Coventry City Council

LOCAL PLAN TRANSPORT MODEL VALIDATION REPORT

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SEPTEMBER 2019

CONFIDENTIAL

Coventry City **Council**

LOCAL PLAN TRANSPORT MODEL VALIDATION REPORT

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Coventry City **Council**

LOCAL PLAN TRANSPORT MODEL VALIDATION REPORT

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1 INTRODUCTION

1 INTRODUCTION

1.1.1 WSP were commissioned by Coventry City Council (CCC) to support them with their Local Air Quality Plan submission to the Joint Air Quality Unit (JAQU). WSP's support is focused on providing transport modelling services and outputs to assess the impacts of potential air quality proposals. We have provided traffic data from the transport model to feed into air quality modelling being undertaken by Atkins. The transport model which will be used is the strategic transport model, Coventry Area Strategic Model (CASM).

1.1.2 WSP developed the CASM to support CCC Local Plan and Highway England's (HE) M6 Junction 2 to 4 Smart motorway scheme. CASM currently has a base year of 2013 and forecast years of 2021 and 2031 have been developed for the purposes of the air quality assessments.

1.1.3 As part of the JAQU Evidence Package there are a range of Transport Modelling Deliverables that are required to be prepared. These are listed below:

- Local Plan Transport Modelling Tracking Tables (T1)
- Local Plan Transport Model Validation Report (T2)
- Local Plan Transport Modelling Methodology Report (T3)
- Local Plan Transport Model Forecasting Report (T4)

1.1.4 This report is the Local Pan Transport Model Validation Repot (T2) and is structured into the following chapters:

- Chapter 2: An Overview of CASM
- Chapter 3: Data Collection
- Chapter 4: Model Calibration/ Validation
- Chapter 5: Conclusions

[redacted]

- Appendix B Highway Network Changes 2013 to 2018
- Appendix C: Technical Note on Count Factoring

2

OVERVIEW OF CASM

2 OVERVIEW OF CASM

2.1 BACKGROUND

2.1.1 In 2015 WSP developed the Coventry Area Strategic Model (CASM) to support the Coventry Local Plan and Highways England Junction M6 2-4 Smart Motorway Project. CASM was developed from the West Midlands model PRISM. The model covers the area shown in Figure 1.

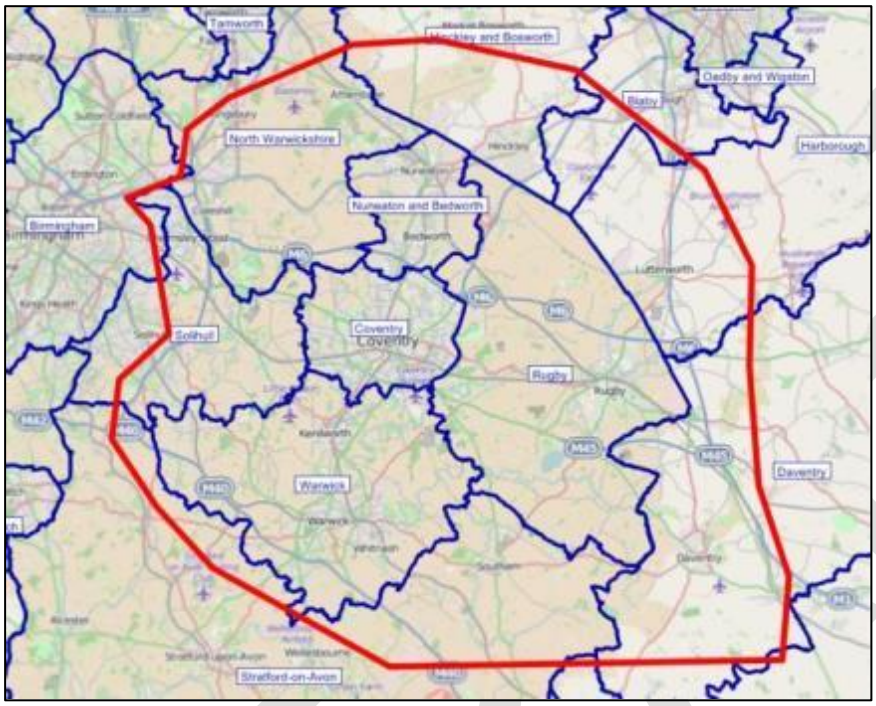


Figure 1: Coventry Area Strategic Model Area

2.1.2 CASM consists of the following models:

- CASM Transport Demand Model (TDM)
- CASM Highway Assignment Model (HAM)
- CASM Public Transport Assignment Model (PTAM).

2.1.3 These models are calibrated and validated to 2013 base year and the reports for this can be made available.

2.1.4 In 2016, the CASM forecast models were developed by WSP for use by Highway England's Consultants (Jacobs) to undertake an economic assessment of the M6 Junction 2 to Junction 4 Smart Motorway scheme proposals using the full CASM suite of models (TDM, HAM, and PTAM). Four forecast year models were produced: 2019, 2026, 2034 and 2041 with and without the M6 Junction 2 to 4 schemes proposals.

2.1.5 These forecasts contain all developments and infrastructure in the area which at the time were considered to have a high level of certainty of being realised, in line with Department for Transport (DfT) TAG Unit M4 Forecasting and Uncertainty, March 2014. Note these forecasts were developed constrained to NTEM version 6.2; NTEM version 7.2 is the latest version but this was not available

when the forecasting work was undertaken. Highways England reviewed all the modelling work undertaken and it was considered appropriate for use as a modelling tool.

2.1.6 Since the work undertaken in 2016, CASM has been used for numerous scheme and developer assessments which has required model updates in the local areas where assessments were being undertaken. The latest version of CASM which will be used for this assessment has been updated to include the following:

- Improvements in various areas in Coventry including around the A46 Stoneleigh Junction, Eastern Green, Kings Hill, Whitley and Baginton areas and Coventry City Centre.
- Within the CASM HAM the Car Non- Work matrix has been split into Car Commute and Car Other
- Refined zone system around the A46 Stoneleigh Junction area
- Use of updated uncertainty logs for land use proposals for CCC, Warwickshire County Council (WCC) and Solihull Metropolitan Borough Council (SMBC)
- Use of NTEM 7.2

2.2 SOFTWARE PLATFORM

2.2.1 The existing wide-area PRISM model is developed within PTV VISUM, the transport modelling software developed by PTV. At the start of the project it was agreed the development of CASM in VISUM would be most appropriate software for CASM. The advantages of this are that improvements made in CASM could be easily adopted into PRISM and the models would be compatible with each other. With the HAM, PTAM and TDM models all within VISUM this allows the models to interact together easily when extracting and inputting data between models. VISUM also has a strong graphic capability which is important in presenting information to clients and the general public.

2.2.2 The CASM model has been developed in the latest software version at the time of development, VISUM 15.00-03.

2.3 CASM TRANSPORT DEMAND MODEL STRUCTURE OVERVIEW

2.3.1 It was agreed, by the CASM development working group (HE, Jacobs and WSP), appropriate for the CASM model to follow a classic 'four stage' modelling structure: trip generation, mode choice, distribution and assignment. More details on the CASM Transport Demand Model can be found within the CASM Demand Model Development and Calibration Report.

2.3.2 Figure 2 provides a simplified overview of the model structure which was agreed at the Inception stages of the model development and documented within the CASM ASR (February 2015). The trip generation, mode choice and the trip distribution elements follow a fairly conventional approach, with a hierarchy in line with the Department for Transport (DfT) Transport Analysis Guidance (TAG) default (which is favoured by RAND Europe, developers of the PRISM demand model). This was important as CASM was developed from PRISM and given the close geographical proximity it was deemed important for the two models to be developed using a similar approach. The assignment model in the base year is not based on synthetic matrices from the transport demand model, but observed information as this was available for the process. It is linked to the transport demand model incrementally to develop future year demand.

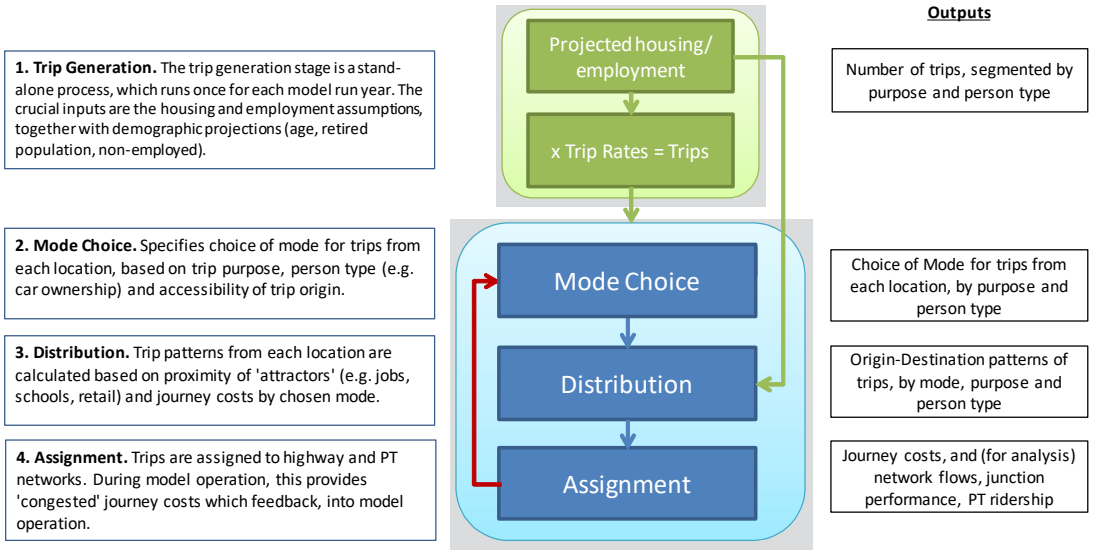


Figure 2: Overview of Model Structure, using TAG Default Hierarchy

2.4 MODEL TIME PERIODS

2.4.1 The CASM TDM has a base year of 2013, which was identified to be the best representation of traffic in Coventry as in 2014 there were significant junction improvements occurring on the Coventry highway network including Toll Bar End and junctions around the Friargate development near Coventry Station.

2.4.2 The CASM TDM considers 'all day' trips, which are split down into time periods:

- AM Peak: 07:00-10:00
- Inter Peak: 10:00-16:00
- PM Peak: 16:00-19:00.

2.4.3 The above segments are used for the synthetic matrix in the demand model, more details about this can be found in the CASM Model Development and Calibration Report. For the CASM HAM, the following peak hours are represented:

- AM: 0800-0900
- IP: 1100-1400 (average hour)
- PM: 1700-1800.

2.4.4 For CASM PTAM, CASM follows the PRISM approach of modelling average two hour peaks:

- AM: 0700-0900
- IP: 1000-1200
- PM: 1600-1800

2.5 USER CLASSES

2.5.1 The CASM HAM and PTAM have the following user classes:

- CASM HAM
  - Car Work
  - Car Non- Work Commute
  - Car Non- Work Other
  - Light Goods Vehicles (LGV)
  - Heavy Goods Vehicles (HGV)

- CASM PTAM
  - Fare - which represents passengers who pay for their journey as a cash fare at the time of making the journey
  - Non- Fare - which represents those passengers who do not pay at time of travel (e.g those who receive a concession (such as senior citizens), season tickets and pass holders
  - Planet Long Distance (PLD) – Planet is a strategic public transport model which has been used by the Strategic Rail Authority (SRA) to evaluate many projects such as Thames Link 2000 and Crossrail. It has been used to represent long distance demand passing through the study area to include all network loadings within the study area.

2.6 CASM HAM SIMULATION AREA

2.6.1 The CASM HAM area of simulation where junctions are modelled in detail is shown in Figure 3.

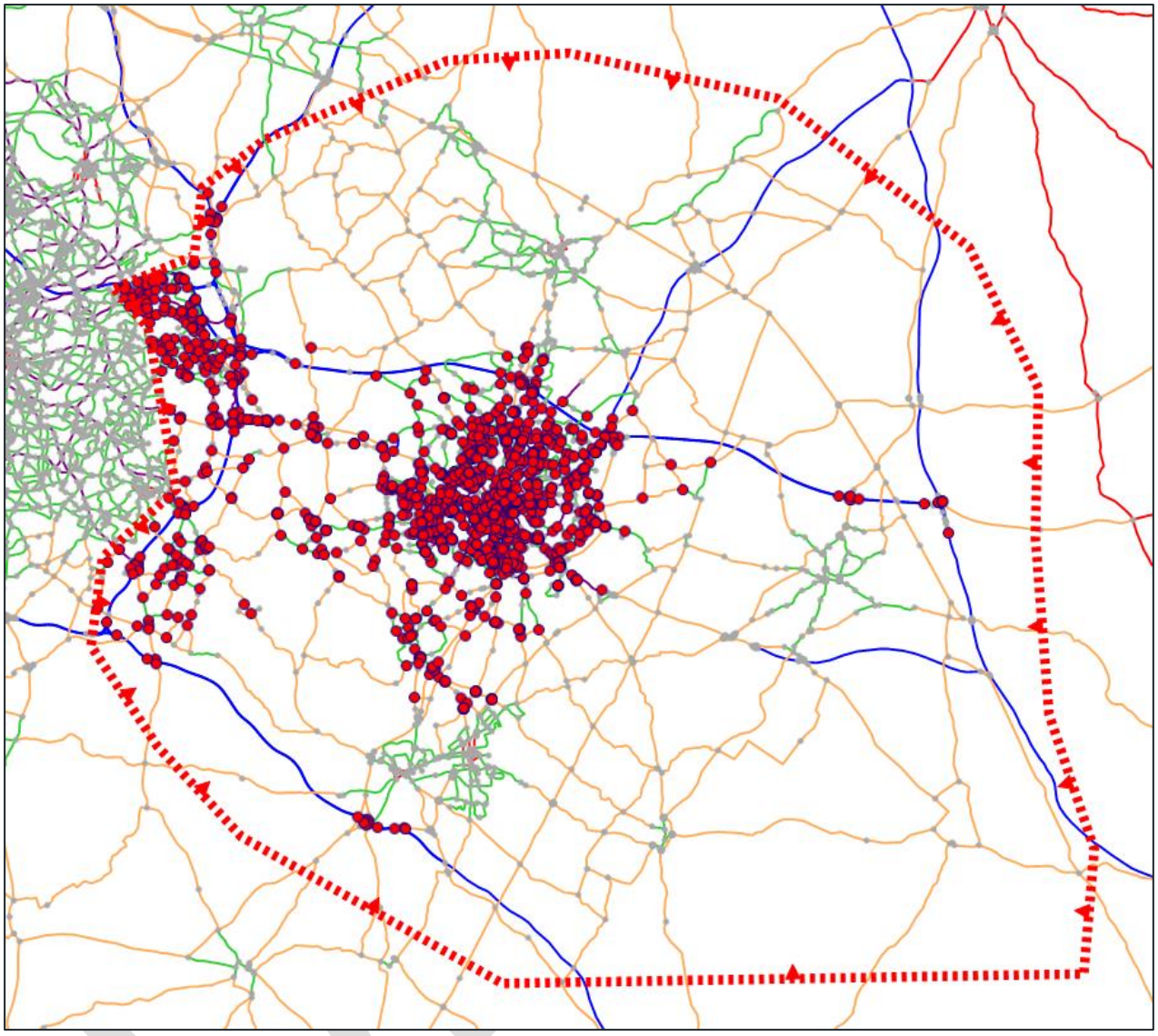


Figure 3: CASM HAM Simulation Area

2.7 PASSENGER CAR UNIT FACTORS

2.7.1 Within the CASM HAM the four user classes are assigned to the VISUM network in vehicles. However, it is important to enter conversion factors from vehicles to Passenger Car Units (PCU) so that the speed-flow curves (Volume Delay Functions in VISUM) and link capacities are applied correctly during the assignment.

2.7.2 The factors to convert each vehicle type into PCU within the CASM HAM are below:

- Car 1.0
- LGV 1.0
- HGV 2.5

2.7.3 These are consistent with the PCU factors used within PRISM and TAG criteria for dual carriageways and motorways.

3

DATA COLLECTION

3 DATA COLLECTION

3.1 INTRODUCTION

3.1.1 This chapter of the report will outline the following:

- 2018 Data Collected for the Air Quality study
- Analysis undertaken on 2018 data compared to 2013 data and traffic changes over the 5 years
- 2013 CASM data

3.2 2018 DATA COLLECTION FOR AIR QUALITY STUDY

3.2.1 CCC undertook data collection surveys in the Coventry area during February 2018 and in March 2018. For both months the following data was collected:

- Automatic Traffic Count (ATCs)
- Manual Classified Counts (MCCs)
- Automatic Registration Plate Recognition (ANPR) data

3.2.2 The locations of ANPR, ATC and MCC data are shown in Figure 4 to Figure 6.

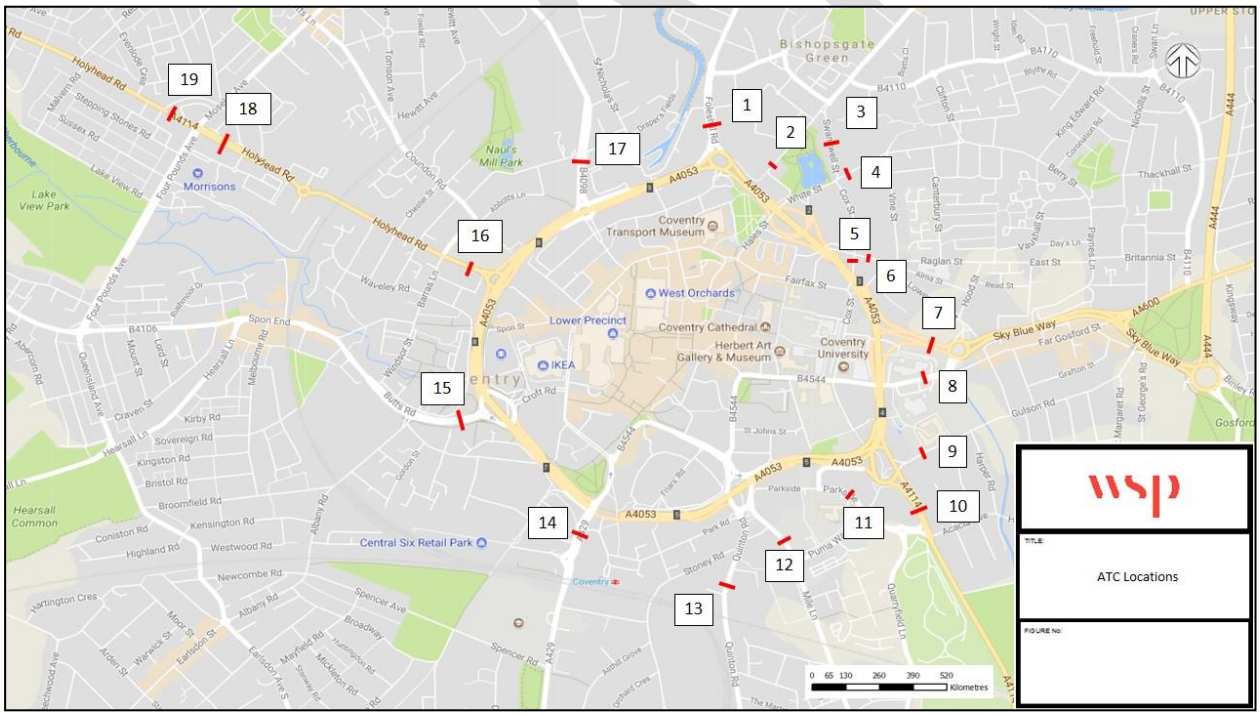


Figure 4: ATC Locations

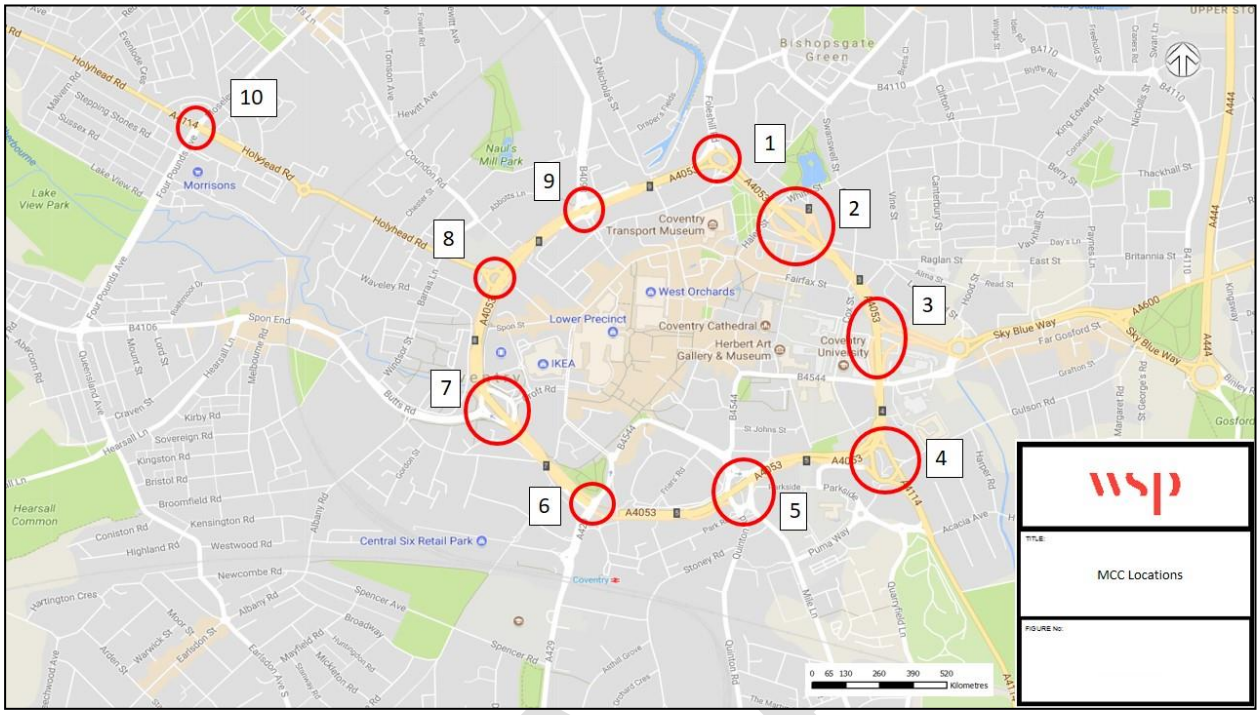


Figure 5: MCC Locations

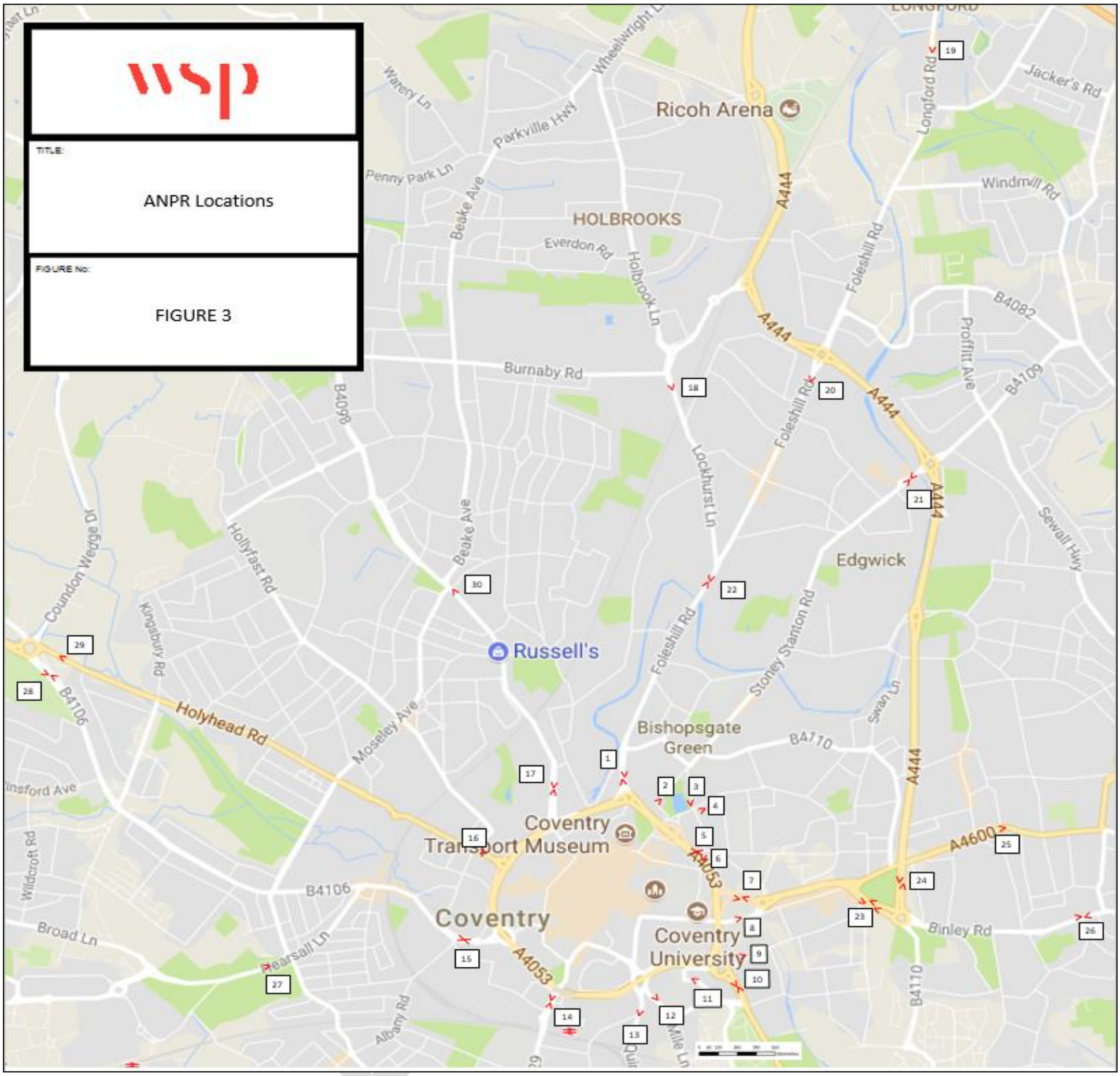


Figure 6: ANPR Locations

3.2.3 On 2nd February for a week the following surveys were undertaken:

- ANPR and ATC surveys at site locations 10,16 and 22

3.2.4 In March 2018 the following surveys were undertaken:

- ANPR surveys 7-day week (24 hours a day) at all locations
- ATCs at all locations for two weeks
- MCCs one neutral weekday

3.3 2013 TO 2018 CHANGES IN COVENTRY

3.3.1 The CASM model has a base year of 2013 and the air quality counts were undertaken in 2018. Between the two years there have obviously been changes in the highway network and vehicle demand which we have investigated in detail.

HIGHWAY NETWORK

3.3.2 The changes in the highway network between 2013 and 2018 are summarised in the Appendix B. In summary there are several locations where ATC's were undertaken where the highway network has changed since 2013. As a part of this CASM 2013 Air Quality update process we have retained the 2013 highway network. However, throughout the calibration and validation process of the 2018 counts we were conscious of the network changes which occurred since 2018.

