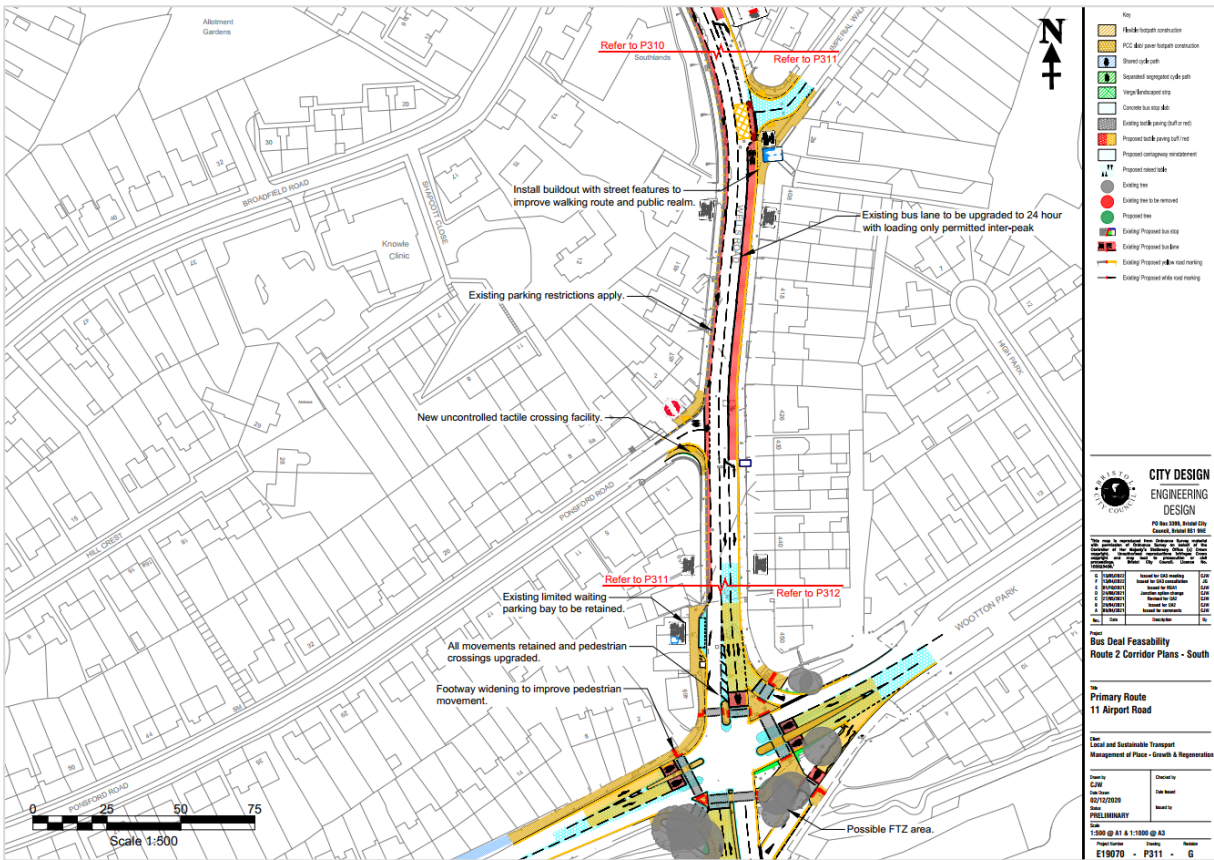
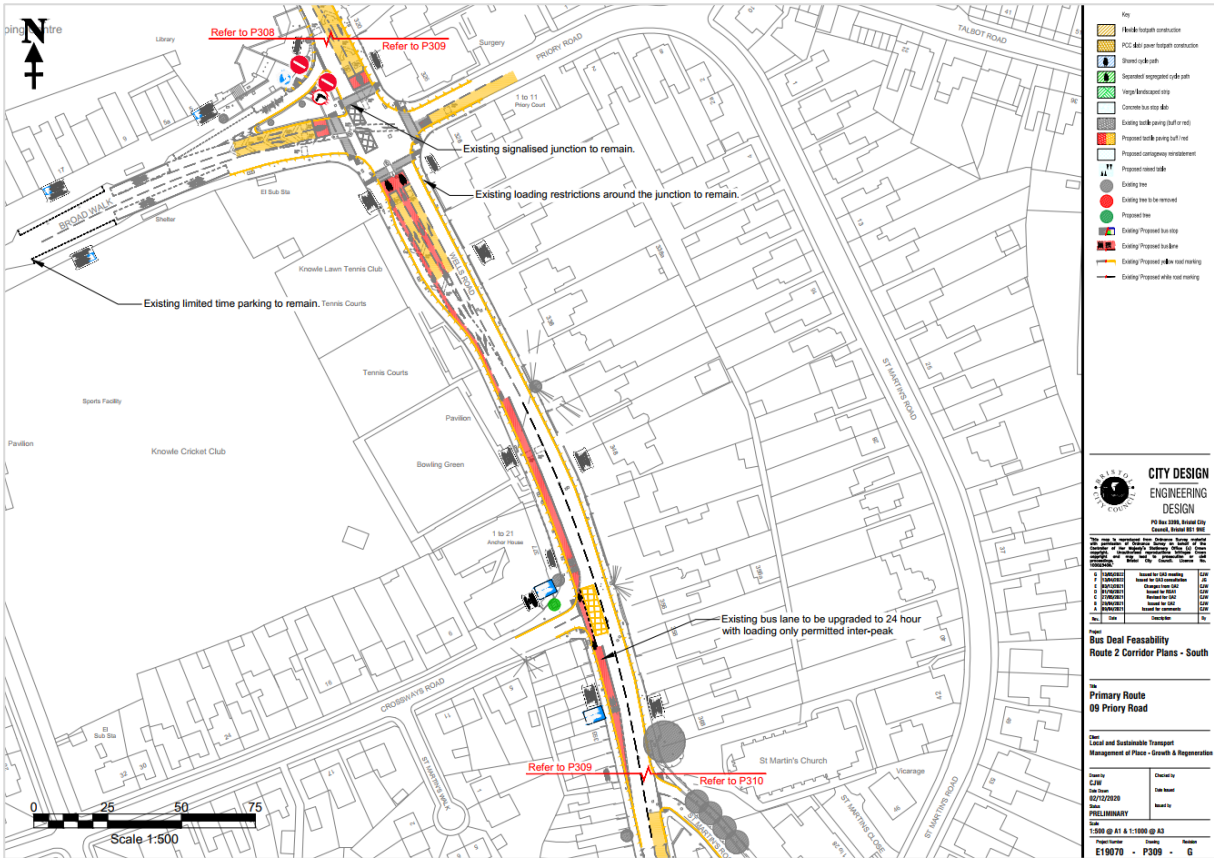




