M5 Junction 10 Improvements Scheme

Transport Assessment

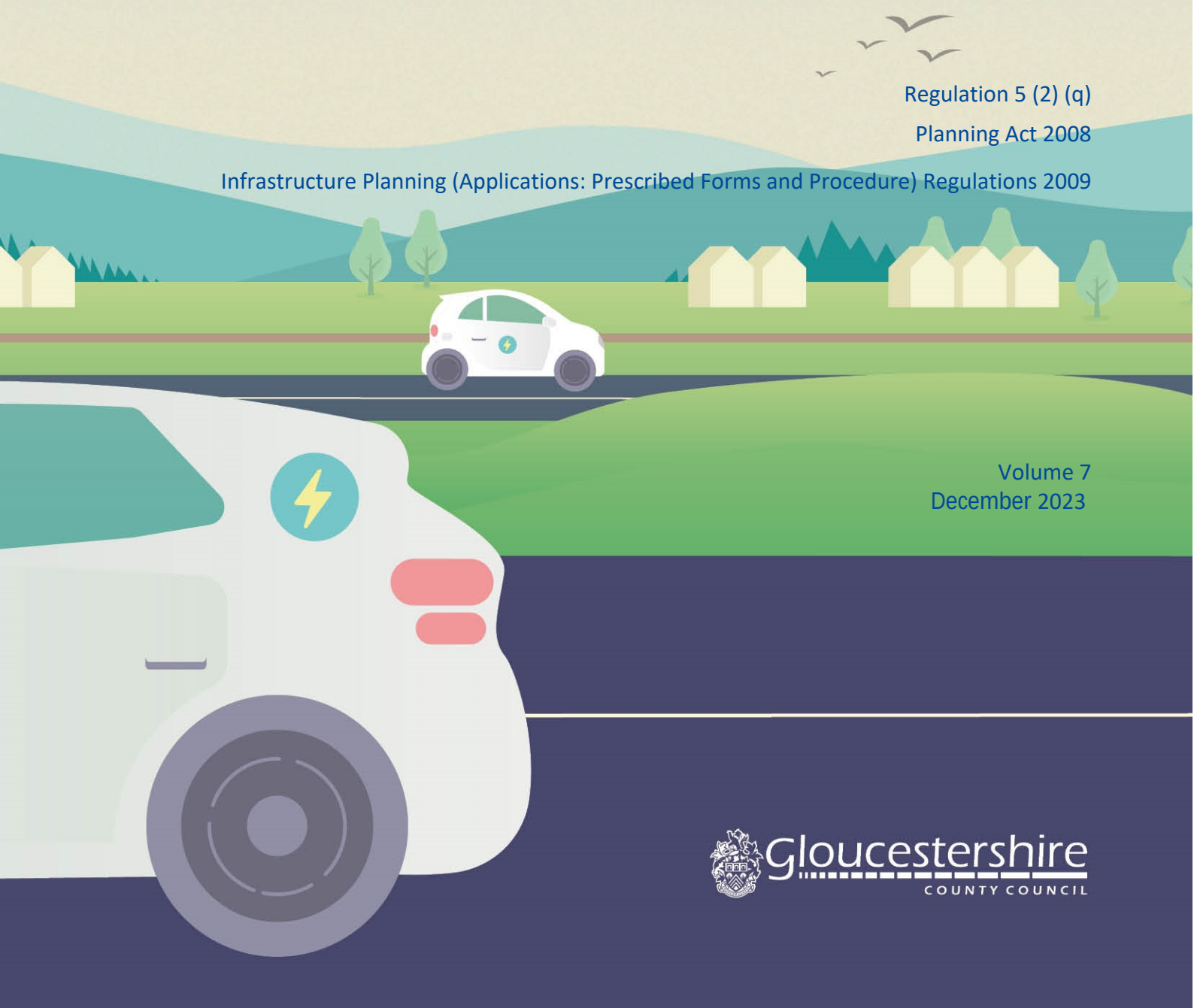
Appendix K - Traffic Data Package Report

TR010063 - APP 7.5

Regulation 5 (2) (q)

Planning Act 2008

Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009



Volume 7

December 2023

Gloucestershire COUNTY COUNCIL

Infrastructure Planning

Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009

M5 Junction 10 Improvements Scheme

Development Consent Order 202[x]

7.5 Transport Assessment

Appendix J – Traffic Data Package Report

Regulation Number:	Regulation 5(2)(q)
Planning Inspectorate Scheme Reference	TR010063
Application Document Reference	TR010063 – APP 7.5
Author:	M5 Junction 10 Improvements Scheme Project Team

Version	Date	Status of Version
Rev 0	December]2023	DCO Application

M5 Junction 10 Improvements Scheme

Transport Data Package Report

Date: 22/09/23

Status: A1 APPROVED - PUBLISHED

Gloucestershire COUNTY COUNCIL

Notice

This document and its contents have been prepared and are intended solely for the Client's information and use in relation to M5 Junction 10 Improvements Scheme

SNC Lavalin assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 67 pages including the cover.

Document history

Revision	Status	Purpose description	Originated	Checked	Reviewed	Authorised	Date
C04	A1	Includes accident data Moved DPR to new template	LB/SA	PA	HF	LJ	18/03/21
C03	A1	added Appendix C	SA	PA	AC	TT	25/03/21
C02	A1	Includes Operational Modelling Data	LB	PA	AC	TT	19/01/21
C01	A1	Draft	HM	PA	AC	TT	13/08/20

Client signoff

Client	**Gloucestershire County Council**
Project	**M5 Junction 10 Improvements Scheme**
Job number	**5197035**
Client signature / date	

Contents

1. Introduction

1.1. Overview

1.1.1. Gloucestershire County Council (GCC) is the scheme promoter for M5J10 improvement scheme and has commissioned Atkins to progress the scheme through Highways England (HE) Project Control Framework (PCF) Stage 3, following the approval of the Housing Infrastructure Fund (HIF) Outline Business Case (OBC) application to Homes England (HoE) in March 2020. The scheme progressed through Stage 2 in autumn 2019 while waiting for the HIF funding results.

1.1.2. The scheme includes upgrading Junction 10 of the M5 to all movements with associated improvements to surrounding transport infrastructure, collectively identified as the Junction 10 Improvements Scheme. This includes the following measures:

- An all-movements junction at M5 Junction 10;
- A4019 widening, east of Junction 10 including a bus lane on the A4019 east bound carriageway from West Cheltenham Fire Station to Gallagher Retail Park Junction;
- A38/A4019 junction improvements at Coombe Hill;
- A new link Road from J10 to the West Cheltenham development/Cyber Park; and
- Extension/improvements to Arle Court Park and Interchange.

1.2. Purpose of the report

1.2.1. This document comprise of 'Transport Data Package' report for the M5 Junction 10 transport scheme. The purpose of this report is to provide a summary of the traffic data collected to inform the scheme while establishing the statistical accuracy of the data where possible, and provide recommendations as to the robustness of the survey data as a basis for model development and analysis.

1.2.2. Traffic modelling work for this stage is being undertaken using the latest version of the Gloucestershire Countywide Traffic Model which is identified as Version 2.1 (GCTM V2.1). This model was developed by GCC outside the current scope of J10, but taking into account this scheme amongst many others to be tested by GCC in near future including M5J9 improvements and already has a data collection report.

1.2.3. Summary information for the model development including a data collection report detailing the traffic survey and data collection process undertaken to assist in the development of the GCTM V2.1 is presented in Appendix A.

1.2.4. Summary of the data collected and used for operation modelling of the scheme is presented in Appendix B.

1.2.5. Similarly, Appendix C consists of local accident data collected and used for informing COBALT assessment.

Appendices

Appendix A. – GCTM V2.1 Data Collection Report

ATKINS

Member of the SNC-Lavalin Group

Gloucestershire Countywide Traffic Model Version 2.1

Data Collection Report

17 July 2020

Notice

This document and its contents have been prepared and are intended solely as information for and use in relation to Draft

Atkins Limited assumes no responsibility to any other party in respect of or arising out of or in connection with this document and/or its contents.

This document has 45 pages including the cover.

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	Draft for GCC Review	AD	RD	DD	SB	17/07/2020

Client signoff

Client	
Project	Gloucestershire Countywide Traffic Model Version 2.1
Job number	5198258
Client signature/date	

Contents

Tables

Figures

Glossary

Item	Definition
2011 Census	Office for National Statistics 2011 Census Population Survey for all countries of the United Kingdom
2014 Business Register and Employment Survey	Office for National Statistics publication of employee and employment estimates at detailed geographical and industrial levels, regarded as the official source of employee and employment estimates by detailed geography and industry.
ATC	Automatic Traffic Count
DfT	Department for Transport
DfT Base Year Freight Matrices	Modelled road freight vehicle movements for a base year of 2006, produced by the Base Year Freight Matrices (BYFM) study
DMRB	The Design Manual for Roads and Bridges, containing information about current standards relating to the design, assessment and operation of motorway and all-purpose trunk roads in the United Kingdom.
GCC	Gloucestershire County Council
GCTM	Gloucestershire Countywide Traffic Model
HGV	Heavy Goods Vehicle (also known as OGV) – Goods carrying vehicle over 3,500kg design gross weight
ITN Layer	Ordnance Survey MasterMap Integrated Transport Network Layer, consisting of a fully topologically structured link-and-node network representing the roads network of Great Britain, from motorways to pedestrianised streets.
LGV	Light Goods Vehicle – Goods carrying vehicle under 3,500kg design gross weight
LMVR/MVR	Local Model Validation Report/Model Validation Report
LSOA	Lower Super Output Area
JCS	The Joint Core Strategy for Gloucester, Cheltenham and Tewkesbury
MCC	Manual Classified Count
MCTC	Manual Classified Turning Count
MPD	Mobile Phone Data
MSOA	Middle Super Output Area
National Travel Survey	The DfT National Travel Survey (NTS) is a household survey designed to monitor long-term trends in personal travel and to inform the development of policy. It is the primary source of data on personal travel patterns by residents of England within Great Britain.
National Trip End Model	The DfT National Trip End Model (NTEM) model forecasts the growth in trip origin-destinations (or productions-attractions) up to 2051 for use in transport modelling.
OD	Origin Destination
PCF	Highways England Project Control Framework
RoF	Region of Focus – the core detailed traffic model area

Item	Definition
SATURN	Simulation and Assignment of Traffic in Urban Road Networks - A suite of computer programmes designed to store traffic and road based information, route the traffic through the road network (assignment), and analyse the operational capabilities of the junctions (simulation)
SOBC	Strategic Outline Business Case
SWRTM	Highways England South West Regional Traffic Model
WebTRIS (formerly TRADs)	Highways England Trunk Road Information System – a database of traffic flow information for all trunk roads
TAG	Transport Appraisal Guidance – a series of Department for Transport advisory documents available online
TomTom Trafficstats	A suite of web services allowing for the collection of historical GPS traffic data collected form TomTom navigation devices.
TrafficMaster	A GPS sourced dataset providing detailed analysis of congestion. It is free of charge to English Local Authorities by the DfT.

1. Introduction

Atkins has been commissioned by Gloucestershire County Council (GCC) to undertake traffic modelling assessments relating to both the M5 Junction 9/A46 Ashchurch scheme and the M5 Junction 10 Transport scheme in line with Highways England (HE) Project Control Framework Stages 2 and 3 respectively. This work is being undertaken using the latest version of the Gloucestershire Countywide Traffic Model which is identified as Version 2.1. This supersedes Version 2.0, which was used as the basis for appraisal of the M5 Junction/A46 Ashchurch scheme conducted for the Strategic Outline Business Case (SOBC) submitted to the Department for Transport (DfT) in January 2020.

This Data Collection report details the traffic survey and data collection process undertaken to assist in the development of the traffic model (both from parent models and the various iterations of developing the GCTM itself). The purpose of this report is to provide a summary of the data collected, establish the statistical accuracy of the data where possible, and provide recommendations as to the robustness of the survey data as a basis for model development.

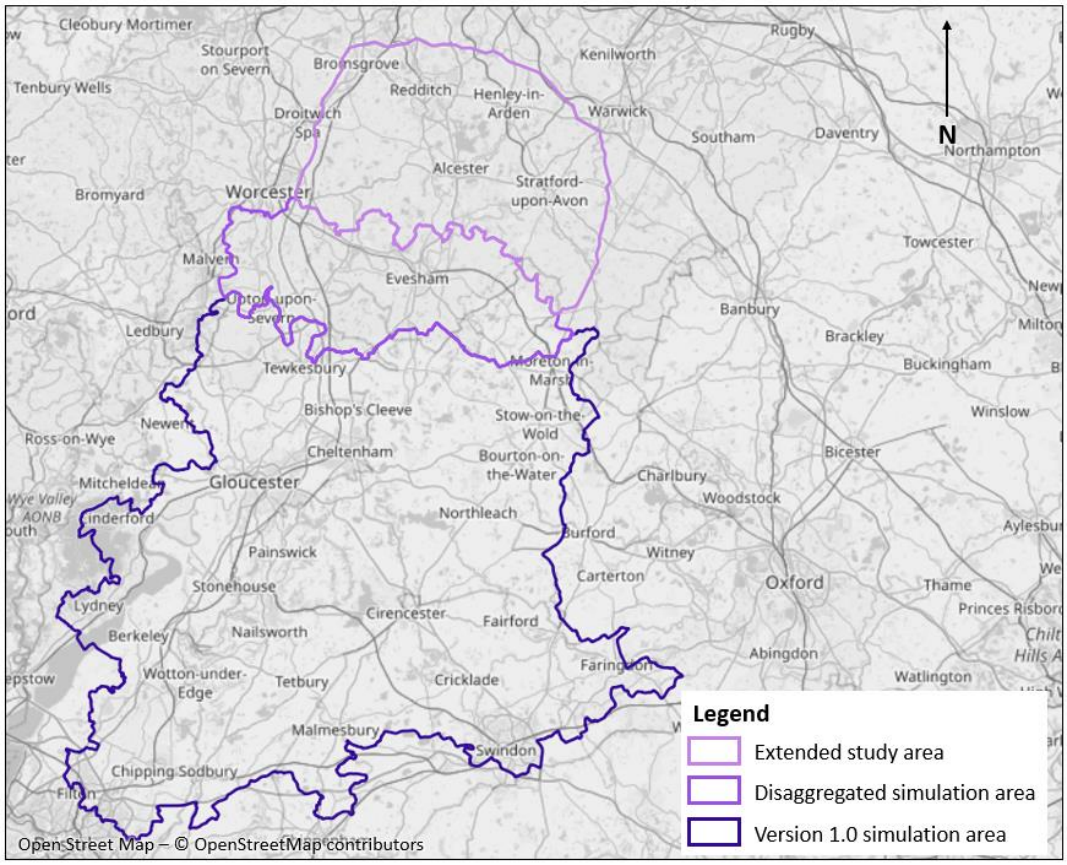
1.1. Model Development History

The original version of the GCTM model (Version 1.0) was developed by Mott MacDonald from the Highways England A417 Missing Link PCF Stage 2 traffic model, which was in turn derived from the Highways England South West Regional Traffic Model (SWRTM). Version 1.0 included a series of enhancements to the A417 Missing Link model network and zone structure around M5 Junction 10 and in the Stroud area, however there remained a relative lack of detail in the vicinity of Tewkesbury and M5 Junction 9.

For the specific purposes of developing the SOBC for the M5 Junction 9 and A46 (Ashchurch) Transport Scheme, Version 2.0 of the GCTM involved extending the “fully modelled area” of the GCTM to encompass the core scheme study area in more detail, whilst also introducing a suitable level of simulation coding north of the study area, including the M6 and A46 strategic corridors south of Birmingham, recognising the potential for the scheme to affect wider strategic movements. The zoning system was disaggregated in the core study area (in Tewkesbury, Evesham and surrounding areas), and a skeletal simulation network was included to capture strategic routes south of the Birmingham motorway box. From a data collection perspective, additional readily available observed data for the extended area was collated from a variety of sources (as detailed in this report) to allow for further traffic volume (at a screenline and individual link level) and journey time validation.

Further updates were made in response to comments from Highways England; primarily this involved including additional network links representing rural roads within the core study area for the M5 Junction 9 and A46 (Ashchurch) scheme, but also incorporating some additional traffic count data. This updated version of the model is identified as the GCTM V2.1 – which is the model version associated with this report. Figure 1-1 shows the extents of both the original GCTM Version 1.0 simulation area and the extended simulation area incorporated for Version 2.0 and 2.1.

Figure 1-1 – GCTM Model Network Simulation Area Extension



1.2. Model Specification

1.2.1. Base year

Consistent with previous version of the GCTM and the A417 Missing Link and South West Regional Transport Model (SWRTM) Parent Models, Version 2.1 of the GCTM reflects average March 2015 weekday traffic conditions and is calibrated and validated against corresponding traffic levels and journey times.

1.2.2. Time periods

The model time periods are as follows:

- AM average hour: 0700-1000;
- IP (inter peak) average hour: 1000 – 1600;
- PM average hour: 1600-1900; and
- OP (off peak) average hour: 1900 – 0700.

AM, IP and PM modelled time periods were calibrated and validated against the observed counts and journey times in the modelled area, whereas the OP model is used for factoring the modelled periods to daily levels.

1.2.3. Model user class

As different combinations of vehicles and users have different values of time and vehicle operating costs, they must be split into user classes. In order to be compliant with TAG Unit M3.1, user classes should comprise the following as a minimum: cars on business, other cars, Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs). The trip matrix for this model is TAG compliant as shown in Table 1-1.

Table 1-1 - User class definitions

User Class Number	Vehicle Type	Purpose
1	Car	Employer's Business
2	Car	Commuting
3	Car	Other
4	Light Goods Vehicle (LGV)	Includes Personal and Freight
5	Heavy Goods Vehicle (HGV)	Freight/Business

1.3. Scope of data collection

The data collection exercise included the following key elements:

- Derivation of the GCTM trip matrices; disaggregating and reprocessing of the A417 Missing Link Stage 2 prior trip matrices using relevant 2011 Census data;
- Analysis of relevant count data derived from various sources including data extracted from the Highways England WebTRIS platform as well as the collation of data held by GCC and Worcestershire County Council (WCC) for the local road network;
- Obtaining GPS journey time data for journey time validation on key routes; and
- Verifying the highway network condition through on-site observations, including analysis of traffic signal timings along the A46 through Ashchurch.

1.4. Report structure

Following this introduction, the remainder of this report is delivered as follows:

- Chapter 2 describes the use of the parent models (the A417 Missing Link Stage 2 and original SWRTM) for the development of both trip matrix and network development;
- Chapter 3 details the count data that was used in the model development;
- Chapter 4 details the journey time data collected for key journey time route validation; and
- Chapter 5 summarises the data collection elements and provides an overall recommendation regarding the suitability of the data for ongoing use in scheme appraisal (in particular the M5 Junction 9/A46 Ashchurch and M5 Junction 10 transport improvement schemes) and other potential uses.

2. Use of Existing Parent Models

This section details the use of the existing parent models (the SWRTM and A417 Missing Link model) for both trip matrix development and network development in the GCTM. The process used to disaggregate and refine the trip matrices for the GCTM is also detailed.

Use of count data and journey time data derived from these models for calibration and validation of the GCTM is discussed in subsequent chapters of this report alongside additional traffic count and journey time data sources used to supplement this data.

2.1. SWRTM Matrix Development

The SWRTM prior matrices represent the basis for the GCTM prior matrices (as was the case for the A417 Missing Link model). The highway matrices are comprised of a range of data sources as follows:

- Mobile Phone Data (MPD) – travel demand origin and destination data supplied by Highways England's Traffic Information System (TIS);
- 2011 Census and Office of National Statistics (ONS) Data – used to derive the model zoning system (based on output areas), understand spatial characteristics of the MPD (from resident and workplace populations) and review matrix distribution, verifying the attributes of the MPD;
- National Travel Survey Data – again used to review the characteristics of the MPD;
- Trafficmaster Origin-Destination data – obtained for the development of LGV matrices; and
- DfT Base Year Freight Matrices (BYFM) – used to develop HGV matrices.

An overview regarding the use of these data sources to develop the SWRTM prior matrices is provided below. Full details of this process are presented in the SWRTM Model Validation Report.

2.1.1. Mobile Phone Data

MPD represents the primary data source for the development of the SWRTM car user class prior matrices. The data was utilised to understand the trips per person by road, their origin and destination, and the nature of the trip. MPD was provided on the following basis:

- Person trips by road for all vehicle types combined (i.e. excluding rail);
- OD trips between 1,802 model zones (Middle Super Output Area (MSOA) level within the Region of Focus (RoF));
- Average for typical weekdays (between 2 – 27 March 2015 inclusive);
- 24hr trip data disaggregated by hour between 0500 – 2000hrs with trips assigned to each hour based upon the start time of the trip at its origin. Off-peak split into two periods (midnight to 0500 and 1900 to midnight);
- Three purposes with home-based trips being split by direction;
  - Home-based Work (HBW/commute) (to/from home);
  - Home-based Other (to/from home); and
  - Non-home-based;

Matrices were supplied in expanded form, representing trips made by the whole population in an average weekday during the study period.

The final dataset taken forward for development of the prior matrices of the RTMs included person trips for all motorised modes, including rail, as an initial attempt to exclude these rail trips had proven unsuccessful on verification.

2.1.2. LGV and HGV Data

LGV data was incorporated in the matrix using TrafficMaster data for the period September 2013 to August 2014, and March 2015 to August 2015 (weekdays only), based on a sample of around 2% of the national fleet. The data was resolved at Lower Super Output Area (LSOA) level and disaggregated to hourly intervals. The full methodology for converting TrafficMaster data into the assignment matrices is recorded in the Regional Traffic Model Technical Guidance (RTMTG); a zone correspondence list was drawn up between LSOAs and SWRTM zones, and the data was scaled up using expansion factors from observations of the preliminary networks.

