M5 Junction 10 Improvements Scheme

Transport Assessment

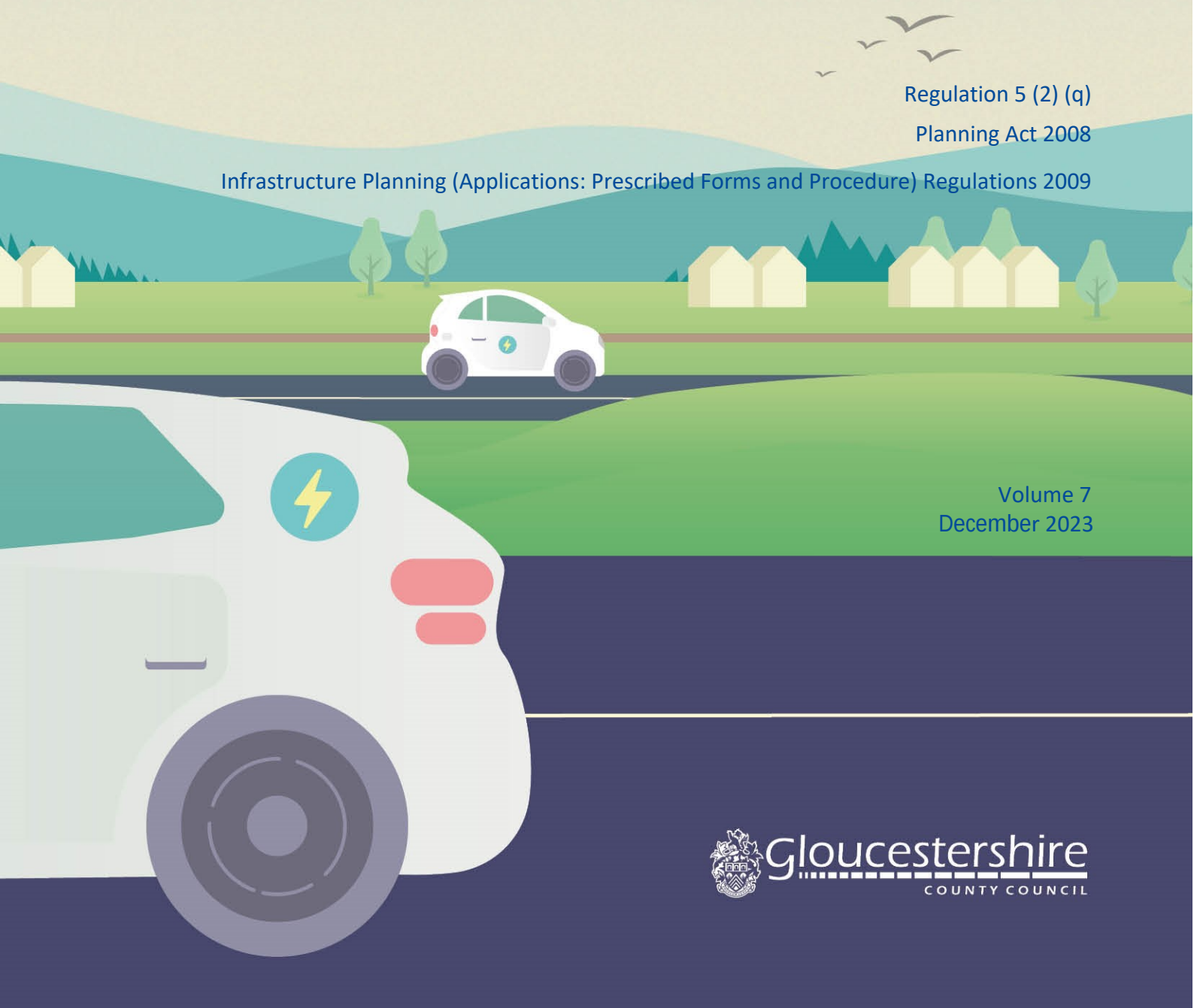
Appendix J - Transport Model Package

TR010063 - APP 7.5

Regulation 5 (2) (q)

Planning Act 2008

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



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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 – Transport Model Package

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M5 Junction 10 Improvements Scheme

Transport Model Package Report

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This document has 200 pages including the cover.

Document history

Revision	Status	Purpose description	Originated	Checked	Reviewed	Authorised	Date
C06	A1	Updated to reflect TAG Databook 1.20.2	IS	PA	HF	LJ	23/06/23
P06	S3	Addressed NH Comments	IS	PA	HF	---	14/02/23
C05	A1	Report update for GCTM V2.3 model	IS	PA	HF	LJ	15/12/22
C04	A1	FINAL	LB	PA	AC	TT	03/06/21
C03	A1	Updated for GCC Comments	PA	RD	AC	TT	07/05/21
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Client signoff

Client	**Gloucestershire County Council**
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Contents

Tables

Figures

1. Introduction

1.1. Purpose of this Report

1.1.1. The Transport Model Package is one of a series of documents that set out the scheme's traffic modelling and economic assessment. These include:

- Appraisal Specification Report
- Transport Data Package
- Transport Model Package
- Transport Forecasting Package
- Transport Assessment
- Economic Appraisal Package
- Combined Modelling and Appraisal Report
- Benefits Register

1.1.2. The purpose of the Transport Model Package is to report on the development and suitability of the base year model created for the M5 J10 Stage 3.

1.1.3. Gloucestershire County Council (GCC) originally commissioned Atkins to extend the Gloucestershire Countywide Traffic Model (GCTM Version 1), using version 11.4.07H of the SATURN software suite. This extended model was referred to as Version 2.0 of the GCTM, with the base model completed in March 2020 (detailed in Revision 1.0 of the Version 2.3 model LMVR).

1.1.4. The base model has now been revised further for M5J10 Stage 3. This updated Transport Model Package Report sets out the methodology for the base model extension (including further refinements from Version 2.1) and provides the performance results for Version 2.3 of the GCTM against key validation criteria, consistent with the Department for Transport (DfT) TAG guidance.

1.2. Background

1.2.1. The scheme proposal involves the upgrading Junction 10 of the M5 to all movements with associated improvements to surrounding transport infrastructure, as listed in section 2.1. The M5 represents the key strategic link connecting the South West of England to the West Midlands and wider UK highway network whereas the A4019 also forms an important corridor, linking Cheltenham city centre and the M5 at a strategic level.

1.2.2. The GCTM was identified as the most suitable tool available for the appraisal of the proposed scheme. The GCTM is a strategic SATURN model, developed specifically for GCC's usage in assessing major highway interventions and land use strategies across the Gloucestershire region. It is derived from the National Highways A417 Missing Link Stage 2 traffic model, which itself was developed from the South West Regional Traffic Model (SWRTM).

1.2.3. However, a key issue identified with Version 1.0 of the GCTM (GCTM V1.0) was that it did not contain enough network or zonal detail within the Cheltenham area as well as surrounding areas of the M5 J10. There was also a limited level of model validation undertaken in the area.

1.2.4. GCC commissioned Atkins to extend the Gloucestershire Countywide Traffic Model (GCTM V1.0), to provide a strategic modelling tool capable of conducting initial options testing for the proposed M5 Junction 9/A46 (Ashchurch) scheme. This extended model was referred to as GCTM Version 2.0 (GCTM V2.0).

1.2.5. The GCTM V2.0 was further refined to address the comments from National Highways. This update of GCTM is referred to as GCTM Version 2.1.

1.2.6. GCTM V2.1 was further amended in the subsequent stage of the M5J9 scheme assessment, by adjusting speed flow curve capacities along the A46 east of Teddington Hands Roundabout and around Evesham to refine the representation of traffic impacts associated with the M5 Junction 9 and A46 (Ashchurch) Transport Scheme. This update to the GTCM model is referred to as GCTM V2.2.

1.2.7. The GCTM V2.2 was adopted as a starting point for M5J10 Stage 3 modelling. A detailed study of GCTM V2.2 was carried out and the model was further refined in the areas surrounding A4019 for the highway network and zoning system. This update of the GCTM Model is referred to as GCTM V2.3.

1.2.8. The primary purpose of the model extension is to provide a strategic modelling tool capable of conducting initial options testing for the proposed M5 Junction 9 which will inform a Strategic Outline Business Case (OBC) submission to the Department for Transport. It is also intended that the extended model will be used to provide the evidence base for the JCS strategic allocations for the 2042 plan period, given Version 2.3 will include enhancements to the GCTM within the Tewkesbury area. Version 2.3 will be used for ongoing assessment of the M5 Junction 10 Transport Improvements scheme (aligning with National Highways PCF Stage 3), meaning both major schemes i.e., M5J10 and M5J9 are appraised using the same modelling tool.

1.2.9. It is important to note that the GCTM has been developed and validated to represent average hour peak period conditions (i.e. the average hourly flow between 07:00-10:00 and 16:00-19:00), consistent with the parent model. There may be a need to consider uplifting these assignments to represent peak hour conditions for the purposes of operational assessment tasks.

1.3. Report Structure

1.3.1. Following this introduction, the report is structured as follows:

- Section 2 outlines the proposed uses of the model and key considerations;
- Section 3 defines the standards against which the model will be validated;
- Section 4 describes the key features of the model;
- Section 5 summarises the observed data used for model calibration and validation;
- Section 6 describes the network development;
- Section 7 describes the matrix development;
- Section 8 describes the procedures used to calibrate the model;
- Section 9 describes the matrix estimation procedure;
- Section 10 presents the calibration and validation results;
- Section 11 presents the Variable Demand Model Setup; and
- Section 12 summarises the model performance and fitness for purpose

2. Proposed Uses of the Model and Key Model Design Considerations

2.1. Proposed Uses of the Model

2.1.1. As noted in the introduction, a key initial use for the extended GCTM (now Version 2.3) is to inform option testing for the M5 Junction 10 scheme. However, it is also intended that the model will be used in a wider capacity by GCC to support land use assessment (such as the JCS) and other future highway scheme improvement testing across the county.

2.1.2. Gloucestershire faces significant challenges to achieve its vision for economic growth. A Joint Core Strategy (JCS) – a partnership between Gloucester City Council (GCC), Cheltenham Borough Council and Tewkesbury Borough Council was formed to produce a co-ordinated strategic development plan to show how the region will develop during the period up to 2031. This includes a shared spatial vision targeting 35,175 new homes and 39,500 new jobs by 2031. Major development of new housing (c.9,000 homes) and employment land (c.100ha) is proposed in strategic and safeguarded allocations in the West and North West of Cheltenham, much of which lies within Tewkesbury Borough Council. This, in turn, is linked to wider economic investment, including a government supported and nationally significant Cyber Park 2 adjacent to GCHQ, predicted to generate c.7,000 jobs.

2.1.3. However, to unlock the housing and job opportunities, a highways network is needed that has the capacity to accommodate the increased traffic it will generate, within a sustainable transport context. A Business Case was submitted in March 2019 to the Housing Infrastructure Fund (HIF), wherein an investment case was made for the following infrastructure improvements shown in Figure 2-1 which together make up the M5 Junction 10 Improvement Scheme:

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

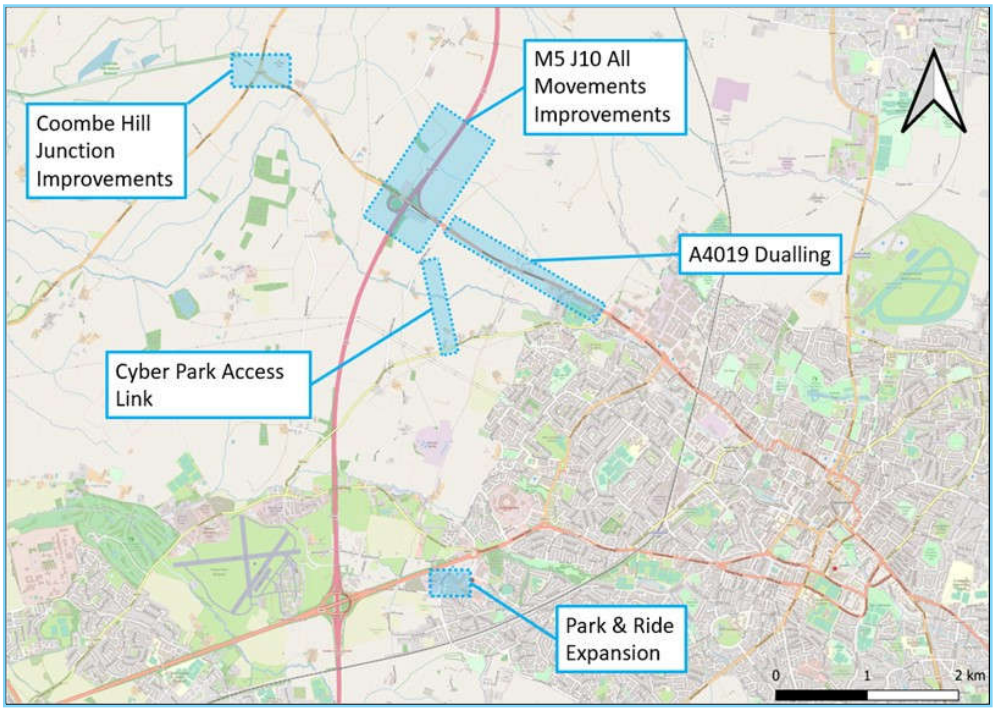

Figure 2-1 - M5 Junction 10 Scheme Area

2.2. Key Model Design Considerations

2.2.1. To ensure the model extension is appropriate for the intended use of the model, the following design aspects have been considered:

- An integral element of the model extension is that it accurately represents current traffic and network conditions in the M5/A46 area. This ensures that it can be used as a reliable foundation from which the option testing for the proposed M5 Junction 9 scheme can be undertaken. The limitation to this is that the timescale requirements for the initial Strategic Outline Business Case meant that it was not possible to undertake additional data collection for the specific purpose of the study – instead, revalidation of the model has been reliant on existing count data which could be obtained from various sources.
- To enable testing of the proposed scheme and accurately consider the changes in traffic patterns as a result, it was also necessary to ensure that the base model extension encompassed the whole of Tewkesbury and other urban areas surrounding the A46 route, including Evesham.
- In addition to impacts on the local road network, it was recognised the scheme may influence wider strategic movements. As such, strategic routes north of the study have been considered for inclusion within an extended simulation area.
- As the GCTM extension is being developed to support the appraisal of highway scheme improvements, the model will be required to provide outputs that are compatible with the DfT Transport User Benefit Analysis (TUBA) software. Any application of this type needs to adhere to TAG guidelines, including the values of time and operating costs adopted, as well as aspects such as assignment convergence.

2.2.2. It is also important to recognise the original design considerations for Version 2.3 of the GCTM. Whilst detailed coverage of the existing model encompasses all of Gloucestershire, it was identified as important to focus calibration and validation on key areas of interest for the JCS and Stroud Local Plan (SLP) land use strategies. Version 1 of the model focussed on ensuring a high level of accuracy around the areas of North West Cheltenham and also proposed major allocations within Stroud. Consequently, it is important that Version 2.3 seeks to maintain the existing level of validation in these areas as well as the overall Gloucestershire area.

3. Model Standards

3.1.1. The GCTM Version 2.3 extension consists of detailed coding of simulated junctions and links in the core study area of Gloucestershire, combined with the existing simulated network in the GCTM area, plus buffer network in the peripheral regions around Gloucestershire.

3.1.2. The highway assignment model has been developed in accordance with Department for Transport (DfT) guidance as detailed in TAG Unit M3-1, Highway Assignment Modelling[1].

3.2. Validation Criteria and Acceptability Guidelines

3.2.1. The below text quoted from TAG unit M3-1 summarises the validation criteria for a highway assignment model.

3.2.2. "The validation of a highway assignment model should include comparisons of the following:

- Assigned flows and counts totalled for each screenline or cordon, as a check on the quality of the trip matrices;
- Assigned flows and counts on individual links and turning movements at junctions as a check on the quality of the assignment; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment."

3.3. Trip Matrix Validation

3.3.1. The measure that should be used for trip matrix validation is the percentage difference between modelled flows and counts. Comparisons at screenline level provide information on the quality of the trip matrices. TAG Unit M3-1 describes the validation criterion and acceptability guideline as shown in Table 3-1.

Table 3-1 - Screenline Flow Validation Criterion and Acceptability Guideline[2]

Criteria	Acceptability Guideline
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines

[1] https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling
[2] Taken from Table 1 of the TAG Unit M3-1 guidance

3.3.2. With regards to screenline validation, the following should be noted[3]:

- Screenlines should normally be made up of 5 links or more;
- The comparisons for screenlines containing high flow routes such as motorways should be presented both including and excluding such routes;
- The comparisons should be presented separately for (a) roadside interview screenlines; (b) the other screenlines used as constraints in matrix estimation; and (c) screenlines used for independent validation;
- The comparisons should be presented by vehicle type (preferably cars, light goods vehicles and other good vehicles); and
- The comparisons should be presented separately for each modelled period.

3.4. Link Flow and Turning Movement Validation

3.4.1. The measures used for link flow validation are the absolute and percentage differences between modelled flows and observed counts, and the Geoffrey E Haver (GEH) measure. The GEH measure uses the GEH statistic as defined below:

$$GEH = \sqrt{\frac{(M-C)^2}{\frac{1}{2}(M+C)}}$$

Where: GEH is the GEH statistic;

M is the modelled flow; and

C is the observed flow

3.4.2. TAG Unit M3-1 describes the link flow and turning movement validation criteria and acceptability guidelines as show in Table 3-2.

Table 3-2 - Link and Turning Movement Validation Criteria and Acceptability Guidelines[4]

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

[3] TAG Unit M3-1 Highway Assignment Modelling, January 2014, pg. 18
[4] Taken from Table 2 of the TAG Unit M3-1 guidance

3.4.3. Regarding flow validation, the following should be noted[5]:

- The above criteria should be applied to both link flows and turning movements;
- The acceptability guideline should be applied to link flows but may be difficult to achieve for turning movements;
- The comparisons should be presented for cars and all vehicles but not for light and other goods vehicles unless sufficiently accurate link counts have been obtained;
- The comparisons should be presented separately for each modelled period; and
- It is recommended that comparisons using both measures are reported in the model validation report.

3.5. Journey Time Validation

3.5.1. The measure used for journey time validation is the percentage difference between modelled and observed journey times, subject to an absolute maximum difference. The validation criterion and acceptability guideline for journey times are defined in Table 3-3.

Table 3-3 - Journey Time Validation Criterion and Acceptability Guidelines[6]

Criteria	Acceptability Guidelines
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of cases

3.6. Convergence Criteria Standards

3.6.1. The advice on model convergence is set out in TAG Unit M3-1 and is reproduced in Table 3-4.

Table 3-4 - Summary of Convergence Measures and Base Model Acceptable Values[7]

Measure of Convergence	Base Model Acceptable Values
Delta and %GAP	Less than 0.1% or at least stable with convergence fully documented and all other criteria met
Percentage of links with flow change (P)<1%	Four consecutive iterations greater than 98%
Percentage of links with cost change (P2)<1%	Four consecutive iterations greater than 98%
Percentage change in total user costs (V)	Four consecutive iterations less than 0.1% (Stochastic User Equilibrium only)

[5] TAG Unit M3-1 Highway Assignment Modelling, January 2014, pg. 19
[6] Taken from Table 3 of the TAG Unit M3-1 guidance
[7] Taken from Table 4 of the TAG Unit M3-1 guidance

3.7. Intended Impact of Matrix Estimation

3.7.1. TAG Unit M3-1 states that the changes brought about by matrix estimation (ME) should be carefully monitored by the following means:

- Regression analysis of matrix zonal cell values, prior to and post ME (slopes, intercepts and R2 values);
- Regression analysis of zonal trip ends, prior to and post ME (slopes, intercepts and R2 values);
- Trip length distributions, prior to and post ME; and
- Sector to sector level matrices, prior to and post ME, with absolute and percentage changes.
- The changes introduced by the application of ME should not be significant and are assessed using TAG Unit M3-1, as show in Table 3-5.

Table 3-5 - Significance of ME Criteria[8]

Measure	Significance Criteria
Matrix zonal cell levels	Slope within 0.98<Slope<1.02, Intercept near zone, R2 in excess of 0.95
Matrix zonal trip ends	Slope within 0.99<Slope<1.01, Intercept near zero, R2 in excess of 0.98
Trip length distributions	Means within 5% Standard deviations within 5%
Sector to sector level matrices	Differences within 5%

3.7.2. The unit states that limits to matrix estimation changes should be respected, even if this makes it difficult to achieve the link flow and journey time validation acceptability as stated earlier in this chapter, and a lower standard of validation should be reported.

3.7.3. All outliers and exceedances of the above criteria should be examined for their importance in the accuracy of the matrices in the modelled area.

[8] Taken from Table 5 of the TAG Unit M3-1 guidance

4. Key Features of the Model

4.1.1. This chapter details the specification of the GCTM Version 2.3 extension in terms of temporal scope, spatial coverage and the level of network and zoning detail, demonstrating its suitability for its intended purposes. This section also sets out the details regarding some of the key characteristics of the model. Further detail on the development of the model is included in subsequent chapters of the report.

4.1.2. As identified in Section 1.2, the A417 Missing Link PCF Stage 2 traffic model was used as the starting point in the original development of the GCTM. As such, the specification for the GCTM largely mirrors the specification for this model. However, Version 2.3 (as with Version 2.0) involves extending the detailed simulation area of the model as well as the associated zoning system whilst also refreshing other elements such as generalised cost parameters based on the latest relevant guidance. Key features of the GCTM extension are provided below.

4.2. Model Base Year

4.2.1. Consistent previous versions of the GCTM and the A417 Missing Link Parent Model, Version 2.3 of GCTM has been developed to reflect 2015, average March weekday traffic conditions. As per the existing model, the AM, IP and PM modelled time periods will be calibrated and validated against observed counts adjusted to March 2015 traffic levels and journey times in the modelled area.

4.3. Modelling System and Software

4.3.1. The GCTM extension has been developed using SATURN Version 11.4.07H, consistent which is regarded as the industry standard strategic highway assignment modelling software.

4.3.2. The GCTM Version 2.3 model will use the same TAG-based approach adopted on both the SWRTM and A417 models. The modelling system once fully developed will therefore comprise:

- Trip end model – used for estimating the number of trips generated/attracted by a specific zone;
- Demand model – used for estimating how travellers respond to changes in their travel costs (requiring possible refinement to the base model at a later stage); and
- Highway assignment model – used for estimating travel costs and identifying the routes travellers may choose through the road network.

4.4. Modelled Areas

Fully Modelled Area

4.4.1. For the original GCTM (Version 1), the fully modelled area within the Gloucestershire model was consistent with the A417 Missing Link model. This included all areas of Gloucestershire, with all motorways, A-roads, B-roads included plus any minor roads deemed as providing an important role in enabling strategic traffic movements with the area. The network in this area is also fully simulated except for the urban areas of Swindon and parts of Bishop's Cleeve, within which fixed speed coding was used.

4.4.2. Recognising the design considerations listed in Section 2.2 of this report, Version 2.0 of the GCTM extended the simulation coding network area to encompass areas of Worcestershire to the south east of Worcester (including Evesham and surrounding settlements) to a level of detail consistent with the rest of the GCTM. Any areas of buffer network in the northern part of the existing fully modelled area (such as Bishop's Cleeve) have been converted to simulation coding.

4.4.3. The fully modelled area for Version 2.3 is largely consistent with Version 2.1 but includes some additional rural links in the Tewkesbury area (as detailed in the section 6.3 of this report).

4.4.4. The original (Version 1.0) and extended (Version 2.3) network simulation areas are both shown in Figure 4-1 with further detail on the associated network enhancements provided in Chapter 6.3.

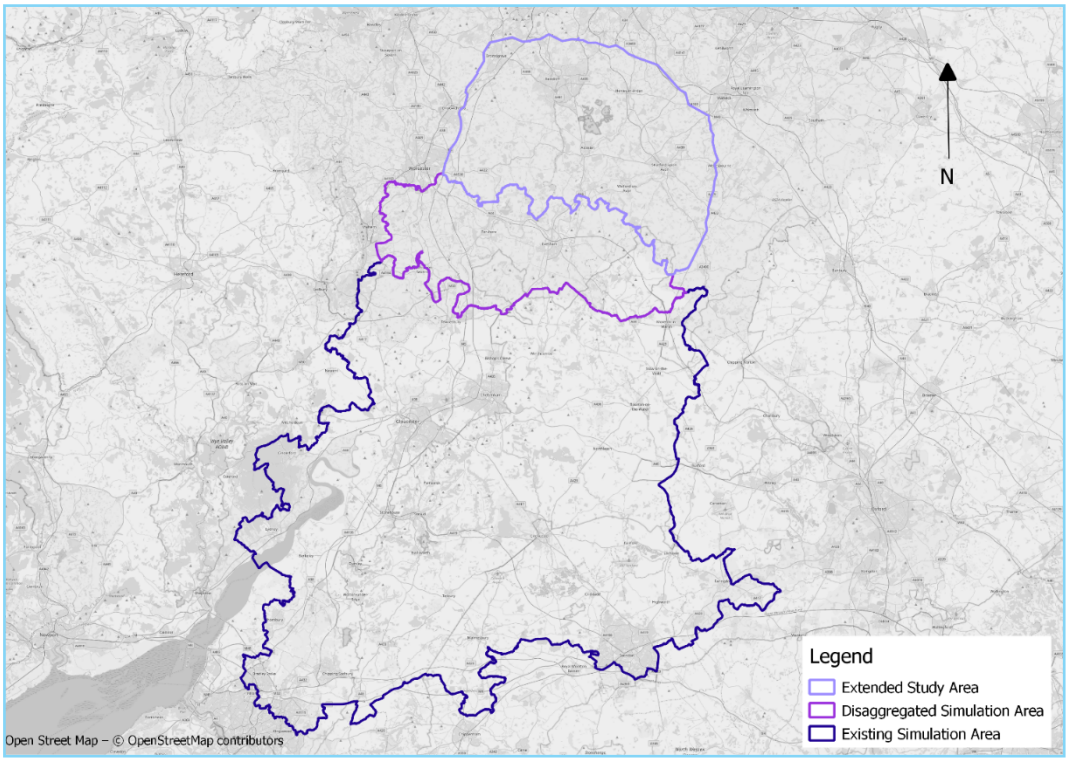

Figure 4-1 - GCTM Version 2.3 Extension to Version 1.0 Fully Modelled Area

External Area

4.4.5. Outside of the extended fully modelled area, in accordance with the approach adopted for the SWRTM and A417 models, the GCTM consists of areas of fixed speed buffer coding, with varying levels of detail and network density. No changes to either the extent or coding detail within these external areas has been undertaken as part of the extension of the GCTM, except for the addition of some zone connectors for the zones representing parts of Birmingham to avoid overloading some of the new adjacent areas of simulation network with unrealistically high levels of traffic.

4.5. Zoning System

4.5.1. The GCTM zoning system is derived from the SWRTM zoning system which is based on 2011 Census Output Areas (OAs), or aggregations thereof. The SWRTM zoning system (originally consisting of 1901 zones) has been disaggregated incrementally, firstly as part of the A417 Missing Link PCF Stage 2 model (consisting of 1940 zones) and then as part of the original GCTM Version 1 (consisting of 1973 zones).

4.5.2. As part of the GCTM Version 2.0 extension, it was identified that the zoning system in the vicinity of M5 Junction 9 and A46 corridor would need to be further disaggregated to provide an appropriate level of detail, capable of reflecting local changes in trips distribution associated with any potential scheme improvement. As such, 16 existing zones were disaggregated to create 131 new zones in the M5 Junction 9 core study area, according to 2011 Census Lower Super Output Areas (LSOAs) and Outputs Areas (OAs). This includes zones within Tewkesbury, Evesham and Bishops Cleeve as well as the wider south Worcestershire area now included within the extended fully modelled area. Further refinements to the zone structure were made in and around Gallagher retail park area as part of Version 2.3. The extended version of the GCTM now consists of 2091 zones as a result of this process. All new zones added as part of the base model extension are classified with a “25XXX” numbering system.

4.5.3. The disaggregated areas of the zoning system are shown in Figure 4-2.

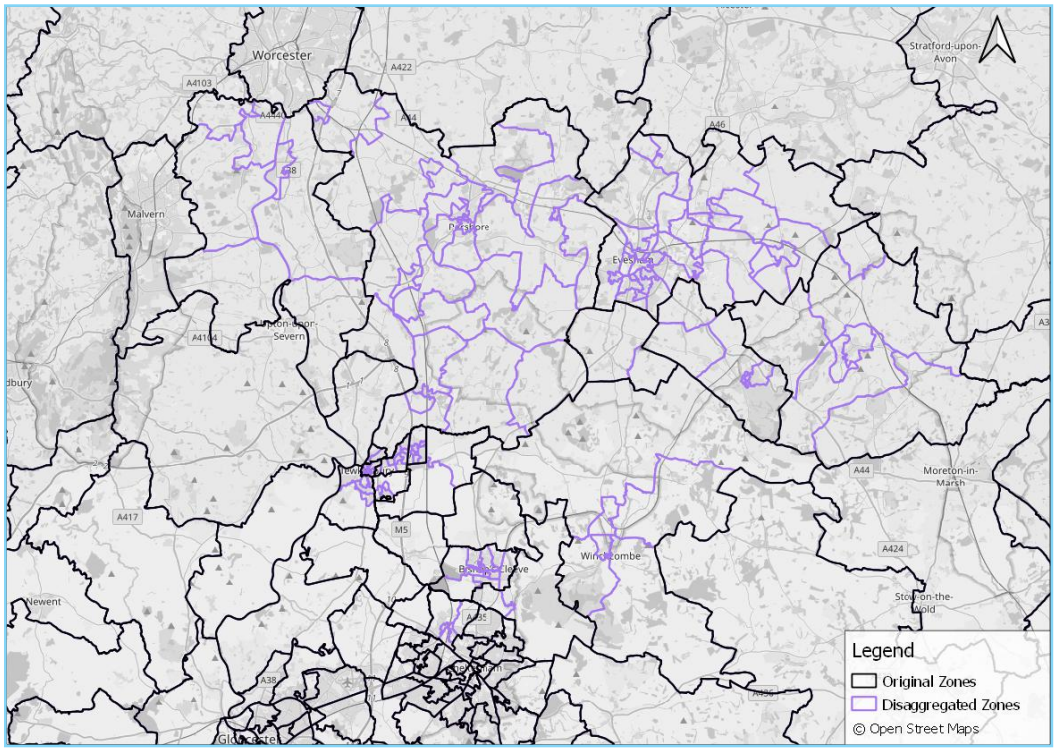

Figure 4-2 - GCTM Version 2.0 and Version 2.3 Disaggregated Zoning System

4.6. Centroid Connectors

4.6.1. Centroid connectors provide connectivity between zones and the highway link network. There are two forms of zone connection which can be adopted within SATURN simulation coding:

- "Spanning" connectors – used to load trips along the length of a link; and
- "Spigot" connectors – used to load trips at an exact location

4.6.2. For the original GCTM (Version 1) the use and coding of centroid connectors adopted the same approach used in both the SWRTM and A417 model, involving the use of spanning connectors as opposed to spigot in most cases within the fully modelled area. As part of the Version 2.0 and 2.3 model extension, for newly included rural areas the same approach was adopted, although 'spigot' connectors were used within areas of Tewkesbury where it was deemed appropriate or necessary to ensure a more detailed representation of trips accessing and egressing the network.

