Bournville Transport Study

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Birmingham City Council

Bournville Places for People
16 June 2023

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1. Introduction

1.1 Background

In October 2021, Birmingham City Council (BCC) published the Birmingham Transport Plan 2031 (BTP), in which one of the core aims is 'Prioritising active travel in local neighbourhoods' with the intention that active travel *"will become the choice for most people making short trips in their local neighbourhood. Cars will no longer dominate street life around homes and schools. A limit of 20mph will be standard on all local roads. Residential neighbourhoods and local centres will be places where people are put first."*

Currently, residents in many parts of Birmingham find that the streets outside their homes are dominated by motor traffic as residential roads are used to avoid congestion along the main roads. During the Covid-19 pandemic, changes to working patterns resulted in residents experiencing quieter and less congested roads. Through the Emergency Active Travel Fund (funded by the Department for Transport (DfT) in June 2020) BCC gained an opportunity to rapidly introduce schemes to maintain these benefits by piloting Places for People (PfP) in areas across Birmingham. Further to this, DfT allocated an Active Travel Fund grant to Local Authorities to enhance the initial schemes and make them permanent.

BCC's Places for People programme aims to reduce the amount of traffic and reduce car reliance in residential neighbourhoods. The aim of the programme is to increase levels of active mode uptake and reconnect communities. As part of Places for People, residents can continue to drive on to their street, but it makes it harder for traffic to drive through the area. The Bournville and Cotteridge Ward has been identified as part of this programme.

As Birmingham begins to navigate its post-Covid recovery, the longer-term impacts and changes resulting from the Covid-19 pandemic on travel and transport are still unknown. However, BCC's Covid-19 Economic Recovery Strategy outlines the need to take radical action to achieve zero carbon emissions, which can be realised through lessons learnt from the pandemic. The substantial decrease in vehicle usage during the pandemic improved air quality and made safer streets for all users.

Data suggested that vehicle use has essentially returned to pre-pandemic levels, however the same observations cannot be made for public transport, particularly traditional Monday to Friday commuting patterns, indicating a change in wider commuting behaviour. However, it is also highlighted that further work is required to build on the benefits of increased levels of walking and cycling that were realised during the pandemic. Looking forward, interventions that will sustain and encourage uptake in active travel choices need to look at areas holistically, instead of singular localised interventions, with the aim to further encourage behavioural change towards more sustainable modes and create an integrated multi-modal system that benefits all road users.

With this in mind, BCC commissioned Jacobs to carry out an area wide transport study of Bournville and its environs, to consider current and historic network performance across the study area and the impacts of the proposed Places for People measures with a view to identifying further interventions to deliver efficient network management; and develop a mitigation strategy for the residual network, (the area without Places for People measures), focusing on displaced traffic, particularly along boundary roads and those adjacent to the proposed Places for People measures.

1.2 Study area

Bournville is located to the south-west of Birmingham City Centre and was founded by the Quaker Cadbury family for the employees at the Cadbury Factory. Bournville was originally designed to be a 'garden village' as part of a 20th century urban planning movement promoting satellite communities surrounding the central city and segregated greenbelts. The study area is the extent of Bournville & Cotteridge ward which is shown in Figure 1-1.

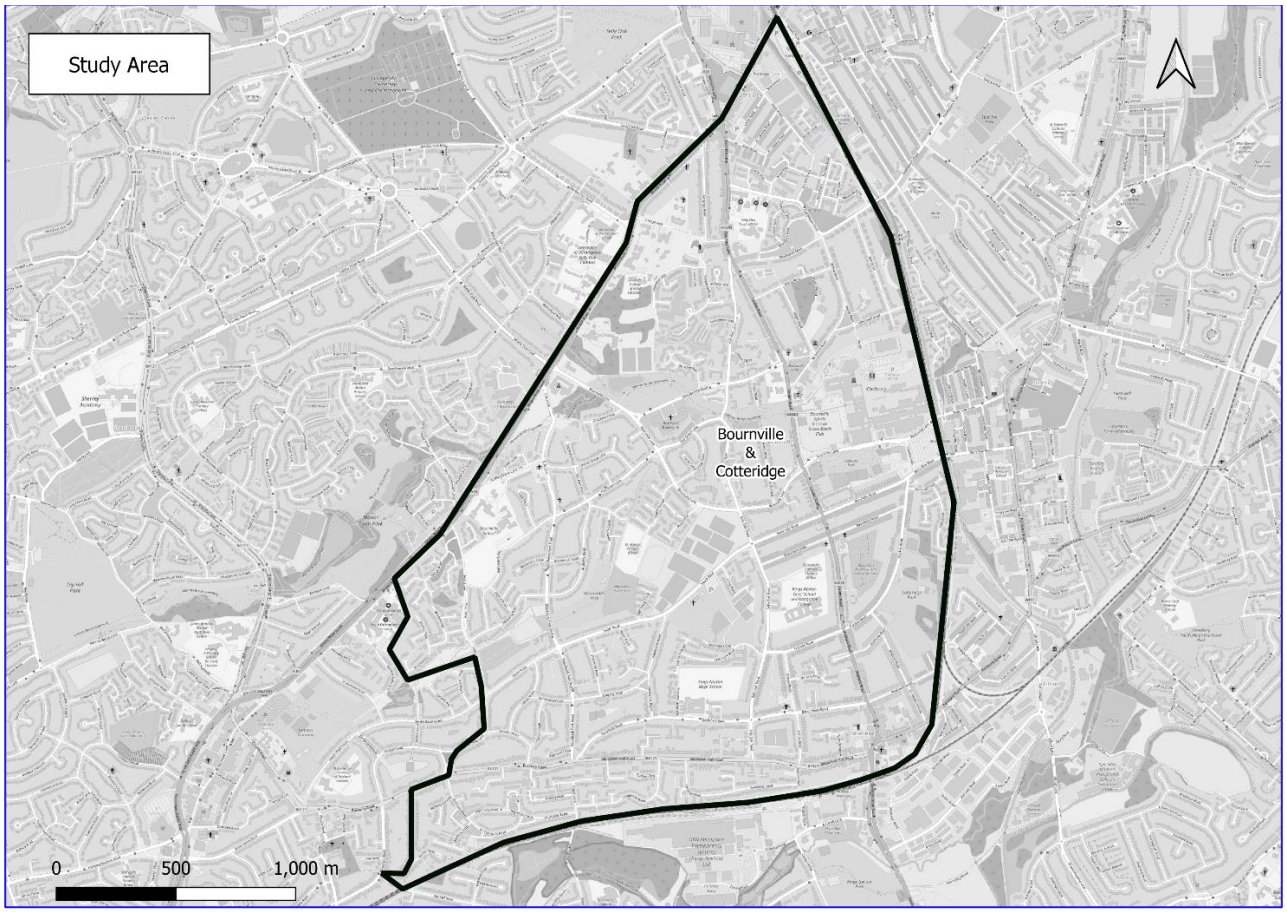

Figure 1-1: Study Area

The study area is bounded by the A38 Bristol Road to the northwest, the Worcester to Birmingham Canal and the Cross-City railway line to the east and A441 Pershore Road and B4121 Middleton Hall Road/ Bunbury Road to the south. These key roads are identified in Figure 1-2.

Further to the above, the boundary roads comprise of:

- A38 Bristol Road South;
- B4121 Middleton Hall Road; and
- A4040 Linden Road.

Key roads that lie within the study area include:

- Heath Road;
- Selly Oak Road;
- Bournville Lane;
- Mary Vale Road; and
- Franklin Road.

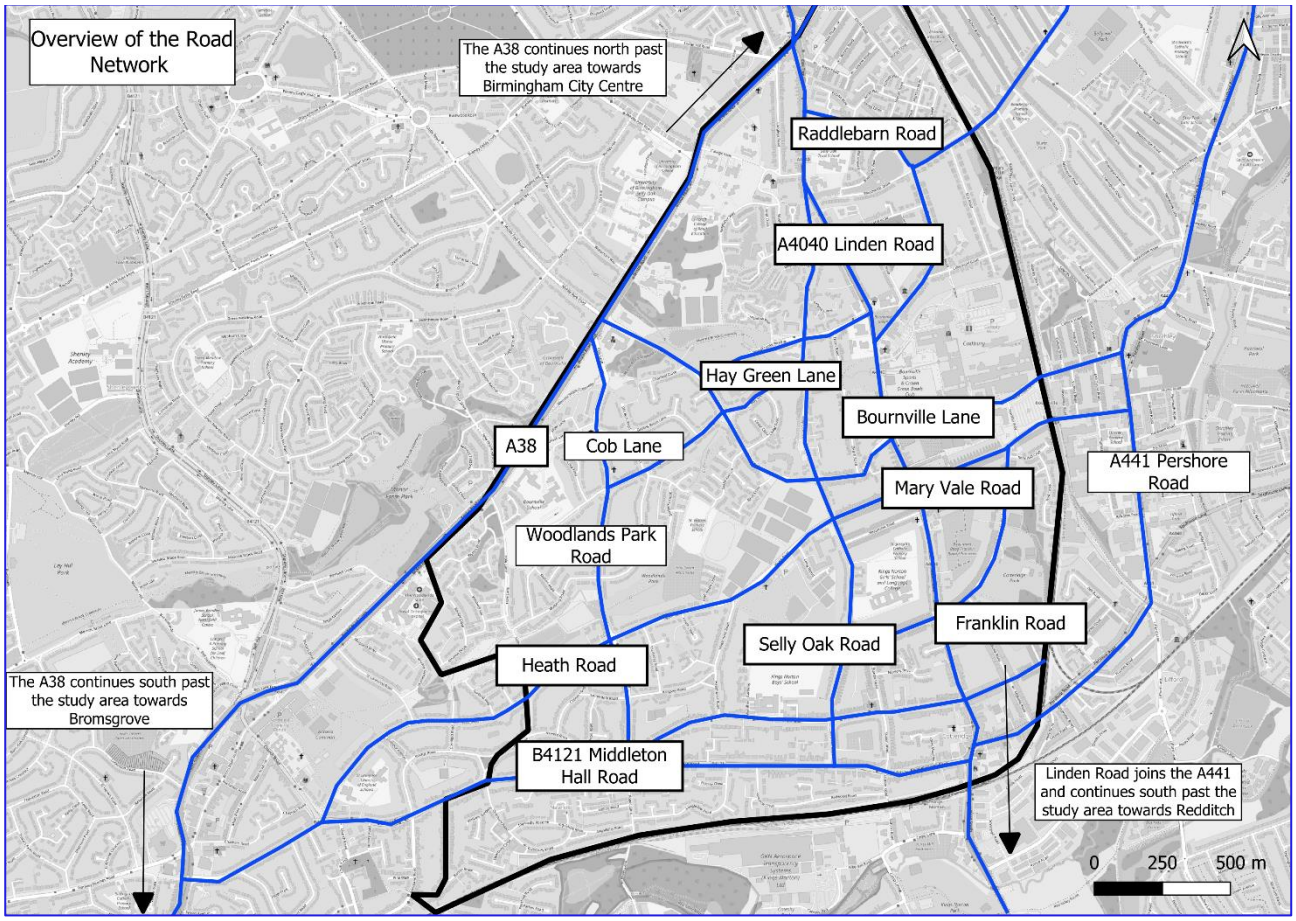

Figure 1-2: Overview of the road network

2. Baseline data

The following section outlines the existing socio-economic, transport and environmental conditions of the study area taken from various data sources.

2.1 Census data

Population statistics have been obtained from Census (2021) data, sourced from the Office of National Statistics (ONS, 2021) and has been tabulated in Table 2-1. The Lower Super Output Areas (LSOAs) selected are shown in Figure 2-1. The population of the study area equals 26,617 across all 15 LSOAs. The number of residents within each LSOA remains mostly consistent. Birmingham 096A has the most residents and Birmingham 112A the least. Overall, the population of all usual residents remains consistent across all selected LSOAs.

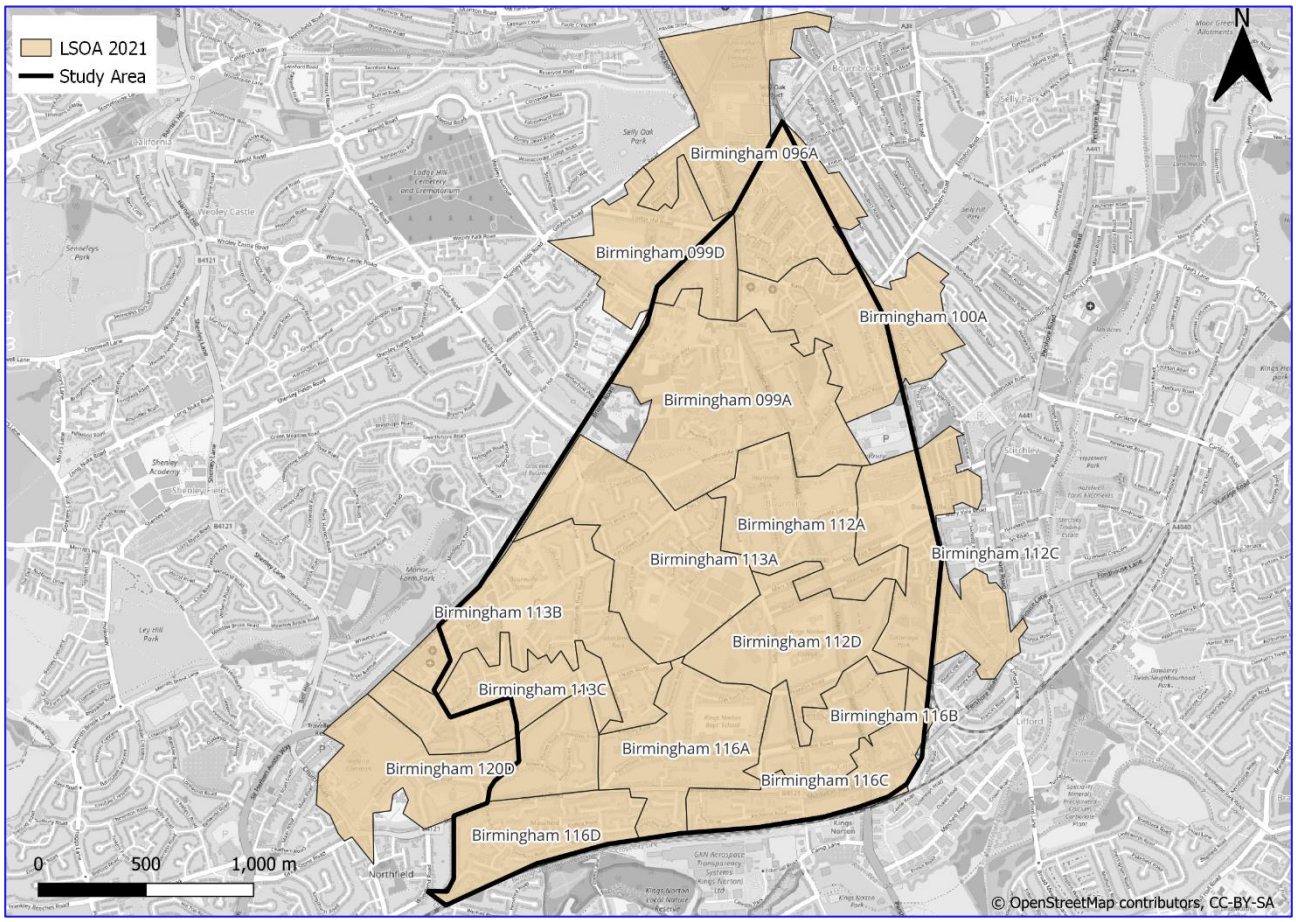

Figure 2-1: Study Area Lower Super Output Areas

Table 2-1: Population data for Study Area LSOA (ONS, 2021)

2021 super output area - lower layer	All usual residents	Area Square kilometre	Density (number of persons per Square kilometre) (2021)
E01009284: Birmingham 096A	4343	665	6.5
E01009281: Birmingham 099A	1545	683	2.3
E01009295: Birmingham 099D	1694	366	4.6
E01009280: Birmingham 100A	1728	442	3.9
E01008951: Birmingham 112A	1405	380	3.7
E01008955: Birmingham 112C	1673	483	3.5
E01008956: Birmingham 112D	1416	375	3.8
E01008950: Birmingham 113A	1428	545	2.6
E01008954: Birmingham 113B	1434	514	2.8
E01008958: Birmingham 113C	1554	326	4.8
E01008959: Birmingham 116A	1730	378	4.6
E01008960: Birmingham 116B	1543	234	6.6
E01008961: Birmingham 116C	1409	273	5.2
E01008962: Birmingham 116D	2088	278	7.5
E01009218: Birmingham 120D	1627	503	3.2
Total	**26,617**		

The population density is displayed in more detail in Figure 2-2. Figure 2-2 shows the population density (number of persons per hectare) by LSOA. The southeast section of the study area has more densely populated residential areas. This may reflect the employment history of the area due to the Cadburys factory being located towards the eastern section of the study area.

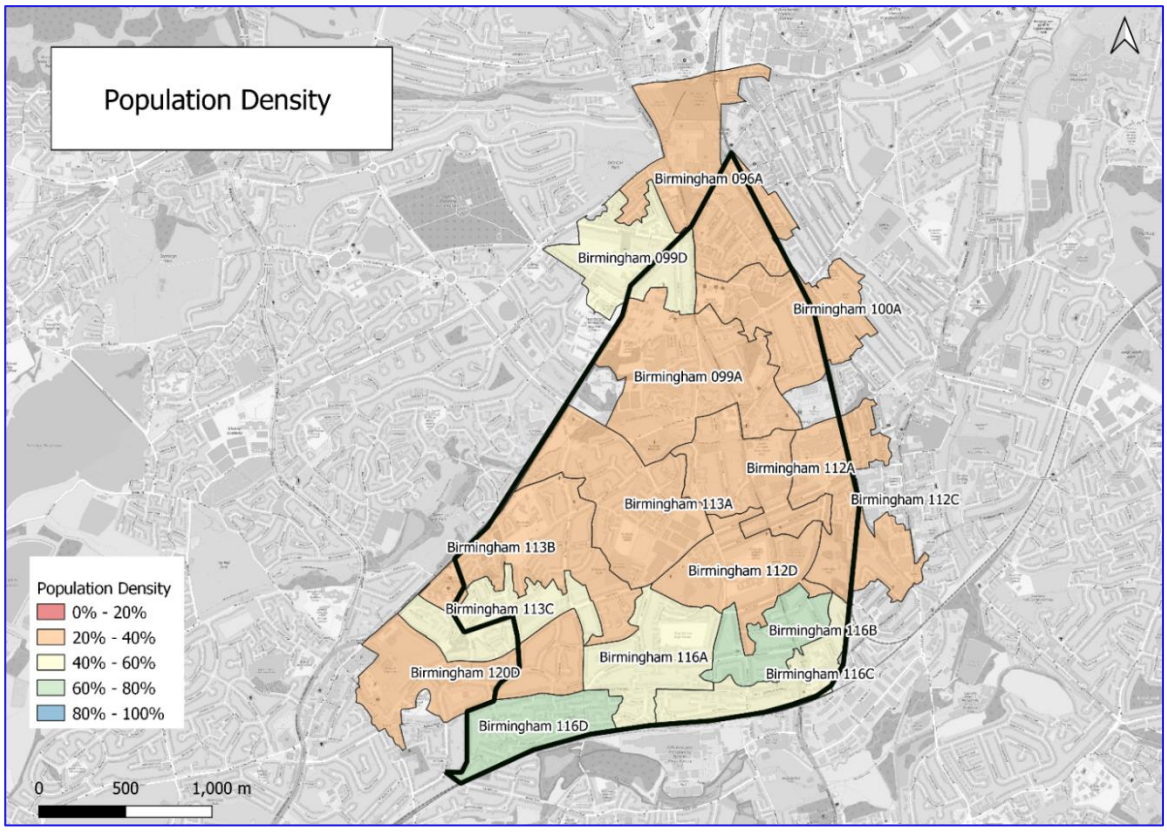

Figure 2-2: Study Area Population Density

2.2 Index of Multiple Deprivation

The English Indices of Deprivation are the official measure of relative levels of deprivation across England, split into 32,844 neighbourhood areas known as LSOAs. Index of Multiple Deprivation (IMD) is calculated by the Department of Levelling Up, Housing and Communities and is based on seven combined and weighted indicators:

- Income deprivation (22.5%);
- Employment deprivation (22.5%);
- Education, skills and training deprivation (13.5%);
- Health deprivation and disability (13.5%);
- Crime (9.3%);
- Barriers to housing and services (9.3%); and
- Living environment deprivation (9.3%).

The IMD ranks each LSOA based upon the above indicators. An LSOA with a rank of 1 is considered the most deprived and an LSOA with a rank of 32,844 is the least deprived. LSOAs are also divided into 10 deciles, with LSOAs in decile 1 falling within the most deprived 10% of LSOAs nationally and LSOAs in decile 10 falling within the least deprived 10% nationally. Figure 2-3 shows that the majority of Bournville falls within 50% most deprived neighbourhoods. However, the southwest corner of the study area falls within the bottom 10%-20% most deprived neighbourhoods nationally with a similar pattern along the eastern edge of the study area. The study area also has one of the least deprived neighbourhoods nationally which covers a section of Linden Road, Rowheath Playing Fields and Kings Norton Girls' School and Sixth Form.

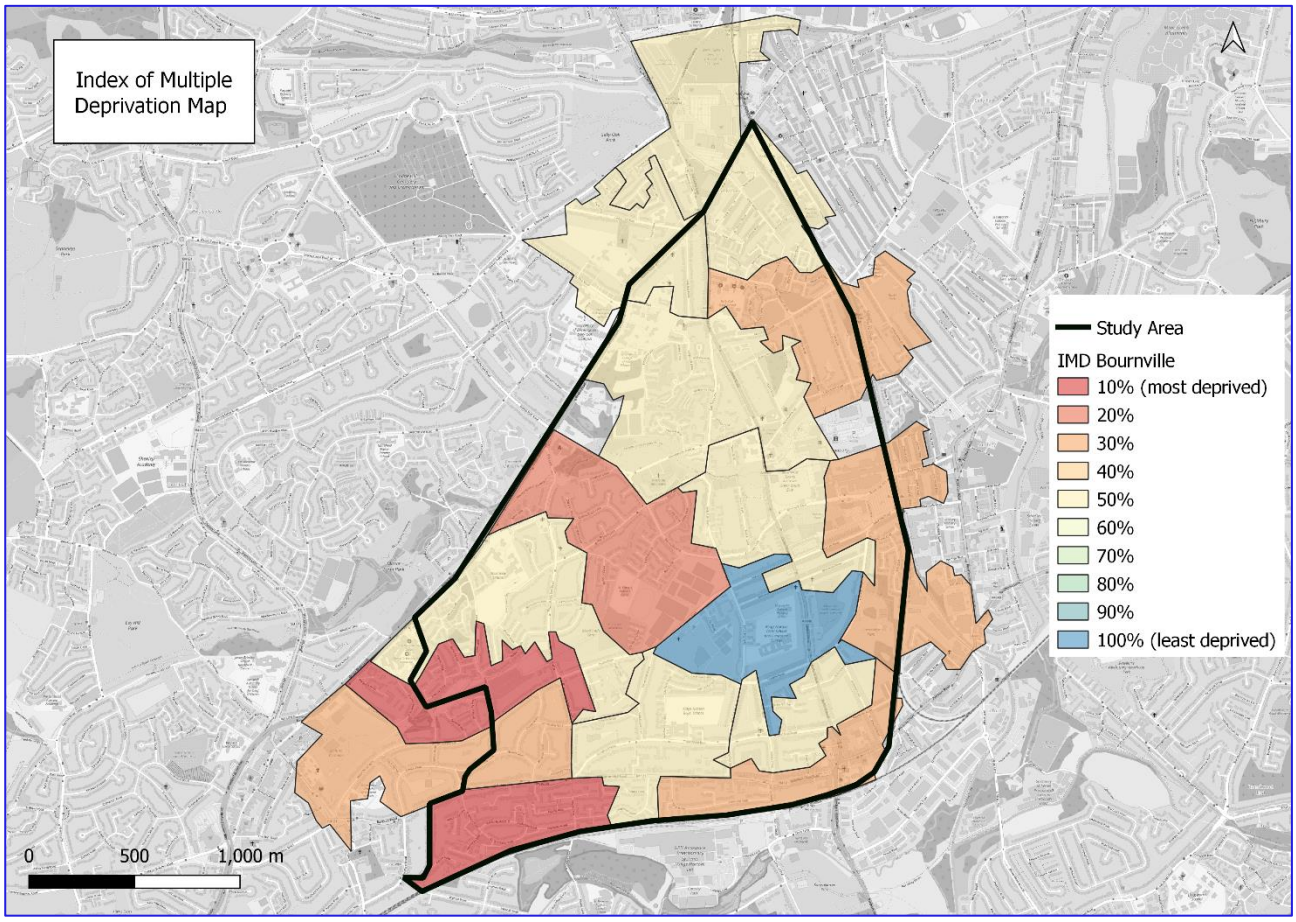

Figure 2-3: Indices of Multiple Deprivation (2019)

2.3 Age structure

Age statistics have been obtained using Census (2021) data sourced from ONS (2021) and is presented in Table 2-2. The age structure of the study area is made up of 16% of residents aged between aged 10 to 19 and 23% of residents aged 60+. There are spikes in the number of residents aged 20 to 29 (16%). Additionally, there is also a considerable number of young people with 16% of the residents aged up to 15 which presents an opportunity for uptake in walking and cycling for educational and leisure purposes.