VEHICLE DEMAND

3.3.3 We have looked at the changes in traffic flow in Coventry using a number of sources including:

- National Trip End Model (NTEM)
- Coventry cordon counts undertaken by Mott Mac Donald bi-annually
- DfT Count Point data

3.3.4 NTEM 7.2 data shows a small reduction in traffic growth in Coventry as shown in Table 1.

Table 1: NTEM 7.2 Traffic Changes 2018 to 2013

	2018 to 2013
AM	0.991
IP	0.981
PM	0.990

3.3.5 Mott Mac Donald undertake bi-annual Automatic Traffic Counts (ATC's) in Coventry city centre across a cordon which is illustrated in Figure 7.

Figure 7: Coventry Cordon Counts

3.3.6 ATC counts were undertaken across the cordon in 2013, 2105 and 2017. Detailed analysis of the data has been undertaken and the change in traffic volumes during the CASM peak hours, 8:00-9:00, average hour 11:00-14:00 and 17:00-18:00 between 2013 and 2017 shows overall reductions in traffic flow, these are illustrated in Table 2.

Table 2: Coventry City Centre Cordon Traffic Growth 2013 to 2017

	2013 to 2017 Factors	2017 to 2013 Factors
AM	-10%	10%
IP	-4%	4%
PM	-7%	7%

3.3.7 The traffic changes in the local Coventry cordon data is showing reductions in traffic which is contrary to the data JAQU quoted in their correspondence to WSP in June 2018:

- DfT CP data for Coventry suggests 2013-2016 (last available) growth of 16% and WebTRIS (SRN) sample site suggests growth of 20% from 2013 to 2017.

3.3.8 Using the change in the Coventry cordon counts is the most reliable local information and is justified by the fact that the cordon data is local and close to Coventry City Centre and therefore a better source of evidence for traffic changes compared to the DfT CP data and WebTRIS. Appendix C provides more detail on why the cordon count data was used instead of the DfT CP data.

3.3.9 There are a few reasons which contribute to traffic volumes decreasing in the peak hours between 2013 and 2017. During this period several employees in the city centre moved offices away from Coventry and some moved closer to public transport provision with reduced car parking facilities which encouraged the use of public transport travel to work. The changes in the location of employees has been taken into consideration within the CASM TDM. In addition to these changes within the cordon data between 2013 and 2017 there are increases in traffic demand outside the peak hours. This peak spreading could be happening for a variety of reasons but will be affected by the number of highway scheme improvements which were being undertaken during this period, including Friargate and Toll Bar. The changes in traffic volumes between 2013 and 2018 have therefore been used using the Coventry Cordon data.

3.4 2013 CASM DATA

3.4.1 The CASM Data Collection Report (June 2018) provides a more in-depth analysis of the existing data sources and the data collected for the study.

EXISTING DATA

3.4.2 In addition to the data commissioned as part of this study, several readily available data sources were collated to assist in the development of the CASM HAM and PTAM calibration and validation exercise:

- Traffic count data stored on Spectrum (West Midlands Count Database)
- Highways England long term monitoring data Traffic Flow Data System (TRADS Sites)
- Traffic count data from Warwickshire County Council
- Trafficmaster origin- destination data
- Trafficmaster journey time data
- 2011 Census Method of Travel to Work data
- Traffic signal timings
- Public Transport data.

TRAFFIC COUNT DATA ON SPECTRUM

3.4.3 The West Midlands Spectrum count database was interrogated to obtain traffic count data in the study area, illustrated in Figure 1. Figure 8 presents the Spectrum traffic count data used within the CASM HAM. Traffic count data was extracted for 2011, 2012, 2013 and 2014. More details on what data was used within the CASM HAM and how count data was factored to 2013 levels is detailed within Chapter 5 section 5.6 of the CASM Local Model Validation Report June 2018.

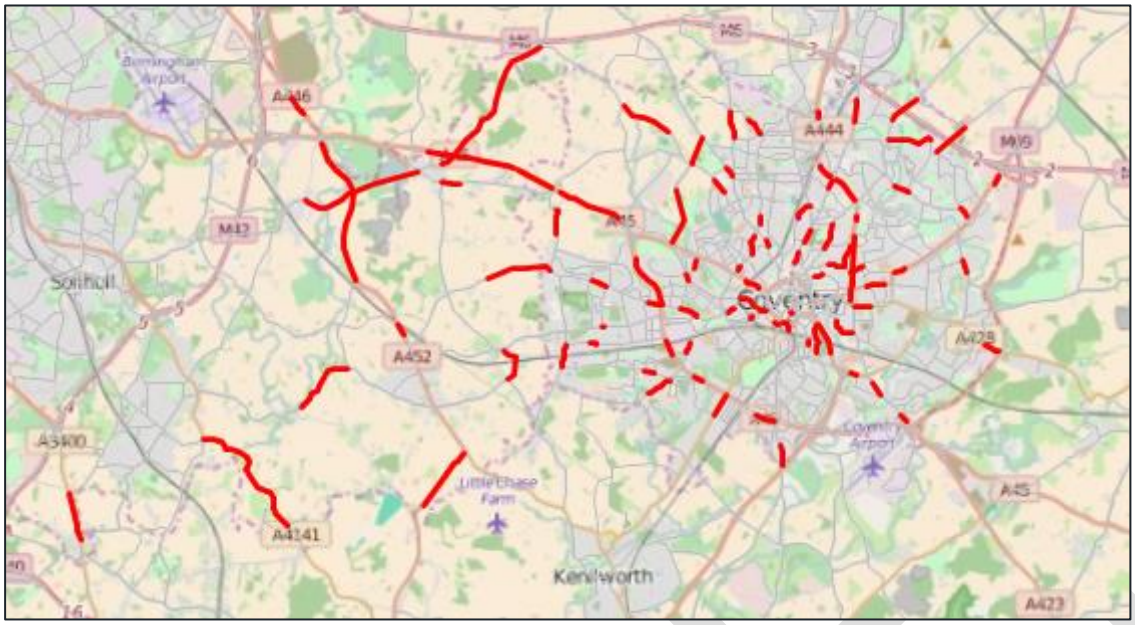


Figure 8: CASM HAM Spectrum Traffic Counts

HIGHWAYS ENGLAND TRADS SITES

3.4.4 Traffic data for the strategic road network is readily available from the TRADS website. The CASM HAM uses TRADS data at many sites on the M6, M40, M1, M5 and M42 corridors, illustrated in Figure 9. Where possible TRADS data was extracted from two weeks in June and September 2013 and an average was calculated.

Figure 9: CASM HAM TRADS Traffic Counts

WARWICKSHIRE COUNTY COUNCIL COUNT DATA

3.4.5 Warwickshire County Council (WCC) provided WSP count data from 2012, 2013 and 2014. The location of this data is illustrated in Figure 10. More details on how this data was factored to 2013 levels can be found within Chapter 5 section 5.6 of the CASM Local Model Validation Report June 2018.

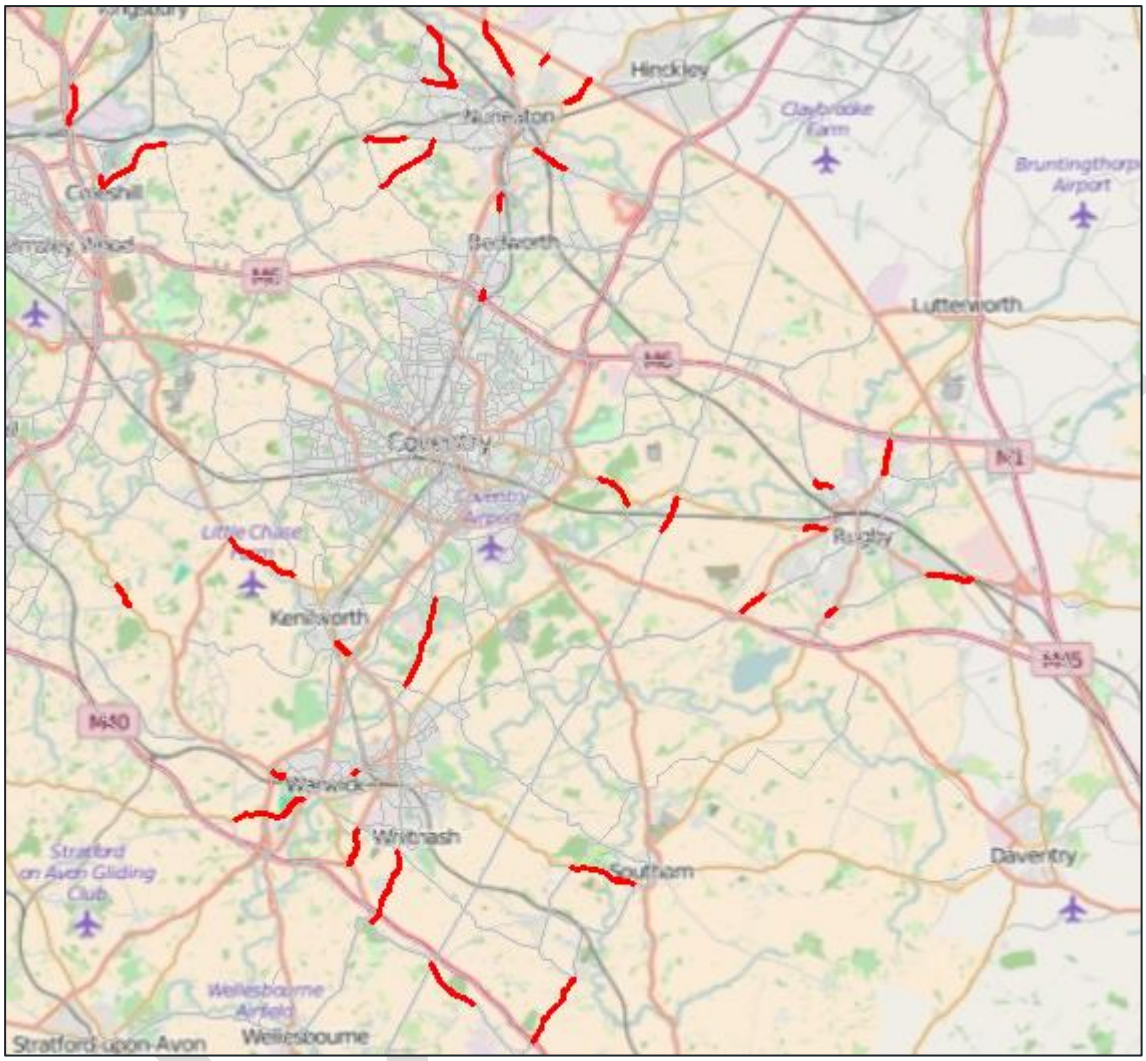


Figure 10: CASM HAM Warwickshire County Council Traffic Counts

TRAFFICMASTER ORIGIN AND DESTINATION DATA

3.4.6 Trafficmaster origin and destination data was used to enhance the CASM HAM prior matrix in some locations. More details on how this data was used within the prior matrix developed can be found in Chapter 5 section 5.3 of the CASM Local Model Validation Report June 2018.

TRAFFICMASTER JOURNEY TIME DATA

3.4.7 Chapter 3 and Appendix L and M of the CASM Data Collection Report provide a summary of the Trafficmaster journey time data used in the model development. Figure 11 and Figure 13 illustrate the journey time routes which were assessed within the CASM HAM.

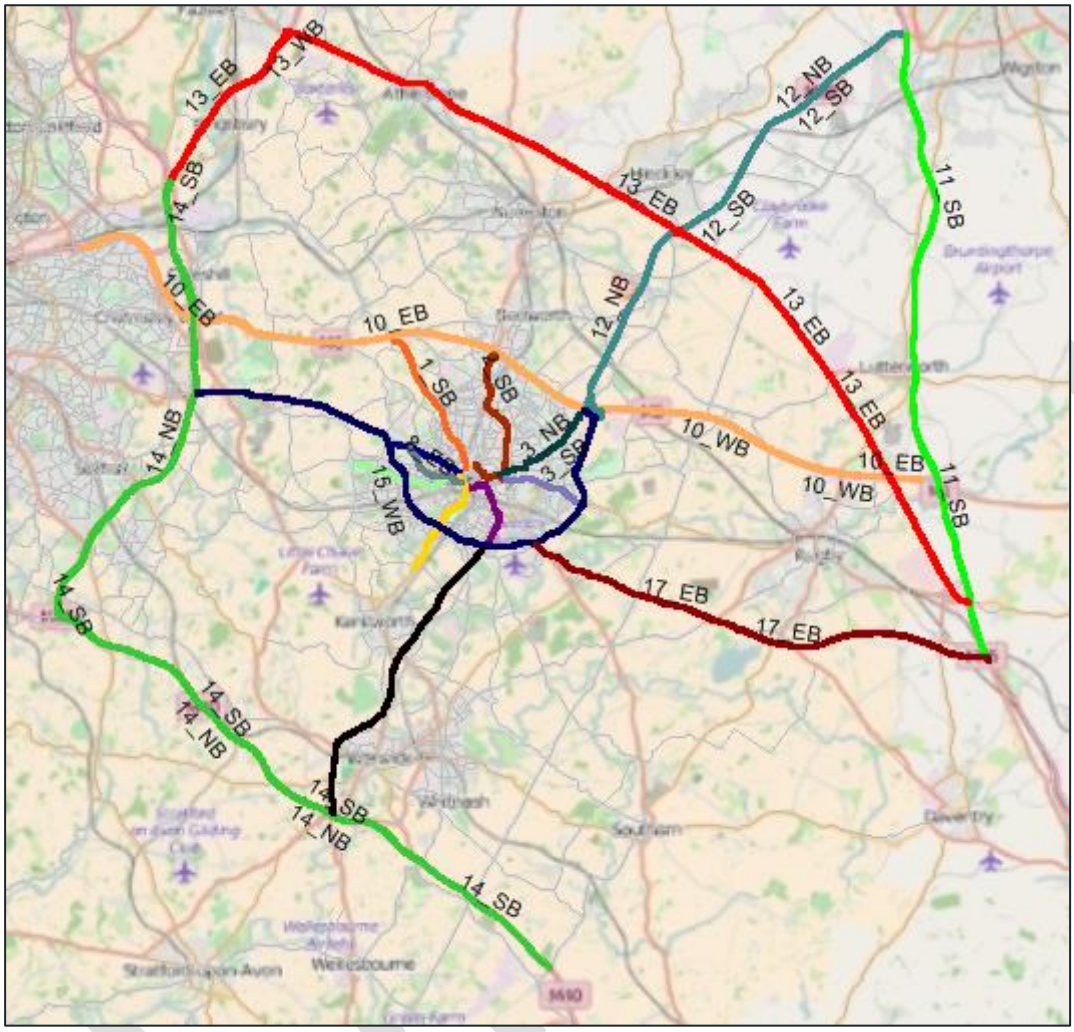


Figure 11: CASM HAM Journey Time Routes Study Area View

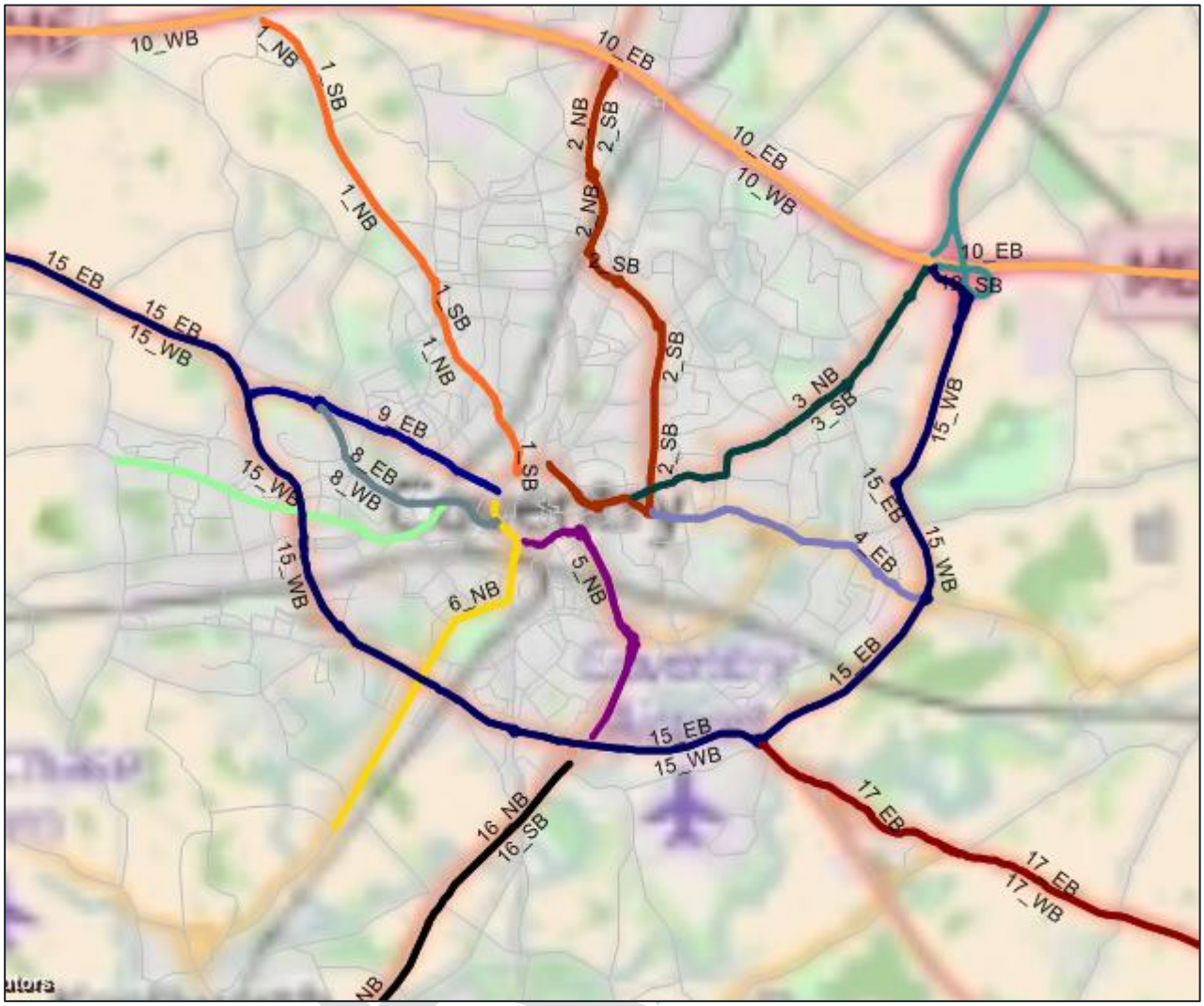


Figure 12: CASM HAM Journey Time Routes Coventry Area View

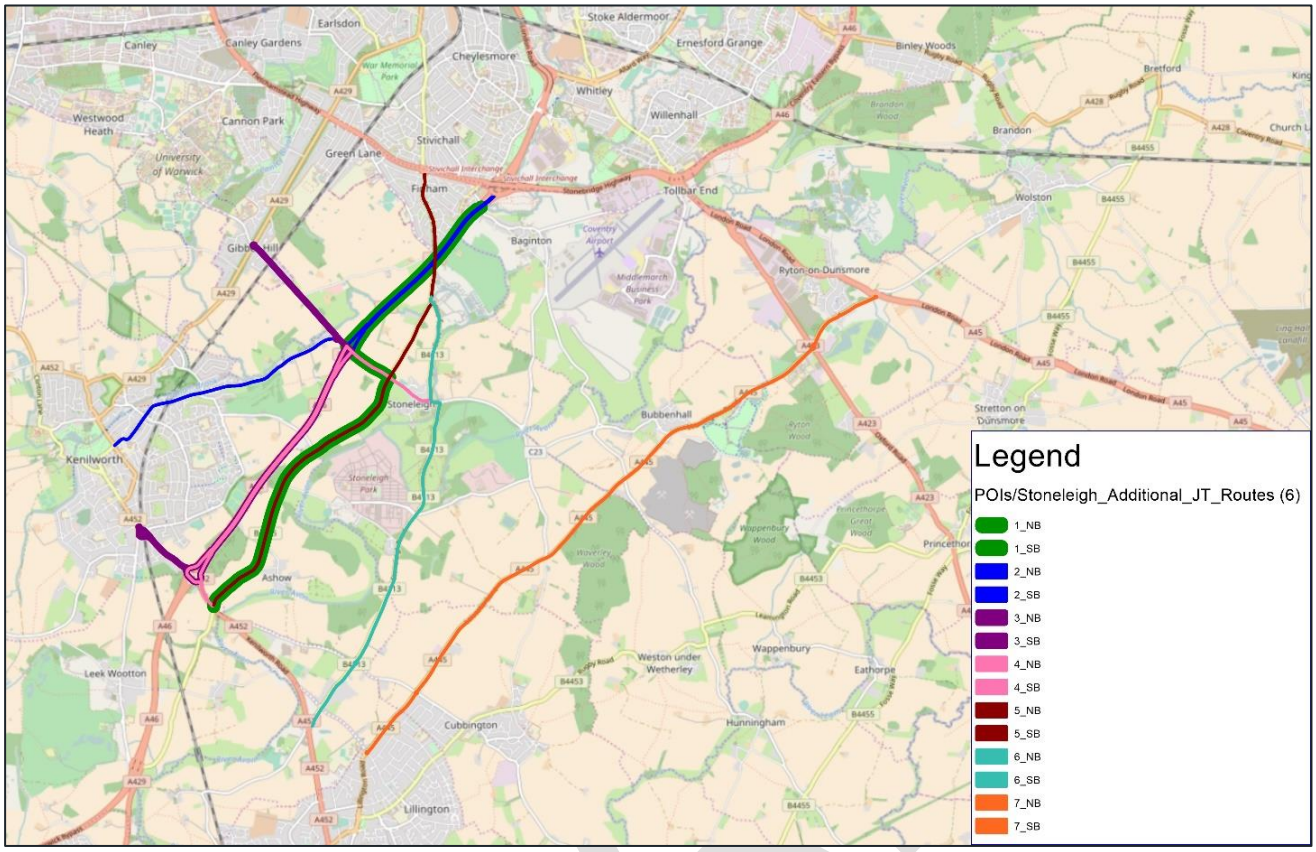


Figure 13: CASM HAM South Coventry Journey Time Routes

3.4.8 Table 3 and Table 4 provide the CASM HAM journey time route numbers, directions and corresponding description.

Table 3: CASM HAM Journey Time Routes

Journey Time Route Number	Description
1 (NB/SB)	B4098 (between M6 and Coventry Inner Ring Road
2 (NB/SB)	A444 (between M6 J3 and Inner Ring Rad J1/ Foleshill
3 (NB/SB)	A4600 (between M6 J2 and A444)-
4 (EB/WB)	A428 (between A46 and A444)
5 (NB/SB)	A444 (between A45 and Inner Ring Road J6)
6 (NB/SB)	A429 Kenilworth Road (between Gibbet Hill Road and Inner Ring Road Junction with A4114)
7 (EB/WB)	Broad Lane (between Banner Lane and B4101 Allesley Old Road)
8 (EB/WB)	B4101 (between Allesley Old Road and Inner Ring Road
9 (EB/WB)	A4414 (between A45 from Outer Ring Road to Inner Ring
10 (EB/WB)	M6 (between junction with M1 and M6 Junction 5)
11 (NB/SB)	M1 (between junction with M69 and A45/A46 Junction)
12 (NB/SB)	M69 (between M1 and M6)
13 (EB/WB)	A5 (between Junction 18 on M1 and M42 Junction with
14 (NB/SB)	M40 Junction 12 and M42 Junction 19
15 (EB/WB)	A46/ A45 (between M6 Junction 2 and M42 Junction 6)
16 (NB/SB)	A46 (between M40 junction 15 and A45 Outer Ring Road)
17 (EB/WB)	M45 and A45 (between A45 Outer Ring Road and M1)

Table 4: CASM HAM South Coventry Journey Time Routes

Journey Time Route Number	Description
1 (NB/SB)	B4115 and A46 via Stoneleigh Road
2 (NB/SB)	Kenilwoth to Coventry Outer Ring Road via Dalehouse Lane, Stoneleigh Junction and A46
3 (NB/SB)	Kenilworth to Gibbet Hill Road via A452, A46, Stoneleigh Junction and Stoneleigh Road
4 (EB/WB)	A452 South to Stoneleigh via A452, A46, Stoneleigh Junction and Stoneleigh Road
5 (NB/SB)	B4115 from Ashow to Coventry
6 (NB/SB)	B4113 Stoneleigh Road between A452 and Junction between B4115 and Coventry Road
7 (EB/WB)	A445 between Royal Leamington Spa to Ryton-on-Dunsmore

2011 CENSUS

3.4.9 Census data was used to provide the highway Method of Travel to Work mapped to the CASM zone system. This was used to supplement the origin and destination information within the prior matrices. Further details on how this data has been used in the CASM HAM development are outlined in Chapter 5 section 5.3 of the CASM Local Model Validation Report June 2018.

PUBLIC TRANSPORT DATA

3.4.10 The only recently collected available public transport data available was the Coventry City Centre cordon data which is collected bi-annually by Mott MacDonald, on behalf of Centro for general monitoring processes.

3.5 ADDITIONAL SURVEYS

3.5.1 Additional surveys were commissioned to provide extra information on highway and public transport demand within the CASM study area and specifically A46 Phase 1 area. The surveys commissioned were:

- Railway station entry and exit counts
- Railway station questionnaires, both face to face interview and postcards
- Bus cordon surveys
- Bus journey boarding and alighting counts
- Highway Manual Classified Counts (MCCs)
- Highways Automatic Traffic Counts (ATCs)

3.5.2 More details about these surveys can be found in the CASM Data Collection Report June 2018.

3.6 COUNTS

3.6.1 The traffic counts used for calibration, validation and screenlines are presented in Figure 14, Figure 15 and Figure 16.