4.6.3. Buffer connectors have been used outside the fully modelled area. These connectors include assumed distances, which are taken into account in routing within the assignment model. The length applied to these buffer centroid connectors is based on the distance from the loading point on the network to the population weighted centroid of the zone.

4.7. Time Periods

4.7.1. The highway assignment model includes four weekday time periods as shown in Table 4-1. These time periods remain consistent with the original SWRTM.

Table 4-1 - Time periods

Model Time Period	Temporal Coverage
AM weekday average hour	0700 – 1000
IP (Inter Peak) weekday average hour	1000 – 1600
PM weekday average hour	1600 – 1900
OP (Off Peak) weekday average hour	1900 – 0700

4.7.2. As per the existing models, only the three daytime periods are subject to calibration and validation, with the Off Peak (OP) model simply used as an alternative method for factoring from modelled periods to daily levels. This assignment has been produced by factoring the inter-peak assignment based on observed data.

4.7.3. In retaining the average hour assignments, it is recognised that in some cases, there will remain a need to assess traffic impacts at a peak hour level in model forecasts. In this regard, the proposed approach to assessing peak hour effects in the forecasts will (at least in the first instance) be based on an uplift to the post- peak period trip matrices. The uplifted matrices would then need to be reassigned to the peak period models in SATURN. This approach would provide a proportionate approach to identifying problem areas across the network, allowing for potential reassignment issues to be captured, but with no further validation against observed data conducted unless deemed necessary.

4.7.4. It is important to note however, following this broad assessment, it may still be desirable to investigate problem areas in a greater level of detail; for example, through the use of local junction assessment models, to be considered on a case-by-case basis.

4.8. User Classes/Vehicle Types

4.8.1. The GCTM Version 2.3 adopts the same five user classes as used in previous GCTM versions. These user classes are set out in Table 4-2

Table 4-2 - 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

4.8.2. The vehicle-to-PCU conversion factors used for the various user classes are summarised in Table 4-3, taken originally from the DfT TAG Unit A5.4[9].

Table 4-3 - PCU Factors by Vehicle Type

Vehicle Type	Description	PCU Factor
Car	Private car	1.0
Light Goods Vehicle	Goods vehicle using car-based chassis	1.0
HGV	Heavy Goods vehicle	2.5

4.9. Assignment Methodology

4.9.1. Route choice within a highway assignment model is generated using the generalised cost of travel time, vehicle operating cost and tolling/congestion charging in accordance with TAG Unit A1.3. The assignment procedure used is an equilibrium assignment, distributing demand according to Wardrop's first principle of traffic equilibrium:

"Traffic arranges itself on congested networks such that the cost of travel on all routes used between each origin-destination pair is equal to the minimum cost of travel and unused routes have equal or greater costs."

4.9.2. The Wardrop User Equilibrium as implemented in SATURN is based on the 'Frank-Wolfe Algorithm', which employs an iterative process to minimise an 'Objective Function'. The travel costs are

[9] TAG Unit A5.4: https://www.gov.uk/government/publications/webtag-tag-unit-a5-4-marginal-external-costs-may-2018

recalculated during each iteration and then compared to the previous iteration. The process is terminated once successive iteration costs have not changed significantly. This process enables multi-routeing between any origin-destination pair.

4.10. Values of Time and Vehicle Operating Costs

4.10.1. The Value of Time (VoT) and Vehicle Operating Costs (VOC) used for the GCTM V2.3 were calculated based on the January 2023 TAG Databook (v1.20.2). Table 4-4 and Table 4-5 show the VoT in Pence per Minute (PPM) and VOC in Pence per Kilometre (PPK) for the five user classes used in the GCTM base model.

4.10.2. The average speed used to inform these figures was taken directly from Version 1 of the GCTM.

Table 4-4 - Values of Time in Pence per Minute

User Class Number	Description	AM Peak	Interpeak	PM Peak
1	Car (business)	29.93	30.67	30.37
2	Car (commute)	20.07	20.40	20.14
3	Car (other)	13.85	14.75	14.50
4	LGV	21.69	21.69	21.69
	OGV1*	21.60	21.60	21.60
	OGV2*	21.60	21.60	21.60
5	HGV* - weighted average	49.69	49.69	49.69

*Includes HGV multiplier (2.3) for consistency with RTM technical guidance and to reflect the fact that route choice for HGVs is typically based on an operator's VoT rather than a driver's VoT.

Table 4-5 - Vehicle Operating Costs in Pence per Kilometre

User Class Number	Description	AM Peak	Interpeak	PM Peak
1	Car (business)	12.67	12.62	12.62
2	Car (commute)	6.23	6.18	6.18
3	Car (other)	6.23	6.18	6.18
4	LGV	13.78	13.77	13.77
	OGV1*	27.20	27.20	27.20
	OGV2*	51.20	51.20	51.20
5	HGV – weighted average*	41.60	41.60	41.60

*A 60:40 OGV1/OGV2 split was assumed for all RTMs based on a review of classified count data

4.11. Capacity Restraint Mechanisms: Junction Modelling and Speed/Flow Relationships

4.11.1. The simulation network of the model includes detailed coding of each junction within the area. This specifies the junction type, turn capacities, lane allocation and, where appropriate, signal timing data. Both longer links in urban areas and rural links largely have capacity restraint from the link itself, rather than the junctions at either end. Therefore, Speed Flow Curves (SFCs) are used to model the impact of the flow on the link on the delay exhibited.

4.11.2. Appendix A outlines the SFCs applied for the GCTM Version 2.3.

5. Calibration and Validation Data

5.1.1. To help inform an understanding of trip rates and patterns in the GCTM, a range of additional data was collated, beyond that used to produce Version 1 of the GCTM. This new data was used to calibrate and validate the base year model within the extended fully modelled area, whilst existing data was retained to ensure calibration and validation within the existing fully modelled area remained robust. This section summarises the both the existing and new data collated as used in calibration and validation of Version 2.3 of the GCTM.

5.2. GCTM Version 1 Existing Data

5.2.1. All data used to calibrate and validate Version 1 of the GCTM (adjusted to March 2015 levels) was retained as part of the Version 2.3 model. This includes traffic count data from a variety of sources and journey time data derived from the DfT's Traffic Master dataset.

5.2.2. An overview of these data sources is presented below, with full details available in Chapter 5 of the Version 1 LMVR (produced by Mott MacDonald July 2019).

Existing Count Data

A417 Missing Link Count Data

5.2.3. The A417 Missing Link model (used as the basis of the GCTM Version 1) made use of data originally used in the calibration and validation of the SWRTM combined with additional automatic traffic counts (ATCs).

5.2.4. The locations of these counts, and the screenlines they form, are shown in Figure 5-1.

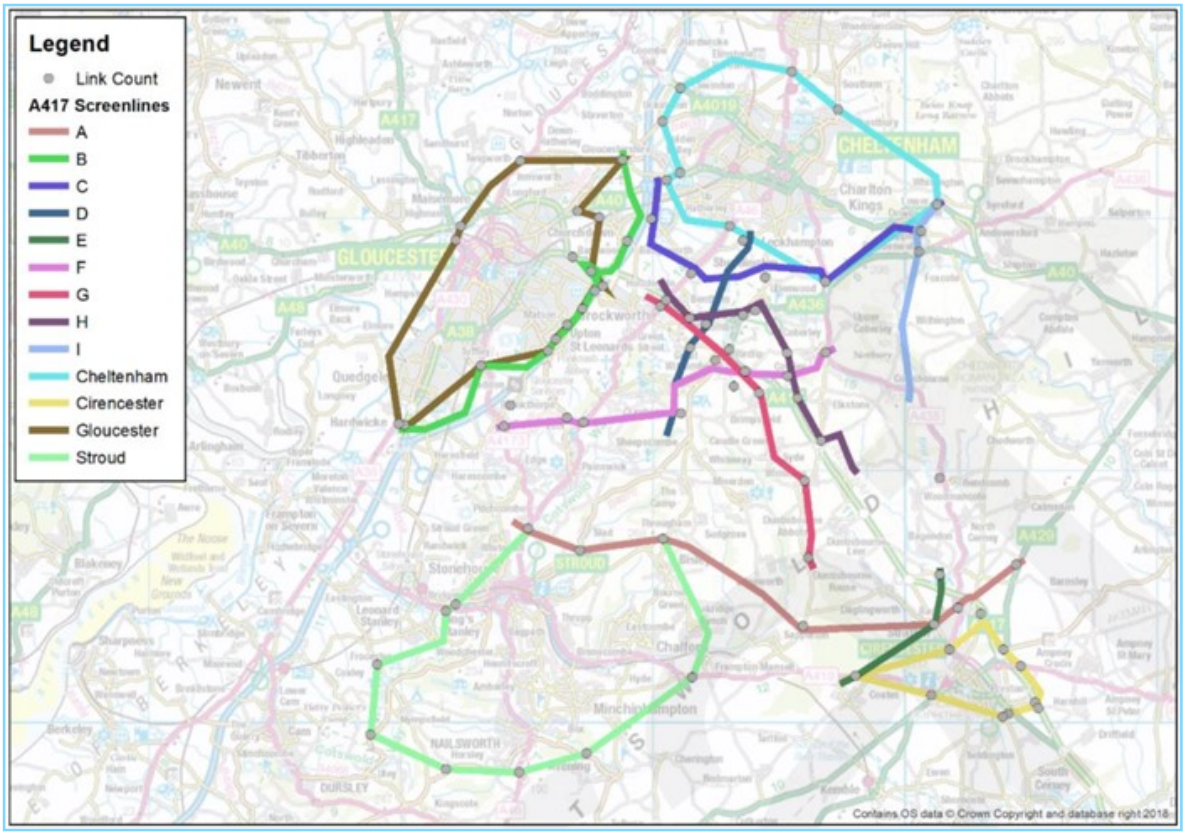

Figure 5-1 - A417 Missing Link Traffic Counts and Screenlines (Mott MacDonald GCTM v1 LMVR)

Gloucestershire Traffic Count Data

5.2.5. In addition to the data derived from the A417 Missing Link model, ATC data collected by GCC in 2018 was also used for calibration and validation of the GCTM Version 1, focusing on the Stroud and M5

J10 areas. In addition, MCTCs from the Stroud area also commissioned by GCC were used to derive vehicle classifications which were then applied to the ATCs. The GCC ATC and MCTC data is shown in Figure 5-2.

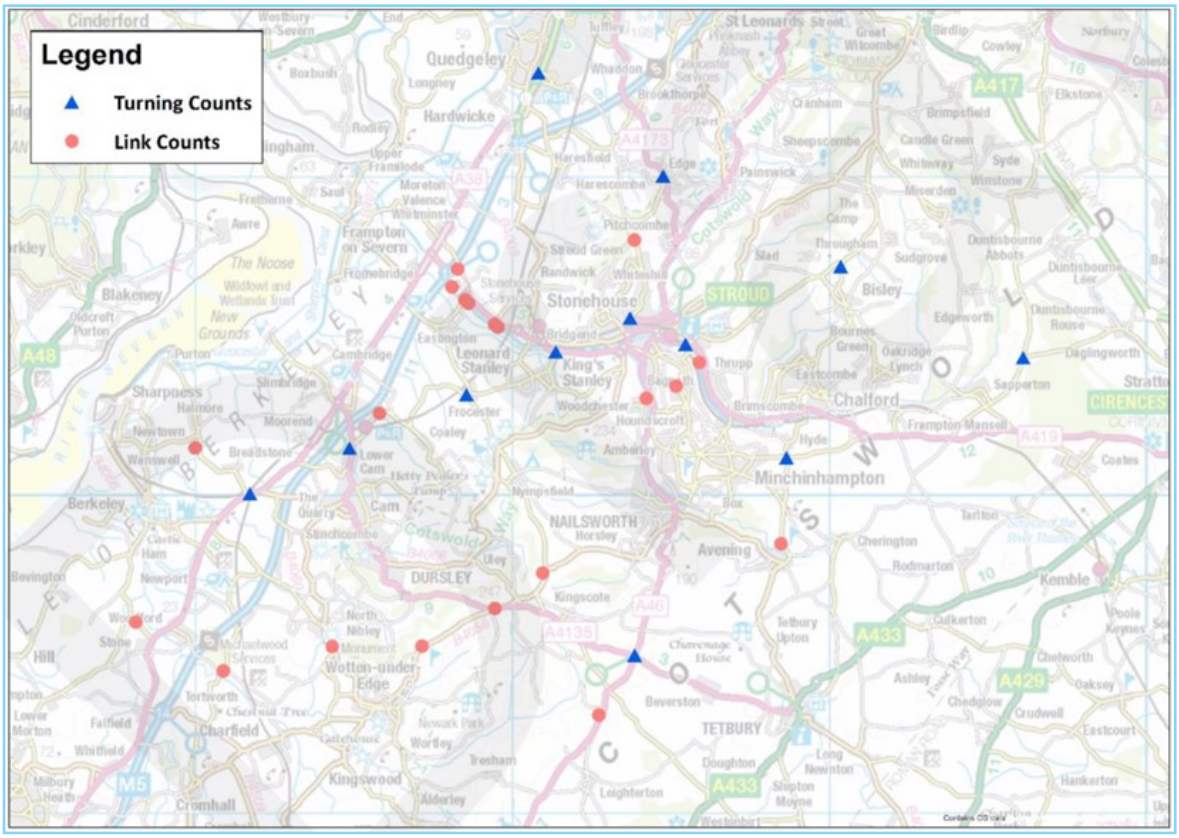

Figure 5-2 - GCC ATC & MCTC Locations (Mott MacDonald GCTM v1 LMVR)

Screenlines

5.2.6. The screenlines used in the A417 model are shown in Figure 5-1, but some revisions were made before they were used in GCTM Version 1, including an extension of Screenline A, updated counts included in Screenline B, and improved count coverage in the Stroud cordon.

5.2.7. These screenlines were supplemented with four further calibration screenlines and one validation screenline around Stroud, and an additional three calibration screenlines around M5 J10. These are shown in Figure 5-3 and Figure 5-4.

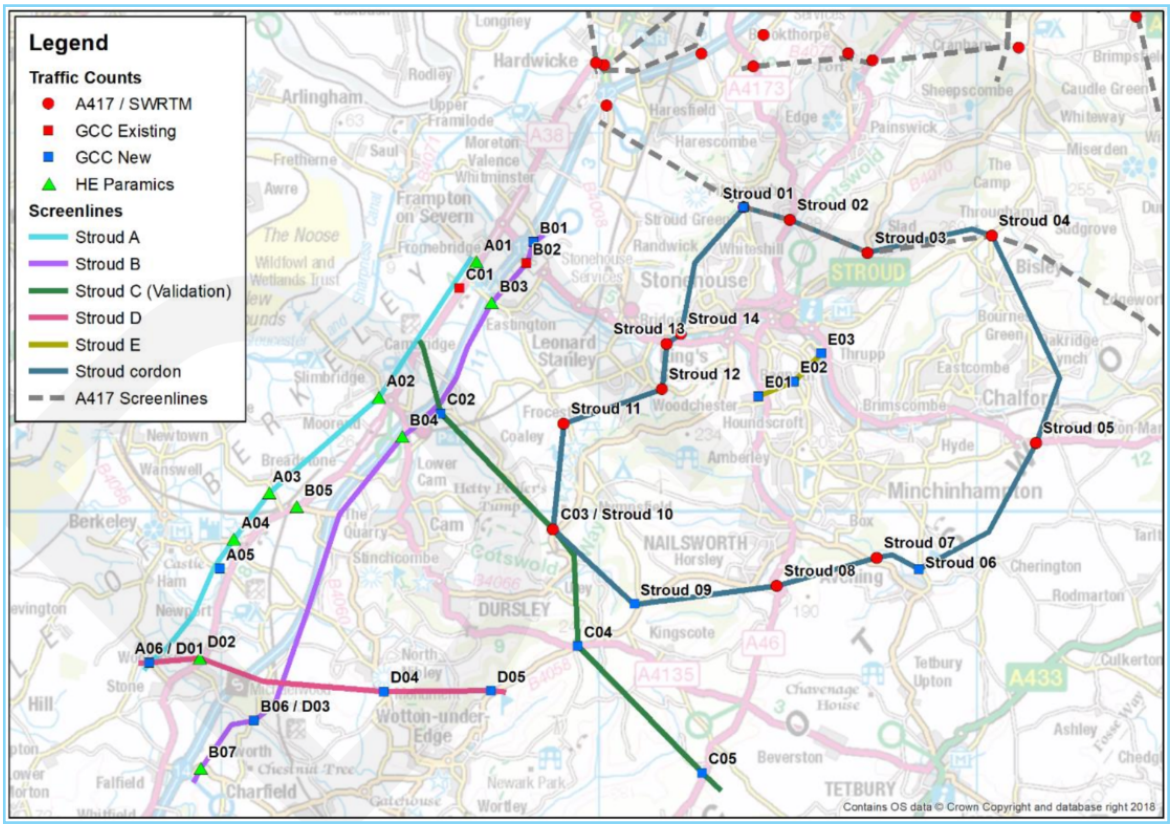

Figure 5-3 - Screenlines - Stroud Area (Mott MacDonald GCTM v1 LMVR)

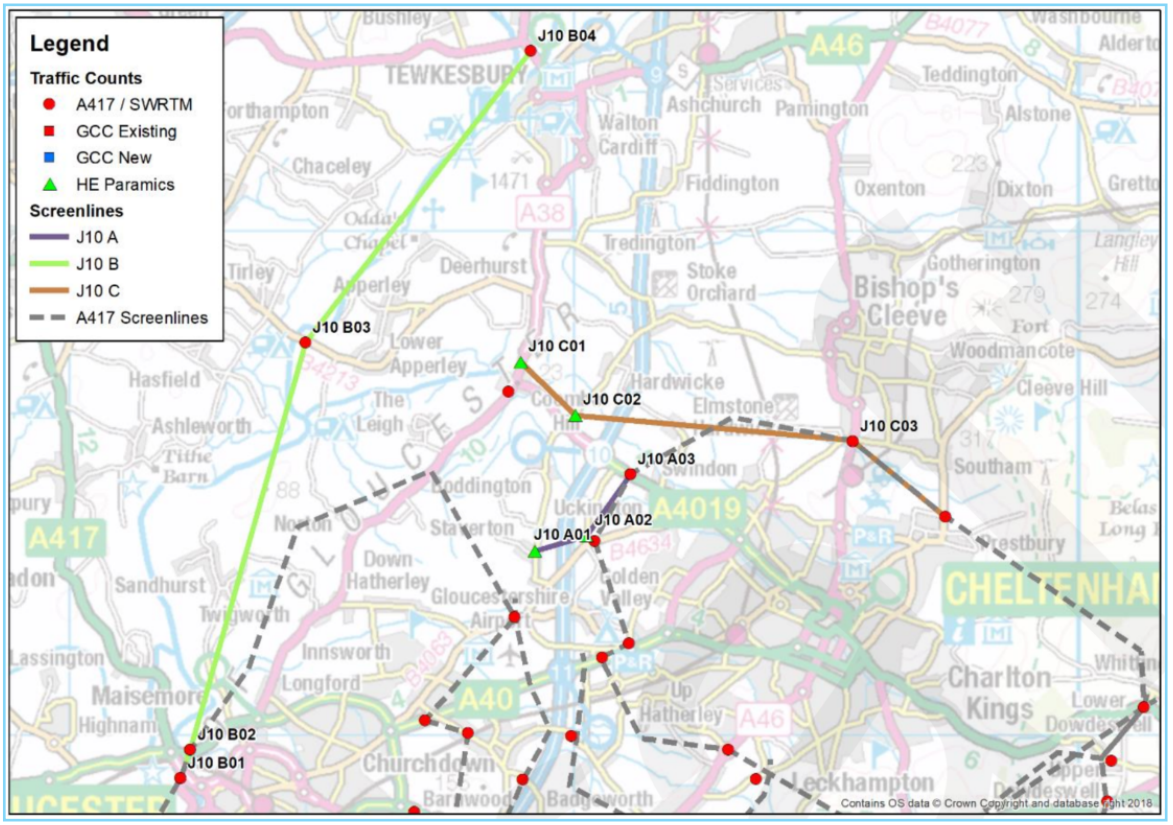

Figure 5-4 - Screenlines - M5 J10 Area (Mott MacDonald GCTM v1 LMVR)

Turning Counts

5.2.8. In addition to the link counts, a selection of turning counts were inherited from the A417 model, and the GCTM Version 1. The locations of the counts from the GCTM Version 1 is shown in Figure 5-5.

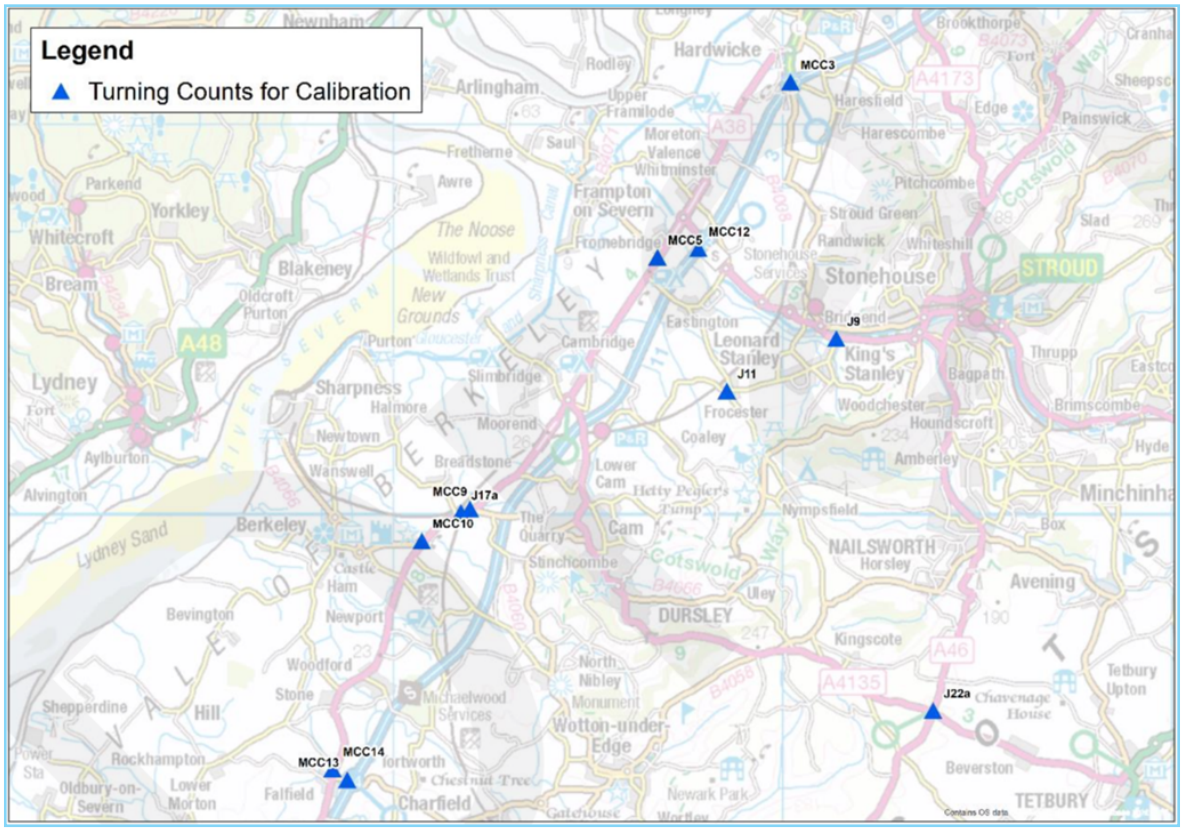

Figure 5-5 - GCTM Turning Counts (Mott MacDonald GCTM v1 LMVR)

Existing Journey Time Data

5.2.9. Version 1 of the GCTM includes journey validation routes as used in the existing SWRTM and A417 Missing Link models, derived from the DfT's Traffic Master dataset for March 2015. These journey time routes were supplemented with additional local routes around Stroud and M5 J10, also derived from Traffic Master data. These existing routes are shown in Figure 5-6.

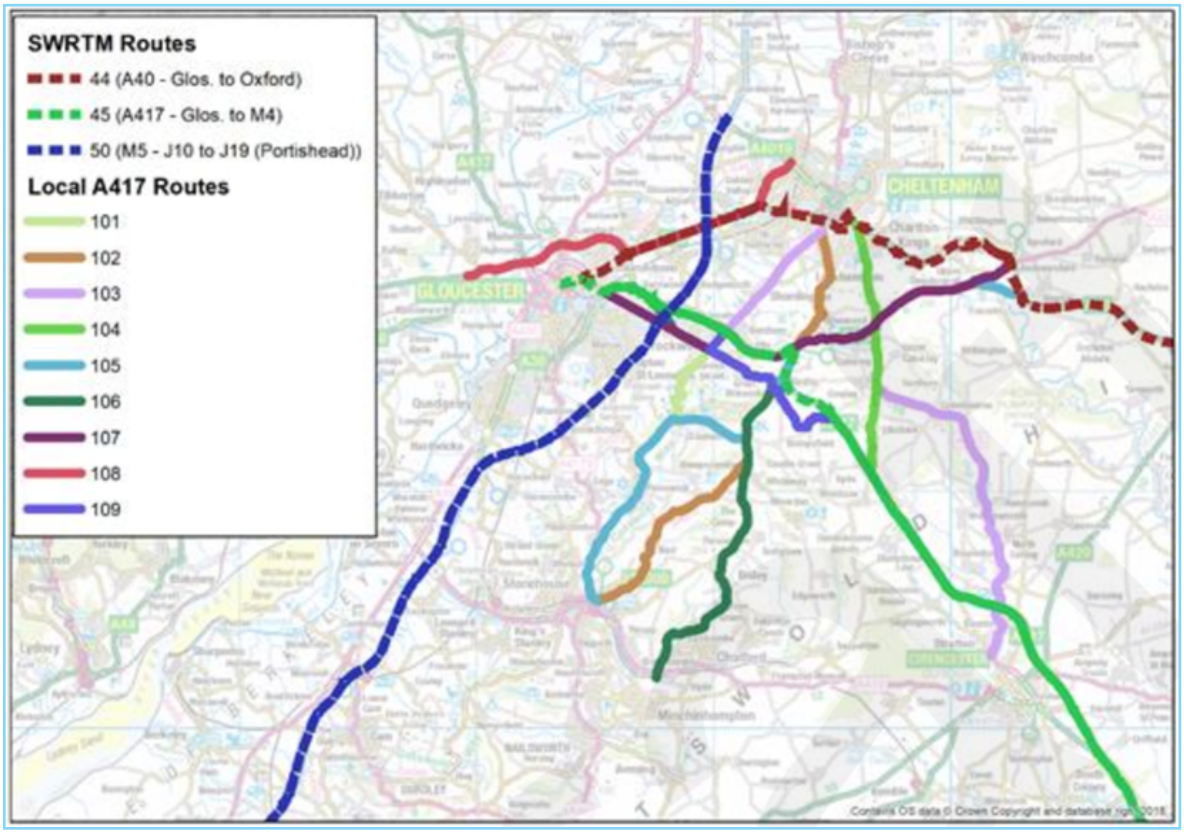

Figure 5-6 - SWRTM and A417 Journey Time Routes (Mott MacDonald GCTM v1 LMVR)

5.2.10. For the production of the GCTM Version 1 these journey time routes were supplemented with additional local routes in the Stroud and M5 J10 areas, derived from TrafficMaster data. These are show in Figure 5-7 and Figure 5-8.