Table 2-2: Age Structure within the study area (ONS, 2021).

Age Categories	No.	%
All usual residents	26,617	100%
Age 0-9	2,652	10%
Age 10-19	4,204	16%
Age 20-29	4,175	16%
Age 30-39	3,310	12%
Age 40-49	3,146	12%
Age 50-59	3,123	12%
Age 60-69	2,595	10%
Age 70-79	2,058	8%
Age 80+	1,354	5%

2.4 Private vehicles

Table 2-3 shows the car and van availability within the study area. The data shows that majority of households in each LSOA have access to either one car or van. However, there are also a significant proportion of households that do not have a car or van, particularly in the southern and northern extents of the study area. Low private vehicle ownership levels in the southern extents of the study area aligns with the IMD data that identifies high levels of deprivation in same LSOAs. However, where IMD identifies less deprived areas (particularly in the central regions of the study area) there is a higher level of car ownership, with over 50% of households in Birmingham 112A, 112C and 112D having access to one or more private vehicles.

Table 2-3: Car and van availability within the study area (ONS, 2021).

2021 super output area - lower layer	All categories: Car or van availability	No cars or vans in household %	1 car or van in household %	2 cars or vans in household %	3 cars or vans in household%
E01009284: Birmingham 096A	992	43%	39%	14%	4%
E01009281: Birmingham 099A	696	29%	46%	20%	5%
E01009295: Birmingham 099D	667	40%	39%	14%	7%
E01009280: Birmingham 100A	745	22%	50%	23%	5%
E01008951: Birmingham 112A	612	25%	50%	21%	4%
E01008955: Birmingham 112C	744	26%	56%	15%	3%
E01008956: Birmingham 112D	555	21%	50%	25%	5%
E01008950: Birmingham 113A	717	31%	44%	19%	6%
E01008954: Birmingham 113B	599	18%	44%	30%	8%
E01008958: Birmingham 113C	767	39%	40%	18%	3%
E01008959: Birmingham 116A	802	28%	45%	23%	5%
E01008960: Birmingham 116B	624	21%	46%	24%	8%
E01008961: Birmingham 116C	725	35%	45%	15%	5%
E01008962: Birmingham 116D	856	42%	39%	15%	4%
E01009218: Birmingham 120D	644	26%	32%	33%	9%
Total	**10,745**	**31%**	**44%**	**20%**	**5%**

2.5 Method of travel to work

Method of travel to work data is shown below in Table 2-4. It should be noted that this census was carried out during the Covid-19 pandemic and therefore a substantial number of people were working from home during this time.

From the data, the most common way to travel to work is by private car or van with 4,013 residents choosing this mode. This indicates a high car dependency within the study area. However, the second most popular mode of travel is by walking, with 847 residents walking to work, followed by bus (680), rail (451) and then cycling (242). This shows that active modes (walking and cycling) and public transport infrastructure are being underutilised within the study area, therefore there is likely room for improvement if infrastructure becomes available.

Table 2-4: Method of travel to work data (ONS, 2021).

2021 super output area - lower layer	All categories: Method of travel to work	Rail	Bus, Minibus, Coach	Driving a car or van	Bicycle	On foot
E01009284: Birmingham 096A	1,120	85	97	295	22	149
E01009281: Birmingham 099A	591	5	20	215	17	47
E01009295: Birmingham 099D	590	17	48	202	15	57
E01009280: Birmingham 100A	859	18	26	336	18	70
E01008951: Birmingham 112A	650	24	28	213	12	55
E01008955: Birmingham 112C	904	61	43	277	17	85
E01008956: Birmingham 112D	673	28	27	228	25	43
E01008950: Birmingham 113A	533	14	33	223	12	39
E01008954: Birmingham 113B	578	9	28	274	6	34
E01008958: Birmingham 113C	582	10	64	291	9	41
E01008959: Birmingham 116A	736	32	44	285	15	47
E01008960: Birmingham 116B	848	46	38	293	33	42
E01008961: Birmingham 116C	743	53	49	272	17	61
E01008962: Birmingham 116D	724	35	115	317	13	41
E01009218: Birmingham 120D	690	14	20	292	11	36
Total	**10,821**	**451**	**680**	**4,013**	**242**	**847**

2.6 Active mode

Table 2-4 above shows that walking and cycling are not as popular a mode of transport as driving within the study area, only making up 10% of all commuting trips. Figure 2-4 shows the current cycle routes and the BCC Local Cycling and Walking Infrastructure Plan (LCWIP) proposed cycling routes within the study area. The Rea Valley National Cycle Network Route 5 (NCN5) is located to the east of the study area and connects Kings Norton to Birmingham City Centre and is also shown in Figure 2-4. Most of the routes, both proposed and existing are situated towards the Western side of the study area and do not connect to the Rea Valley Cycle Route 5 or the Canal towpath. Low levels of cycle uptake as detailed in Table 2-4 may be due to the lack of connectivity between existing cycling infrastructure. Additionally, if the current trend of high-level private vehicle ownership continues then uptake in the number of residents walking and cycling is likely to stay low.

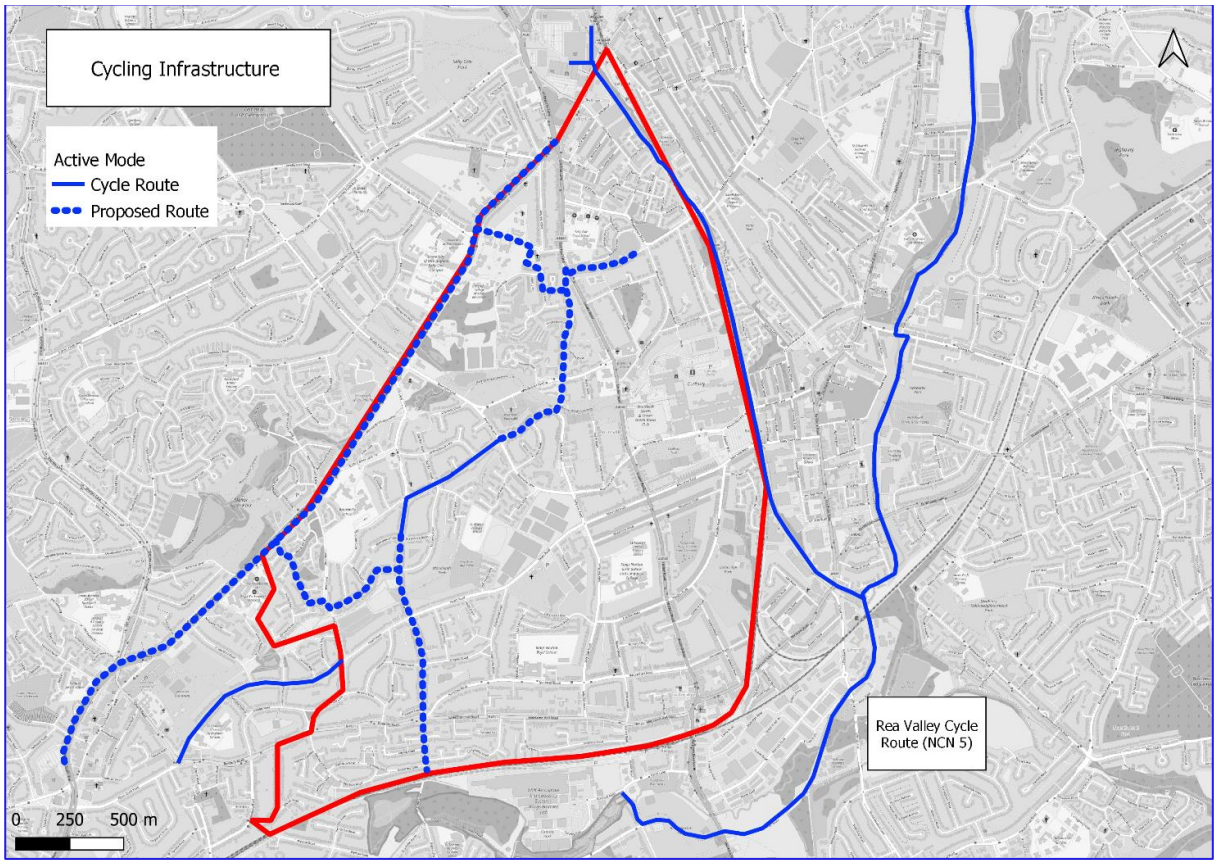

Figure 2-4: Study Area Cycling Infrastructure

2.7 Walking and cycling isochrone map

It is important to emphasise how Places for People aims to encourage individuals to reconsider their mode of transport for those shorter journeys within their local area. As stated in Section 2.6. there is limited uptake in walking and cycling within the study area. To examine whether key locations and trip attractors can be reached by walking and cycling, shapefiles have been taken from BCC's People for Places website and have been used to create the isochrone figures below (Figure 2-5 to Figure 2-10) which display how easy it is to reach key services within 5 to 15 minutes via walking and cycling.

The isochrones are centred around key locations in the area, which include[1]:

- Bournville railway station;
- Selly Oak railway station;
- Kings Norton railway station;
- Kafenion (at Sycamore Road); and
- Clean Kilo (at Mary Vale Road).

Distances have been calculated against 5-15 minutes travel time. The isochrones represent the distance that can be covered during this time through both walking and cycling. The isochrones indicate that the entire extent of the study area can be covered in around 15 minutes of walking and just 10 minutes of cycling.

[1] Bournville | Places for People | Birmingham City Council

The results from isochrone maps indicate there is an opportunity to encourage an uptake in cycling and walking due to the accessibility to key trip attractors and distances that can be covered in such short times.

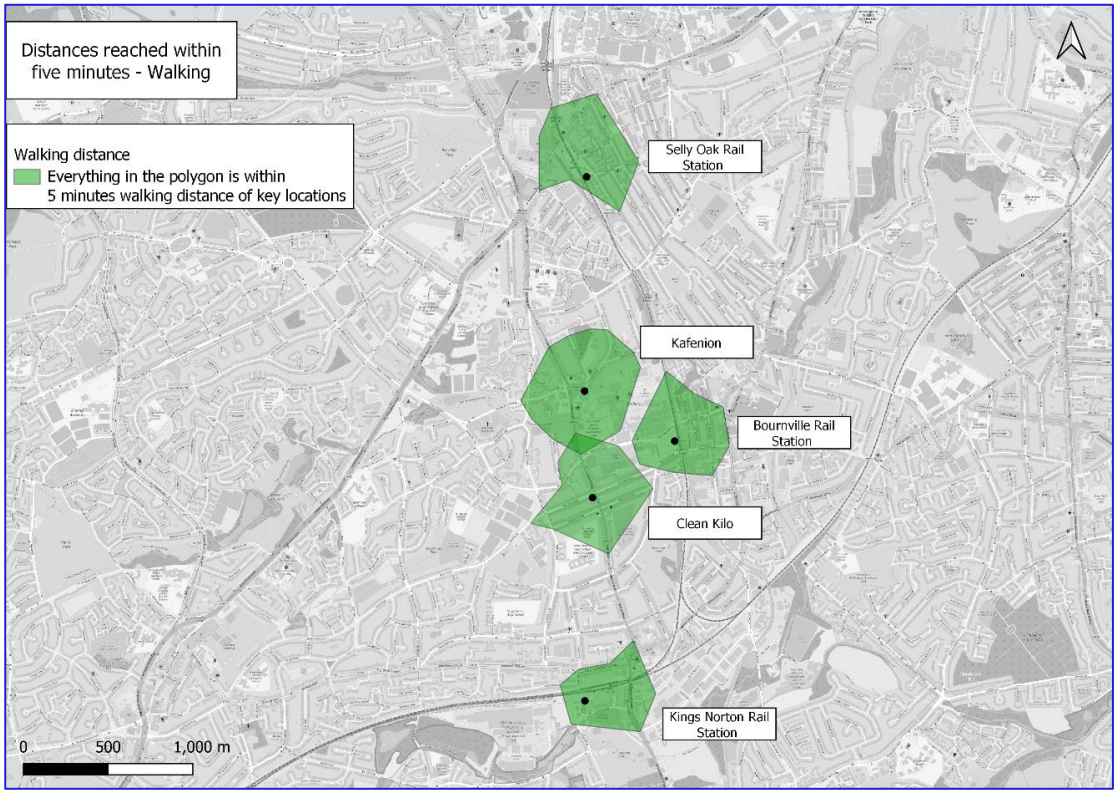

Figure 2-5: Walking distances within 5 minutes of key locations

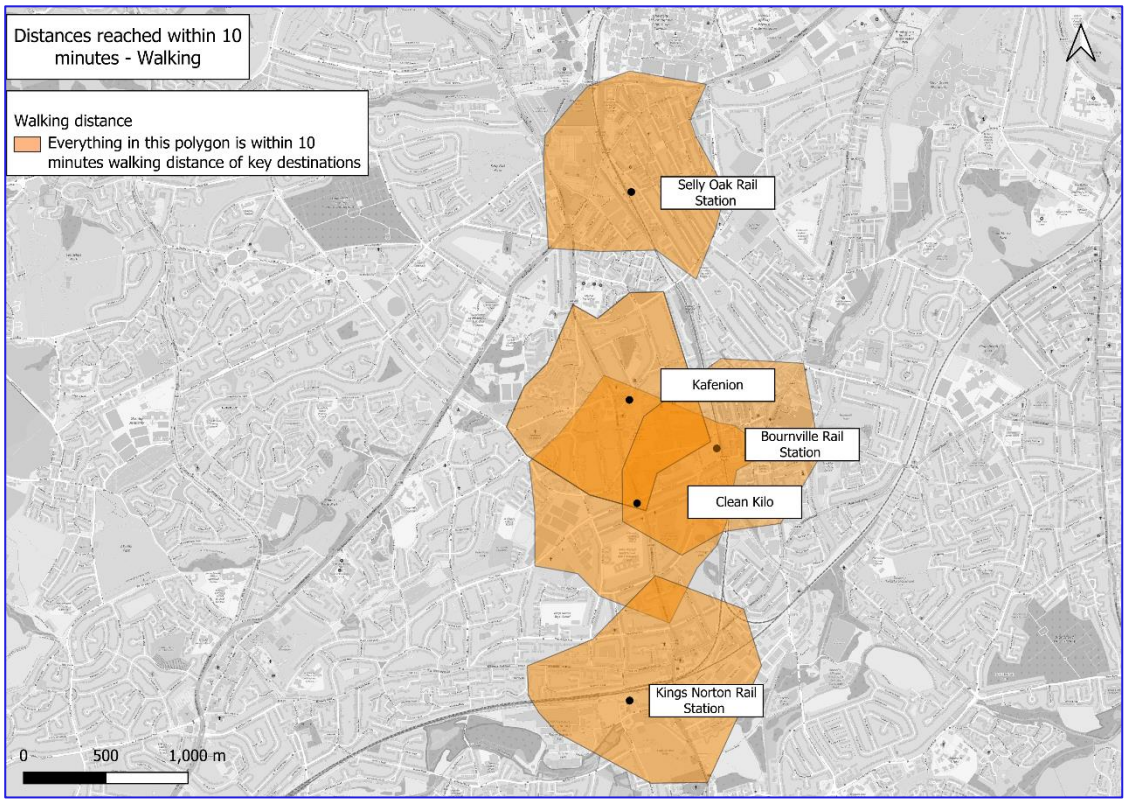

Figure 2-6: Walking distances within 10 minutes of key locations

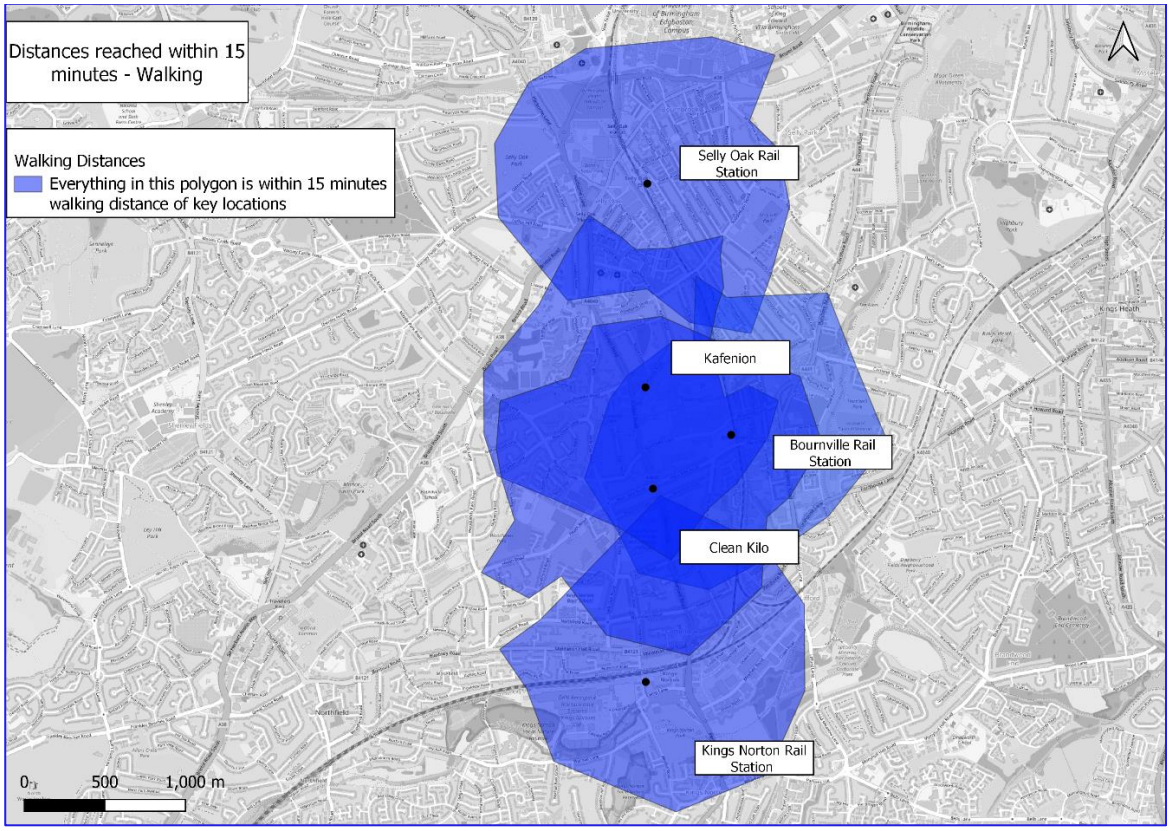

Figure 2-7: Walking distances within 15 minutes of key locations

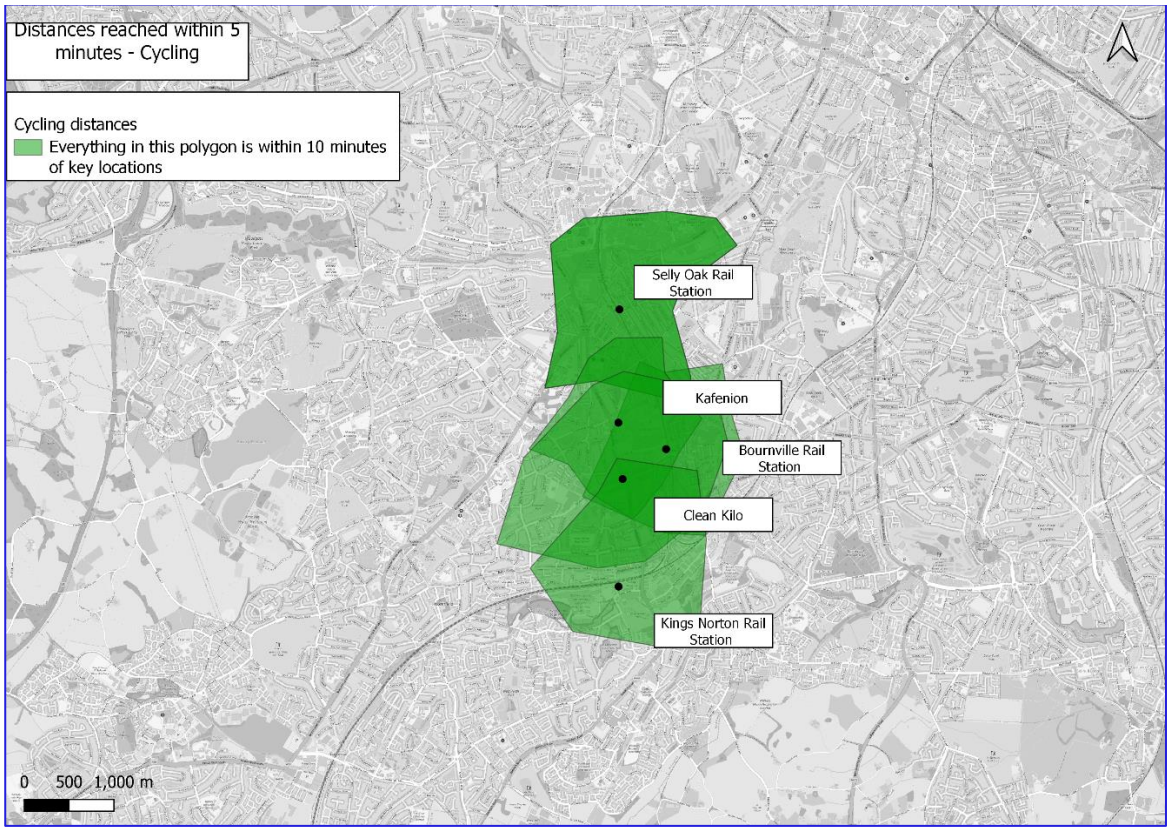

Figure 2-8: Cycling distances with 5 minutes of key locations

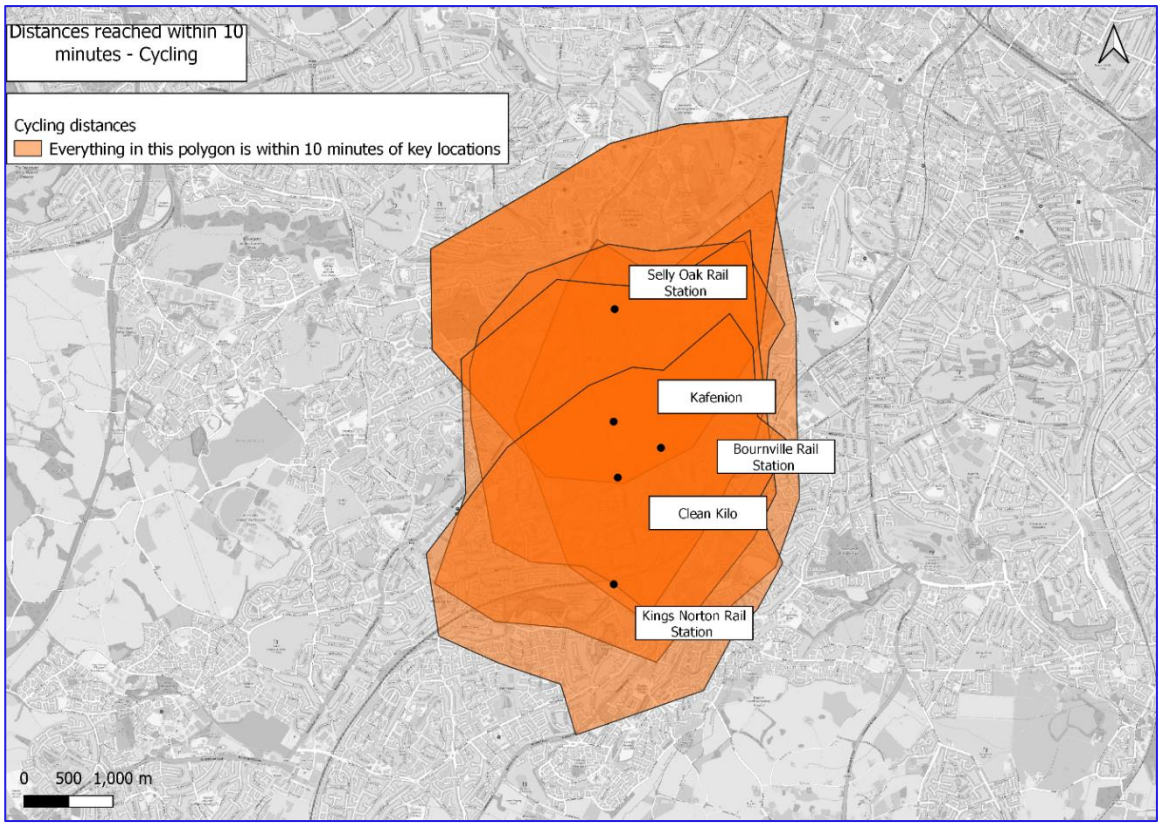

Figure 2-9: Cycling distances within 10 minutes of key locations

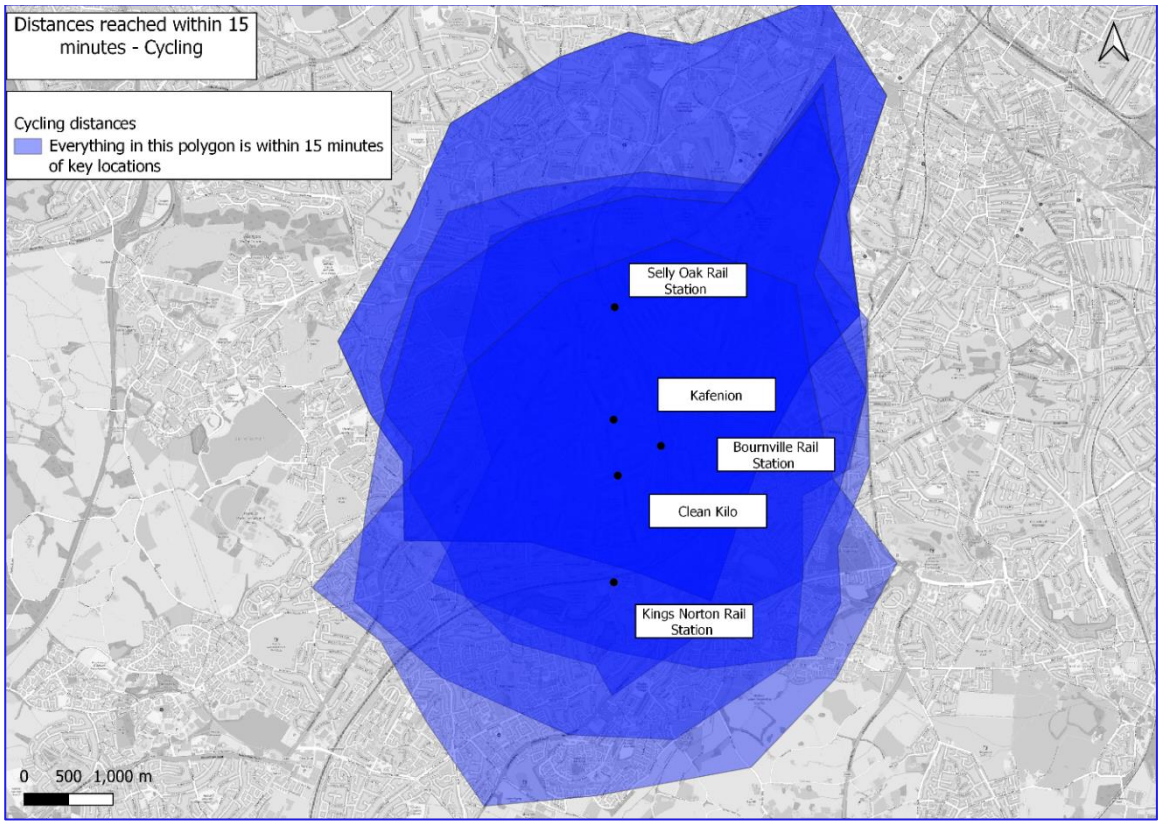

Figure 2-10: Cycling distances within 15 minutes of key locations

2.8 Safety

STATS19 collision data from 2015-2019 was obtained to help understand the safety conditions in and around the study area. The data covers a five-year period to not include Covid-19 pandemic years in which the amount of traffic reduced. A buffer was applied to the study area using a GIS Tool to capture the collisions that also occurred outside of the immediate study area.