The HGV data was sourced from the DfT's Base Year Freight Matrices, which represents daily demand from 2006, and was therefore factored up to 2015 levels. The data comprised vehicles per average day between various OD pairs, split into three classes: articulated, rigids and vans. The data was then converted to average hour matrices using a set of conversion factors derived from observed count data. Again, the full methodology is outlined in the RTMTG.

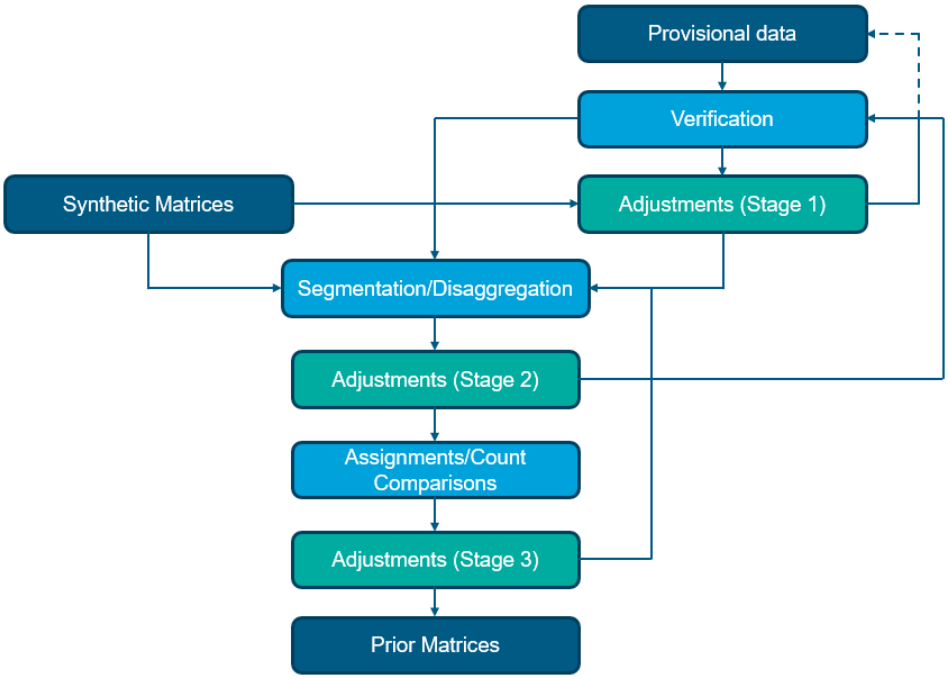
2.1.3. Verification and Adjustment of MPD

It was necessary to perform a variety of matrix verification tests on the MPD in order to identify any potential limitations of the dataset. Six initial tests were carried out and the following limitations were found:

- Definition of a trip;
- Spatial resolution and data accuracy;
- Identification of short trips;
- Identification of mode, vehicle type and vehicle occupancy;
- Identification of trip purpose;
- Expansion of mobile phone data sample; and
- Potential consequences of Telefonica's stochastic rounding of trips into integers, due to privacy reasons.

Understanding these shortcomings allowed for a process to be developed so that the MPD produced a set of matrices that met the specification. The method of developing the matrices as presented in the SWRTM MVR is shown in Figure 2-1.

Figure 2-1 - Summary of SWRTM matrix development process



Source: Highways England, SWRTM MVR v5.0, pg. 68

Each adjustment within the process was designed to address limitations that were identified during the verification. The main elements that needed to be overcome in the matrix development process were as follows:

- Allocation of MPD trips to the correct time periods;
- Correcting for bias in the data associated with the mobile phone-owning population;
- Disaggregating the MSOA-based MPD data to match the SWRTM zoning system;
- Identification of car trips through elimination of other modes;

- Providing a more reliable estimate of short distance movements using a synthetic estimate;
- Adjusting trip rates to be more aligned with observed sources;
- Adjusting trip lengths to be more aligned with observed sources.

National Travel Survey and Census Data

National Travel Survey data from 2011 was used to check and adjust the MPD as part of the above verification process. The data was used to benchmark:

- Trip rates by purpose, time period and direction;
- Average trip length and distribution by purpose and time period;
- Trip purpose distribution; and
- Flow profiles.

The data was also used for adjusting trip rates where necessary, and identifying calibration targets for the matrices.

From the 2011 Census, Journey to Work data was used for accessing origin-destination data for commute trips. It was used in conjunction with MPD to verify HBW trip ends and trip distribution, as well as misallocated trip ends in certain areas of the model.

Employment data, traffic count data and National Trip End Model

Similar to the Journey to Work data, employment data from the 2014 Business Register and Employment Survey was used to derived synthetic trip ends, identifying the number of people employed in different types of employment. Traffic count data was used to verify the MPD and prior matrices by comparing observed and modelled flows, and National Trip End Model trip ends were adopted to supplement existing trip ends.

2.2. GCTM Matrix Disaggregation

SWRTM zoning was based on aggregations of 2011 Census Output Areas (OAs), with a total of 1901 zones. This was incrementally disaggregated, firstly for the purposes of the A417 Missing Link model with enhancements to improve granularity in the A417 Missing link study area, bringing the total number of zones to 1914. For the GCTM, the zoning system in the vicinity of M5 Junction 9 and the A46 corridor was further disaggregated initially for Version 1.0 and again for Versions 2.0 and 2.1, creating an additional 128 new zones according to 2011 Census OAs and Lower Super Output Areas (LSOAs). The final disaggregated zoning system for GCTM V2.1 in the Gloucestershire area is shown in Figure 2-2.

To inform the process of disaggregation, statistics were collected from the 2011 Census on the number of households, workers and jobs in each of the new zones, and used as follows:

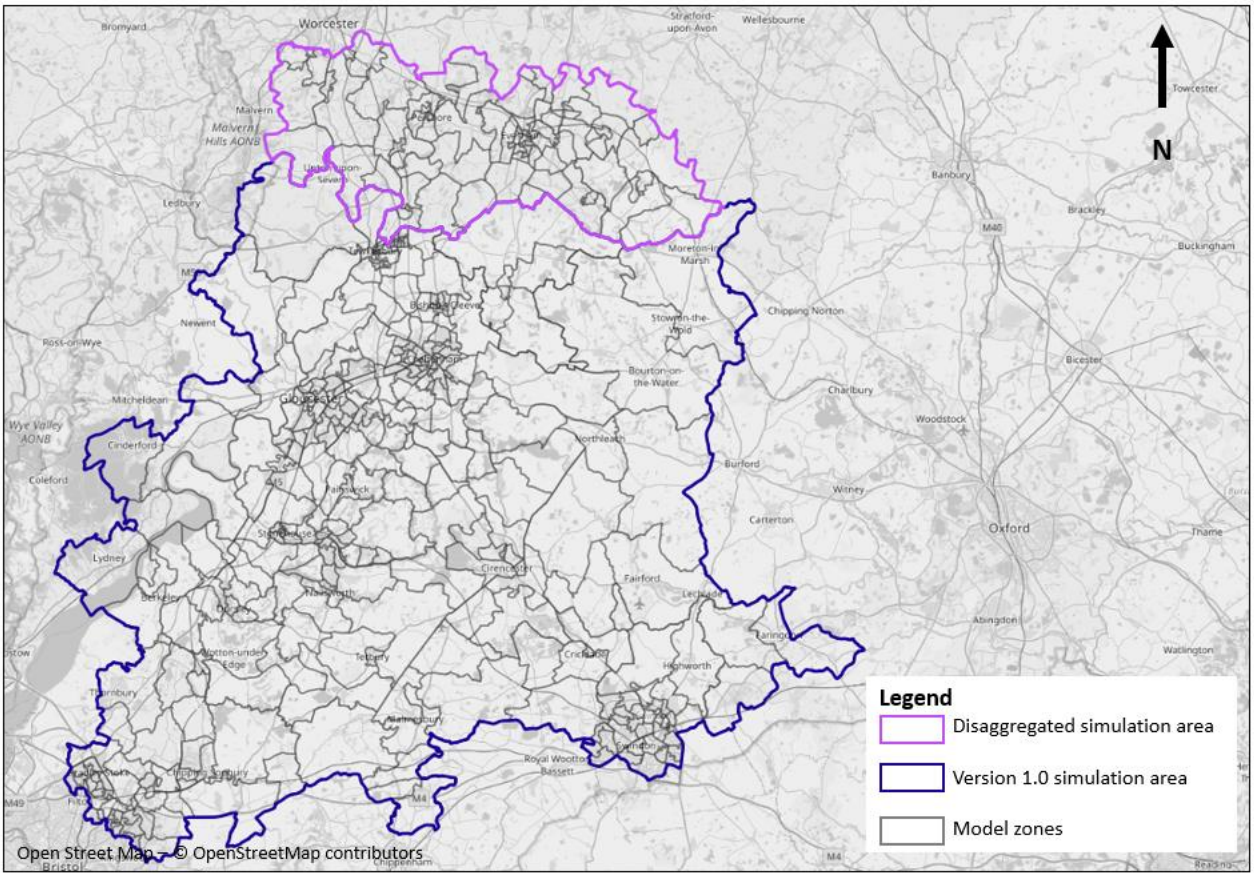
- Resident population to inform the home end of home-based trips; and
- Workplace population to inform the non-home end of home-based work employee business trips and the split of LGVs and HGVs.

These statistics were used to calculate proportions of trips for each zone, while maintaining the overall number of trips in the matrix. Factors were assigned to user classes, in line with the logical factor that would affect the number of trip departures or arrivals. The statistics categories for each user class are shown in Table 2-1.

Table 2-1 - Census statistics used for zone disaggregation

User class	Source (origin trips)	Source (Destination trips)
1 – Car business	Workplace population	Workplace population
2 – Car Commuting	AM peak – Residential population Inter-peak – Residential population PM peak – Workplace population	AM peak – Workplace population Inter-peak – Workplace population PM peak – Residential population
3 – Car Other	Residential population	Residential population
4 – LGV	Workplace population	Workplace population
5 - HGV	Workplace population	Workplace population

Figure 2-2 - GCTM V2.1 disaggregated zoning system



Following the disaggregation process, the distribution of trips across the model zones was reviewed as part of an initial prior matrix assignment, with comparisons made against local count data to ensure that the disaggregation proportions applied were appropriate in key areas of the model (for example for zones with large employment and retail land uses) and making sure there were no high concentrations of trips in areas with low population density.

2.3. Use of Data for Network Development

This section details the use of data sources both for the initial development of the SWRTM parent model network and also the refinements carried out for the GCTM.

2.3.1. SWRTM Network Construction

Details regarding data sources used for the initial SWRTM network are as follows:

Ordnance Survey data

The Integrated Transport Network (ITN) layer from Ordnance Survey was used for developing the initial model network structure and defining road classification in the SWRTM, using the ITN June 2015 version. The Nature layer was also used for distinguishing between different road types such as single and dual carriageway, roundabouts and slip roads.

Signal data

Signalised junctions along the SRN and on adjacent roads were identified as the network was built, and exact locations and types were obtained from Local Authorities. Other data requested for each junction included layout plans, controller specifications and signal timings; these were fed into LinSig to process them for use as signal timing data within SATURN.

Where there was no available data from Highways England or the Local Authority, site visits were carried out to determine signal timings and staging.

Google data

In conjunction with the ITN layer from Ordnance Survey, Google Maps and Google Street View were used to illustrate the characteristics of the road layout and inform the application of speed flow curves. They were also sources of information about junction type, the number of approach arms, the number of lanes and turn allocations.

Highways England Roadworks database

The Highways England Roadworks database was used to inform the status of the SRN during March 2015, including information on capacity and speed restrictions to be reflected in the base model coding.

2.3.2. A417 Missing Link Model Network Refinement

The network data was largely inherited from the SWRTM, including the base network. Ordnance Survey data and the ITN layer were used to add detail to the local model network, with additional TrafficMaster journey time data used for classifying the links and the speeds on the new local network.

2.3.3. GCTM Network Refinement

Further detail was added to the network for the GCTM using both Ordnance Survey mapping and GIS software. Additional nodes were incorporated using these sources to determine link lengths and locations, resulting in a geospatially accurate highway network. Junctions were observed using Google Maps and Google Street View similarly to the SWRTM.

For the development of Version 2.0 – site visits were also conducted to further understand the nature of the key junction locations in the extended area of the model – noting that the extended area was on the periphery of the original SWRTM RoF. Additional signal data was required through Ashchurch and along the A46 in order to incorporate accurate timing and staging arrangements in the SATURN model. Site visits were undertaken to record this information at the following locations:

- Aston Cross (A46-B4079);
- A46-Northway Lane junction;
- A46-Alexandra Way junction;
- M5 J9 circulatory north-east signals;
- M5 J9 circulatory north-west signals;
- A438-Shannon Way;
- A438-A38SB; and
- A438-Morrisons Supermarket access.

The general condition of the A46 corridor was also observed, with delays and queuing noted in both directions along the A46 and on the A438 towards Tewkesbury.

3. Count Data

Traffic count data is required to identify observed traffic flows on key links and junctions in the study area, for use in the model calibration and validation process. TAG guidance (Unit M1.2) recommends that longer term count data is used where possible to due to the greater confidence level that this data provides compared to 1-day surveys. However, short-term, manually classified count data (MCCs) can provide valuable information in terms of vehicle type proportions (with a much higher degree of accuracy compared to automatic traffic counters (ATCs)) as well as individual turning movements for key junctions within the strategic model network. For this reason, a combination of both count data types has been used in the development of the GCTM.

Different count data types have been collated from a range of sources for the development of the GCTM. This includes data used originally for the development of the SWRTM and A417 Stage 2 Missing Link models and additional data collated specifically for the GCTM, to enhance the overall level of model validation. This chapter provides an overview of the data used in the HE parent models (focused on the Gloucestershire area where data was retained for calibration/validation of the GCTM) before detailing the additional count data used specifically for the GCTM. It also summarises the checks undertaken at various stages or data collation to make sure the counts used can be considered robust and suitable for model development.

3.1. Count Data Quality Check Requirements

3.2. SWRTM/A417 Missing Link Existing Count Data

This section provides an overview of the count data sources derived from the SWRTM and A417 Stage 2 Missing Link base model development which have been retained for use in development of the GCTM base model. Details regarding the full data processing and checking of this data is provided in the respective Highways England Data Collection reports, however further checks were undertaken as part of the GCTM validation setup – making sure that existing count data corresponded with new data on adjacent links incorporated specifically for the GCTM.

3.2.1. Original SWRTM Data Sources

There were four main sources of count data collected for the development of the SWRTM. This includes:

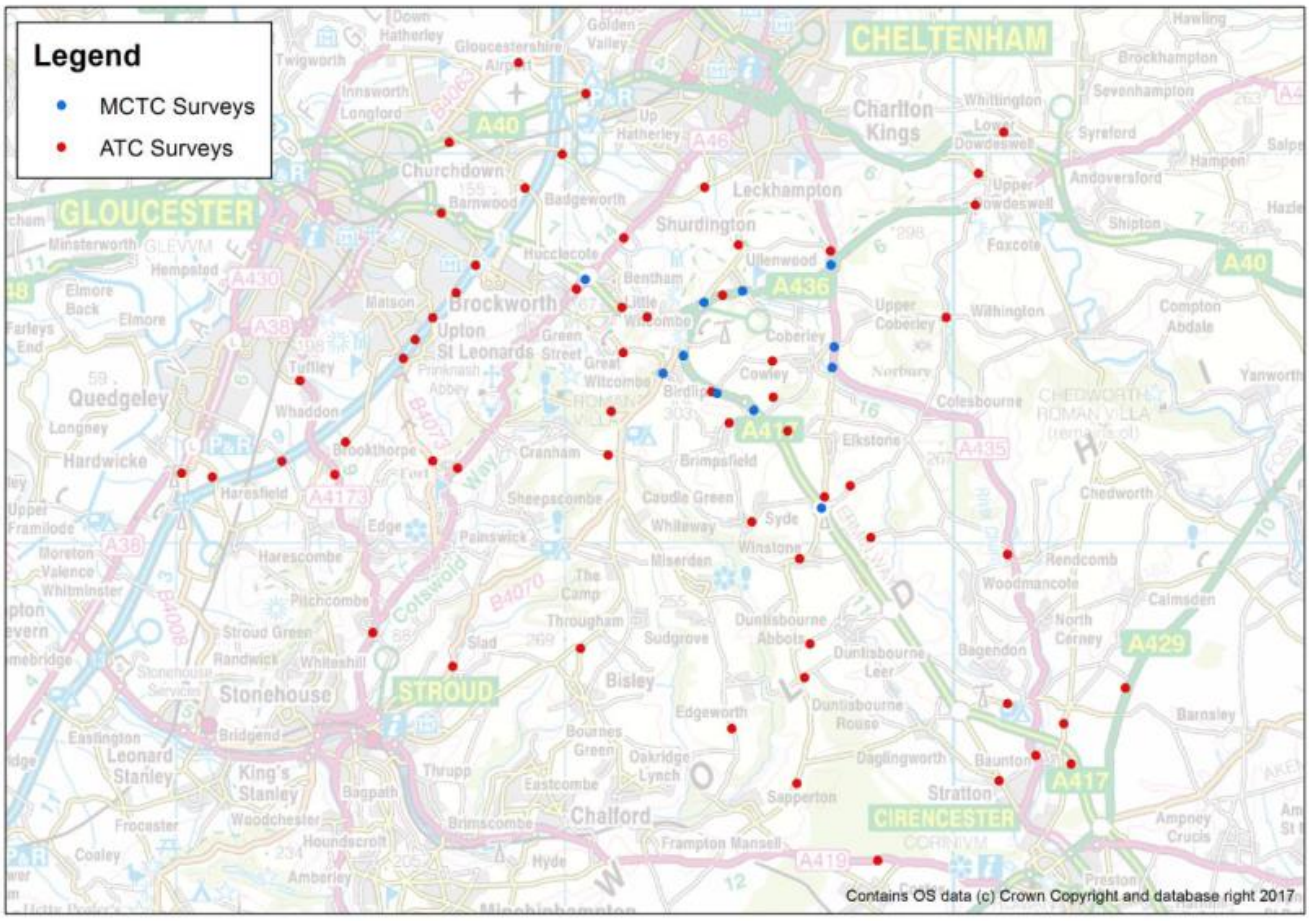
- Highways England Traffic Data from the TRADS database (now replaced by WebTRIS), used to provide data for traffic flows at various points along the SRN, as well as HGV proportions (based on vehicles longer than 6.6m). March 2015 data was used to establish AADT and average hour traffic flows, and longitudinal data provided a seasonal profile for motorways and trunk roads.
- Local authority data (ATCs, MCCs and Manual Classified Turning Counts (MCTCs)) for the South West region was also collected to supplement the SRN data and provide a view of the flows on local roads.
- It was necessary to collect additional data specifically for the SWRTM and later for the A417 Missing Link model including ATCs and MCCs. Around 200 sites were surveyed specifically for the SWRTM (for the whole region) as reported in the respective traffic data collection report. This was primarily automatic traffic counts (ATCs) with a subset of classified counts undertaken at some sites.
- Finally, the DfT Traffic Count database was used for MCCs and ATCs across the South West.

Suitable available data, collected from 2013 onwards, was used and factored to the model base period of March 2015 (based on long-term monitoring data from the TRADs database) before being incorporated within the model calibration count deck.

3.2.2. A417 Missing Link Model

Data collection for the A417 Missing Link model is documented in PCF Stage 1 Data Collection Report (17th February 2017) – and confirms the use of ATC and MCTC data in model development. This includes the use of existing data (primarily sourced from the SWRTM) and inclusion of new 2016 surveys. The locations of these sites (in terms of the A417 core study area) is shown in Figure 3-1.

Figure 3-1 - A417 Missing Link Model Count Site Locations



Source: A417 Missing Link at Air Balloon Traffic Data Collection Report (Mott MacDonald on behalf of Highways England 17/02/2017)

The PCF Stage 1 Data Collection Report confirms that all ATC and MCTC data was checked to ensure its accuracy and reliability. These checks included:

- Tidality – ATC flows were plotted by time and direction and judged as to whether the inbound/outbound flows were as expected.
- Anomalies – any spikes and troughs in the data that did not follow the overall trend of the site were removed from the dataset.
- Cross checking ATC with MCTC data – ATC flows were plotted and compared against adjacent MCTC locations – judging whether the expected profiles were in line with expected trends.

The report states that "*anomalous results were relatively rare, but when observed these instances were removed from the dataset*".

The cross checks against MCTC data also revealed that the direction of flow for site C05 (A435 north of junction with A436) was mislabelled – which was corrected in subsequent data manipulation.

All data was adjusted to represent March 2015 traffic levels based on seasonality and annual adjustment factors calculated from continuous monitoring data. Data was processed to represent average hourly traffic levels for the three model time periods.