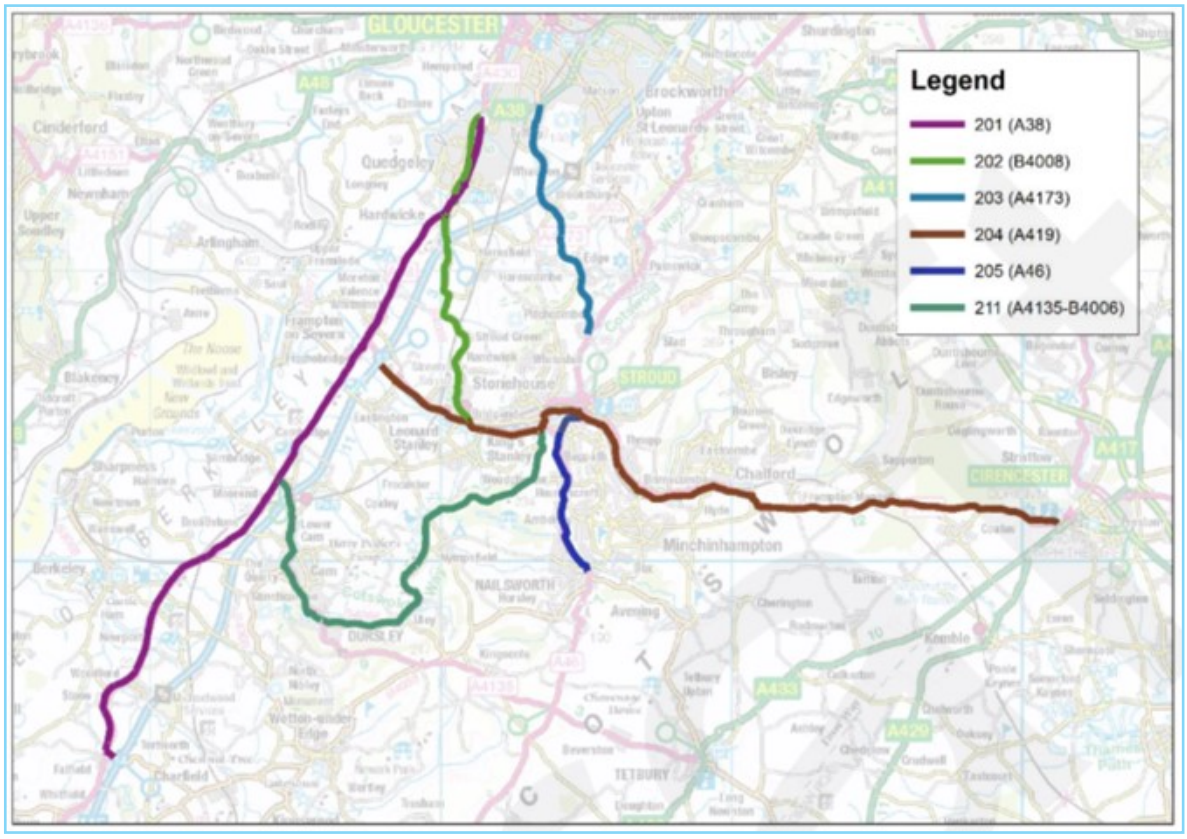

Figure 5-7 - Local Journey Time Routes – Stroud (Mott MacDonald GCTM v1 LMVR)

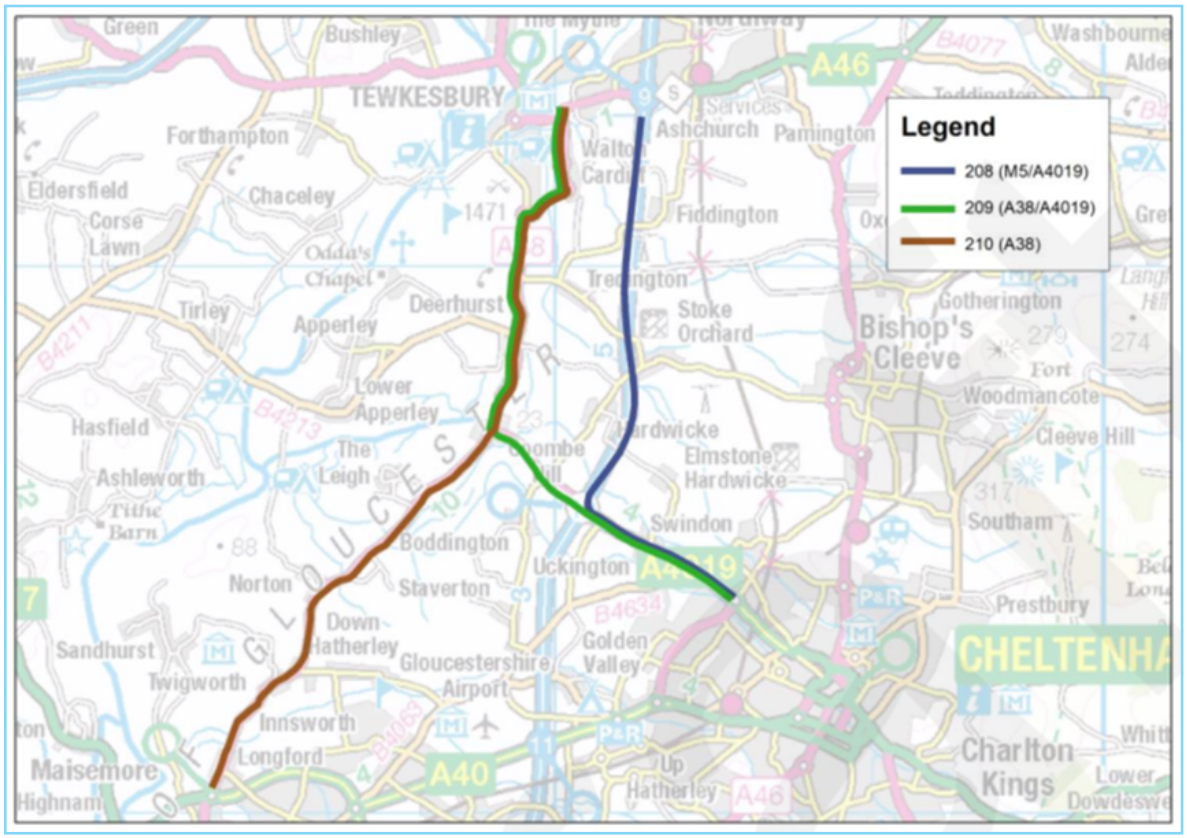

Figure 5-8 - Local Journey Time Routes - M5 J10 (Mott MacDonald GCTM v1 LMVR)

5.3. GCTM Version 2.3 Additional Traffic Data

5.3.1. A review of the data presented in Section 5.1 found that there was a very limited amount of observed traffic data used to calibrate Version 1 of the GCTM in Tewkesbury and surrounding areas, with only one count used in Tewkesbury as part of the identified M5 J10 screenline. At the outset of the project, it was also recognised that there was not sufficient time to undertake new data collection surveys to meet the timescales of the December 2019 SOBC submission for the M5 Junction 9/A46 Ashchurch improvement scheme.

5.3.2. Consequently, for the purposes of the Version 2.0 extension, Atkins identified a range of readily available data sources which could be used to supplement the existing dataset and ensure robust calibration and validation in the vicinity of the proposed M5 Junction 9/A46 Ashchurch scheme. This data includes:

- Strategic road network traffic count data from the Highways England WebTRIS count database;
- Local road network traffic count data from the following data sources:
- Automatic Traffic Count (ATC) and Manual Classified Turning Count (MCTC) held by GCC;
- ATC data held by Worcestershire County Council;
- ATC data used as part of recent DfT National Transport Model updates; and
- TomTom journey time data for routes in the vicinity of the proposed scheme extracted for March 2015.

5.3.3. Version 2.3 also includes additional WebTRIS data for the Strategic Road Network, Local network count data and Journey time data that were utilised as part of GCTM V2.0 and GCTM V2.1. Details regarding each of these data sources is provided below.

WebTRIS Data

5.3.4. The M5 and A46 trunk road both represent key strategic links likely to be affected by the proposed M5 J9 Ashchurch improvement scheme both local and at a wider level. It was important to obtain reliable count data for various sections of both these routes, beyond what had already been included as part of the Version 1 base model development (which includes data for the M5 between J9 and J10 to the south of Tewkesbury).

5.3.5. For Version 2.0, Highways England WebTRIS data was collated for 39 sites along the M5 between J9 and 4a (Bromsgrove), and the A46 between Tewkesbury and Alcester. Data was collected from March 2013 – March 2018 subject to availability – with March 2015 data used where available, but also considering the roadworks during the period, along the M5 as part of the Smart Motorway programme. As part of the Version 2.1 update, an additional 6 sites were collated to fill gaps in the existing data available on the M5 mainline corridor within the Version 1 fully modelled area providing full coverage of the corridor throughout Gloucestershire.

5.3.6. Data was processed for each of the modelled time periods, with all data adjusted to represent March 2015 levels based on annual/monthly changes in traffic levels (as was the case with data used for GCTM Version 1). This was achieved by calculating factors from sites where continuous long-term data was available, and separately for A46 and M5 sites, recognising the potential for different traffic patterns on the two strategic routes. The locations of the sites used are shown in Figure 5-9 and Figure 5-10.

Local Road Network Count Data

5.3.7. Existing count data for the local road network available from 2014 onwards within the core M5 Junction 9 study area and wider fully modelled area was requested from both GCC and Worcestershire County Council (WCC). The following data was received and utilised during calibration and validation of both Versions 2.0 and 2.1:

- 2 ATC sites collected in July 2017 over a 2-week period for the purposes of developing the GCC Tewkesbury Paramics Model (TPM);10 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.
- Turning Count (TC) sites received from GCC across north Gloucestershire between Bishop's Cleeve and Moreton-in-Marsh;
- 8 ATC sites received from WCC with south Worcestershire and northern Gloucestershire; and
- 2 ATC sites utilised for NTMv5 validation, north of Alcester on the A445 and A431.

5.3.8. As with the WebTRIS data, all available count data was processed for each of the modelled time periods and adjusted to represent March 2015 traffic levels – using the same adjustment factors calculated for the A46. The locations for local road network sites are shown in Figure 5-11.

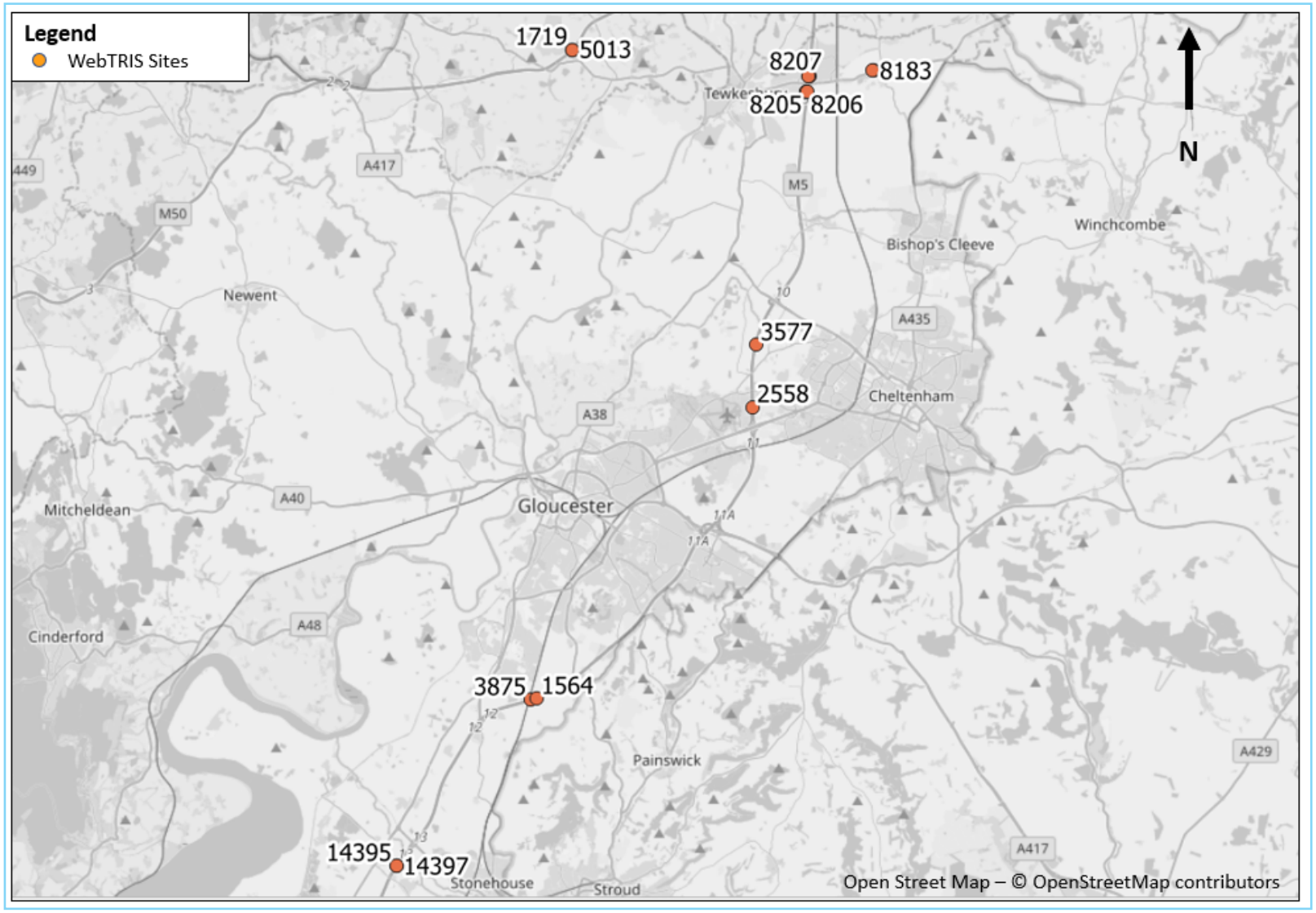

Figure 5-9 - Additional GCTM V2.1 WebTRIS Count Site Locations (within Gloucestershire)

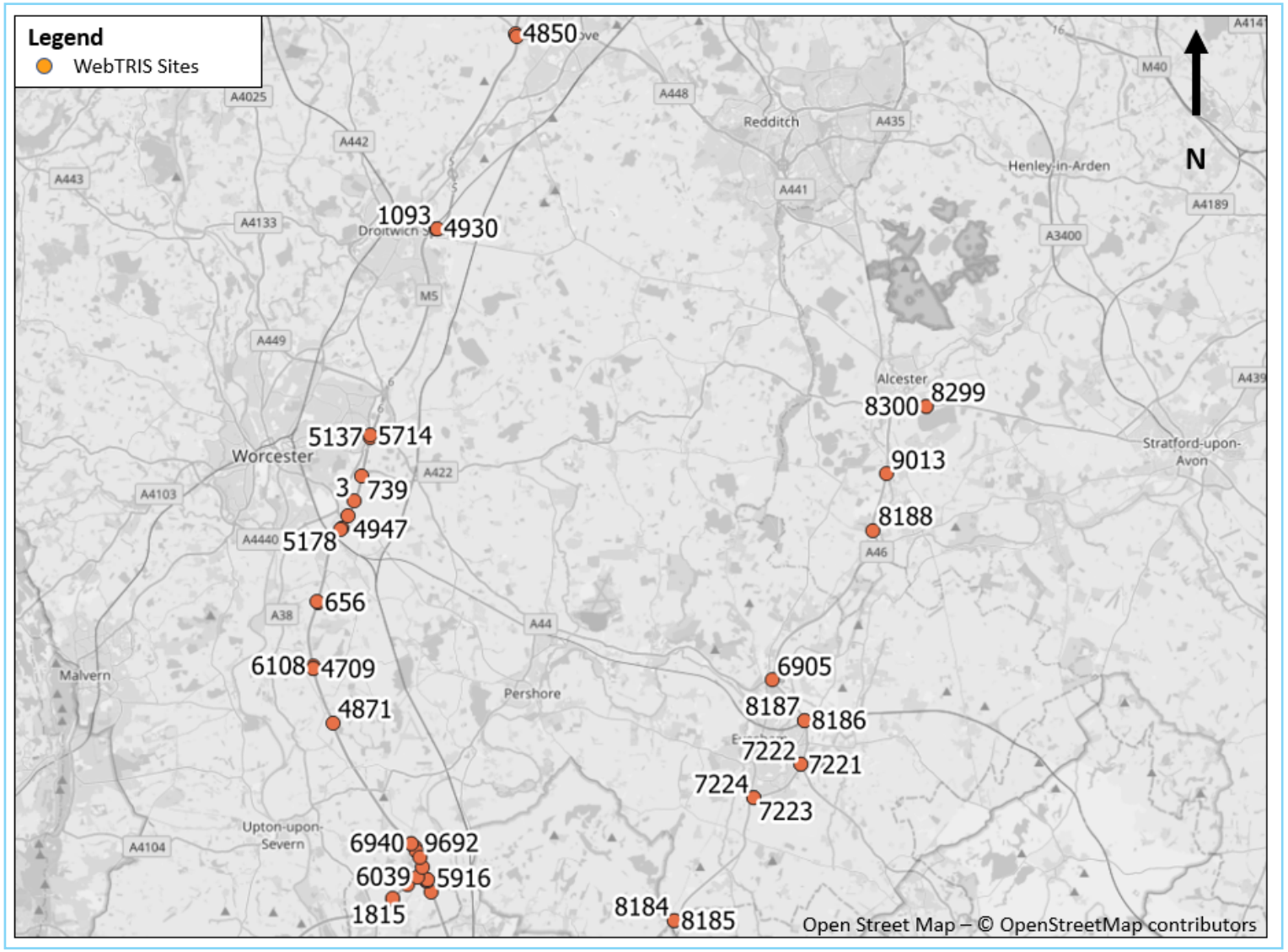

Figure 5-10 - Additional GCTM V2.1 WebTRIS Count Site Locations (north of Gloucestershire)

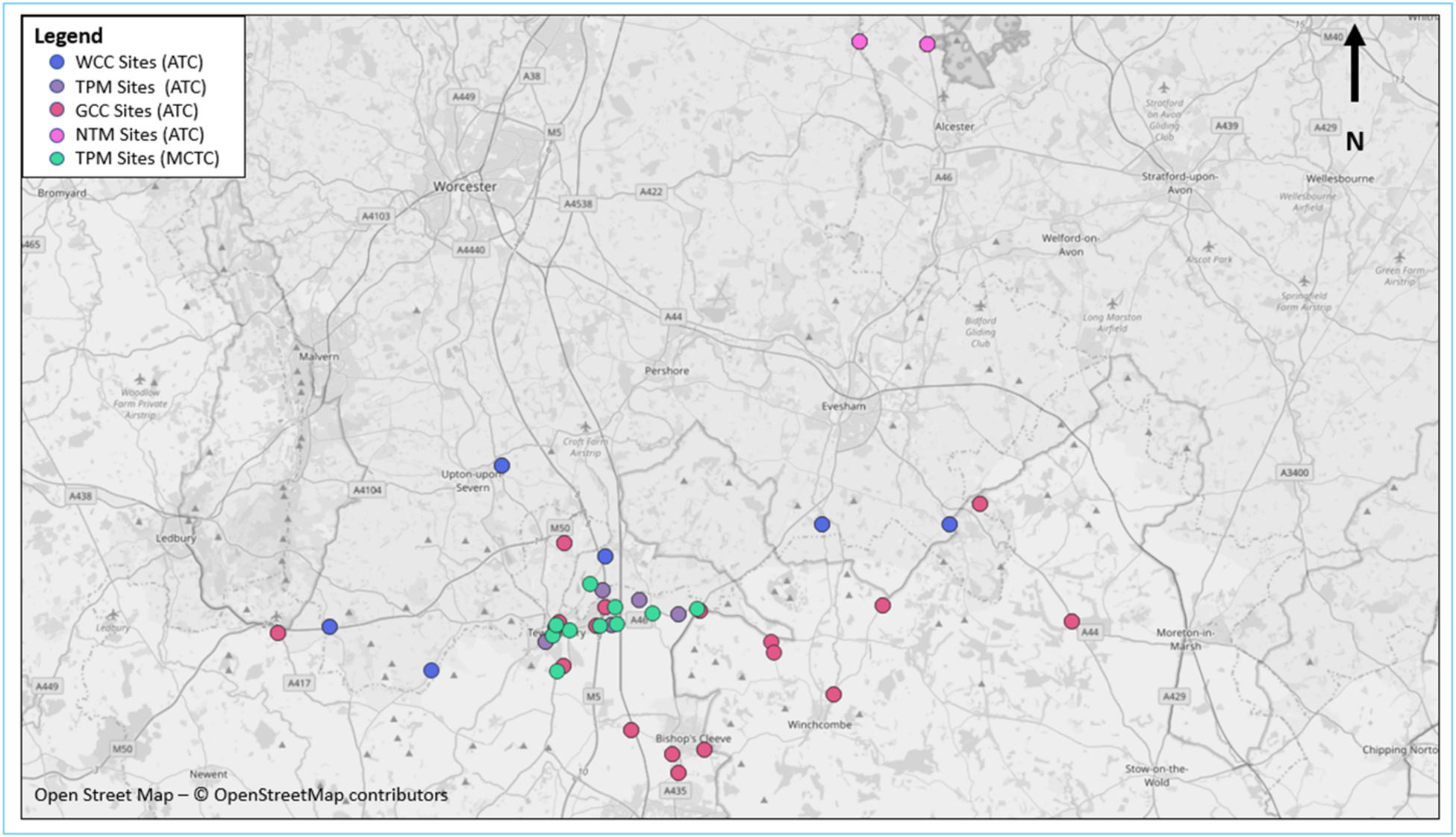

Figure 5-11 - Additional GCTM V2.1 ATC/MCTC Traffic Count Locations

M5 Junction 9/Tewkesbury Cordon

5.3.9. Having collated the available additional count data sources, a suitable additional cordon screenline was identified, made up of link counts surrounding M5 Junction 9 and Tewkesbury (both inbound and outbound). This cordon provides an added means of ensuring that the overall level of traffic around the existing junction is accurate and appropriate for the purposes of appraising the M5 Junction 9/A46 Ashchurch Improvement scheme. The location of the cordon points is shown in Figure 5-12. It should be noted that for the M5 between Junction 9 and Junction 8 (to the north), in the southbound (inbound) direction, counts for the southbound off-slip and the mainline within the junction were summed together to produce the mainline flow north of the diverge point.

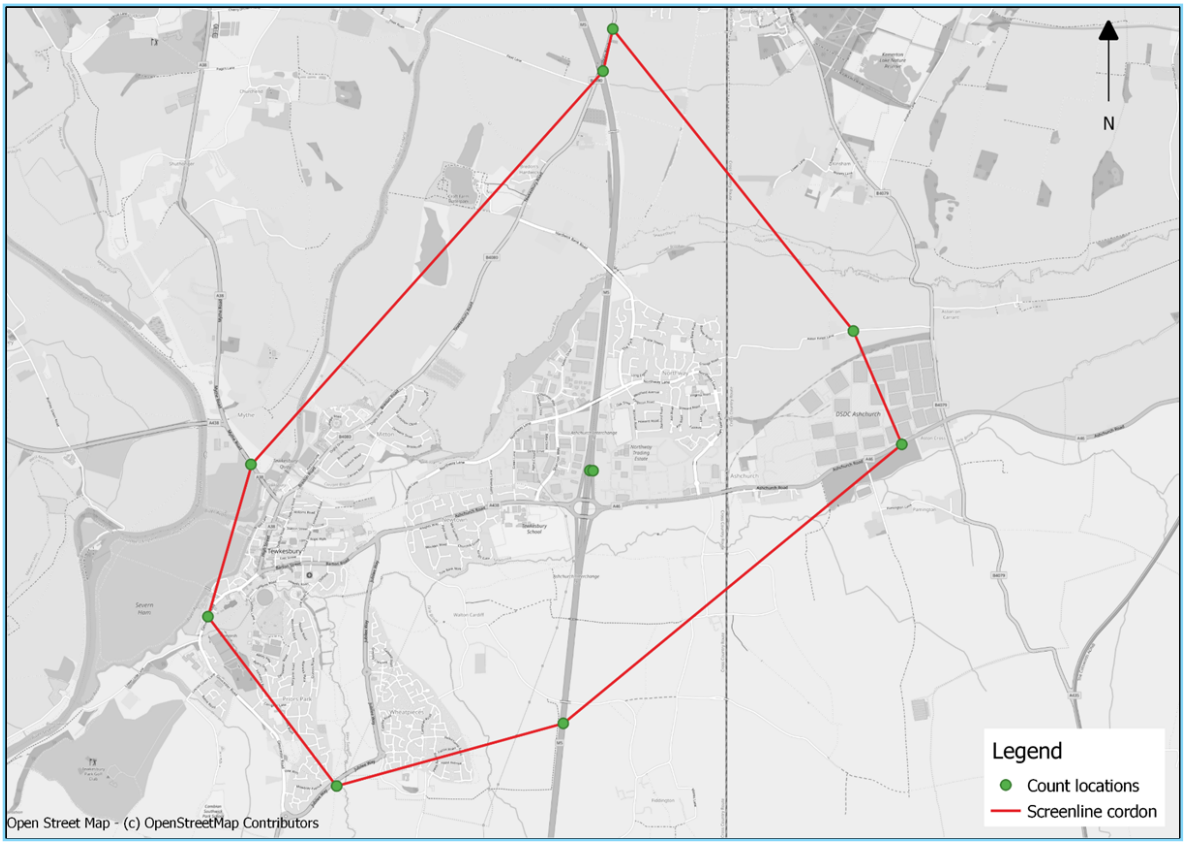

Figure 5-12 - Tewkesbury Cordon

Journey Time Data

5.3.10. March 2015 TomTom journey time data was collated across six routes for the purpose of journey time validation. This data provided cumulative journey times along key routes in the model, in both directions for each route.

5.3.11. The six routes are shown in Figure 5-13. Route 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 B 4079/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.

5.3.12. It should also be noted that modelled journey times between Junction 10 and 9 to the south are validated using already available Trafficmaster data (for the route shown in Figure 5-8).

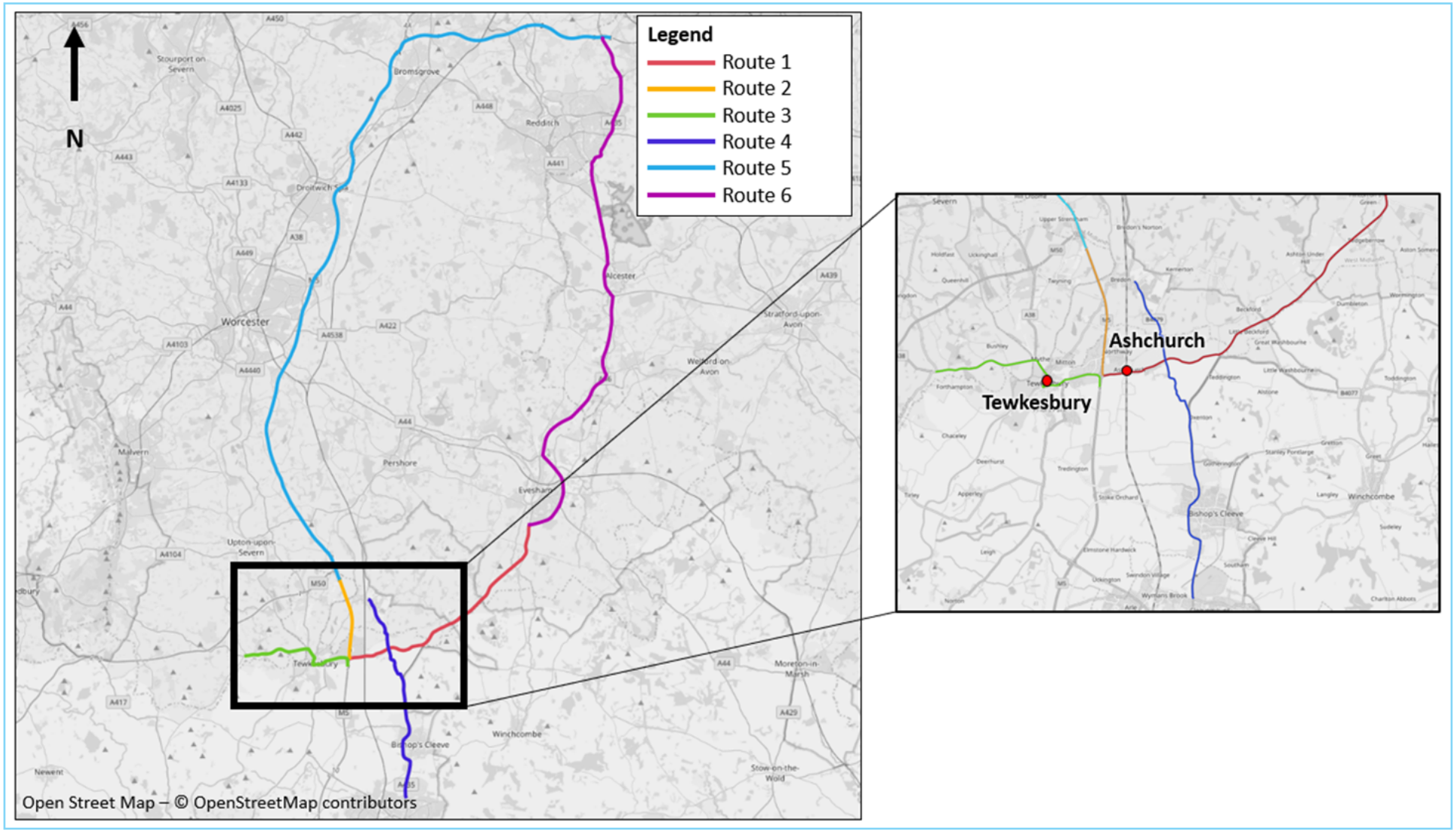

Figure 5-13 - Journey time routes

5.4. Additional Data Review

5.4.1. The following sections provide details regarding the checks undertaken to ensure robustness of the new data sources incorporated within the GCTM Version 2.1.

Traffic Count Checks

5.4.2. Errors in ATC data can result from several different causes such as equipment failure, road closures, incidents or seasonality whilst the short-term nature of MCTC sites means they can be unreliable in terms of traffic volume due to daily fluctuations in traffic. All new count sites were checked to ensure consistency and reliability, using the following methods:

- General sense-check – any recorded peaks or troughs in the data, inconsistent with the overall trend of the survey site were investigated and removed from the dataset where deemed appropriate;
- Tidality – all flows were plotted within the developed model network by time period and direction to ensure the observed patterns in flow were as expected and consistent for adjacent locations;
- Cross-checking – all link and turning flows were compared against adjacent links and junction turning flow data to ensure flows were consistent in terms of volume by each time period.

5.4.3. These checks identified a small number of link count sites with outliers where traffic flows were atypical compared with surrounding locations. Where possible, duplicate counts (i.e. alternative counts for the same location) were used to substitute the originally selected sites or alternative date ranges for counts were used (for example WebTRIS site data is often continuously recorded and hence available for different dates).

Journey Time Data Checks

5.4.4. Checks on the journey time data consisted of two main elements. These were:

- Checks on sample size; and
- Checks of journey route distance against SATURN coded distance.

5.4.5. 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 in Table 5-1.

5.4.6. 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 5-1 - Journey time data sample sizes

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

5.4.7. 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. 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.

6. Network Development

6.1.1. Having identified the core study area for the GCTM extension and enhanced the zoning system within the extension and the major urban areas around M5 Junction 9, it was also necessary to improve the level of detail of the highway network. This chapter sets out the refinements made to the model network including changes originally made for Version 2.1 and additional changes made for Version 2.3.

6.2. Overview of GCTM Extension Network Development

6.2.1. The development of the network of the GCTM extension consisted of the following:

- A review of junction designs and link characteristics; and
- A review of signalised junction timings.

6.3. Network Coverage

6.3.1. The development of the extended and enhanced model network made use of Ordnance Survey (OS) mapping data together with GIS software. The process of enhancing the network first involved the incorporation of additional nodes and links within network GIS files, enabling geospatially accurate representation of the highway network within SATURN.

6.3.2. Links were added to the network in several areas to ensure there was sufficient detail. These areas are shown in Figure 6-1.

6.3.3. Main routes added into the network were:

- The Green
- Gallagher Road;
- Manor Road;
- Church Road;
- Swindon Road
- Windyridge Road;
- Hayden Road;
- Evesham Road in Bishop's Cleeve; and
- The link through Ashchurch Rural Area near M5J9.

6.3.4. Some more minor links were also added in and around Junction 9 as well as several stub links designed to enable traffic from the disaggregated zoning system (see Section 4.4) to access the network accurately.