Table 2-5 summarises the total number of collisions by year and their severity, the location of these collisions has been mapped in Figure 2-11. The overall number of collisions is reducing slightly in the most recent years. A total of six fatal collisions have occurred in the five-year period analysed.

Table 2-5: Summary table of STATS19 Collision Data

Year	Slight	Serious	Fatal	Total	Including NMUs
2015	123	14	1	138	41
2016	69	20	1	117	37
2017	99	12	0	111	45
2018	95	14	1	110	41
2019	83	17	3	103	34
Total	**469**	**77**	**6**	**579**	**198**

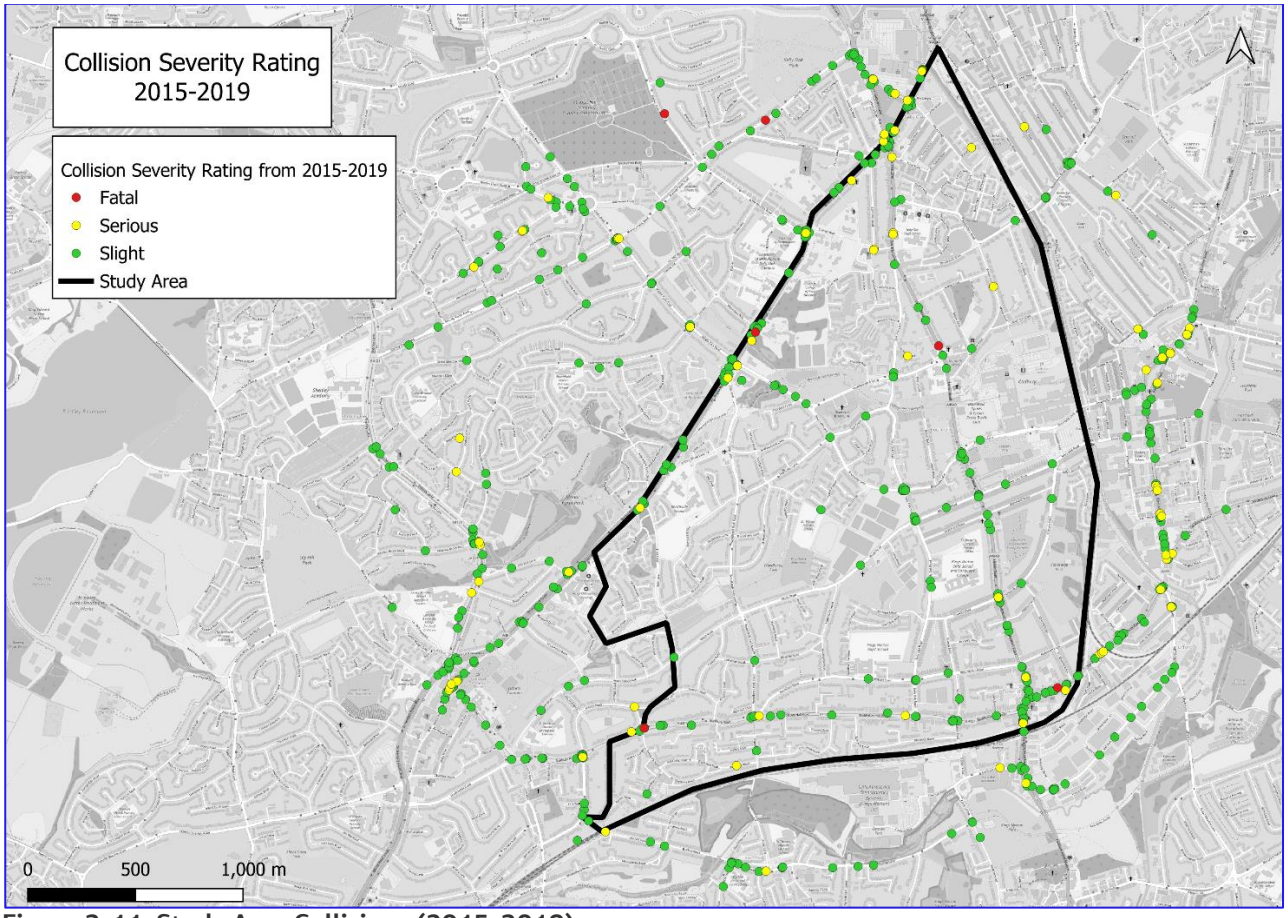

Figure 2-11: Study Area Collisions (2015-2019)

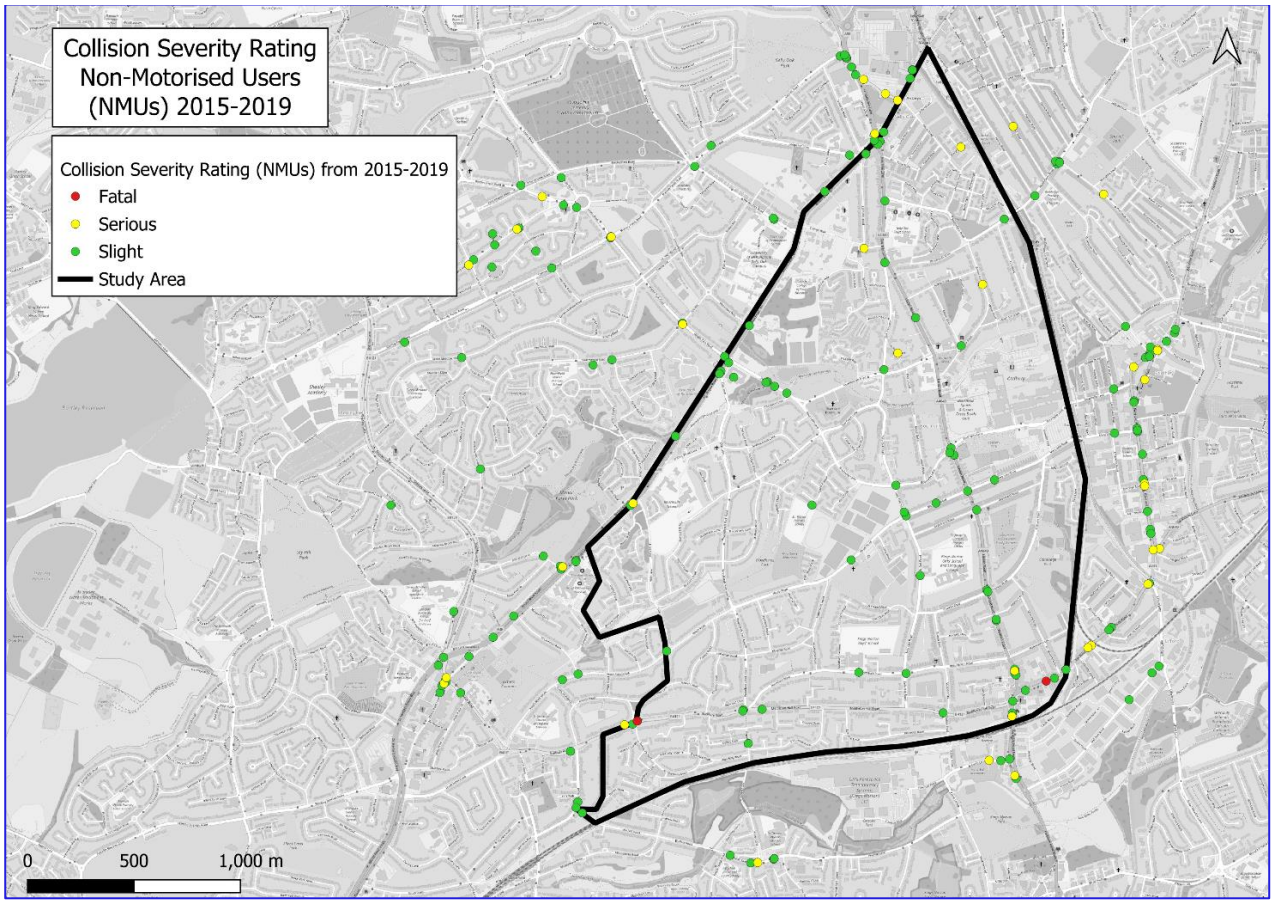

Figure 2-12: Study Area Non-Motorised User Collisions (2015-2019)

The locations of the six fatal collisions are listed below:

Within the study area:

- Linden Road near to Birmingham City University Bournville Campus;
- Bristol Road, near to Witherford Way;
- Pershore Road near to Midland Road; and
- Bunbury Road near to Hole Lane.

In the study area buffer zone:

- Gibbins Road near to Lodge Hill Road; and
- Weoley Avenue, near to Lodge Hill Cemetery and Crematorium.

Figure 2-13 shows the location of collision clusters which have been tabulated in Table 2-6. A 50m buffer was applied to each collision and then intersected with all collisions over a five-year period, if four or more collisions occurred within a 50m boundary then these were classified as a 'cluster'.

It should be noted that the number of collisions to determine a cluster, as part of this study, differs from Birmingham City Council's criteria for identifying collision clusters to determine eligibility for Local Safety Scheme funding. This BCC definition of collision clusters includes nine injury collisions per km over the last three years.

Table 2-6. Collision Cluster locations

ID	Collision Cluster locations	Number of collisions
1	Pershore Road Mini roundabout	31
2	Station Road	5
3	Northfield Road	4
4	Bunbury Road Woodlands Road Junction	5
5	Bunbury Road Hole Lane Junction	5
6	Bristol Road South and Hole Lane Junction	5
7	Bristol Road South near to Bournville Lane, Cob Lane, Middle Park Road	26
8	Bristol Road Witherford Way Junction	8
9	Bristol Road Weoley Park Road	9
10	Bristol Road, Oak Tree Lane, and Harborne Lane Junction	15
11	Bristol Road Chapel Lane Junction	9
12	Bristol Road north of Chapel Lane	5
13	Linden Road Bournville Lane Junction	4
14	Selly Oak Road, Bournville Lane Junction	5
15	Linden Road between Mary Vale and Beaumont Road	9
16	Linden Road, Franklin Road Junction	7
17	Selly Oak, Heath Road and Mary Vale Road Junction	4

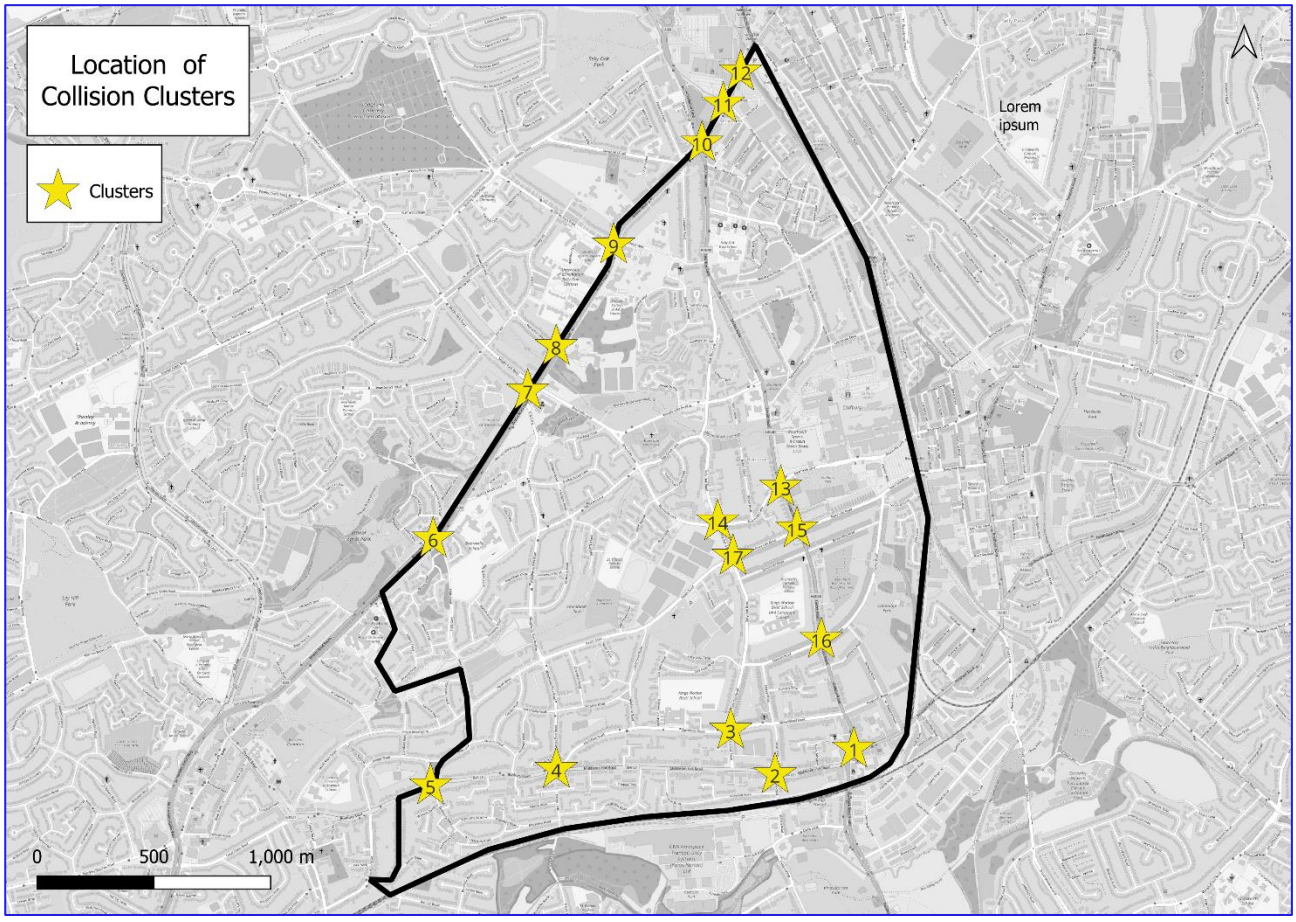

Figure 2-13: Study Area Collision Clusters (2015-2019)

2.9 Bus provision

The study area is served by 12 bus routes that operate from Birmingham City Centre to Bournville and surrounding areas, connecting key centres in the region – the routes are shown in Figure 214. Buses access Birmingham City Centre via Bristol Road (A38) or Pershore Road (A441). Most of the buses operate along the boundary roads (A38 Bristol Road South, A4040 Linden Road, Church Road, and B4121 Middleton Hall Road) that define the study area. The 27 and 46 bus services operate within the study area boundary travelling down from Woodbrooke Road, Hay Green Lane and southwards via Woodlands Park Road. The 883 also operates within the study area, travelling across the northern section of the reach. Information on the different bus services is displayed below in Table 2-7.

Table 2-7: Bus Service Information (2023, Q1)

Service Number	Operator	Route	Frequency		
			Mon-Fri	Sat	Sun
11A	National Express West Midlands	Birmingham Outer Circle - Acocks Green	Every 8 mins	Every 10 mins	Every 15 mins
11C	National Express West Midlands	Birmingham Outer Circle - Clockwise	Every 4 mins	Every 10 mins	Every 15 mins
20	National Express West Midlands	QE Hospital - Cofton Hackett	Every 30 mins	Every 30 mins	Every 30 mins
27	National Express West Midlands	Maypole - Cofton Hackett	Every 30 mins	Every 30 mins	Every 30 mins
38	Kevs Cars and Coaches	Northfield - Selly Oak via Cotteridge	Hourly	Hourly	-
46	National Express West Midlands	QE Hospital – Northfield	Every 30 mins	Every 30 mins	Every 30 mins
48	National Express West Midlands	West Bromwich - Q.E. Hospital	Every 20 mins	Every 30 mins	Every 30 mins
61	National Express West Midlands	Birmingham – Frankley	Every 12 mins	Every 15 mins	Every 20 mins
63	National Express West Midlands	Birmingham – Frankley	Every 12 mins	Every 15 mins	Every 20 mins
848	The Green Bus	Longbridge - King Edward VI School	School Service	-	-
882	The Green Bus	King Edwards VI Five Ways - Nisham High School	School Service	-	-
883	The Green Bus	King Edwards VI Five Ways School - Small Heath	School Service	-	-

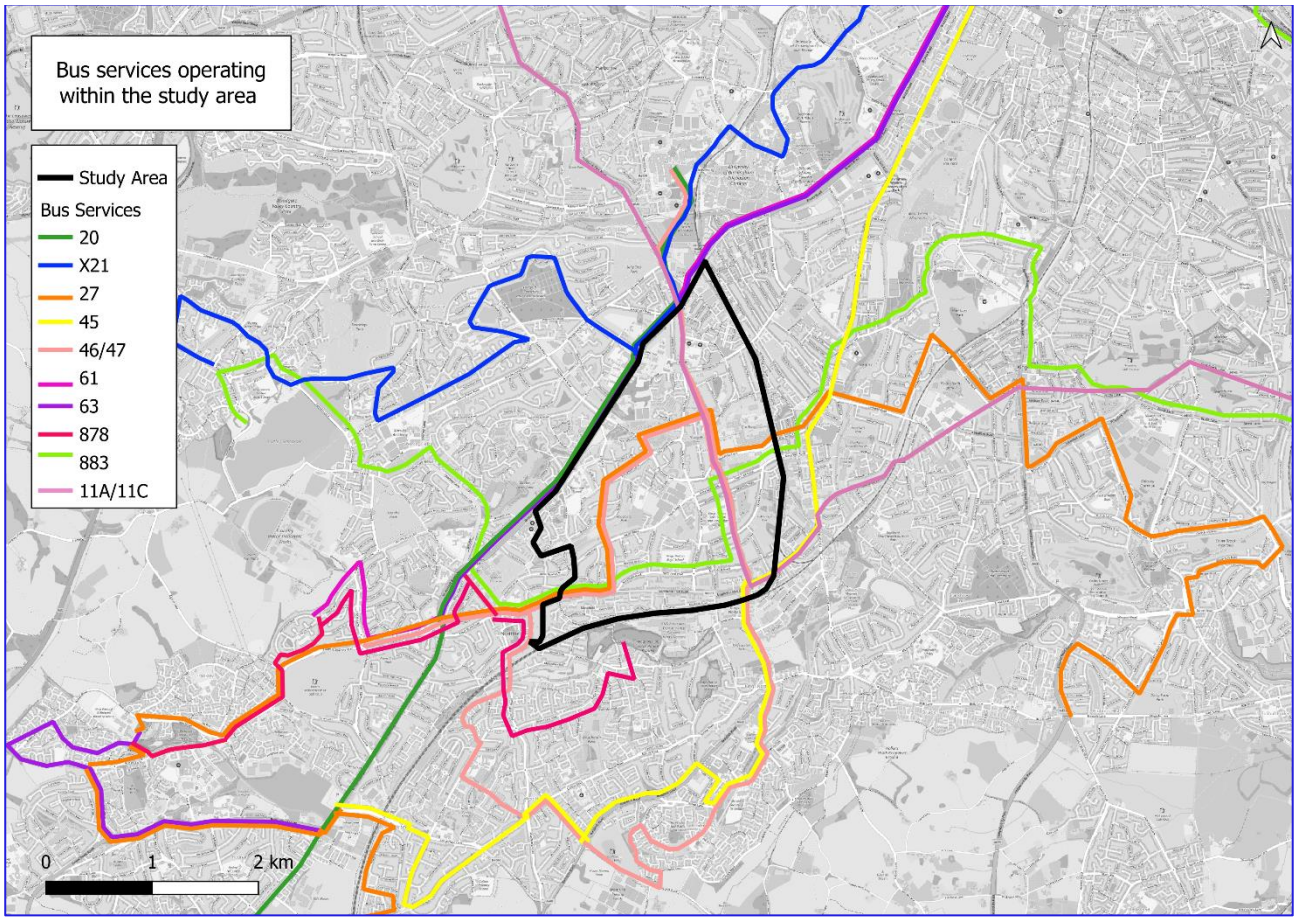

Figure 2-14: Bus network operating within and around the study area (2023, Q1).

2.10 Rail network

The study area is well connected to the National Rail service with four railway stations operating frequent rail services nearby. Bournville Railway station sits on the cross-city line which runs from Redditch to Lichfield Via Birmingham New Street. The other surrounding stations: Selly Oak, Northfield and Kings Norton operate along the same route, Table 2-8 details the current operating hours and frequencies of available services. The location of the stations in proximity to the study area is shown in Figure 2-15.