3.3. GCTM Version 1 Count Data

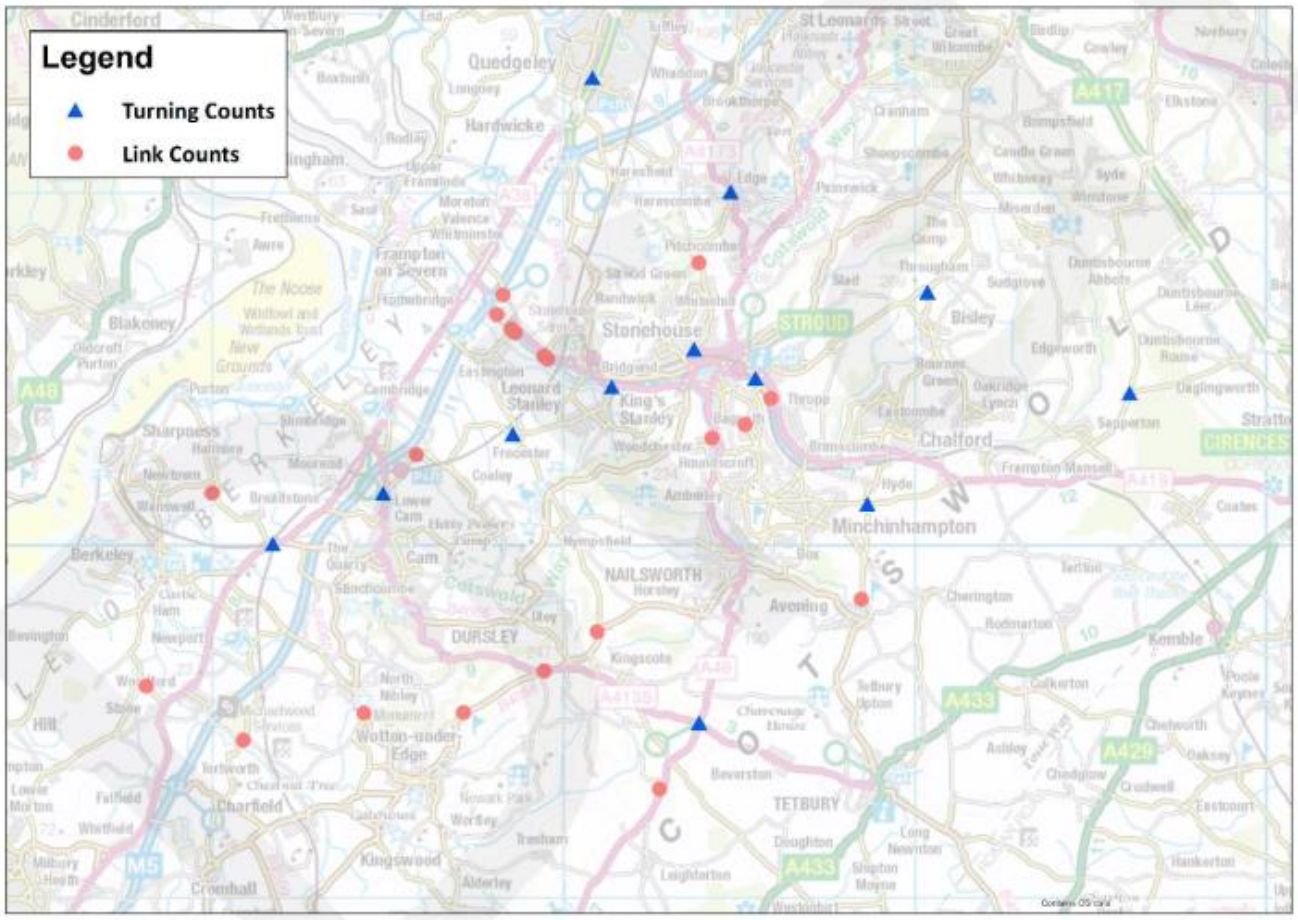
For the purposes of producing Version 1.0 of the GCTM, Mott MacDonald undertook a review of all existing count data available for the original GCTM fully modelled area. The focus of this review was to ensure there was a suitable range of data in the Stroud and M5 J10 areas for the intended purposes of assessing the Stroud

Local Plan and the M5 Junction 10 improvement scheme. This was reported in the initial GCTM Model Specification Report. In summary this included:

- Carrying forward the count data for the Gloucestershire area used in the calibration and validation of the A417 Missing Link model (as detailed above);
- Count data from late 2017 collected for the purposes of developing two Highways England Paramics models – M5 J10-11 and M5 J12-14.

An additional data collection exercise was also undertaken by GCC in late 2018 to provide further data coverage in the Stroud study areas. These additional locations are shown in Figure 3 -2.

Figure 3 -2 - GCTM Version 1 Additional Count Data Collection Locations for Stroud Area



Source: GCTM Version 1 LMVR (Mott MacDonald 10 July 2019)

Following this review process, the following data was taken forward for use in calibration and validation of the GCTM Version 1.0:

- 8 counts (4 bi-directional) taken from the SWRTM count database for the M5 mainline including:
  - Junction 9 to Junction 10
  - Junction 11 to Junction 11a
  - Junction 12 to Junction 13
  - Junction 14 to Junction 15
- A further 236 link counts (204 used in calibration, 32 used in validation); and
- 16 MCTC locations (5 taken from the A417 study area, 11 for the Stroud area).

The link count data (not including the M5 mainline) was used to form a total of 13 screenlines across the fully modelled area (9 used in calibration, 4 used as independent validation screenlines), several of which are consistent with or extensions of those used for the A417 Missing Link model. These are shown in Figure 3-3. MCTC Locations are shown in Figure 3-3.

.

The checks undertaken for the A417 Missing Link Model were repeated for new data sources with no new issues found. However, as reported in the Version 1.0 LMVR, turning count data collected for the J9-J10 Paramics model was not included due to a motorway incident on the day of the surveys resulting in closure of the mainline – causing atypical traffic patterns on surrounding routes.

Figure 3-3 - GCTM Version 1 Screenlines

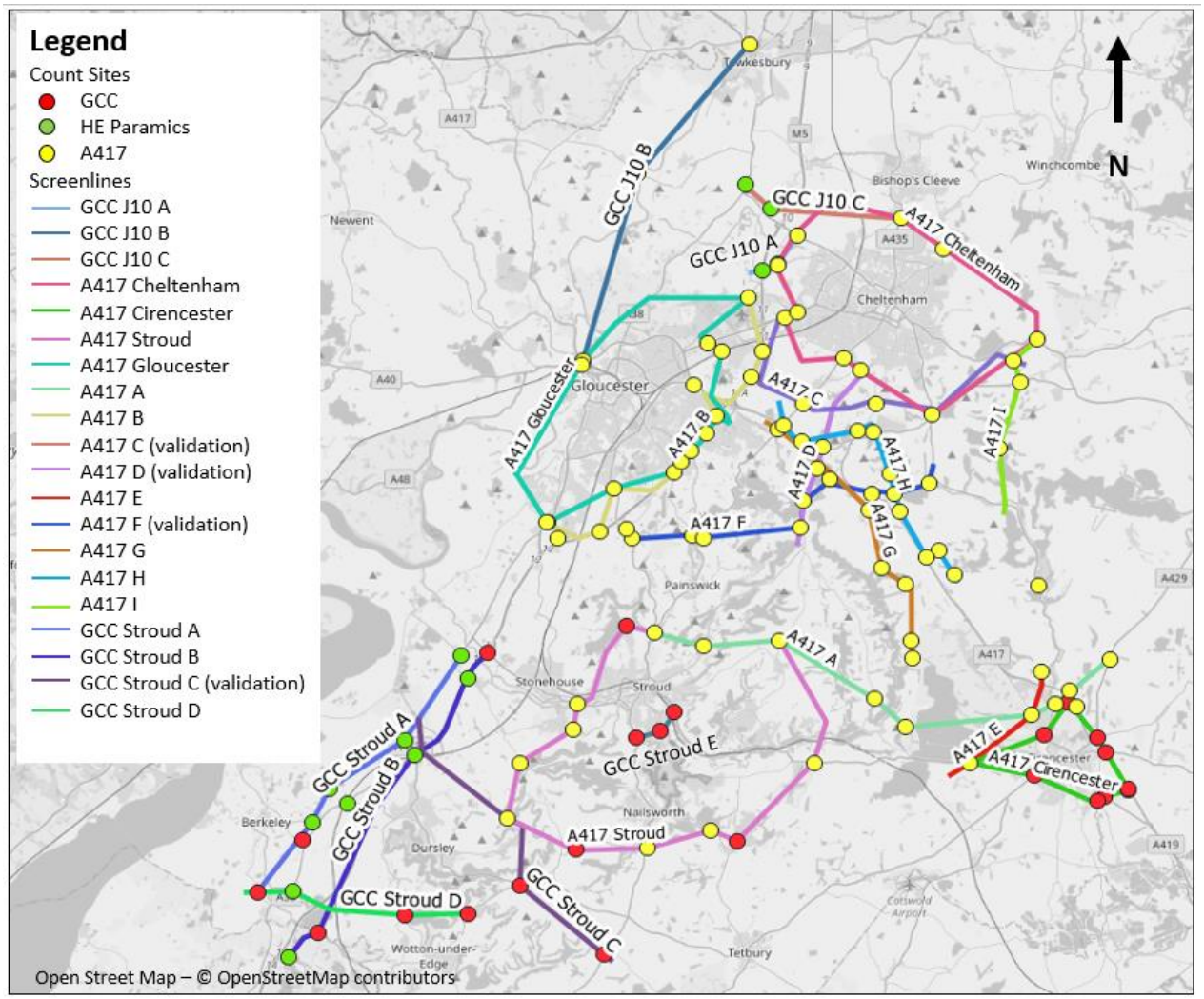
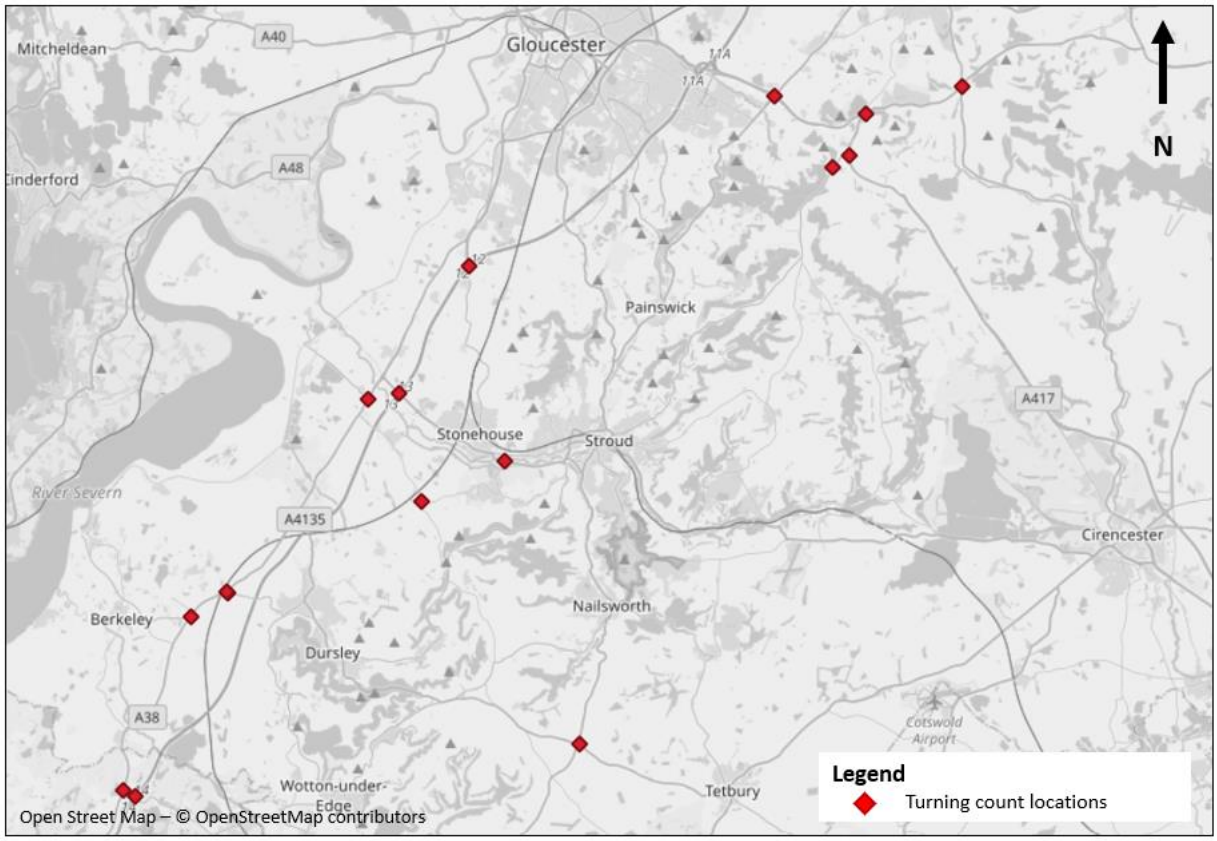


Figure 3-4 - GCTM Version 1 MCTC Locations



3.4. GCTM Version 2.1 Count Data

The development of Versions 2.0 and 2.1 of the GCTM involved the extension of the fully modelled area and also inclusion of the strategic network to the north in simulation detail in order to be able to effectively model the impacts of the M5 Junction 9/A46 (Ashchurch) transport scheme. Additional count data was also required for these areas in order to be able to demonstrate the accuracy of the base model in the vicinity of the scheme and on key strategic routes affected by the scheme.

Owing to the timescales required for model development in order to inform the SOBC for the scheme, it was not feasible to conduct any new data collection as part of the Version 2.0 update. However, numerous existing count data sources from 2014 onwards were available to provide suitable coverage including:

- 40 permanent link counts taken from the Highways England WebTRIS database including all sections of the M5 mainline as far as the M5/M42 Interchange and various sections of the A46 between M5 Junction 9 and Alcester;
- 10 counts (5-bidirectional) from ATC sites collected in July 2017 over a 2-week period for the purposes of developing the GCC Tewkesbury Paramics Model (TPM);
- 8 MCTCs conducted for a single weekday in July 2017 for peak periods only (07:00-10:00 and 16:00-19:00) – again for the purposes of the TPM development;
- 34 counts (17 bi-directional) from additional ATC sites received from GCC across north Gloucestershire between Bishop's Cleeve and Moreton-in-Marsh;
- 16 counts (8 bi-directional) from ATC sites received from Worcestershire County Council (WCC) for locations north of the Gloucestershire border; and
- 4 counts (2 bi-directional) from ATC sites utilised for National Transport Model (version 5) validation, north of Alcester on the A445 and A431.

All 244 link counts used in calibration/validation of Version 1.0 were also retained, with consistency checks undertaken for those sites near to the new locations for each individual model time period. Following a review of the Version 2.0 LMVR, Highways England identified the need for additional validation to be conducted on the

M5 mainline – for those sections of the mainline not originally included in Version 1.0 (within the original modelled area). Data for a further 4 sections of the M5 mainline (8 counts covering northbound and southbound) was therefore collated from WebTRIS as part of the Version 2.1 update, providing full coverage of the M5 mainline corridor between Junction 8 and Junction 15 (within Gloucestershire) and also between Junction 4a (the interchange with the M42 southwest of Birmingham) and Junction 8. Four counts for the A417 strategic link, originally included in the A417 Missing Link model but not in the GCTM Version 1.0 were also incorporated.

Locations of new WebTRIS sites included for Version 2.1 both within Gloucestershire and for the extended simulation area north of Gloucestershire are shown in Figure 3-5 and Figure 3-6 respectively. Other sources of count data collated as part of the Version 2.1 updated are presented in Figure 3-7.

Figure 3-5 – Additional GCTM V2.1 WebTRIS Site Locations within Gloucestershire

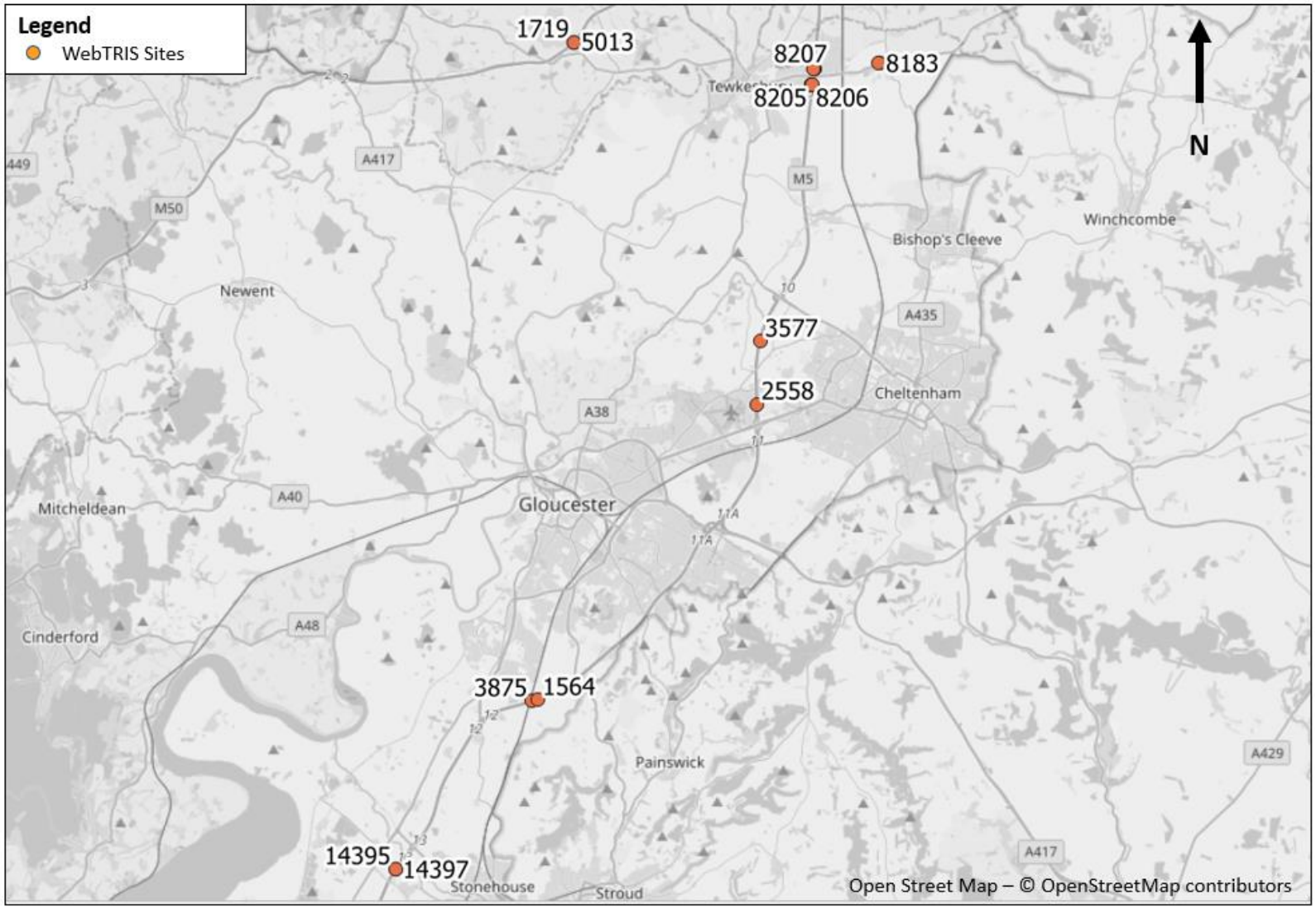


Figure 3-6 – Additional GCTM V2.1 WebTRIS Site Locations North of Gloucestershire