6.3.5. Figure 6-2 shows the extent of simulation and buffer network for GCTM v2.3 model.

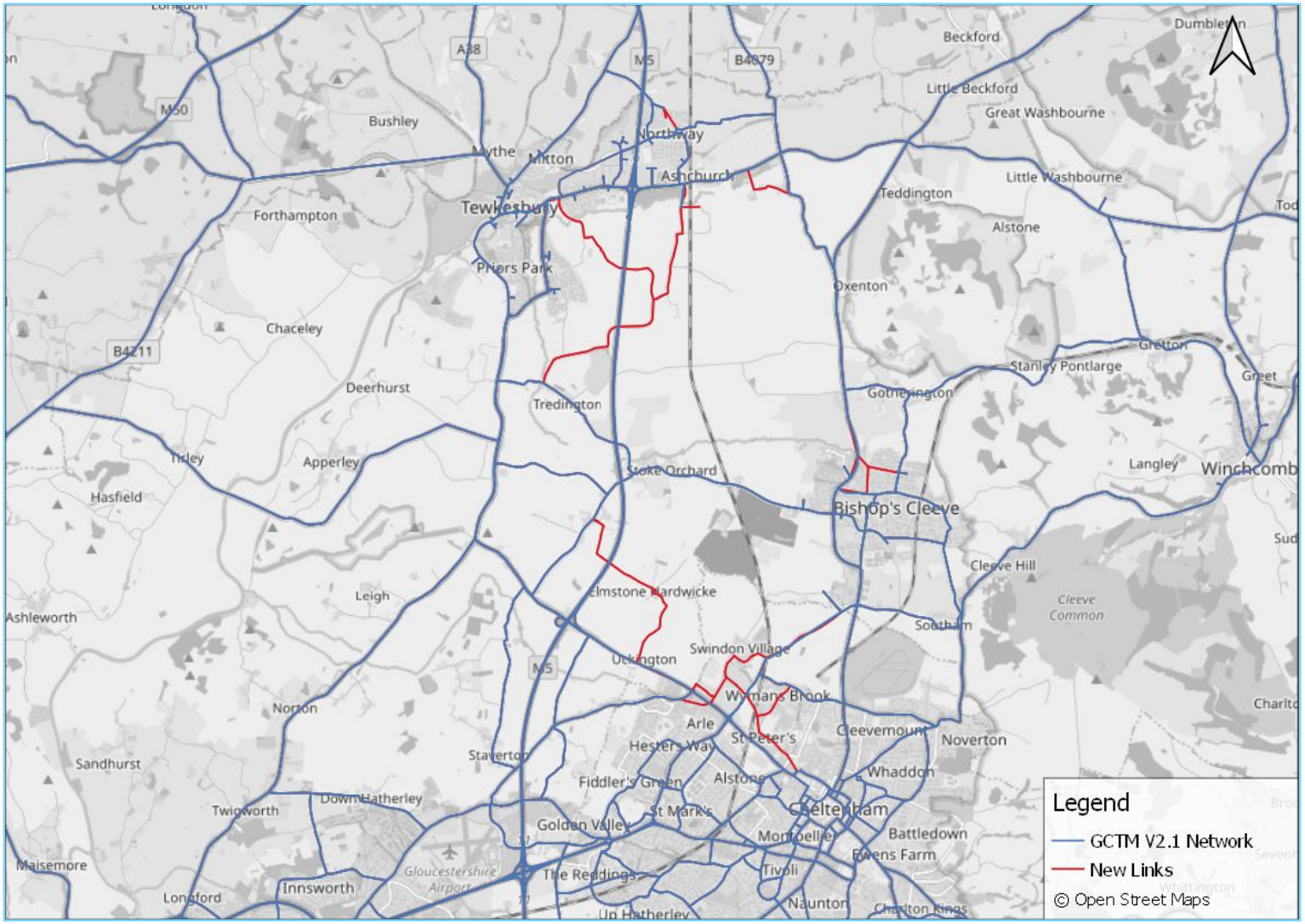

Figure 6-1 - GCTM V2.3 Model Network

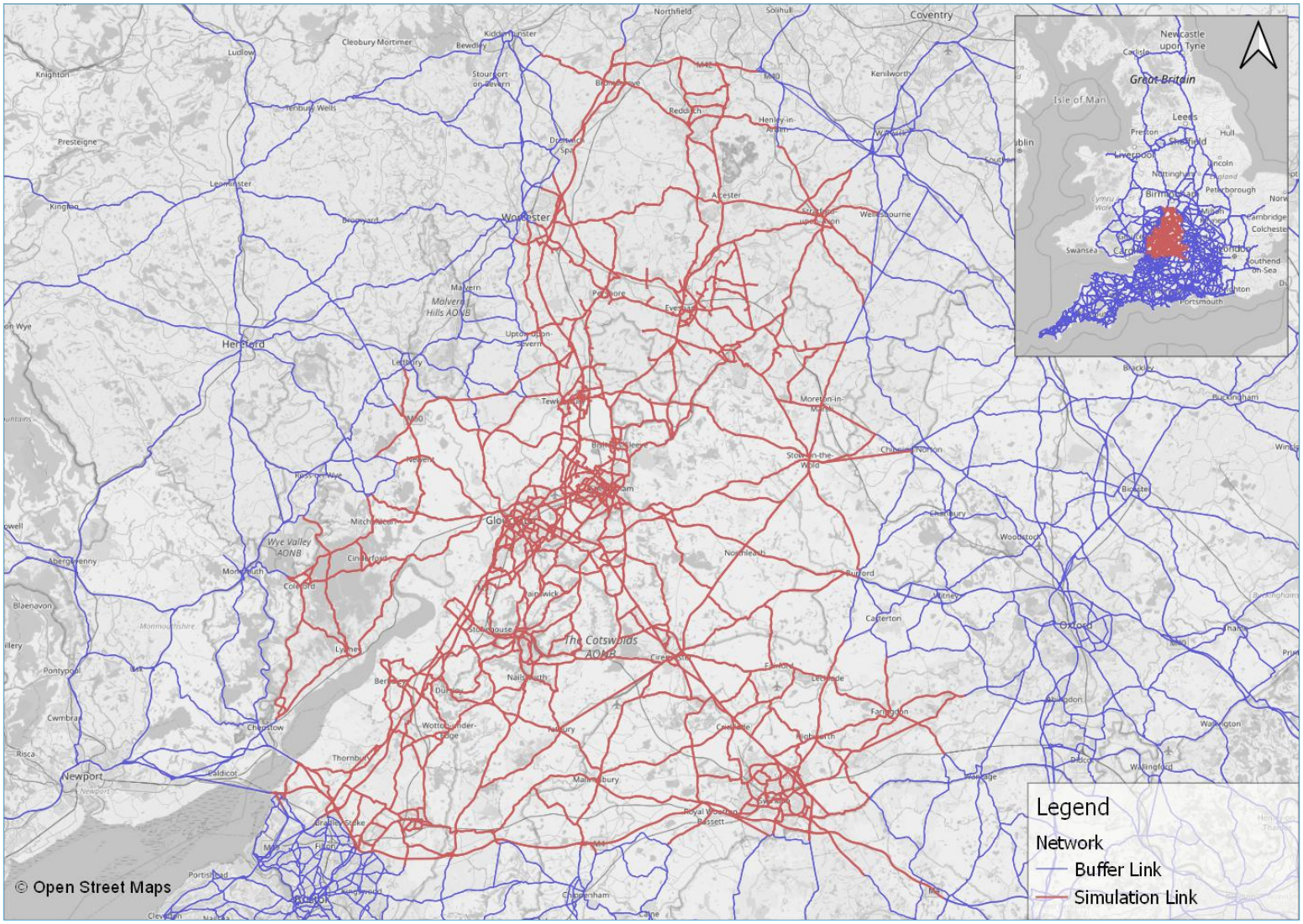

Figure 6-2 - GCTM V2.3 Model Wider Network

6.4. Junction and link characteristics

6.4.1. As part of the network development and calibration, junctions and links were reviewed for their characteristics, including junction saturation flows, link length and speed limits/speed-flow curves.

6.4.2. The saturation flows used for coding of newly added junctions were taken from the Regional Traffic Model (RTM) network coding manual. The values were chosen based on the characteristics of the junctions in question, and values for key junctions were refined during the calibration process.

6.4.3. Link lengths were checked for accuracy, and a review was conducted to check that link distances and speeds were consistent on opposing sides of the roads. In addition, SFCs were checked throughout the model extension area to check that these were appropriate for the characteristics of the roads.

6.5. Signalised junction staging and timings

6.5.1. In order to calibrate the signal timings at junctions along the A46, a site visit to Ashchurch and Tewkesbury was undertaken on Thursday 3 October 2019 during the AM peak. The purpose of the visit was to assess the signal timings and staging of key signalised junctions throughout this key stretch of the A46, and to understand the impact that this was having on traffic during the AM peak. The following junctions were visited (from east of Ashchurch, heading WB):

- 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.

6.5.2. In addition to recording the signal timings and stagings at each junction, the general conditions along the Tewkesbury-Ashchurch corridor were assessed, to assist with model calibration. It was noted that the junction at Aston Cross (see Figure 6-3 and Figure 6-4) caused long queues in both directions along the A46, exacerbated by a significant volume of HGV traffic. Around the western exit of M5 J9, onto the A438 through Tewkesbury, significant queues were observed tailing back from the Shannon Way junction, onto the exit the M5 J9 circulatory (see Figure 6-5). These queues were observed throughout the duration of the AM peak period (from the start of the site visit at 07:30), but with a clear spike in congestion around 08:30 before beginning to tail off after 09:00 which matches with the trends seen in the TomTom data collected for the purposes of journey time validation.

6.5.3. These observations enabled improved calibration of the model in this key area, and the better replication of peak conditions along the corridor.

Figure 6-3 - Junction at Aston Cross

Figure 6-4 - Eastbound queue at Aston Cross

Figure 6-5 - Queues from A46-Shannon Way junction

7. Trip Matrix Development

7.1. Overview

7.1.1. GCTM V2.3 utilises the GCTM V2.1 demand matrices as starting point with a bit of zone refinement around Gallagher retail park. This section summarises the approach taken to construct the base year trip matrices for the extended GCTM Version 2.1, derived from the original GCTM matrix.

7.2. GCTM Extension Prior Matrix Development Methodology

7.2.1. The development of the GCTM Version 2.3 prior matrices involved disaggregating the existing zones in the extension area to the required level of detail. The method for the disaggregation is detailed below.

Zone Disaggregation

7.2.2. As detailed in Section 4.5, the zoning system for the GCTM extension was based upon the existing GCTM zones, divided into several smaller zones, based upon UK Census OAs and LSOAs.

7.2.3. In disaggregating the GCTM extension matrices, it was necessary to ensure that the new prior matrix reflected differences in land use across the model area. To inform this process, UK Census statistics on the number of households, workers and jobs in each new zone was collected. Given the differing spatial aggregation of the areas (OA, LSOA etc.) used to inform the GCTM extension zoning, the following UK Census statistics used were:

- Resident population to inform the home end of home-based trips; and
- Workplace population to inform the non-home end of home-based work employers business trips.

7.2.4. These statistics were used to calculate proportions for each new zone, whilst maintaining the overall number of trips. Different factors were applied for each user class, dependent on the most logical factor that would influence the number of trip departures (origins) or arrivals (destinations). For example, trip origins in the AM peak utilise the proportion of residents within each OA, whilst for destinations, proportions were based upon the workplace population (reflecting the typical nature of trip patterns for journeys to work). In the PM peak, origin factors were based on the workplace population, with destinations based upon the residential population – reflecting return journeys. The relevant statistics used for each user class are shown in Table 7-1.

Table 7-1 - 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

Calibration adjustments

7.2.5. Following the production of the initial prior matrices, early assignments of the model were undertaken to understand the suitability of matrices prior to calibration. A number of checks were undertaken, comparing flows against screenlines and individual key links across the study area. This resulted in minor alterations to the initial matrices, accounting for detailed land use considerations that would not have been reflected following the initial zone disaggregation. In particular, the zone encompassing

the Morrisons supermarket and western edge of Newtown, Tewkesbury, was split, to better reflect the movement of trips within Tewkesbury, either side of the A438/A38 junction.

7.2.6. Final GCTM Version 2.3 prior matrix totals for each user class are presented in Table 7-2.

Table 7-2 - Final GCTM Prior Matrix totals by user class (PCUs)

User class	AM peak	Inter-peak	PM peak
Car (Business)	381,161	362,455	344,771
Car (Commuter)	1,991,970	855,581	1,919,239
Car (Other)	2,127,136	2,769,132	3,116,424
LGV	629,730	600,770	508,637
HGV	298,499	287,355	188,452
Total	5,428,496	4,875,294	6,077,522

8. Calibration and Validation Procedures

8.1. General

8.1.1. Model calibration refers to the process of refining and confirming the values of model parameters and improving origin-destination movements in the demand matrices to improve overall model performance. This performance is benchmarked against data collected as part of the study.

8.1.2. Model validation on the other hand aims to demonstrate that the calibrated model reproduces observed base year traffic conditions. This is done by comparing model outputs with data independent of that used in model calibration.

8.1.3. This section sets out the procedures followed during model calibration, including which counts were utilised for calibration and validation, the assignment methodology used, and any adjustments made to speed-flow curves (SFCs).

8.2. Calibration/Validation Counts

8.2.1. For the GCTM Version 2.3, all calibration and validation screenlines used in Version 1 (as detailed in Chapter 5) have been retained. This includes 17 calibration screenlines and 4 validation screenlines. A further calibration cordon screenline was also included for Tewkesbury (as shown in Figure 5-12) to be able to verify the correct volumes of traffic were entering/leaving the core study area around Tewkesbury and Ashchurch.

8.2.2. In terms of individual link and turning counts, a total of 292 calibration counts (for one direction) and 122 validation counts (excluded from the matrix estimation process) were used. 68 of the validation counts used were derived from the available MCTC data.

8.2.3. For inter-peak, the majority of turning count data was not available for this time period, whilst 3 counts used in calibration were also unavailable. Hence a total of 290 calibration counts and 44 validation counts are used for the inter-peak model.

8.2.4. The locations of calibration and validation links and junction MCTCs (used to provide additional validation data in the AM and PM peak only) are shown in Figure 8-1. The location of all calibration and validation screenlines is shown in Figure 8-2.

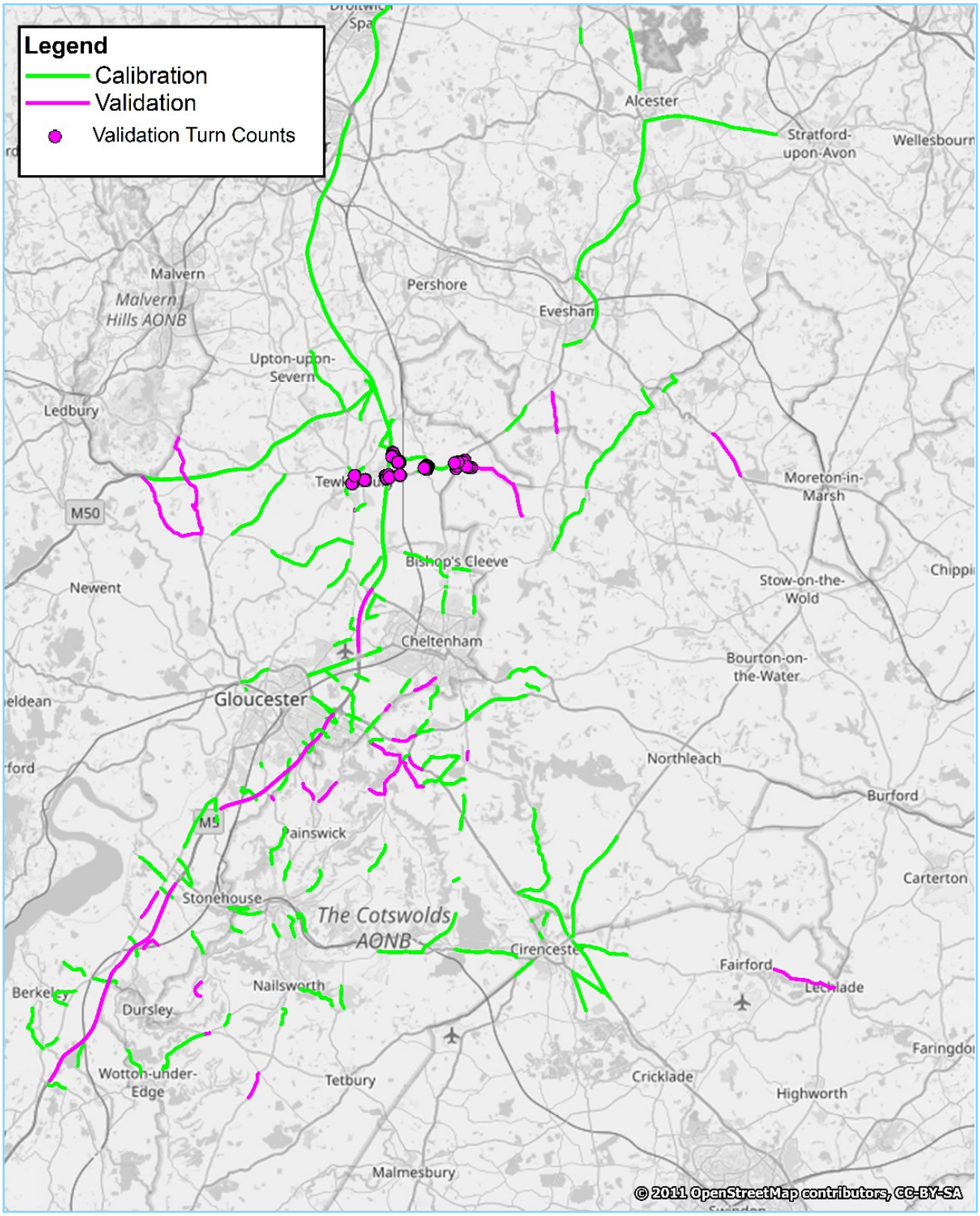

Figure 8-1 - Base Model Calibration/Validation Locations

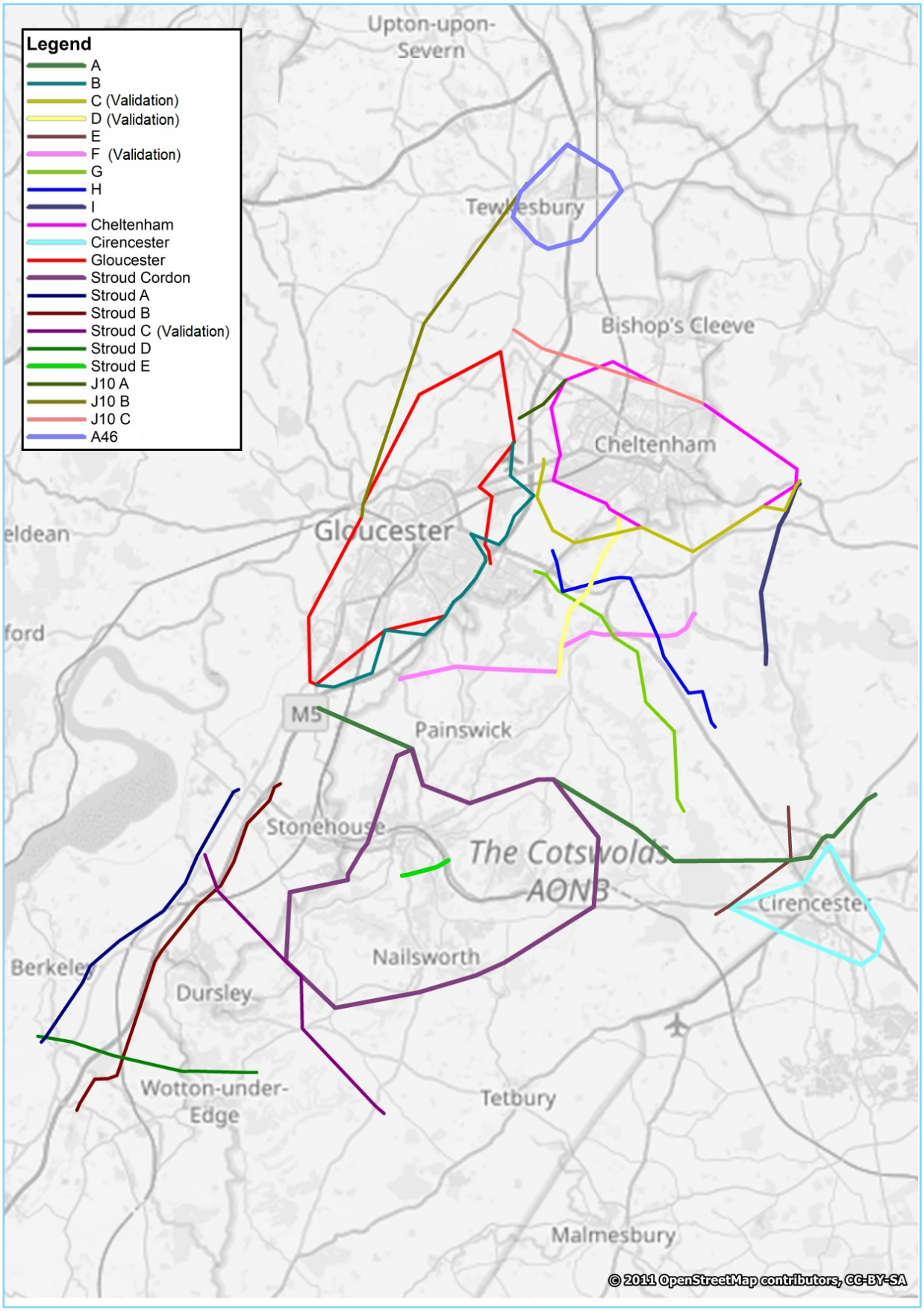

Figure 8-2 - Base Model Calibration/Validation Screenline Locations

8.3. Assignment Parameters

8.3.1. Model assignments were carried out using a Wardrop User Equilibrium procedure which aims to minimise the cost of travel for all vehicles within the network. The assignment is based on minimum generalised cost routes where the generalised cost is defined as a linear combination of time and distance:

$$Generalised\ cost = \beta \times time + \alpha \times distance$$

8.3.2. Full details of the parameters used in this procedure can be found in Section 4.9.

8.4. Calibration Procedure

8.4.1. The calibration procedure involved a series of steps designed to improve the performance of the model and ensure it was replicating observed March 2015 traffic flows and journey times. Tasks included:

- Ensuring network characteristics, such as free-flow speeds and signal phases/timings represent observed conditions;
- Ensuring capacity controls, such as speed-flow curves, saturation flows and turn capacities were appropriate to replicate observed conditions;
- Checking the routing of vehicles in the model, by verifying routes from select link analysis in the P1X module of SATURN against online route planners; and
- Once calibration of the initial assignment had been carried out, matrix estimation (ME) was applied to 'fit' prior trip matrices to traffic flows in the study area.

8.5. Speed/Flow Curves

8.5.1. Speed-flow curves (SFCs) can be used to represent delays on the network, replicating observed road conditions. Appendix A sets out the SFCs used in the GCTM. During model calibration, the application of these SFCs was adjusted, with different SFCs selected to reflect the appropriate speeds and capacities on a specific link. These were adjusted until link travel times were better representing observed travel times.

9. Matrix Estimation

9.1. Case for Matrix Estimation

9.1.1. TAG unit M3.1 advises that the primary purpose of ME is to refine estimates of trips which have been synthesised (the 'prior' matrices). To check the need to use ME, prior matrix modelled flows along each screenline in each time period were compared against observed flows. Appendix B provides a comparison of modelled and observed flows along all screenlines for each time period which shows that the majority of screenline flows are generally within ±15% of observed flows but most do not meet the ±5% criteria.

9.1.2. Although the prior matrix assignment was judged to provide a suitable starting point for model development, as modelled flows did not meet TAG criteria, ME was judged to be an appropriate step to take to improve the calibration of the matrices, as was the case with the Version 1 of the GCTM.

9.2. Matrix Estimation Procedure

9.2.1. ME is undertaken using the SATME2 module of SATURN and aims to produce an estimated matrix that is consistent with observed traffic counts. The equation used may be written as:

$$T_{ij} = tij \, \Pi_a X_a^{Pija}$$

where: Tij is the output matrix of OD pairs ij;

tij is the prior matrix of OD pairs ij;

∏a product over all counted links a;

Xa is the balancing factor associated with the counted link; and

Pija is the fraction of trips from i to j using link a.

9.2.2. The ME process is dependent on several factors including the quality of the prior matrix, traffic routeing, and the order and consistency of observed traffic counts. It is therefore essential that the process is monitored to ensure the following:

- The trip matrix is converging to a stable solution;
- Trip length distributions are reasonable; and
- Travel patterns at a sector level are reasonable.

9.2.3. The matrix estimation provides a method by which an initial estimate of the trip matrix can be adjusted in order to reflect observed traffic count data. This process is accomplished within SATURN through use of the SATPIJA program, which creates a file in which each element represents the proportion (P) of the trips between a particular origin-destination pair (IJ) which uses the counted link (A). The SATME2 program then uses the PIJA file to adjust the prior matrix to create the most likely trip matrix consistent with the information contained in the count file. Finally, the output matrix is assigned back to the model network and is compared to the observed count to gauge the degree to which these match. This process is looped for a limited number of iterations until satisfactory model calibration is achieved.

9.3. Impact of Matrix Estimation

9.3.1. This section describes the resulting impact of the matrix estimation process on the GCTM prior matrices. The criteria for assessing the impact of ME is set out in Section 0.

Matrix Totals

9.3.2. For trips that have at least one end within the extended GCTM fully modelled area, a comparison of matrix trip totals for all user classes, before and after ME, is shown in Table 9-4.

Table 9-1 - Comparison of Matrix Trip Totals - Prior vs Post-ME

User Class	AM		IP		PM	
	Pre_ME	Post_ME	Pre_ME	Post_ME	Pre_ME	Post_ME
UC1	60,367	58,715	57,878	57,598	53,692	52,974
UC2	336,488	329,585	144,085	143,837	316,622	312,333
UC3	376,520	372,157	509,970	509,304	546,417	542,254
UC4	84,523	86,656	79,981	82,190	70,432	72,304
UC5	29,737	33,382	28,627	32,042	18,774	20,492
Total	887,636	880,494	820,542	824,972	1,005,936	1,000,357

Table 9-2 - Change in Matrix Trip Totals - Prior vs Post-ME

User Class	AM		IP		PM	
	change	%change	change	%change	change	%change
UC1	-1652	-3%	-280	0%	-718	-1%
UC2	-6904	-2%	-248	0%	-4289	-1%
UC3	-4364	-1%	-666	0%	-4163	-1%
UC4	2133	3%	2209	3%	1872	3%
UC5	3645	12%	3415	12%	1718	9%
Total	-7142	-0.8%	4430	0.5%	-5579	-0.6%

9.3.3. Analysis of the changes shows the changes in the overall matrix totals are within ±1% of the prior matrix totals for each of the three time periods, demonstrating little overall change in terms of matrix size. Changes in individual car user classes and LGVs (User Classes 1-4) are all within ±3%. Changes in HGV totals (UC5) are larger than other user classes (between 9% to 12%) although as with Version 1 of the GCTM, the larger scale of changes made by ME to these matrices are potentially a reflection of the greater uncertainty of the prior matrices which were derived originally from 2006 Base Year Freight (2006 BYF) matrices for the SWRTM. This pattern is shared with the donor models which precede the GCTM.

Trip Length Distribution

9.3.4. A comparison of the trip length distribution for all trips with at least one trip end in the GCTM Version 2.3 fully modelled area has been undertaken between the prior and post ME matrices.

9.3.5. Figure 9-1 to Figure 9-3 show the trip length distribution broken down by distance bands for both the prior matrix assignment and post-ME assignment. These show that the trip length distribution does not change significantly in any time period.