Table 2-8 Rail Service Information (2023, Q1)

Stations	Destinations	Operating Hours	Frequency
Bournville	Lichfield Trent Valley via Birmingham New Street	06:47-22:26	Every 30 mins
Bournville	Four Oaks via Birmingham New Street	06:29-23:19	Every 10-20 mins
Bournville	Bromsgrove	06:06-23:16	Every 30 mins
Bournville	Redditch	05:54-23:28	Every 30 mins
Selly Oak	Lichfield Trent Valley via Birmingham New Street	06:50-22:29	Every 30 mins
Selly Oak	Four Oaks via Birmingham New Street	06:32-23:22	Every 10-20 mins
Selly Oak	Bromsgrove	06:03-23:13	Every 30 mins

Stations	Destinations	Operating Hours	Frequency
Selly Oak	Redditch	05:51-23:25	Every 30 mins
Northfield	Lichfield Trent Valley via Birmingham New Street	06:42-22:21	Every 30 mins
Northfield	Four Oaks via Birmingham New Street	06:23-23:14	Every 10-20 mins
Northfield	Bromsgrove	06:12-23:23	Every 30 mins
Northfield	Redditch	06:00-23:34	Every 30 mins
Kings Norton	Lichfield Trent Valley via Birmingham New Street	06:45-22:24	Every 30 mins
Kings Norton	Four Oaks via Birmingham New Street	06:27-23:17	Every 10-20 mins
Kings Norton	Bromsgrove	06:09-23:19	Every 30 mins
Kings Norton	Redditch	05:57-23:31	Every 30 mins

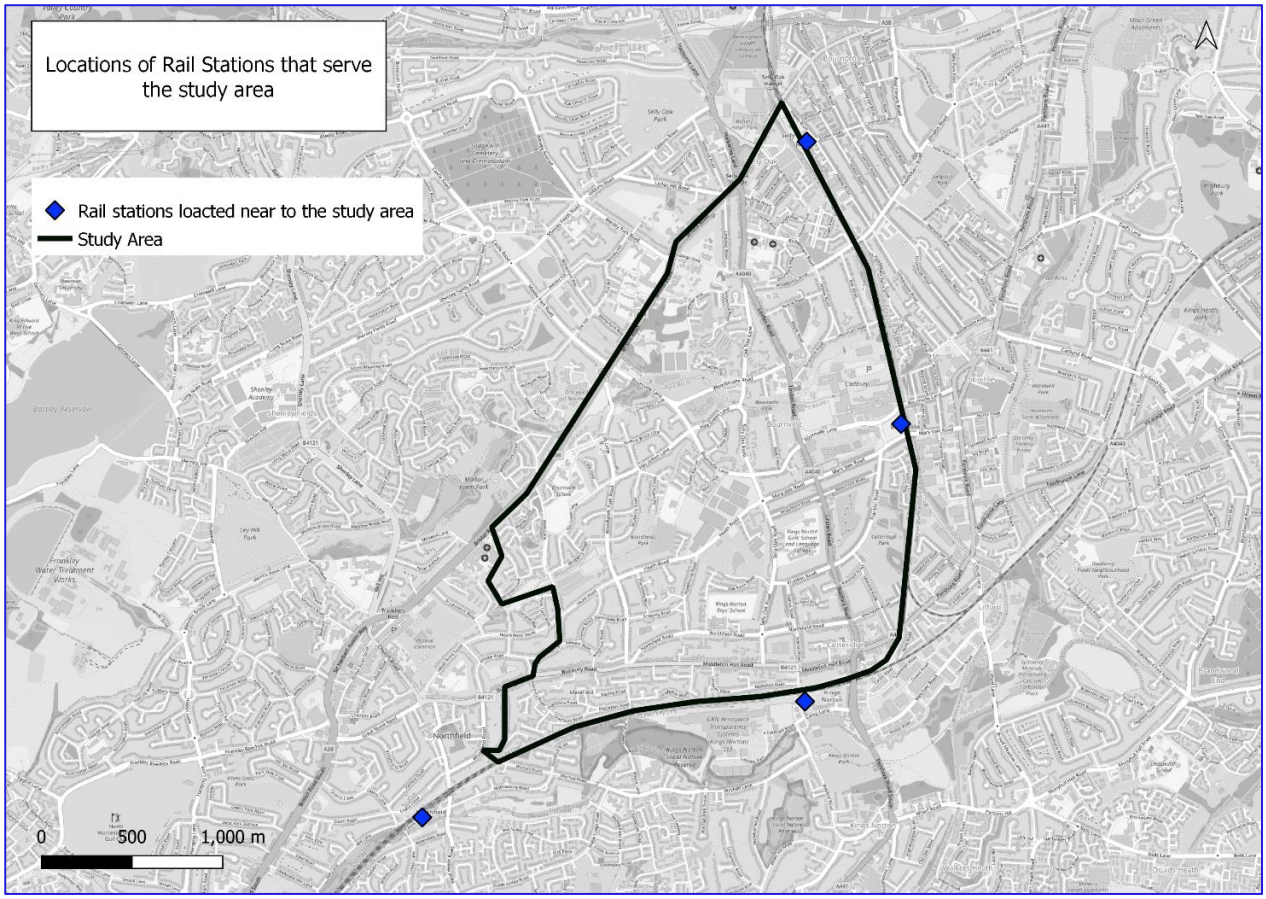

Figure 2-15: Location of railway stations in close proximity to the study area

2.11 Conservation Area

Bournville conservation area falls partially within the study area and is shown below in Figure 2-16. The conservation area is located towards the eastern section of the study area. The conservation area also contains listed buildings.

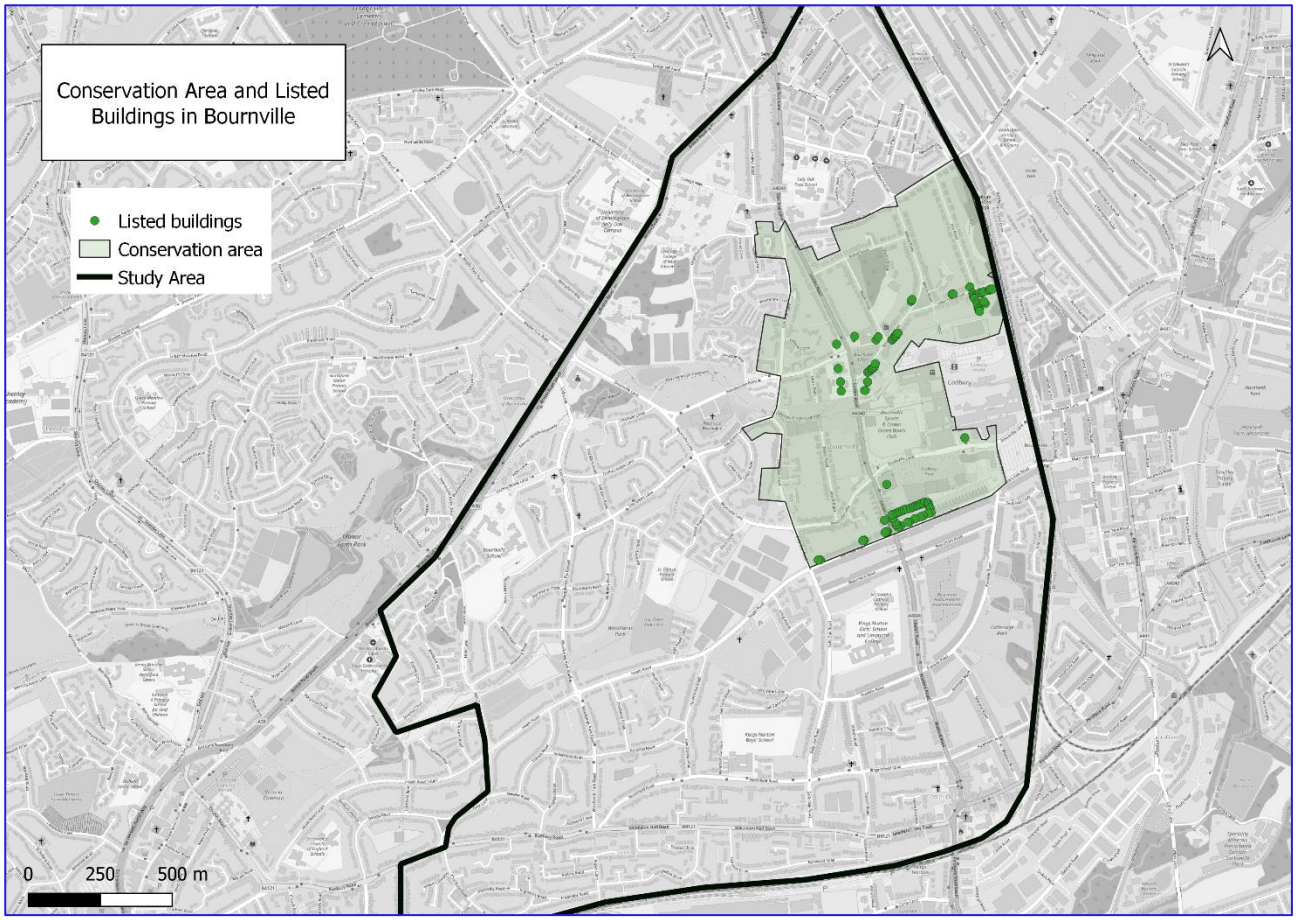

Figure 2-16: Conservation area and listed buildings

2.12 Air quality

The nearest Air Quality Monitoring Station is in Selly Oak; therefore, air quality data was obtained from National Atmospheric Emissions Inventory for the study area which covers the period of 1990-2019. The key pollutants and their total emissions for all sectors and road transport are listed in Table 2-9.

According to the Transport and Environment statistics published by the government in Autumn 2021, the most significant air pollutants from the transport sector are nitrogen oxides and particulate matter. In the study area, nitrogen oxide emissions from road transport make up a large proportion of the overall nitrogen oxide emissions from all sectors, as detailed in Table 2-9.

Table 2-9: Pollutants table, by emission type, all sector emissions and road transport emissions.

Pollutant	Emissions – all sectors (t)	Emissions - Road Transport (t)
Carbon Dioxide (as Carbon)	31059.47	11169.29
PM 10 (Particulate Matter <10µm)	52.15	8.47
PM 2.5 (Particulate Matter <2.5µm)	32.62	5.41
Nitrous Oxide as NO2	197.33	96.33
Nitrous Oxide	4.1	1.34

2.13 Traffic flow data

Existing traffic flow data was collected from various Department for Transport (DfT) count points across the study area. There are 19 count locations which lie within and close to the study area, the location of these count points is shown in Figure 2-17.

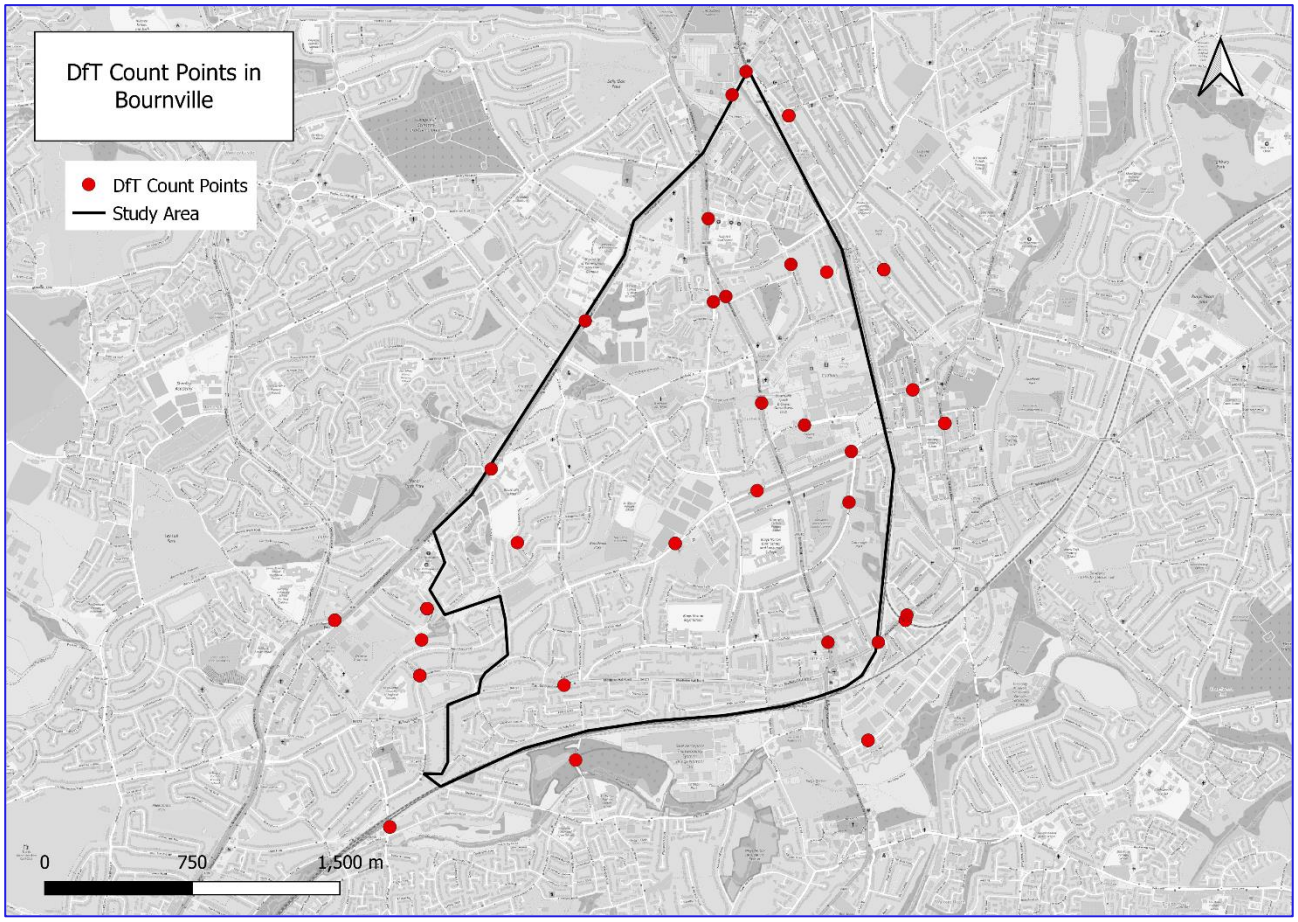

Figure 2-17: Location of DfT count points in the study area

2.14 Commissioned traffic data surveys

Additional traffic data surveys were commissioned in November 2022 to inform the transport study. Table 2- and Figure 2-18 provide an overview of the commissioned surveys.

Table 2-10. Traffic survey overview

Survey/ Data Source	Description	Locations
Automatic Traffic Count (ATC)	Counts collected between Tuesday 15 November 2022 to Thursday 01 December for seven consecutive days (24 hours per day).	▪ Refer to Figure 2-18 ▪ Refer to Appendix A for tabulated flows
Manual Classified Turning Count (MCTC)	Tuesday 15 November 2022 (0700-1900)	▪ Refer to Figure 2-18 ▪ Refer to Appendix A for tabulated flows
Journey Times	TrafficMaster data provided by BCC for the month of October 2022.	▪ All A roads and B roads within the modelled area.

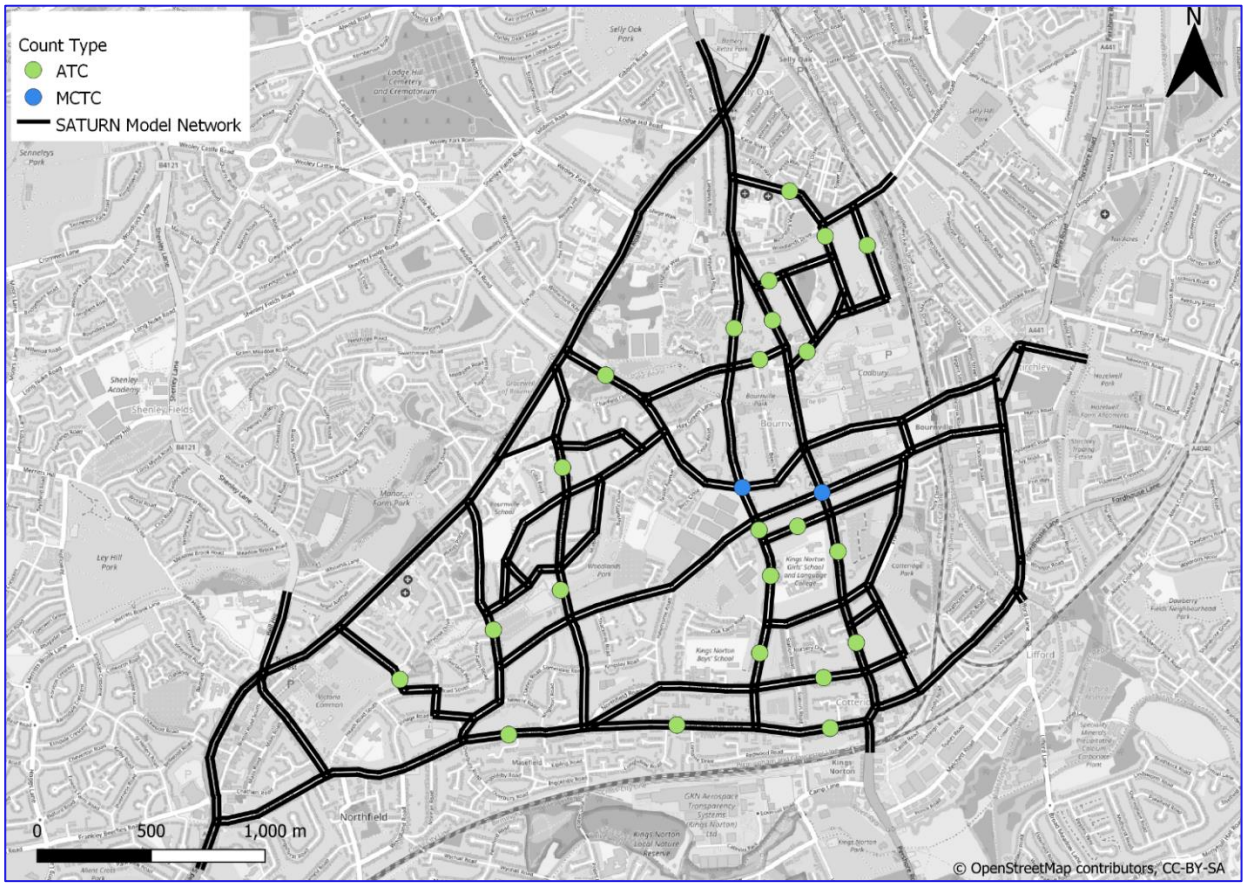

Figure 2-18: Overview of traffic surveys and other data sources used to inform the Base Model development

2.14.1 Manual Classified Turning Counts

A number of 12-hour Manual Classified Turning Counts (MCTCs) have been carried out on Tuesday 15 November 2022 between 07:00 and 19:00.

MCTCs were classified into Car, Light Goods Vehicle (LGV), Other Goods Vehicle (OGV) 1, OGV 2 and Public Service Vehicle (PSV). Car and LGV have been considered as light vehicles and OGV1, OGV2 and PSV have been considered as HGVs (Heavy Goods Vehicle).

2.14.2 Automatic Traffic Count

Automatic Traffic Count (ATC) surveys were undertaken for one week between Tuesday 15 November 2022 to Thursday 01 December. The ATCs recorded traffic in both directions based on 12 vehicle classes and provided speeds for that location.

2.14.3 TrafficMaster

TrafficMaster data (2019) was downloaded from Transport for West Midlands (TfWM) Data Insight site and has been mapped using GIS software. It should be noted that the only existing data available was limited to the boundary roads of the study area. Neutral months of June and November were selected due to the lack of school holidays and limited seasonal changes in traffic flow. The AM and PM peak speeds for both months are shown in Figure 2-19 to Figure 2-22.

June 2019 AM peak shows that Bristol Road South was operating normally with speeds averaging between 30-40 mph. On Linden Road speeds were lower, averaging between 10-20mph in some locations, particularly heading northbound. Typically speeds between 0-10 mph were recorded at major junctions on the boundary roads, Bell Lane and A38, Middleton Hall Lane and A441 and Oak Tree Lane and the A38. Results from the November AM data showed a similar picture, with low speeds on the major junctions on the boundary roads.

Similarly, the PM peaks showed similar speeds along the boundary roads. In June, the PM peak speeds along Church Road and south sections of Linden Road were low, averaging between 0-10 mph. However, overall speeds averaged between 20-30 mph. Results from the November PM data were almost identical with low speeds on Church Road and Linden Road.