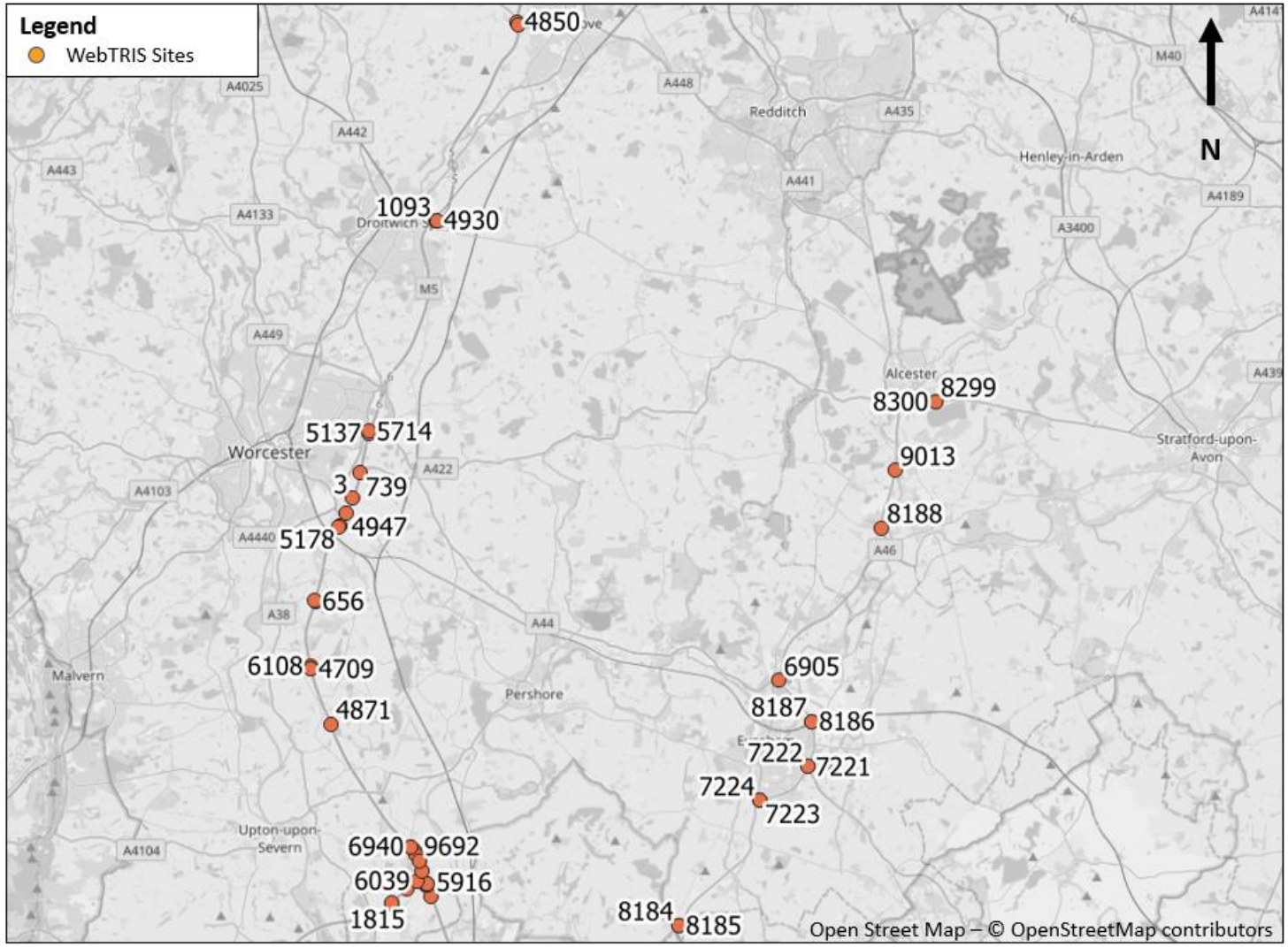
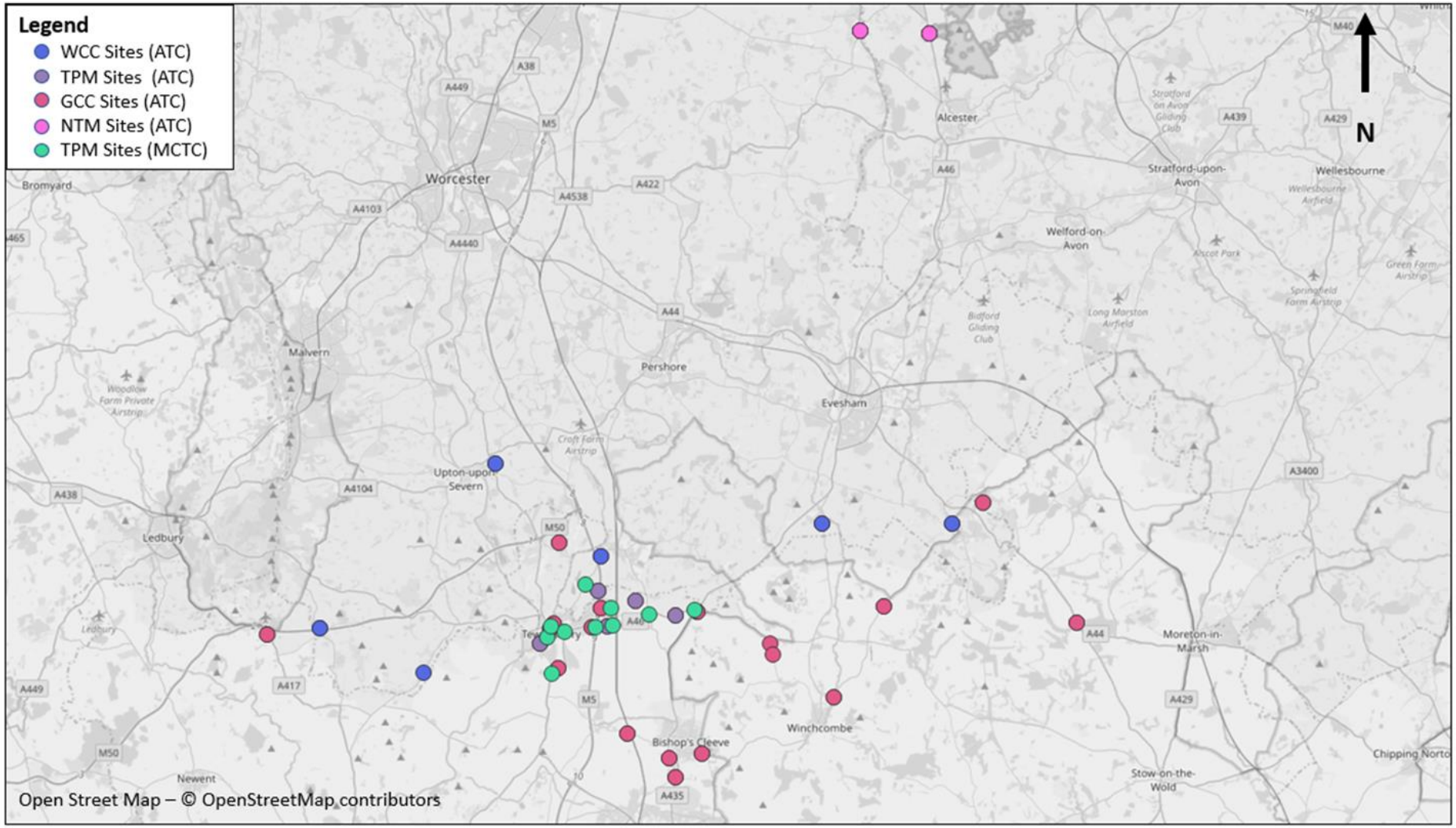


Figure 3-7 – Additional GCTM V2.1 ATC/MCTC Locations



3.4.1. Version 2.1 Count Data Checks

As a further check on the quality of count data included within the Version 2.1 update, confidence interval analysis was undertaken for the additional ATC data collated where data was available for individual days of the week. In some instances it was noted that some of the counts conducted included the week of the Cheltenham festival (during March) and so data collected during these weeks was excluded.

It was not possible to undertake the same analysis for data used in earlier phases of model development, as this was not available in its raw format. Confidence intervals were also not calculated for additional WebTRIS data sites, however daily volumes were analysed to ensure that flows were consistent by time period, ensuring there were no apparent incidents affecting the volume of traffic.

Guidance on the accuracy of long-term ATC data is provided in DMRB[1] which recommends that data is of the order ±5% of the total count at the 95% confidence interval. It is also advised that counts with 95% confidence intervals wider than ±15% should not be used in calibration and validation.

An individual site summary of all the processed ATC data collected for the Version 2.1 update, including descriptions, total vehicles (prior to adjustment for seasonality or year), date and the confidence interval by time period is provided in Appendix A. Table 3-1 provides an overall summary of the data analysed.

Table 3-1 – Summary of ATC Accuracy

Accuracy	AM Peak	Inter-peak	PM Peak
No. of counts <=5%	34	26	25
No. of counts <=15%	43	42	43
No. of counts >15%	0	1	0
Total counts	**43**	**43**	**43**

The table above shows that with the exception one site during the inter-peak, all counts analysed re within the ±15% threshold for the 95% confidence interval, suggesting the data is suitable for use in model calibration and validation. The count where the inter-peak volume does not satisfy the criteria was located on Grange Road for the eastbound direction. This is a narrow rural road where there are typically less than 20 vehicles per hour during the inter-peak – and so the count is still considered acceptable for all time periods.

As with Version 1, the same count data checks carried out for the A417 Missing Link model were repeated for the GCTM Version 2.1 data preparation, including cross-checking ATCs for adjacent locations and with MCTC data – judging whether the expected profiles were in line with expected trends.

The following anomalies were identified:

- An ATC site sourced from Gloucestershire's traffic data team located on the A438 immediately to the west of M5 Junction 9. For the westbound direction during the AM peak, this count did not match with the adjacent turning count or with or link counts located further west on the link during this particular time period. The count was removed from the calibration process but retained as an independent validation count as the inter-peak and PM peak time period as well as data for the opposite direction matched well with the adjacent sites. The westbound AM peak anomaly was considered as part of the overall link validation review. It was noted that count was made up of two separate loop counters (one for each lane of traffic) which may have been a cause of the inconsistency.
- Analysis of traffic volumes around M5 Junction 8 demonstrated that the southbound off-slip traffic count (derived from WebTRIS) did not correspond with mainline data for the M5 and M50 (also from WebTRIS). The off-slip count was discarded.

Appendix A provides a summary of the processed data for the additional sites collated for the Version 2,1 update (prior to adjustment for seasonality and annual growth to represent March 2015 conditions. This includes confidence interval values where these were able to be calculated.

[1] Design Manual for Roads and Bridges, Volume 12, Section 1, Chapter 6: Survey Methodology and Analysis

4. Journey Time Data

Journey time data for key routes in the model area is required to demonstrate that the GCTM replicates delays in key areas accurately.

Journey time data used in the GCTM V2.1 consists of the following:

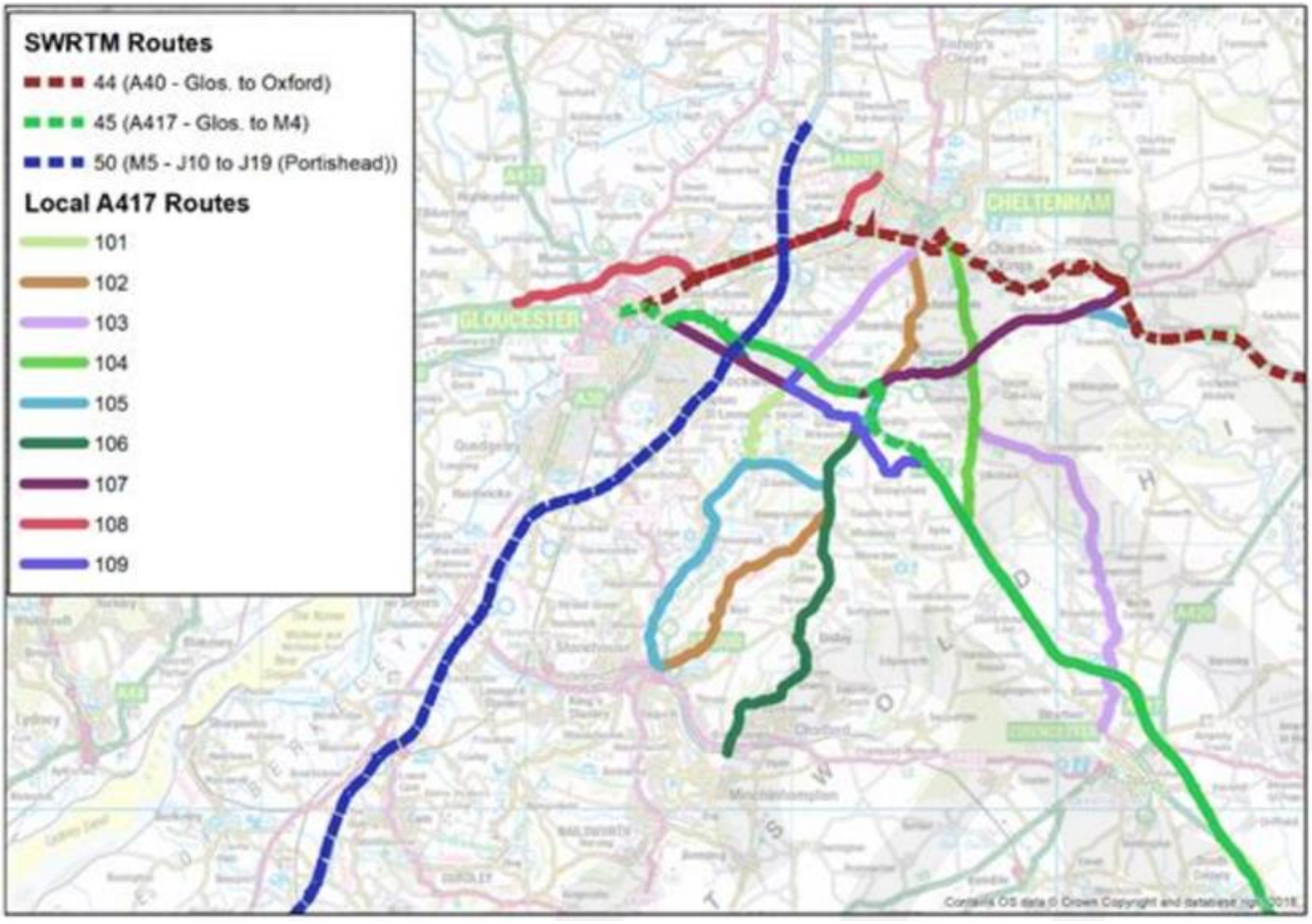
- March 2015 Trafficmaster GPS data for a total of twelve routes (bi-directional) used in the validation of the A417 Missing Link Stage 2 model (shown in Figure 4-1). This includes three routes used originally in the validation of the SWRTM, the rest were included for the specific purpose developing the A417 Missing Link model;
- March 2015 Trafficmaster GPS data for a further nine routes, six covering the Stroud area and three covering the M5 Junction 10 study area (shown in Figure 4-2 and Figure 4-3 respectively) used in the original GCTM Version 1.0 development; and
- March 2015 TomTom Trafficstats GPS data for six routes covering the Tewkesbury area and A46 corridor (four local routes) and the main strategic routes to the north (the M5 corridor and the A46/A435 between Evesham and the M42).

Further details, including the checks undertaken to ensure data was suitable for the purposes of base model validation are provided below.

4.1. GCTM Version 1.0 Journey Time Routes

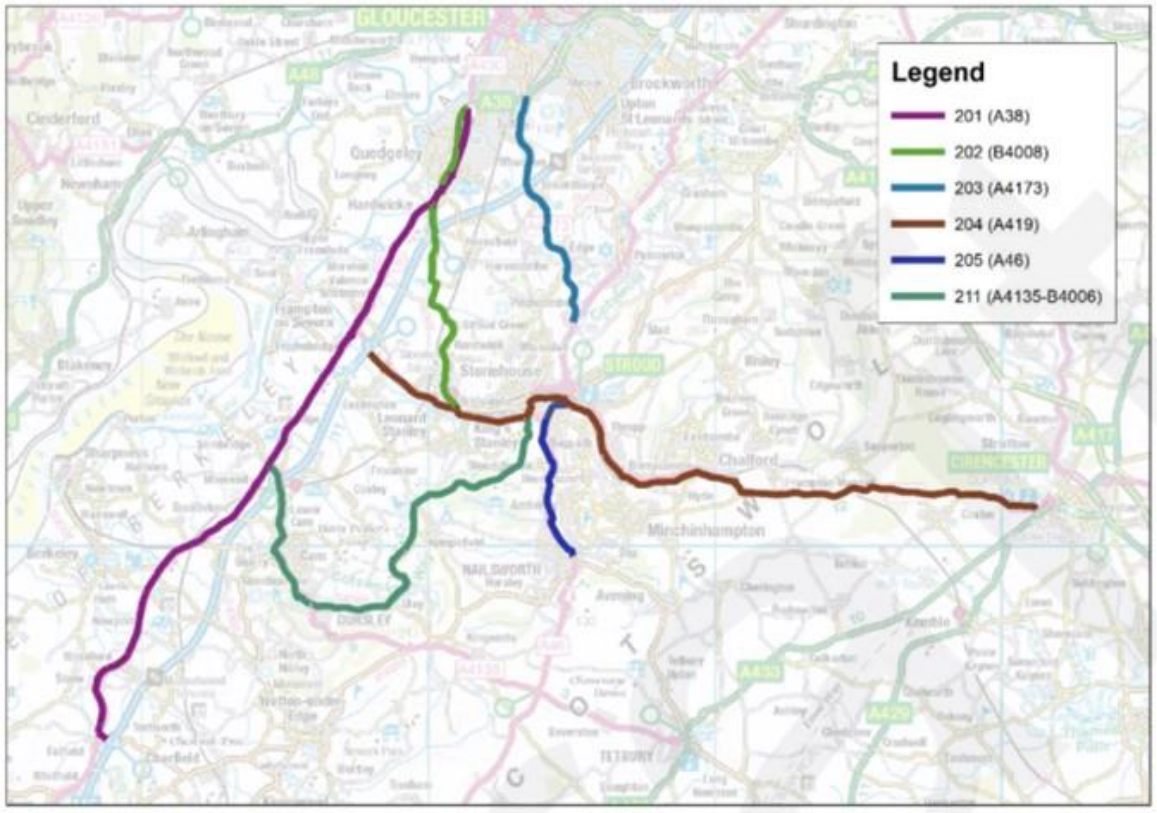
The locations of all journey time routes used for the GCTM Version 1.0 development are shown in Figure 4-1, Figure 4-2 and Figure 4-3.

Figure 4-1 - A417 Missing Link Stage 2 Journey Time Routes



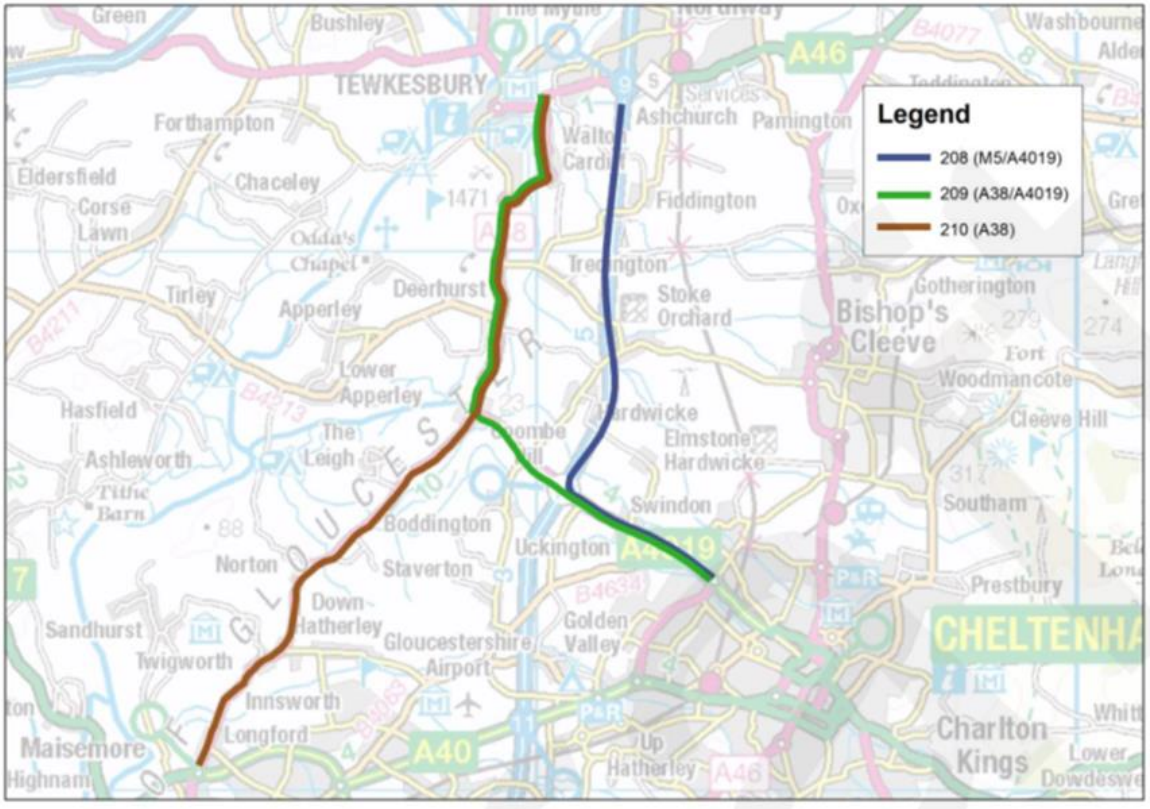
Source: GCTM Version 1 LMVR (Mott MacDonald 10 July 2019)

Figure 4-2 – GCTM Version 1.0 Stroud Study Area Journey Time Routes



Source: GCTM Version 1 LMVR (Mott MacDonald 10 July 2019)

Figure 4-3 – GCTM Version 1.0 M5 Junction 10 Study Area



Source: GCTM Version 1 LMVR (Mott MacDonald 10 July 2019)

The Version 1.0 LMVR documents the consistent checks which Mott MacDonald undertook on the Trafficmaster dataset throughout each phase of model development (as routes were added to initially as part of the A417 Missing Link model and again as part of the GCTM Version 1.0).

The Trafficmaster dataset includes the length of each link. The lengths of all links which Trafficmaster data was processed for was compared against the length in the opposite direction to ensure all required links had been processed. In addition, the link lengths were then compared to the SATURN model link lengths between the selected timing points to ensure consistency with the model. No issues were identified for any routes.

Once journey times were calculated from the Trafficmaster dataset for each link, checks were undertaken on the derived speeds. This included identifying the minimum and maximum speeds and investigating whether the speeds appeared reasonable and whether they occurred in sensible locations. The calculated speeds on each link were also plotted in GIS to identify whether the speeds were logical.

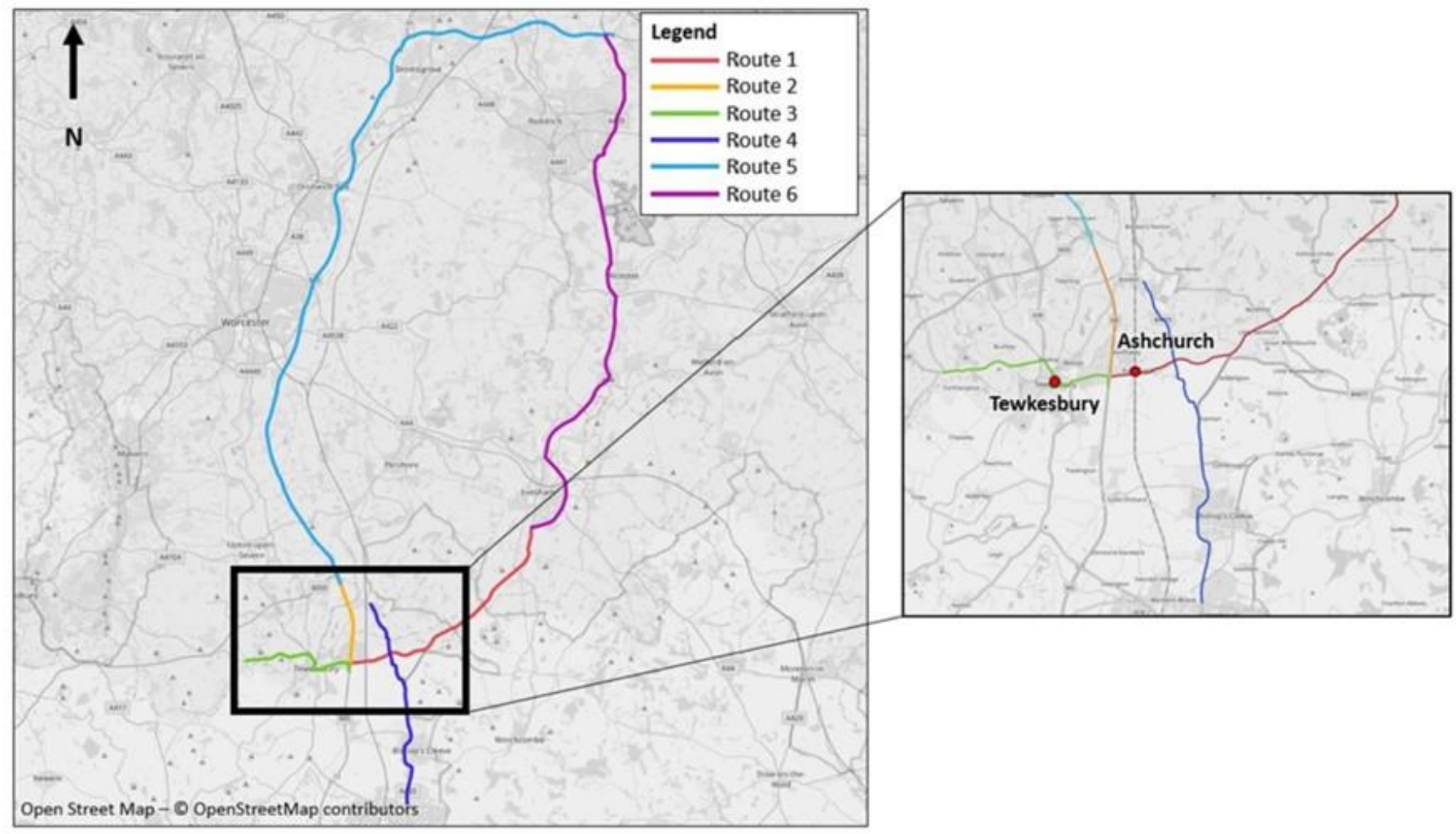
4.2. Version 2.0/2.1 Journey Time Routes

As part of the Version 2.0 update, Atkins collated March 2015 TomTom journey time data across six routes for the purpose of journey time validation. These routes were selected specifically to ensure that the model was capable of reflecting observed journey times and delays for areas directly affected by the proposed M5 Junction 9/A46 Ashchurch Transport scheme. This included consideration of local routes in the immediate study (such as the A46 corridor between M5 Junction 9 and Evesham) but also the key strategic routes to the north of Gloucestershire, noting the potential for the scheme to have an influence on wider strategic movements (by improving the connectivity of the A46 between Gloucestershire and the West Midlands).