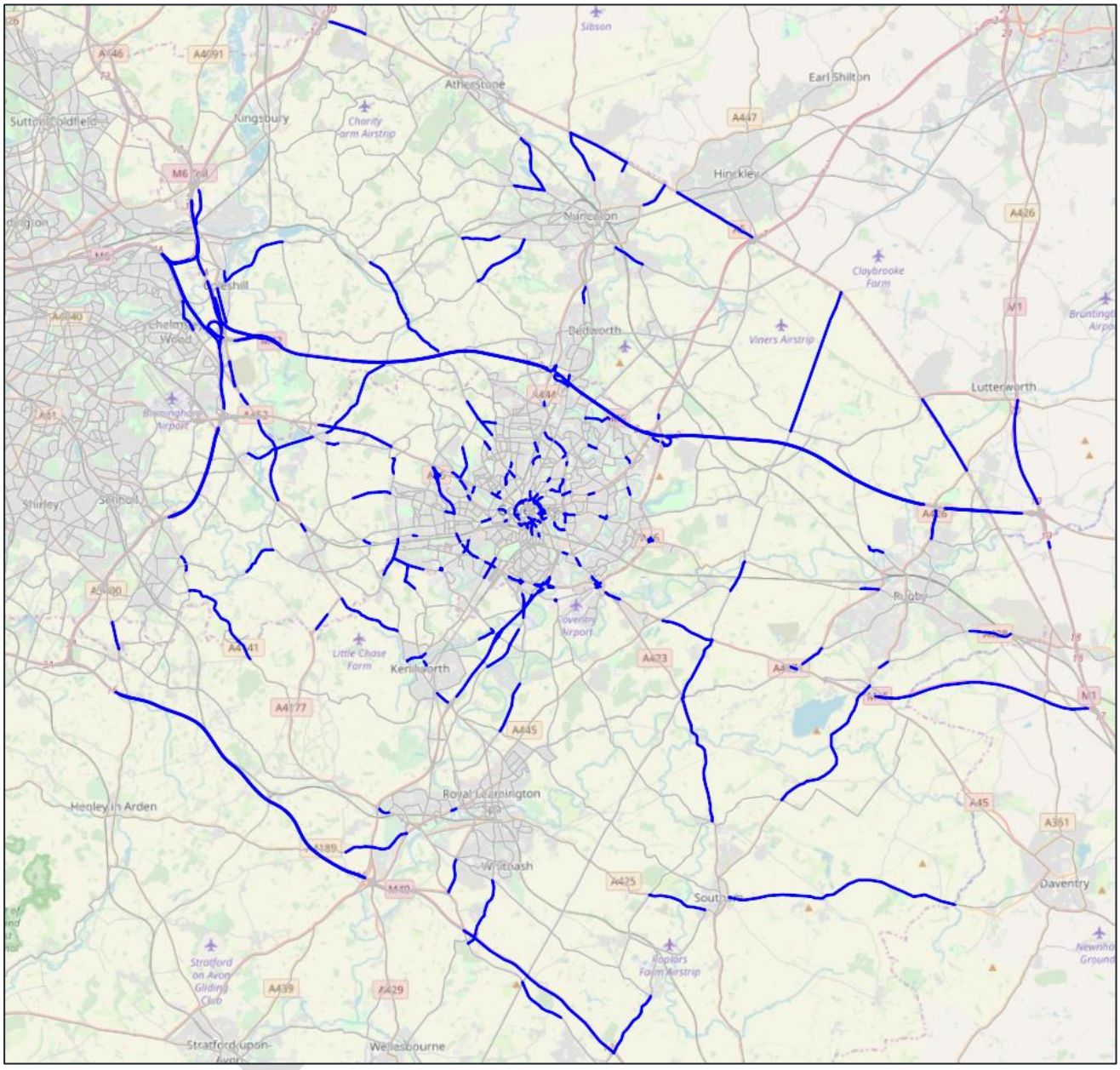


Figure 14: CASM HAM Calibration Counts

3.6.2 The CASM HAM contains 108 one-way count locations which are used in the validation process. The locations of these counts are displayed in Figure 15.

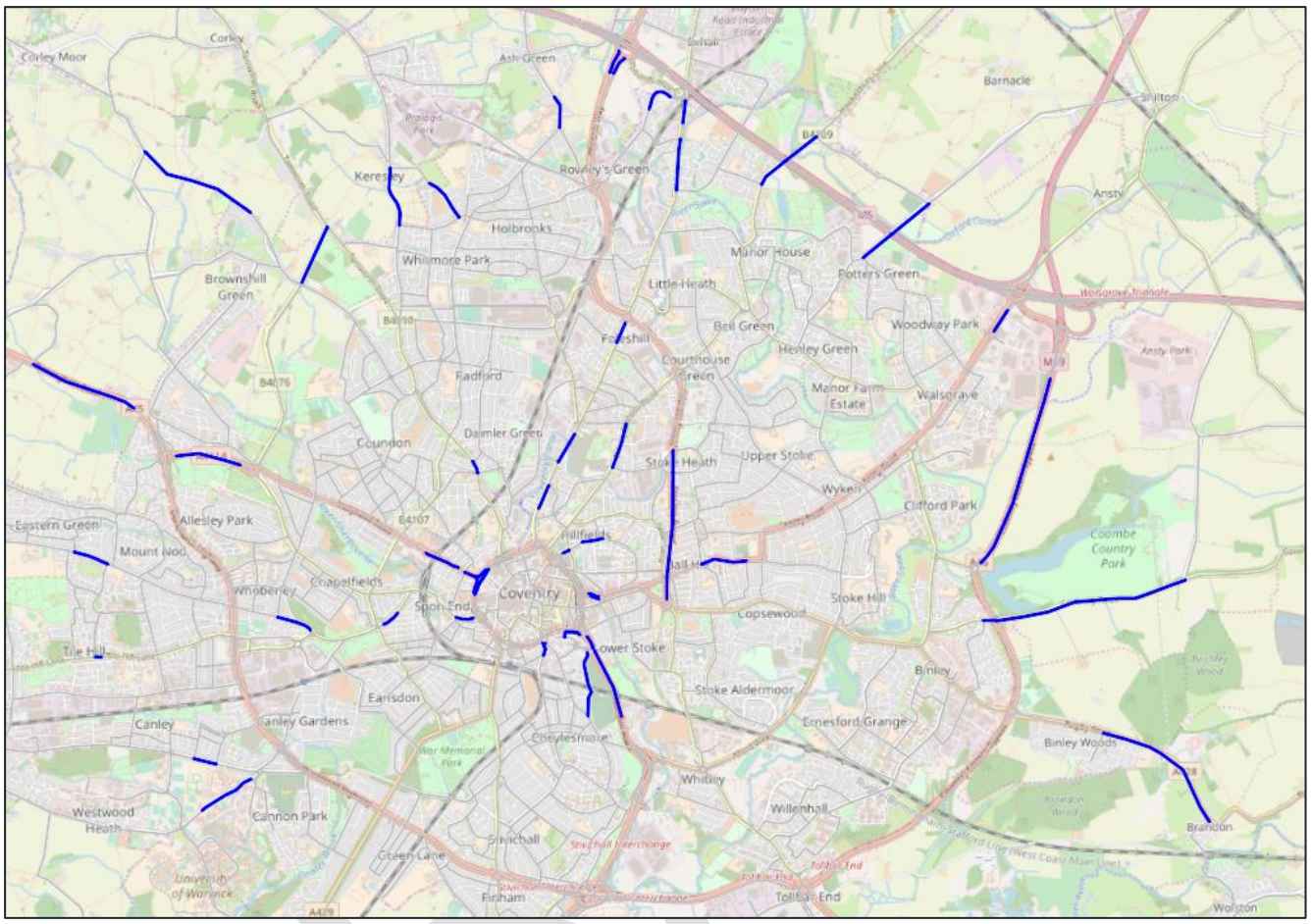


Figure 15: CASM HAM Validation Counts

3.6.3 Figure 16 presents the location of the 5 screenlines / cordons which have been assessed within the HAM. The Outer Coventry Cordon is for validation purposes and has been left out of the matrix estimation process. The other screenlines/ cordons are for calibration purposes.

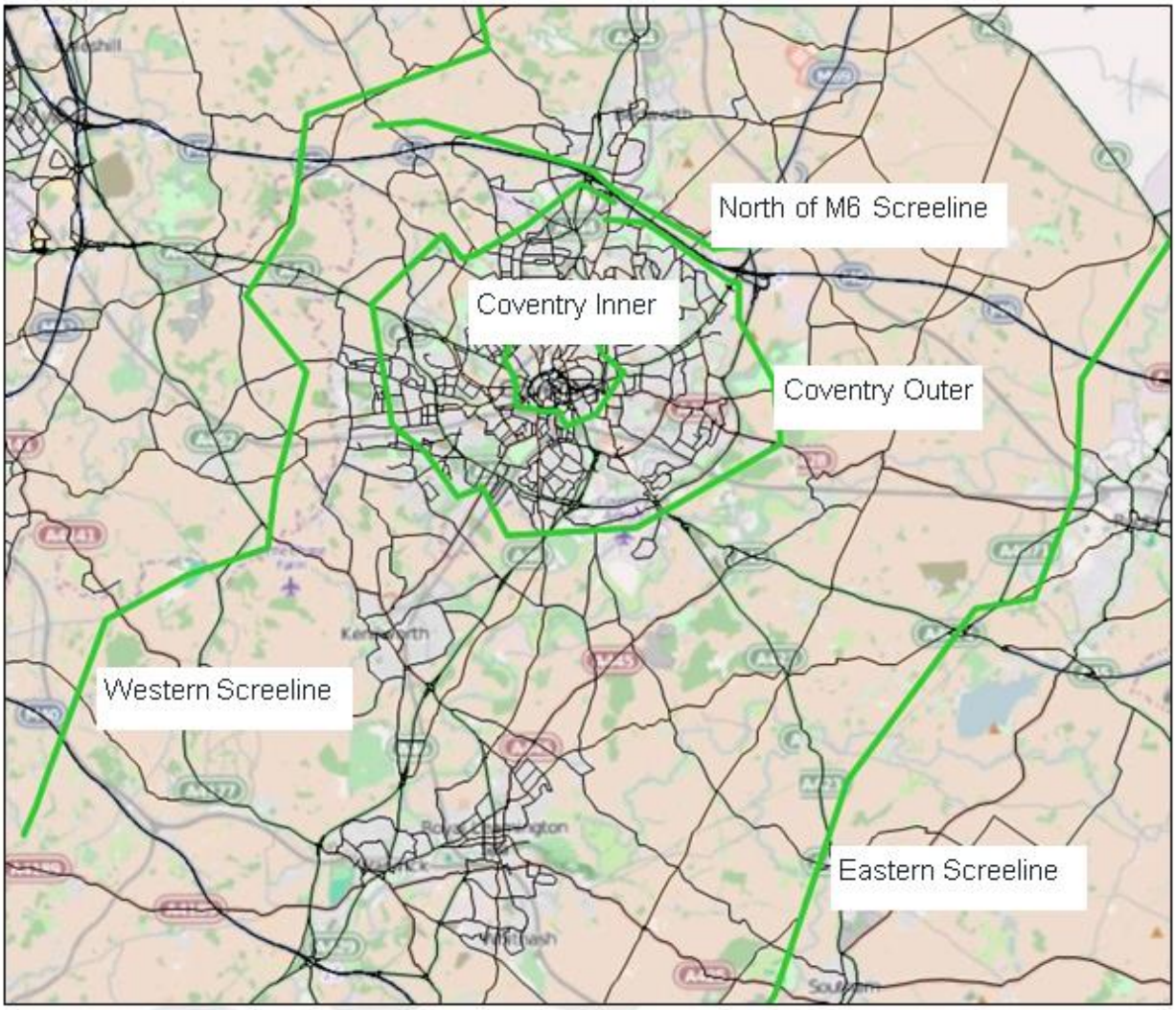


Figure 16: CASM HAM Screenlines and Cordons Counts

4

MODEL CALIBRATION/ VALIDATION

4 MODEL CALIBRATION/ VALIDATION

4.1 INTRODUCTION

4.1.1 This chapter presents the CASM HAM calibration and validation results for the final assignments used for the air quality work for all time periods. Towards the end of the chapter there is some discussion of the specific application of the traffic model in assessing air quality and how well it validates for this purpose. It highlights areas where the accuracy of the traffic data is strong and also weak at locations which are specifically sensitive in terms of air quality.

4.2 CALIBRATION AND VALIDATION CRITERIA

4.2.1 Transport Models should be developed in accordance with the DfT TAG guidance and should meet the criteria shown in Table 1.

Table 1: TAG Model Calibration and Validation Criteria

Measure	Criteria	Acceptability Guideline
Flow Criteria		
Observed flow < 700 vph	Modelled flow within ±100 vph	> 85 % of links
Observed flow 700 - 2,700 vph	Modelled flow within ±15%	> 85 % of links
Observed flow > 2,700 vph	Modelled flow within ±400 vph	> 85 % of links
Total screenline flows (normally >5 links) to be within ±5%		All (or nearly all) screenlines
Criteria		
GEH Statistic for individual links < 5		> 85 % of links
Differences between modelled flows and counts should be less than 5% of the counts		All (or nearly all) screenlines
Journey Times		
Modelled journey time within ±15% (or 1 minute, if higher than 15%) of observed journey time		> 85% of routes

4.2.2 More than 85% of links are required to meet either the 'GEH' or the 'Flow criteria, and 'all or nearly all' screenlines within 5% of the counts.

4.2.3 Model calibration refers to traffic count data which has been used as part of the model and matrix calibration, e.g. input to the matrix estimation process.

4.2.4 Model validation refers to independent observed count data which has not been used for calibration. TAG guidance advises that validation screenlines should be used which are positioned so that at least one or two major junctions lie between the validation screenlines and other types of screenlines. This is adhered to with the CASM screenlines. In addition, journey times are

compared to check the modelled speeds and levels of delay are in accordance with observed conditions. The journey time route used in model validation are shown in Figure 11 to Figure 13.

4.2.5 Both sets of traffic count data (for calibration and validation) are subject to the criteria defined in Table 1, i.e. a comparison of the individual counts is made as well as for a set of screenlines. The results of model calibration are discussed in section 4.4, whilst the model validation results are discussed section 4.5. The calibration and validation screenlines are shown graphically in Figure 16.

4.3 FINAL PERFORMANCE

4.3.1 This section of the report presents the CASM HAM final performance, this is split into the following sections:

- Count Calibration
  - Whole model
  - Coventry City
  - Priority ATC's collected for Air Quality study
- Count Validation
- Screenlines and Cordons
- Journey Times

4.3.2 The count calibration has been assessed at three levels:

- The whole of the model as shown in Figure 1
- Coventry City area, which is the focus of the air quality work as defined with Atkins and Coventry City Council, shown in Figure 2
- Priority counts for the air quality study, identified by Atkins and CCC, as illustrated in Figure 3.

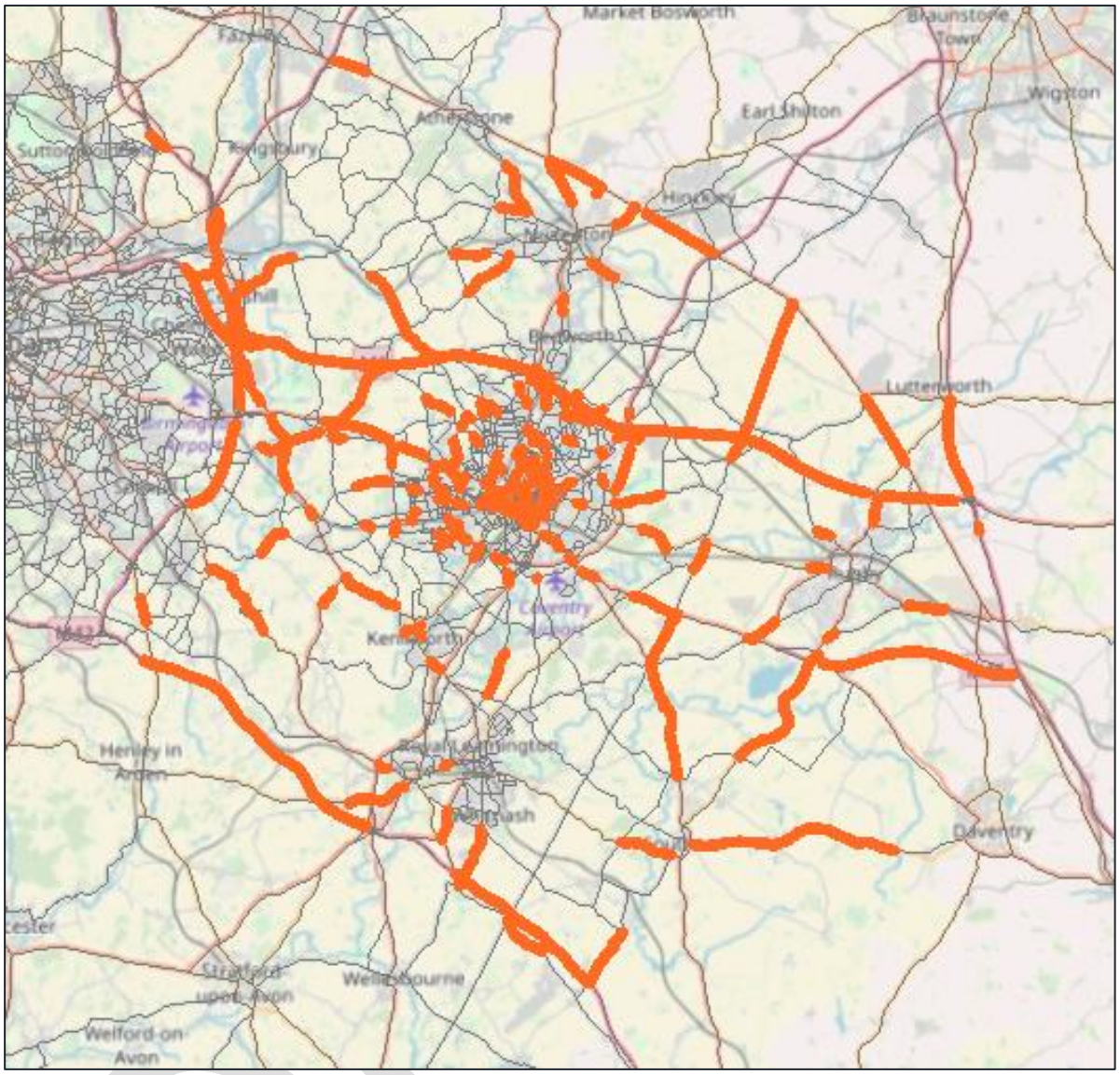


Figure 1: CASM Wider Area

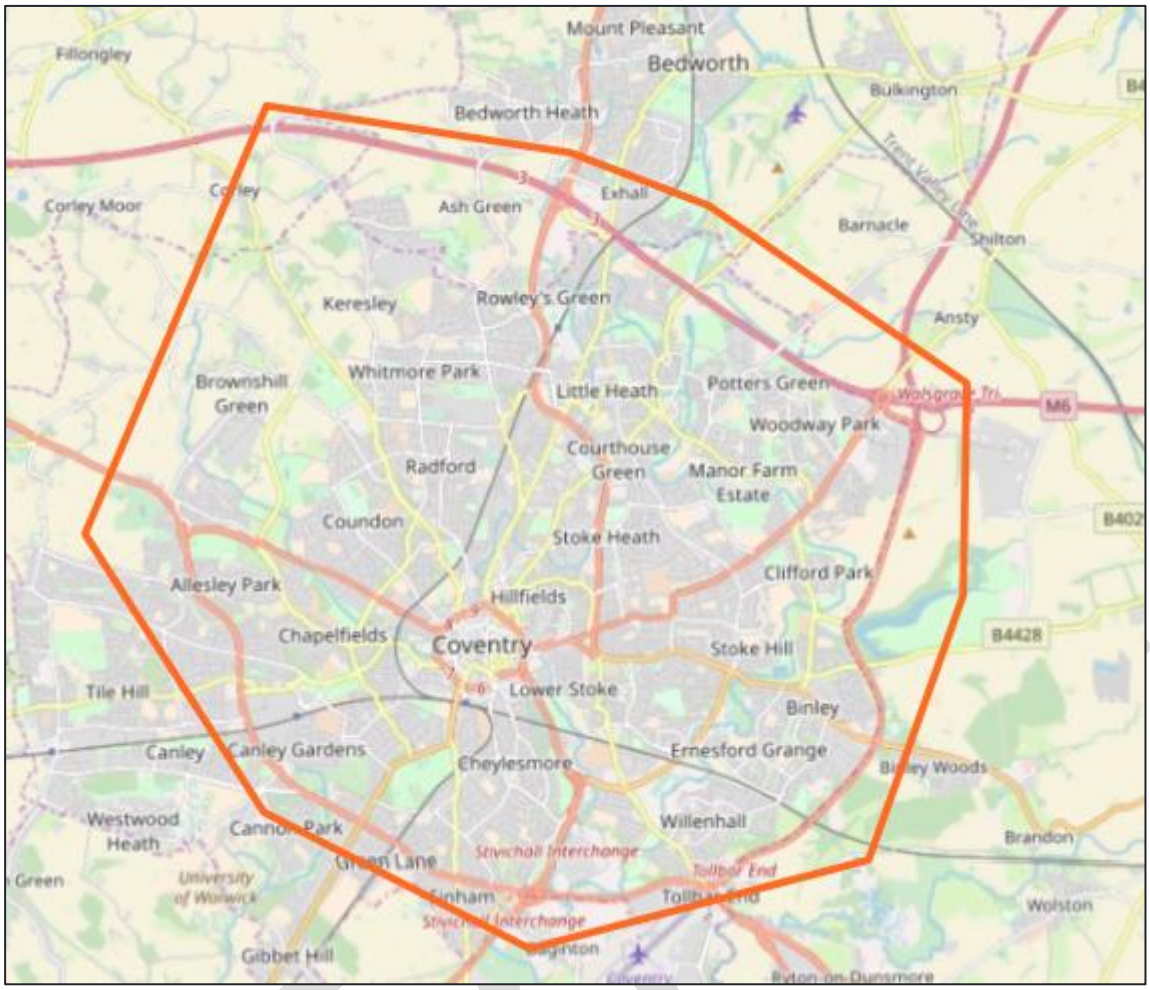


Figure 2: Coventry City Area

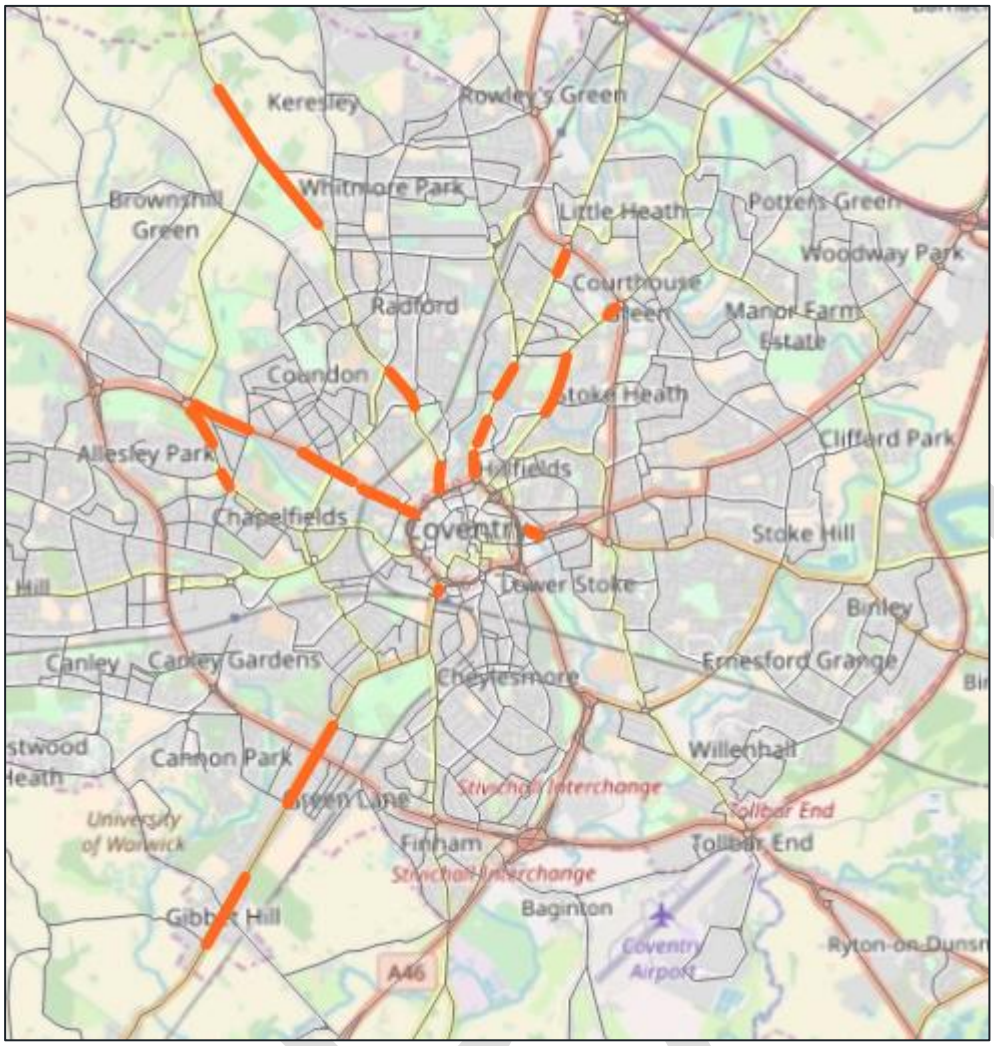


Figure 3: Air Quality Priority Counts

4.4 WHOLE MODEL COUNT CALIBRATION

4.4.1 Table 2 and Figure 4 show the final calibration performance of the CASM HAM AM Peak. Table 2 shows that TAG criteria is met for all individual vehicle types and is 77% for total vehicles, lower than the TAG criteria of 85%. However, 18 counts have a GEH of 6 or lower, resulting in 81% of counts meeting flow of a GEH of 6 or lower.

4.4.2 Figure 4 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 2: CASM HAM AM Peak Calibration Final Performance Whole Model

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria Met	% GEH or Flow Criteria Met	GEH>10
Car	481	374	384	80%	17
LGV	481	448	473	98%	3
HGV	481	442	472	98%	3
Total Vehicles	481	353	366	77%	20
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	446,600	435,102		-2.57%	

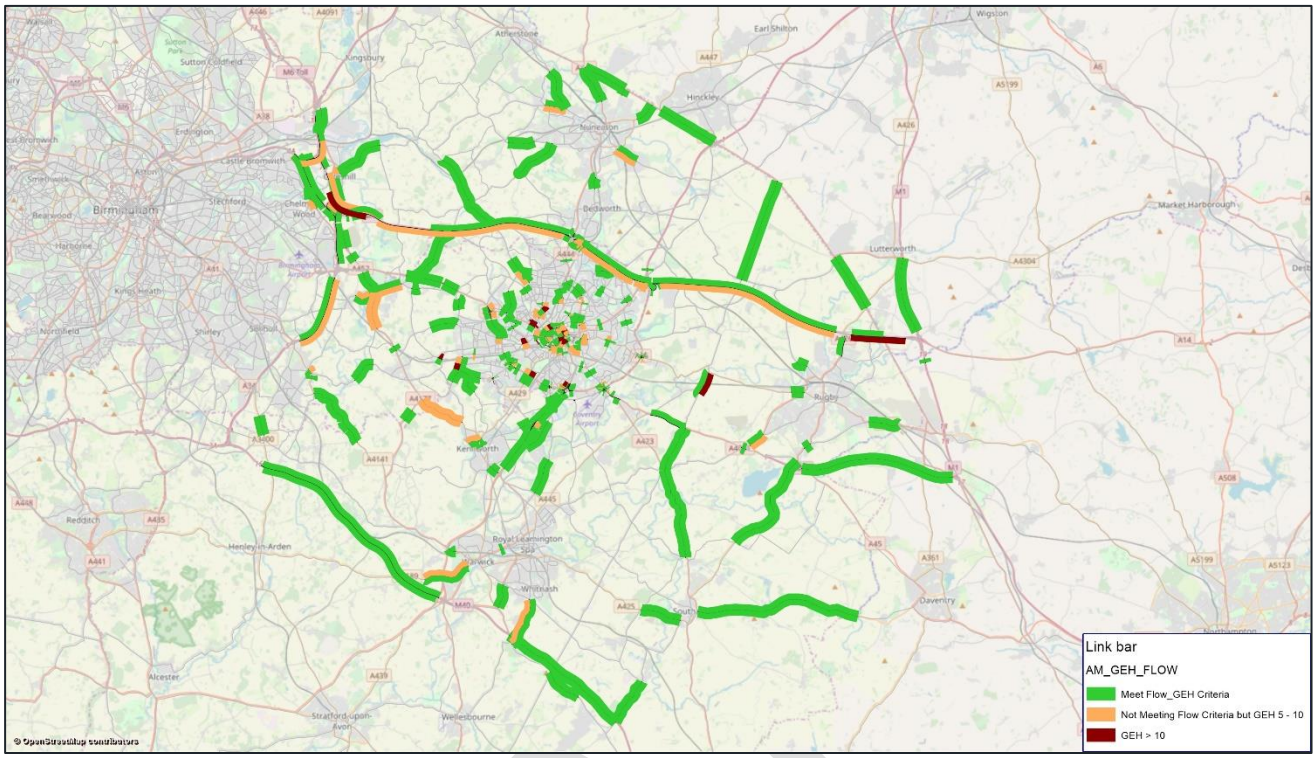


Figure 4: CASM HAM AM Peak Calibration Final Performance Whole Model

4.4.3 Table 3 and Figure 5 show the final calibration performance of the CASM HAM Inter Peak. Table 3 shows that TAG criteria is met for all vehicle types and total vehicles.