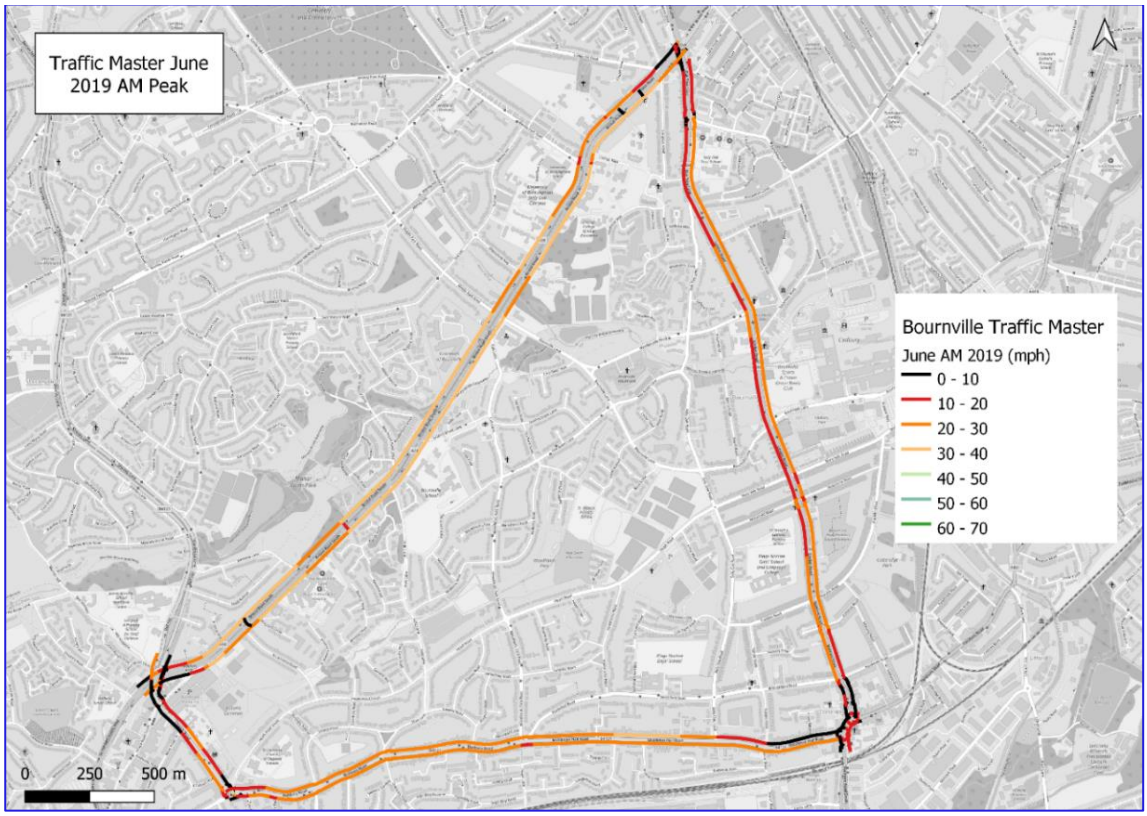

Figure 2-19: Traffic Master data – June 2019 AM Peak

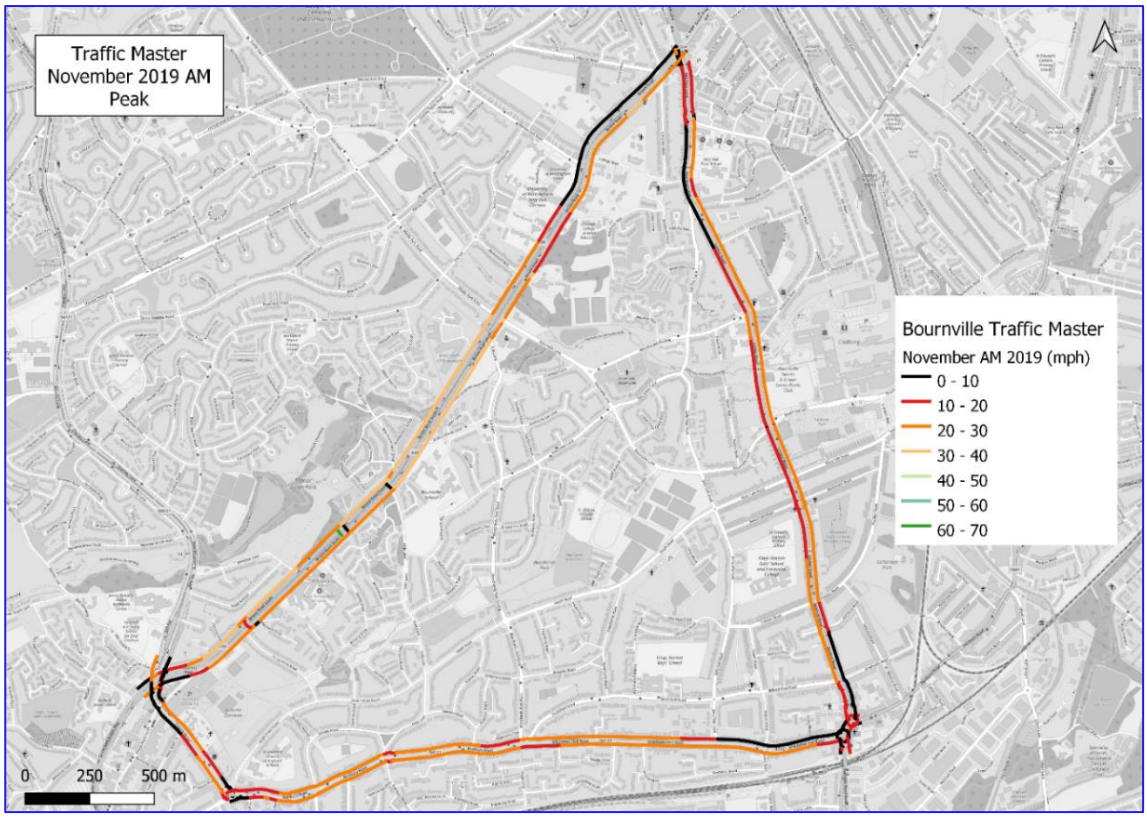

Figure 2-20: Traffic Master data – November 2019 AM Peak

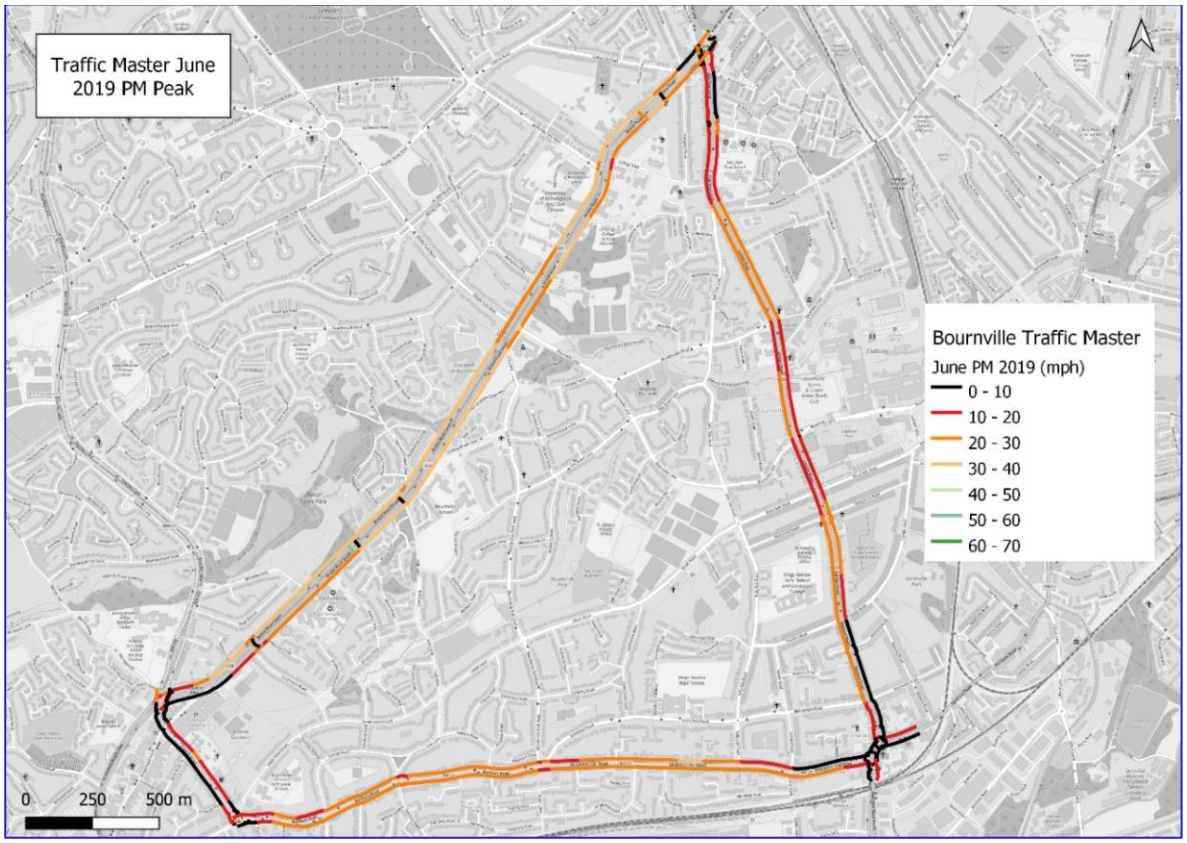

Figure 2-21: Traffic Master data – June 2019 PM Peak

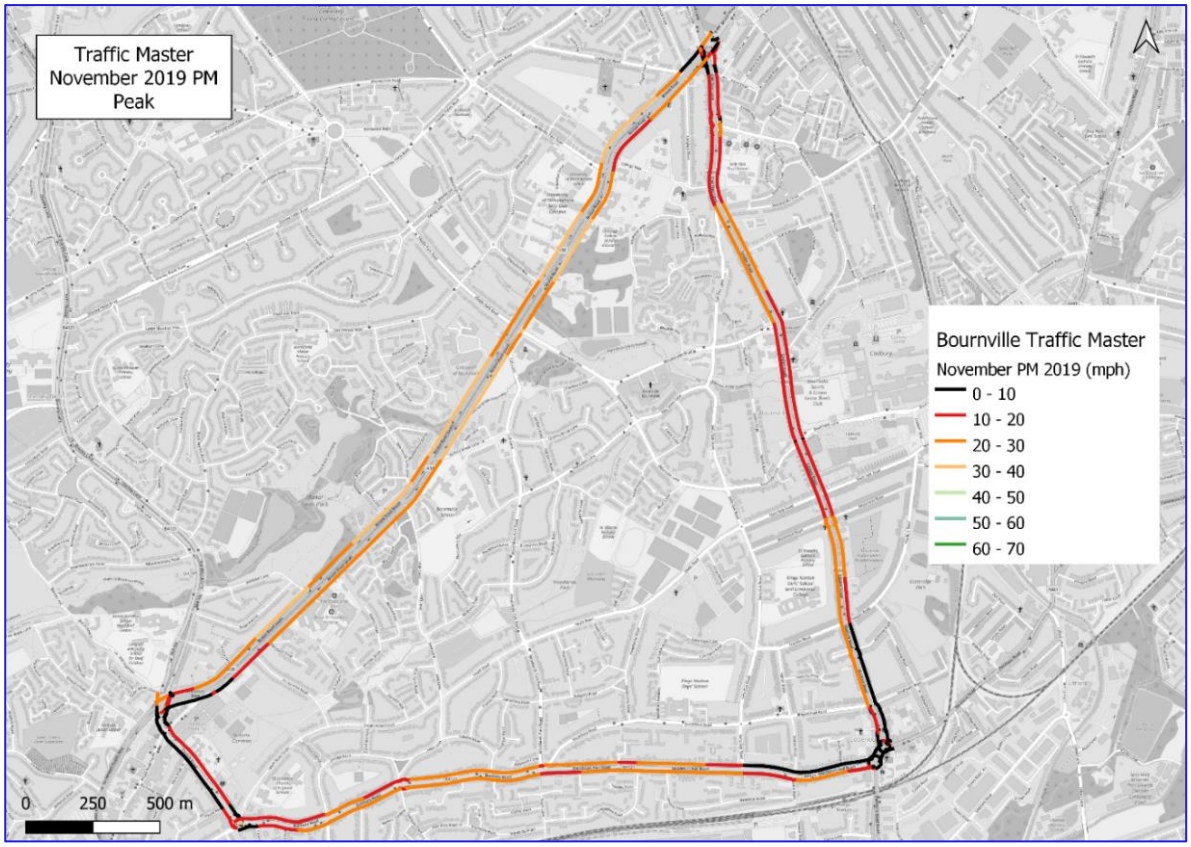

Figure 2-22: Traffic Master data – November 2019 PM Peak

2.15 Delay

As with the TrafficMaster data, 2019 delay data was downloaded from TfWM Insight site and has been mapped using GIS software, with data also restricted to the boundary roads of the study area. Neutral months of June and November were again selected due to the lack of school holidays and limited seasonal changes in traffic flow. The AM and PM peak speeds for both months are shown in Figure 2-23 to Figure 2-26.

All four datasets showed delays on at least one approach to the A441 Pershore Road / A4040 Linden Road / B4121 Middleton Hall Road double mini roundabout junction. At its worst, in the November PM dataset, the delays on the A4040 Linden Road and the B4121 Middleton Hall Road both stretched back approximately 500m to Franklin Road and Selly Oak Road, respectively.

Delays were also seen at the A38 Bristol Road / A4040 Oak Tree Lane junction in the November AM and June PM datasets. The worst-case scenario, in November AM, saw high delays on the A38 northbound stretching back approximately 780m to College Walk, with delays on the A4040 Oak Tree Lane northbound also stretching back approximately 780m to Acacia Road.

Finally, delays were also seen at the A38 Bristol Road / Bell Hill / Bell Lane junction in all datasets. The worst-case scenario, in June PM, saw delays on Bell Lane and Church Road for approximately 450m, nearly all the way back to the B4121 Middleton Hall Road junction. There were also short sections of delays on both A38 approaches and Bell Hill.

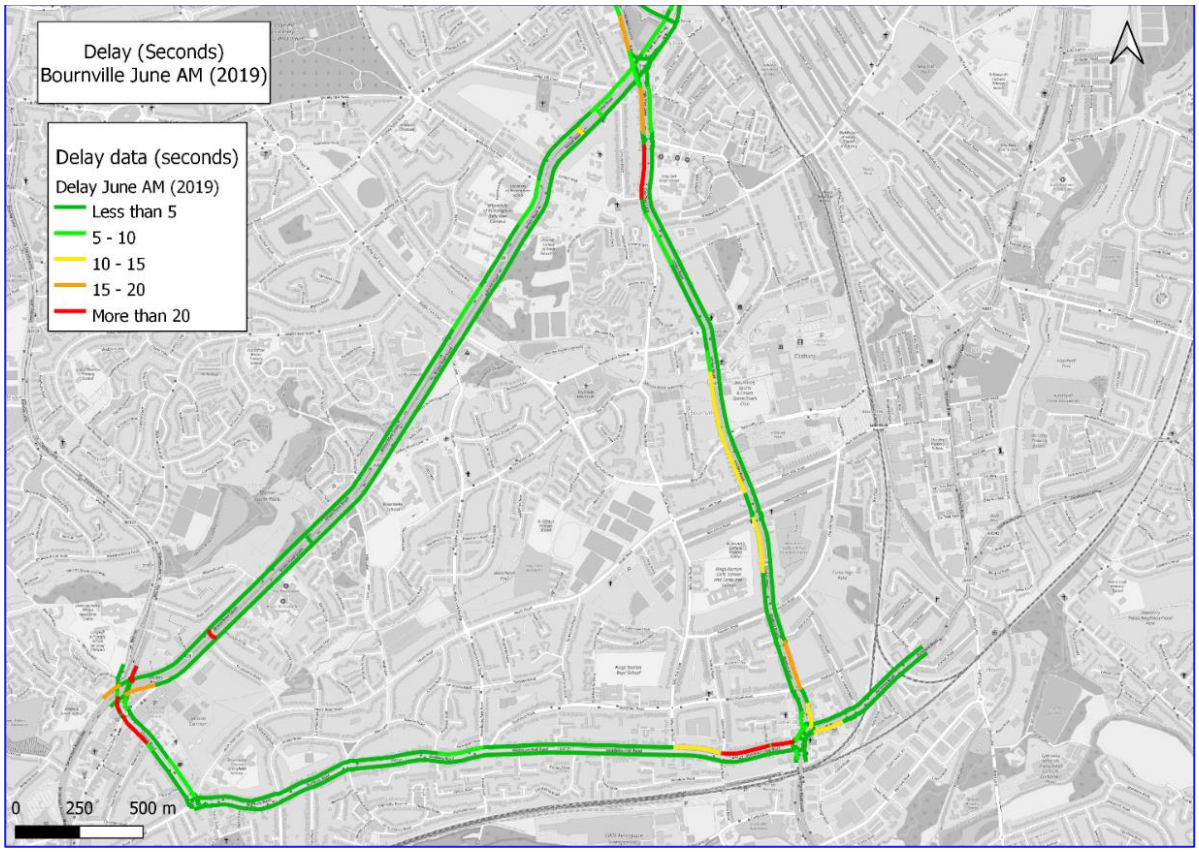

Figure 2-23: Delay data – June 2019 AM Peak

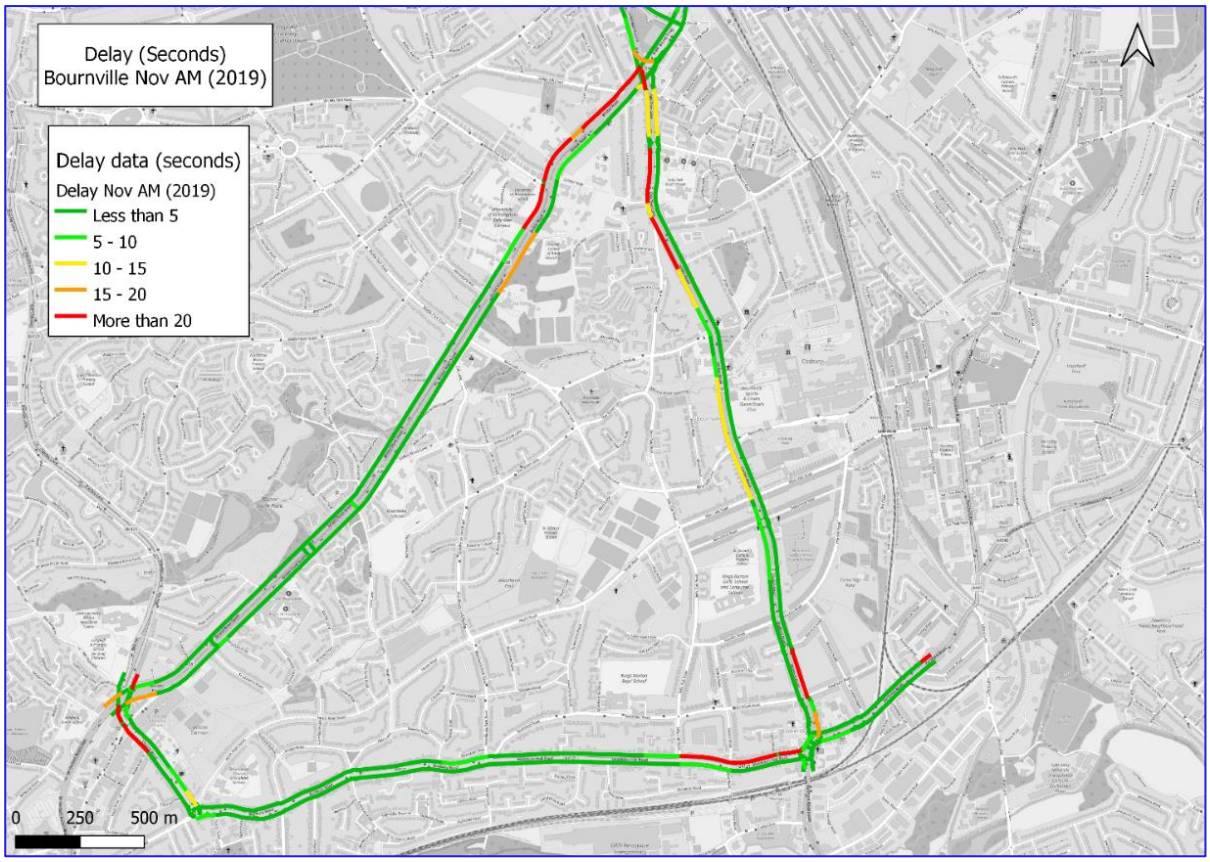

Figure 2-24: Delay data – November 2019 AM Peak

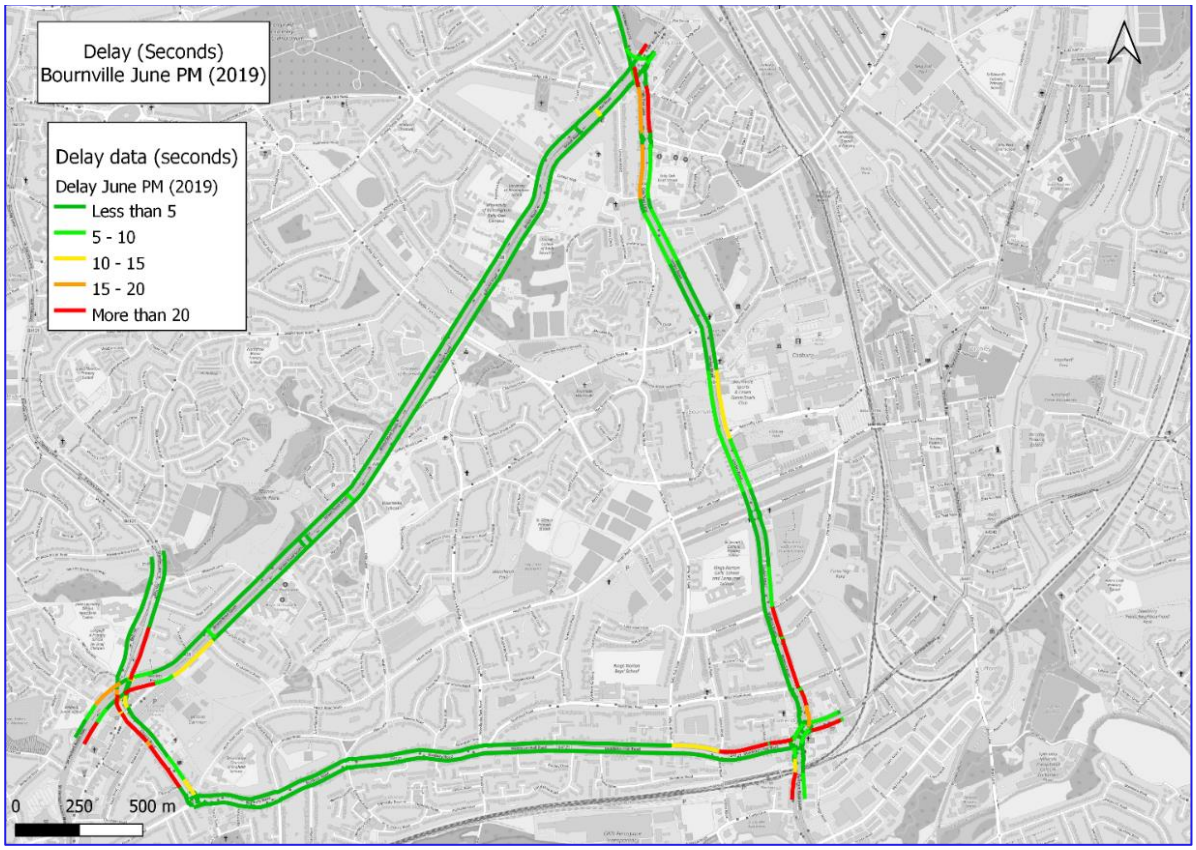

Figure 2-25: Delay data – June 2019 PM Peak

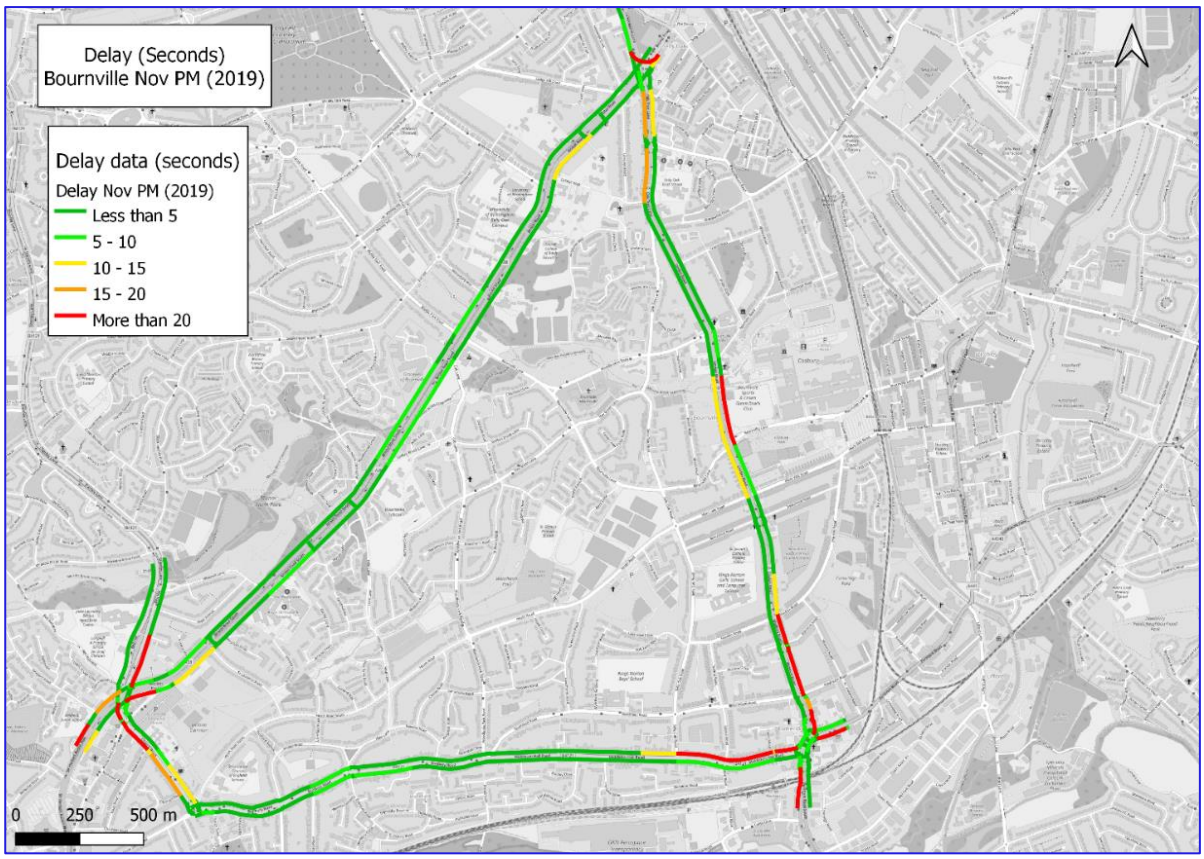

Figure 2-26: Delay data – November 2019 PM Peak

3. Local initiatives and policies

A number of local and regional policies and initiatives have already been adopted within the study area to help reduce traffic congestion and improve air quality, these are set out in the sections below.

3.1 Reimagining Transport in the West Midlands: A conversation about Change TfWM (2021)

TfWM published the West Midlands Local Transport Plan (LTP) Green Paper in 2021. The LTP aims to support conversations on the future of transport in the West Midlands, which will be used to support the West Midlands Combined Authority (WMCA) in the development of a new statutory LTP for the region.

The purpose of the Green Paper is to drive engagement with all stakeholders across the region to create a fully inclusive, sustainable transport network that meets everyone's needs. To achieve this, the Green Paper identifies five 'motives for change' along with proposed objectives for the LTP.

Although all the motives for change are important, the Green Paper identifies the need to tackle the climate emergency as the most urgent to fully align with the WMCA's zero carbon target by 2041. The five motives for change and proposed objectives that are set out in the West Midlands LTP Green Paper are listed below;

- **Sustaining economic success:** Mobility market transformation. Includes supporting industrial transformation of the mobility sector to position West Midlands as a global leader in future transport by creating a local transport market that enables innovation, development and deployment of transport products and services that best support Inclusive Growth;
- **Creating a fairer society:** Fair access. Involves improving social mobility by improving equity of access to opportunity by ensuring everyone, regardless of personal circumstance, has safe, usable, and affordable travel choices that enable them to prosper;
- **Supporting local communities and places:** Streets for communities. Involves strengthening communities by reducing the dominance of motorised transport in local neighbourhoods to enable repurposing of streets;
- **Becoming more active:** Physically active - Enable safe, convenient and accessible walking and cycling opportunities, to increase active travel for whole journeys and as part of journeys, improving the health, wellbeing and productivity of people today as well as leaving a healthy legacy for future generations; and
- **Tackling the climate emergency:** Transport decarbonisation. Involved protecting the future of our own community as well as communities around the world from the effects of climate change by rapidly reducing transport carbon emissions at a rate consistent with WM 2041.

3.2 Birmingham Transport Plan (BCC, 2021)

The Birmingham Transport Plan (BTP) 2031 outlines how Birmingham's transport system must be transformed to counter the challenges likely to arise between 2021 and 2031. This plan has a vision for Birmingham to have:

- A sustainable, green, inclusive, go-anywhere network;
- Safe and healthy environments that make walking and cycling the first choice for people making short journeys;
- A fully integrated, high quality public transport system will be the go-to choice for long trips; and
- A smart innovative, carbon neutral and low emission network will support sustainable and inclusive economic success, tackles the climate emergency and promote the health and well-being of Birmingham's citizens.

The objectives of this plan are to:

- Sustain economic success and support the creation of new jobs, development of new skills and inward investment;
- Support, empower and connect communities to create a healthier and just society and a better quality of life for all citizens;
- Reduce the negative impacts of transport on the environment to make Birmingham a great place to live, grow up and age in; and
- Urgently and drastically reduce carbon emissions from transport to contribute to the City Council's and the region's decarbonisation commitments.

Delivery of the BTP's vision is to be guided by four principles:

- Reallocating road space - change away from prioritising private cars, to support the delivery of public transport and active travel networks fit for a global city;
- Transforming the city centre - creation of a network of pedestrianised streets and public spaces, integrated with public transport services and cycling infrastructure. Access to the city centre for private cars will be limited, with no through trips allowed;
- Prioritising active travel in local neighbourhoods - Walking, cycling and active travel will become the first choice for most people making short journeys in their local neighbourhoods; and
- Managing demand through parking measures - Parking will be used as a means to manage demand for travel by car through availability, pricing and restrictions.

3.3 Our Future City Plan (BCC, 2021)

The vision of Birmingham's 'Our Future City Plan' is to deliver:

- An innovative global city where prosperity is shared by all – happy healthy and affordable;
- Connected culturally distinct neighbourhoods that showcase the best environmental quality, resilience and adaptability; and
- A city proud of its unique identity and diversity that embraces technology and creativity, beauty and imagination.

This vision is underpinned by four principles to help guide the development of Birmingham.