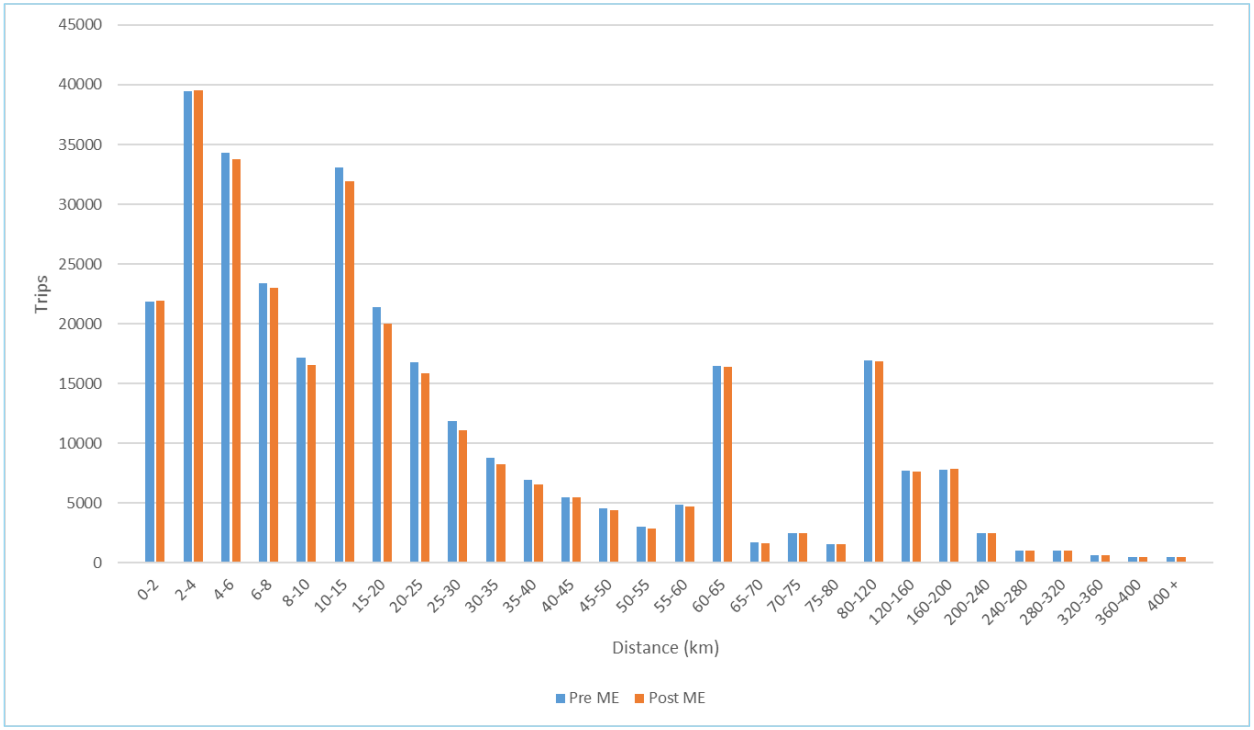

Figure 9-1 - AM Peak Trip Length Distribution – Total Vehicles

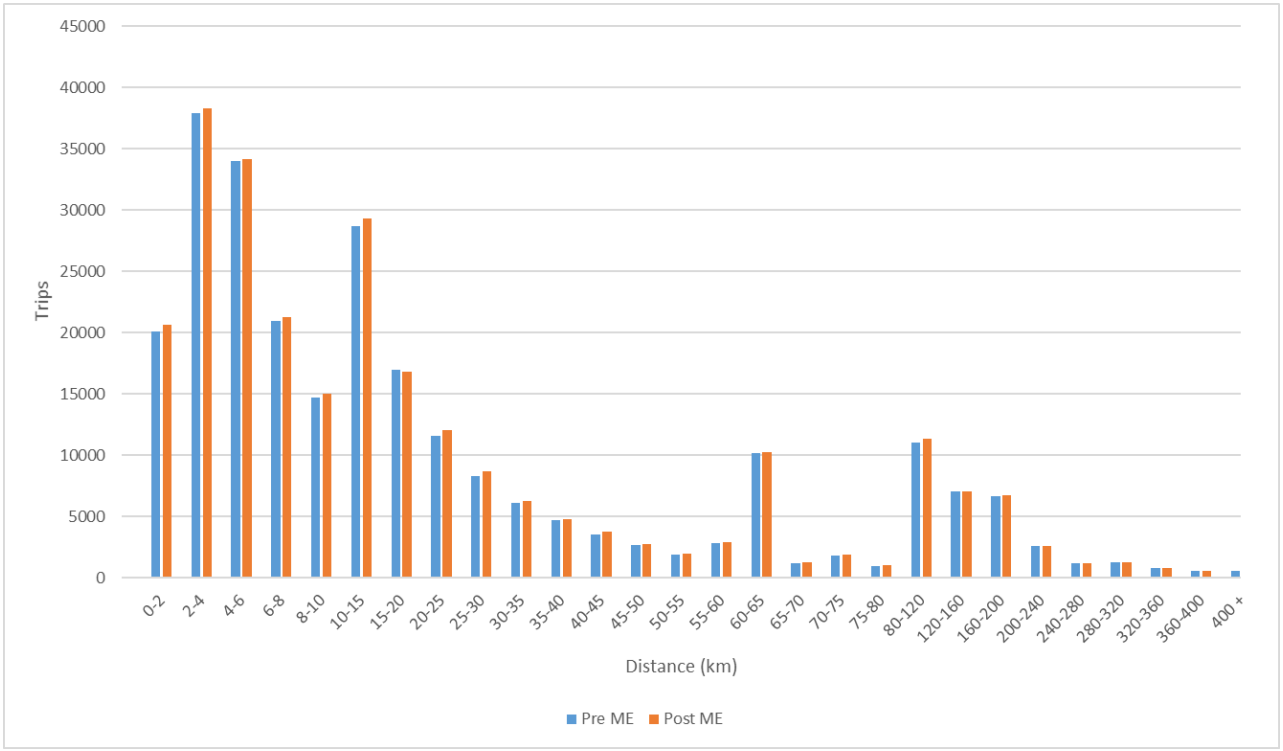

Figure 9-2 - Inter-peak Trip Length Distribution - Total Vehicles

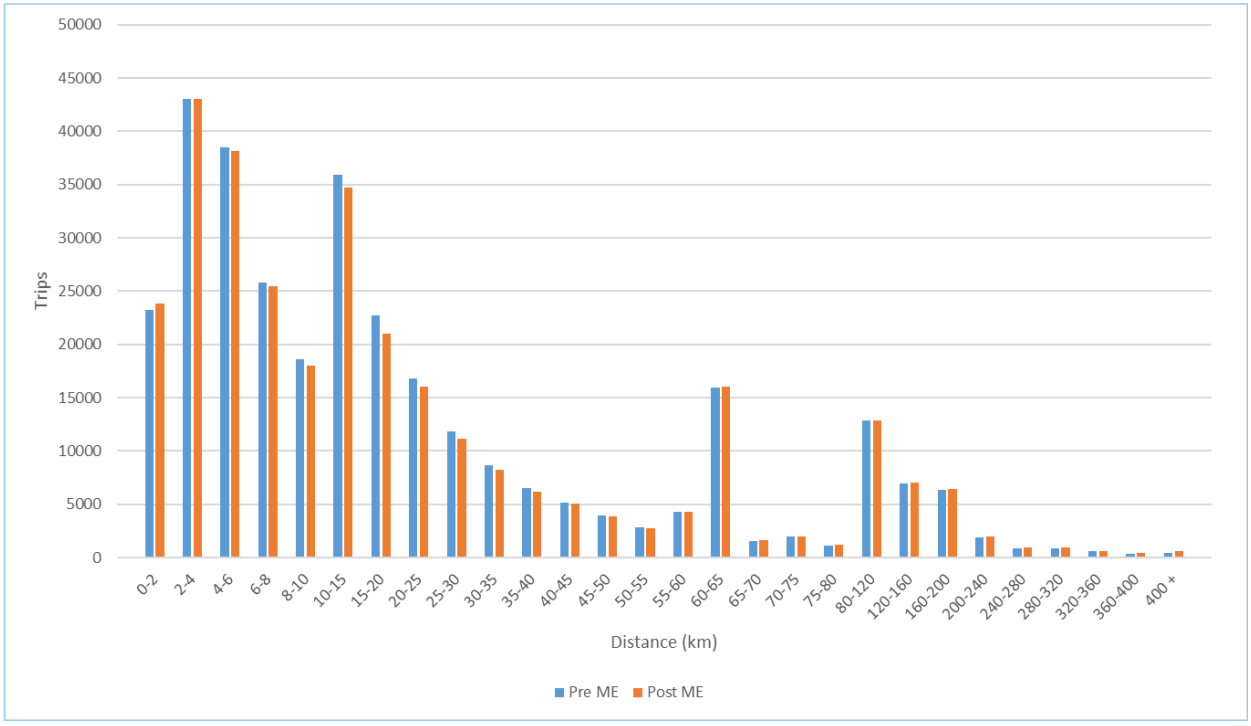

Figure 9-3 - PM Peak Trip Length Distribution - Total Vehicles

9.3.6. Average trip length comparisons broken down by user class are shown are shown in Table 9-3.

Table 9-3 - Prior vs. Post Average Trip Length and Standard Deviation

User Class	Assignment	AM		IP		PM	
		Mean (km)	Std Dev (km)	Mean (km)	Std Dev (km)	Mean (km)	Std Dev (km)
UC1	Prior	64.45	70.50	62.47	77.96	62.95	79.73
	Post	66.29	72.30	63.19	78.73	66.51	84.94
	% Diff	2.86%	2.55%	1.16%	0.99%	5.65%	6.53%
UC2	Prior	31.11	39.27	33.58	49.53	31.30	40.70
	Post	31.63	40.28	33.77	50.10	31.78	41.87
	% Diff	1.68%	2.58%	0.59%	1.15%	1.52%	2.89%
UC3	Prior	20.58	40.48	21.52	42.61	19.88	37.67
	Post	20.60	41.31	21.54	43.02	20.10	39.01
	% Diff	0.10%	2.03%	0.10%	0.95%	1.07%	3.55%
UC4	Prior	37.55	50.25	37.68	52.53	35.06	48.81
	Post	34.84	47.11	35.77	50.84	33.76	47.49
	% Diff	-7.20%	-6.25%	-5.08%	-3.23%	-3.72%	-2.72%
UC5	Prior	111.62	101.86	111.55	101.79	111.81	101.98
	Post	98.57	97.92	100.30	100.44	104.90	102.83
	% Diff	-11.68%	-3.87%	-10.09%	-1.33%	-6.18%	0.83%
Car	Prior	29.71	50.08	27.67	56.70	27.28	52.70

User Class	Assignment	AM		IP		PM	
		Mean (km)	Std Dev (km)	Mean (km)	Std Dev (km)	Mean (km)	Std Dev (km)
	Post	30.02	51.30	27.76	57.28	27.79	55.27
	% Diff	1.06%	2.42%	0.32%	1.03%	1.87%	4.89%
Total	Prior	34.78	60.47	33.76	64.89	30.60	61.78
	Post	35.05	59.78	33.88	64.63	31.25	63.23
	% Diff	0.75%	-1.14%	0.35%	-0.40%	2.11%	2.35%

9.3.7. TAG Unit M3.1 advises that changes in trip length distribution should be within or close to ± 5%. As displayed, overall vehicle changes are well within this threshold. For car user classes, the majority values are also within this threshold, with the exception being for UC1 (car employer's business) in the PM peak where there is a change of 5.7% (close to the threshold).

9.3.8. LGVs also show a reasonable level of performance against the targets, although the AM peak changes are greater than for the inter-peak and PM period periods. The results for HGVs show the largest variation, which is attributed to the fact that demand matrices for HGVs are based on adjustments to the 2006 BYF matrices which provides a coarser prior matrix.

Sector Analysis

9.3.9. For the purposes of sector analysis, the model zoning has been grouped as shown in Figure 9-4.

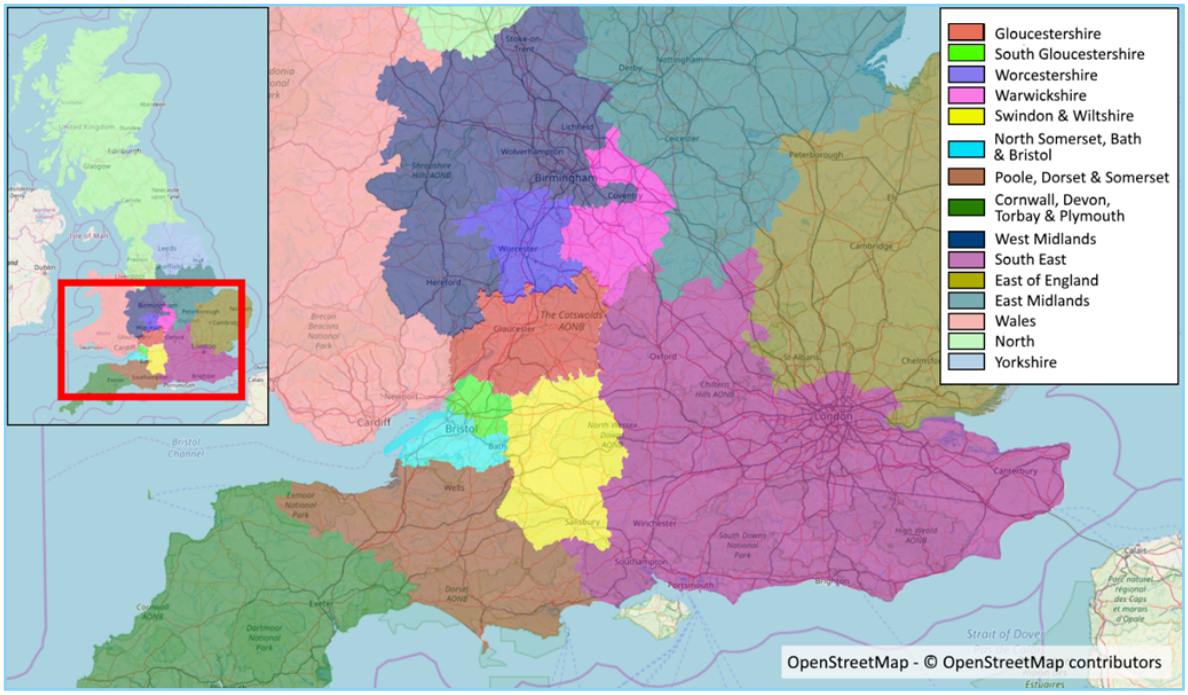

Figure 9-4 - Base Matrices Analysis Sector System

9.3.10. Analyses of sector-to-sector movements before and after matrix estimation (based on the same sector system used for the GCTM Version 1) are summarised in Table 9-4. To avoid large percentage differences, which represent only a small number of trips, sector to sector movements with fewer than 100 trips in the prior matrices have been excluded from this analysis in the same manner adopted in the SWRTM analyses and in Version 1 of the GCTM. The GEH statistic has also been used to assess the changes between the post and prior matrices, in addition to considering the proportional changes.

Table 9-4 - AM Peak Pre-ME vs Post-ME Sector Percentage Changes

Full Matrix		No. Cells with >100 trips in prior	% of cells with <5% change	% of cells with <10% change	% of cells with GEH <5
Car	AM	138	87%	90%	81%
	IP	136	79%	86%	87%
	PM	130	78%	87%	78%
LGV	AM	85	74%	82%	91%
	IP	81	73%	80%	95%
	PM	74	68%	77%	92%
HGV	AM	73	75%	81%	90%
	IP	73	79%	85%	90%
	PM	57	88%	89%	91%
Total	AM	157	86%	90%	84%
	IP	156	77%	85%	92%
	PM	149	77%	87%	85%

9.3.11. The analysis shows that the majority of sector-to-sector movements have a GEH less than 5 between the prior and post estimation matrices. Generally, more than 80% of all sector to sector movements in all time periods have changed by less than 10% compared to the prior. Further analysis of all sector origin and destination trip totals (as shown in Appendix C) show changes of no greater than ±10% across all time periods, with the exception of South Gloucestershire (the smallest sector) with a change in origin totals of -14% and -11% in the AM and PM peak respectively. The overall changes are therefore considered acceptable.

Matrix Trip Ends

9.3.12. Linear regression analysis of the post and prior ME matrices has been undertaken based on the expression:

$$y = A+Bx$$

9.3.13. The results of this analysis are presented in Table 9-5 for origin trip ends and Table 9-6 for destination trips ends located within the simulation area. The tables shows that the significance criteria relating to origin and destination trip ends were all met, indicating insignificant change.

Table 9-5 - Origin Trip End Changes - Prior vs Post-ME

Measure	TAG Significance Criteria	AM	IP	PM
Slope	Within 0.99 and 1.01	1.00	1.00	1.00
Intercept	Near Zero	-0.63	0.40	-0.50
R square	In excess of 0.98	1.00	1.00	1.00

Table 9-6 - Destination Trip End Changes Prior vs Post-ME

Measure	TAG Significance Criteria	AM	IP	PM
Slope	Within 0.99 and 1.01	1.00	1.00	1.00
Intercept	Near Zero	-3.16	1.93	-2.55
R square	In excess of 0.98	1.00	1.00	1.00

Matrix Zonal Values

The impact of ME on individual zone to zone movements within the simulation network area, between the prior and post-ME matrices is set out in Table 9-7, Table 9-8 and

Table 9-9

Table 9-7 - Matrix Zonal Cell Value Changes - Prior vs Post-ME AM

Measure	TAG Criteria	EB	Com	Other	LGV	HGV	Total
Slope	Within 0.98 and 1.02	1	1	1	1	1	1
Intercept	Near Zero	0	-0.001	-0.001	0	0.001	0
R square	in excess of 0.95	1	1	1	1	0.99	1

Table 9-8 - Matrix Zonal Cell Value Changes - Prior vs Post-ME IP

Measure	TAG Criteria	EB	Com	Other	LGV	HGV	Total
Slope	Within 0.98 and 1.02	1	1	1	1	1	1
Intercept	Near Zero	0	0	0	0	0.001	0
R square	in excess of 0.95	1	1	1	1	0.99	1

Table 9-9 - Matrix Zonal Cell Value Changes - Prior vs Post-ME PM

Measure	TAG Criteria	EB	Com	Other	LGV	HGV	Total
Slope	Within 0.99 and 1.01	1	1	1	1	1	1
Intercept	Near Zero	0	-0.001	-0.001	0	0	0
R square	in excess of 0.95	1	1	1	1	0.999	1

9.3.14. As displayed, the slope, intercept and R^2 across all time periods indicates that zonal cell values have not changed materially from the prior matrix.

10. Calibration and Validation Results

10.1. Overview

10.1.1. The calibration and validation procedure was conducted in conjunction with the ME process as set out in Sections 8 and 9. An iterative process was undertaken whereby the validation of the model was assessed using comparisons of the modelled and observed data as discussed below. Adjustments were made to the model to reduce the differences between the modelled and observed data.

10.1.2. The model was validated by means of the following comparisons:

- Modelled and observed traffic flows across the identified calibration and validation screenlines by time period;
- Modelled and observed traffic flows on individual links compared by cars and all vehicles and by time period;
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment; and
- Route choice validation.

10.1.3. Validation against each of elements is detailed in this chapter. The final section presents the levels of model convergence achieved.

10.2. Full Model Flow Calibration and Validation Results

10.2.1. Table 10-1 and provide a high-level overview of validation achieved across the whole the GCTM for both total vehicles and cars respectively.

Table 10-1 - Summary of calibration and validation in the GCTM area (Total)

Metric	Criteria		AM	IP	PM
Screenlines within 5%	All or nearly all	Calibration	97%	97%	92%
			35/36	35/36	33/36
		Validation	88%	88%	88%
			7/8	7/8	7/8
		Total	95%	96%	91%
			42/44	42/44	40/44
Screenlines GEH <4 (not TAG criteria)	(DMRB criteria)	Calibration	97%	100%	97%
		Validation	100%	100%	100%
		Total	97%	100%	98%
Flows passing GEH or flow criteria	>85%	Calibration	94%	94%	94%
			285/304	295/304	285/304
		Validation	89%	92%	92%
			116/130	50/52	119/130
		Total	93%	93%	93%
Journey Time Routes	>85%		96%	100%	94%

Table 10-2 - Summary of calibration and validation (Car)

Metric	Criteria		AM	IP	PM
Screenlines within 5%	All or nearly all	Calibration	94%	100%	92%
			34/36	36/36	33/36
		Validation	7/8	6/8	6/8
			88%	75%	75%
		Total	93%	96%	89%
			41/44	42/44	39/44
Flows passing GEH or flow criteria	>85%	Calibration	93%	97%	93%
			284/304	296/304	284/304
		Validation	86%	94%	88%
			115/130	49/52	114/130
		Total	92%	97%	92%

10.2.2. Table 10-1 and Table 10-2 demonstrate that:

- Screenline level comparisons of modelled versus observed flows meet the ±5% criteria in nearly all instances for both total vehicles and cars. A total of two screenlines do not meet this criteria for total vehicles in all time periods – however all of these screenlines (across all time periods) have a GEH of less than 4.0 and so the level of traffic for these areas can still be considered representative;
- The number of calibration and validation links passing the individual link flow criteria is well in excess of the 85% threshold defined in TAG criteria for both total vehicles and cars, indicating strong overall performance in terms of individual traffic volumes;
- Over 94% of model journey time routes satisfy the TAG criteria.

10.2.3. Overall therefore, calibration and validation results of links flows and journey times all meet the relevant TAG criteria. Further detail regarding these results is provided in the following sections.

10.3. Screenline Performance

10.3.1. The screenlines used for the calibration and validation process were discussed and presented in Chapter 5. Screenline results for total vehicles within the fully modelled area are illustrated for each model time period in Figure 10-1, Figure 10-2 and Figure 10-3. Table 10-3 provides the individual results for each screenline by each time period (for total vehicles), results for cars are shown in Appendix D.

10.3.2. As concluded above, the overall screenline performance is strong, with the majority of screenlines meeting the modelled versus observed flows within ±5% TAG criteria. Further analysis demonstrates:

- Stroud screenline C in the westbound direction does not meet the criteria in either the AM peak or inter-peak, however, the GEH value for both time periods is 2.0 or lower, demonstrating a good fit is still achieved;
- J10 screenline A does not meet the criteria in the AM, IP (for the northbound direction) and PM (for northbound and the southbound direction), however again, the GEH values are less than 5.0, demonstrating a good fit is achieved.
- For the PM Peak, the A417 screenlines F (southbound only) and G (eastbound only) do not meet the ±5% criteria, but have GEH values of less than 4.0

10.3.3. Overall, the screenline performance for the GCTM Version 2.3 can be considered robust. The results are also very consistent with those produced for Version 1, with the only additional screenline (the cordon around Tewkesbury and Ashchurch) demonstrating very strong results, with less than ±3%

difference between modelled and observed flows. Individual link results within each screenline are displayed in Appendix E.

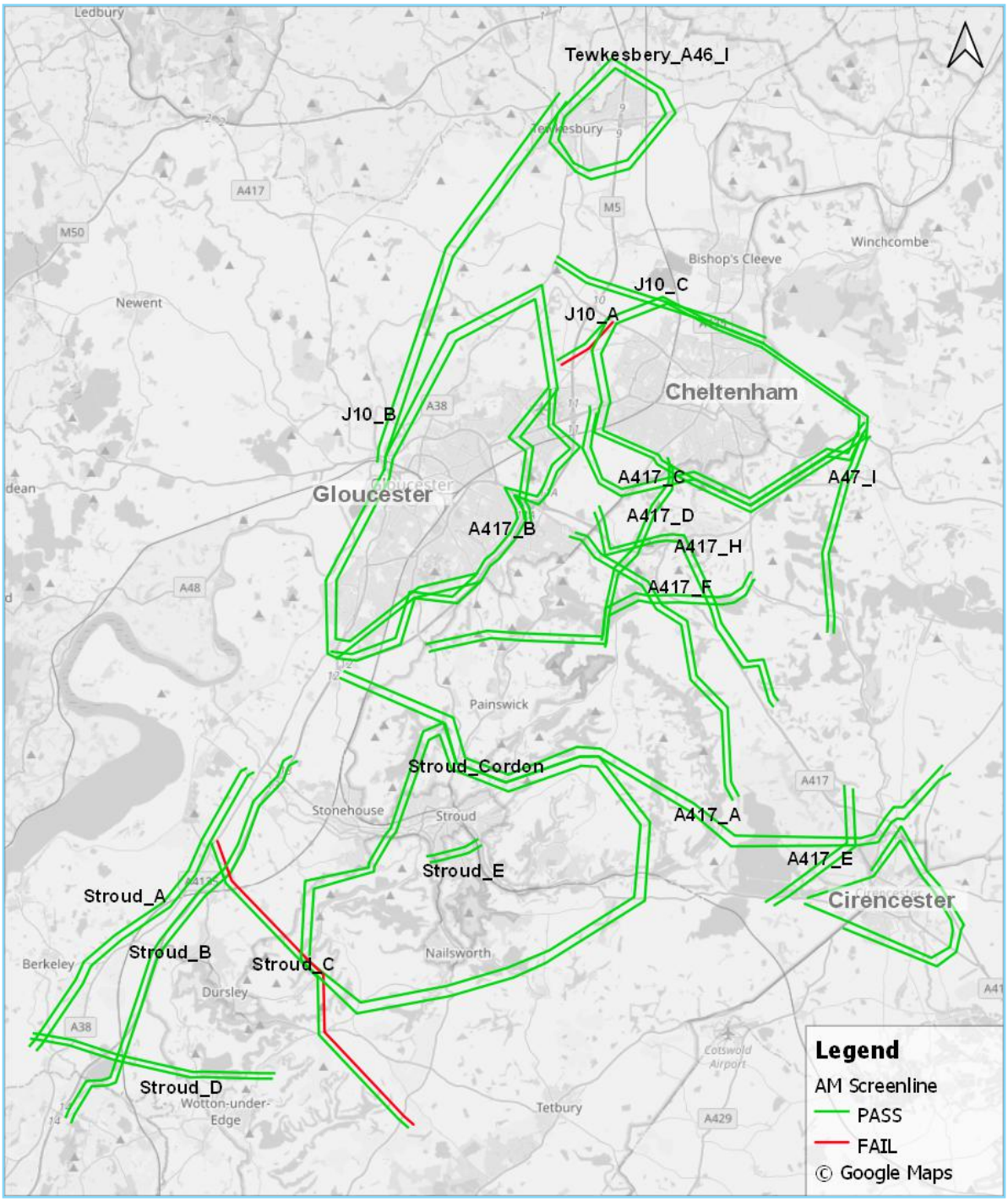

Figure 10-1 - AM Peak Screenline Performance

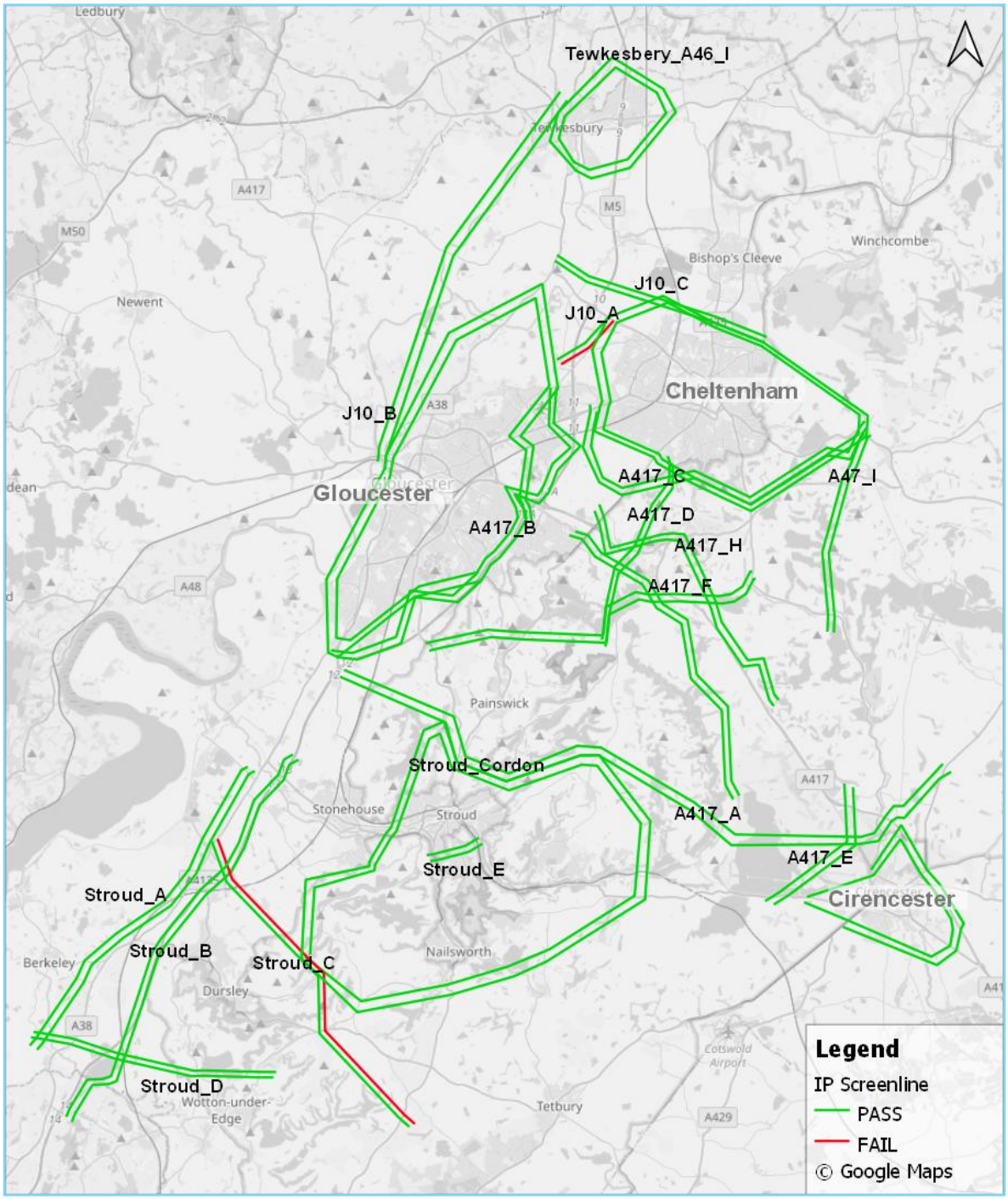

Figure 10-2 - Inter-Peak Screenline Performance

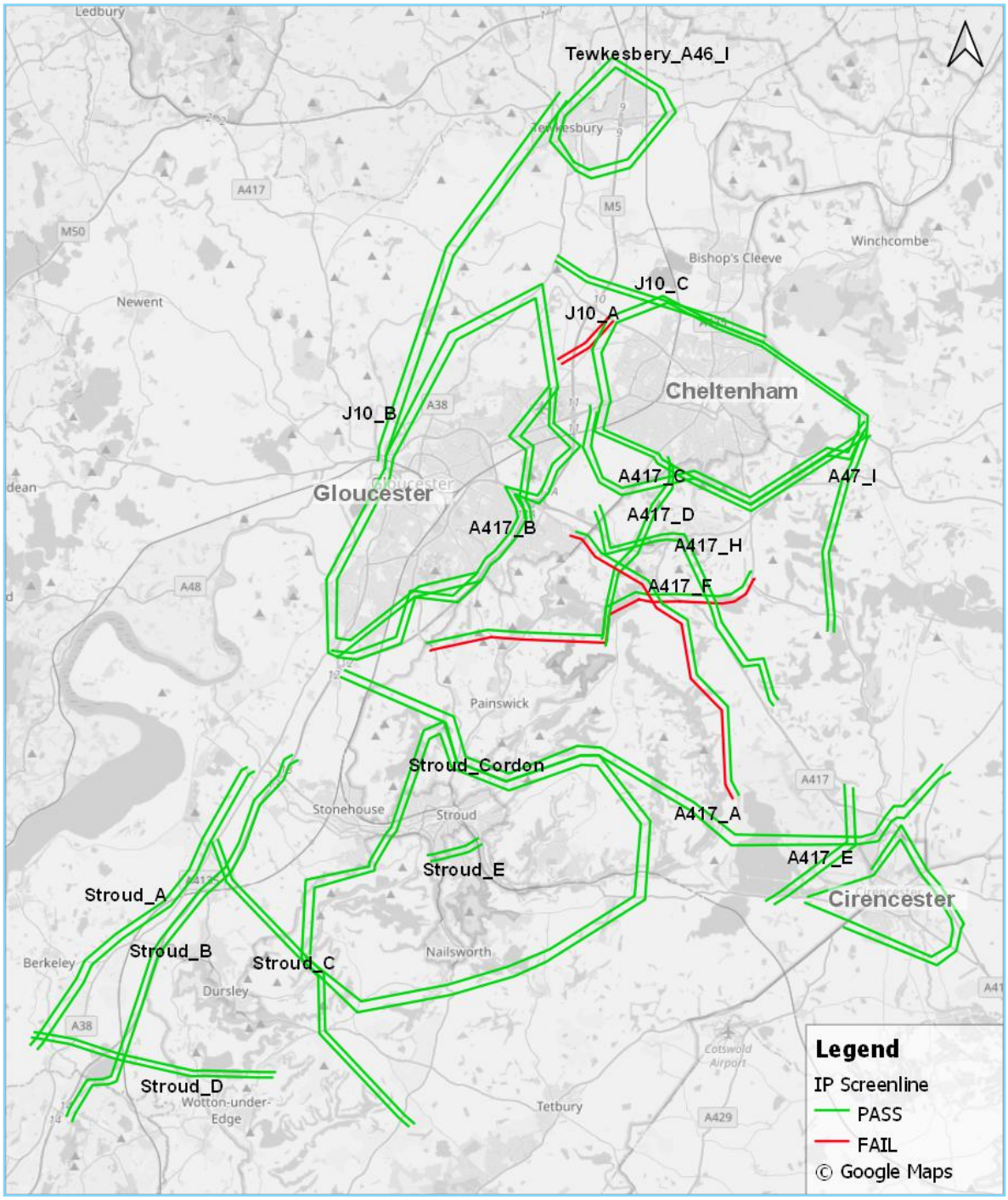

Figure 10-3 - PM Peak Screenline Performance

Table 10-3 - Summary of Flow Calibration Screenlines Post ME (Total Vehicles)