4.4.4 Figure 5 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 3: CASM HAM Inter Peak Calibration Final Performance Whole Model

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	443	410	420	93%	4
LGV	443	433	441	100%	0
HGV	443	440	440	99%	0
Total Vehicles	443	398	409	92%	4
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	281,492	276,022		-1.94%	

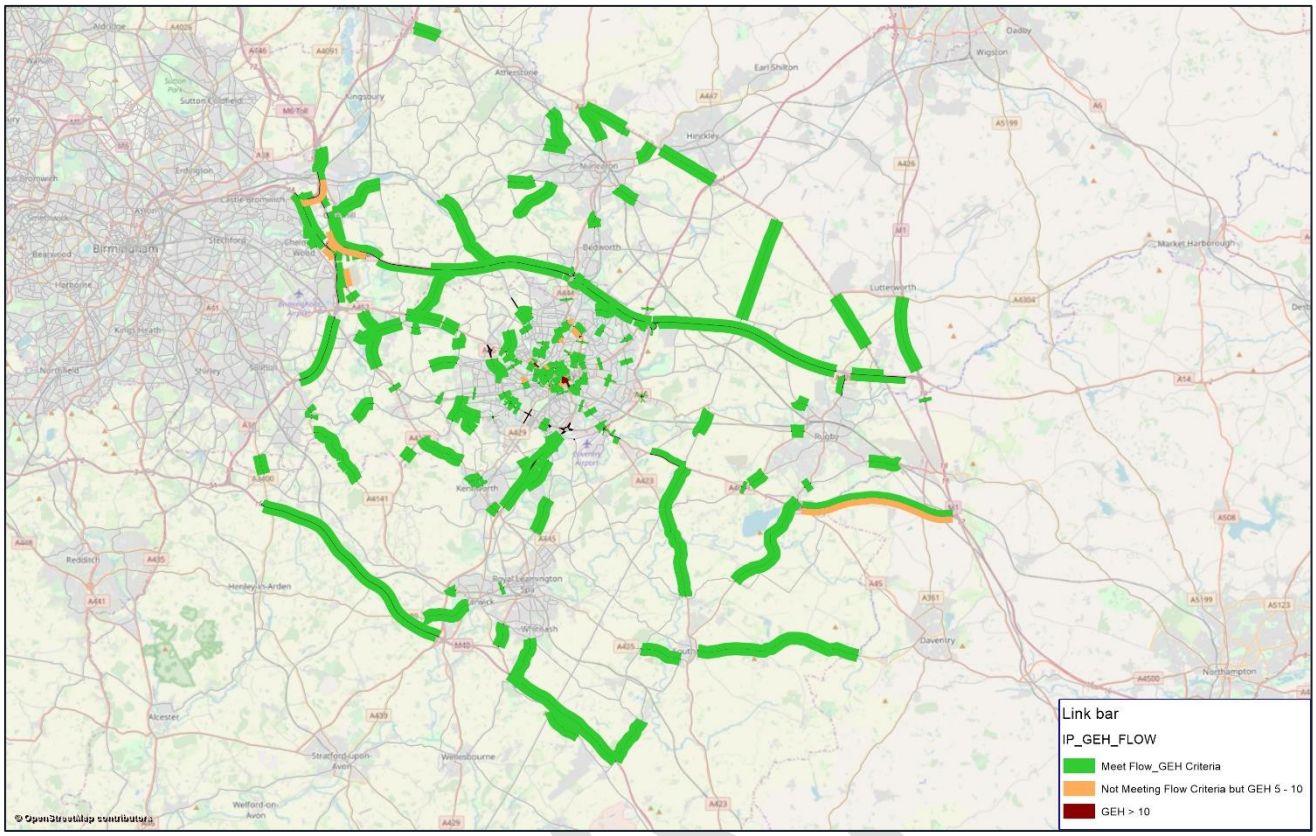


Figure 5: CASM HAM Inter Peak Calibration Final Performance Whole Model

4.4.5 Table 4 shows the final calibration performance of the CASM HAM PM Peak. Table 4 shows that TAG criteria is met for vehicle classes separately. 79% of links meet TAG criteria for all vehicles, slightly outside criteria; however there are 25 counts which have a GEH of below 6, resulting in 84% of counts meeting flow or GEH of 6 or less.

4.4.6 Figure 6 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 4: CASM HAM PM Peak Calibration Final Performance Whole Model

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	481	362	383	82%	14
LGV	481	456	476	99%	1
HGV	481	453	477	99%	0
Total Vehicles	481	351	374	79%	19
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	457,466	449,393		-1.76%	

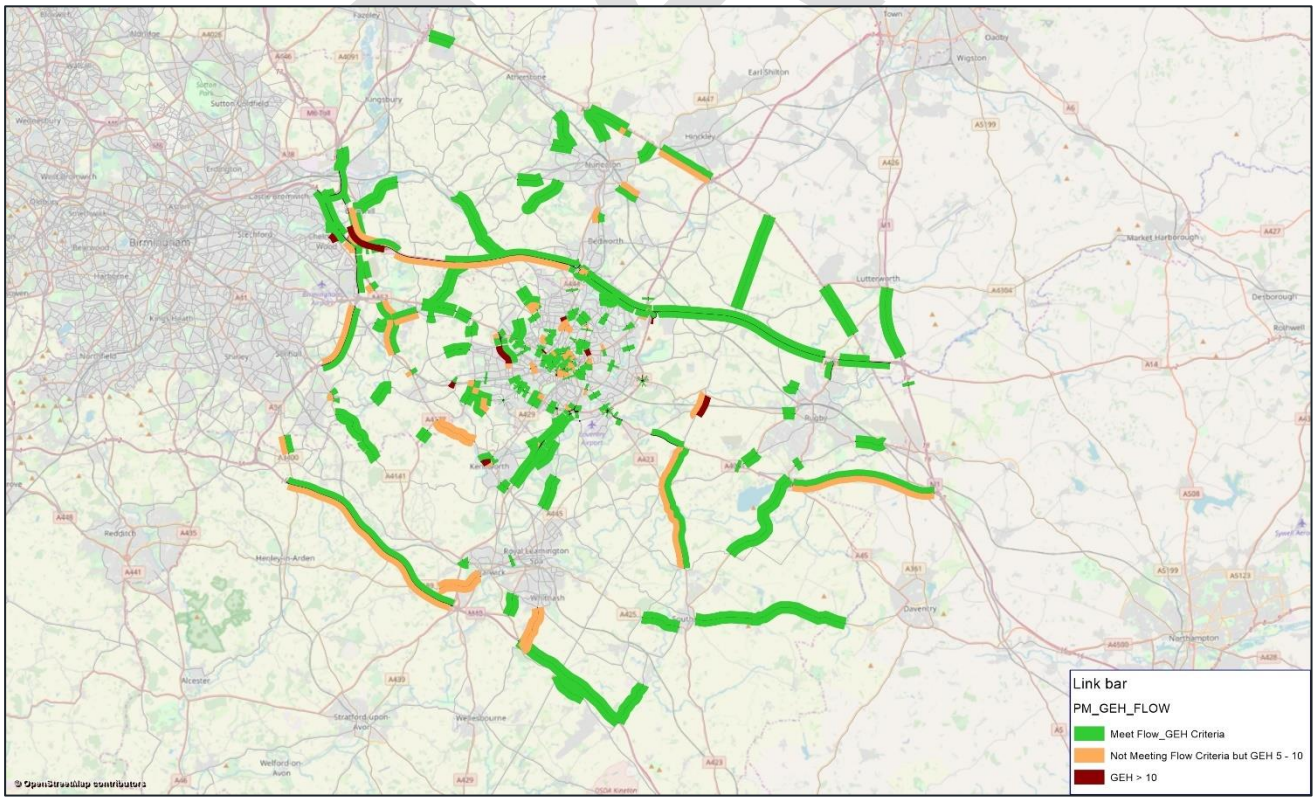


Figure 6: CASM HAM PM Peak Calibration Final Performance Whole Model

4.5 COVENTRY CITY COUNT CALIBRATION

4.5.1 Table 5 and Figure 7 show the final calibration performance of the CASM HAM AM Peak in the Coventry City area. Table 5 shows that TAG criteria is met for all individual vehicle types and is 74% for total vehicles, lower than the TAG criteria of 85%. However, 10 counts have a GEH of 6 or lower, resulting in 78% of counts meeting flow of a GEH of 6 or lower.

4.5.2 Figure 7 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 5: CASM HAM AM Peak Calibration Final Performance Coventry City

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	286	205	211	75%	15
LGV	286	273	282	99%	1
HGV	286	264	284	99%	2
Total Vehicles	286	201	205	74%	15
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	242,555	235,192		-3.04%	

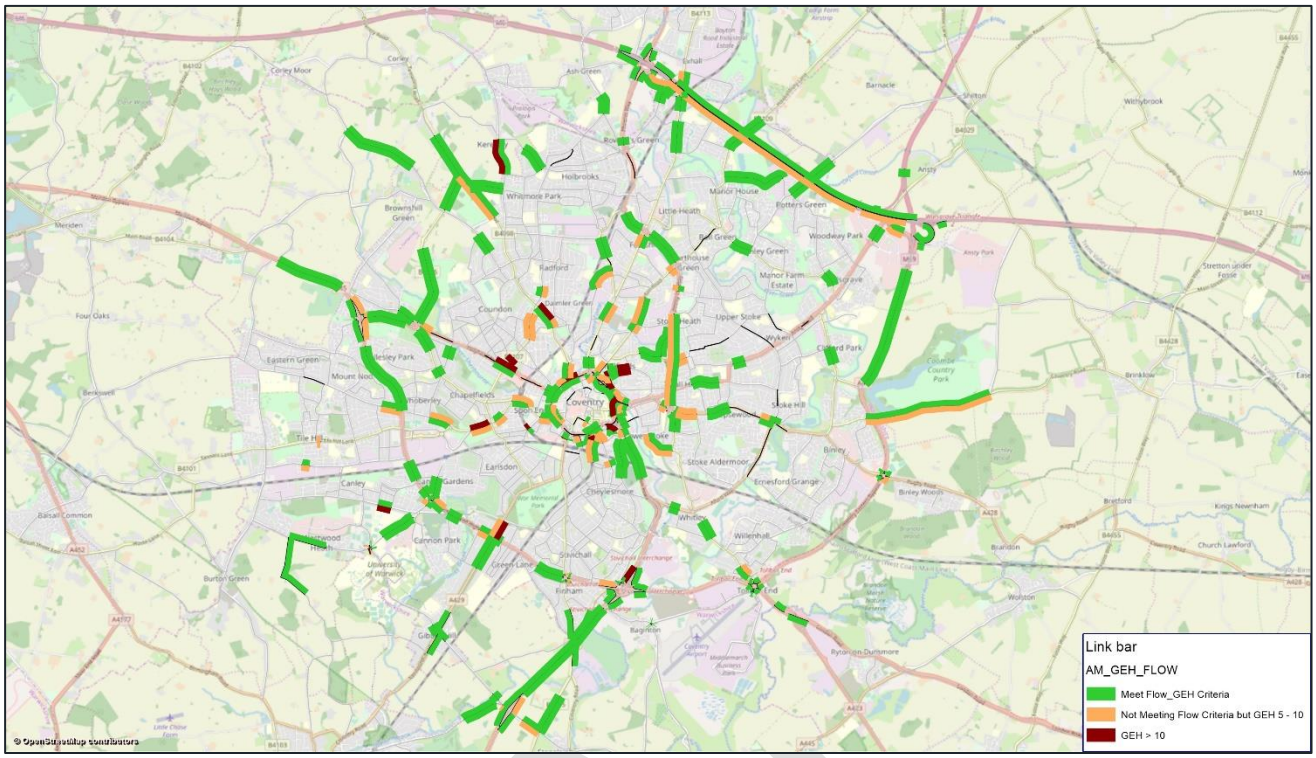


Figure 7: CASM HAM AM Peak Calibration Final Performance

4.5.3 Table 6 and Figure 8 show the final calibration performance of the CASM HAM Inter Peak. Table 6 shows that TAG criteria is met for all vehicle types and total vehicles.

4.5.4 Figure 8 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH <= 10 are red.

Table 6: CASM HAM Inter Peak Calibration Final Performance Coventry City

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	248	219	226	89%	4
LGV	248	245	248	100%	0
HGV	248	247	247	100%	0
Total Vehicles	248	220	223	89%	4
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	150,939	147,895		-2.02%	

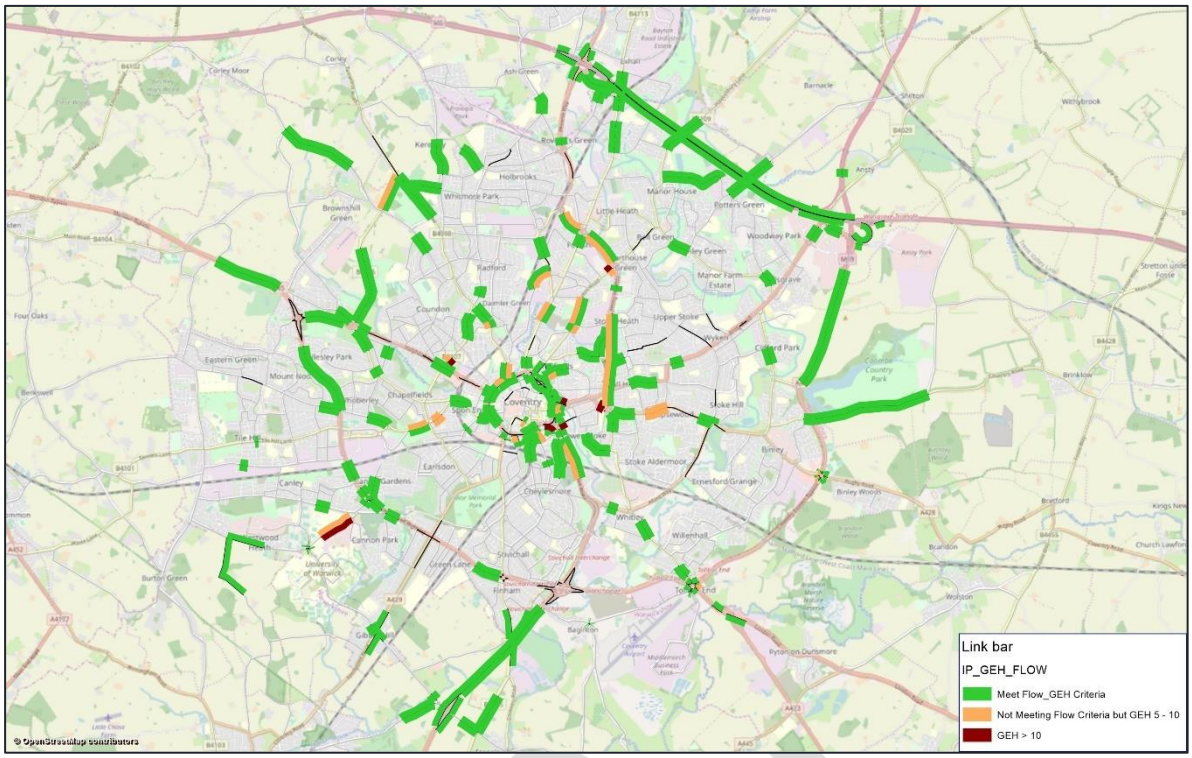


Figure 8: CASM HAM Inter Peak Calibration Final Performance Coventry City

4.5.5 Table 7 shows the final calibration performance of the CASM HAM PM Peak. Table 7 shows that TAG criteria is met for vehicle classes separately. 79% of links meet TAG criteria for all vehicles, slightly outside criteria; however there are 15 counts which have a GEH of below 6, resulting in 84% of counts meeting flow or GEH of 6 or less.

4.5.6 Figure 9 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH <= 10 are red.

Table 7: CASM HAM PM Peak Calibration Final Performance Coventry City

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	286	206	215	79%	9
LGV	286	273	286	100%	0
HGV	286	278	285	100%	0
Total Vehicles	286	208	218	79%	13
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	250,258	245,662		-1.84%	

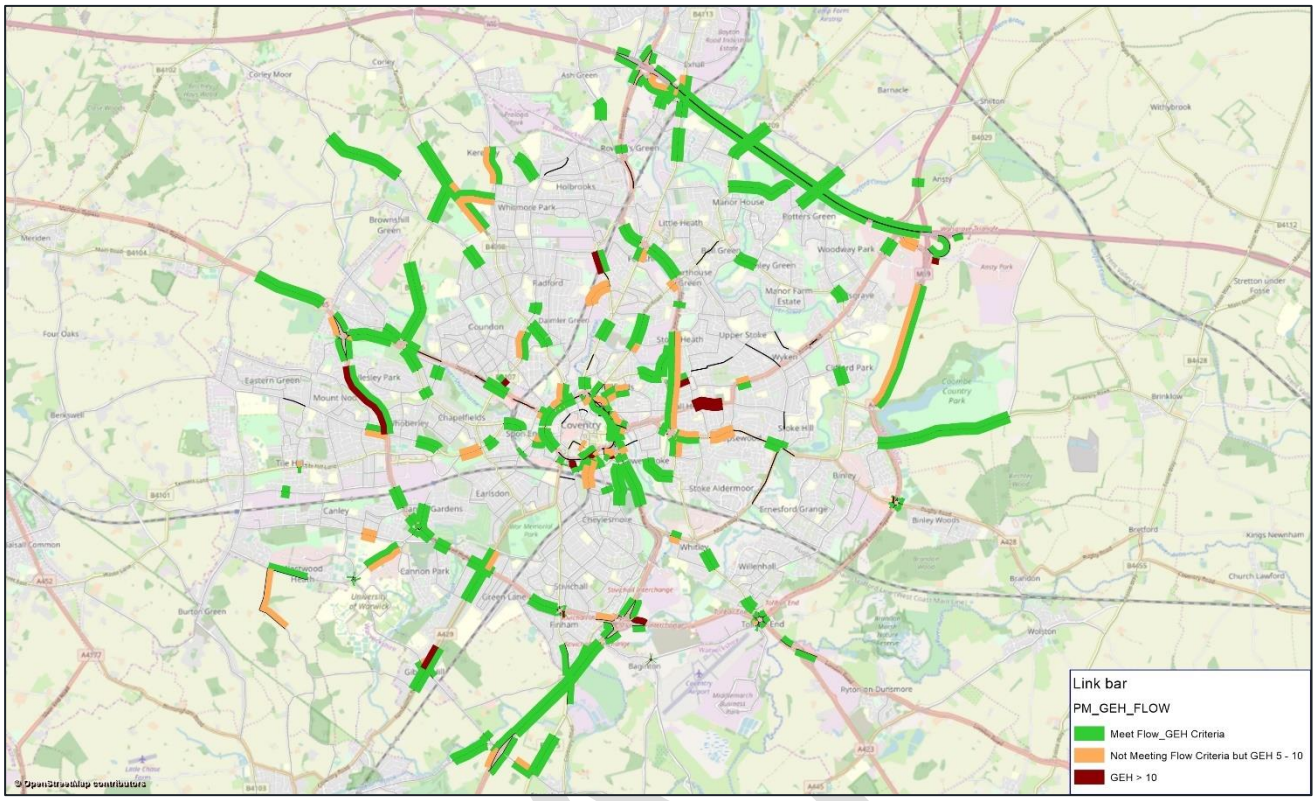


Figure 9: CASM HAM PM Peak Calibration Final Performance Coventry City

4.6 AIR QUALITY PRIORITY COUNT CALIBRATION/ VALIDATION

4.6.1 Table 8 and Figure 10 show the final calibration performance of the CASM HAM AM Peak. Table 8 shows that TAG criteria is met for all individual vehicle types and is 56% for total vehicles, lower than the TAG criteria of 85%.

4.6.2 Figure 10 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 8: CASM HAM AM Peak Calibration Final Performance Air Quality Priority

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	48	26	27	56%	5
LGV	48	46	48	100%	0
HGV	48	40	48	100%	1
Total Vehicles	48	26	26	56%	5
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	35,090	36,528		4.10%	

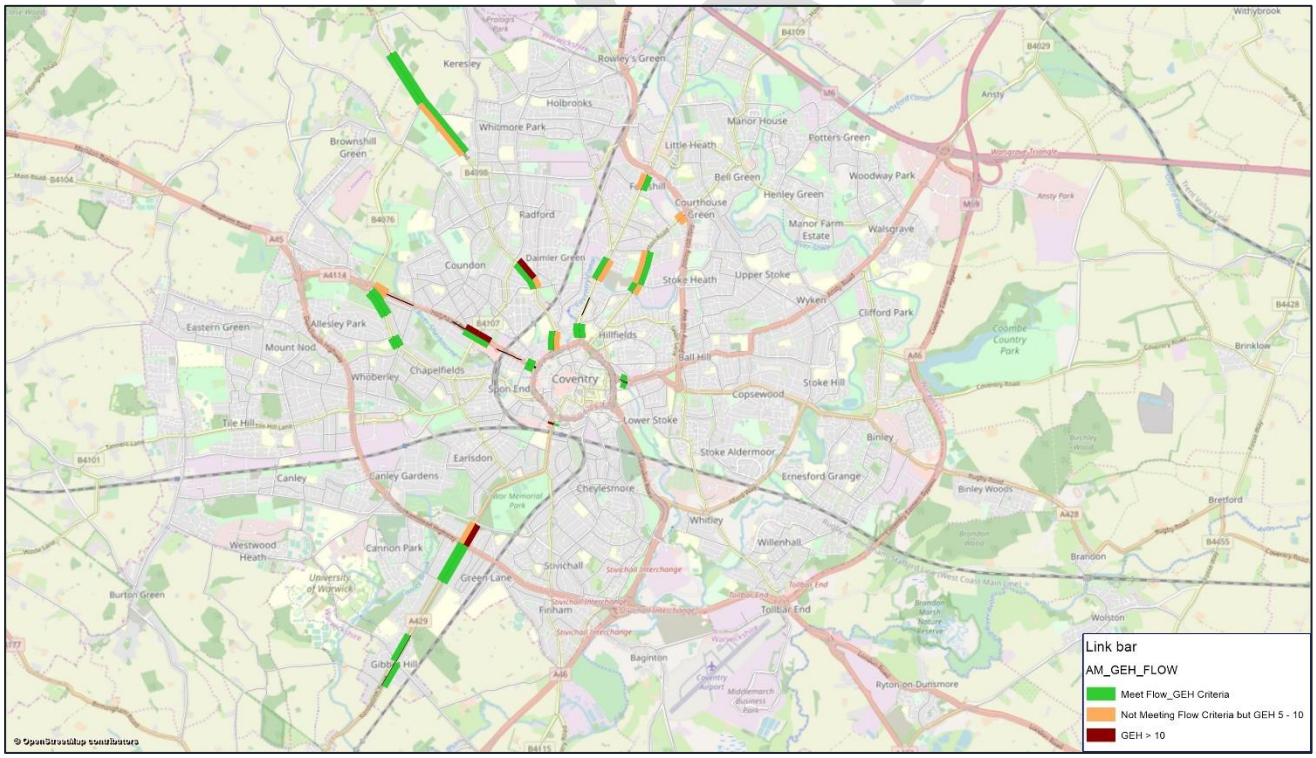


Figure 10: CASM HAM AM Peak Calibration Final Performance Air Quality Priority

4.6.3 Table 9 and Figure 11 show the final calibration performance of the CASM HAM Inter Peak. Table 9 shows that TAG criteria is met for all vehicles types and total vehicles. Figure 11 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 9: CASM HAM Inter Peak Calibration Final Performance Air Quality Priority

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	40	29	28	75%	3
LGV	40	40	40	100%	0
HGV	40	39	40	100%	0
Total Vehicles	40	30	30	75%	2
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	24,102	24,886		3.25%	

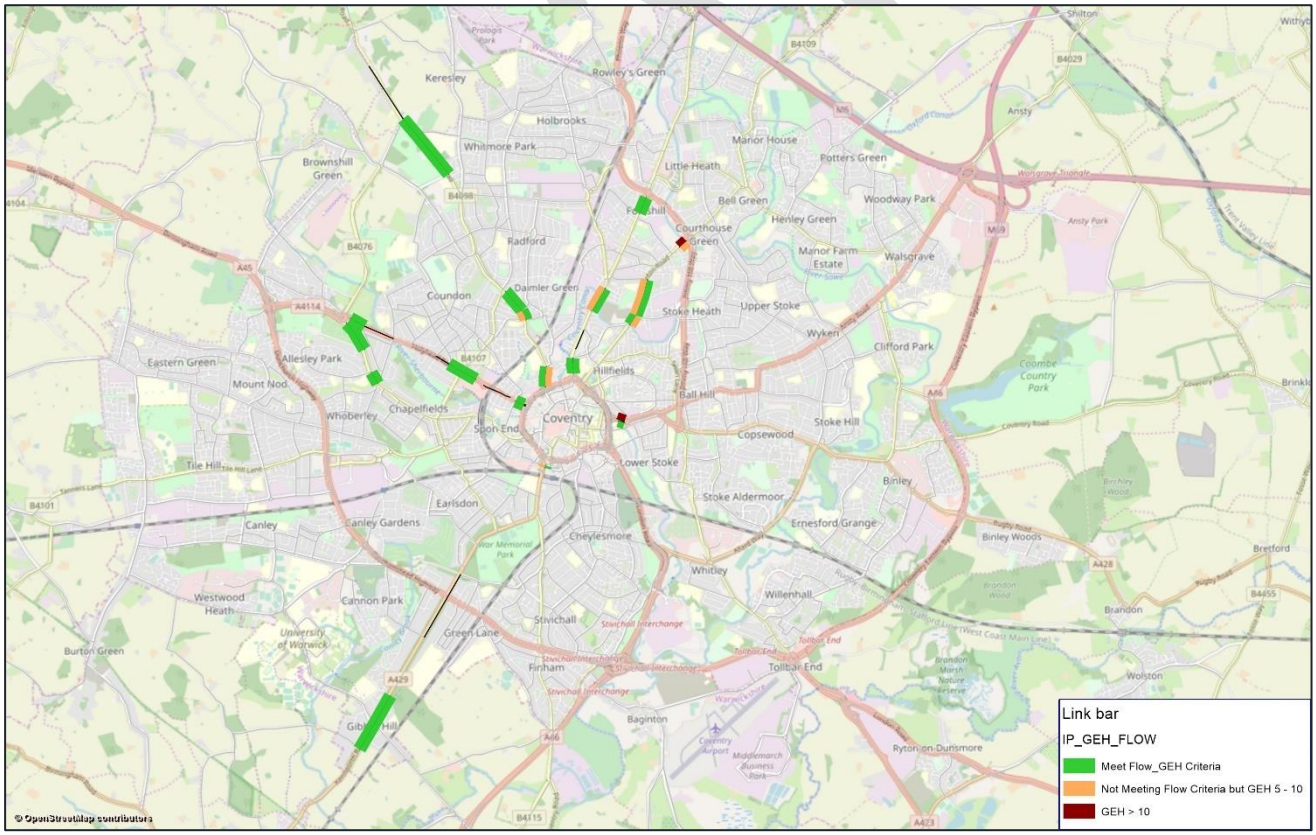


Figure 11: CASM HAM Inter Peak Calibration Final Performance Air Quality Priority

4.6.4 Table 10 shows the final calibration performance of the CASM HAM PM Peak. Table 10 shows that TAG criteria is met for vehicle classes separately. 75% of links meet TAG criteria for all vehicles, slightly outside criteria.