- **Green City** – Move the city towards green growth focused on technology, innovation and manufacturing. The city should make it easy for communities to make environmentally friendly choices in the way they live, work and play;
- **Equitable City** – Access to jobs, training, housing and healthcare for all;
- **Liveable City** – Unique and diverse neighbourhoods that are attractive, distinct and green, connected by walking and cycling routes to schools, local shops and community facilities; and
- **Distinctive City** – A city that promotes and is proud of its character and diversity.

3.4 Birmingham Development Plan (BDP) 2031 (BCC, 2017)

The vision of the BDP is to by 2031 ensure Birmingham is renowned as an enterprising, innovative and green city that has delivered sustainable growth meeting the needs of its population and strengthening its global competitiveness.

To deliver this vision by 2031 the following objectives have been developed:

- To develop Birmingham as a City of sustainable neighbourhoods that are safe, diverse and inclusive with locally distinctive character;
- To make provision for a significant increase in the City's population;
- To create a prosperous, successful and enterprising economy with benefits felt by all;
- To promote Birmingham's national and international role;
- To provide high quality connections throughout the City and with other places including encouraging the increased use of public transport, walking and cycling;
- To create a more sustainable City that minimises its carbon footprint and waste and promotes brownfield regeneration while allowing the City to grow;
- To strengthen Birmingham's quality institutions and role as a learning City and extend the education infrastructure securing significant school places;
- To encourage better health and well-being through the provision of new and existing recreation, sport and leisure facilities linked to good quality public open space;
- To protect and enhance the City's heritage assets and historic environment;
- To conserve and enhance Birmingham's natural environments, allowing biodiversity and wildlife to flourish; and
- To ensure that the City has the infrastructure in place to support its future growth and prosperity.

3.5 Places for People - Phase 1 Bournville

BCC's Places for People programme aims to reduce the amount of traffic and reduce car reliance in residential neighbourhoods. The aim of the programme is to increase levels of active mode uptake and reconnect communities. As part of Places for People, residents can continue to drive on to their street, but it makes it harder for traffic to drive through the area. Bournville has been identified as part of this programme.

Modal filters were introduced on Franklin Road and Oak Tree Lane in Bournville as part of PfP in 2020. They were designed to prevent through traffic and vehicles from using unsuitable routes whilst keeping the road open to pedestrians and cyclists. The aim was to encourage people to walk and cycle more for local trips. The modal filters take the form of wooden planters in the carriageway, with a central removable bollard between the planters and have been supplemented with appropriate advanced signage indicating where the road is closed (except for cyclists).

3.6 Car Free School Streets

Locally, BCC has highlighted that many schools are experiencing traffic related issues at the peak pick up times at the start and end of the day. To help ease the congestion that occurs during the peak pick up times, BCC is introducing Car Free School Streets which will involve restricting traffic in streets surrounding schools at drop off and pick up times. St Francis CE Primary School are currently involved in this scheme. Since September 2019, traffic restrictions have been in place on Teazel Avenue Monday to Friday between 08:30-09:00 and 15:00-16:00.

Additionally, more recent interventions (e.g. bollards and yellow lines) as part of the Safer School Streets initiative have been implemented or are in the process of being implemented within Bournville, including Bournville Village Primary School (along Woodbrooke Road) and outside Kings Norton Boys' School (on Northfield Road).

3.7 Birmingham Walking and Cycling Strategy with Local Cycling and Walking Infrastructure Plan (LCWIP)

The Birmingham Walking and Cycling Strategy sets out a ten-year plan to ensure that active travel becomes the popular choice for short journeys and to increase the opportunities for recreational cycling and walking. The strategy includes three key objectives with linked policies and actions.

To achieve this aim, the following objectives have been developed:

- Enable walking and cycling – Providing training, improving access to bikes, tackling safety issues and securing funding;
- Develop a great city for walking and cycling – Providing safe infrastructure, managing traffic and maintaining streets; and
- Inspire Walking and Cycling – Organising events, distributing information and evaluating outcomes.

3.8 Clean Air Strategy (BCC, 2019)

Currently, poor air quality in Birmingham is contributing to hundreds of premature and preventable deaths, whilst making existing health conditions worse. BCC has proposed a Clean Air Strategy that sets out a series of high-level pledges as to how the council and others can contribute towards cleaner air.

The strategy aims to encourage a greater understanding of the types of air pollution, its sources, greater collaboration between BCC and other significant stakeholders in the city and to embed key priorities around improving air quality into the Council's decision-making processes.

The strategy includes several pledges that provide clear guidance around the role BCC will take in improving air quality in the city – including - collaboration with partners, clean air for schools, protecting the vulnerable, planning for the future. The pledges are:

- Improve the air quality monitoring at schools across the city;
- Support businesses to encourage active travel amongst staff;
- Actively participate in joint initiatives such as West Midlands Air Quality Improvement Programme, led by the University of Birmingham which seeks to improve the understanding of pollution sources and levels of exposure;
- Further development of the Birmingham Transport Plan to encourage more people to adopt active modes of transport in order to improve air quality and everyone's health; and
- Enhanced capability and capacity around the capture and sharing of air quality data from the across the city.

4. Existing and proposed measures

This section of the report details the existing and proposed measures within the study area.

4.1 Existing measures

Section 4.1 provides an overview of the existing measures within the study area. Figure 4-1 presents the existing measures as detailed below.

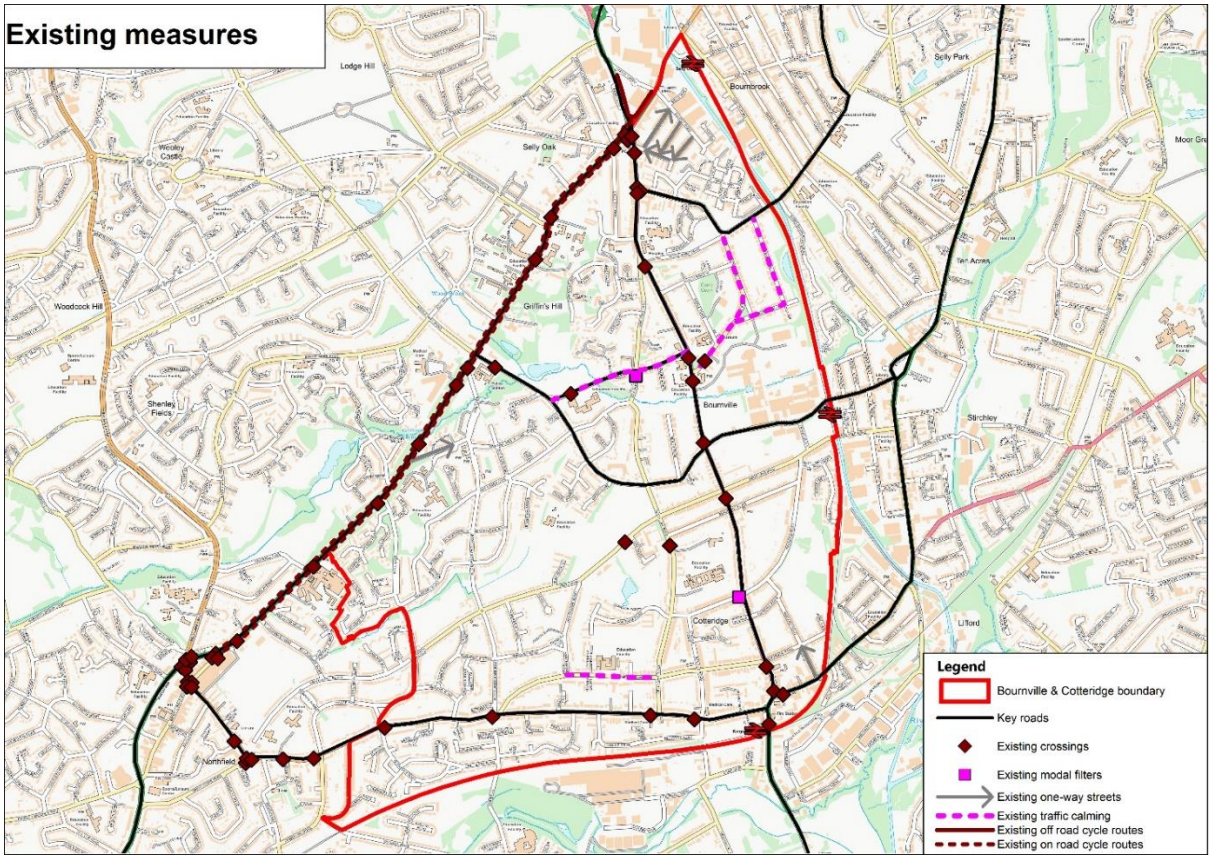

Figure 4-1: Existing measures

4.1.1 Modal filters

There are two modal filters within the study area, introduced with the Emergency Active Travel Fund during the Covid-19 pandemic and made permanent in April 2022. These are at the following locations:

- Oak Tree Lane, south of Woodbrooke Road; and
- Franklin Road, west of A4040 Linden Road.

4.1.2 One-way streets

There are several existing one-way streets within the study area, as follows:

- A one-way system in the streets east of the A38 / A4040 Oak Tree Lane junction;
    - One-way northbound on Lottie Road, from Katie Road to Elliot Road;
    - One-way southbound on Winnie Road, from Elliot Road to Katie Road;
    - One-way southbound on Gleave Road, from Elliot Road to Katie Road;

    - One-way westbound on Katie Road, from Gleave Road to Lottie Road;
- One-way eastbound on Griffons Brook Lane, from the A38 to Alder Lane; and
- One-way northbound on Midland Road, from the A441 Pershore Road to Rowheath Road.

4.1.3 Cycle facilities

There is a segregated two-way cycle route on the A38, which currently ends south of the A38 / A4040 Oak Tree Lane junction, near the northern extent of the Bournville study area. The cycle route continues along the A38 in both directions as either advisory cycle lanes, mandatory cycle lanes, or within a bus lane.

Aside from some advanced cycle stop lines at a few junctions, there are no further existing cycle facilities within the study area.

4.1.4 Traffic calming

There are several areas within the study area with speed cushions / road humps as existing traffic calming measures. These are as follows:

- Woodbrooke Road, between Bournville Lane and the A4040 Linden Road (covering the School Zones for the Dame Elizabeth Cadbury School and the Bournville Village Primary School);
- Willow Road, between Raddlebarn Road and Laburnum Road;
- Elm Road, between Raddlebarn Road and Laburnum Road;
- Laburnum Road, between Elm Road and Willow Road; and
- Northfield Road, between Hawthorne Road and Selly Oak Road (covering the School Zone for the Kings Norton Boys School)

As an extension to the speed cushions on Willow Road, surface treatments made to mimic the appearance of speed cushions are present along the high street on Sycamore Road. Drivers unfamiliar with the area are likely to slow down as they would for speed cushions, but locals may ignore these measures.

4.1.5 Crossing facilities

There are many crossing facilities throughout the study area and on the nearby key roads in Northfield, both on the key boundary roads and on internal residential roads. These are as follows:

- Various signalised crossings away from junctions on the A38: north of Langleys Road, north of College Walk, south of Weoley Park Road, south of Cob Lane, north of Griffons Brook Lane, south of Hole Lane, north of Whitehall Lane and south of St Lawrence Road;
- Signalised crossings on the north, east and south arms of the A38 / A4040 Oak Tree Lane junction;
- Footbridge over the A38 south of Bournville Lane;
- Signalised crossings on the south and west arms of the A38 / Bristol Road South junction;
- Signalised crossings on all arms of the A38 / Bell Lane junction;
- Signalised crossings on all arms of the Bristol Road South / Bell Lane junction;
- Various signalised crossing away from junctions on the A4040: south of Katie Road, south of Woodlands Drive, south of Woodbrooke Road, south of Sycamore Road, north of Bournville Lane, south of Mary Vale Road, north of the A441 Pershore Road. Also, a Zebra crossing on the A4040 south of Rowheath Road;
- Signalised crossings on all arms of the A4040 Oak Tree Lane / Raddlebarn Road junction;

- Zebra crossing on Raddlebarn Road, east of Elm Road;
- Zebra crossing on Sycamore Road, east of A4040 Linden Road;
- Zebra crossing on Woodbrooke Road, east of Bournville Lane;
- Signalised crossing on Bournville Lane, east of the A38;
- Zebra crossing on Selly Oak Road, south of Beaumont Road;
- Signalised crossing on Heath Road, west of Long Wood;
- Various signalised and Zebra crossings away from junctions on the B4121 Middleton Hall Road: signalised crossing west of the A441 Pershore Road, zebra crossing west of Station Road, signalised crossing west of Selly Oak Road, zebra crossing west of Woodlands Park Road, Zebra crossing east of Hole Lane, signalised crossing west of Innage Road and signalised crossing west of Rectory Road;
- Signalised crossings on all arms of the B4121 Great Stone Road / Church Road junction; and
- Signalised crossing on Church Road, north of Chatham Road.

4.2 Overview of proposals

This section provides an overview of the proposed measures within the study area. Figure 4-2 presents the proposed measures, which also includes the existing measures.

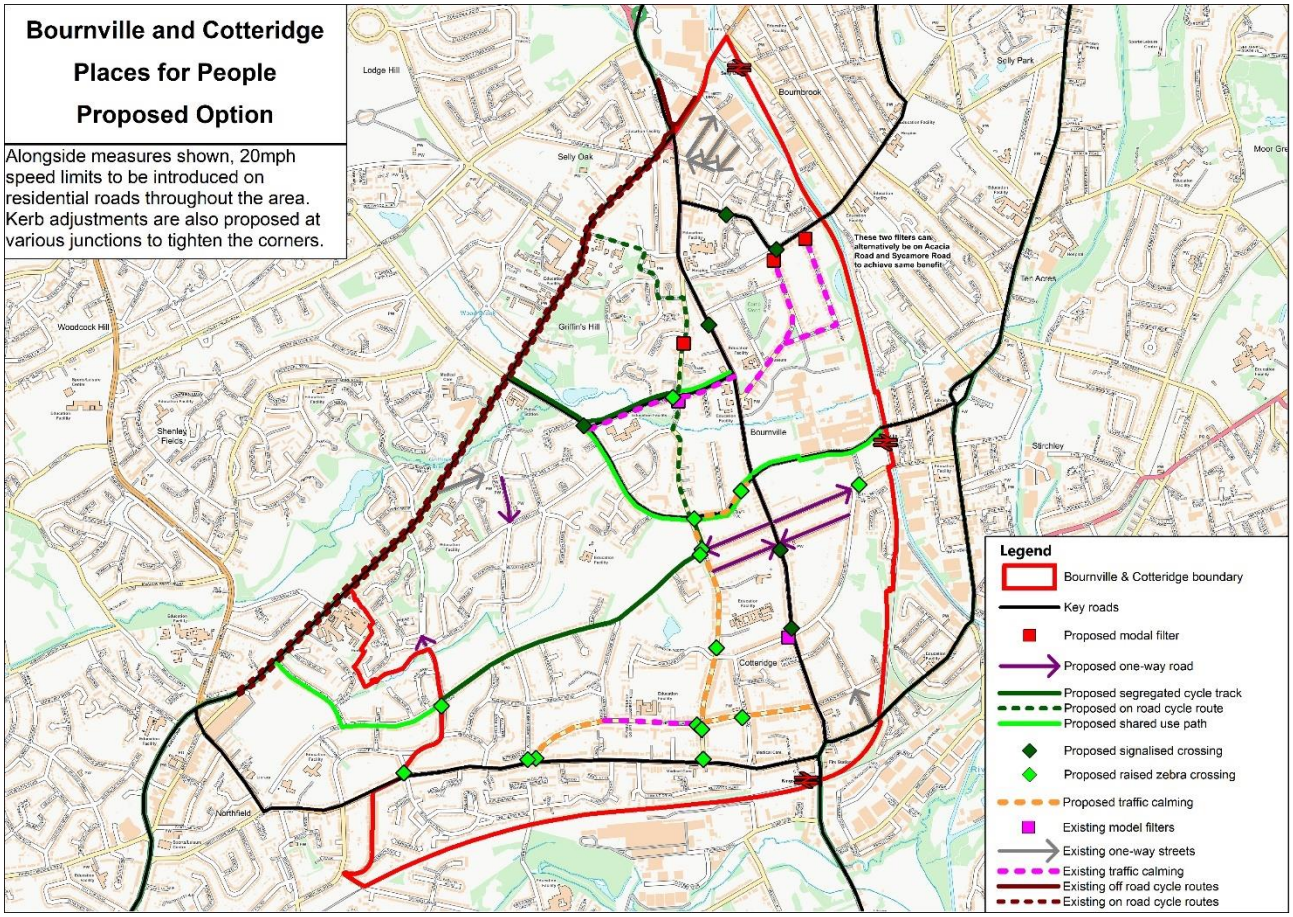

Figure 4-2: Proposed measures

4.2.1 Modal filters

Additional modal filters are proposed at the following locations:

- Willow Road, south of Raddlebarn Road;
- Elm Road, south of Raddlebarn Road; and
- Oak Tree Lane, south of Westholme Croft.

The two modal filters on Willow Road and Elm Road could alternatively be located on Acacia Road and Sycamore Road, to the east of Linden Road, to achieve a similar impact.

4.2.2 One-way streets

It is also proposed to introduce one-way street systems at the following locations:

- Westbound on Mary Vale Road from Linden Road to Heath Road;
- Eastbound on Mary Vale Road from Linden Road to Franklin Road;
- Eastbound on Beaumont Road from Heath Road to Linden Road;
- Westbound on Beaumont Road from Franklin Road to Linden Road;
- Southbound on Cob Lane, from Griffins Brook Lane to Hay Green Lane; and
- Northbound on Hole Lane from Mulberry Road to Jervoise Drive.

This series of one-way sections around Mary Vale Road and Beaumont Road ensures there is not a straight route along either of these roads, requiring vehicles to perform multiple turning manoeuvres to traverse east-west through the area, making it a less attractive route. HGVs in particular will find it difficult to perform these turns, encouraging non-local HGV traffic to utilise more suitable routes.

The two one-way sections on Cob Lane and Hole Lane restrict through movements in opposite directions on the two key roads through the area, to and from the A38.

4.2.3 Cycle facilities

Various cycle routes are also proposed within the study area either as segregated cycle facilities, shared use facilities on widened footways, or on carriageway routes taking advantage of the reduced vehicle flows from the modal filters. The proposed routes are as follows:

- On-carriageway route along Selly Oak Road (north of Bournville Lane), Oak Tree Lane, Hoyland Way, Sellywood Road and College Walk;
- Segregated cycle route along Bournville Lane and Woodbrooke Road, between the A38 and Oak Tree Lane. The route then continues as a shared use facility along the eastern section of Woodbrooke Road to Linden Road, to link to the Bournville Village Primary School and the Sycamore Road high street;
- Shared use cycle route along the rest of Bournville Lane, east from Woodbrooke Road. This route provides a link to the Bournville railway station; and
- Segregated cycle route along Selly Oak Road, between Bournville Lane and Heath Road; and along Heath Road, between Selly Oak Road and Hole Lane. The route then continues as shared use on Heath Road South and St. Lawrence Road to link to the A38.

4.2.4 Traffic calming

The existing traffic calming on Northfield Road is proposed to be extended east and west to Linden Road and Middleton Hall Road, so that the entire Northfield Road corridor is included. Traffic calming is also proposed along Selly Oak Road between Bournville Lane and Northfield Road and on Bournville Lane between Selly Oak Road and Linden Road.

4.2.5 Crossing facilities

New crossing facilities are proposed to be introduced throughout Bournville, consisting of either signalised crossings or Zebra crossings on raised tables. These will ensure permeability of the area for pedestrians (and cyclists if Toucan crossings are installed along cyclist routes), as well as further controlling the speed of vehicles. Kerb adjustments are also proposed at various junction to tighten the corner radii, which will slow vehicle speeds and shorten the crossing distance for pedestrians at the junction.

5. Traffic model

Various through routes within the study area are proposed to be prohibited using modal filters and one-way systems. It is anticipated that this may result in more traffic being pushed to the boundary roads (the A38 Bristol Road, B4121 Middleton Hall Road and A4040 Linden Road), as well as some key internal roads. It is proposed that Linden Road and Northfield Road are kept open as they are on bus routes, as well as Bournville Lane, Woodbrooke Road and Raddlebarn Road which need to be kept open as access roads into the area.

To understand the impact of the proposed measures, a high-level modelling exercise was completed using the BCC SATURN 2022 model, together with the existing and commissioned traffic data. A cordoned base model for the AM and PM 2023 peak hours was created for the study area as detailed in Figure 2-19 below, (further details on the model build can be found in 6.7). The following model scenarios were created:

- 2023 Base Model - AM Peak Hour;
- 2023 Base Model - PM Peak Hour;
- 2023 Proposed Measures - AM Peak Hour; and
- 2023 Proposed Measures - AM Peak Hour.

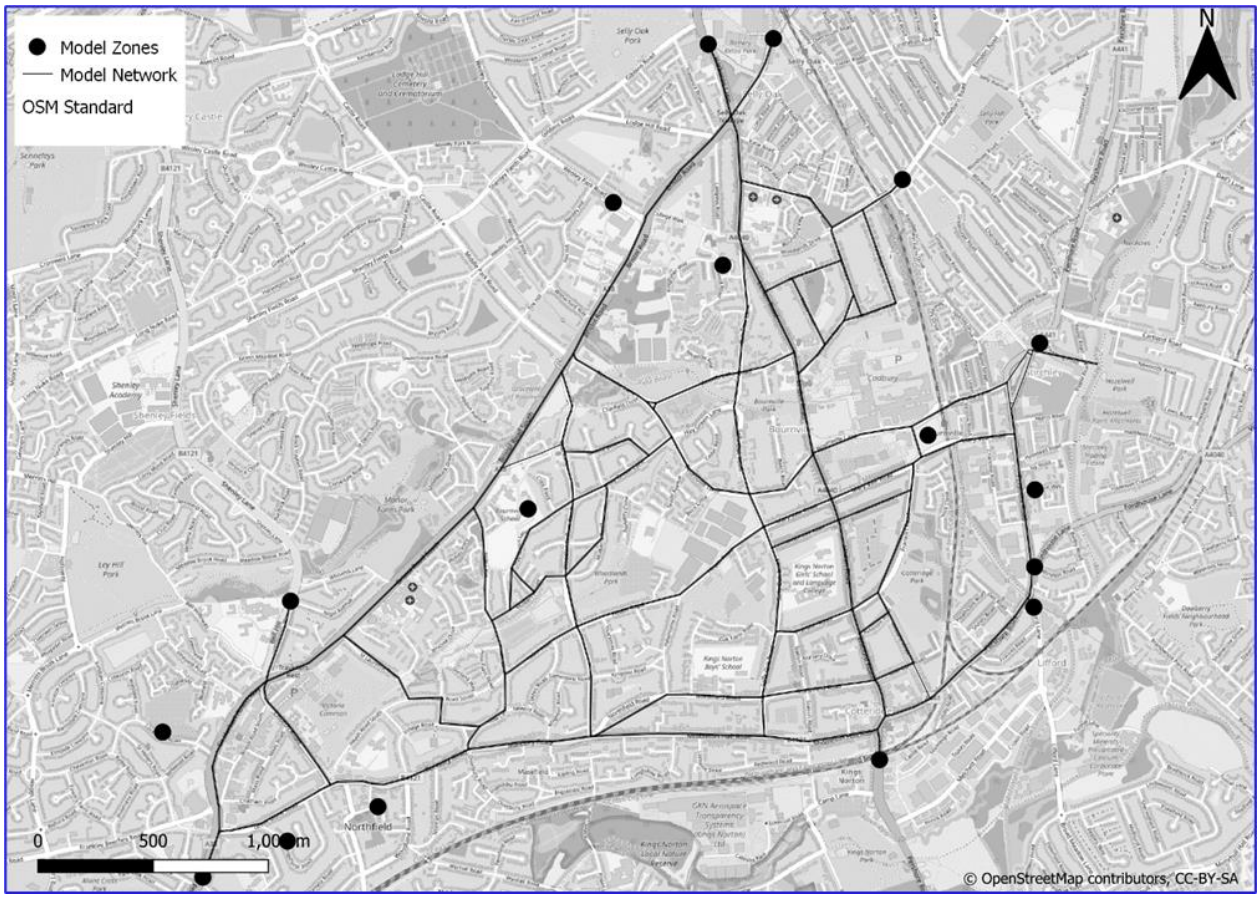

Figure 5-1. Model Network

6. Impact and mitigation

6.1 Impact of proposed measures

Results from modelling of the proposed measures as summarised in section 4, can be seen in Figure 6-1 for the AM peak and Figure 6-2 for the PM peak (exact PCU values on key links in the model can be found in 6.8).