Screenline	Direction	Cal/Val	Count Sites	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
A417_A	NB	Calibration	10	3,149	3,101	-1.5%	0.8	2,559	2,562	0.1%	0.1	3,266	3,285	0.6%	0.3
	SB	Calibration	10	3,333	3,347	0.4%	0.2	2,443	2,448	0.2%	0.1	3,178	3,164	-0.4%	0.2
A417_B	EB	Calibration	14	7,302	7,404	1.4%	1.2	5,103	5,002	-2.0%	1.4	6,769	6,626	-2.1%	1.7
	WB	Calibration	14	7,049	6,765	-4.0%	3.4	5,279	5,290	0.2%	0.1	7,961	7,848	-1.4%	1.3
A417_C	NB	Validation	7	4,571	4,572	0.0%	0.0	2,870	2,562	0.1%	0.1	4,096	4,214	2.9%	1.8
	SB	Validation	7	4,091	4,149	1.4%	0.9	2,921	2,448	0.2%	0.1	4,536	4,483	-1.2%	0.8
A417_D	EB	Validation	4	2,202	2,182	-0.9%	0.4	1,428	5,002	-2.0%	1.4	1,942	1,895	-2.4%	1.1
	WB	Validation	4	1,833	1,774	-3.2%	1.4	1,526	5,290	0.2%	0.1	2,099	2,100	0.0%	0.0
A417_E	EB	Calibration	4	2,194	2,200	0.3%	0.1	1,327	1,332	0.4%	0.1	1,594	1,593	0.0%	0.0
	WB	Calibration	4	1,522	1,532	0.7%	0.3	1,461	1,486	1.7%	0.6	2,105	2,163	2.7%	1.2
A417_F	NB	Validation	9	2,638	2,636	0.1%	0.0	2,103	2,019	-4.0%	1.8	2,847	2,773	-2.6%	1.4
	SB	Validation	9	2,635	2,601	-1.3%	0.7	1,914	1,853	-3.2%	1.4	2,876	2,684	-6.7%	3.6
A417_G	EB	Calibration	6	1,445	1,382	-4.4%	1.7	771	761	-1.2%	0.3	1,011	1,082	7.0%	2.2
	WB	Calibration	6	803	829	3.3%	0.9	810	797	-1.6%	0.5	1,490	1,503	0.9%	0.3
A417_H	EB	Calibration	8	2,109	2,122	0.6%	0.3	1,295	1,318	1.8%	0.6	1,888	1,891	0.1%	0.0
	WB	Calibration	8	1,685	1,743	3.4%	1.4	1,242	1,265	1.9%	0.6	2,008	2,082	3.7%	1.7
A417_I	EB	Calibration	4	1,124	1,128	0.4%	0.1	785	787	0.3%	0.1	999	998	-0.1%	0.0
	WB	Calibration	4	981	983	0.1%	0.0	862	864	0.2%	0.0	1,158	1,162	0.4%	0.1
Cirencester	IB	Calibration	9	5,862	5,827	-0.6%	0.5	4,405	4,402	-0.1%	0.1	5,345	5,322	-0.4%	0.3
	OB	Calibration	9	5,103	5,098	-0.1%	0.1	4,307	4,337	0.7%	0.5	5,857	5,878	0.4%	0.3
J10_A	NB	Calibration	3	748	631	-15.6%	4.4	772	728	-5.7%	1.6	1,340	1,193	-11.0%	4.1
	SB	Calibration	3	1,402	1,350	-3.7%	1.4	814	794	-2.5%	0.7	873	767	-12.0%	3.7

Screenline	Direction	Cal/Val	Count Sites	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
J10_B	EB	Calibration	4	3,426	3,404	-0.6%	0.4	2,507	2,498	-0.4%	0.2	2,643	2,719	2.9%	1.5
	WB	Calibration	4	2,499	2,555	2.3%	1.1	2,653	2,627	-1.0%	0.5	3,884	3,883	0.0%	0.0
J10_C	NB	Calibration	4	1,437	1,441	0.3%	0.1	1,457	1,457	0.0%	0.0	2,101	2,102	0.1%	0.0
	SB	Calibration	4	1,877	1,890	0.7%	0.3	1,449	1,450	0.1%	0.0	1,626	1,624	-0.2%	0.1
Stroud_A	EB	Calibration	6	895	909	1.6%	0.5	676	676	0.0%	0.0	721	734	1.8%	0.5
	WB	Calibration	6	701	691	-1.4%	0.4	686	678	-1.2%	0.3	884	872	-1.3%	0.4
Stroud_B	EB	Calibration	7	2,353	2,255	-4.2%	2.0	1,737	1,739	0.2%	0.1	2,462	2,482	0.8%	0.4
	WB	Calibration	7	2,633	2,617	-0.6%	0.3	1,869	1,874	0.2%	0.1	2,378	2,361	-0.7%	0.3
Stroud_C	EB	Validation	5	1,567	1,552	-1.0%	0.4	1,089	1,130	3.7%	1.2	1,213	1,267	4.5%	1.5
	WB	Validation	5	1,189	1,259	6.0%	2.0	1,086	1,143	5.3%	1.7	1,447	1,443	-0.3%	0.1
Stroud cordon	IB	Calibration	14	3,397	3,366	-0.9%	0.5	2,879	2,854	-0.9%	0.5	4,064	4,036	-0.7%	0.4
	OB	Calibration	14	4,071	4,022	-1.2%	0.8	2,872	2,849	-0.8%	0.4	3,401	3,366	-1.0%	0.6
Stroud_D	NB	Calibration	5	710	717	1.1%	0.3	693	692	-0.1%	0.0	997	972	-2.5%	0.8
	SB	Calibration	5	1,017	981	-3.5%	1.1	640	636	-0.7%	0.2	689	699	1.5%	0.4
Stroud_E	NB	Calibration	4	1,460	1,461	0.0%	0.0	1,435	1,435	0.0%	0.0	1,659	1,656	-0.2%	0.1
	SB	Calibration	4	1,594	1,592	-0.1%	0.0	1,335	1,335	0.0%	0.0	1,433	1,433	0.0%	0.0
Cheltenham	IB	Calibration	10	6,667	6,608	-0.9%	0.7	4,726	4,632	-2.0%	1.4	6,115	6,025	-1.5%	1.2
	OB	Calibration	10	5,636	5,594	-0.7%	0.6	4,722	4,618	-2.2%	1.5	6,857	6,778	-1.2%	1.0
Gloucester	IB	Calibration	13	9,993	9,890	-1.0%	1.0	7,562	7,484	-1.0%	0.9	9,829	9,765	-0.7%	0.7
	OB	Calibration	13	9,066	9,105	0.4%	0.4	7,476	7,321	-2.1%	1.8	9,996	9,925	-0.7%	0.7
Tewkesbury A46	IB	Calibration	9	8,509	8,662	1.8%	1.7	7,267	7,421	2.1%	1.8	8,448	8,586	1.6%	1.5
	OB	Calibration	8	8,182	8,315	1.6%	1.5	7,324	7,501	2.4%	2.1	8,986	9,169	2.0%	1.9

10.4. Link Flow Performance

10.4.1. As shown in Table 10-1, modelled flows provide a good match against observed flows at the individual link or turn flow level, with over 90% of individual model flows passing in all time periods.

10.4.2. The performance of individual links is illustrated for each model time period in Figure 10-4, Figure 10-5 and Figure 10-6.

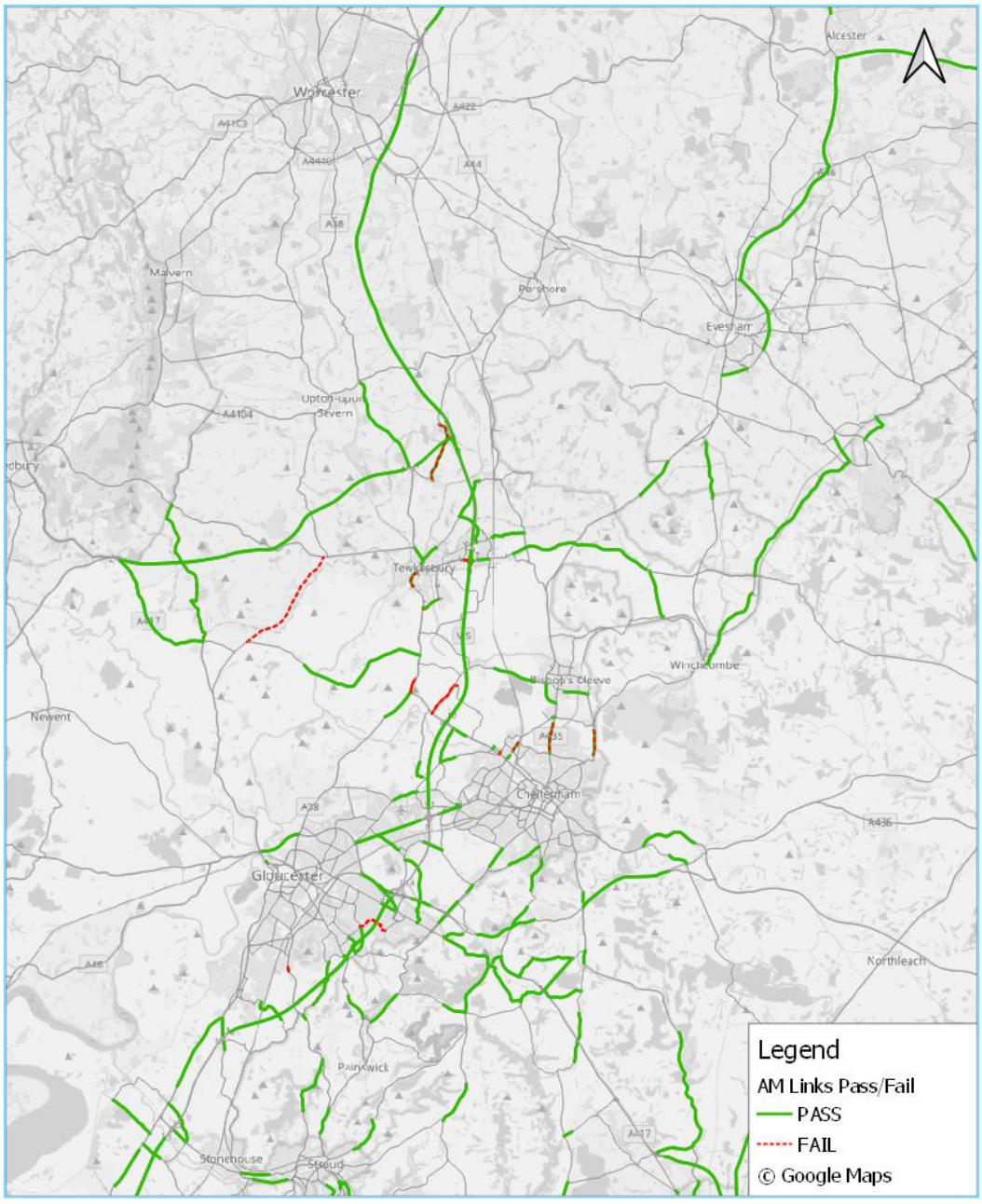

Figure 10-4 - AM Link Performance

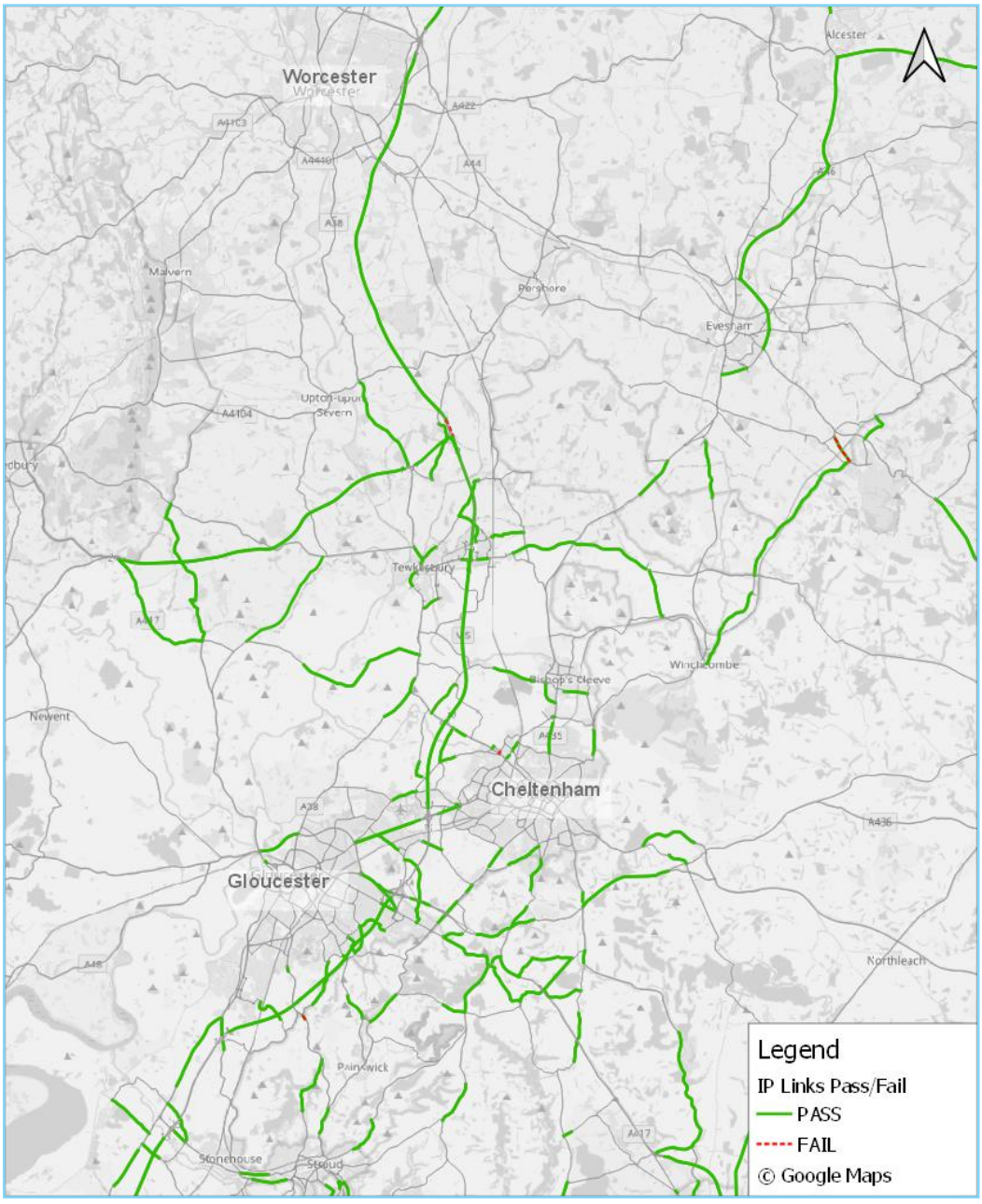

Figure 10-5 - Inter-peak Link Performance

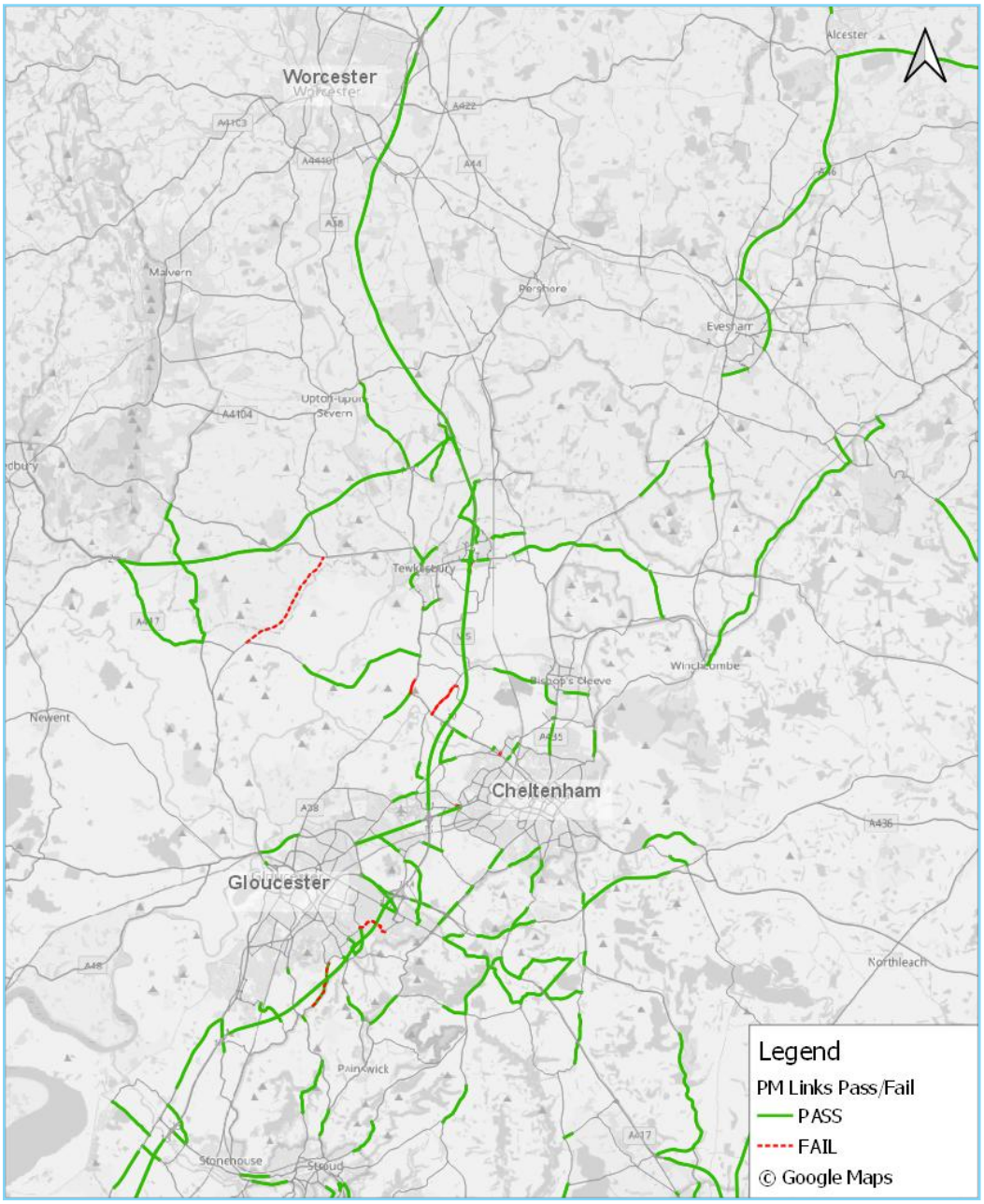

Figure 10-6 - PM Peak Link Performance

10.4.3. The plots demonstrate that flows across the strategic and significant local road network match well with observed flows (where data for comparison is available). Whilst links which do not meet the flow criteria have a high percentage difference. However, the GEH value for these links is less than 5. Some links which do not meet the flow criteria are found in rural areas or where observed flows are lower.

10.5. Model Performance Around Junction10

10.5.1. This section provides details the model performance around M5J10 scheme area. A summary of journey time (JT) and flow comparison between observed and modelled values for selected routes and links is presented in subsequent sections.

Strategic Link Performance

10.5.2. This section summaries screenlines and links flow performance in and around the M5J10. Figure 10-7 shows the location of calibration and validation screenlines considered around M5 J10 while developing GCTM v2.3.

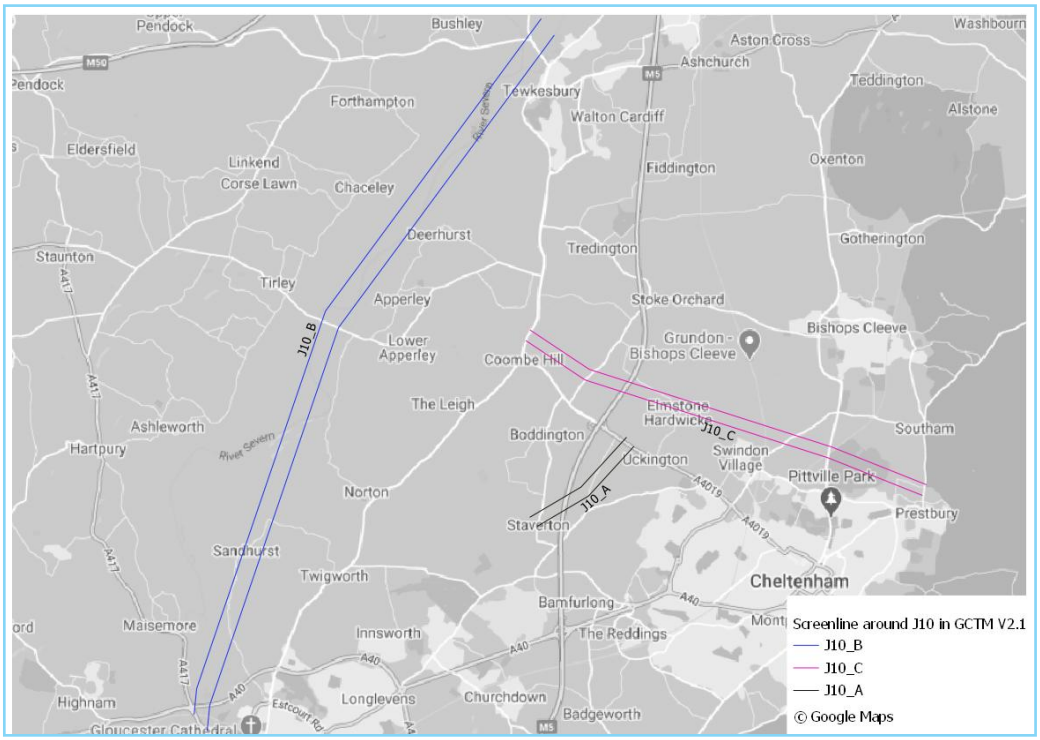

Figure 10-7- Screenline around M5J10 in GCTM v2.3

10.5.3. As presented in Table 10-4, J10 screenline 'A' doesn't meet the TAG flow criteria in the AM peak and Inter-peak (for the northbound direction) However, Northbound and Southbound in the PM peak does not meet the TAG flow criteria (less than a 5% difference between modelled and observed flows).

10.5.4. As presented in Table 10-4, it is noted that the GEH values for the failing screenlines (reference Screenline J10 A) are less than 5.0 and all the counts on the screenline are passing the TAG GEH criteria, demonstrating that a good fit is still achieved.

Table 10-4 - Screenline around J10

Screenline	Direction	AM				IP				PM			
		Observed	Modelled	% Difference	GEH	Observed	Modelled	% Difference	GEH	Observed	Modelled	% Difference	GEH
J10_A	NB	748	631	-15.6%	4.4	772	728	-5.7%	1.6	1,340	1,193	-11.0%	4.1
	SB	1,402	1,350	-3.7%	1.4	814	794	-2.5%	0.7	873	767	-12.0%	3.7
J10_B	EB	3,426	3,404	-0.6%	0.4	2,507	2,498	-0.4%	0.2	2,643	2,719	2.9%	1.5
	WB	2,499	2,555	2.3%	1.1	2,653	2,627	-1.0%	0.5	3,884	3,883	0.0%	0.0
J10_C	NB	1,437	1,441	0.3%	0.1	1,457	1,457	0.0%	0.0	2,101	2,102	0.1%	0.0
	SB	1,877	1,890	0.7%	0.3	1,449	1,450	0.1%	0.0	1,626	1,624	-0.2%	0.1

10.5.5. Figure 10-8 shows the individual links that form part of the screenlines described in Table 10-4.

10.5.6. From Table 10-5 it can be seen that Screenline J10_A fails the TAG flow criteria due to the low traffic volumes on one of the links. In AM peak, the observed flow is 31 vehicles on the minor Staverton Road through Boddington while comparisons against equivalent modelled flows of 3 of these links show flow differences of only -28 because of the low observed flows these equate to % age flow differences of 90%. Due to the very low observed flow on the minor Staverton Road, in this case the calculated GEH value of 6.8 for this link also fails the TAG assessment criteria (GEH required value of less than 5). Similarly in analysis of the IP results, there are high % age flow differences on the same screenline link.

10.5.7. In PM peak, the observed flow on Staverton Road in both direction is very low in comparison to modelled link flows and have high percentage flow difference around 55% to 75% but very near to GEH criteria (Refer link Flow F in the Table 10-5)

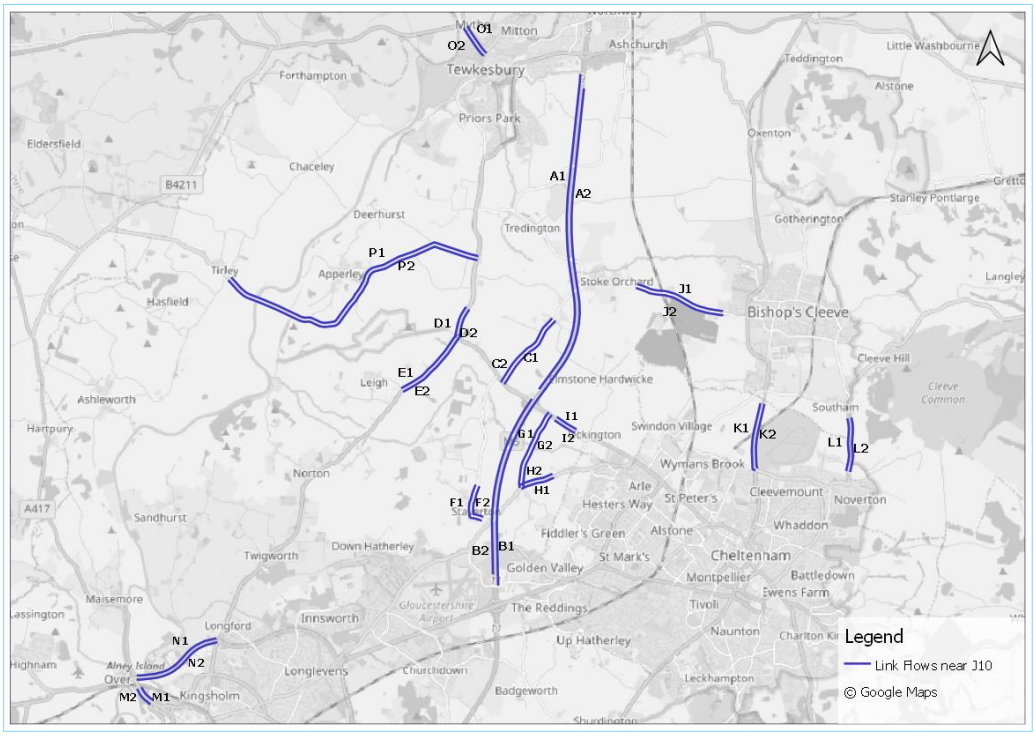

Figure 10-8 - Link Flows near J10

Table 10-5 - Links Performance around J10

ID	Screenline	Dir	Cal/Val	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
A1	-	NB	C	2931	3106	6%	3.2	3008	3190	6%	3.3	3667	3767	3%	1.6
A2	-	SB	C	3786	3788	0%	0.0	2687	2913	8%	4.3	3198	3482	9%	4.9
B1	-	SB	V	3012	3065	2%	1.0	2472	2472	0%	0.0	2848	3046	7%	3.6
B2	-	NB	V	2626	2799	7%	3.3	2793	2868	3%	1.4	3040	3192	5%	2.7
C1	Z_J10_C	SB	C	195	38	-80%	14.5	129	22	-83%	12.3	176	35	-80%	13.8
C2	Z_J10_C	NB	C	219	74	-66%	12.0	127	34	-73%	10.4	224	49	-78%	15.0
D1	Z_J10_C	NB	C	410	559	36%	6.8	467	561	20%	4.1	652	828	27%	6.5
D2	Z_J10_C	SB	C	747	916	23%	5.8	445	552	24%	4.8	491	631	29%	5.9
E1	-	NB	C	538	441	-18%	4.4	320	303	-6%	1.0	431	407	-6%	1.2
E2	-	SB	C	402	459	14%	2.8	340	334	-2%	0.3	533	483	-9%	2.2
F1	Z_J10_A	NB	C	31	3	-90%	6.8	37	7	-81%	6.4	63	29	-55%	5.1
F2	Z_J10_A	SB	C	77	55	-28%	2.6	34	21	-38%	2.5	29	7	-74%	5.0
G1	Z_J10_A	NB	C	129	155	20%	2.2	108	140	29%	2.8	177	212	19%	2.5
G2	Z_J10_A	SB	C	252	275	9%	1.4	110	123	12%	1.2	117	138	18%	1.9
H1	-	WB	C	246	260	6%	0.9	267	235	-12%	2.0	365	403	10%	1.9
H2	-	EB	C	381	397	4%	0.8	236	293	24%	3.5	314	339	8%	1.4
I1	Z_J10_A	EB	C	1073	1020	-5%	1.6	670	650	-3%	0.8	727	622	-14%	4.0
I2	Z_J10_A	WB	C	587	473	-19%	5.0	626	581	-7%	1.8	1099	952	-13%	4.6
J1	-	EB	C	395	398	1%	0.2	181	215	19%	2.4	280	280	0%	0.0
J2	-	WB	C	212	255	20%	2.8	174	183	5%	0.7	296	301	2%	0.3
K2	Z_J10_C	SB	C	472	595	26%	5.3	560	512	-9%	2.1	594	569	-4%	1.0

ID	Screenline	Dir	Cal/Val	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
K1	Z_J10_C	NB	C	461	454	-1%	0.3	523	466	-11%	2.6	746	606	-19%	5.4
L1	Z_J10_C	NB	C	347	354	2%	0.4	339	397	17%	3.0	479	620	29%	6.0
L2	Z_J10_C	SB	C	463	341	-26%	6.1	315	364	16%	2.7	366	389	6%	1.2
M2	Z_J10_B	NB	C	1138	1070	-6%	2.0	1272	1167	-8%	3.0	1930	1839	-5%	2.1
M1	Z_J10_B	SB	C	1490	1457	-2%	0.9	1143	1029	-10%	3.5	1058	1051	-1%	0.2
N1	Z_J10_B	EB	C	1194	1228	3%	1.0	894	1008	13%	3.7	1082	1088	1%	0.2
N2	Z_J10_B	WB	C	871	939	8%	2.2	895	1002	12%	3.5	1208	1306	8%	2.8
O1	Z_J10_B	SB	C	462	439	-5%	1.1	359	350	-3%	0.5	389	465	20%	3.7
O2	Z_J10_B	NB	C	369	425	15%	2.8	365	337	-8%	1.5	485	478	-2%	0.3
P2	Z_J10_B	WB	C	121	121	0%	0.0	121	121	0%	0.0	261	260	0%	0.0
P1	Z_J10_B	EB	C	280	279	0%	0.0	111	111	0%	0.0	114	114	0%	0.0

Journey Time Validation

10.5.8. Figure 10-9 show the JT routes considered in and around the J10 area. Table 10-6 below shows the JT performance on these selected routes. Except for JT route 208A NB and 209B NB rest of the JT routes pass the TAG (Transport Appraisal guidance) criteria. Both 208A and 209B routes are over 11km long and the modelled JT time is slower by about 1.4min to 2.7min in comparison to the observed JT. Figure 10-10 to Figure 10-33 show a detailed comparison of modelled and observed time and distance plots for these JT routes.