4.6.5 Figure 12 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH <= 10 are red.

Table 10: CASM HAM PM Peak Calibration Final Performance Air Quality Priority

Calibration Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	48	36	34	75%	1
LGV	48	46	48	100%	0
HGV	48	48	48	100%	0
Total Vehicles	48	36	34	75%	1
Total Traffic Count (all sites)	**Observed**	**Modelled**		**% Difference**	
Total Vehicles	37,179	38,165		2.65%	

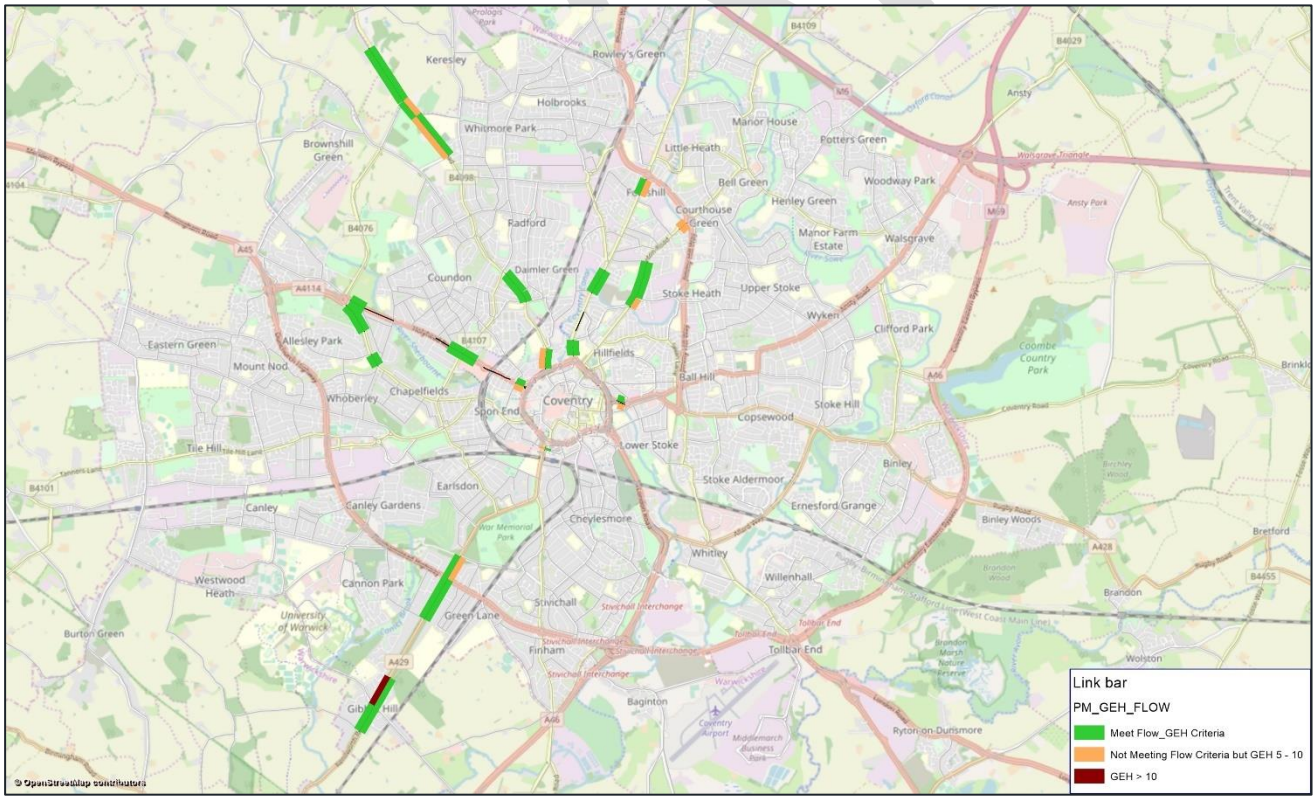


Figure 12: CASM HAM PM Peak Calibration Final Performance Air Quality Priority

4.7 COUNT VALIDATION

4.7.1 Table 11 and Figure 13 show the final validation performance of the CASM HAM AM Peak. Table 11 shows that TAG criteria is met for the individual vehicle classes. At total vehicle level 69% of counts meet TAG criteria.

4.7.2 Figure 13 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 11: CASM HAM AM Peak Validation Final Performance

Validation Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	108	63	78	72%	9
LGV	108	91	105	97%	3
HGV	108	86	108	100%	3
Total Vehicles	108	65	75	69%	10

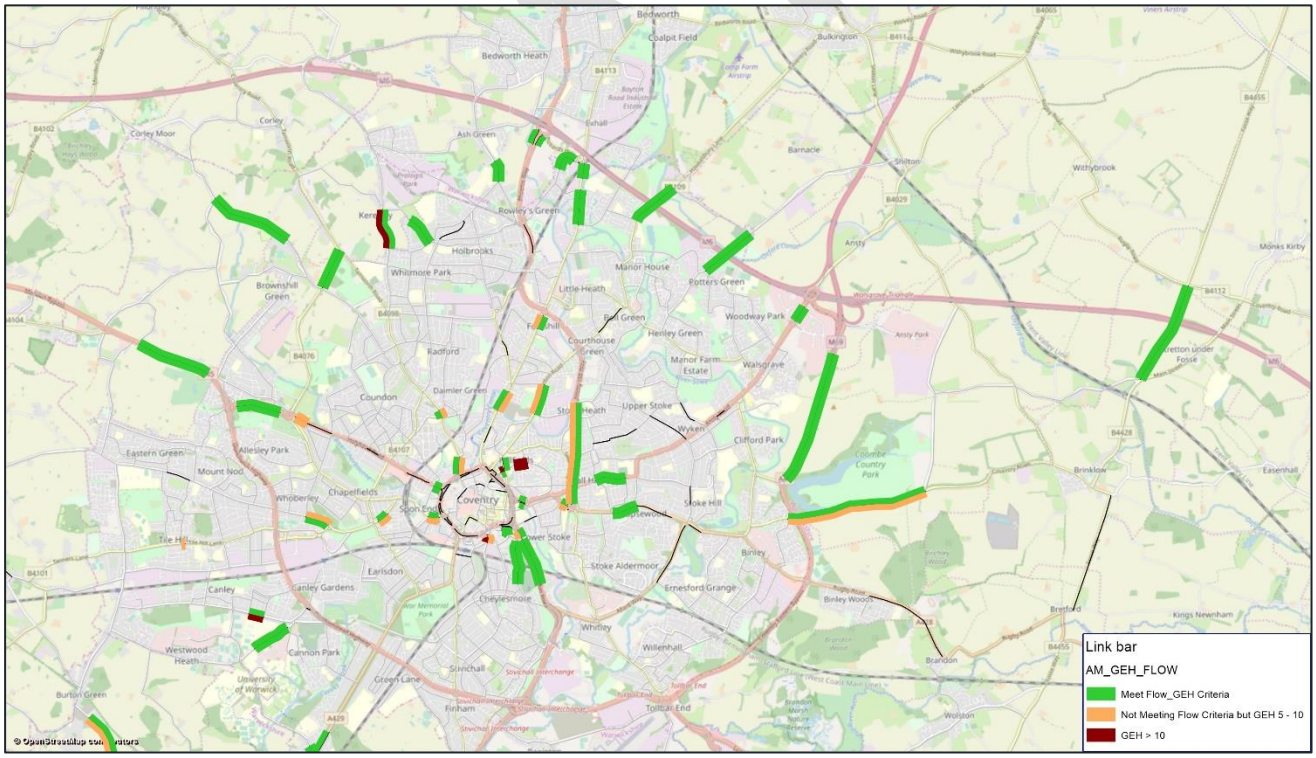


Figure 13: CASM HAM AM Peak Validation Performance

4.7.3 Table 12 and Figure 14 show the final validation performance of the CASM HAM Inter Peak. Table 12 shows that TAG criteria is met for the individual vehicle classes and all vehicles. Figure 14 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 12: CASM HAM Inter Peak Validation Final Performance

Validation Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	108	79	87	81%	5
LGV	108	100	108	100%	0
HGV	108	99	108	100%	0
Total Vehicles	108	81	89	82%	6

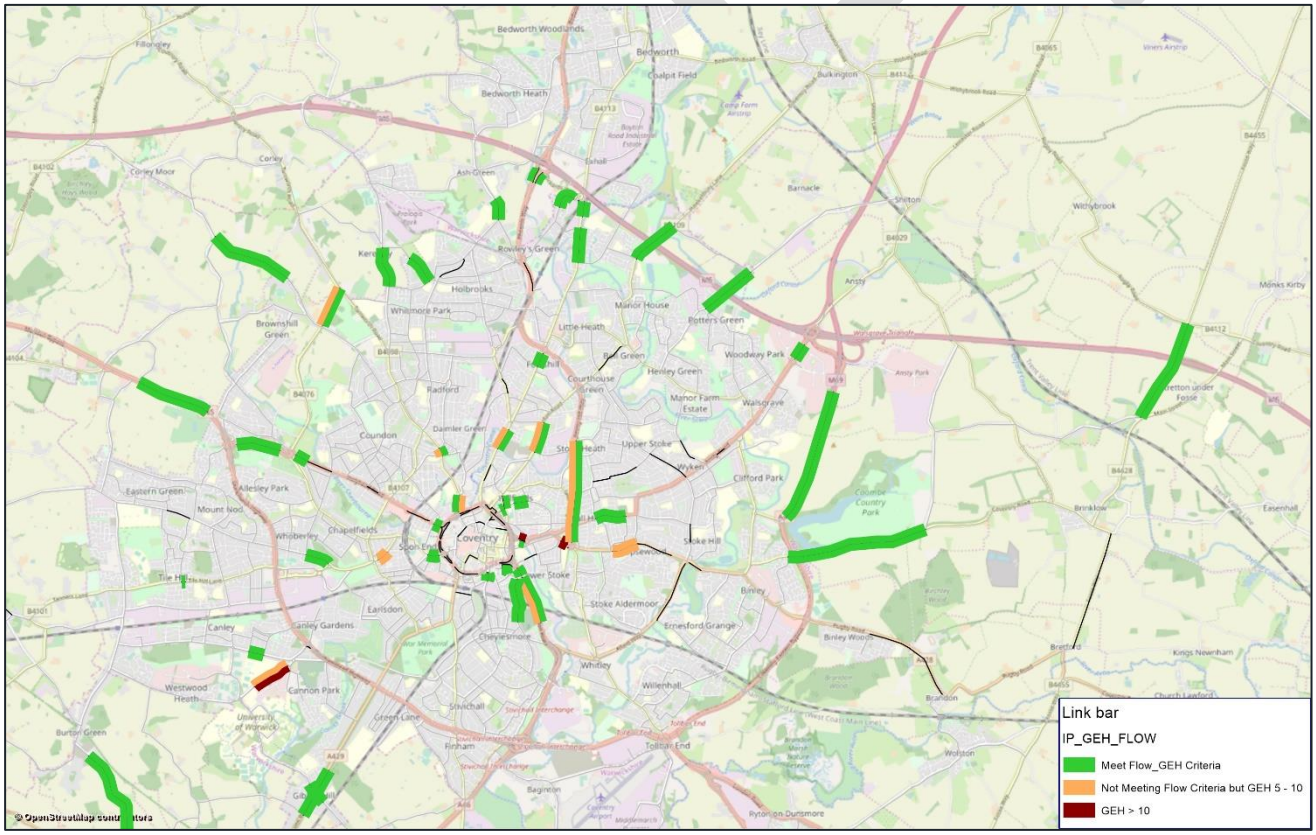


Figure 14: CASM HAM Inter Peak Validation Performance

4.7.4 Table 13 and Figure 15 show the final validation performance of the CASM HAM PM Peak. Table 13 shows that TAG criteria is met for LGV and HGV's. For car and total vehicles, 78% and 76% of counts meet TAG criteria respectively, lower than 85%.

4.7.5 Figure 15 graphically presents the performance. All counts meeting either flow or GEH criteria are coloured in green, those not meeting flow criteria but have a GEH between 5 and 10 are orange and those with a GEH > 10 are red.

Table 13: CASM HAM PM Peak Validation Final Performance

Validation Counts

Vehicle Class	Number of Counts	GEH<5	Flow Criteria	% GEH or Flow Criteria Met	GEH>10
Car	108	72	85	78%	7
LGV	108	98	108	100%	0
HGV	108	101	108	100%	0
Total Vehicles	108	72	82	75%	8

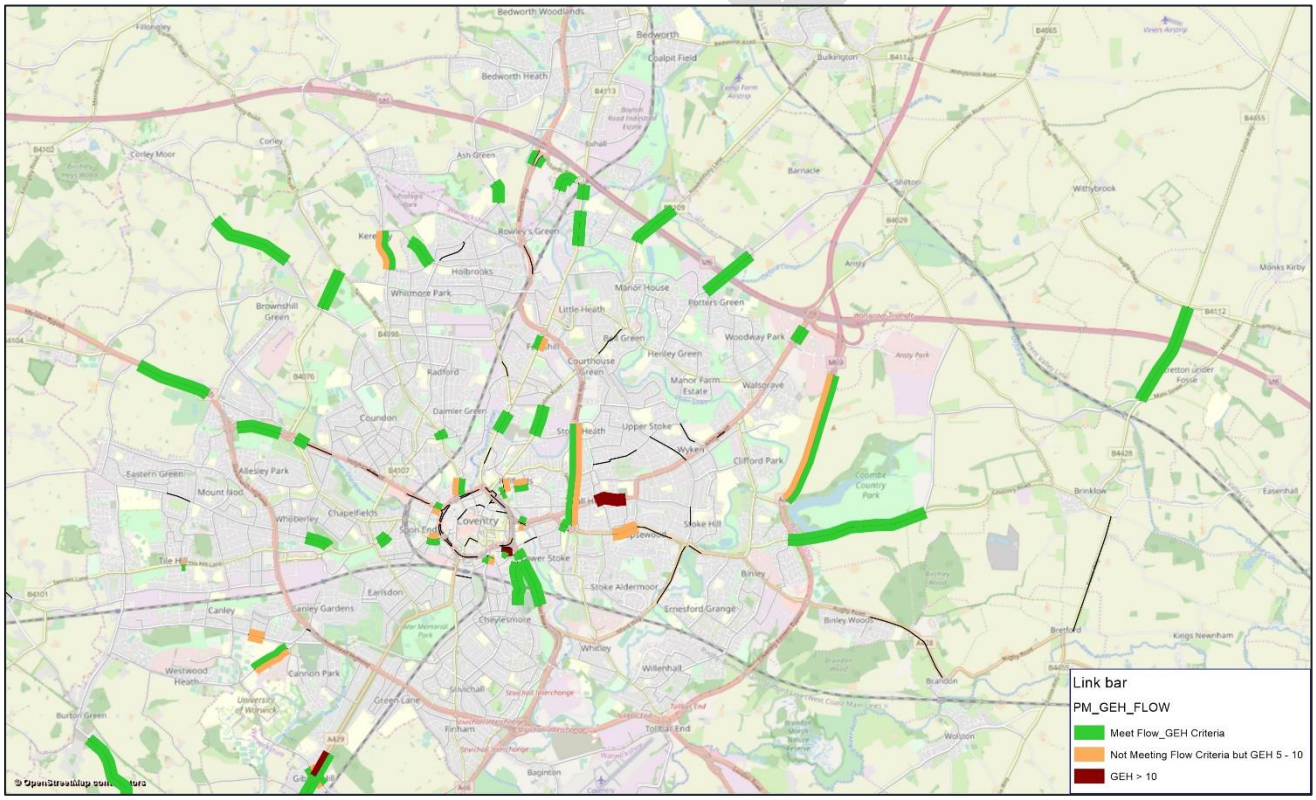


Figure 15: CASM HAM PM Peak Validation Performance

4.8 SCREENLINE AND CORDON

4.8.1 The CASM HAM has 8 calibration screenlines and cordons and 2 validation cordons. The number of screenlines and cordons which meet criteria for all vehicles in the CASM HAM models is summarised in Table 14.

Table 14: CASM HAM Screenline and Cordon Performance Passing TAG Criteria

	AM Peak	Inter Peak	PM Peak
Calibration	7	8	8
Validation	1	2	2

4.8.2 Table 14 demonstrates that all screenlines and cordons meet criteria with the exception of one calibration screenline and one validation screenline. The screenlines in the AM peak which fall outside criteria is the North of M6 Screenline Northbound and Coventry outer cordon outbound. Although they fail to meet criteria they are only slightly outside with a GEH of 4.9 and 6.2. The most important screenlines for the air quality work are those within Coventry City, which are Coventry Inner and Coventry outer. Both these screenlies in all time periods meet criteria with the exception of Coventry Outer Outbound in the AM peak. This screenline shows that the modelled flow is 660 vehicles lower than the observed number, 11,875 vehicles, which is a -6% change. So although this screenline does not meet criteria it is not far out from criteria so is not of concern of the air quality study.

4.8.3 Detailed performance of each calibration screenline/ cordon for each time period by vehicle class can be found in Table 15 to Table 17. Table 18 to Table 20 present the validation cordon performance.

Table 15: CASM HAM AM peak Calibration Screenline / Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Western N/S Screenline	Westbound	11632	11366	-266	-2%	2.5	✓	✓	✓
Western N/S Screenline	Eastbound	12214	12107	-107	-1%	1.0	✓	✓	✓
North of M6 Screenline	Northbound	4305	3997	-308	-7%	4.8	×	×	×
North of M6 Screenline	Southbound	5764	5849	85	1%	1.1	✓	✓	✓
Eastern N/S Screenline	Westbound	8460	8168	-292	-3%	3.2	✓	✓	✓
Eastern N/S Screenline	Eastbound	8613	8615	2	0%	0.0	✓	✓	✓
Coventry Inner Cordon	Inbound	13421	13468	47	0%	0.4	✓	✓	✓
Coventry Inner Cordon	Outbound	10435	10345	-90	-1%	0.9	✓	✓	✓
Total		74844	73915	-929	-1%		**88%**	**88%**	**88%**
LGV									
Western N/S Screenline	Westbound	1063	1024	-39	-4%	1.2	✓	✓	✓
Western N/S Screenline	Eastbound	1117	1216	99	9%	2.9	×	✓	✓
North of M6 Screenline	Northbound	537	433	-104	-19%	4.7	×	×	×
North of M6 Screenline	Southbound	671	740	69	10%	2.6	×	✓	✓
Eastern N/S Screenline	Westbound	509	508	-1	0%	0.0	✓	✓	✓
Eastern N/S Screenline	Eastbound	1120	984	-136	-12%	4.2	×	×	×
Coventry Inner Cordon	Inbound	1227	1035	-192	-16%	5.7	×	×	×
Coventry Inner Cordon	Outbound	963	940	-23	-2%	0.7	✓	✓	✓
Total		7208	6880	-328	-5%		**38%**	**63%**	**63%**
HGV									
Western N/S Screenline	Westbound	1757	1616	-141	-8%	3.4	×	✓	✓
Western N/S Screenline	Eastbound	1808	1738	-70	-4%	1.7	✓	✓	✓
North of M6 Screenline	Northbound	224	294	70	31%	4.3	×	×	×
North of M6 Screenline	Southbound	394	487	93	24%	4.4	×	×	×
Eastern N/S Screenline	Westbound	1329	1172	-157	-12%	4.4	×	×	×
Eastern N/S Screenline	Eastbound	1333	1340	7	1%	0.2	✓	✓	✓
Coventry Inner Cordon	Inbound	497	482	-15	-3%	0.7	✓	✓	✓
Coventry Inner Cordon	Outbound	389	393	4	1%	0.2	✓	✓	✓
Total		7731	7522	-209	-3%		**50%**	**63%**	**63%**
Total Vehicles									
Western N/S Screenline	Westbound	14449	14004	-445	-3%	3.7	✓	✓	✓
Western N/S Screenline	Eastbound	15138	15060	-78	-1%	0.6	✓	✓	✓
North of M6 Screenline	Northbound	5068	4723	-345	-6.81%	4.9	×	×	×
North of M6 Screenline	Southbound	6829	7076	247	4%	3.0	✓	✓	✓
Eastern N/S Screenline	Westbound	10297	9847	-450	-4%	4.5	✓	×	✓
Eastern N/S Screenline	Eastbound	11068	10940	-128	-1%	1.2	✓	✓	✓
Coventry Inner Cordon	Inbound	15149	14984	-165	-1%	1.3	✓	✓	✓
Coventry Inner Cordon	Outbound	11787	11681	-106	-1%	1.0	✓	✓	✓
Total		89786	88315	-1471	-2%		**88%**	**75%**	**88%**
All Goods Vehicles									
Western N/S Screenline	Westbound	2820	2640	-180	-6%	3.4	×	✓	✓
Western N/S Screenline	Eastbound	2925	2954	29	1%	0.5	✓	✓	✓
North of M6 Screenline	Northbound	762	727	-35	-5%	1.3	✓	✓	✓
North of M6 Screenline	Southbound	1065	1227	162	15%	4.8	×	×	×
Eastern N/S Screenline	Westbound	1838	1680	-158	-9%	3.8	×	✓	✓
Eastern N/S Screenline	Eastbound	2453	2324	-129	-5%	2.6	×	✓	✓
Coventry Inner Cordon	Inbound	1724	1517	-207	-12%	5.2	×	×	×
Coventry Inner Cordon	Outbound	1352	1333	-19	-1%	0.5	✓	✓	✓
Total		14939	14402	-537	-4%		**38%**	**75%**	**75%**

Table 16: CASM HAM Inter peak Calibration Screenline / Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Western N/S Screenline	Westbound	6768	6828	60	1%	0.7	✓	✓	✓
Western N/S Screenline	Eastbound	6594	6529	-65	-1%	0.8	✓	✓	✓
North of M6 Screenline	Northbound	3061	3073	12	0%	0.2	✓	✓	✓
North of M6 Screenline	Southbound	2913	2995	82	3%	1.5	✓	✓	✓
Eastern N/S Screenline	Westbound	5251	5291	40	1%	0.5	✓	✓	✓
Eastern N/S Screenline	Eastbound	4702	4850	148	3%	2.1	✓	✓	✓
Coventry Inner Cordon	Inbound	8610	8301	-309	-4%	3.4	✓	✓	✓
Coventry Inner Cordon	Outbound	8532	8344	-188	-2%	2.0	✓	✓	✓
Total		46433	46211	-222	0%		**100%**	**100%**	**100%**
LGV									
Western N/S Screenline	Westbound	1065	1113	48	5%	1.5	✓	✓	✓
Western N/S Screenline	Eastbound	930	993	63	7%	2.0	×	✓	✓
North of M6 Screenline	Northbound	472	497	25	5%	1.1	×	✓	✓
North of M6 Screenline	Southbound	467	484	17	4%	0.8	✓	✓	✓
Eastern N/S Screenline	Westbound	598	615	17	3%	0.7	✓	✓	✓
Eastern N/S Screenline	Eastbound	738	741	3	0%	0.1	✓	✓	✓
Coventry Inner Cordon	Inbound	1128	1044	-84	-7%	2.6	×	✓	✓
Coventry Inner Cordon	Outbound	1130	1094	-36	-3%	1.1	✓	✓	✓
Total		6527	6581	54	1%		**63%**	**100%**	**100%**
HGV									
Western N/S Screenline	Westbound	1940	1862	-78	-4%	1.8	✓	✓	✓
Western N/S Screenline	Eastbound	1840	1727	-113	-6%	2.7	×	✓	✓
North of M6 Screenline	Northbound	234	268	34	15%	2.2	×	✓	✓
North of M6 Screenline	Southbound	425	424	-1	0%	0.0	✓	✓	✓
Eastern N/S Screenline	Westbound	1556	1452	-104	-7%	2.7	×	✓	✓
Eastern N/S Screenline	Eastbound	1440	1390	-50	-4%	1.3	✓	✓	✓
Coventry Inner Cordon	Inbound	453	419	-34	-8%	1.6	×	✓	✓
Coventry Inner Cordon	Outbound	453	414	-39	-9%	1.9	×	✓	✓
Total		8340	7956	-384	-5%		**38%**	**100%**	**100%**
Total Vehicles									
Western N/S Screenline	Westbound	9775	9805	30	0%	0.3	✓	✓	✓
Western N/S Screenline	Eastbound	9363	9246	-117	-1%	1.2	✓	✓	✓
North of M6 Screenline	Northbound	3766	3837	71	1.88%	1.2	✓	✓	✓
North of M6 Screenline	Southbound	3806	3903	97	3%	1.6	✓	✓	✓
Eastern N/S Screenline	Westbound	7405	7360	-45	-1%	0.5	✓	✓	✓
Eastern N/S Screenline	Eastbound	6880	6977	97	1%	1.2	✓	✓	✓
Coventry Inner Cordon	Inbound	10188	9760	-428	-4%	4.3	✓	×	✓
Coventry Inner Cordon	Outbound	10120	9851	-269	-3%	2.7	✓	✓	✓
Total		61304	60739	-565	-1%		**100%**	**88%**	**100%**
All Goods Vehicles									
Western N/S Screenline	Westbound	3004	2975	-29	-1%	0.5	✓	✓	✓
Western N/S Screenline	Eastbound	2769	2720	-49	-2%	0.9	✓	✓	✓
North of M6 Screenline	Northbound	706	765	59	8%	2.2	×	✓	✓
North of M6 Screenline	Southbound	892	908	16	2%	0.5	✓	✓	✓
Eastern N/S Screenline	Westbound	2154	2067	-87	-4%	1.9	✓	✓	✓
Eastern N/S Screenline	Eastbound	2179	2131	-48	-2%	1.0	✓	✓	✓
Coventry Inner Cordon	Inbound	1581	1463	-118	-7%	3.0	×	✓	✓
Coventry Inner Cordon	Outbound	1582	1508	-74	-5%	1.9	✓	✓	✓
Total		14868	14537	-331	-2%		**75%**	**100%**	**100%**