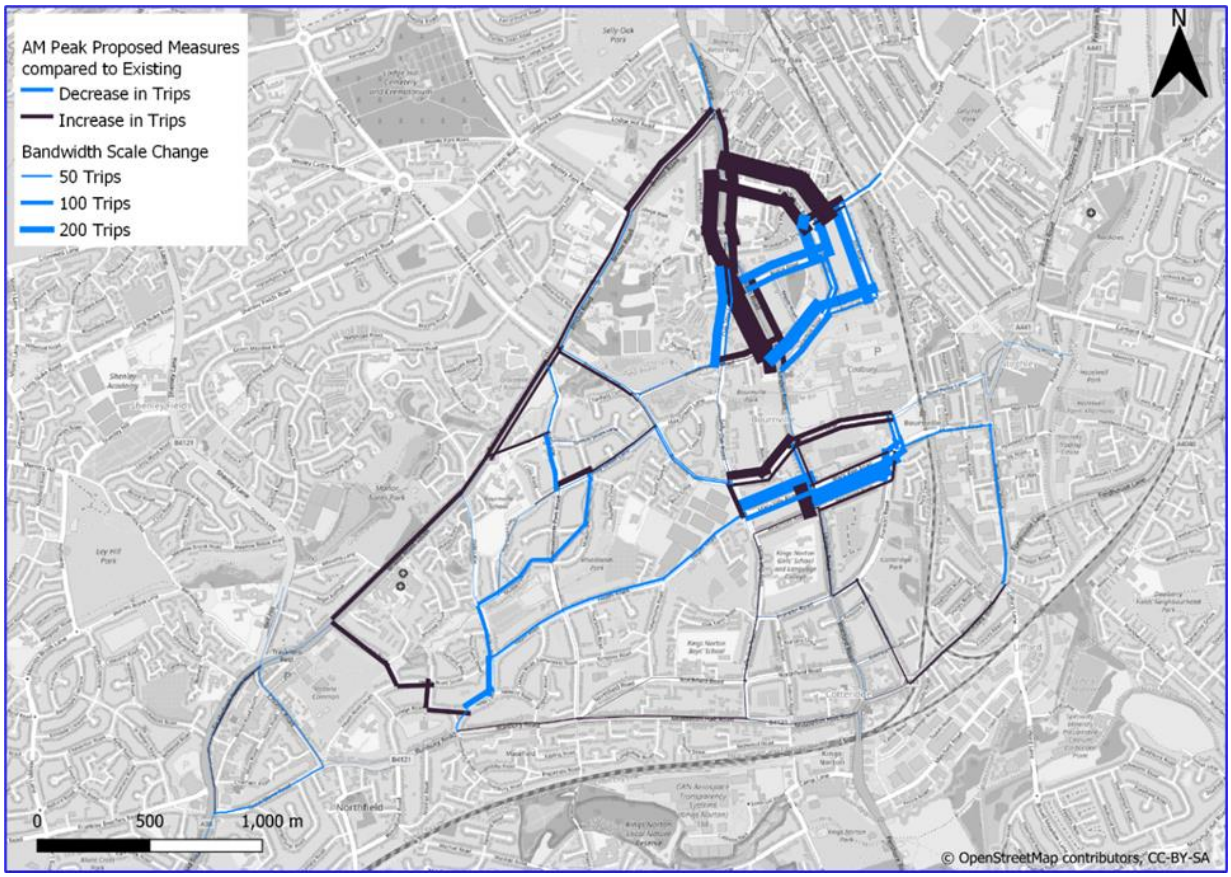

Figure 6-1: AM Peak Proposed Measures compared to existing situation

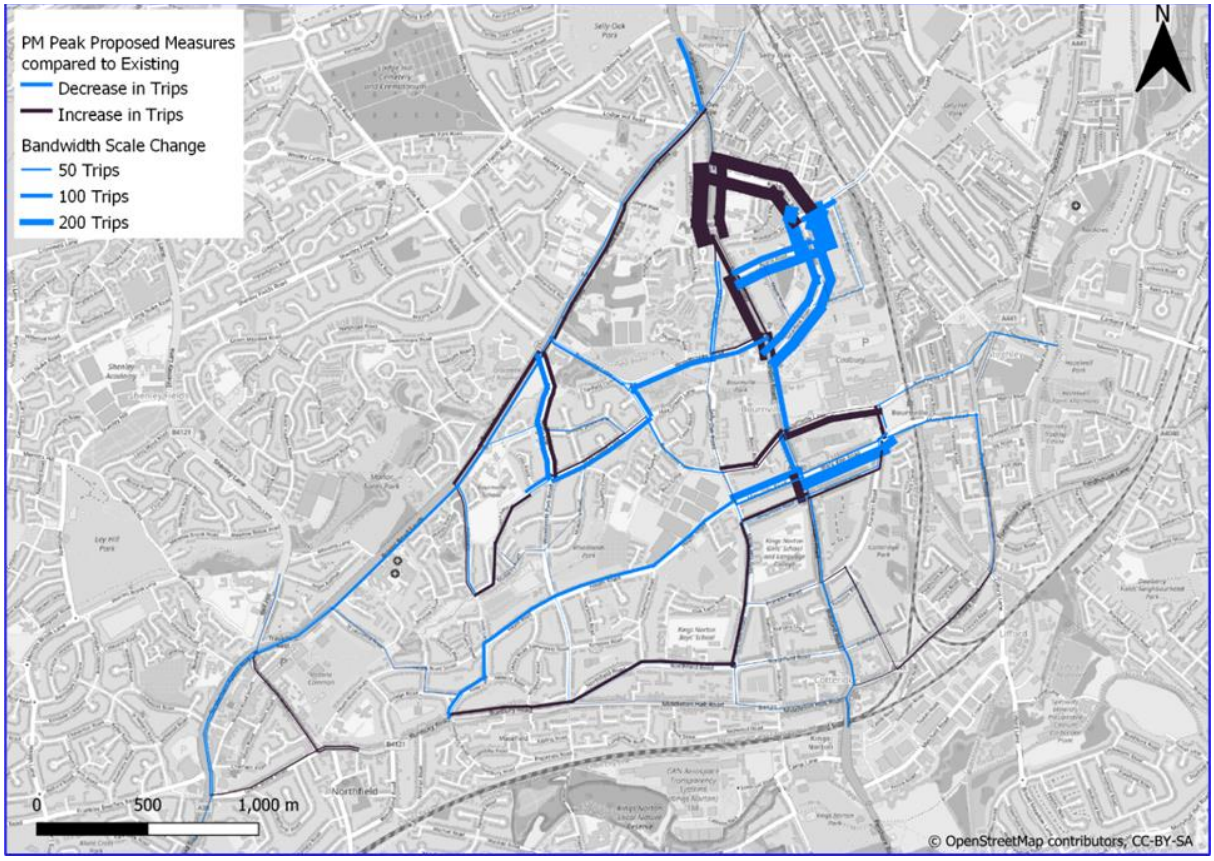

Figure 6-2: PM Peak Proposed Measures compared to existing situation

The key changes in reassigned traffic are as follows:

- The results for the proposed measures are similar for the AM and PM peak hours. However, the AM peak has more traffic rerouting along the A38 and the proposed measures have a larger impact on the AM network compared to PM.
- The modelling also shows that there is expected to be some rerouting of traffic from Sycamore Road and Acacia Road onto A4040 Oak Tree Lane and Raddlebarn Road. With the modal filters on Willow Road and Elm Road preventing traffic from accessing Raddlebarn Road, vehicles are now expected to access via A4040 Oak Tree Lane/Raddlebarn Road signals.
- The proposed one-way schemes on Beaumont Road and Mary Vale Road are expected to divert traffic onto Bournville Lane for east/west movements. Additionally, traffic that previously routed via Heath Road south to travel across Bournville is now expected to use the A38.
- The proposed one-way scheme on Cob Lane is expected to redirect traffic onto the A38 and reduce rat-running through Bournville. Additionally, traffic is also anticipated to continue on Hay Green Lane and use the A4040 Linden Road.

6.2 Network capacity review

Following the modelling exercise, a high-level review of traffic capacity was undertaken on those roads likely to experience increased traffic due to the proposed measures. The capacity review used National Highways Design Manual for Roads and Bridges Volume 5 Part 3 TA79/99 Traffic Capacity of Urban Roads as a guide. Table 6 -1 details the capacity of vehicles per hour, existing traffic taken from available peak hour data, together with the increase in traffic per hour taken from the modelling results and finally confirmation of whether the combined traffic at each location is within capacity.

Table 6-1 Capacity Review (per direction)

Capacity * Per direction	Location	Existing	Increase	Total	Within Capacity
1,470	Oak Tree Lane - Northbound	500	600	1,100	Yes
1,470	Oak Tree Lane - Southbound	300	600	900	Yes
1,470	Linden Road - Northbound	300	850	1,150	Yes
1,260	Raddlebarn Road - Eastbound	400	430	830	Yes
1,260	Raddlebarn Road - Westbound	400	440	840	Yes
1,260	Bournville Lane - Eastbound	200	400	600	Yes
1,260	Bournville Lane - Westbound	300	500	800	Yes
900	Northfield Road - Westbound	100	300	400	Yes
750	Beaumont Road - Eastbound	300	320	620	Yes
750	Cob Lane - Southbound	100	250	350	Yes

* Assumes HGV of 15% or less

6.3 Proposed mitigation measures

The following are high-level mitigation measures to alleviate the impact on the boundary roads. Figure 6-3 shows the location of the proposed mitigation measures.

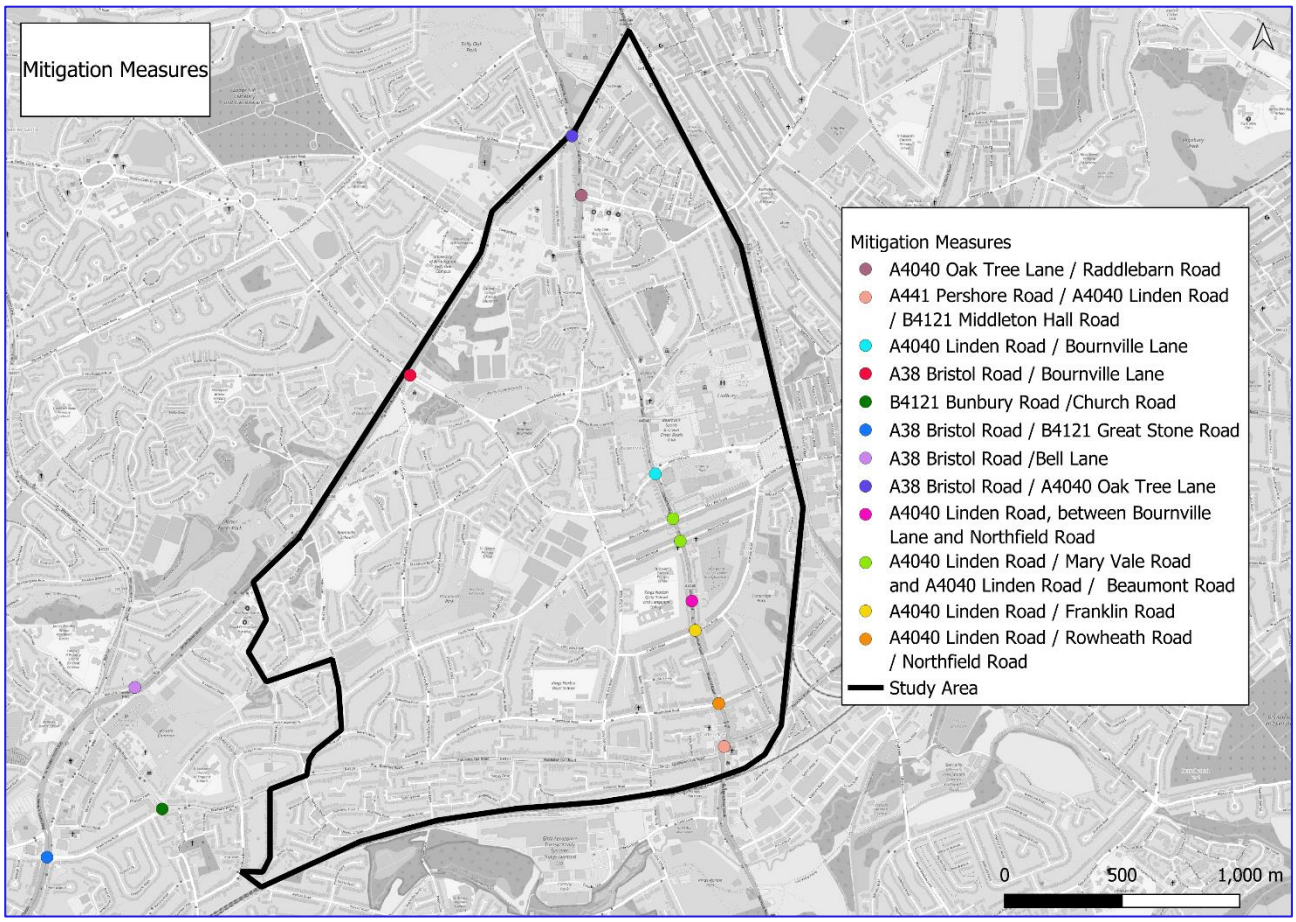

Figure 6-3: Proposed Mitigation Measures

6.3.1 A4040 Oak Tree Lane / Raddlebarn Road

The current layout of this junction is a 3-arm signalised junction. All arms are single carriageways, each of which flare to provide 2 lane entries. The northbound arm includes a dedicated right turn lane with internal storage past the stop line, for right turns into Raddlebarn Road. There is on-street parking along the western side of the A4040 carriageway to the north, south and through the junction.

The area around this junction is highly constrained by existing buildings / third party land, so there is little scope for widening the carriageway to improve capacity. However, the existing carriageway space could be reallocated to create additional capacity for certain movements.

The right turn lane from the A4040 northbound to Raddlebarn Road is currently 15m long (queueing capacity for approximately 3 vehicles). The proposed modal filters on Willow Road and Elm Road are expected to increase the number of right turns at this junction, likely resulting in this right turn facility being inadequate. An option would be for the southbound exit lane to be realigned into the space marked off to protect the southbound bus stop, with this bus stop being within the carriageway. This would allow for the right turn lane to be extended through this space to approximately 40m, increasing the queueing capacity from 3 to 8 vehicles.

The on-street parking to the south and through the junction could alternatively be removed, with the introduction of double yellow lines. This would allow for the ahead lane to be reallocated into this

carriageway space, thereby creating additional space for the right turn lane to be extended. This could similarly extend the right turn to approximately 40m, before being constrained by the bus stop.

If both of the above measures are implemented, then a longer right turn could be introduced down to the school zone, at approximately 90m for a queueing capacity of 12 vehicles.

6.3.2 A441 Pershore Road / A4040 Linden Road / B4121 Middleton Hall Road

The current layout of this junction is two mini roundabouts in close proximity, with signalised pedestrian crossings nearby on all four approaches. There are two lanes in each direction between the two mini roundabouts, but there are also bus stops in each direction which each blocking one lane when a bus is stationary.

A mitigation could be that the bus stops between the junctions are removed, as these are likely impacting the operation of the junctions by effectively reducing the number of approach lanes. This is especially significant in this location with two junctions located so close together, as capacity issues can quickly cause queues to block back into the other junction and further exacerbate the capacity issues. Both lanes are required to be fully usable to contain the queues in the available space.

There are already alternative bus stops on three of the four arms of these junction, with only one missing on the B4121 Middleton Hall Road. The services which utilise these bus stops between the mini roundabouts could therefore transfer to these other existing nearby bus stops, with a new bus stop introduced on the B4121 Middleton Hall Road.

6.3.3 A4040 Linden Road / Bournville Lane

The current layout of this junction is a 4-arm priority crossroads, with a slight stagger. All arms are single carriageways on approach, with Bournville Lane east flaring to provide 2 entry lanes and the A4040 Linden Road featuring short right turn bays from both directions.

The configuration of the staggered junction layout means there is limited stacking space for right turning vehicles on the A4040 Linden Road, which may result in the blocking back of ahead movements if there are more than one or two vehicles turning wanting to turn right. This junction requires further investigation, including after the proposed measures are in place, to determine if right turning vehicles are consistently blocking ahead movements due to the constrained length of right turn bays. If this is the case, then one or both of the right turns at this junction could be banned. If just one of the right turns is banned, this would enable the remaining right turn bay to be significantly increased in length.

The bus stop on the A4040 Linden Road south of the junction is immediately south of a kerbed refuge island in the centre of the carriageway. This kerbed island prevents vehicles from being able to pass a stationary bus at the stop, despite the wide central hatched area which would otherwise facilitate this. This may therefore result in vehicles blocking back into the A4040 Linden Road / Bournville Lane junction, as they wait for the bus to drop off and pick up passengers. As a quick win, options could include the kerbed island relocated north, or the bus stop relocated south (or both) so that a sufficient gap is created between the two.

6.3.4 B4121 Bunbury Road / Church Road

The current layout of this junction is a 3-arm signalised junction, in which all three arms have a single approach lane which flare to two entry lanes. There are staggered pedestrian crossings on all arms, built into the operation of the junction.

The B4121 carriageway is approximately 9m wide, which can therefore support a total of three 3m wide lanes. A mitigation could include the lengthening of the flare lanes on the B4121 eastbound and westbound, making use of this wide carriageway.

6.3.5 A38 Bristol Road / B4121 Great Stone Road

The current layout of this junction is a 3-arm signalised junction. The A38 is a dual carriageway, which flares to provide three lane entries on the north and south arms. The B4121 Great Stone Road is a single

carriageway, which flares to provide a two-lane entry. The east and south arms have staggered pedestrian crossings built into the operation of the junction.

The lack of parking restrictions along the south side of the carriageway on the B4121 result in the usable width of the carriageway being significantly reduced on the approach to the junction. An option could include the creation of a parking layby by widening the carriageway into the grass verge, outside those properties which do not have off street parking available. Single yellow line parking restrictions should then be introduced between this parking layby and Kingshurst Road, as per the restrictions in the opposite carriageway lane.

If this parking layby is created, the full width of the 9m carriageway will become usable. This will enable the westbound flare lane to be lengthened.

6.3.6 A38 Bristol Road / Bell Lane

The current layout of this junction is a 4-arm signalised junction. The A38 is a dual carriageway, which flares to provide three lane entries on the east and west arms. Bell Hill (the north arm) is also a dual carriageway, with a short left turn filter lane and a right turn facility into Saxon Wood Close near to the stop line. Bell Lane (the south arm) is a single carriageway, which flares to provide a two lane entry. There are staggered pedestrian crossings on all arms, built into the operation of the junction.

An option could include the conversion of Bell Lane to one-way northbound between Bristol Road South and the A38. This would allow for both lanes to be used for northbound traffic at the A38 Bristol Road / Bell Lane junction, increasing the capacity of this arm. It would also remove the need for a right turn from the A38 west, alleviating the capacity issues on this arm too. Traffic currently travelling southbound on Bell Lane towards the high street can divert via the A38 / Bristol Road South junction, to the east of this junction, or via Lockwood Road (which is already one-way from the A38 towards the high street) to the south west.

Additionally the left turn filter on Bell Hill could also be lengthened by widening into the wide footway on the northeast corner of this junction, south from the existing parking layby. Similarly, a short right turn lane could be provided on approach to the turn to Saxon Wood Close, to reduce the likelihood that this right turn blocks the ahead traffic to the A38 Bristol Road / Bell Lane junction, or vice-versa that the ahead traffic blocks the right turn.

6.3.7 A38 Bristol Road / A4040 Oak Tree Lane

The current layout of this junction is a 4-arm signalised junction. The A38 south is a dual carriageway with an additional lane for a bus lane, with four lanes on entry to the junction. Two of these lanes are left turns to the A38 bypass around Selly Oak, with two ahead lanes into Selly Oak. Right turns from the A38 south are banned. The A4040 north (part of the A38 bypass) is a dual carriageway which flares to provide three entry lanes. It has a single ahead lane and two right turn lanes, with left turns into Selly Oak banned. The B384 Bristol Road has three lanes for the whole section from the previous junction, with one left turn lane, two ahead lanes and banned right turns. The A4040 Oak Tree Lane is a single carriageway road which flares to provide four entry lanes, consisting of a left turn filter lane, two ahead lanes and one right turn lane. This is the only arm at this junction with no banned movements. There is a two-way cycle track running through this junction, linking to the A38 south, A4040 north and B384 arms.

There is little which can be done to improve capacity at this junction without demolishing nearby buildings to create more space. The junction is already large, with each arm featuring at least 3 entry lanes and right turns already banned on two arms. The existing cycle track also adds to the constraints around the junction.

Nevertheless, the A4040 Oak Tree Lane northbound could be widened slightly into the wide footway, as far as the existing pedestrian crossing south of Katie Road, to increase the length of the flare lanes by approximately 20m.

Additionally right turns on the A4040 Oak Tree Lane could also be banned, so that lane 1 becomes left only (feeding into the left turn filter) and lanes 2 and 3 are ahead only. Any right turns from here will be for local access in Selly Oak only (such as to local residences, the high street, or the railway station), as longer distance trips would instead go ahead onto the A38 bypass. These trips can instead be accommodated by turning right

further south on the A4040 at Raddlebarn Road and entering Selly Oak from the south, or by going ahead on the A38 bypass and entering Selly Oak from the north.

6.3.8 A4040 Linden Road, between Bournville Lane and Northfield Road

The carriageway along the section of the A4040 Linden Road between Bournville Lane and Northfield Road generally lacks parking restrictions, aside from a few localised areas. A mitigation could be that the double / single yellow line parking restrictions are extended along this section of carriageway to keep the link flowing smoothly. All properties along this section have off street parking available to them within their curtilage, so on-street parking is not a requirement for residents.

6.3.9 A4040 Linden Road / Mary Vale Road and A4040 Linden Road / Beaumont Road

Both of these junctions are 4-arm priority crossroads, with single carriageway approaches on all arms. The A4040 Linden Road has right turn bays for each movement into the side roads.

However, the configuration of the junction layout, restricts the stacking space for right turning vehicles. This layout is usually only required when the crossroad is staggered, such as with the A4040 Linden Road / Bournville Lane to the north. Neither of these crossroads are staggered, so this existing arrangement is not required.

An option could include the reversal of the right turn bays into Mary Vale Road and Beaumont Road from their existing layout. This would also enable the right turn bays to be extended, utilising the area of hatching along the A4040 Linden Road. Between the two junctions, the right turn bays could be extended to halfway to the next junction, fully utilising this space if required. To the north of Mary Vale Road and the south of Beaumont Road, the right turn bays could also be extended if required to ensure right turning vehicles do not block ahead traffic.

The improved right turn bays could benefit the proposed alternating one-way system along Mary Vale Road and Beaumont Road.

6.3.10 A4040 Linden Road / Franklin Road

Due to the existing modal filter on the west arm of Franklin Road, the current layout of this junction is a 3-arm priority junction, with single carriageway approaches on all arms and no right turn bay on the A4040 Linden Road.

A right turn bay could be provided on the A4040 Linden Road northbound (for movements to Franklin Road east). Due to width constraints along the A4040 to the south, this right turn bay can only be approximately 10m long, but this would allow 1 or 2 right turning vehicles to be stored without blocking ahead traffic.

Due to the existing modal filter, a right turn bay on the A4040 southbound is not required.

6.3.11 A4040 Linden Road / Rowheath Road / Northfield Road

The current layout of this junction is a 4-arm priority crossroads. All arms are single carriageways on approach with no right turn bays on the A4040 Linden Road.

Rowheath Road could either be converted to one-way westbound or right turns from the A4040 Linden Road south into Rowheath Road are banned. Either of these options could prevent right turners blocking ahead traffic along the A4040, ensuring that the link flows smoothly away from the A441 Pershore Road / A4040 Linden Road junction and does not block back to this junction.

Similarly, right turns from the A4040 Linden Road north into Northfield Road could be banned (Northfield Road cannot be made one-way as recommended for Rowheath Road due to a bus route on this road). This would prevent right turners blocking ahead traffic along the A4040, helping to keep the link flowing smoothly southbound, as this location is shown to experience delays.

6.4 Mitigation measures for further consideration

6.4.1 A441 Pershore Road / A4040 Linden Road / B4121 Middleton Hall Road

An option could include the conversion of these two junctions to 3-arm signalised junctions, in a linked network with each other. This would allow for greater control of the flows through the junctions, as well as linking the pedestrian crossings into the operation of the junctions.

6.4.2 A38 Bristol Road / Bournville Lane

The current layout of this junction is a 3-arm priority junction, with left in and left out only for the A38. It is opposite another 3-arm priority left in / left out junction with Middle Park Road. The A38 is a dual carriageway, with an advisory cycle lane in each direction. Bournville Lane is a single carriageway road.

Bournville Lane is highlighted as a key road through the Bournville study area, but as a left in / left out junction only southbound vehicles on the A38 can access this road. Therefore, this junction could be converted to an all-movement junction, turning it into a 4-arm crossroads, enabling access to Bournville Lane for A38 northbound traffic and for traffic from Middle Park Road. This junction would likely need to be signalised to enable the safe and efficient operation of the 4-arm crossroads.

Enabling all movements at Bournville Lane would alleviate some of the pressure on the A38 / A4040 Oak Tree Lane junction, as certain movements at that junction could be transferred here instead.

6.4.3 A4040 Linden Road / Bournville Lane

The current layout of this junction is a 4-arm priority crossroads, with a slight stagger. All arms are single carriageways on approach, with Bournville Lane east flaring to provide 2 entry lanes and the A4040 Linden Road featuring short right turn bays from both directions.

The configuration of the staggered junction layout means there is limited stacking space for right turning vehicles on the A4040 Linden Road, which may result in the blocking back of ahead movements if there are more than one or two vehicles turning wanting to turn right. If this is the case, then one or both of the right turns at this junction could be banned. If just one of the right turns is banned, this would enable the remaining right turn bay to be significantly increased in length.