This data provided cumulative journey times along key routes in the model, in both directions for each route. The six routes are shown in Figure 4-4, and the descriptions are as follows:

- Route 1 (red): A46 from M5J9 roundabout to A46/A4184 roundabout at Evesham;
- Route 2 (orange): M5J9 slip road to J8;
- Route 3 (green): M5J9 off slip to A438, A38 through Tewkesbury, A438 to B4211 junction NW of Tewkesbury;
- Route 4 (dark blue): Racecourse Roundabout (Cheltenham) to B4079/Kemerton Road Junction, Bredon;
- Route 5 (light blue): M5 from J8, via Catshill Interchange to M42/A435 Portway Island Roundabout; and
- Route 6 (purple): M42/A435 Portway Island Roundabout to A46/A4184 roundabout at Evesham.

Figure 4-4 – GCTM Version 2.0/2.1 Additional Journey Time Routes



Checks on the TomTom journey time data consisted of the following elements:

- Checks of journey route distance against SATURN coded distance;
- Checks on speed by individual time period; and
- Checks on sample size.

The modelled distances were compared with the TomTom distances along each route to ensure that they were consistent. Where any significant differences in distances arose, the model was checked, and, where necessary, corrected. In particular due to the sparser nodes on the strategic network, it was found that on a couple of the motorway-based journey time routes, the SATURN nodes were not in the correct location to compare with the TomTom data. By shifting the location of these nodes along the network (i.e. without a net change in link distance), a better match between journey time data and the SATURN network was achieved for comparison purposes.

Checks on speed originally revealed significant variation in delay for Route 4 (between the A435 and B4079). This was attributed to the 2015 Cheltenham Festival (with the racecourse located on the southern end of the route) which took place between the 10th and 13th March. Data was therefore re-extracted, excluding the week of the festival which resulted in a more logical distribution of speed changes across time period and by location.

In terms of sample size, the TomTom data was provided with a sample size for each route and time period, representing the average sample size of each TomTom segment in the route. This was then averaged across the peak period hours to provide the sample sizes presented in Table 4-1. This showed that all of the journey time routes featured an appropriate sample size, ranging from ~4,500 for the M5/M42 routes, to ~150 for the A435/B4079 routes, with no individual segment sample lower than 50.

Table 4-1 – TomTom Journey Time Sample Sizes

Route no.	Route	Average Segment Hourly Sample		
		AM	IP	PM
1	A46 EB	516	468	482
	A46 WB	532	533	444
2	M5 J8 to J9	3,488	3,029	2,854
	M5 J9 to J8	2,957	3,746	3,523
3	A438 WB	139	165	133
	A438 EB	129	137	91
4	A435/B4079 NB	147	141	185
	A435/B4079 SB	172	157	119
5	M5/M42 NB	4,010	4,657	4,309
	M5/M42 SB	4,587	4,288	4,318
6	A435/A46 SB	541	498	445
	A435/A46 NB	519	519	463

Appendix B contains information relating to the travel times of the six routes.

- Table B1 details the average total travel time for each route for individual hours across the model time periods and the Saturday and overnight time periods as well.
- Table B2 shows the variability in travel time for the same time periods, presenting the 25th, 50th (average) and 75th percentiles.

5. Summary

Data collection for development of the GCTM (Version 2.1) has involved the following:

- Use of existing A417 Stage 2 Missing Link model prior matrices (themselves derived originally from the SWRTM prior matrices) which have been developed from a range of data sources including MPD, 2011 National Census Data, National Travel Survey Data, Trafficmaster OD data and DfT base year freight matrices;
- Collation of long-term link count data from a range of data sources on an incremental basis, including WebTRIS data (for the strategic road network) and ATC data collected for the local road network across Gloucestershire and some from within Worcestershire (in the vicinity of Tewkesbury);
- MCTCs for a number of key junctions across the Gloucestershire area either collected for the specific purposes of developing the GCTM or sourced from data collection programmes conducted for several Paramics models focusing on different locations along the M5 corridor;
- March 2015 Trafficmaster GPS journey time data for 21 routes across the original GCTM (Version 1 area) including key routes in the vicinity of Stroud and the M5 Junction 10 study area; and
- March 2015 TomTom GPS journey time data for 6 selected routes in the vicinity of the M5 Junction 9/A46 Ashchurch scheme and longer strategic movements north of Gloucestershire.

Key findings and observations from the data processing and checking activities include:

- As documented in the SWRTM MVR, the MPD used as the primary OD data source to develop the initial SWRTM prior matrices underwent an extension verification process – including elimination of non-car based trips, and correcting for bias in the data associated with the mobile phone-owning population;
- Where possible, the accuracy of ATC data collated for the GCTM Version 2.0/2.1 update was quantified by calculating confidence intervals for all three model time periods. This analysis demonstrated that across all three time periods, the counts achieve very good levels of accuracy, with almost all counts having 95% confidence levels of better than 15%.
- It was not possible to calculate confidence intervals for data already incorporated within the Version 1.0 update (or from earlier stages of model development). However, a number of alternative checks were undertaken to ensure the suitability and accuracy of count data at each stage of developing and expanding the GCTM. This included checks on tidality (to confirm flow directions were logical), checks for anomalies (spikes and troughs not matching overall trends) and cross-checks between ATC and MCTC data to ensure consistency for adjacent locations;
- Journey time data (from both the Trafficmaster and TomTom GPS datasets) was checked by comparing segment distances against the corresponding model network and by checking speeds by individual time period. Available sample rates for the TomTom data (used in the Version 2.0/2.1 update) also confirmed a high sampling rate for those routes.

On the basis of the analysis conducted on the survey data, it is considered that overall the data provides a sound basis for the developing and validating the GCTM base year traffic assignments. Further checks on data have been conducted throughout the model development process and in preparing the models for use in individual scheme assessments as documented in the GCTM 2.1 LMVR and the separate model package overviews for the appraisal of the M5 Junction 9/A46 (Aschurch) transport scheme and the M5 Junction 10 transport improvements scheme.

Appendices

Appendix A. GCTM Version 2.0/2.1 Count Data Summary

Table A-1 – Summary of New ATC Data Collected for GCTM Version 2.0/2.1 Update

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
7002/1	TMU Site 7002/1 on link A46 southbound between A435 near Alcester and B439	Link	WebTRIS	408475	254100	Mar-17	SB	756	-	638	-	927	-
7005/1	TMU Site 7005/1 on link A46 southbound between B4079 and M5	Link	WebTRIS	393883	233584	Mar-17	SB	754	-	667	-	819	-
7005/2	TMU Site 7005/2 on link A46 northbound between M5 and B4079	Link	WebTRIS	393880	233589	Mar-17	NB	923	-	690	-	849	-
M5/7457B	MIDAS site at M5/7457B priority 1 on link 109001601	Link	WebTRIS	388711	255507	Mar-17	NB	3205	-	3372	-	3690	-
M5/7482B	MIDAS site at M5/7482B priority 1 on link 109001601	Link	WebTRIS	388120	253057	Mar-17	NB	3111	-	3263	-	3576	-
30360931	TAME Site 30360931 on link A46 northbound between A4184 and B439	Link	WebTRIS	404123	246217	Mar-16	NB	942	-	653	-	832	-
30360932	TAME Site 30360932 on link A46 southbound between B439 and A4184	Link	WebTRIS	404136	246220	Mar-16	SB	724	-	650	-	921	-
30361812	TAME Site 30361812 on link A46 southbound between B4035 and A44 near Evesham (east)	Link	WebTRIS	405230	242989	Mar-16	SB	1041	-	915	-	1033	-
30361813	TAME Site 30361813 on link A46 northbound between A44 near Evesham (east) and B4035	Link	WebTRIS	405225	242991	Mar-16	NB	944	-	861	-	1059	-
30361814	TAME Site 30361814 on link A46 northbound between A44 near Evesham (south) and A44 near Evesham (east)	Link	WebTRIS	403404	241728	Mar-16	NB	712	-	559	-	694	-
30361815	TAME Site 30361815 on link A46 southbound between A44 near Evesham (east) and A44 near Evesham (south)	Link	WebTRIS	403404	241716	Mar-16	SB	681	-	617	-	830	-
7001/1	TMU Site 7001/1 on link A46 northbound between B439 and A435 near Alcester	Link	WebTRIS	407983	251953	Mar-16	NB	866	-	643	-	796	-
7003/1	TMU Site 7003/1 on link A46 southbound between A4184 and B4035	Link	WebTRIS	405364	244694	Mar-16	SB	1044	-	1035	-	1233	-
7003/2	TMU Site 7003/2 on link A46 northbound between B4035 and A4184	Link	WebTRIS	405360	244691	Mar-16	NB	1154	-	924	-	1108	-
7004/1	TMU Site 7004/1 on A46 northbound between A435 near Bishop's Cleeve and A44 near Evesham (south)	Link	WebTRIS	400351	237031	Mar-16	NB	651	-	543	-	825	-
7004/2	TMU Site 7004/2 on A46 southbound between A44 near Evesham (south) and A435 near Bishop's Cleeve	Link	WebTRIS	400354	237027	Mar-16	SB	731	-	554	-	652	-
7035/1	TMU Site 7035/1 on link M5 J9 southbound exit	Link	WebTRIS	391670	233396	Mar-16	SB	501	-	248	-	257	-
7036/1	TMU Site 7036/1 on link M5 J9 northbound exit	Link	WebTRIS	391552	232870	Mar-16	NB	961	-	636	-	855	-
7036/2	TMU Site 7036/2 on link M5 northbound within J9	Link	WebTRIS	391575	232869	Mar-16	NB	2040	-	2490	-	2862	-
M5/7493A	MIDAS site at M5/7493A priority 1 on link 109001701	Link	WebTRIS	387641	252044	Mar-16	SB	2807	-	2512	-	2672	-
M5/7494B	MIDAS site at M5/7494B priority 1 on link 109002001	Link	WebTRIS	387586	251984	Mar-16	NB	2384	-	2730	-	2863	-
M5/7549A	MIDAS site at M5/7549A priority 1 on link 123004301	Link	WebTRIS	386549	246669	Mar-16	SB	3232	-	2753	-	3008	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
M5/7571B	MIDAS site at M5/7571B priority 1 on link 109001802	Link	WebTRIS	387278	244603	Mar-16	NB	2712	-	3020	-	3258	-
M5/7645B	MIDAS site at M5/7645B priority 1 on link 109001202	Link	WebTRIS	390872	238600	Mar-16	NB	2075	-	2495	-	2774	-
M5/7650B	MIDAS site at M5/7650B priority 1 on link 109002101	Link	WebTRIS	391040	238136	Mar-16	NB	2413	-	2840	-	3447	-
M50/2092A	MIDAS site at M50/2092A priority 1 on link 109011201	Link	WebTRIS	383458	234343	Mar-16	WB	958	-	920	-	1209	-
M50/2092B	MIDAS site at M50/2092B priority 1 on link 109011801	Link	WebTRIS	383440	234346	Mar-16	EB	1117	-	888	-	824	-
7636/1	TMU Site 7636/1 on A46 northbound between A435 near Alcester and A422	Link	WebTRIS	409992	256678	Mar-16	NB	816	-	518	-	597	-
7636/2	TMU Site 7636/2 on A46 southbound between A422 and A435 near Alcester	Link	WebTRIS	409993	256673	Mar-16	SB	478	-	545	-	807	-
M5/7287B	MIDAS site at M5/7287B priority 1 on link 394320270860	Link	WebTRIS	394320	270860	Sep-15	NB	3979	-	3617	-	3922	-
M50/2020B	MIDAS site at M50/2020B priority 1 on link 109002603	Link	WebTRIS	389527	237869	Mar-15	EB	1535	-	1001	-	989	-
7008/1	TMU Site 7008/1 on link M5 J8 northbound exit	Link	WebTRIS	390860	238562	Mar-14	NB	326	-	310	-	610	-
M5/7472A	MIDAS site at M5/7472A priority 1 on link 109001901	Link	WebTRIS	388413	254005	Mar-14	SB	3775	-	3186	-	3666	-
7035/2	TMU Site 7035/2 on link M5 southbound within J9	Link	WebTRIS	391649	233399	Mar-15	SB	2689	-	2132	-	2282	-
M5/7632J	MIDAS site at M5/7632J priority 1 on link 123004401	Link	WebTRIS	390582	239485	Mar-15	SB	613	-	564	-	723	-
M5/7645A	MIDAS site at M5/7645A priority 1 on link 109002201	Link	WebTRIS	390894	238592	Mar-15	SB	2342	-	1812	-	2028	-
M5/7288A	MIDAS site at M5/7288A priority 1 on link 125028901	Link	WebTRIS	394341	270728	Mar-15	SB	4039	-	3529	-	4393	-
M5/7370A	MIDAS site at M5/7370A priority 1 on link 109001401	Link	WebTRIS	391277	263421	Mar-15	SB	3896	-	3295	-	3971	-
M5/7370B	MIDAS aite at M5/7370B priority 1 on link 109003001	Link	WebTRIS	391288	263449	Mar-15	NB	3620	-	3601	-	3966	-
M50/2020A	MIDAS site at M50/2020A priority 1 on link 109012101	Link	WebTRIS	389528	237850	Mar-18	WB	1098	-	1074	-	1466	-
000000005066	Stoke Orchard Rd West Of Bishops Cleeve	ATC	GCC	393143	228010	Sep-18	WB	271	2%	251	3%	393	6%
000000005066	Stoke Orchard Rd West Of Bishops Cleeve	ATC	GCC	393143	228010	Sep-18	EB	143	2%	115	4%	139	4%
000000004109	Tewkesbury Eastern Bypss	ATC	GCC	389799	231165	Mar-19	NB	285	4%	262	5%	399	4%
000000004109	Tewkesbury Eastern Bypss	ATC	GCC	389799	231165	Mar-19	SB	397	2%	252	6%	319	2%
000000004158	High Street, Tewkesbury	ATC	GCC	389388	233065	Mar-19	NB	371	1%	446	4%	564	1%
000000004158	High Street, Tewkesbury	ATC	GCC	389388	233065	Mar-19	SB	559	2%	423	4%	449	2%
000000007001	Trprs Lodge W B-On-Hill	ATC	GCC	414921	233367	Mar-19	NB	246	2%	325	5%	453	4%
000000007001	Trprs Lodge W B-On-Hill	ATC	GCC	414921	233367	Mar-19	SB	440	2%	290	4%	257	3%
000000003007	South Of M50	ATC	GCC	375696	232832	Mar-19	NB	206	2%	186	5%	301	4%
000000003007	South Of M50	ATC	GCC	375696	232832	Mar-19	SB	333	2%	173	4%	190	3%
000000005024	Bishops Cleeve Bypass	ATC	GCC	395163	226796	Mar-19	NB	530	2%	520	5%	791	2%
000000005024	Bishops Cleeve Bypass	ATC	GCC	395163	226796	Mar-19	SB	786	3%	502	3%	549	3%
000000005017	Ashchurch Rd Tewks	ATC	GCC	391414	233161	Mar-19	EB	634	3%	622	6%	762	3%