Table 17: PM peak Calibration Screenline / Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Western N/S Screenline	Westbound	14218	13552	-666	-5%	5.7	✓	×	✓
Western N/S Screenline	Eastbound	12747	12663	-84	-1%	0.7	✓	✓	✓
North of M6 Screenline	Northbound	6286	6215	-71	-1%	0.9	✓	✓	✓
North of M6 Screenline	Southbound	4644	4645	1	0%	0.0	✓	✓	✓
Eastern N/S Screenline	Westbound	10672	10300	-372	-3%	3.6	✓	✓	✓
Eastern N/S Screenline	Eastbound	8560	8538	-22	0%	0.2	✓	✓	✓
Coventry Inner Cordon	Inbound	11823	11727	-96	-1%	0.9	✓	✓	✓
Coventry Inner Cordon	Outbound	14473	14703	230	2%	1.9	✓	✓	✓
Total		83422	82343	-1079	-1%		**100%**	**88%**	**100%**
LGV									
Western N/S Screenline	Westbound	1035	978	-57	-6%	1.8	×	✓	✓
Western N/S Screenline	Eastbound	787	789	2	0%	0.1	✓	✓	✓
North of M6 Screenline	Northbound	637	616	-21	-3%	0.9	✓	✓	✓
North of M6 Screenline	Southbound	497	452	-45	-9%	2.1	×	✓	✓
Eastern N/S Screenline	Westbound	622	592	-30	-5%	1.2	✓	✓	✓
Eastern N/S Screenline	Eastbound	739	741	2	0%	0.1	✓	✓	✓
Coventry Inner Cordon	Inbound	802	869	67	8%	2.3	×	✓	✓
Coventry Inner Cordon	Outbound	979	964	-15	-2%	0.5	✓	✓	✓
Total		6098	6001	-97	-2%		**63%**	**100%**	**100%**
HGV									
Western N/S Screenline	Westbound	1261	1255	-6	-1%	0.2	✓	✓	✓
Western N/S Screenline	Eastbound	1170	1155	-15	-1%	0.4	✓	✓	✓
North of M6 Screenline	Northbound	115	175	60	52%	5.0	×	×	×
North of M6 Screenline	Southbound	201	248	47	23%	3.1	×	✓	✓
Eastern N/S Screenline	Westbound	1122	1050	-72	-6%	2.2	×	✓	✓
Eastern N/S Screenline	Eastbound	935	933	-2	0%	0.1	✓	✓	✓
Coventry Inner Cordon	Inbound	109	158	49	45%	4.2	×	×	×
Coventry Inner Cordon	Outbound	130	170	40	31%	3.3	×	✓	✓
Total		5043	5144	101	2%		**38%**	**75%**	**75%**
Total Vehicles									
Western N/S Screenline	Westbound	16511	15787	-724	-4%	5.7	✓	×	✓
Western N/S Screenline	Eastbound	14702	14603	-99	-1%	0.8	✓	✓	✓
North of M6 Screenline	Northbound	7039	7007	-32	-0.46%	0.4	✓	✓	✓
North of M6 Screenline	Southbound	5341	5347	6	0%	0.1	✓	✓	✓
Eastern N/S Screenline	Westbound	12414	11945	-469	-4%	4.3	✓	×	✓
Eastern N/S Screenline	Eastbound	10236	10211	-25	0%	0.2	✓	✓	✓
Coventry Inner Cordon	Inbound	12736	12753	17	0%	0.2	✓	✓	✓
Coventry Inner Cordon	Outbound	15586	15836	250	2%	2.0	✓	✓	✓
Total		94566	93489	-1077	-1%		**100%**	**75%**	**100%**
All Goods Vehicles									
Western N/S Screenline	Westbound	2297	2233	-64	-3%	1.3	✓	✓	✓
Western N/S Screenline	Eastbound	1956	1944	-12	-1%	0.3	✓	✓	✓
North of M6 Screenline	Northbound	752	791	39	5%	1.4	×	✓	✓
North of M6 Screenline	Southbound	698	700	2	0%	0.1	✓	✓	✓
Eastern N/S Screenline	Westbound	1745	1642	-103	-6%	2.5	×	✓	✓
Eastern N/S Screenline	Eastbound	1673	1674	1	0%	0.0	✓	✓	✓
Coventry Inner Cordon	Inbound	911	1027	116	13%	3.7	×	✓	✓
Coventry Inner Cordon	Outbound	1109	1134	25	2%	0.7	✓	✓	✓
Total		11141	11145	4	0%		**63%**	**100%**	**100%**

Table 18: CASM HAM AM peak Validation Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Coventry Outer Cordon	Inbound	12406	12106	-300	-2%	2.7	✓	✓	✓
Coventry Outer Cordon	Outbound	9644	9422	-222	-2%	2.3	✓	✓	✓
Total		22049	21528	-521	-2%		**100%**	**100%**	**100%**
LGV									
Coventry Outer Cordon	Inbound	1589	1540	-49	-3%	1.2	✓	✓	✓
Coventry Outer Cordon	Outbound	1409	1189	-220	-15.6%	6.1	×	×	×
Total		2997	2729	-268	-9%		**50%**	**50%**	**50%**
HGV									
Coventry Outer Cordon	Inbound	1005	913	-92	-9%	3.0	×	✓	✓
Coventry Outer Cordon	Outbound	823	605	-218	-26%	8.2	×	×	×
Total		1828	1518	-310	-17%		**0%**	**50%**	**50%**
Total Vehicles									
Coventry Outer Cordon	Inbound	14999	14563	-436	-3%	3.6	✓	✓	✓
Coventry Outer Cordon	Outbound	11875	11213	-662	-6%	6.2	×	×	×
Total		26874	25776	-1098	-4%		**50%**	**50%**	**50%**
All Goods Vehicles									
Coventry Outer Cordon	Inbound	2594	2453	-141	-5%	2.8	×	✓	✓
Coventry Outer Cordon	Outbound	2231	1794	-437	-20%	9.8	×	×	×
Total		4825	4247	-578	-12%		**0%**	**50%**	**50%**

Table 19: Inter peak Validation Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Coventry Outer Cordon	Inbound	6317	6600	283	4%	3.5	✓	✓	✓
Coventry Outer Cordon	Outbound	6448	6671	223	3%	2.8	✓	✓	✓
Total		12765	13271	506	4%		**100%**	**100%**	**100%**
LGV									
Coventry Outer Cordon	Inbound	1155	1167	12	1%	0.4	✓	✓	✓
Coventry Outer Cordon	Outbound	1223	1215	-8	-0.7%	0.2	✓	✓	✓
Total		2378	2382	4	0%		**100%**	**100%**	**100%**
HGV									
Coventry Outer Cordon	Inbound	833	729	-104	-12%	3.7	×	✓	✓
Coventry Outer Cordon	Outbound	853	737	-116	-14%	4.1	×	×	×
Total		1685	1466	-219	-13%		**0%**	**50%**	**50%**
Total Vehicles									
Coventry Outer Cordon	Inbound	8307	8495	188	2%	2.0	✓	✓	✓
Coventry Outer Cordon	Outbound	8523	8620	97	1%	1.0	✓	✓	✓
Total		16830	17115	285	2%		**100%**	**100%**	**100%**
All Goods Vehicles									
Coventry Outer Cordon	Inbound	1987	1896	-91	-5%	2.1	✓	✓	✓
Coventry Outer Cordon	Outbound	2076	1952	-124	-6%	2.8	×	✓	✓
Total		4063	3848	-215	-5%		**50%**	**100%**	**100%**

Table 20: PM peak Validation Cordon Performance

Screenlines/ Cordons	Direction	Count	Model	Diff	%	GEH	Diff <5%	GEH <4	Flow or GEH
Car									
Coventry Outer Cordon	Inbound	10953	11106	153	1%	1.5	✓	✓	✓
Coventry Outer Cordon	Outbound	13520	13245	-275	-2%	2.4	✓	✓	✓
Total		24473	24351	-122	-1%		**100%**	**100%**	**100%**
LGV									
Coventry Outer Cordon	Inbound	1132	1022	-110	-10%	3.4	×	✓	✓
Coventry Outer Cordon	Outbound	1302	1280	-22	-1.7%	0.6	✓	✓	✓
Total		2434	2302	-132	-5%		**50%**	**100%**	**100%**
HGV									
Coventry Outer Cordon	Inbound	400	401	1	0%	0.0	✓	✓	✓
Coventry Outer Cordon	Outbound	455	384	-71	-16%	3.5	×	✓	✓
Total		856	785	-71	-8%		**50%**	**100%**	**100%**
Total Vehicles									
Coventry Outer Cordon	Inbound	12486	12525	39	0%	0.4	✓	✓	✓
Coventry Outer Cordon	Outbound	15277	14904	-373	-2%	3.0	✓	✓	✓
Total		27763	27429	-334	-1%		**100%**	**100%**	**100%**
All Goods Vehicles									
Coventry Outer Cordon	Inbound	1532	1423	-109	-7%	2.8	×	✓	✓
Coventry Outer Cordon	Outbound	1757	1664	-93	-5%	2.2	×	✓	✓
Total		3289	3087	-202	-6%		**0%**	**100%**	**100%**

4.9 JOURNEY TIMES

4.9.1 There were 34 one-way journey time routes assessed within the CASM model.

4.9.2 Figure 11 presents the routes within the CASM HAM. Those which were identified at being most important for the air quality study were routes 1,2,6,8 &9.

4.9.3 Table 21 summarises the journey time performance for the 34 routes across the CASM HAM for each time period. The modelled journey times were compared against the median journey time as this reduces the impact of extreme outliers.

Table 21: CASM HAM Journey Time Performance

	AM Peak	Inter Peak	PM peak
All	79%	94%	85%

4.9.4 Table 21 shows that all journey times both on the motorway and across the study area in the CASM HAM meet TAG criteria with the exception of all journey time in the AM peak. Although only 79% of journey time routes fall within 15% of the observed journey time 2 routes are within 18% of the observed time and if these were included would result in 85% of routes are within 18% of the observed journey times.

4.9.5 Of those routes which were identified as priorities for the air quality study the following do not meet criteria.

AM Peak

- Route 2 SB
- Route 6 SB
- Route 9EB/ WB

4.9.6 Some of these routes have quite significant variations in observed journey times and if the observed average journey time is used the following routes meet the criteria:

- Route 2 SB
- Route 6 SB
- Route 9EB/ WB

Inter Peak

4.9.7 The following routes do not meet the observed median journey time:

- Route 6 NB

4.9.8 This routes does not meet the average journey time either

PM Peak

4.9.9 The following routes do not meet the observed median journey time:

- Route 1 NB
- Route 6 NB
- Route 8WB

4.9.10 However some of these routes have quite significant variations in observed journey times and if the observed average journey time is used the following routes meet the criteria:

- Route 1 NB
- Route 8 WB

4.9.11 On some routes within the city the journey time variability along the route across a peak hour is very variable and therefore not always straight forward to represent the median of this within the model. For those routes which do not meet the median criteria it provides additional confidence that they are within the average journey time criteria. This means they are representing a journey time which is experienced along that route within the peak hour which is just outside the median range but within the average range. Route 6 NB is the only route within the IP and PM which does not meet either criteria, the section of the route which falls outside criteria is the northern half of it towards and onto the ring road so this will be taken into consideration for this area as part of this work stream.

Table 22: AM peak Journey Time Performance

Description	Route	Total Modelled Journey Time	Total Average Observed Journey Time	Total Median Observed Journey Time	Median Range		Median Modelled / Observed %age	Within Median Range?	Average Range		Average Modelled / Observed %age	Within Average Range?
B4098 NB	1_NB	00:09:41	00:09:35	00:08:46	07:27	10:05	10%	✓	08:09	11:01	1%	✓
B4098 SB	1_SB	00:12:04	00:14:22	00:12:11	10:21	14:01	-1.00%	✓	12:13	16:31	-16%	×
A444 NB	2_NB	00:10:40	00:10:55	00:09:40	08:13	11:07	10%	✓	09:17	12:33	-2%	✓
A444 SB	2_SB	00:12:53	00:13:10	00:10:53	09:15	12:31	18%	×	11:11	15:08	-2%	✓
A4600 NB	3_NB	00:10:26	00:10:53	00:08:54	07:34	10:14	17%	×	09:15	12:31	-4%	✓
A4600 SB	3_SB	00:10:52	00:15:29	00:12:06	10:17	13:55	-10%	✓	13:10	17:48	-30%	×
A428 EB	4_EB	00:09:14	00:10:15	00:07:35	06:27	08:43	22%	×	08:43	11:47	-10%	✓
A428 WB	4_WB	00:08:10	00:13:02	00:09:18	07:54	10:42	-12%	✓	11:05	14:59	-37%	×
A444-4114 NB	5_NB	00:04:10	00:06:09	00:04:07	03:07	05:07	1%	✓	05:09	07:09	-32%	×
A444-4114 SB	5_SB	00:04:43	00:04:55	00:03:55	02:55	04:55	20%	✓	03:55	05:55	-4%	✓
Kenilworth NB	6_NB	00:08:26	00:11:23	00:08:27	07:11	09:43	0%	✓	09:41	13:05	-26%	×
Kenilworth SB	6_SB	00:17:58	00:16:39	00:12:12	10:22	14:02	47%	×	14:09	19:09	8%	✓
B4101 EB	7_EB	00:12:01	00:13:37	00:10:50	09:12	12:28	11%	✓	11:34	15:40	-12%	✓
B4101 WB	7_WB	00:09:47	00:10:33	00:08:42	07:24	10:00	12%	✓	08:58	12:08	-7%	✓
Butts Rd EB	8_EB	00:09:02	00:11:54	00:09:20	07:56	10:44	-3%	✓	10:07	13:41	-24%	×
Butts Rd WB	8_WB	00:06:25	00:06:47	00:05:49	04:49	06:49	10%	✓	05:46	07:48	-5%	✓
A4114 EB	9_EB	00:11:07	00:10:59	00:08:30	07:14	09:46	31%	×	09:20	12:38	1%	✓
A4114 WB	9_WB	00:06:57	00:06:56	00:05:10	04:10	06:10	35%	×	05:54	07:58	0%	✓
M6 EB	10_EB	00:27:03	0:33:39	0:27:23	23:17	31:29	-1%	✓	28:36	38:42	-20%	×
M6 WB	10_WB	00:29:12	0:36:00	0:30:06	25:35	34:37	-3%	✓	30:36	41:24	-19%	×
M1 NB	11_NB	00:18:27	0:16:25	0:16:04	13:39	18:29	15%	✓	13:57	18:53	12%	✓
M1 SB	11_SB	00:18:27	0:19:32	0:17:18	14:42	19:54	7%	✓	16:36	22:28	-6%	✓
M69 NB	12_NB	00:14:28	0:18:57	0:16:48	14:17	19:19	-14%	✓	16:06	21:48	-24%	×
M69 SB	12_SB	00:16:13	0:15:37	0:15:02	12:47	17:17	8%	✓	13:16	17:58	4%	✓
A5 EB	13_EB	00:49:47	0:55:29	0:49:25	42:00	56:50	1%	✓	47:10	03:48	-10%	✓
A5 WB	13_WB	00:47:37	0:49:47	0:45:41	38:50	52:32	4%	✓	42:19	57:15	-4%	✓
M40-M42 NB	14_NB	00:32:18	0:31:14	0:30:21	25:48	34:54	6%	✓	26:33	35:55	3%	✓
M40-M42 SB	14_SB	00:33:28	0:36:00	0:33:01	28:04	37:58	1%	✓	30:36	41:24	-7%	✓
A45-A46 EB	15_EB	00:28:45	0:32:49	0:27:10	23:06	31:15	6%	✓	27:54	37:44	-12%	✓
A45-A46 WB	15_WB	00:30:28	0:39:06	0:35:03	29:48	40:18	-13%	✓	33:14	44:58	-22%	×
A46 NB	16_NB	00:09:26	0:09:36	0:09:05	07:43	10:27	4%	✓	08:10	11:02	-2%	✓
A46 SB	16_SB	00:09:19	0:09:34	0:09:04	07:42	10:26	3%	✓	08:08	11:00	-3%	✓
A45-M45 EB	17_EB	00:14:55	0:14:58	0:14:46	12:33	16:59	1%	✓	12:43	17:13	0%	✓
A45-M45 WB	17_WB	00:15:07	0:19:23	0:18:48	15:59	21:37	-20%	×	16:29	22:17	-22%	×

Table 23: Inter peak Journey Time Performance

Description	Route	Total Modelled Journey Time	Total Average Observed Journey Time	Total Median Observed Journey Time	Median Range		Median Modelled / Observed %age	Within Median Range?	Average Range		Average Modelled / Observed %age	Within Average Range?
B4098 NB	1_NB	00:09:49	00:09:53	00:08:43	07:25	10:01	13%	✓	08:24	11:22	-1%	✓
B4098 SB	1_SB	00:10:35	00:10:42	00:09:15	07:52	10:38	14%	✓	09:06	12:18	-1%	✓
A444 NB	2_NB	00:09:59	00:10:36	00:09:23	07:59	10:47	6%	✓	09:01	12:11	-6%	✓
A444 SB	2_SB	00:10:37	00:10:55	00:09:27	08:02	10:52	12%	✓	09:17	12:33	-3%	✓
A4600 NB	3_NB	00:09:43	00:11:10	00:09:34	08:08	11:00	2%	✓	09:30	12:50	-13%	✓
A4600 SB	3_SB	00:10:15	00:10:23	00:09:20	07:56	10:44	10%	✓	08:50	11:56	-1%	✓
A428 EB	4_EB	00:07:34	00:08:46	00:07:10	06:05	08:15	6%	✓	07:27	10:05	-14%	✓
A428 WB	4_WB	00:07:22	00:07:59	00:06:40	05:40	07:40	11%	✓	06:47	09:11	-8%	✓
A444-4114 NB	5_NB	00:03:47	00:04:33	00:03:43	02:43	04:43	2%	✓	03:33	05:33	-17%	✓
A444-4114 SB	5_SB	00:04:12	00:04:03	00:03:34	02:34	04:34	18%	✓	03:03	05:03	4%	✓
Kenilworth NB	6_NB	00:06:24	00:09:38	00:07:51	06:40	09:02	-18%	×	08:11	11:05	-34%	×
Kenilworth SB	6_SB	00:08:59	00:10:06	00:08:41	07:23	09:59	3%	✓	08:35	11:37	-11%	✓
B4101 EB	7_EB	00:08:22	00:08:52	00:07:18	06:12	08:24	15%	✓	07:32	10:12	-6%	✓
B4101 WB	7_WB	00:08:41	00:08:27	00:07:00	05:57	08:03	24%	×	07:11	09:43	3%	✓
Butts Rd EB	8_EB	00:05:24	00:06:16	00:05:19	04:19	06:19	2%	✓	05:16	07:16	-14%	✓
Butts Rd WB	8_WB	00:05:37	00:06:02	00:04:44	03:44	05:44	19%	✓	05:02	07:02	-7%	✓
A4114 EB	9_EB	00:06:14	00:06:20	00:05:41	04:41	06:41	10%	✓	05:20	07:20	-2%	✓
A4114 WB	9_WB	00:06:08	00:06:33	00:05:34	04:34	06:34	10%	✓	05:33	07:33	-6%	✓
M6 EB	10_EB	00:26:00	0:25:37	0:24:45	21:02	28:28	5%	✓	21:46	29:28	1%	✓
M6 WB	10_WB	00:26:31	0:26:50	0:25:14	21:27	29:01	5%	✓	22:48	30:51	-1%	✓
M1 NB	11_NB	00:18:11	0:16:57	0:16:23	13:56	18:50	11%	✓	14:24	19:30	7%	✓
M1 SB	11_SB	00:17:58	0:17:09	0:16:18	13:51	18:45	10%	✓	14:35	19:43	5%	✓
M69 NB	12_NB	00:14:05	0:14:17	0:13:35	11:33	15:37	4%	✓	12:08	16:26	-1%	✓
M69 SB	12_SB	00:15:19	0:15:07	0:14:49	12:36	17:02	3%	✓	12:51	17:23	1%	✓
A5 EB	13_EB	00:42:49	0:46:53	0:44:22	37:43	51:01	-3%	✓	39:51	53:55	-9%	✓
A5 WB	13_WB	00:41:23	0:46:20	0:43:51	37:16	50:26	-6%	✓	39:23	53:17	-11%	✓
M40-M42 NB	14_NB	00:31:49	0:30:59	0:29:59	25:29	34:29	6%	✓	26:20	35:38	3%	✓
M40-M42 SB	14_SB	00:31:33	0:31:48	0:30:05	25:34	34:36	5%	✓	27:02	36:34	-1%	✓
A45-A46 EB	15_EB	00:25:14	0:25:42	0:23:36	20:04	27:08	7%	✓	21:51	29:33	-2%	✓
A45-A46 WB	15_WB	00:25:32	0:26:18	0:24:10	20:33	27:48	6%	✓	22:21	30:15	-3%	✓
A46 NB	16_NB	00:09:02	0:09:05	0:08:46	07:27	10:05	3%	✓	07:43	10:27	-1%	✓
A46 SB	16_SB	00:09:01	0:08:59	0:08:47	07:28	10:06	3%	✓	07:38	10:20	0%	✓
A45-M45 EB	17_EB	00:14:45	0:15:07	0:14:49	12:36	17:02	0%	✓	12:51	17:23	-2%	✓
A45-M45 WB	17_WB	00:14:45	0:15:24	0:15:05	12:49	17:21	-2%	✓	13:05	17:43	-4%	✓

Table 24: PM peak Journey Time Performance

Description	Route	Total Modelled Journey Time	Total Average Observed Journey Time	Total Median Observed Journey Time	Median Range		Modelled / Median Observed %age	Within Median Range?	Average Range		Modelled / Average Observed %age	Within Average Range?
B4098 NB	1_NB	00:11:34	00:11:59	00:10:40	09:04	12:16	8%	✓	00:10:11	00:13:47	-3%	✓
B4098 SB	1_SB	00:10:44	00:10:40	00:09:12	07:49	10:35	17%	×	00:09:04	00:12:16	1%	✓
A444 NB	2_NB	00:11:55	00:14:04	00:11:42	09:57	13:27	2%	✓	00:11:57	00:16:11	-15%	×
A444 SB	2_SB	00:11:07	00:15:16	00:12:06	10:17	13:55	-8%	✓	00:12:59	00:17:33	-27%	×
A4600 NB	3_NB	00:10:55	00:13:45	00:12:06	10:17	13:55	-10%	✓	00:11:41	00:15:49	-21%	×
A4600 SB	3_SB	00:11:33	00:12:05	00:10:09	08:38	11:40	14%	✓	00:10:16	00:13:54	-4%	✓
A428 EB	4_EB	00:09:33	00:10:39	00:08:55	07:35	10:15	7%	✓	00:09:03	00:12:15	-10%	✓
A428 WB	4_WB	00:08:48	00:09:27	00:07:37	06:28	08:46	16%	×	00:08:02	00:10:52	-7%	✓
A444-4114 NB	5_NB	00:04:16	00:06:53	00:04:16	03:16	05:16	0%	✓	00:05:51	00:07:55	-38%	×
A444-4114 SB	5_SB	00:04:54	00:05:18	00:04:10	03:10	05:10	18%	✓	00:04:18	00:06:18	-8%	✓
Kenilworth NB	6_NB	00:06:55	00:11:56	00:08:46	07:27	10:05	-21%	×	00:10:09	00:13:43	-42%	×
Kenilworth SB	6_SB	00:09:39	00:16:00	00:12:53	10:57	14:49	-25%	×	00:13:36	00:18:24	-40%	×
B4101 EB	7_EB	00:10:37	00:11:17	00:09:53	08:24	11:22	7%	✓	00:09:35	00:12:59	-6%	✓
B4101 WB	7_WB	00:10:37	00:11:31	00:09:15	07:52	10:38	15%	✓	00:09:47	00:13:15	-8%	✓
Butts Rd EB	8_EB	00:05:21	00:10:15	00:05:53	04:53	06:53	-9%	✓	00:08:43	00:11:47	-48%	×
Butts Rd WB	8_WB	00:06:49	00:07:42	00:04:23	03:23	05:23	56%	×	00:06:33	00:08:51	-11%	✓
A4114 EB	9_EB	00:06:45	00:07:38	00:06:37	05:37	07:37	2%	✓	00:06:29	00:08:47	-12%	✓
A4114 WB	9_WB	00:07:51	00:08:27	00:06:56	05:54	07:58	13%	✓	00:07:11	00:09:43	-7%	✓
M6 EB	10_EB	00:27:03	0:29:27	0:25:55	22:02	29:48	4%	✓	00:25:02	00:33:52	-8%	✓
M6 WB	10_WB	00:28:54	0:33:11	0:28:38	24:20	32:56	1%	✓	00:28:12	00:38:10	-13%	✓
M1 NB	11_NB	00:18:46	0:17:16	0:16:45	14:14	19:16	12%	✓	00:14:41	00:19:51	9%	✓
M1 SB	11_SB	00:18:18	0:17:16	0:16:34	14:05	19:03	10%	✓	00:14:41	00:19:51	6%	✓
M69 NB	12_NB	00:14:44	0:18:01	0:13:59	11:53	16:05	5%	✓	00:15:19	00:20:43	-18%	×
M69 SB	12_SB	00:15:46	0:15:05	0:14:37	12:25	16:49	8%	✓	00:12:49	00:17:21	5%	✓
A5 EB	13_EB	00:49:02	0:54:01	0:49:01	41:40	56:22	0%	✓	00:45:55	01:02:07	-9%	✓
A5 WB	13_WB	00:48:42	0:56:01	0:50:21	42:48	57:54	-3%	✓	00:47:37	01:04:25	-13%	✓
M40-M42 NB	14_NB	00:33:59	0:38:08	0:32:43	27:49	37:37	4%	✓	00:32:25	00:43:51	-11%	✓
M40-M42 SB	14_SB	00:31:56	0:38:33	0:33:35	28:33	38:37	-5%	✓	00:32:46	00:44:20	-17%	×
A45-A46 EB	15_EB	00:30:57	0:31:56	0:27:33	23:25	31:41	12%	✓	00:27:09	00:36:43	-3%	✓
A45-A46 WB	15_WB	00:29:03	0:33:56	0:29:31	25:05	33:57	-2%	✓	00:28:51	00:39:01	-14%	✓
A46 NB	16_NB	00:09:25	0:09:36	0:08:57	07:36	10:18	5%	✓	00:08:10	00:11:02	-2%	✓
A46 SB	16_SB	00:09:28	0:09:08	0:08:44	07:25	10:03	8%	✓	00:07:46	00:10:30	4%	✓
A45-M45 EB	17_EB	00:15:09	0:14:57	0:14:21	12:12	16:30	6%	✓	00:12:42	00:17:12	1%	✓
A45-M45 WB	17_WB	00:15:01	0:15:20	0:14:54	12:40	17:08	1%	✓	00:13:02	00:17:38	-2%	✓

4.10 APPLICATION OF MODEL FOR AIR QUALITY

4.10.1 An important aspect of this work is to ensure there is some analysis of the specification application of the traffic model in assessing air quality. Ultimately the traffic volumes from the AM, Inter and PM peak traffic models are extracted and converted into 24 hour Annual Average Daily Traffic (AADT's) to feed into the air quality modelling being undertaken by Atkins. The factors used to convert from AM, Inter and PM peak hour have been derived from count data within the Coventry area. The factors used are shown in Table 25.