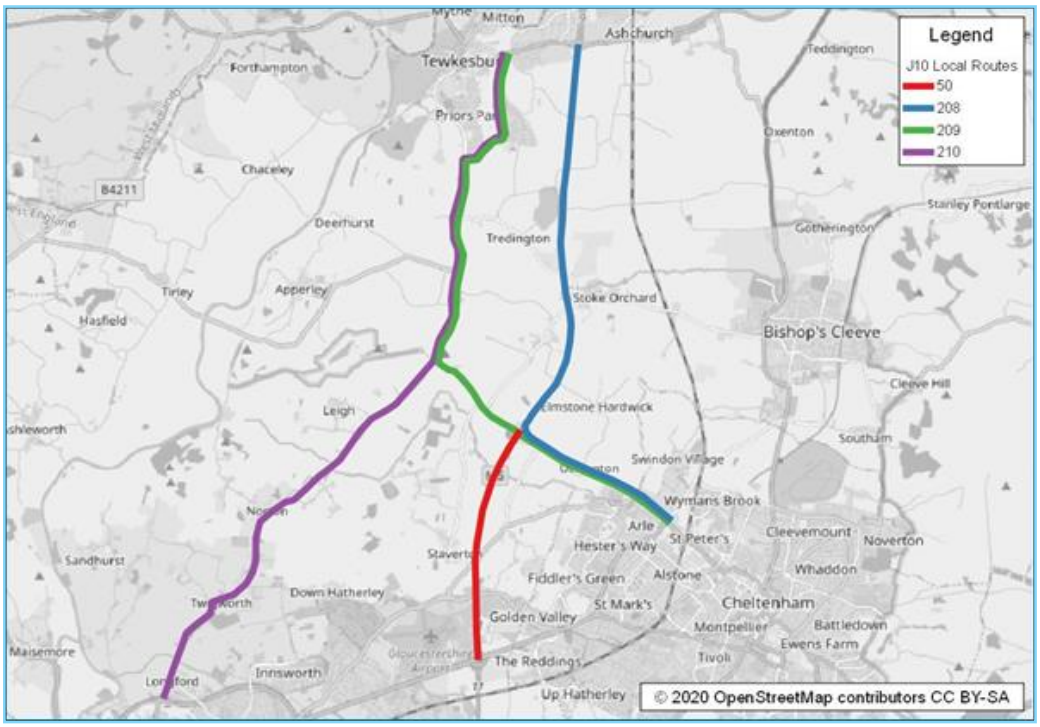

Figure 10-9 - Journey Time routes in GCTM v2.3 around M5 Junction 10

Table 10-6 - Journey Time Validation around M5J10 Scheme Area

Route	AM			IP			PM		
	Observed (min)	Modelled (min)	% Diff	Observed (min)	Modelled (min)	%Diff	Observed (min)	Modelled (min)	% Diff
208A A4019 to M5 J9 (NB)	7.64	9.21	20.6%	7.88	9.27	17.6%	8.04	10.00	24.4%
208B M5 J9 to A 4019 (SB)	8.84	10.00	13.1%	8.56	9.07	5.9%	8.41	9.26	10.1%
209A A38 to A4019 (SB)	13.03	14.83	13.8%	12.63	13.39	6.1%	12.70	13.61	7.2%
209B A4019 to A38 (NB)	11.68	14.05	20.2%	11.82	13.70	15.9%	12.31	15.00	21.9%
210A A38 NB	14.57	14.99	2.9%	14.59	14.79	1.4%	14.87	15.55	4.5%
210B A38 NB	14.68	15.05	2.6%	14.28	14.07	-1.4%	14.39	14.47	0.5%
50A M5 NB J11-J10	2.31	2.54	9.7%	2.37	2.56	8.0%	2.35	2.58	9.6%
50B M5 SB J10-J11	2.68	2.58	-3.6%	2.68	2.51	-6.5%	2.61	2.55	-2.4%