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
000000005017	Ashchurch Rd Tewks	ATC	GCC	391414	233161	Mar-19	WB	448	2%	505	3%	621	9%
000000000275	Hyde Lane	ATC	GCC	395480	225880	Mar-19	NB	503	6%	511	6%	650	10%
000000000275	Hyde Lane	ATC	GCC	395480	225880	Mar-19	SB	676	6%	503	6%	519	6%
000000004149	Bredon Road, Tewkesbury	ATC	GCC	389587	233315	Mar-19	NB	361	2%	383	3%	519	2%
000000004149	Bredon Road, Tewkesbury	ATC	GCC	389587	233315	Mar-19	SB	500	1%	393	4%	485	3%
000000005014	East Of Teddington Hands	ATC	GCC	396538	233870	Mar-19	EB	297	3%	218	5%	245	5%
000000005014	East Of Teddington Hands	ATC	GCC	396538	233870	Mar-19	WB	244	3%	236	4%	291	3%
000000006002	Stanton	ATC	GCC	405586	234170	Mar-19	NB	143	4%	126	4%	182	13%
000000006002	Stanton	ATC	GCC	405586	234170	Mar-19	SB	157	7%	137	8%	149	3%
000000006003	North Of Winchcombe	ATC	GCC	403151	229748	Mar-19	NB	131	4%	140	4%	210	13%
000000006003	North Of Winchcombe	ATC	GCC	403151	229748	Mar-19	SB	177	7%	150	9%	148	4%
000000007011	Broadway Rd, Willersey	ATC	GCC	410336	239182	Jun-19	NB	156	2%	146	4%	153	14%
000000007011	Broadway Rd, Willersey	ATC	GCC	410336	239182	Jun-19	SB	159	6%	158	12%	180	4%
000000010770	Gretton Road (North)	ATC	GCC	400038	232337	Nov-18	NB	74	2%	57	4%	61	14%
000000010771	Gretton Road (South)	ATC	GCC	400196	231810	Nov-18	SB	72	3%	56	12%	61	5%
000000010100	Hillend Road, Twyning	ATC	GCC	389838	237224	Nov-14	NB	37	10%	35	5%	42	5%
000000010100	Hillend Road, Twyning	ATC	GCC	389838	237224	Nov-14	SB	44	12%	35	11%	34	8%
000000010474	The Park	ATC	GCC	391868	234073	Jan-17	NB	135	4%	182	8%	331	4%
000000010474	The Park	ATC	GCC	391868	234073	Jan-17	SB	268	2%	149	6%	159	4%
000000010497	Two Hedges Road	ATC	GCC	396756	227016	Mar-17	EB	161	3%	159	6%	222	7%
000000010497	Two Hedges Road	ATC	GCC	396756	227016	Mar-17	WB	255	3%	167	4%	203	8%
407422	B4211 Corse Lawn	ATC	WCC	383250	230950	Feb-17	All	274	5%	185	11%	241	6%
407524	B4632 Long Acre, Station Road, Broadway	ATC	WCC	408850	238150	Oct-18	NB	139	-	237	-	259	-
407524	B4632 Long Acre, Station Road, Broadway	ATC	WCC	408850	238150	Oct-18	SB	177	-	201	-	148	-
407549	B4078 Winchcombe Road, Sedgeberrow	ATC	WCC	402550	238150	Jun-19	NB	1	-	0	-	0	-
407549	B4078 Winchcombe Road, Sedgeberrow	ATC	WCC	402550	238150	Jun-19	SB	42	-	52	-	51	-
2060095	A38 Sth of A4014 junction	ATC	WCC	386750	241050	Mar-17	NB	466	4%	281	9%	275	5%
2060095	A38 Sth of A4014 junction	ATC	WCC	386750	241050	Mar-17	SB	319	5%	311	13%	586	7%
13021731	B4080 Tewkesbury Road, Bredon	ATC	WCC	391850	236550	Jan-14	SB	278	7%	171	7%	192	15%
13021731	B4080 Tewkesbury Road, Bredon	ATC	WCC	391850	236550	Jan-14	NB	154	9%	179	11%	276	10%
17022188	B4208 Pendock	ATC	WCC	378250	233150	Nov-17	NB	96	-	75	-	76	-
17022188	B4208 Pendock	ATC	WCC	378250	233150	Nov-17	SB	75	-	68	-	89	-
3655_IC_26_7.	A441	ATC	NTM	404392	261867	Mar-15	SB	138	-	159	-	226	-
3655_IC_26_7.	A441	ATC	NTM	404392	261867	Mar-15	NB	265	-	184	-	200	-
3655_IC_26_6.	A435	ATC	NTM	407736	261751	Mar-15	SB	714	-	467	-	680	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
3655_IC_26_6.	A435	ATC	NTM	407736	261751	Mar-15	NB	796	-	545	-	796	-
TPM ATC1	Church Street	ATC	Tewkesbury Paramics	388906	232358	Jul-17	NB	380	2%	427	4%	529	3%
TPM ATC1	Church Street	ATC	Tewkesbury Paramics	388906	232358	Jul-17	SB	457	2%	420	4%	451	4%
TPM ATC2	Harwick Bank Road	ATC	Tewkesbury Paramics	391715	234900	Jul-17	NB	164	2%	157	6%	293	3%
TPM ATC2	Harwick Bank Road	ATC	Tewkesbury Paramics	391715	234900	Jul-17	SB	227	2%	130	4%	178	2%
TPM ATC3	Grange Road	ATC	Tewkesbury Paramics	393539	234394	Jul-17	EB	26	15%	14	16%	33	9%
TPM ATC3	Grange Road	ATC	Tewkesbury Paramics	393539	234394	Jul-17	WB	19	10%	12	7%	18	9%
TPM ATC4	A46 East of Aston Cross	ATC	Tewkesbury Paramics	395491	233718	Jul-17	EB	657	2%	605	5%	675	4%
TPM ATC4	A46 East of Aston Cross	ATC	Tewkesbury Paramics	395491	233718	Jul-17	WB	662	3%	629	4%	664	6%
TPM ATC5	A46 nr petrol station, Ashchurch	ATC	Tewkesbury Paramics	392184	233178	Jul-17	EB	849	2%	778	3%	880	4%
TPM ATC5	A46 nr petrol station, Ashchurch	ATC	Tewkesbury Paramics	392184	233178	Jul-17	WB	1053	4%	857	3%	974	6%
TPM TC3	M5 North to A46 East	MCTC	Tewkesbury Paramics Model	391610	233130	01/07/2017	SB	324	-	-	-	209	-
TPM TC3	M5 North to Circ	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	SB	204	-	-	-	99	-
TPM TC3	A46 East to M5 South	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	WB	548	-	-	-	571	-
TPM TC3	A46 East to Circ	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	WB	476	-	-	-	634	-
TPM TC3	M5 South to A46 West	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	NB	426	-	-	-	370	-
TPM TC3	M5 South to Circ	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	NB	496	-	-	-	485	-
TPM TC3	A46 West to M5 North	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	EB	125	-	-	-	194	-
TPM TC3	A46 West to Circ	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	EB	553	-	-	-	608	-
TPM TC3	M5 J9 NB On-Slip	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	NB	373	-	-	-	515	-
TPM TC3	M5 J9 A46 Eastbound Exit	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	EB	1070	-	-	-	899	-
TPM TC3	M5 J9 SB On-Slip	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	SB	850	-	-	-	973	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
TPM TC3	M5 J9 A46 Westbound Exit	MCTC	Tewkesbury Paramics Model	391610	233130	12/07/2017	WB	859	-	-	-	784	-
TPM TC1	From Gloucester Road SB	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	SB	482	-	-	-	441	-
TPM TC1	From Jubilee Way	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	SB	350	-	-	-	324	-
TPM TC1	From Gloucester Road NB	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	NB	470	-	-	-	722	-
TPM TC1	To Gloucester Road NB	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	NB	358	-	-	-	567	-
TPM TC1	To Jubilee Way	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	NB	244	-	-	-	370	-
TPM TC1	To Gloucester Road SB	MCTC	Tewkesbury Paramics Model	389460	230928	12/07/2017	SB	700	-	-	-	550	-
TPM TC5	A38 Ashchurch Road East to A38 South	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	E to S	178	-	-	-	325	-
TPM TC5	A38 Ashchurch Road East to A38 Ashchurch Road West	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	E to W	386	-	-	-	522	-
TPM TC5	A38 South to A38 Ashchurch Road East	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	S to E	320	-	-	-	203	-
TPM TC5	A38 South to A38 Ashchurch Road West	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	S to W	132	-	-	-	137	-
TPM TC5	A38 Ashchurch Road West to A38 Ashchurch Road East	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	W to E	475	-	-	-	415	-
TPM TC5	A38 Ashchurch Road West to A38 South	MCTC	Tewkesbury Paramics Model	390120	232917	12/07/2017	W to S	69	-	-	-	177	-
TPM TC7	A38 High Street to A438 Barton Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	N to E	142	-	-	-	139	-
TPM TC7	A38 High Street to Church Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	N to W	343	-	-	-	296	-
TPM TC7	A438 Barton Street to A38 High Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	E to N	145	-	-	-	192	-
TPM TC7	A438 Barton Street to Church Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	E to W	172	-	-	-	219	-
TPM TC7	Church Street to A38 High Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	W to N	212	-	-	-	343	-
TPM TC7	Church Street to A438 Barton Street	MCTC	Tewkesbury Paramics Model	389277	232672	12/07/2017	W to E	216	-	-	-	202	-
TPM TC9	B4080 Bredon Road to A38 High Street	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	E to S	214	-	-	-	187	-
TPM TC9	B4080 Bredon Road to A38 Mythe Road	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	E to W	119	-	-	-	157	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
TPM TC9	A38 High Street to B4080 Bredon Road	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	S to E	118	-	-	-	193	-
TPM TC9	A38 High Street to A38 Mythe Road	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	S to W	221	-	-	-	347	-
TPM TC9	A38 Mythe Road to B4080 Bredon Road	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	W to E	114	-	-	-	117	-
TPM TC9	A38 Mythe Road to A38 High Street	MCTC	Tewkesbury Paramics Model	389431	233177	12/07/2017	W to S	371	-	-	-	292	-
TPM TC11	B4080 Tewkesbury Road North to Hardwick Bank Road	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	N to E	110	-	-	-	63	-
TPM TC11	B4080 Tewkesbury Road North to B4080 Tewkesbury Road South	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	N to S	190	-	-	-	195	-
TPM TC11	Hardwick Bank Road to B4080 Tewkesbury Road North	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	E to N	63	-	-	-	131	-
TPM TC11	Hardwick Bank Road to B4080 Tewkesbury Road South	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	E to S	112	-	-	-	175	-
TPM TC11	B4080 Tewkesbury Road South to B4080 Tewkesbury Road North	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	S to N	156	-	-	-	184	-
TPM TC11	B4080 Tewkesbury Road South to Hardwick Bank Road	MCTC	Tewkesbury Paramics Model	391135	235193	12/07/2017	S to E	122	-	-	-	105	-
TPM TC12	Hardwick Bank Road to Northway Lane East	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	N to E	102	-	-	-	52	-
TPM TC12	Hardwick Bank Road to Northway Lane West	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	N to W	40	-	-	-	30	-
TPM TC12	Northway Lane East to Hardwick Bank Road	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	E to N	41	-	-	-	86	-
TPM TC12	Northway Lane East to Northway Lane West	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	E to W	88	-	-	-	118	-
TPM TC12	Northway Lane West to Hardwick Bank Road	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	W to N	41	-	-	-	51	-
TPM TC12	Northway Lane West to Northway Lane East	MCTC	Tewkesbury Paramics Model	392343	234079	12/07/2017	W to E	125	-	-	-	140	-
TPM TC14	B4079 North to A46 East	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	N to E	59	-	-	-	43	-
TPM TC14	B4079 North to B4079 South	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	N to S	87	-	-	-	65	-
TPM TC14	B4079 North to A46 West	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	N to W	99	-	-	-	39	-
TPM TC14	A46 East to B4079 North	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	E to N	14	-	-	-	33	-
TPM TC14	A46 East to B4079 South	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	E to S	1	-	-	-	3	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
TPM TC14	A46 East to A46 West	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	E to W	614	-	-	-	639	-
TPM TC14	B4079 South to B4079 North	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	S to N	55	-	-	-	108	-
TPM TC14	B4079 South to A46 East	MCTC	Tewkesbury Paramics Model	394195	233748	14/07/2017	S to E	3	-	-	-	4	-
TPM TC14	B4079 South A46 West	MCTC	Tewkesbury Paramics	394195	233748	14/07/2017	S to W	208	-	-	-	147	-
TPM TC14	A46 West to B4079 North	MCTC	Tewkesbury Paramics	394195	233748	14/07/2017	W to N	35	-	-	-	58	-
TPM TC14	A46 West to A46 East	MCTC	Tewkesbury Paramics	394195	233748	14/07/2017	W to E	530	-	-	-	678	-
TPM TC14	A46 West to B4079 South	MCTC	Tewkesbury Paramics	394195	233748	14/07/2017	W to S	100	-	-	-	102	-
TPM TC17	Northway Lane to A46 East	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	N to E	137	-	-	-	122	-
TPM TC17	Northway Lane to A46 West	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	N to W	159	-	-	-	159	-
TPM TC17	A46 East to Northway Lane	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	E to N	110	-	-	-	112	-
TPM TC17	A46 East to A46 West	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	E to W	846	-	-	-	793	-
TPM TC17	A46 West to Northway Lane	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	W to N	114	-	-	-	115	-
TPM TC17	A46 West to A46 East	MCTC	Tewkesbury Paramics	392432	233210	12/07/2017	W to E	753	-	-	-	801	-
TPM TC18	A46 North East to B4077	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	NE to SE	11	-	-	-	24	-
TPM TC18	A46 North East to A435	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	NE to SE	320	-	-	-	269	-
TPM TC18	A46 North East to A46 West	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	NE to W	391	-	-	-	373	-
TPM TC18	B4077 to A46 North East	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	SE to NE	7	-	-	-	11	-
TPM TC18	B4077 to A435	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	SE to S	82	-	-	-	76	-
TPM TC18	B4077 to A46 West	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	SE to W	166	-	-	-	219	-
TPM TC18	A435 to A46 North East	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	S to NE	245	-	-	-	349	-
TPM TC18	A435 to B4077	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	S to SE	75	-	-	-	71	-

Site	Description	Type	Source	XCoord	YCoord	Date	Direction	AM Peak		Inter-peak		PM Peak	
								Total Veh	CI	Total Veh	CI	Total Veh	CI
TPM TC18	A435 to A46 West	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	S to W	51	-	-	-	36	-
TPM TC18	A46 West to A46 North East	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	W to NE	390	-	-	-	475	-
TPM TC18	A46 West to B4077	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	W to SE	228	-	-	-	176	-
TPM TC18	A46 West to A435	MCTC	Tewkesbury Paramics	396404	233952	12/07/2017	W to S	56	-	-	-	45	-

Appendix B. GCTM Version 2.0/2.1 Journey Time Route Summary

B.1. Average Travel Times

Route no.	Route	Length (km)	Average travel Time (hh.mm.ss)													
			Weekday 7-8	Weekday 8-9	Weekday 9-10	Weekday 10-11	Weekday 11-12	Weekday 12-13	Weekday 13-14	Weekday 14-15	Weekday 15-16	Weekday 16-17	Weekday 17-18	Weekday 18-19	Sat 10-16	Overnight
1	A46 EB	15.90	00:15:49	00:16:41	00:15:15	00:15:24	00:15:17	00:15:00	00:15:01	00:14:57	00:15:13	00:15:34	00:15:59	00:15:05	00:14:36	00:13:34
	A46 WB	16.21	00:18:31	00:19:38	00:17:45	00:16:58	00:17:30	00:16:42	00:15:56	00:15:37	00:16:19	00:17:36	00:16:59	00:15:06	00:15:12	00:14:12
2	M5 J8 to J9	5.94	00:03:54	00:04:10	00:04:16	00:03:59	00:03:41	00:03:39	00:03:38	00:03:35	00:03:35	00:03:39	00:03:36	00:03:28	00:03:26	00:03:48
	M5 J9 to J8	5.94	00:03:25	00:03:28	00:03:29	00:03:34	00:03:32	00:03:33	00:03:34	00:03:32	00:03:30	00:03:30	00:03:30	00:03:31	00:03:16	00:03:45
3	A438 WB	11.09	00:12:20	00:17:21	00:14:34	00:18:28	00:17:08	00:16:56	00:16:09	00:14:25	00:14:57	00:14:19	00:15:57	00:11:33	00:16:18	00:12:19
	A438 EB	10.65	00:13:56	00:18:02	00:15:29	00:15:52	00:16:24	00:14:50	00:19:22	00:12:37	00:13:43	00:14:23	00:13:50	00:14:07	00:19:35	00:13:16
4	A435/B4079 NB	14.10	00:15:53	00:17:21	00:15:52	00:16:00	00:16:45	00:16:03	00:15:43	00:15:48	00:15:57	00:17:26	00:19:44	00:20:43	00:15:33	00:13:30
	A435/B4079 SB	14.13	00:18:02	00:23:02	00:17:21	00:20:36	00:25:00	00:21:54	00:17:08	00:15:57	00:17:01	00:17:29	00:18:29	00:16:58	00:23:22	00:13:36
5	M5/M42 NB	50.88	00:37:25	00:36:05	00:29:43	00:29:26	00:29:34	00:29:53	00:30:14	00:30:09	00:30:51	00:31:01	00:31:59	00:30:23	00:27:33	00:30:50
	M5/M42 SB	50.84	00:30:42	00:30:27	00:30:23	00:31:01	00:30:05	00:29:23	00:29:24	00:29:24	00:29:22	00:29:36	00:29:42	00:29:16	00:30:54	00:31:11
6	A435/A46 SB	36.16	00:34:17	00:37:35	00:33:39	00:34:08	00:34:06	00:33:47	00:32:33	00:32:23	00:33:09	00:33:06	00:34:26	00:31:34	00:34:53	00:30:25
	A435/A46 NB	36.13	00:32:59	00:35:47	00:32:49	00:32:35	00:32:39	00:32:51	00:32:14	00:32:50	00:34:20	00:36:18	00:40:46	00:33:15	00:32:14	00:30:54

B.2. Travel Time Variability

Time period	Percentile	R1 EB	R1 WB	R2 SB	R2 NB	R3 WB	R3 EB	R4 NB	R4 SB	R5 NB	R5 SB	R6 SB	R6 NB
Mon - Fri 7-8	25%	00:13:16	00:13:36	00:03:17	00:02:59	00:08:47	00:09:16	00:12:53	00:13:25	00:27:02	00:26:38	00:27:37	00:27:07
	50%	00:14:45	00:15:15	00:03:42	00:03:15	00:10:30	00:10:36	00:14:41	00:15:40	00:30:47	00:29:12	00:30:43	00:29:59
	75%	00:16:42	00:19:40	00:04:32	00:03:43	00:13:33	00:14:25	00:17:03	00:19:14	00:38:29	00:34:04	00:35:45	00:34:42
Mon - Fri 8-9	25%	00:13:23	00:13:48	00:03:10	00:03:00	00:11:37	00:10:57	00:13:26	00:14:07	00:25:58	00:25:54	00:28:11	00:28:02
	50%	00:14:48	00:15:23	00:03:35	00:03:18	00:14:42	00:13:46	00:15:20	00:17:31	00:29:26	00:28:15	00:32:00	00:31:23
	75%	00:17:04	00:21:03	00:04:19	00:03:53	00:19:40	00:20:02	00:18:32	00:25:00	00:37:00	00:32:58	00:38:32	00:37:46
Mon - Fri 9-10	25%	00:13:06	00:13:40	00:03:06	00:03:02	00:10:01	00:10:22	00:13:13	00:13:49	00:25:35	00:25:54	00:27:54	00:27:45
	50%	00:14:22	00:14:55	00:03:30	00:03:20	00:11:48	00:12:11	00:14:35	00:15:41	00:28:00	00:28:16	00:30:52	00:30:40
	75%	00:15:55	00:17:09	00:04:14	00:03:58	00:14:36	00:15:23	00:16:23	00:18:11	00:33:21	00:33:14	00:34:52	00:34:39
Mon - Fri 10-11	25%	00:13:12	00:13:41	00:03:10	00:03:05	00:13:09	00:11:35	00:13:21	00:13:54	00:25:57	00:26:07	00:28:06	00:27:52
	50%	00:14:29	00:14:54	00:03:32	00:03:23	00:15:13	00:13:21	00:14:44	00:15:58	00:28:22	00:28:26	00:31:06	00:30:48
	75%	00:16:14	00:17:04	00:04:18	00:04:05	00:19:54	00:16:21	00:16:43	00:20:03	00:33:45	00:33:37	00:34:53	00:34:32
Mon - Fri 11-12	25%	00:13:06	00:13:29	00:03:08	00:03:05	00:10:52	00:10:47	00:13:17	00:13:51	00:26:01	00:26:05	00:28:08	00:27:57
	50%	00:14:22	00:14:40	00:03:31	00:03:23	00:17:43	00:13:23	00:14:52	00:15:56	00:28:31	00:28:22	00:31:06	00:30:58
	75%	00:15:58	00:16:41	00:04:18	00:04:06	00:20:28	00:20:05	00:17:13	00:24:03	00:33:59	00:33:37	00:34:52	00:34:44
Mon - Fri 12-13	25%	00:13:07	00:13:27	00:03:07	00:03:06	00:12:00	00:10:51	00:13:01	00:13:33	00:26:12	00:26:00	00:27:56	00:28:02
	50%	00:14:20	00:14:38	00:03:29	00:03:24	00:14:19	00:12:55	00:14:28	00:15:24	00:28:44	00:28:20	00:30:46	00:31:08
	75%	00:15:55	00:16:37	00:04:16	00:04:05	00:19:14	00:16:00	00:16:34	00:19:25	00:34:06	00:33:46	00:34:23	00:34:49
Mon - Fri 13-14	25%	00:13:00	00:13:20	00:03:07	00:03:05	00:11:23	00:13:53	00:12:49	00:13:09	00:26:16	00:25:58	00:27:41	00:27:53
	50%	00:14:13	00:14:31	00:03:28	00:03:23	00:14:00	00:18:43	00:14:08	00:14:42	00:28:52	00:28:20	00:30:26	00:30:45
	75%	00:15:46	00:16:20	00:04:15	00:04:05	00:16:41	00:21:41	00:16:07	00:17:06	00:34:08	00:33:36	00:34:09	00:34:37
Mon - Fri 14-15	25%	00:12:59	00:13:20	00:03:04	00:03:05	00:09:46	00:09:08	00:13:11	00:13:21	00:26:15	00:25:46	00:27:29	00:28:00
	50%	00:14:16	00:14:29	00:03:26	00:03:22	00:11:31	00:10:49	00:14:39	00:14:50	00:28:49	00:28:03	00:30:13	00:31:01
	75%	00:15:55	00:16:23	00:04:08	00:04:00	00:14:29	00:13:26	00:16:45	00:16:56	00:33:49	00:32:53	00:34:00	00:35:08
Mon - Fri 15-16	25%	00:12:59	00:13:20	00:03:04	00:03:04	00:10:26	00:09:05	00:13:06	00:13:24	00:26:16	00:25:47	00:27:36	00:28:01
	50%	00:14:14	00:14:35	00:03:27	00:03:21	00:12:25	00:10:46	00:14:36	00:15:18	00:28:54	00:28:02	00:30:36	00:31:16
	75%	00:15:49	00:16:50	00:03:58	00:03:55	00:16:03	00:14:12	00:16:53	00:17:41	00:33:46	00:32:15	00:35:00	00:36:37
Mon - Fri 16-17	25%	00:13:10	00:13:32	00:03:06	00:03:06	00:10:12	00:10:14	00:13:28	00:13:31	00:26:21	00:26:11	00:27:20	00:28:14
	50%	00:14:29	00:15:04	00:03:29	00:03:22	00:12:17	00:12:32	00:15:03	00:15:27	00:28:53	00:28:29	00:30:04	00:31:54
	75%	00:16:12	00:18:50	00:04:04	00:03:52	00:15:34	00:15:44	00:18:08	00:18:29	00:33:21	00:32:26	00:34:21	00:38:22
Mon - Fri 17-18	25%	00:13:15	00:13:15	00:03:04	00:03:05	00:11:03	00:09:53	00:13:38	00:13:25	00:26:24	00:26:00	00:27:27	00:28:51
	50%	00:14:38	00:14:42	00:03:28	00:03:21	00:13:07	00:11:41	00:15:46	00:15:33	00:29:11	00:28:14	00:30:49	00:35:00
	75%	00:17:02	00:18:17	00:03:57	00:03:51	00:17:04	00:14:49	00:21:55	00:19:12	00:34:46	00:31:54	00:36:59	00:44:50
Mon - Fri 18-19	25%	00:13:03	00:13:03	00:03:00	00:03:05	00:08:46	00:10:40	00:13:48	00:13:06	00:26:01	00:25:48	00:26:52	00:27:34

Time period	Percentile	R1 EB	R1 WB	R2 SB	R2 NB	R3 WB	R3 EB	R4 NB	R4 SB	R5 NB	R5 SB	R6 SB	R6 NB
	50%	00:14:22	00:14:12	00:03:20	00:03:22	00:10:04	00:13:18	00:15:42	00:15:01	00:28:34	00:28:01	00:29:22	00:30:36
	75%	00:15:58	00:16:04	00:03:48	00:03:55	00:12:24	00:15:51	00:20:21	00:17:38	00:33:16	00:31:36	00:32:56	00:35:12
Sat 10-16	25%	00:12:39	00:13:00	00:03:00	00:02:56	00:11:48	00:12:12	00:12:53	00:13:49	00:24:47	00:24:54	00:27:18	00:27:13
	50%	00:13:48	00:14:03	00:03:21	00:03:11	00:13:57	00:17:30	00:14:16	00:16:32	00:26:55	00:26:59	00:30:02	00:29:50
	75%	00:15:14	00:15:49	00:03:45	00:03:28	00:17:16	00:23:06	00:16:18	00:27:13	00:29:26	00:29:30	00:34:13	00:33:29
Mon - Sun 22-6	25%	00:11:53	00:12:31	00:03:13	00:03:13	00:09:58	00:11:00	00:11:50	00:11:52	00:26:36	00:26:37	00:26:54	00:26:46
	50%	00:12:51	00:13:38	00:03:53	00:03:55	00:11:33	00:12:25	00:13:02	00:13:06	00:31:30	00:31:04	00:30:24	00:30:21
	75%	00:14:15	00:15:01	00:04:19	00:04:14	00:13:13	00:14:12	00:14:28	00:14:47	00:34:50	00:34:52	00:32:50	00:33:08

Rob Davies
Atkins Limited
The Axis
10 Holliday Street
Birmingham
B1 1TF

Rob.Davies@atkinsglobal.com

Appendix B. – Data Collection for Operational Modelling

Technical Note

Project:	M5 J10 Stage 3: Operational Modelling		
Subject:	Data Package Report		
Author:	EM		
Date:	15/01/2021	Project No.:	5188483.350
Distribution:		Representing:	

Document history

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 1.0	First Draft	EM	LB	DG	AC	15/01/2021

Client signoff

Client	Gloucestershire County Council
Project	M5 J10 Stage 3: Operational Modelling
Project No.	5188483.350
Client signature / date	

1. Introduction

Atkins was commissioned by Gloucestershire County Council (GCC) to progress the M5 J10 Transport Scheme through the Highways England Project Control Framework (PCF) Stage 3. This report presents the data used for the operational modelling, including a Paramics Discovery v22.0.1 microsimulation model and a strategic SATURN highway assignment model.