Table 25: 24 AADT Factors

Measure	Factor
AM peak hour to 7:00-10:00	2.634
Inter peak hour to 10:00-16:00	6.265
PM peak hour to 16:00-19:00	2.710
12 AAWT to 24hr AADT	1.17

4.10.2 Table 25 shows that the IP traffic flows takes the highest proportion to calculate the 24hour AADT with the AM and PM traffic flows taking a smaller proportion. This means that the strong performance and accuracy between observed and modelled flows within the Inter Peak especially with those counts identified as air quality priority counts will result in greater accuracy for the 24 hour AADT.

4.10.3 The locations in all three-time periods where the modelled traffic flows for the air quality priority counts are adrift from the observed (not meeting TAG criteria) is summarised in Table 26. The air quality team have been made aware of these locations and they will be taking this into consideration in the air quality modelling work stream.

Key for Table 30

Modelled traffic flows higher than observed
Modelled traffic flows lower than observed
Modelled traffic flows inline with observed

Table 26: Summary of Air Quality Priority Count Locations Traffic Model Performance

Location		AM	IP	PM
B4098	North of Long Lane (NB and SB)		N/A	
	South of Long Lane, North of Sanspits Land (NB and SB)	NB Direction modelled flow 150 vehicles higher than observed		SB Direction modelled flow 170 vehicles higher than observed
	South of Sandpits Lane (NB and SB)	NB Direction modelled flow 100 vehicles lower than observed		NB Direction modelled flow 135 vehicles lower than observed
	South of Engleton Road North of Bede Road (NB and SB)	SB Direction modelled flow of 280 vehicles higher than observed		
	North of Lydgate Road south of Bede Road (NB and SB)	SB Direction modelled flow 220 higher than observed	NB Direction modelled flow 190 higher than observed	
	North of the ring road south of Bede Road (NB and SB)	SB Direction modelled flow 260 vehicles higher than observed	SB Direction modelled flow 260 vehicles higher than observed	NB Direction modelled flow 225 vehicles higher than observed
B4113	North of the ring road south of Harnall Lane West (NB and SB)			
	North of Cash's Lane south of Pridmore Road (NB and SB)	SB Direction modelled flow 170 vehicles lower than observed	NB Direction modelled flow 170 vehicles lower than observed	

	South of A444 north of Churchill Avenue (NB and SB)	NB Direction modelled flow 140 vehicles lower than observed		SB Direction modelled flow 130 vehicles lower than observed
B4109	South of Red Lane North of Leicester Causeway	SB Direction modelled flow 230 vehicles lower than observed	SB Direction modelled flow 140 vehicles lower than observed	SB Direction modelled flow 140 vehicles lower than observed
	South of St Pauls Road north of Red Lane	NB Direction modelled flow 130 vehicles higher than observed	NB Direction modelled flow 210 vehicles lower than observed	
	West of A444 east of Eden Street	Both directions modelled flow lower than observed (140 NB and 220 SB)	Both directions modelled flow lower than observed (300 NB and 190 SB)	Both directions modelled flow lower than observed (160 NB and 190 SB)
A4600	Between ring road and roundabout with Gosford Street (EB and WB)		SB Direction modelled flow 420 vehicles higher than observed	NB Direction modelled flow 290 vehicles higher than observed
A429	South of ring road	NB Direction modelled flow 500 vehicles higher than observed	NB Direction modelled flow 230 vehicles higher than observed	NB Direction modelled flow 260 vehicles higher than observed
	North of A45 south of Coat of Arms Bridge Road	NB Direction modelled flow 190 vehicles higher than observed SB Direction modelled flow 395 vehicles lower than observed	N/A	SB Direction modelled flow 170 vehicles lower than observed
	South of A45 north of Cannon Hill Road		N/A	
	North of Gibbet Hill Road			NB Direction modelled flow 360 vehicles lower than observed
	South of Gibbet Hill Road			
B4106	North of Brookside Avenue south of Winsford Avenue			
	North of Allesley Hall Drive before roundabout with Holyhead Road			
A4114	East of Barras Lane west of the ring road			

	East of Moseley Avenue	SB Direction modelled flow 350 vehicles higher than observed		
	West of Moseley Avenue	SB Direction modelled flow 340 vehicles higher than observed		
	Before roundabout with Allesley Old Road to the west of Dulverton Avenue	NB/ SB Direction modelled flow higher than observed (NB 190 and SB 260)		

4.11 MODEL CONVERGENCE

4.11.1 Each user class is assigned over a number of iterations until a level of stability or 'convergence' is achieved. The TAG-recommended convergence criteria, which is pre-set set within VISUM, is set out in Table 27.

Table 27: TAG Convergence Criteria

Measure of Convergence	Acceptable Value
'Delta' and % Gap	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow changes < 1% ('P')	Four consecutive iterations greater than 98%

4.11.2 The results of the assignment are shown in Table 28 to Table 30 for the three-peak time CASM HAM models. These demonstrate that the vehicle classes converge 'naturally', i.e. according to the settings defined within the model.

Table 28: CASM HAM Convergence Results AM peak

PrT System	Model Stability 'P'				
	Duality Gap	Final Iteration -3	Final Iteration -2	Final Iteration -1	Final Iteration
All User Classes	0.00003930	0.938	0.969	0.965	0.992

Table 29: CASM HAM Convergence Results Inter peak

PrT System	Model Stability 'P'				
	Duality Gap	Final Iteration -3	Final Iteration -2	Final Iteration -1	Final Iteration
All User Classes	0.00000935	0.937	0.986	0.986	0.991

Table 30: CASM HAM Convergence Results PM peak

PrT System	Model Stability 'P'				
	Duality Gap	Final Iteration -3	Final Iteration -2	Final Iteration -1	Final Iteration
All User Classes	0.00002880	0.978	0.957	0.985	0.991

5 SUMMARY

5 SUMMARY

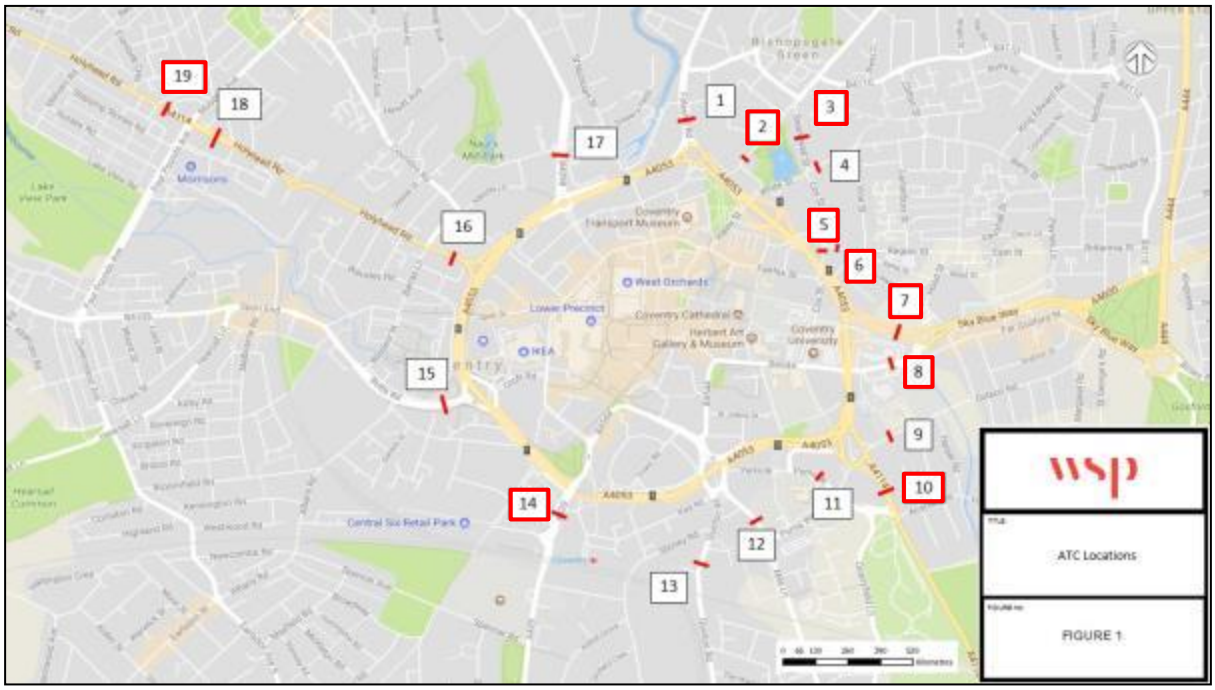
5.1.1 Overall this report has provided an overview of the CASM model, the background of the model and its previous uses. It has summarised the data collection undertaken for the air quality study and the previous comprehensive data collection process which has fed into the development of the CASM model. It provides details on the model calibration and validation and highlighted areas where the performance of the traffic model is weaker than desired. The CASM model under predicts the traffic in Air Quality priority areas on B4113 and B4109. The conversion of the traffic data into 24 hour AADT has been summarised and those locations where performance of the model is weaker against observed data have been highlighted.

5.1.2 Overall WSP, CCC and Atkins considered the performance of the base year CASM model suitable for assessing the interventions proposed for the air quality study given the timescales which the project was working towards.

Appendix A

Appendix B

[redacted]

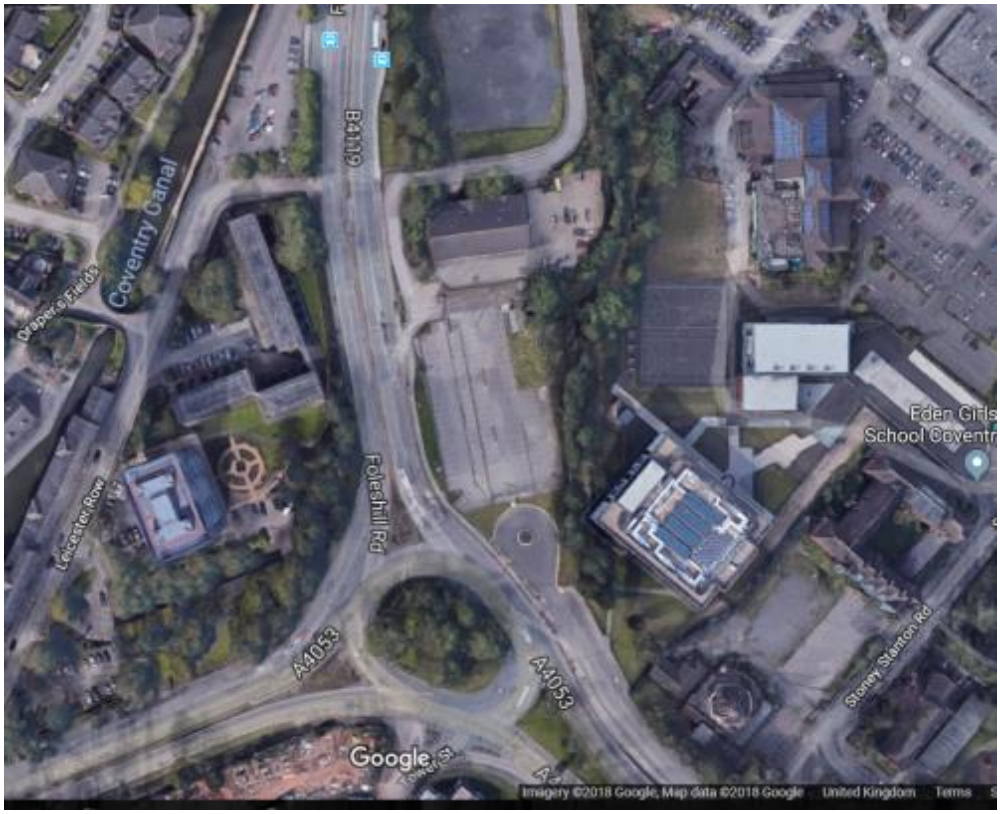


Changes at ATC locations

ATC No.	Changes Observed in 2018	Implemented in 2019 DM **seelink
2	New School built with access onto 1-way system.	NA
3	New School built with access onto 1-way system.	NA
5	Previous signalised junction removed, changed to give-way with N-S Priority.	No
6	Same as 5.	No
7	Rbt to east of count site has been re-designed.	No
8	Road pedestrianised, reduced to 20mph, multiple access changes.	NA
10	Rbt to north of count site has been re-designed, signals removed.	Yes
14	Graded rbt to north of count site re-designed, eastern movements removed (in relation to ringway).	Yes
19	Left turn before junction removed.	NA

2013 (07/2012 Google Sat Images)

2018



ATC 1

Comments: No Changes noted.

2013 (07/2012 Google Sat Images)

2018

ATC 2

Comments: Eden Girls School Coventry access on Stoney Stanton Rd not functioning/still in construction. Road is a one-way system, trips could be significantly higher in the 2018 counts compared to 2013.

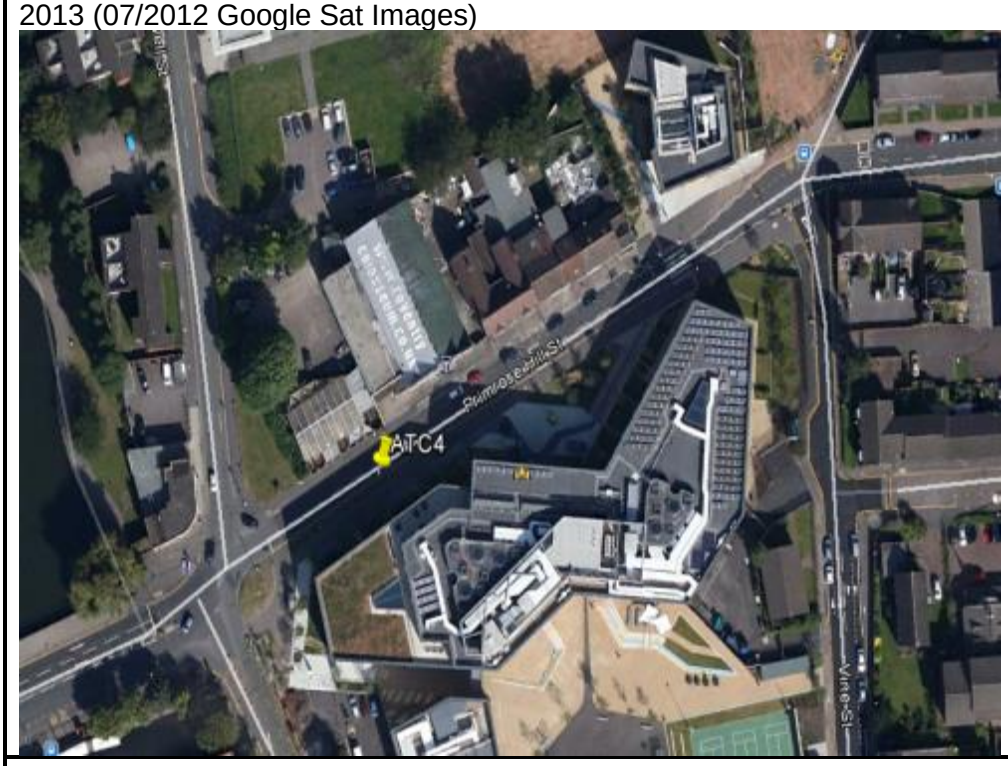
2013 (07/2012 Google Sat Images)

2018

ATC 3

Comments: Eden Girls School Coventry access on Stoney Stanton Rd not functioning/still in construction. Road is a one-way system, trips could be significantly higher in the 2018 counts compared to 2013.

2013 (07/2012 Google Sat Images)



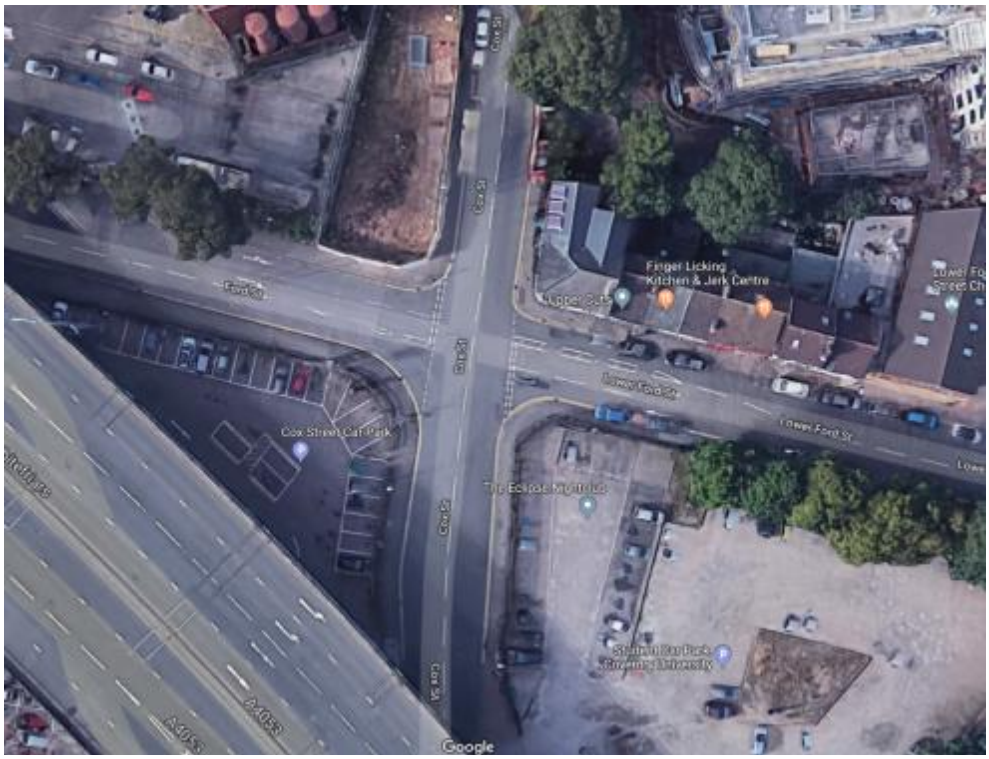
2018

ATC 4

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018



ATC 5

Comments: Junction appears signalised in late 2012/13 but has since been converted into give way junction with the priority flow being north/south flow on Cox St.

2013 (07/2012 Google Sat Images)

2018

ATC 6

Comments: Same as comments for ATC5, Lower Ford St. and Cox St. junction converted from signalised to give way.

2013 (07/2012 Google Sat Images)

2018

ATC 7: Comments: Nearby rbt; arm removed from rbt to the south east, southern arm redesigned and right turn lane on northern arm removed.

2013 (07/2012 Google Sat Images)

2018

ATC 8

Comments: Gosford St. pedestrianised with an access removed to the west of the now William Morris Building (Coventry University). Mini rbt added to the east including a redesign of all access on the southern side of Gosford St. Speed reduced to 20 mph.

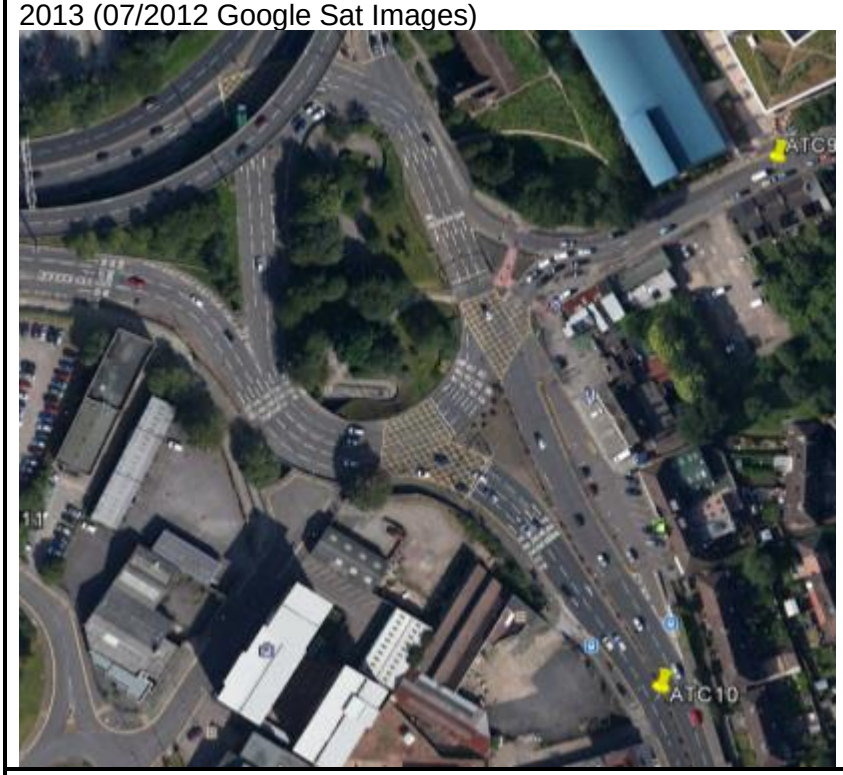
2013 (07/2012 Google Sat Images)

2018

ATC 9

Comments: No changes observed.

2013 (07/2012 Google Sat Images)



2018

ATC 10

Comments: Changes to rbt north of count site, westbound circulatory movements reduced to 1 lane from 4. Signals removed and changed to give way.

2013 (07/2012 Google Sat Images)

2018

ATC 11

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 12

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 13

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 14

Comments: Redesign of area to eliminate existing graded junction to the north. North and northwest bound lanes reduced by 1 allowing right turns past Jubilee Church, eastbound movement onto ringway removed with an apx. 0.8mile 2-4 min detour around Butts Rd junction to northwest. 20 mph zone added.

2013 (07/2012 Google Sat Images)

2018

ATC 15

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 16

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 17
Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 18

Comments: No changes observed.

2013 (07/2012 Google Sat Images)

2018

ATC 19

Comments: Lammas Rd made one way, left turn from Holyhead Rd (A4114) removed.

Appendix C

[redacted]

TECHNICAL NOTE

DATE:	29 November 2018	**CONFIDENTIALITY:**	Confidential
SUBJECT:	DfT Response - CASM Air Quality Count Factoring		
PROJECT:	70001991-046	**AUTHOR:**	Amina Guecioueur
CHECKED:	Christine Palmer	**APPROVED:**	David Whittle

INTRODUCTION

This technical note details the methodology and reasoning behind the factoring of traffic count data within the Air Quality (AQ) Coventry Area Strategic Model (CASM). CASM has a base year of 2013, therefore all input data within the model, like journey times and traffic count data, to which CASM was calibrated and validated to, corresponds with that year. The inputs have either been collected in 2013 or factored to it.

The AQ CASM incorporated additional traffic counts at key locations within Coventry that had been undertaken in 2018. Therefore this data was required to be factored back to with the base year of 2013. Analysis was undertaken to compare potential methodologies before these factored counts were used within the calibration process.

The additional traffic counts that required factoring were undertaken by ANPR during 2018, and are shown in blue Figure 1.

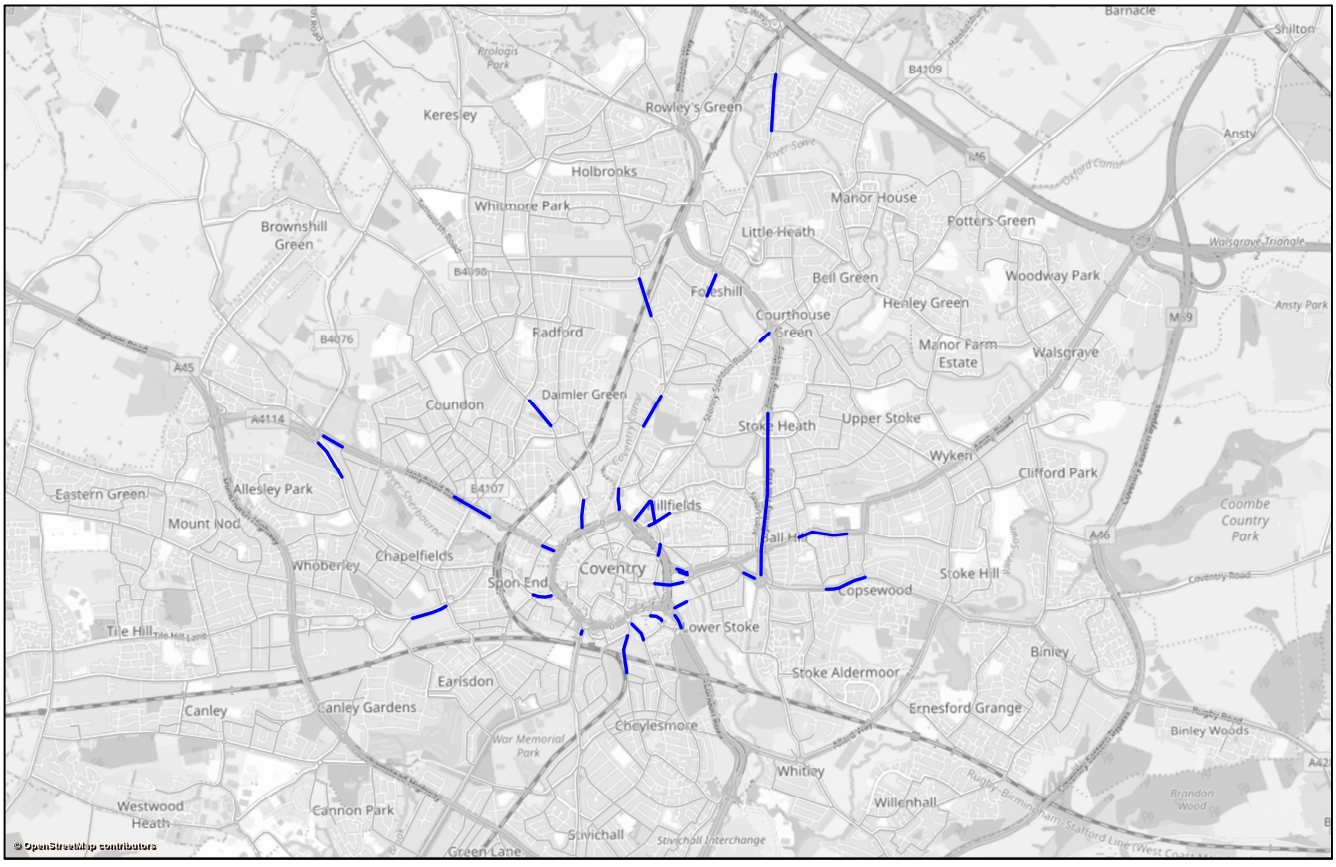


Figure 1: 2018 Locations of Coventry Count Data

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SUBJECT:	DfT Response - CASM Air Quality Count Factoring		
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CHECKED:	Christine Palmer	**APPROVED:**	David Whittle

DFT TRAFFIC COUNTS

The DfT's traffic counts formed one potential dataset that could have been used to factor these additional traffic counts. Within the Coventry area, during 2013, 40 DfT traffic counts are listed.