The bus stop on the A4040 Linden Road south of the junction is immediately south of a kerbed refuge island in the centre of the carriageway. This kerbed island prevents vehicles from being able to pass a stationary bus at the stop, despite the wide central hatched area which would otherwise facilitate this. This may therefore result in vehicles blocking back into the A4040 Linden Road / Bournville Lane junction, as they wait for the bus to drop off and pick up passengers. As mentioned in section 6.3.3, a quick win would be for either the kerbed island to be moved north, or the bus stop to be moved south (or both) so that a sufficient gap is created between the two. However further investigation may be required to understand the level of impact of right-turning vehicles on ahead movements, once the quick-win measures have been implemented.

6.5 Summary of proposed mitigation measures

Table 6 -1 presents the proposed mitigation measures and indicates if the measures are able to be implemented as 'quick wins'.

Table 6 -1. Proposed Mitigation Measures

Location of mitigation measure	'Quick wins'
A4040 Oak Tree Lane / Raddlebarn Road	Yes
A441 Pershore Road / A4040 Linden Road / B4121 Middleton Hall Road	Yes (bus stops)
A4040 Linden Road / Bournville Lane (bus stop or kerbed island relocation)	Yes
B4121 Bunbury Road /Church Road	Yes
A38 Bristol Road / B4121 Great Stone Road	Yes

Location of mitigation measure	'Quick wins'
A38 Bristol Road / Bell Lane	Yes
A38 Bristol Road / A4040 Oak Tree Lane	Yes
A4040 Linden Road, between Bournville Lane and Northfield Road	Yes
A4040 Linden Road / Mary Vale Road and A4040 Linden Road / Beaumont Road	Yes
A4040 Linden Road / Franklin Road	Yes
A4040 Linden Road / Rowheath Road / Northfield Road	Yes
A441 Pershore Road / A4040 Linden Road / B4121 Middleton Hall Road	No (junction improvements)
A38 Bristol Road / Bournville Lane	No
A4040 Linden Road / Bournville Lane (determination of right turning vehicle impacts)	Further investigation required

6.6 Appendix A: Commissioned traffic data

Figure A-1 to Figure A-4 show the AM and PM average traffic flow data.

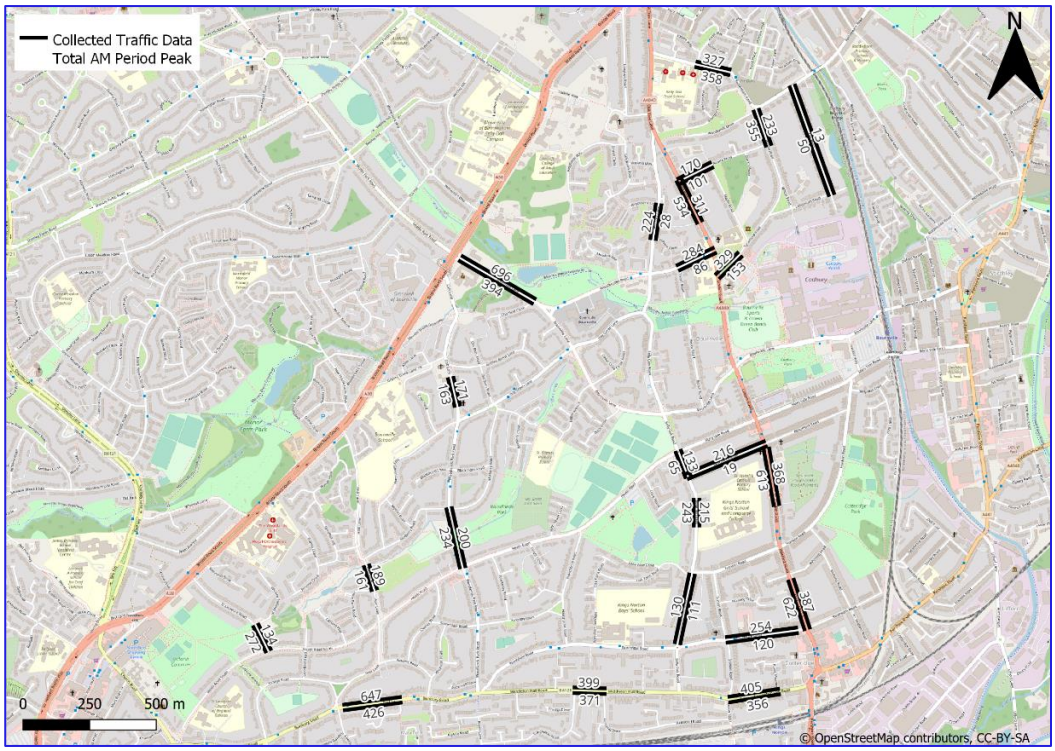

Figure A-1. Average AM Peak Commissioned ATC counts

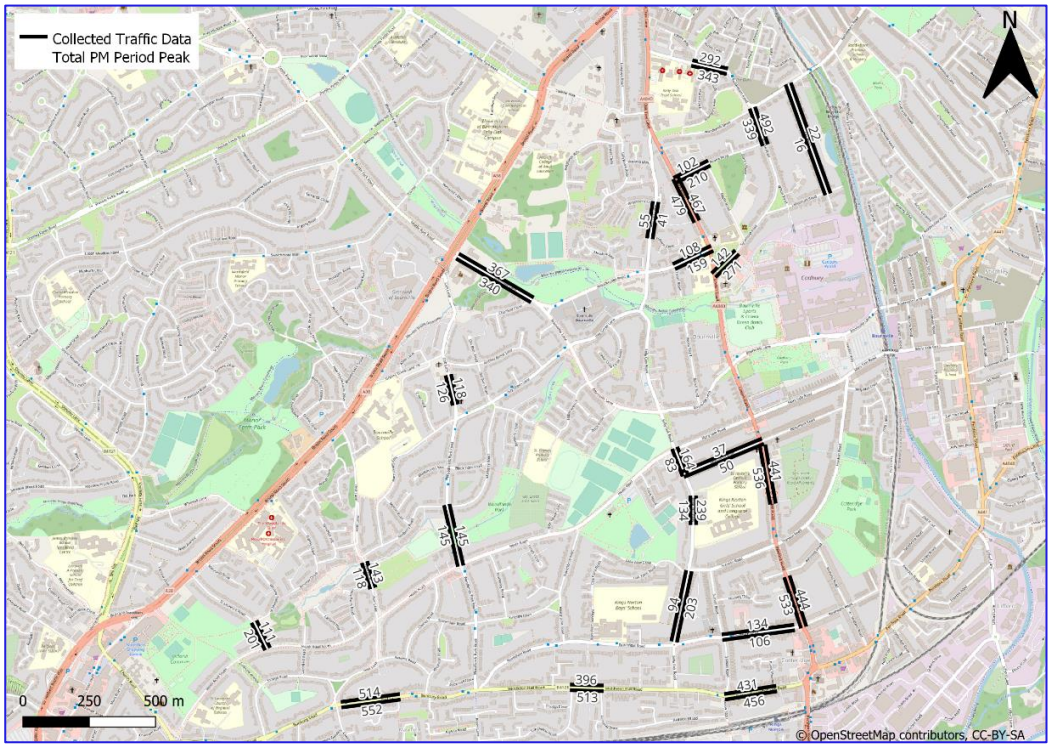

Figure A-2. Average PM Peak Commissioned ATC counts

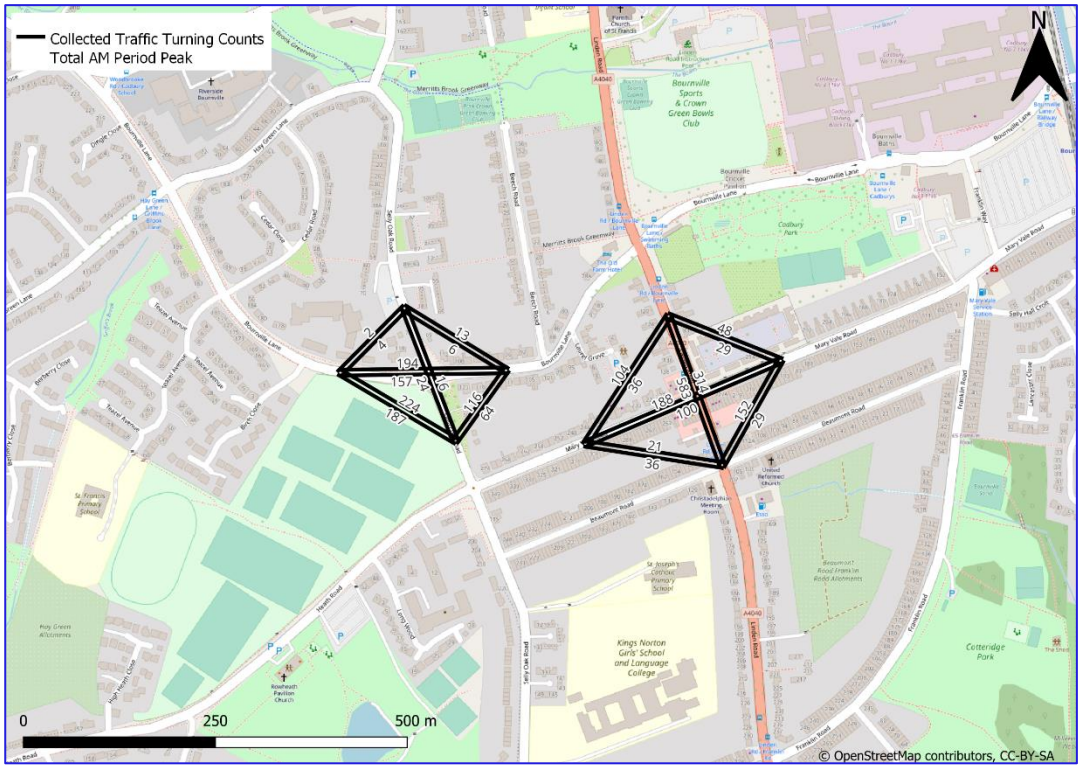

Figure A-3. Average AM Peak Commissioned Turning counts

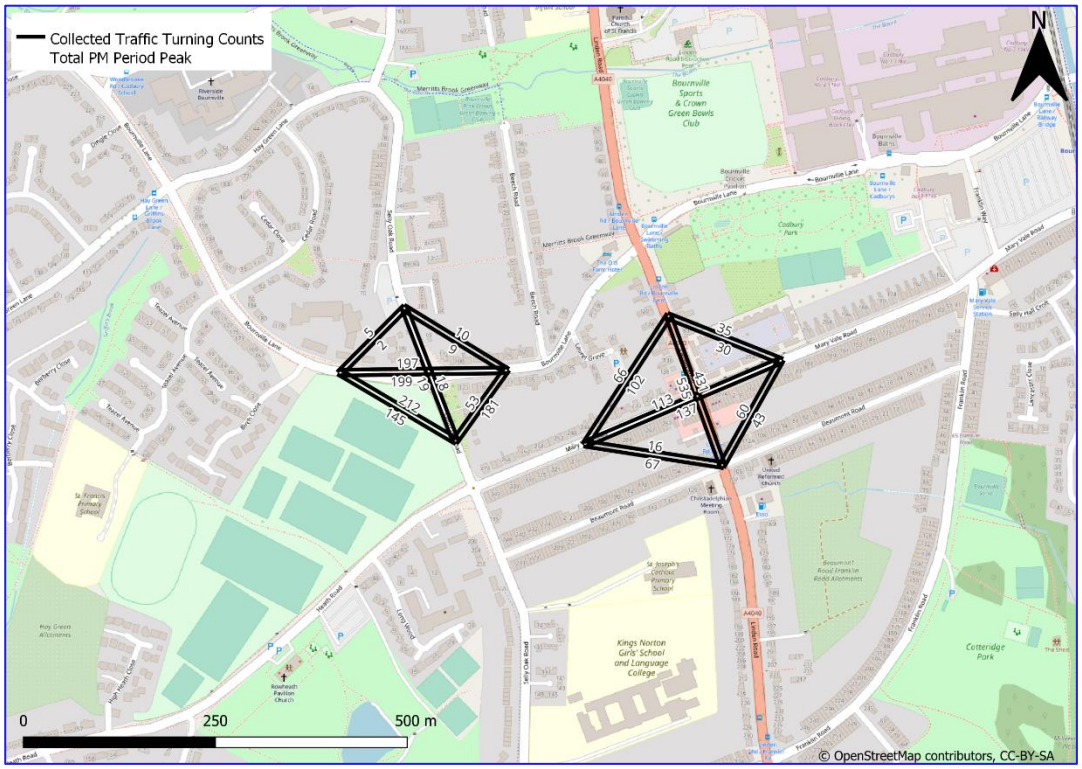

Figure A-4. Average PM Peak Commissioned Turning counts

6.7 Appendix B: Model specifications

A.1 Model specification

The Base Model simulated traffic conditions for 2023. The Base Model was constructed to simulate the following time periods based on the commissioned traffic surveys:

- 2022 weekday AM Peak hour (07:30 – 09:30); and
- 2022 weekday PM Peak hour (15:30 – 19:30).

A.2 Network construction

The basic road network, such as the roads and junctions, were constructed in GIS and coded in SATURN. Speed limits were assigned to the links based on current locations and assigned a standardised speed flow curve derived from the existing BCM SATURN Model.

A.3 Matrix development

A.3.1 Model zones

Seventeen zones were identified around the network, which are shown in Figure B-1. These were determined using the existing zones in the BCM SATURN Model with an extra zone to represent Bournville Station in more detail.

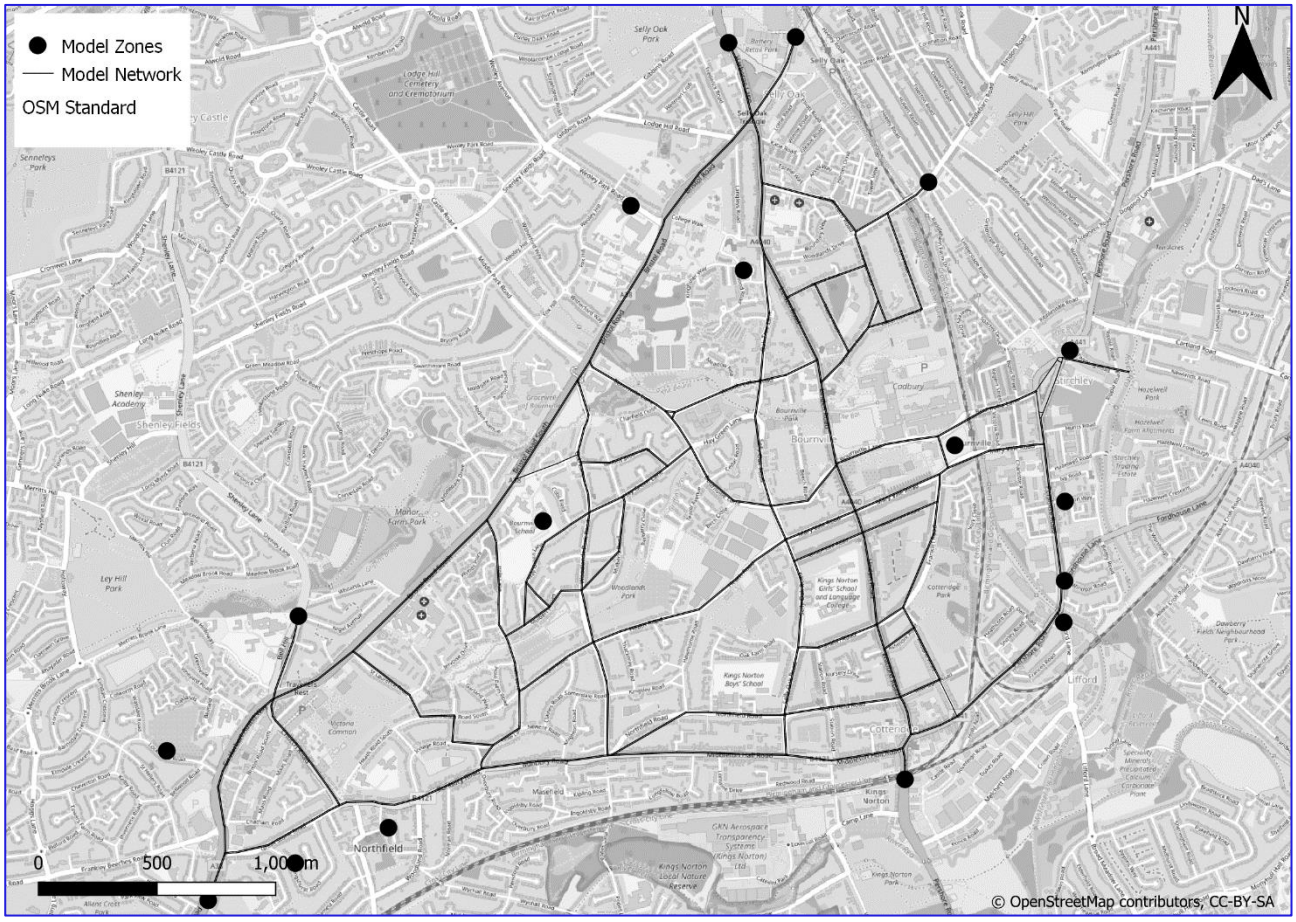

Figure B-1. Model Zone Locations

A.4 Calibration and Validation methodology

The calibration and validation process ensures that the model accurately reflects existing traffic conditions. The process was based on DfT Transport Appraisal Guidance (TAG) criteria. Validation of the model was not deemed necessary based on the early stage and timescale of the project.

Appraisal guidance sets out measures to compare the Base Model against observed independent data to quantify how accurately the Base Model simulates existing conditions. Primary model calibration measures are:

- Assigned flows and count comparison on individual links and turning movements at junctions, as a check on the quality of the assignment; and
- Modelled and observed journey time comparison along routes, as a check on the quality of the network and the assignment.

The following model calibration measures were used:

The absolute and percentage differences between modelled flows and counts was the calibration measure used to calibrate. The GEH statistic was used as an indicator as both measures are broadly consistent; therefore, link and turning flows that meet either criterion during calibration should be regarded as satisfactory.

The primary calibration measure used was the link flow and turning movement outlined in Table B-1 (reproduced from Table 2 in TAG Unit M3.1). TAG requires that results are presented for both car and total vehicles.

Table B-1. Link flow and turning movement calibration criteria

Description of Calibration Criteria	Acceptability Guideline
Flow Criteria	
Individual flows within 100 veh/hr of counts for flows less than 700 veh/hr	> 85% of cases
Individual flows within 15% of counts for flows from 700 veh/hr to 2,700 veh/hr	> 85% of cases
Individual flows within 400 veh/hr or counts for flows more than 2,700 veh/hr	> 85% of cases
GEH Criteria	
GEH <5 for individual flows	> 85% of cases

A.5 Base model calibration

The results from the base model calibration can be seen in Table B-2. It shows both models are calibrated for the link counts while the turning counts were used to provide the movement in the model rather than calibrate to it.

Table B-2. Calibration summary for AM and PM Peak

Time period	Link Count		Turning Count	
	Pass	Fail	Pass	Fail
AM	44 (92%)	4 (8%)	13 (72%)	5 (28%)
PM	44 (92%)	4 (8%)	10 (56%)	8 (44%)

6.8 Appendix C: Key road Passenger Car Unit (PCU) values

Figure C-1 shows the key road locations that have been selected to show the modelled PCU values[2].

Table C-1 shows the modelled PCU flow for the locations shown in Figure C-1.

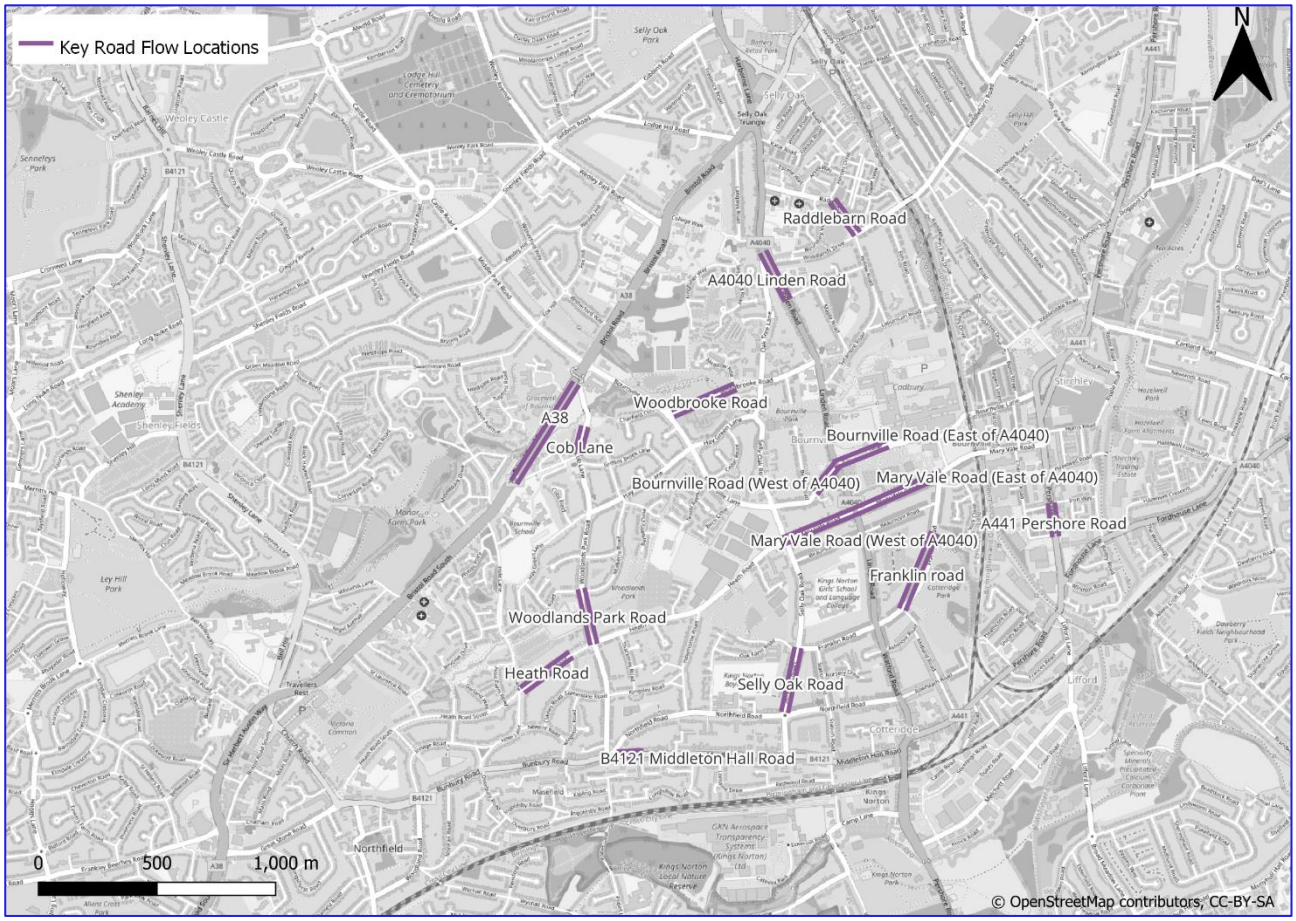

Figure C-1. Key Road Flow Locations

[2] HGVs have a PCU Value of 2.5, buses have a PCU value of 2 and cars/LGVs have a PCU value of 1.

Table C-1. Key Road PCU Flow

Key Road	Direction	AM Existing Flow	AM Proposed	AM Proposed - Existing	PM Existing Flow	PM Proposed	PM Proposed - Existing
A38	NB	1220	1320	100	550	647	97
	SB	496	563	67	728	668	-60
Cob Lane	NB	116	73	-43	128	0	-128
	SB	64	65	1	99	200	101
Woodlands Park Road	NB	166	177	11	62	53	-9
	SB	101	99	-2	48	47	0
Heath Road	EB	338	283	-55	169	85	-84
	WB	65	54	-10	67	64	-2
B4121 Middleton Hall Road	EB	387	407	20	388	384	-4
	WB	367	381	15	515	520	5
Selly Oak Road	NB	201	230	29	28	108	81
	SB	133	128	-4	202	194	-9
Franklin road	NB	42	46	4	57	57	0
	SB	68	71	2	2	2	0
A441 Pershore Road	NB	498	435	-62	508	488	-21
	SB	524	521	-3	574	596	22
Mary Vale Road (West of A4040)	EB	302	0	-302	179	0	-179
	WB	242	114	-128	165	110	-55
Mary Vale Road (East of A4040)	EB	277	341	65	215	169	-46
	WB	238	0	-238	281	0	-281
Bournville Road (West of A4040)	EB	237	454	216	169	269	100
	WB	151	228	77	183	213	30
Bournville Road (East of A4040)	EB	337	450	113	440	457	17
	WB	323	428	105	255	424	169
Woodbrooke Road	EB	452	426	-26	173	178	5
	WB	174	192	18	138	2	-135
A4040 Linden Road	NB	728	1075	347	595	717	122
	SB	508	481	-27	483	497	14
Raddlebarn Road	EB	334	799	465	287	617	330
	WB	360	648	289	337	635	298