2. Base Model Development

Gloucestershire Countywide Traffic Model

The Gloucestershire Countywide Traffic Model (GCTM) is a strategic SATURN highway assignment model that provides a basis for the appraisal of the Stage 3 scheme. The GCTM model reflects average March 2015 weekday traffic conditions. The model was calibrated and validated for the average hours during the AM (0700-1000), IP (1000-1600) and PM (1600-1900) time periods. The following data sources were used in model development:

- GCTM trip matrices obtained by disaggregating and reprocessing of the A417 Missing Link Stage 2 prior trip matrices using relevant 2011 Census data;
- Analysis of relevant count data derived from various sources including data extracted from the Highways England WebTRIS platform as well as the collation of data held by GCC and Worcestershire County Council (WCC) for the local road network; and
- GPS journey time data for journey time validation.

Further details of data used for GCTM development is available in Appendix A.

Paramics Discovery Model

An existing 2017 base-year Paramics Discovery (version 19.0) model was originally developed by Jacobs (legacy CH2M) on behalf of Highways England for the modelling of local transport schemes, with particular focus on the M5 Junction 10 and 11. Atkins undertook a high-level review and sensitivity testing of this model as part of the West Cheltenham Transport Improvement Scheme (WCTIS), in which the resulting model was used to support the Cyber Business Park Phases 1 to 4 schemes.

For this scheme, a cordoned area of the existing 2017 base Paramics model was used, focusing on the M5 J10 and surrounding area affected by Stage 3 of the PCF. This was so that noise from external regions of the model not part of the scheme could be reduced. The model version was updated to version 22.0.1 following updates to the software since the original model development.

Matrices

The existing Paramics Discovery model was developed with a 2017 base year, using a series of ANPR data to develop 3-hour peak period matrices for AM (07:00 – 10:00) and PM (16:00 – 19:00). The data was collected across a 2-week period in November 2017.

For the cordoned M5 J10 model, these existing matrices were used as a basis, and new zones where the model was cut were defined by extracting flows from the larger un-cordoned model.

Model Calibration and Validation

The sections below outline the data used in the model flow and journey time calibration and validation process.

Automatic Traffic Counts (ATC)

As part of the earlier M5J10-J11 Paramics model development and validation, 24-hour ATCs covering a 2-week period were collected in November 2017. A total of 5 counts covering the cordoned model study area were selected for use in the Paramics model flow calibration and validation process. Recorded flows have been averaged to represent neutral weekday flows (Tuesday – Thursday) in both directions during the AM and PM peak hours, 08:00 – 09:00 and 17:00 – 18:00 respectively.

Manual Classified Counts (MCC)

12-hour MCC surveys were undertaken as part of the existing model development on a single neutral weekday

in November 2017 between 07:00 and 19:00. Those coinciding with the cordoned model area were collated for use in calibrating / validating the cordoned base Paramics model. Flows were averaged to represent the AM and PM single peak hour for comparison with the modelled flow.
Both the ATC and MCC counts used in the base model development and calibration / validation process are illustrated in Figure 2-1 below, and the raw data used is detailed in Table 2-1.

Figure 2-1 - Location of existing ATC and MCC surveys used for model calibration and validation

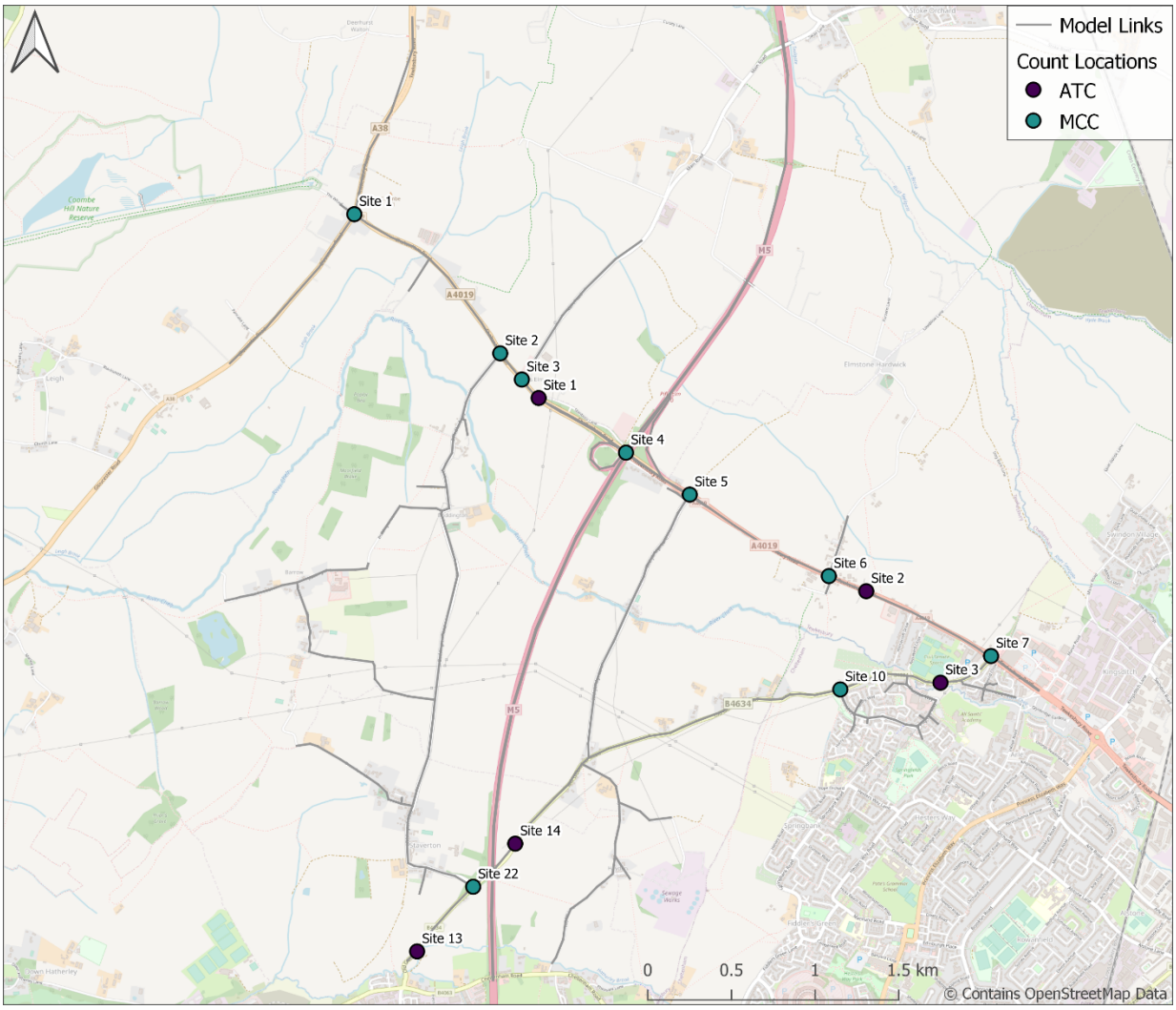


Table 2-1 - Link Count Calibration / Validation Data (Nov 2017)

Ref.	Description	AM (08:00 - 09:00)		PM (17:00 - 18:00)	
		Lights (Car + LGV)	All Vehicles	Lights (Car + LGV)	All Vehicles
MCC 1	Site 1_1 - A38 N to A4019 E	555	563	254	255
	Site 1_2 - A38 N to A38 S	373	382	327	327
	Site 1_4 - A4019 E to A38 S	142	146	308	308
	Site 1_6 - A4019 E to A38 N	374	384	522	522
	Site 1_8 - A38 S to A38 N	421	441	221	224
	Site 1_8 - A38 S to A4019 E	371	379	237	237
MCC 2	Site 2_4 - A4019 E to Piffs Elm Road S	57	57	14	14
	Site 2_5 - A4019 E to A4019 W	469	484	737	739

Ref.	Description	AM (08:00 - 09:00)		PM (17:00 - 18:00)	
		Lights (Car + LGV)	All Vehicles	Lights (Car + LGV)	All Vehicles
	Site 2_7 - Piffs Elm Road S to A4019 W	31	32	63	63
	Site 2_9 - Piffs Elm Road S to A4019 E	14	14	33	33
	Site 2_11 - A4019 W to A4019 E	830	846	478	479
	Site 2_12 - A4019 W to Piffs Elm Road S	102	102	20	20
MCC 3	Site 3_1 - Elmstone Hardwicke N to A4019 E	252	258	117	118
	Site 3_3 - Elmstone Hardwicke N to A4019 W	93	96	94	94
	Site 3_5 - A4019 E to A4019 W	420	431	640	642
	Site 3_6 - A4019 E to Elmstone Hardwicke N	162	166	129	131
	Site 3_10 - A4019 W to Elmstone Hardwicke N	174	178	137	138
	Site 3_11 - A4019 W to A4019 E	667	682	365	365
MCC 4	Site 4_1 - M5 N to A4019 E	445	471	507	511
	Site 4_5 - A4019 E to A4019 W	587	602	733	737
	Site 4_6 - A4019 E to M5 N	289	303	628	639
	Site 4_11 - A4019 W to A4019 E	924	942	487	488
MCC 5	Site 5_4 - A4019 E to Withybridge Lane S	24	24	16	16
	Site 5_5 - A4019 E to A4019 W	632	652	1197	1208
	Site 5_7 - Withybridge Lane S to A4019 W	230	239	178	180
	Site 5_9 - Withybridge Lane S to A4019 E	8	8	4	4
	Site 5_11 - A4019 W to A4019 E	1053	1085	869	874
	Site 5_12 - A4019 W to Withybridge Lane S	313	323	109	109
MCC 6	Site 6_1 - The Green N to A4019 E	205	206	12	12
	Site 6_2 - The Green N to A4019 W	12	12	5	5
	Site 6_5 - A4019 E to A4019 W	659	677	1229	1234
	Site 6_6 - A4019 E to The Green N	15	15	14	14
	Site 6_10 - A4019 W to The Green N	5	6	6	6
	Site 6_11 - A4019 W to A4019 E	1027	1057	862	868
MCC 7	Site 7_1 - Gallagher Retail Park N to A4019 E	7	7	22	22
	Site 7_2 - Gallagher Retail Park N toB4634 S	77	78	168	168
	Site 7_3 - Gallagher Retail Park N to A4019 W	103	104	242	243
	Site 7_4 - A4019 E to B4634 S	101	106	169	169
	Site 7_5 - A4019 E to A4019 W	449	477	788	798
	Site 7_6 - A4019 E to Gallagher Retail Park N	2	2	4	4
	Site 7_7 - B4634 S to A4019 W	104	108	178	179
	Site 7_8 - B4634 S to Gallagher Retail Park N	190	193	164	164
	Site 7_9 - B4634 S to A4019 E	172	177	199	199
	Site 7_10 - A4019 W to Gallagher Retail Park N	245	248	207	208
	Site 7_11 - A4019 W to A4019 E	970	990	571	574

Ref.	Description	AM (08:00 - 09:00)		PM (17:00 - 18:00)	
		Lights (Car + LGV)	All Vehicles	Lights (Car + LGV)	All Vehicles
	Site 7_12 - A4019 W to B4634 S	61	63	106	106
MCC 10	Site 10_4 - B4634 E to Pilgrove Way S	31	31	130	130
	Site 10_5 - B4634 E to B4634 W	225	233	366	367
	Site 10_7 - Pilgrove Way S to B4634 W	53	53	19	19
	Site 10_9 - Pilgrove Way S to B4634 E	111	112	60	60
	Site 10_11 - B4634 W to B4634 E	380	387	359	359
	Site 10_12 - B4634 W to Pilgrove Way S	25	26	43	43
MCC 22	Site 22_2 - B4634 N to B4634 S	350	367	384	385
	Site 22_3 - B4634 N to Unnamed Road W	23	23	14	14
	Site 22_7 - B4634 S to Unnamed Road W	91	94	80	80
	Site 22_8 - B4634 S to B4634 N	469	480	445	448
	Site 22_10 - Unnamed Road W to B4634 N	26	26	46	46
	Site 22_12 - Unnamed Road W to B4634 S	103	103	69	70
ATC 1	ATC 1 - A4019 nr. Elmstone Hardwicke NB	401	421	760	776
	ATC 1 - A4019 nr. Elmstone Hardwicke SB	869	896	506	518
ATC 2	ATC 2 - A4019 nr. Uckington EB	1182	1237	854	875
	ATC 2 - A4019 nr. Uckington WB	622	651	1161	1189
ATC 3	ATC 3 - B4364 Hayden Road	654	672	492	498
	ATC 3 - B4364 Hayden Road	370	380	598	607
ATC 13	ATC 13 - B4364 Old Gloucester Road (lower) NB	495	518	544	554
	ATC 13 - B4364 Old Gloucester Road (lower) SB	427	452	460	469
ATC 14	ATC 14 - B4364 Old Gloucester Road (upper) NB	427	448	498	505
	ATC 14 - B4364 Old Gloucester Road (upper) SB	384	401	402	408

Journey Time Validation

Traffic Master Journey Time (JT) Data for the five routes shown in Figure 2-2 was obtained for the AM and PM peak hours. The Paramics model was calibrated to the November 2017 count data and in absence of November 2017 JT data from DfT, the JT data for March 2018 was used for the JT validation. The weighted average of recorded journey times were obtained to represent neutral weekday times (Tuesday – Thursday), and days with abnormally high or low flows were excluded.

The input Traffic Master data used for the Paramics model journey time validation is detailed in Table 2-2.

Figure 2-2 - Journey Time routes for model validation

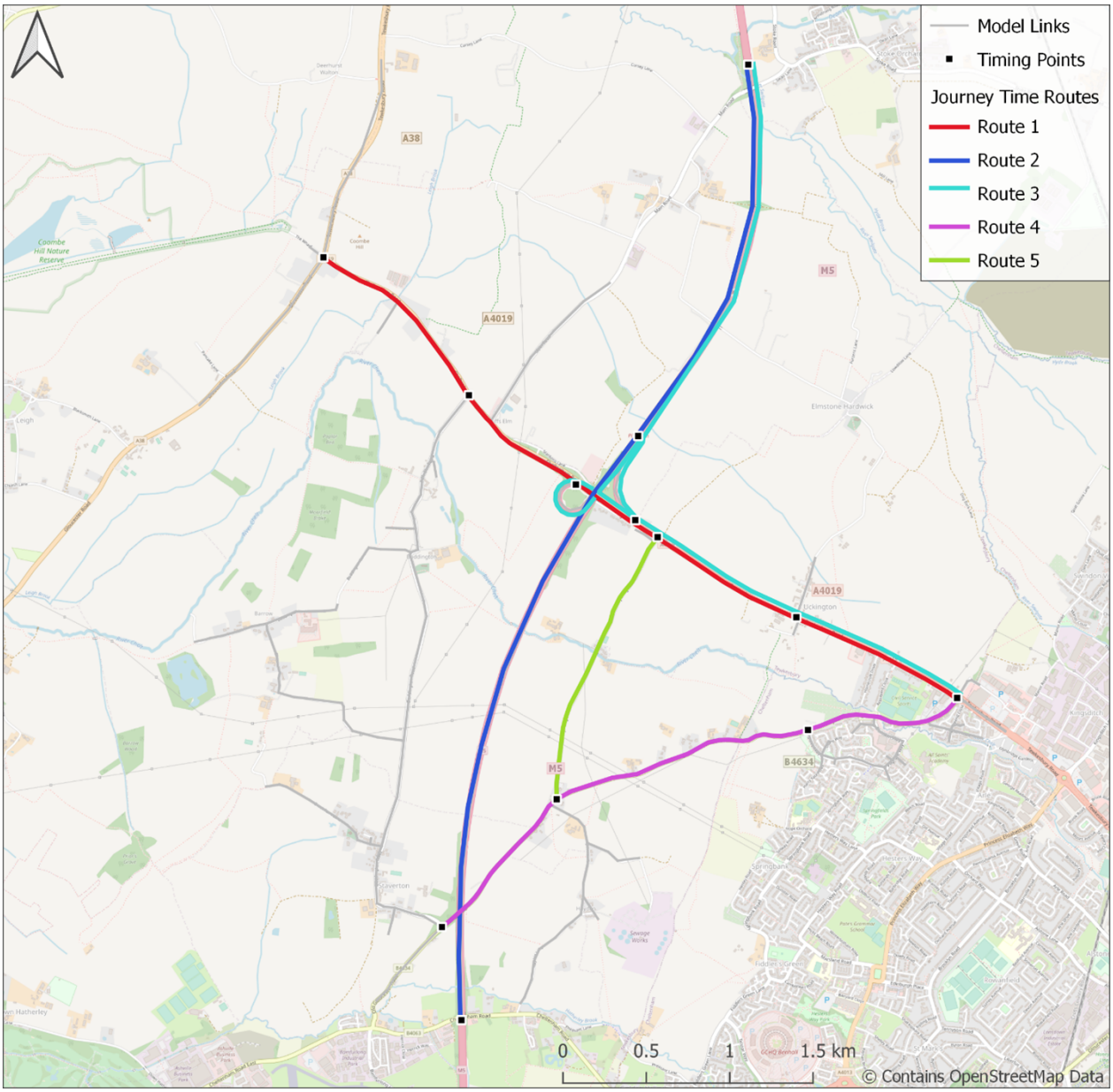


Table 2-2 - Traffic Master Data used for Journey Time Validation (March 2015)

Route	ITN Link ID	Timing Point	Link Length (m)	AM (08:00 - 09:00)	PM (17:00 - 18:00)
|Route 1 Eastbound	4000000017931703B		27	2.55	2.47
	4000000017931704B		22	2.60	2.62
	4000000017823060A		550	30.41	28.57
	4000000017832723A		478	28.28	28.38
	4000000018178095A	Boddington Road Junction	156	8.73	9.03
	4000000017848008A		171	11.30	8.88
	4000000017848009A		201	13.03	13.21
	4000000017832707A		409	18.21	17.82
	4000000017832709A		278	38.59	12.26

Route	ITN Link ID	Timing Point	Link Length (m)	AM (08:00 - 09:00)	PM (17:00 - 18:00)
	4000000017847993A		178	8.21	7.76
	4000000017931688A		22	1.09	0.98
	4000000018200740A	M5 J10 Onslip/A4019	5	0.24	0.22
	4000000017832738A		307	20.92	15.97
	4000000017848059A		146	16.50	7.01
	4000000017873366A		94	6.98	4.86
	4000000017873367A		147	12.68	8.71
	4000000017906146A		39	3.13	2.03
	4000000017931767A		41	3.23	2.13
	4000000017906019A		168	28.52	30.66
	4000000018137960A	The Green	186	28.96	8.65
	4000000017832730A		314	29.06	20.45
	4000000017832737A		428	30.72	24.82
	4000000017848060A		57	4.51	2.93
	4000000017931769A		19	1.24	0.95
	4000000017945831A		8	0.62	0.50
	4000000018178879A		82	6.83	5.02
	4000000018180750A		5	0.49	0.32
	4000000017873341A		84	16.28	11.96
	4000000017931729A		25	1.86	1.32
	4000000018099886A	Old Gloucester Road/A4019	37	2.12	1.68
Route 1 Westbound	4000000017848061B		35	1.63	1.84
	4000000017873340A		81	6.56	10.03
	4000000017931728A		26	1.47	1.55
	4000000017832730B		314	21.87	29.93
	4000000017832737B		428	23.26	26.46
	4000000017848060B		57	2.82	3.21
	4000000017931769B		19	0.90	1.02
	4000000018178879B		82	5.36	5.64
	4000000018180750B	The Green	5	0.37	0.38
	4000000017906020B		61	3.01	2.97
	4000000017931687B		21	1.01	0.99
	4000000018137913B		445	21.78	22.19
	4000000018200739B		7	0.34	0.34
	4000000017847996A		187	8.94	9.46
	4000000017832738B		307	14.73	16.57
	4000000017848059B		146	7.43	7.50

Route	ITN Link ID	Timing Point	Link Length (m)	AM (08:00 - 09:00)	PM (17:00 - 18:00)
	4000000017873366B		94	4.61	5.08
	4000000017873367B		147	13.01	9.92
	4000000017906146B		39	1.99	2.10
	4000000017931767B	M5 J10 Onslip/A4019	41	2.05	2.22
	4000000017832706B		346	13.62	14.06
	4000000017847992B		179	7.14	7.41
	4000000017848008B		171	11.16	10.28
	4000000017848009B	Boddington Road Junction	201	10.70	13.41
	4000000017906030B		47	17.16	13.89
	4000000017823060B		550	28.59	48.93
	4000000017832723B		478	38.34	105.25
	4000000018178095B	Coombe Hill	156	8.71	20.84
Route 2 Northbound	4000000017832112A		624	19.66	19.67
	4000000018200735A		2664	82.64	82.96
	4000000017945809B		12	0.38	0.39
	4000000018200736B	M5 J10	48	1.53	1.55
	4000000017817738B		1194	38.06	38.80
	4000000017817741B		746	23.34	23.76
	5000005122045122B	End of Route 2 NB	700	21.78	22.39
Route 2 Southbound	4000000017817739A		831	53.39	38.96
	4000000017817742A		755	39.94	28.56
	5000005122045119A	M5 J10	711	32.86	22.40
	4000000017822658A		637	21.36	20.35
	4000000017832705A		411	19.34	18.86
	4000000017945810A		12	0.55	0.55
	4000000017816014B	R2 SB End	2635	94.80	91.42
Route 3 Eastbound	4000000017817739A		831	53.39	38.96
	4000000017817742A		755	39.94	28.56
	5000005122045119A	M5 J10	711	32.86	22.40
	4000000017832704A	Slip Road	567	142.51	27.21
	4000000017832738A		307	20.92	15.97
	4000000017848059A		146	16.50	7.01
	4000000017873366A		94	6.98	4.86
	4000000017873367A		147	12.68	8.71
	4000000017906146A		39	3.13	2.03
	4000000017931767A		41	3.23	2.13
	4000000017906019A		168	28.52	30.66