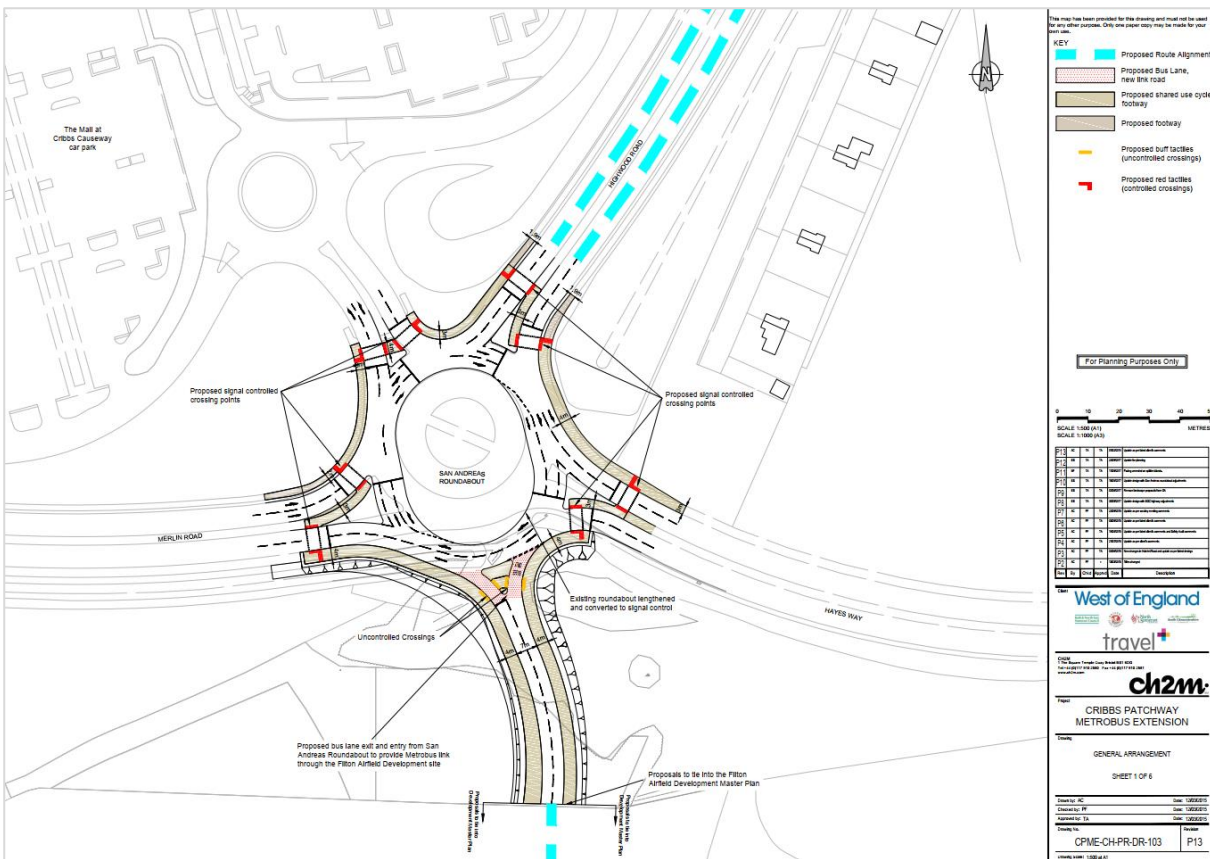
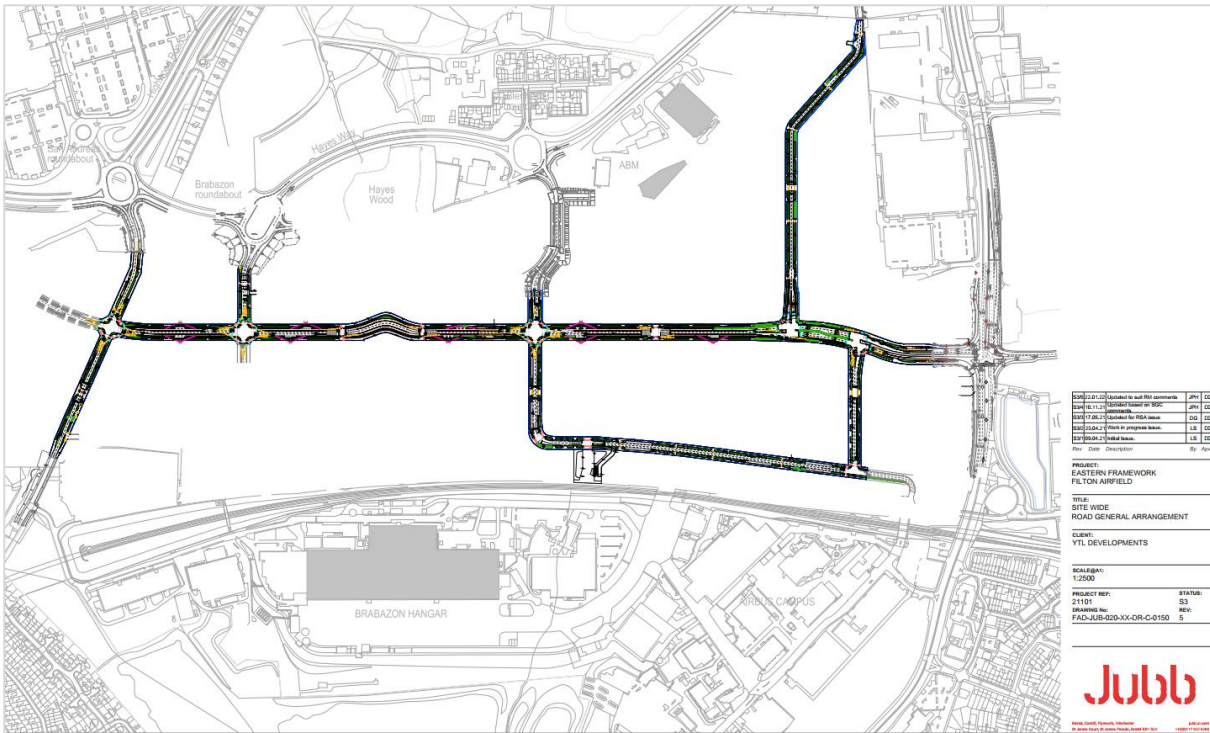




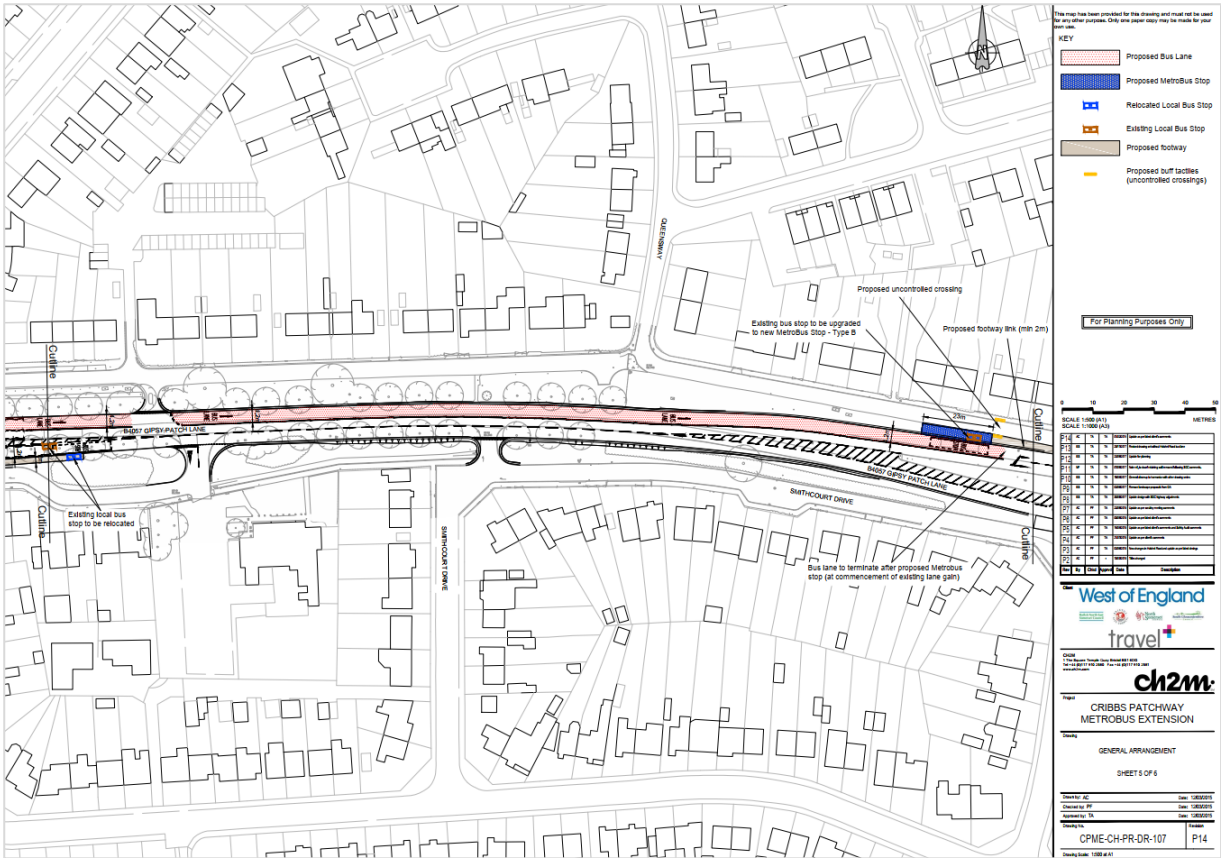