It is important to note that these traffic count volumes are provided as an AADF (annual average daily flow), which is the number of vehicles on an average day of the year, and an annual volume of traffic, which is calculated by multiplying the AADF by the corresponding length of road and number of days in a year. The CASM 2013 Highway Assignment Model is split into 3 peak hour time periods, AM, IP and PM.

Of the 40 DfT counts, only 11 were manually counted, located mainly on A and B roads. Figure 2 displays all 40 counts, showing the manual counts in green, and the remaining 29 estimated counts in orange. Figure 3 shows the counts in the city centre, around the inner ring road, in particular.

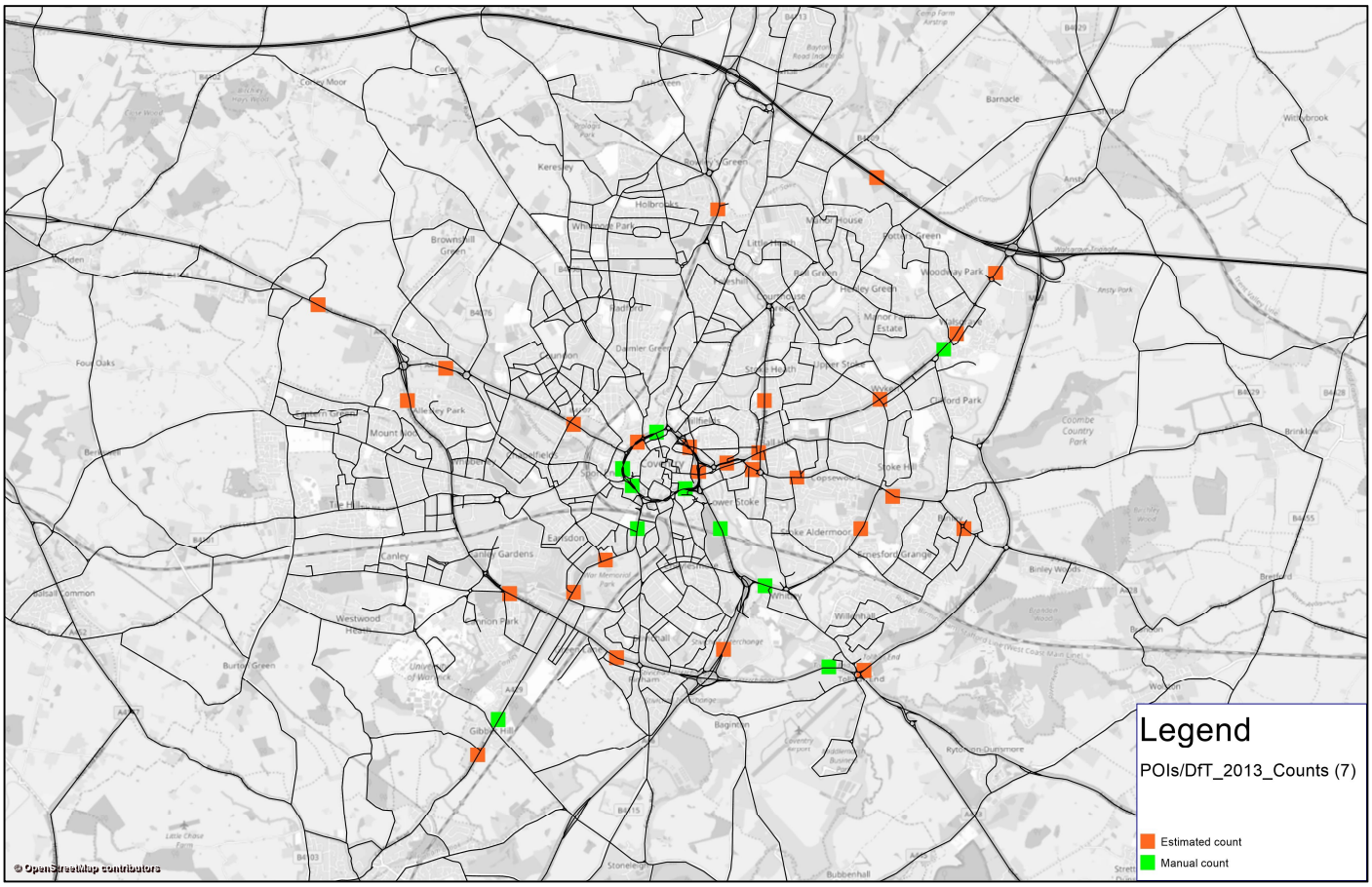

Figure 2: DfT Count Locations in Coventry 2013

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Figure 3: DfT Count Locations in Coventry City Centre 2013

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CHECKED:	Christine Palmer	**APPROVED:**	David Whittle

The estimated counts were either:

- Estimated from nearby links;
- Estimated using previous year's AADF on this link; or
- Dependent on a neighbouring counted link.

Figure 4 displays the estimated counts, classified by colour as shown in the legend, dependent on the methodology used. Figure 5 shows the counts in the city centre, around the inner ring road.

Figure 4: DfT Count Estimation Methods in Coventry 2013

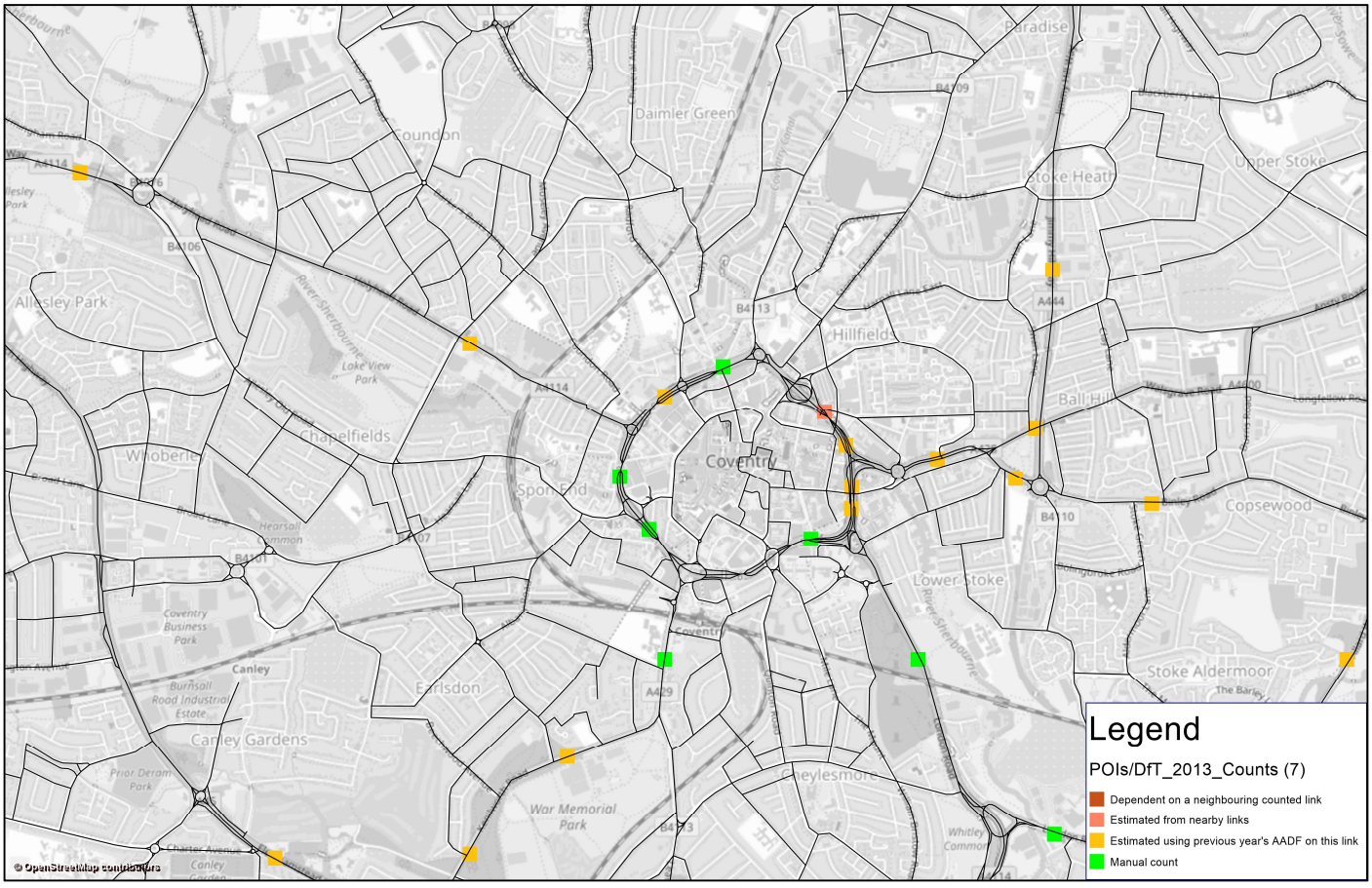

Figure 5: DfT Count Estimation Methods in Coventry City Centre 2013

Figure 5 shows that of the DfT count data in 2013 that could be used in factoring the 2018 AQ counts only 6 are manual counts.

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CHECKED:	Christine Palmer	**APPROVED:**	David Whittle

A comparison was also made against the DfT counts from 2017. Figure 6 displays the location of DfT counts undertaken in both 2013 and 2017. Of these 40 counts, 30 are estimated counts, shown in orange, with the remainder shown in green. Figure 7 shows the counts in the city centre, around the inner ring road, in particular.

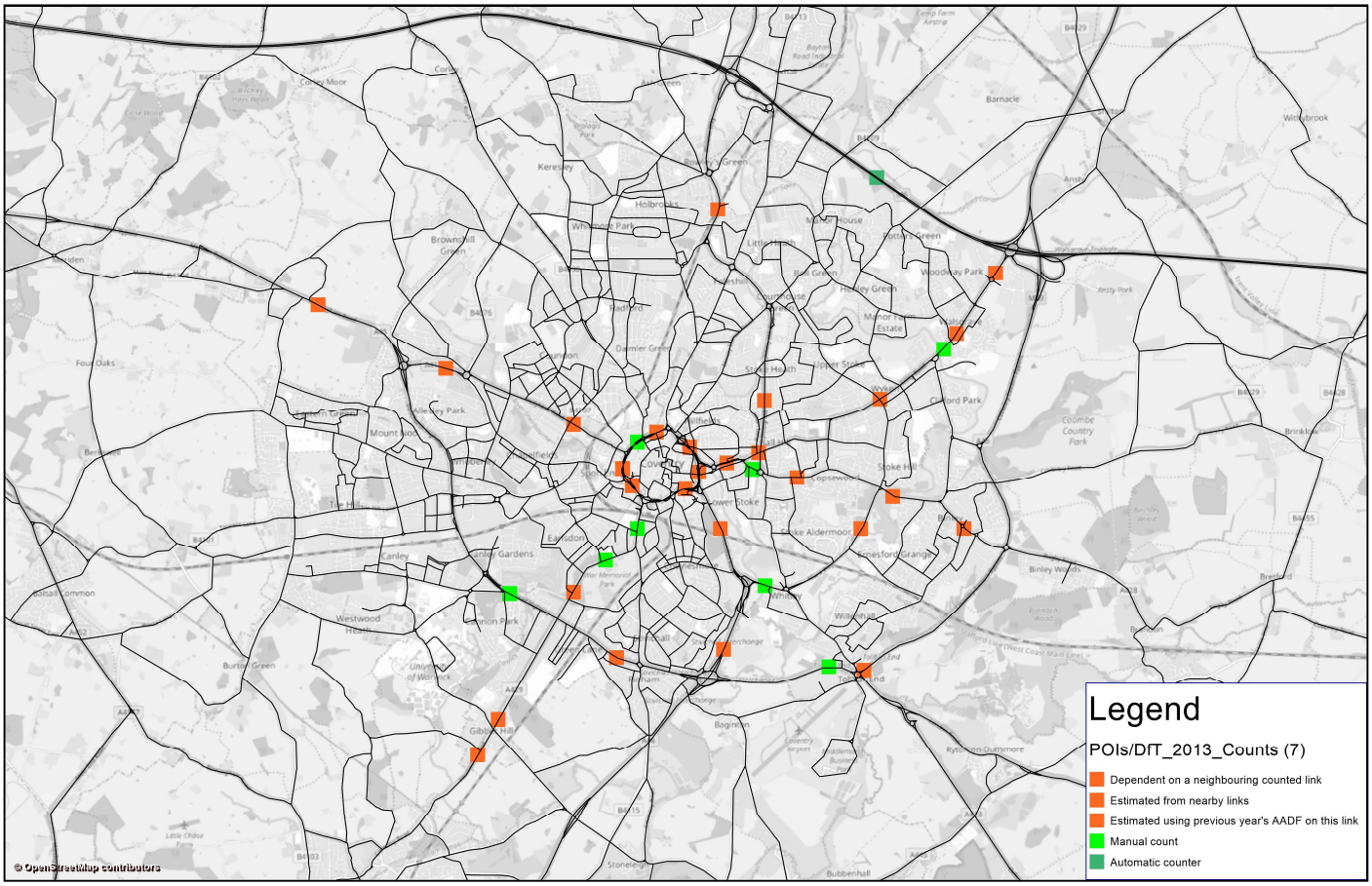

Figure 6: DfT Count Estimation Methods in Coventry 2017

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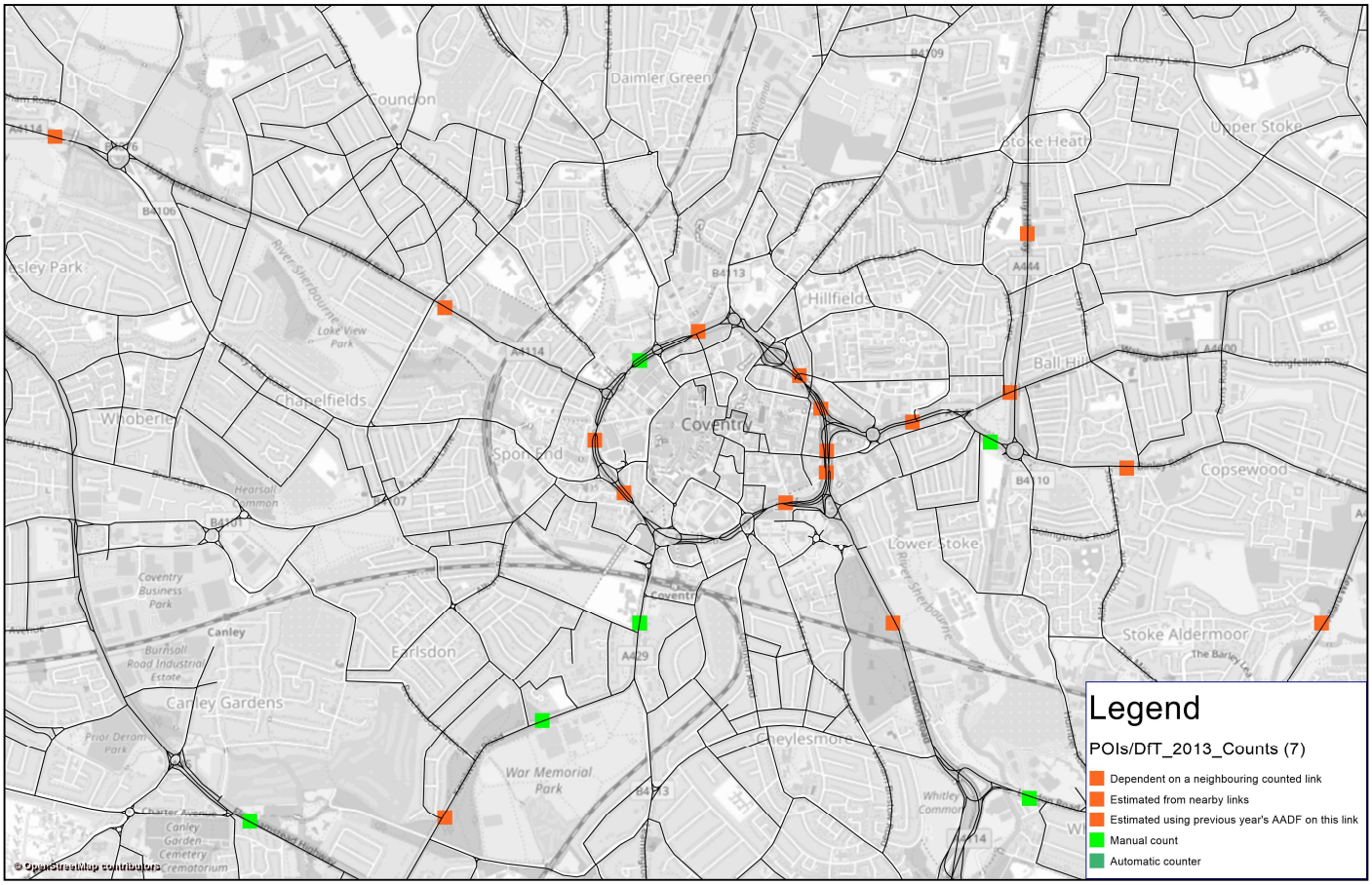

Figure 7: DfT Count Estimation Methods in Coventry City Centre 2017

Of all 40 Coventry counts, only 5 counts are manual counts in both 2013 and 2017; these are shown in Figure 8.

Of these counts located in Coventry City Centre, that could be used in factoring the 2018 AQ counts, only a single count is a manual count in both 2013 and 2017, as shown in Figure 9.

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Figure 8: DfT Manual Counts in Coventry in both 2013 and 2017

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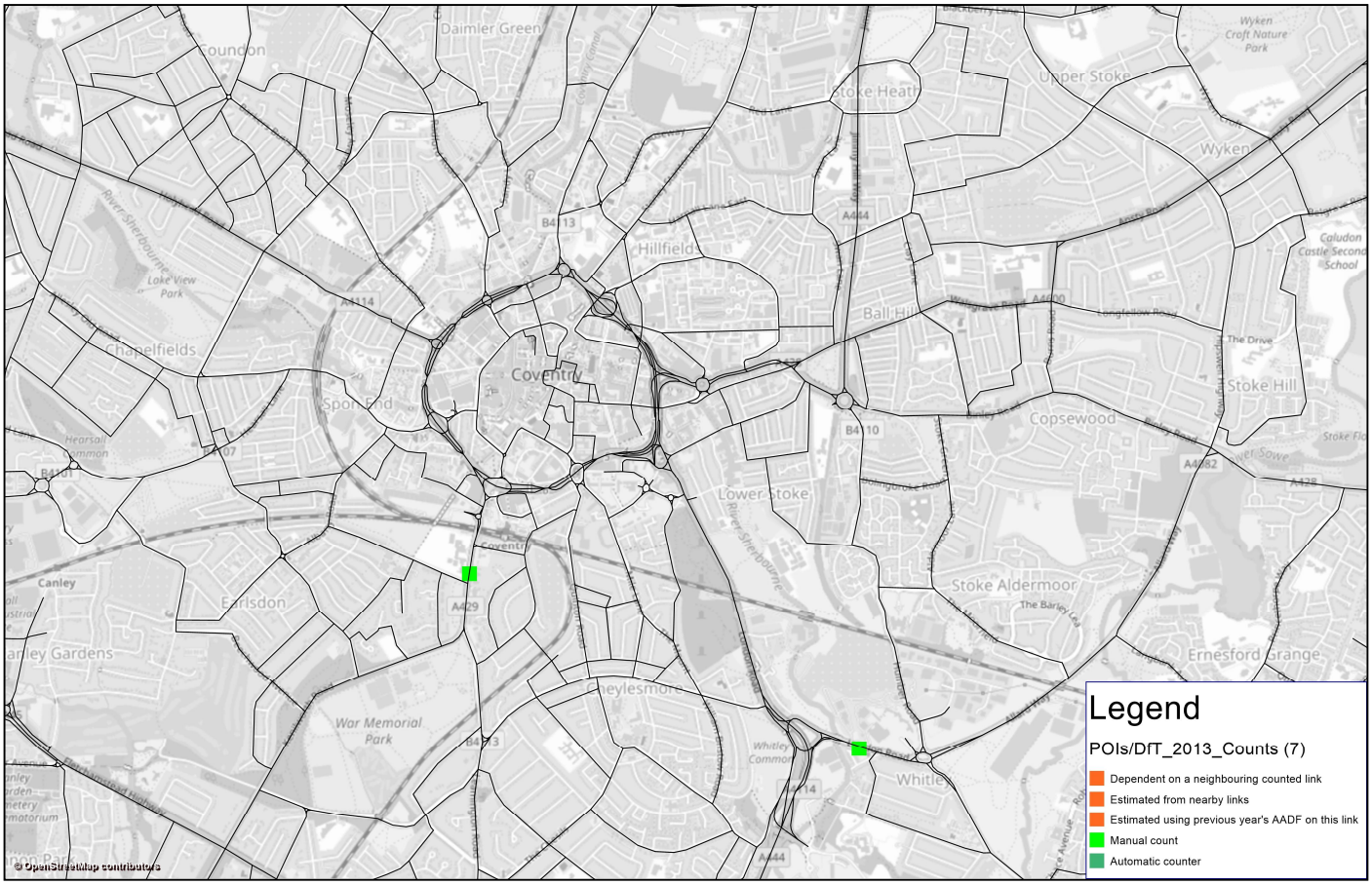

Figure 9: DfT Manual Counts in Coventry City Centre in both 2013 and 2017

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COVENTRY CORDON COUNTS

WSP were provided with cordon survey data, taken during 2013, 2015 and 2017. These Coventry cordon counts are undertaken as part of the Local Transport Plan monitoring programme for nine centres within the West Midlands, and are shown in Figure 10.

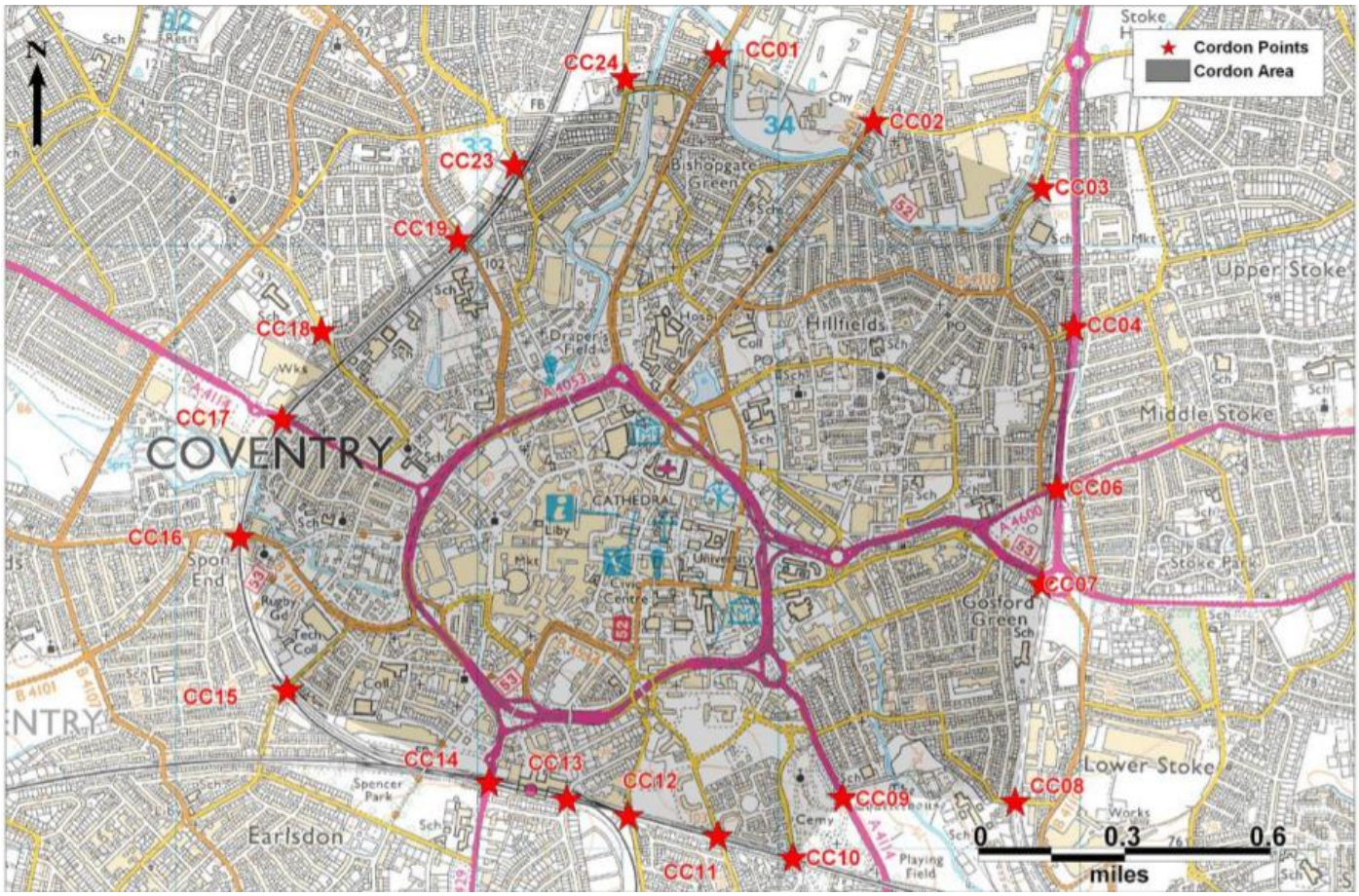

Figure 10: Coventry Cordon Automatic Traffic Counts (source: Motts Macdonald)

The 24 hour biannual cordon counts are all located within a similar to area compared to those collected in 2018, see Figure 1. The Coventry cordon counts are taken on an hourly basis, and allow for the calculation of average peak hour counts, in line with the CASM peak periods listed below:

- AM (08:00 – 09:00);
- IP (average of 11:00 – 14:00); and
- PM (17:00 – 18:00)

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SUMMARY

The table below summarises the data which both the DfT CP sites provide and the Cordon Count provide.

Table 1: Summary of Count Source Differences

Count Source	Number of Counted Site in central Coventry (not estimated)			Data Available for all peak periods?
	2013	2017	Both 2013 and 2017	
DfT CP Data	6	3	1	Annual Average Daily Flow (AADF) only
Cordon Counts	24	24	24	Hourly

The table shows that the Coventry cordon counts provide more locally counted data in peak hour format. This data therefore provides a more robust data set for understanding the changes which have occurred in traffic flow in central Coventry between 2013 and 2017. Therefore the growth factors which have been applied to the 2018 data have used this dataset.

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