Route	ITN Link ID	Timing Point	Link Length (m)	AM (08:00 - 09:00)	PM (17:00 - 18:00)
	4000000018137960A	The Green	186	28.96	8.65
	4000000017832730A		314	29.06	20.45
	4000000017832737A		428	30.72	24.82
	4000000017848060A		57	4.51	2.93
	4000000017931769A		19	1.24	0.95
	4000000017945831A		8	0.62	0.50
	4000000018178879A		82	6.83	5.02
	4000000018180750A		5	0.49	0.32
	4000000017873341A		84	16.28	11.96
	4000000017931729A		25	1.86	1.32
	4000000018099886A	R3 EB End	37	2.12	1.68
Route 3 Westbound	4000000017848061B		35	1.63	1.84
	4000000017873340A		81	6.56	10.03
	4000000017931728A		26	1.47	1.55
	4000000017832730B		314	21.87	29.93
	4000000017832737B		428	23.26	26.46
	4000000017848060B		57	2.82	3.21
	4000000017931769B		19	0.90	1.02
	4000000018178879B		82	5.36	5.64
	4000000018180750B	The Green	5	0.37	0.38
	4000000017906020B		61	3.01	2.97
	4000000017931687B		21	1.01	0.99
	4000000018137913B		445	21.78	22.19
	4000000018200739B		7	0.34	0.34
	4000000017847996A		187	8.94	9.46
	4000000017832738B		307	14.73	16.57
	4000000017848059B		146	7.43	7.50
	4000000017873366B		94	4.61	5.08
	4000000017873367B		147	13.01	9.92
	4000000017906146B		39	1.99	2.10
	4000000017931767B	M5 J10	41	2.05	2.22
	4000000017847995A		475	32.35	31.92
	4000000018200737A		48	2.24	2.26
	4000000018200738A	Slip Road	12	0.61	0.62
	4000000017817738B		1194	38.06	38.80
	4000000017817741B		746	23.34	23.76
	5000005122045122B	R3 WB End	700	21.78	22.39
Route 4	4000000017823051A		833	43.22	41.70

Route	ITN Link ID	Timing Point	Link Length (m)	AM (08:00 - 09:00)	PM (17:00 - 18:00)
Northbound	4000000017871564A		130	7.52	7.05
	4000000017906015A		56	5.49	4.95
	4000000017930663A	Withybridge Lane	25	1.63	1.35
	4000000017817736A		841	45.22	43.69
	4000000017823066A		593	37.04	36.18
	4000000017873297A		100	5.69	5.43
	4000000017906068A	Pilgrove Way	47	2.65	2.58
	4000000018182877B		29	2.33	2.30
	4000000018197047A		415	44.68	35.70
	4000000017832731B		213	17.30	15.05
	4000000017873342B		100	7.97	7.84
	4000000017873343B		89	13.53	11.63
	4000000018106260B		58	4.37	4.21
	4000000018181616B	R4 NB End	33	3.18	3.67
Route 4 Southbound	4000000018182878B		28	6.04	5.26
	4000000017832731A		213	16.63	19.61
	4000000017873342A		100	8.13	8.56
	4000000017873343A		89	9.44	7.33
	4000000018106260A		58	10.82	10.96
	4000000018181616A		33	3.36	3.63
	4000000018197047B	Pilgrove Way	415	26.00	26.06
	4000000017817736B		841	44.14	43.82
	4000000017823066B		593	34.58	34.27
	4000000017873297B		100	5.57	5.46
	4000000017906015B		56	6.70	4.44
	4000000017906068B	Withybridge Lane	47	2.48	2.46
	4000000017823051B		833	40.39	39.19
	4000000017871564B		130	18.68	23.23
	4000000017930663B	R4 SB End	25	1.26	5.61
Route 5 Northbound	4000000017817734A	R5 NB Start	905	51.03	44.74
	4000000017832703A		710	41.38	87.25
	5000005122044985A		55	2.88	2.72
	4000000017931689B	R5 NB End	32	4.62	30.07
Route 5 Southbound	4000000017931689A	R5 SB Start	32	4.21	3.97
	4000000017817734B		905	86.02	67.88
	4000000017832703B		710	37.37	33.19
	5000005122044985B	R5 SB End	55	2.58	2.41

Appendix C. – Local Accident Data for COBALT Assessment

Introduction

The economic assessment of a change in the number of accidents resulting from the scheme was modelled using the DfT's COBA-LT (COst and Benefit to Accidents – Light Touch) software (v2013.2). This is the standard software used to assess and monetise the change in accidents resulting from transport schemes, across the lifetime of a scheme.

As a default, COBA-LT uses national average accidents rates to inform its calculations of costs and benefits. However, to better inform this process, observed accident data local to the scheme in question can be collected. COBA-LT then calculates bespoke accident rates for use when calculating accident benefits.

Observed accident data

To establish the study area for the COBA-LT assessment, and therefore the area for which observed accident data was required, Annual Average Daily Traffic (AADT) flows were extracted from the Do-Minimum and Do-Something scenarios, and plotted in GIS.

By examining the percentage change in AADT flows on links in both the 2025 and 2041 modelled years, a COBA-LT study area was defined, as per Figure 2-3 and Figure 2-4. Generally, a 10% change was taken as a threshold for the COBA-LT study area.

Figure 2-3 - COBA-LT Study Area and percentage change in modelled flows (2025)

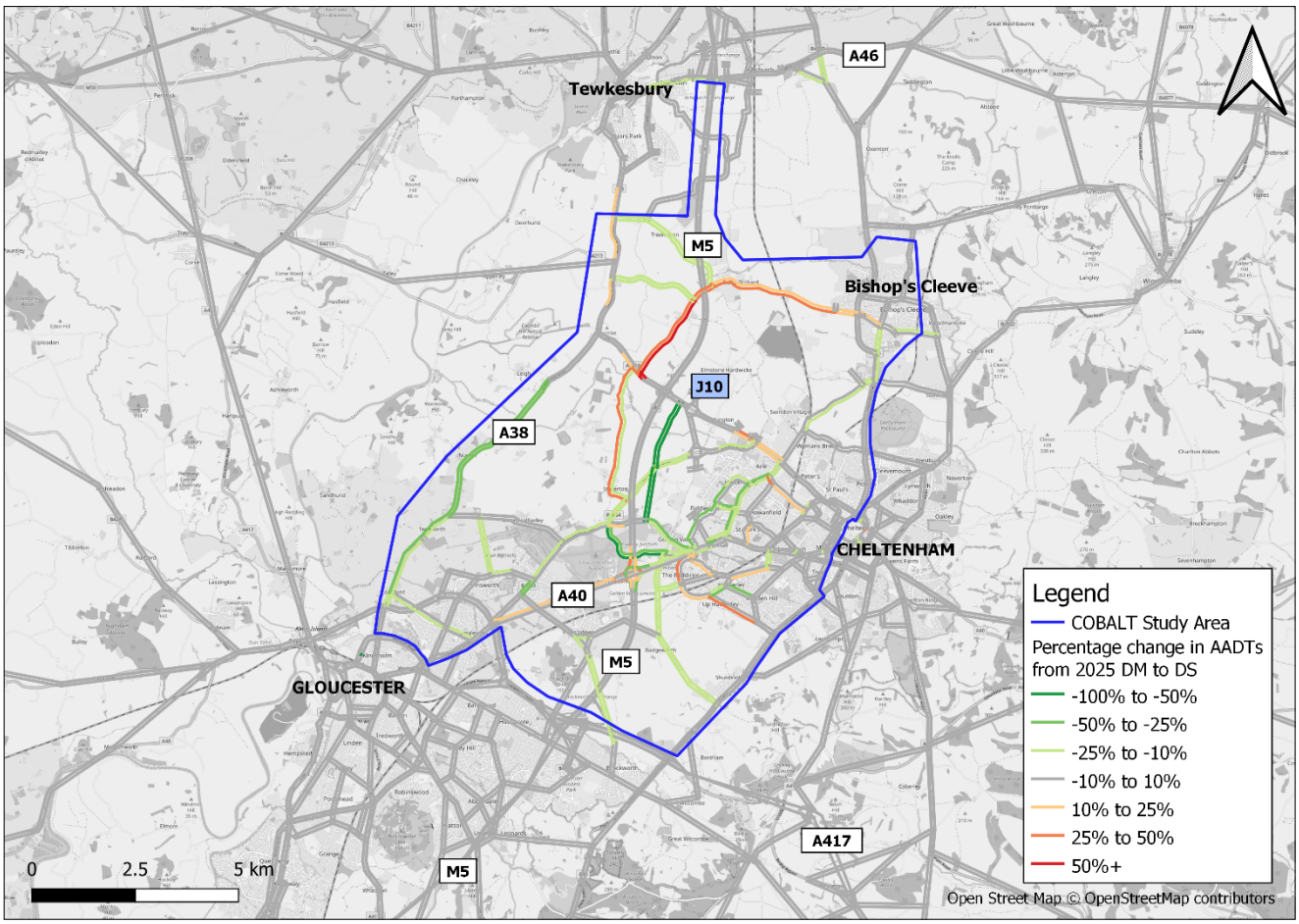
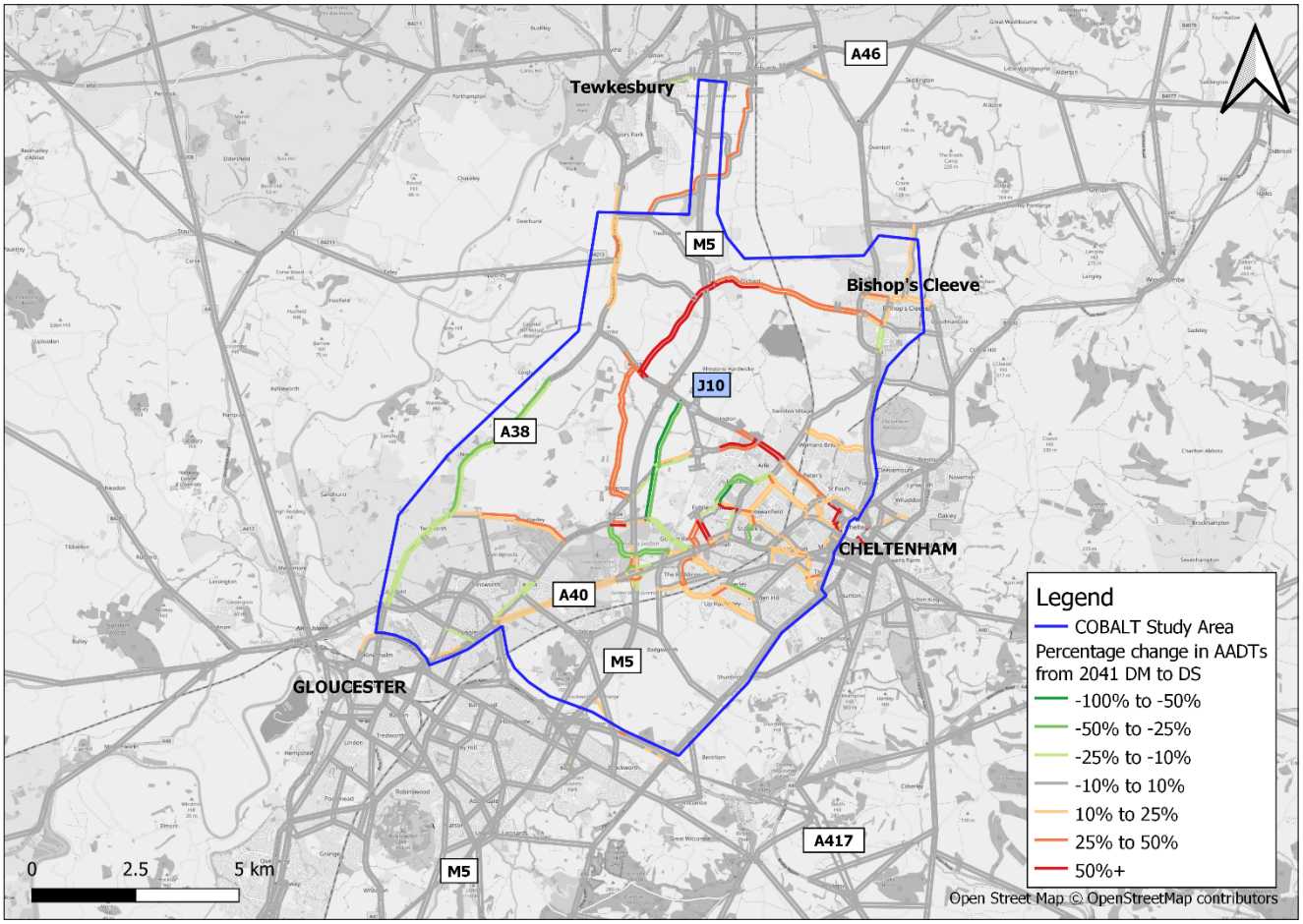


Figure 2-4 - COBA-LT Study Area and percentage change in modelled flows (2041)



Observed accident data was downloaded for this area, from the DfT's Road Safety Data portal. This uses data from the STATS19 accident reporting form to provide detailed data about personal injury road accidents (PIA). The statistics only relate to PIA on public roads that are reported to the police, and therefore, information on damage-only accidents or accidents on private roads or car parks are not included in this data.

This data was downloaded for the period from 01/01/2015 to 31/12/2019, covering the most recent available five-year period. The resulting accident data is shown in Figure 2-5 and Figure 2-6, by year and severity respectively.

Figure 2-5 - PIA Accidents by Year (2015-2019)

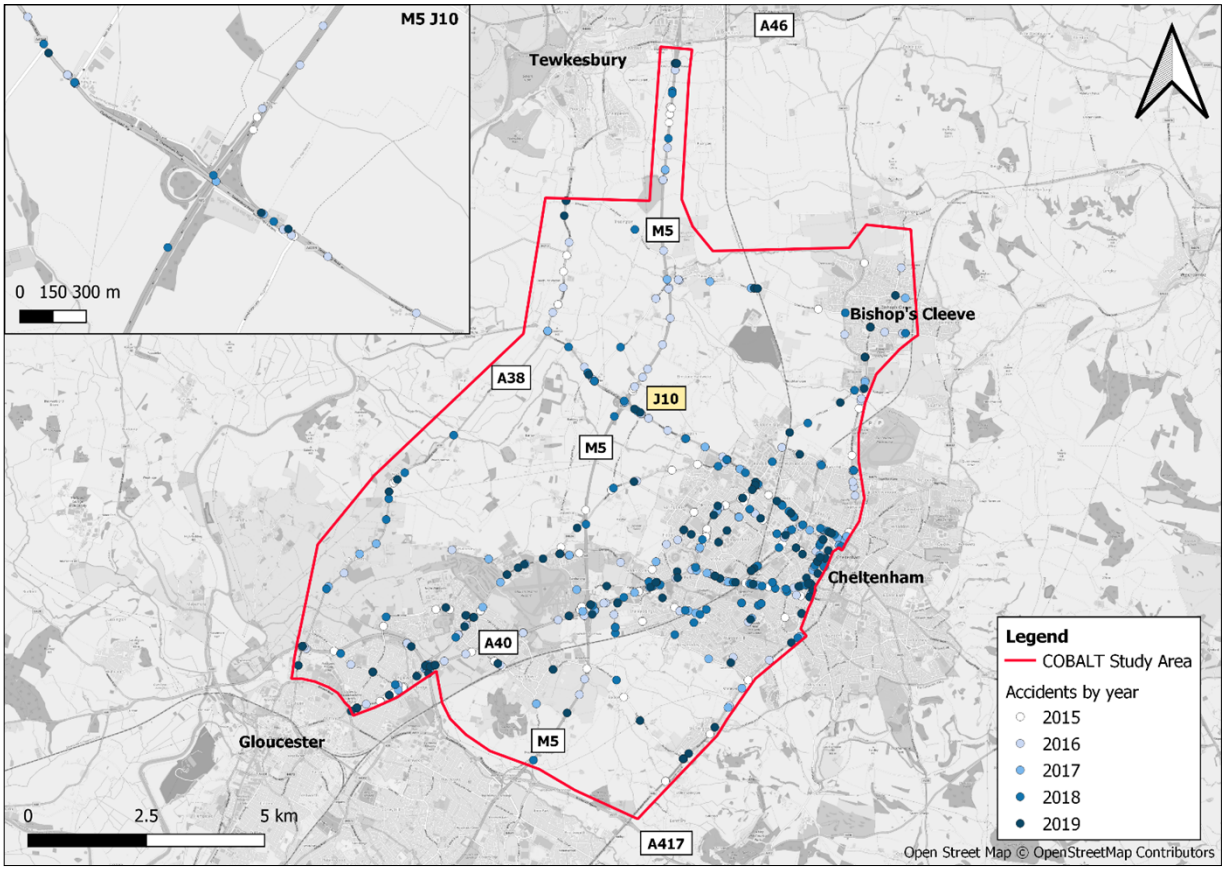
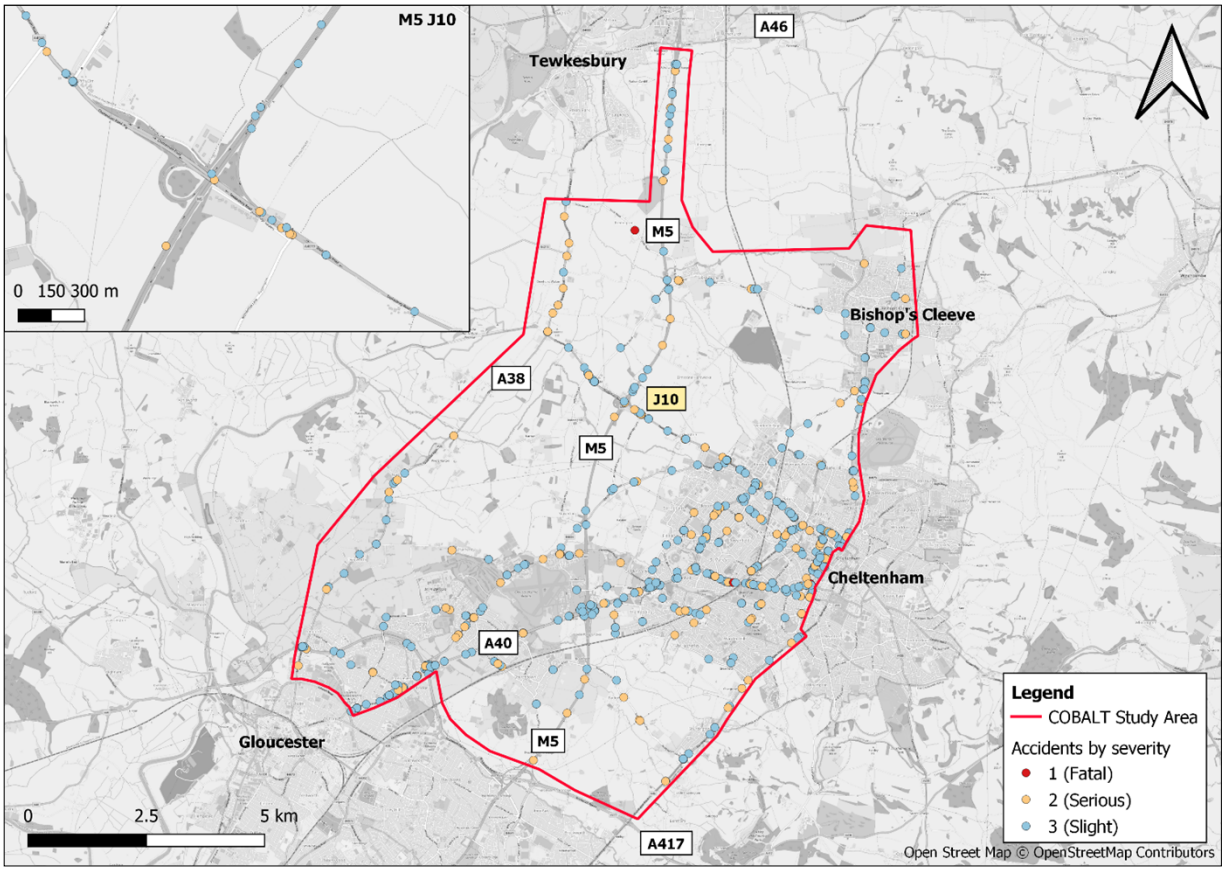


Figure 2-6 - PIA Accidents by Severity (2015-2019)



Post-processing

To prepare the observed accident data for input to COBA-LT, it was queried in GIS, capturing where accidents overlapped with modelled links. This was checked in GIS, and where an accident had overlapped with multiple modelled links (for instance at a junction where multiple links meet), these duplicates were removed from the data set.

To maximise the accuracy of the accident assessment undertaken, the study area was broken down further. Those links (and accidents) within the scheme extents were to be analysed using COBA-LT's separate Link and Junction analysis, while all other links (and therefore accidents) were to be assessed using the combined Link and Junction analysis option.

ATKINS
Member of the SNC-Lavalin Group

5th Floor, Block 5
Shire Hall
Bearland
Gloucester
GL1 2TH

Tel: +44 (0) 8000 514 514