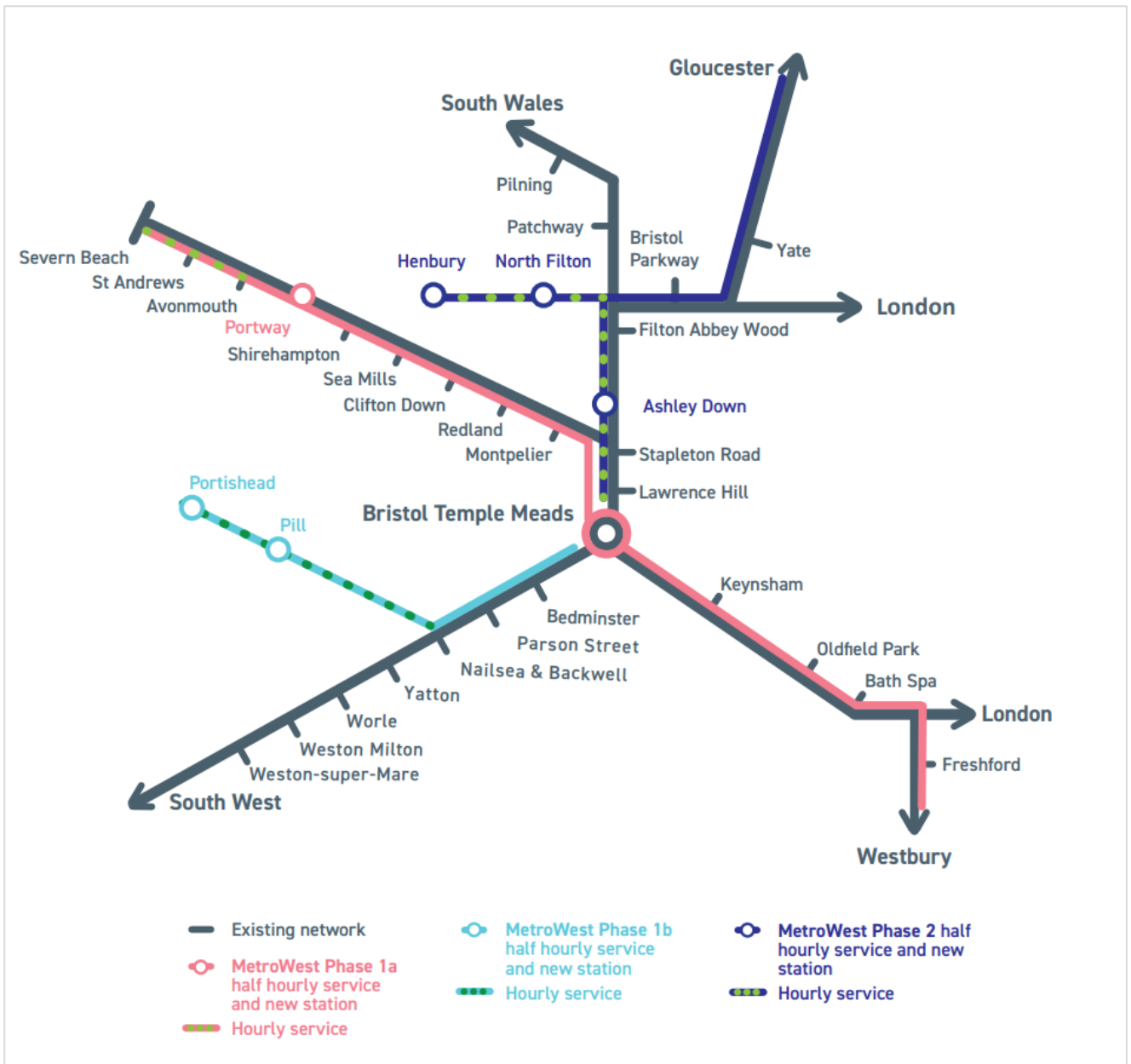
# D.2 Cribbs Patchway Metrobus Extension







## D.3 MetroWest



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<contact info>

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July 2024

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