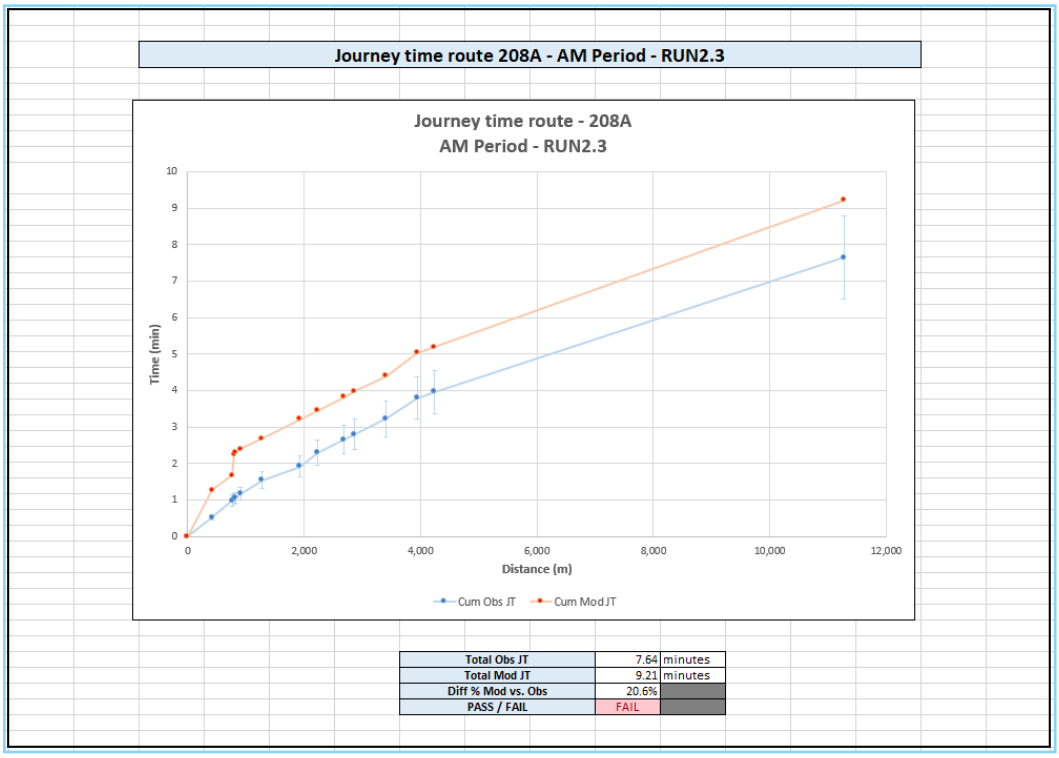

Figure 10-10 - JT Route 208, A4019 To M5 J9 (NB) AM

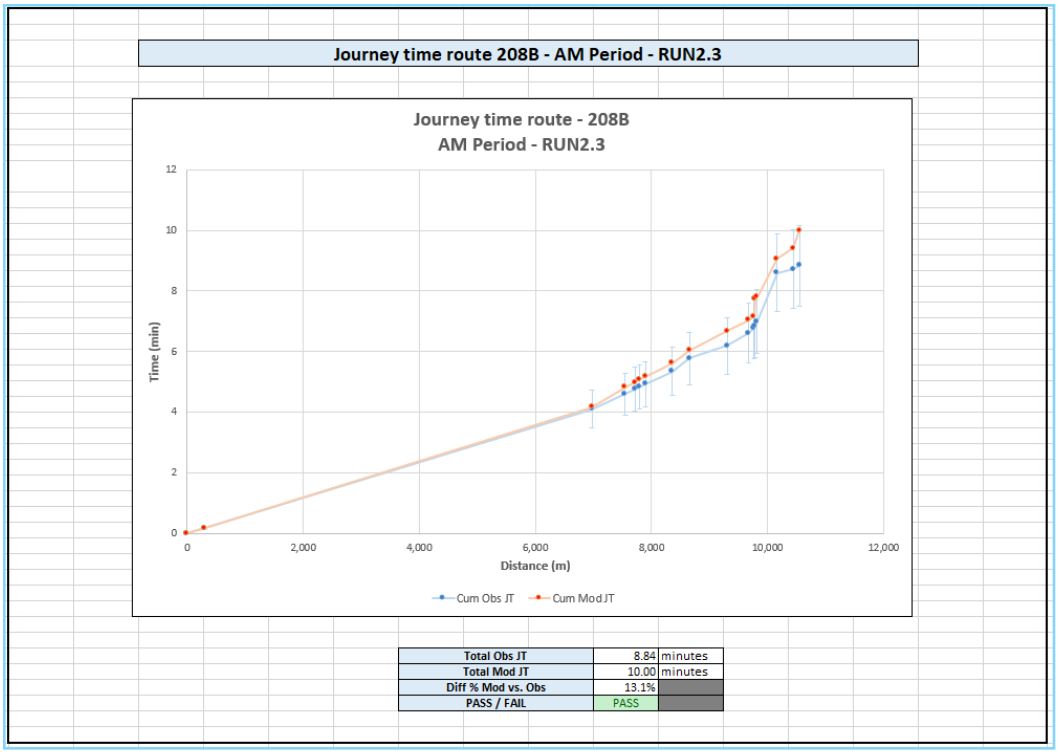

Figure 10-11 - JT Route 208, M5 J9 To A4019 (SB) AM

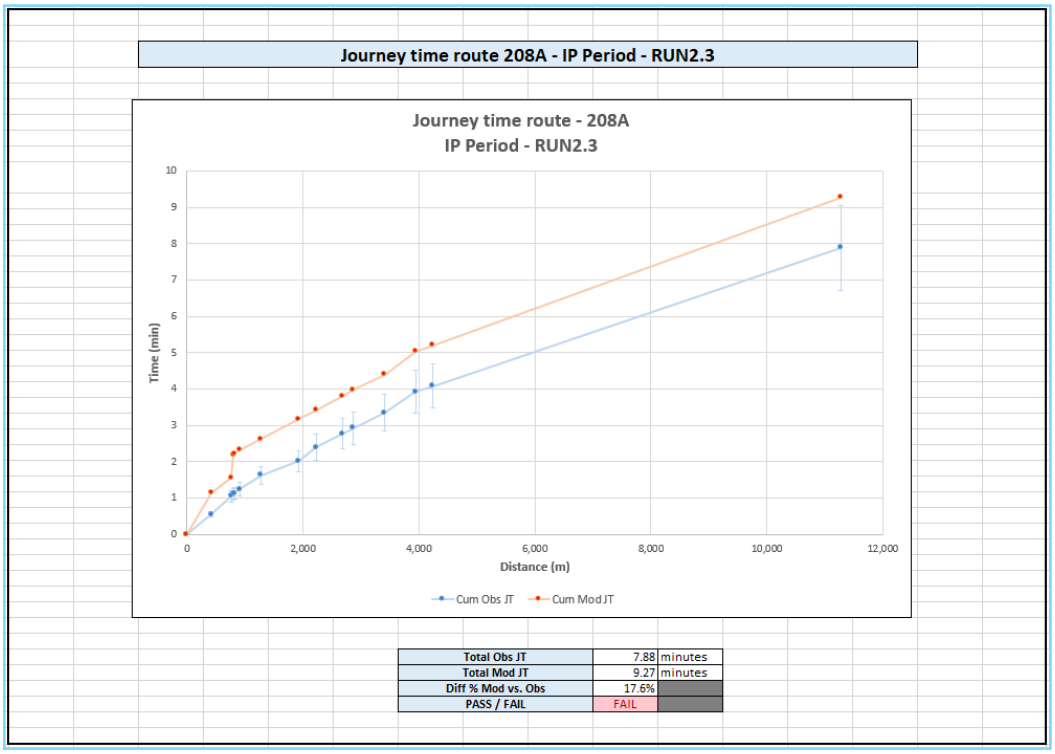

Figure 10-12 - JT Route 208, A4019 To M5 J9 (NB) IP

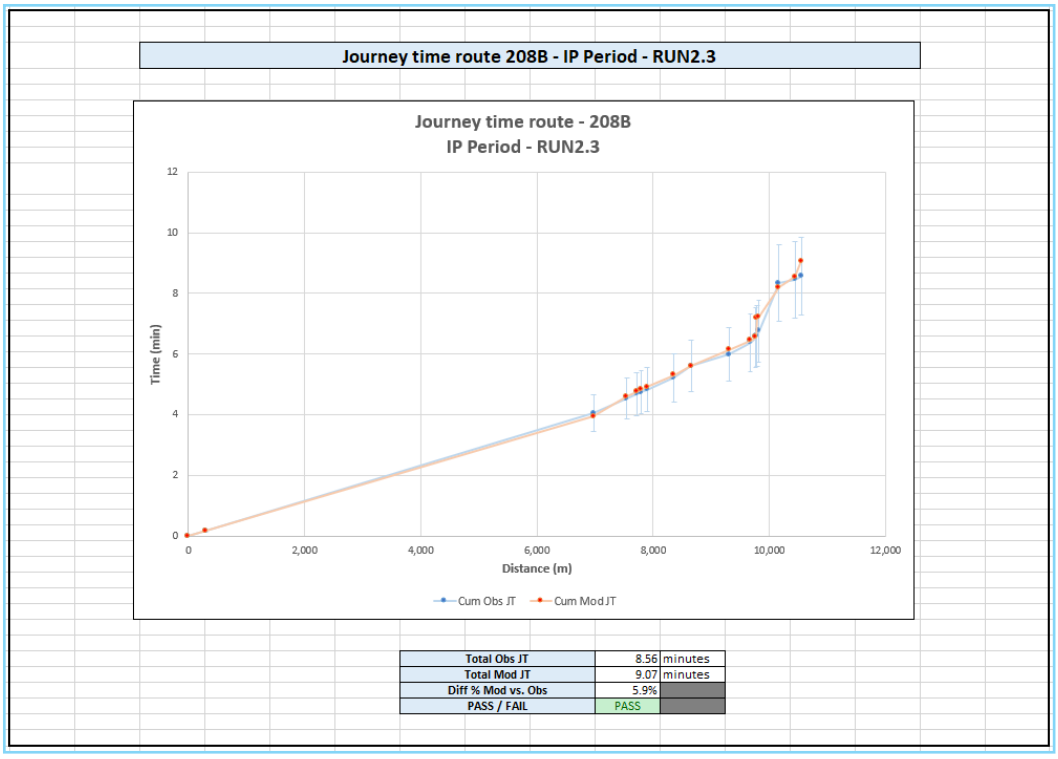

Figure 10-13 - JT Route 208, M5 J9 To A4019 (SB) IP

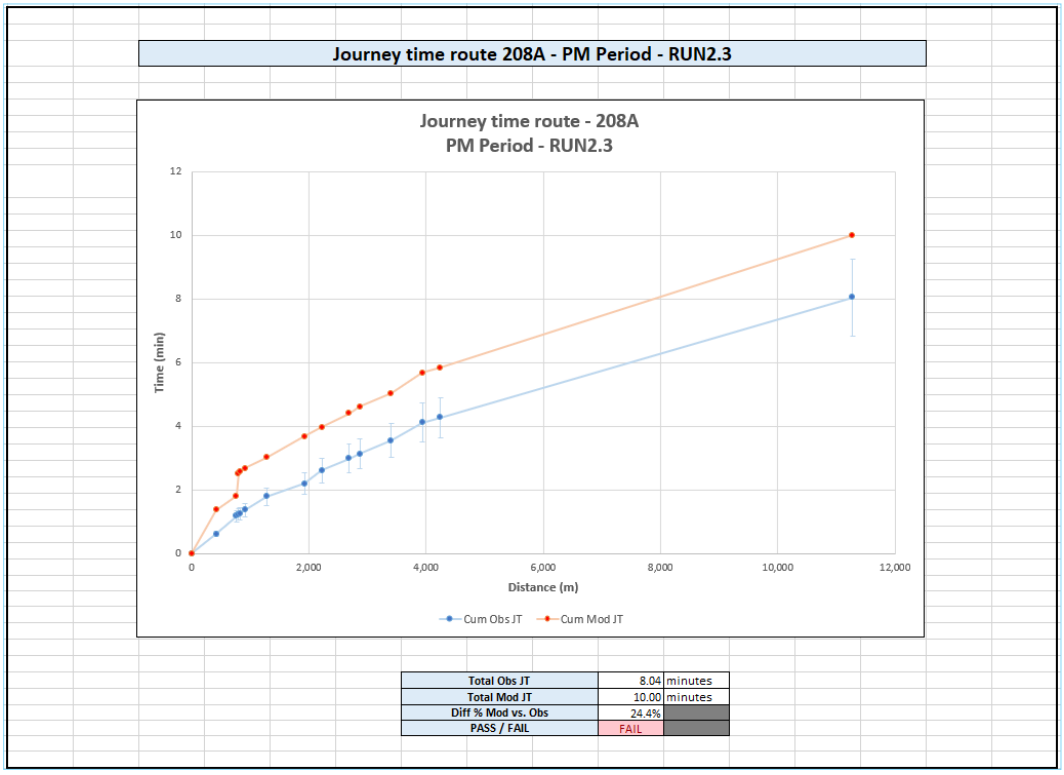

Figure 10-14 - JT Route 208, A4019 to M5 J9 (NB) PM

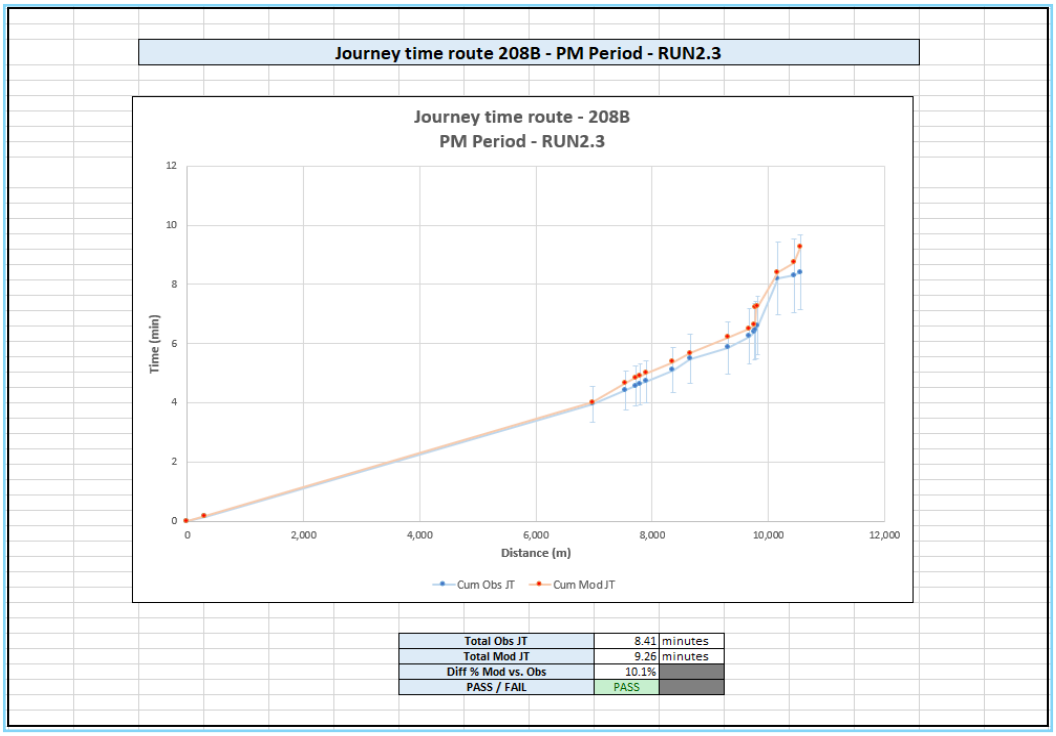

Figure 10-15 - JT Route 208, M5 J9 To A4019 (SB) PM

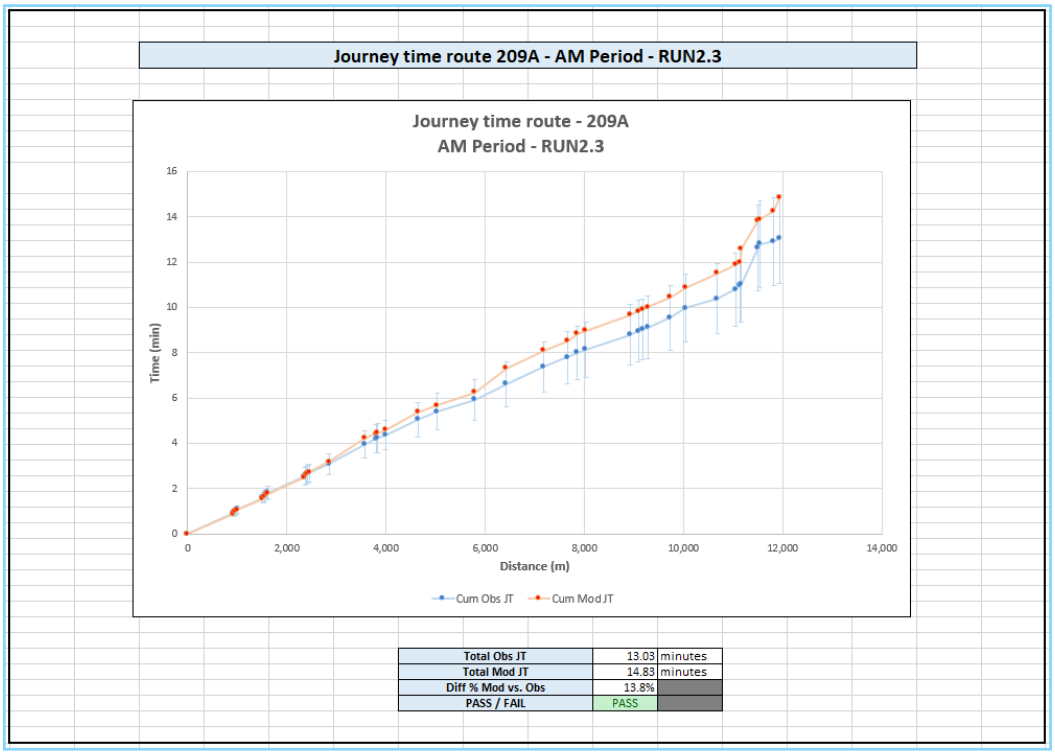

Figure 10-16 - JT Route 209, Cheltenham to Tewkesbury via A38/ A4019 (SB) AM

Figure 10-17 - JT Route 209, Cheltenham to Tewkesbury via A4019/ A38 (NB) AM

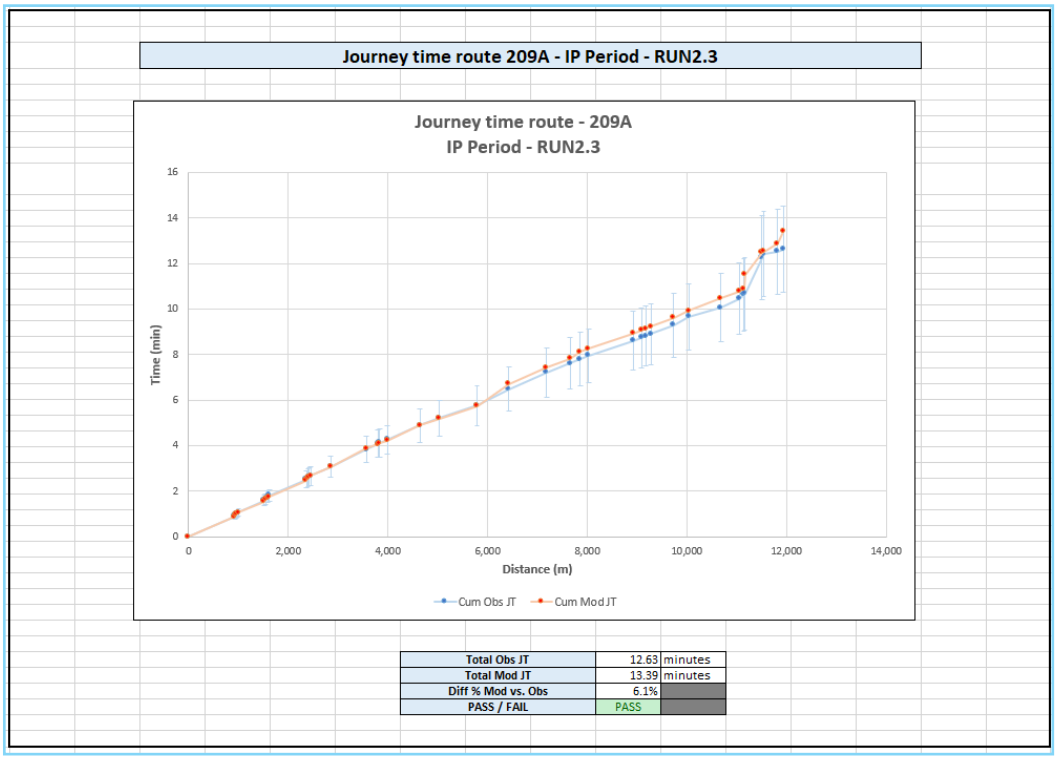

Figure 10-18 - JT Route 209, Cheltenham to Tewkesbury via A38/A4019 (SB) IP

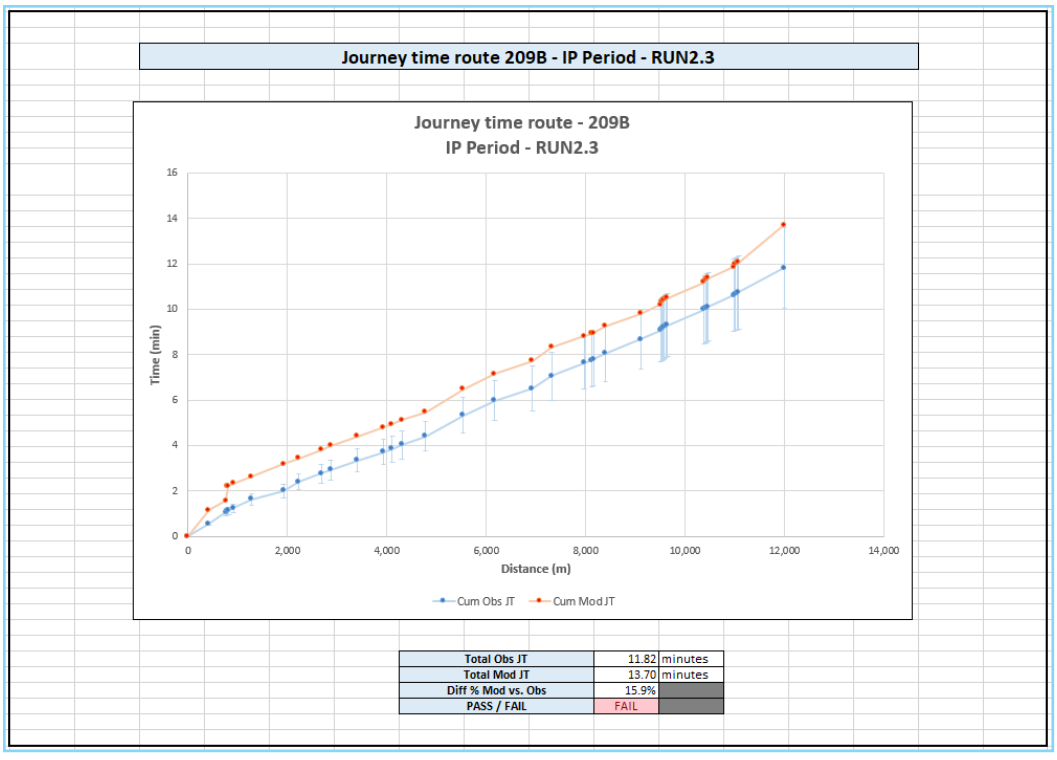

Figure 10-19 - JT Route 209, Cheltenham to Tewkesbury via A4019/A38 (NB) IP

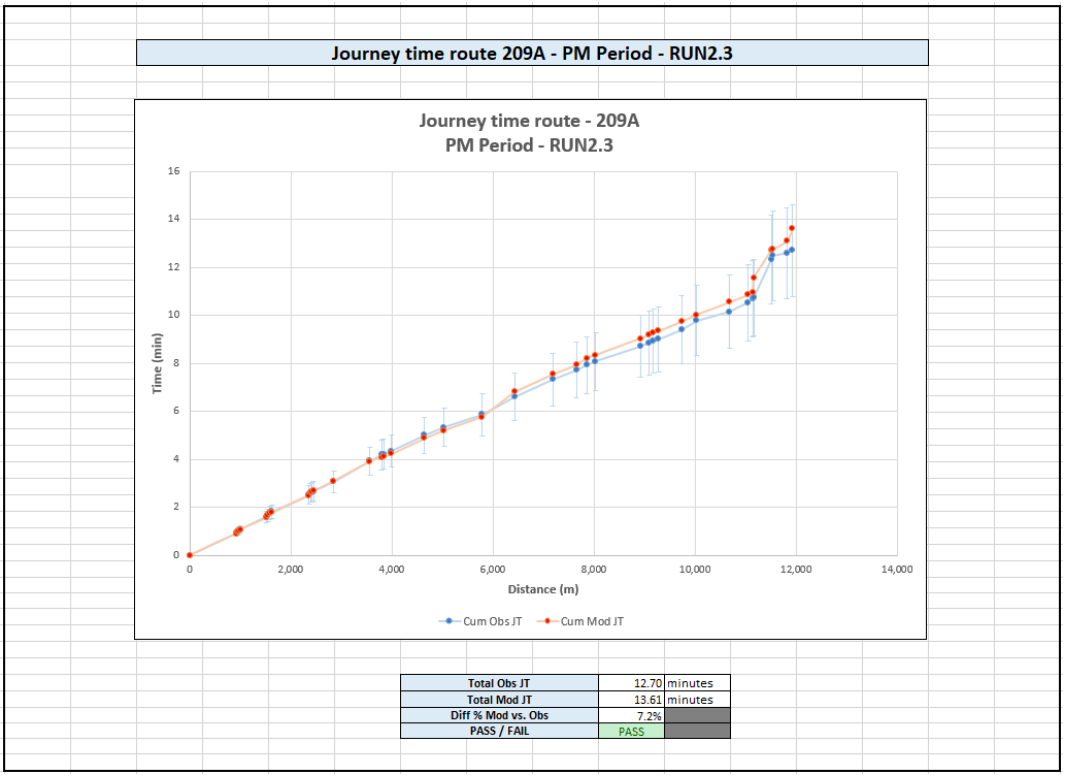

Figure 10-20 - JT Route 209, Cheltenham to Tewkesbury via A38/A4019 (SB) PM

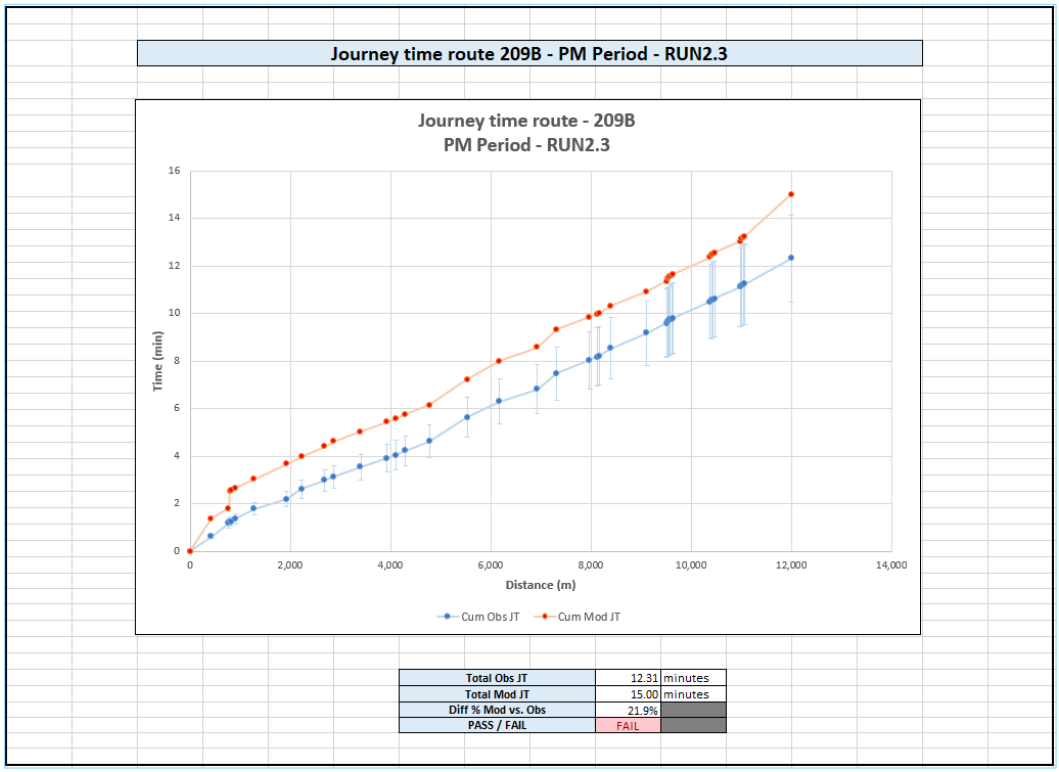

Figure 10-21 - JT Route 209, Cheltenham to Tewkesbury via A4019/A38 (NB) PM

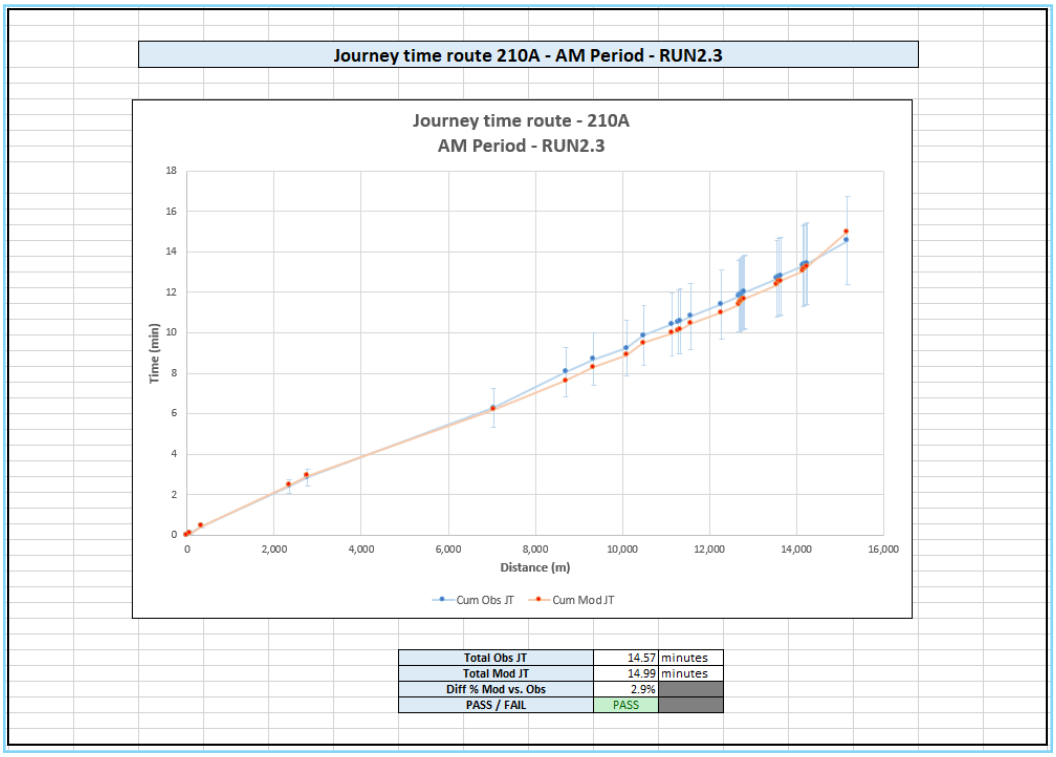

Figure 10-22 - JT Route 210, Gloucester to Tewkesbury via A38/A38 NB AM

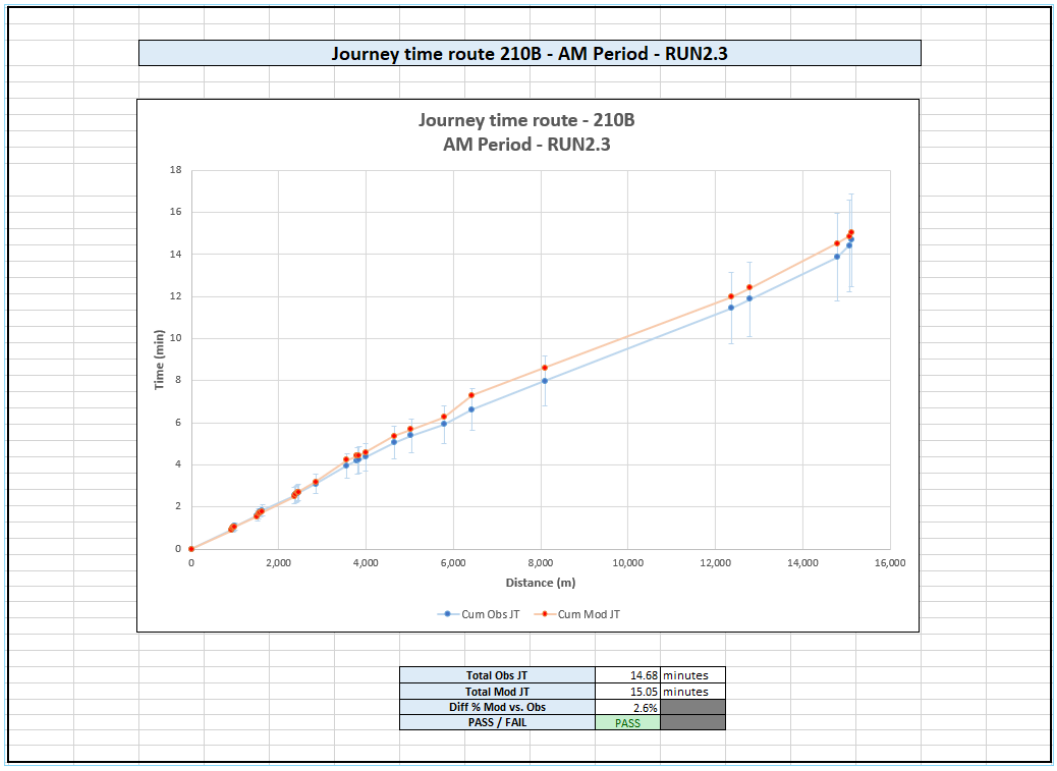

Figure 10-23 - JT Route 210, Tewkesbury to Gloucester via A38/A38 SB AM

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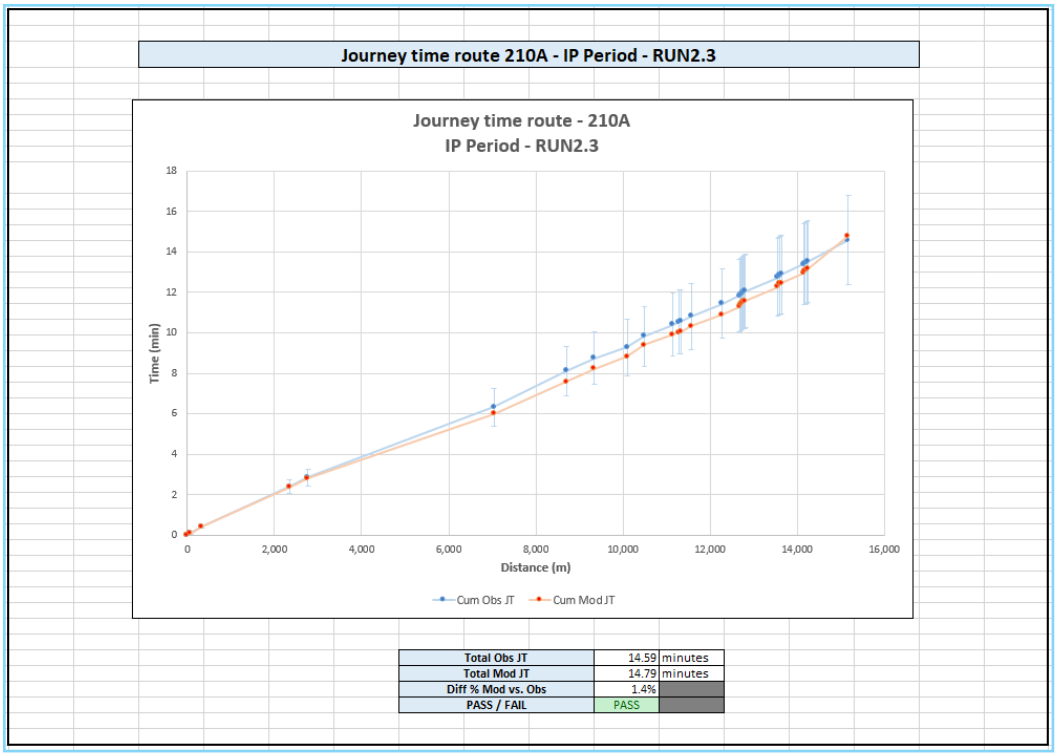


Figure 10-24 - JT Route 210, Gloucester to Tewkesbury via A38/A38 NB IP

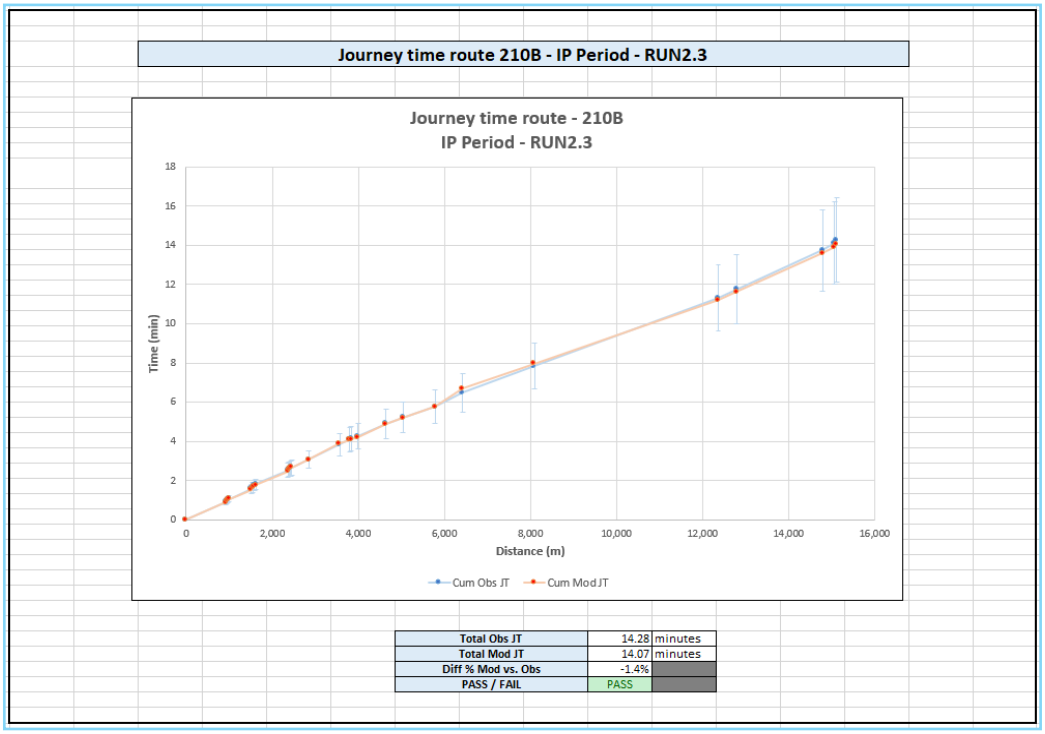


Figure 10-25 - JT Route 210, Tewkesbury To Gloucester via A38/A38 SB IP

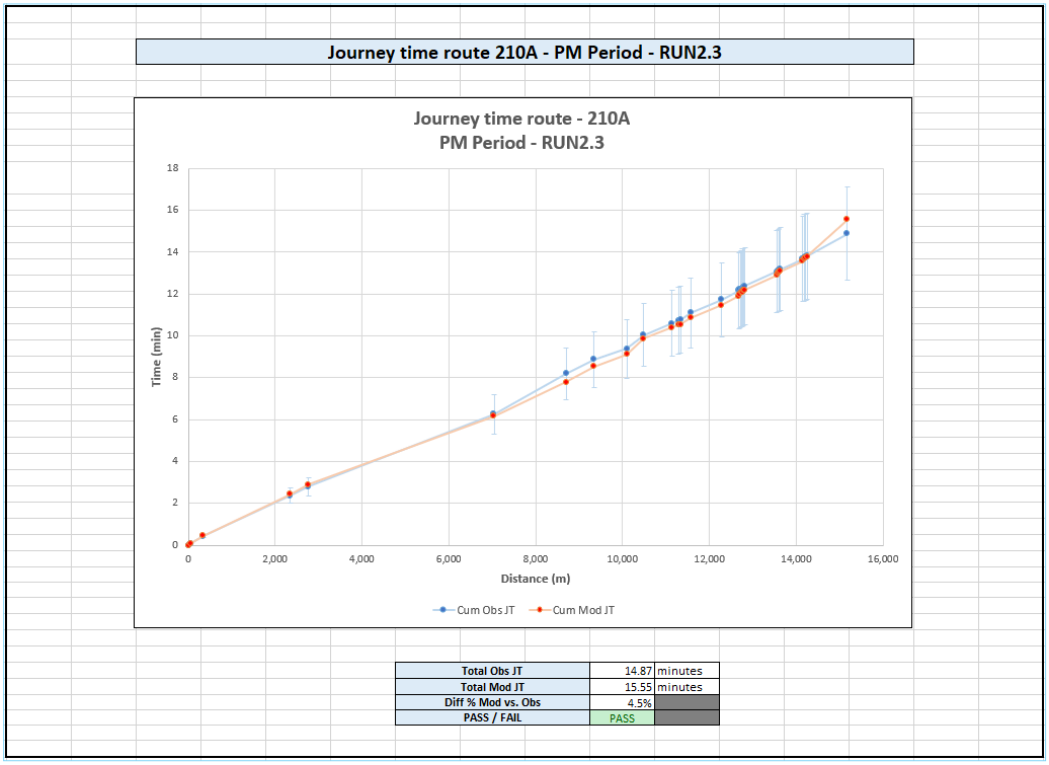


Figure 10-26 - JT Route 210, Gloucester to Tewkesbury via A38/A38 NB PM

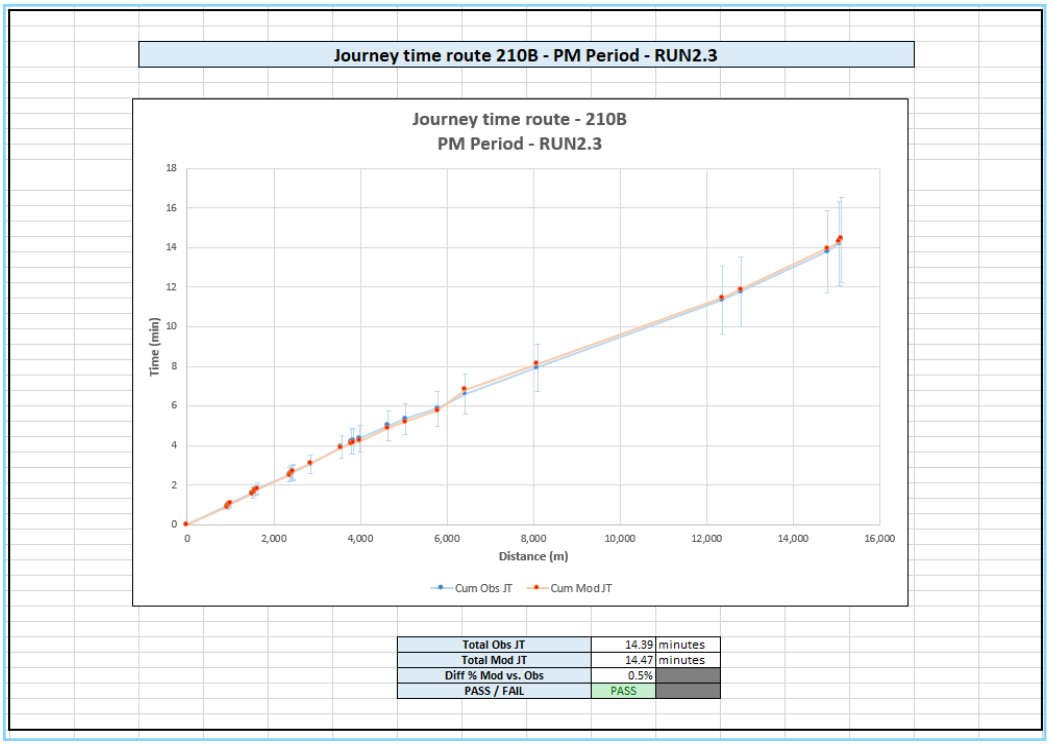


Figure 10-27 - JT Route 210, Tewkesbury To Gloucester via A38/A38 SB PM

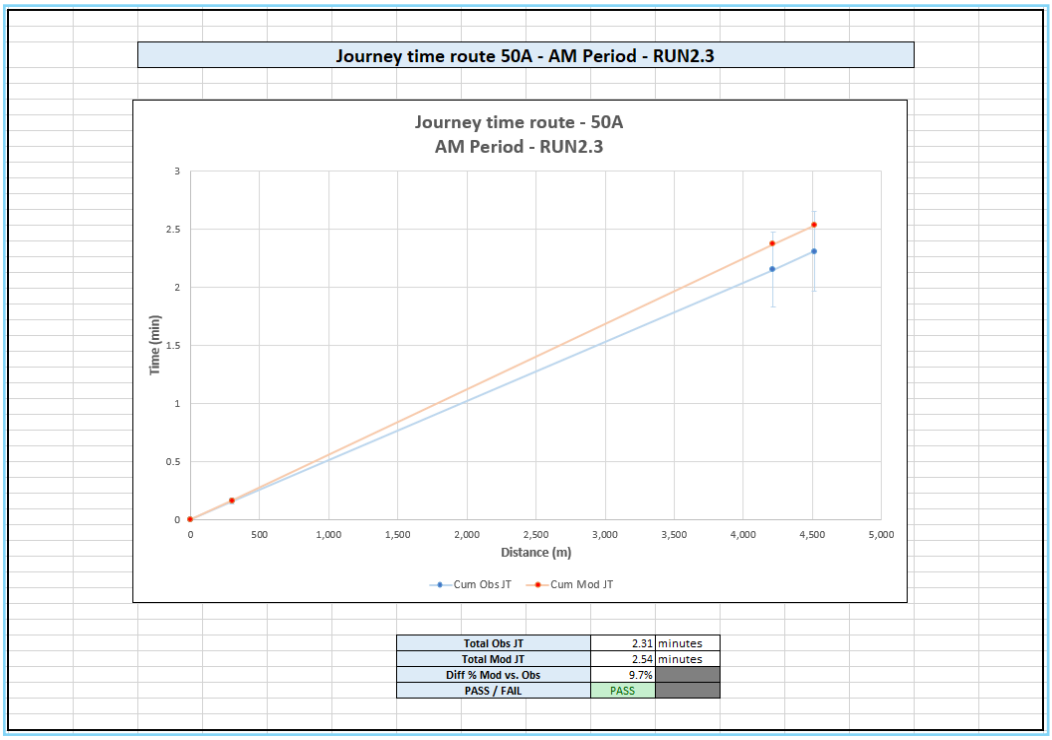


Figure 10-28 - JT Route 50, M5 J11 to J10 NB AM

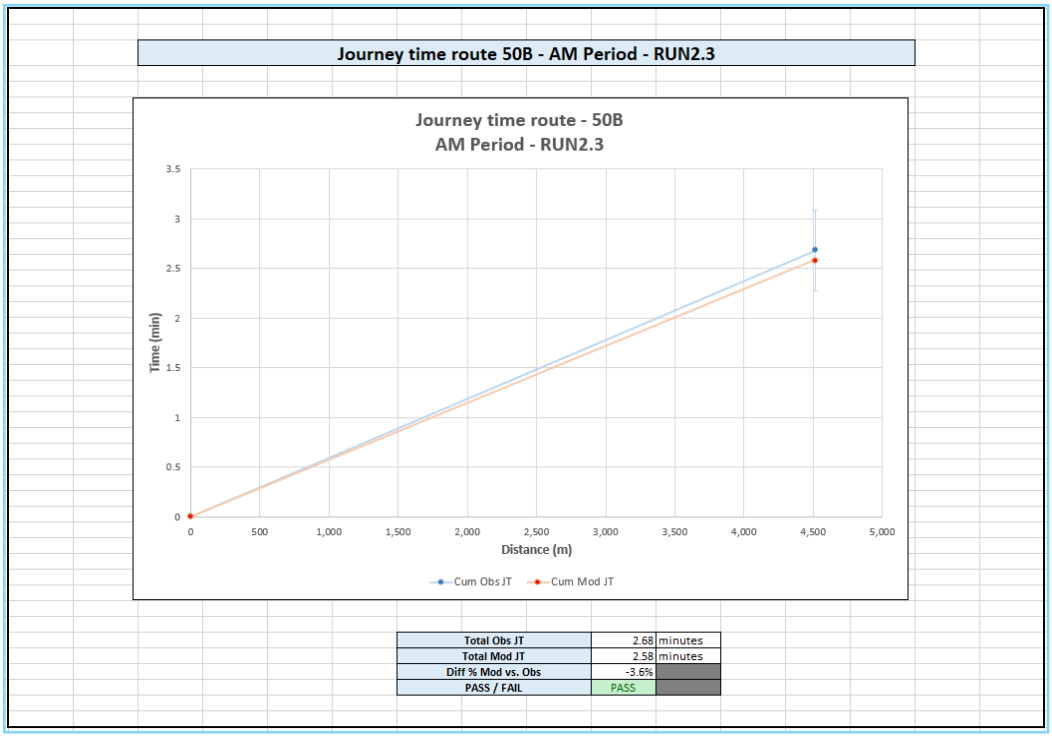


Figure 10-29 - JT Route 50, M5 J10 to J11 SB AM

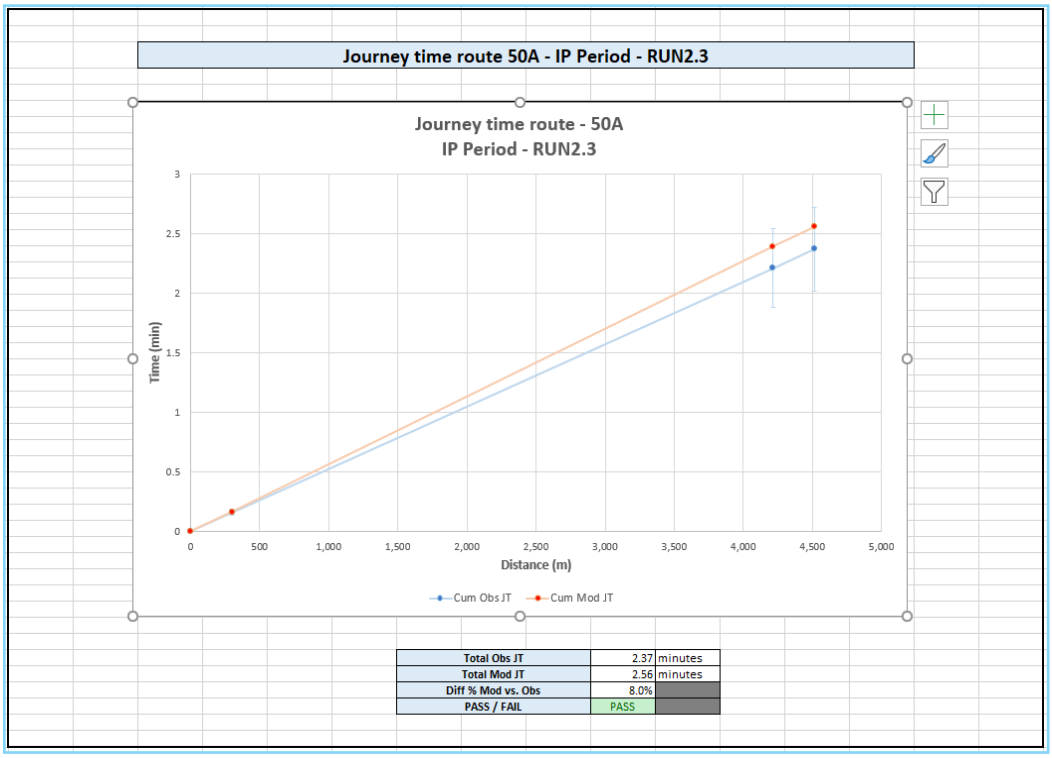


Figure 10-30 - JT Route 50, M5 J11 to J10 NB IP

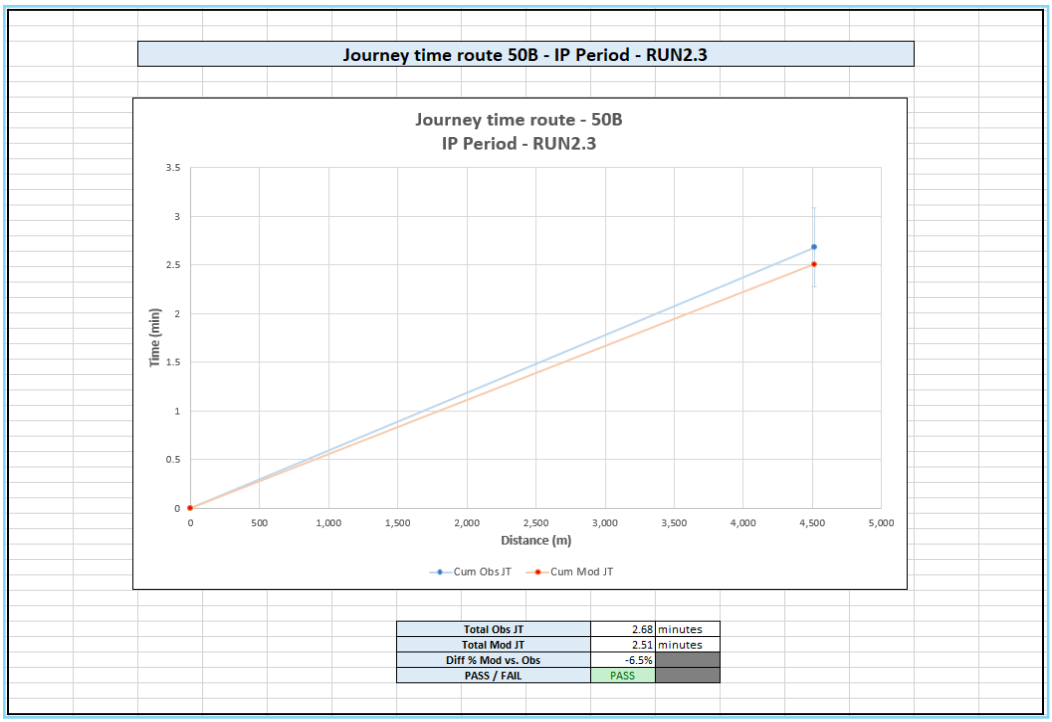


Figure 10-31 - JT Route 50, M5 J10 to J11 SB IP

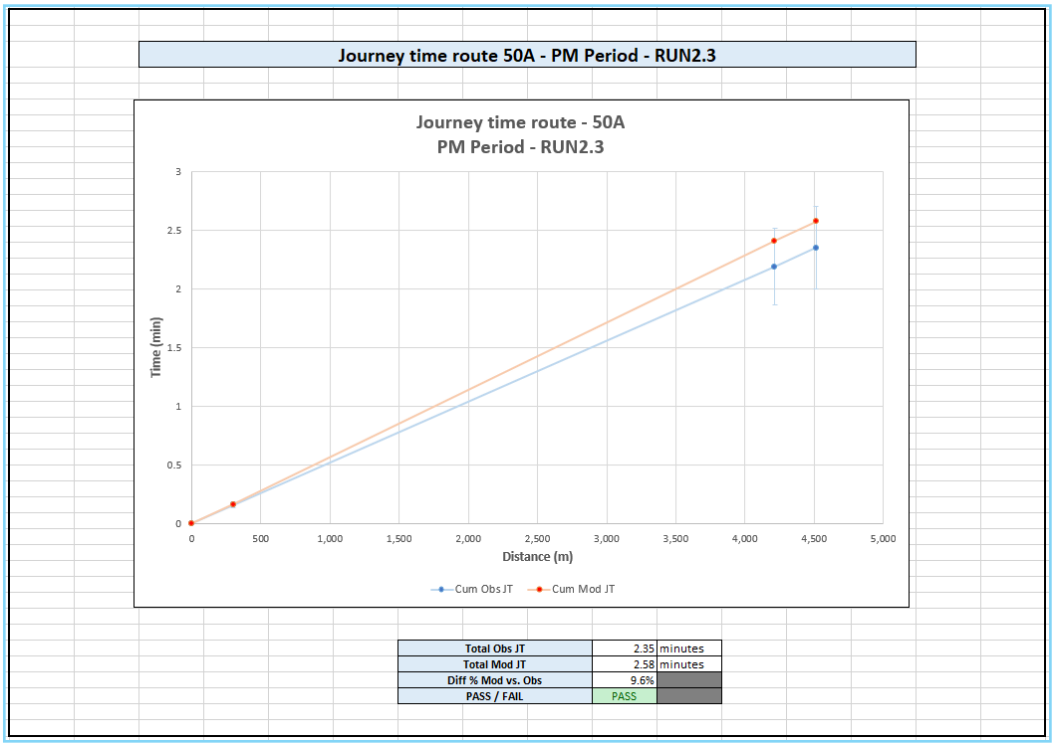


Figure 10-32 - JT Route 50, M5 J11 to J10 NB PM

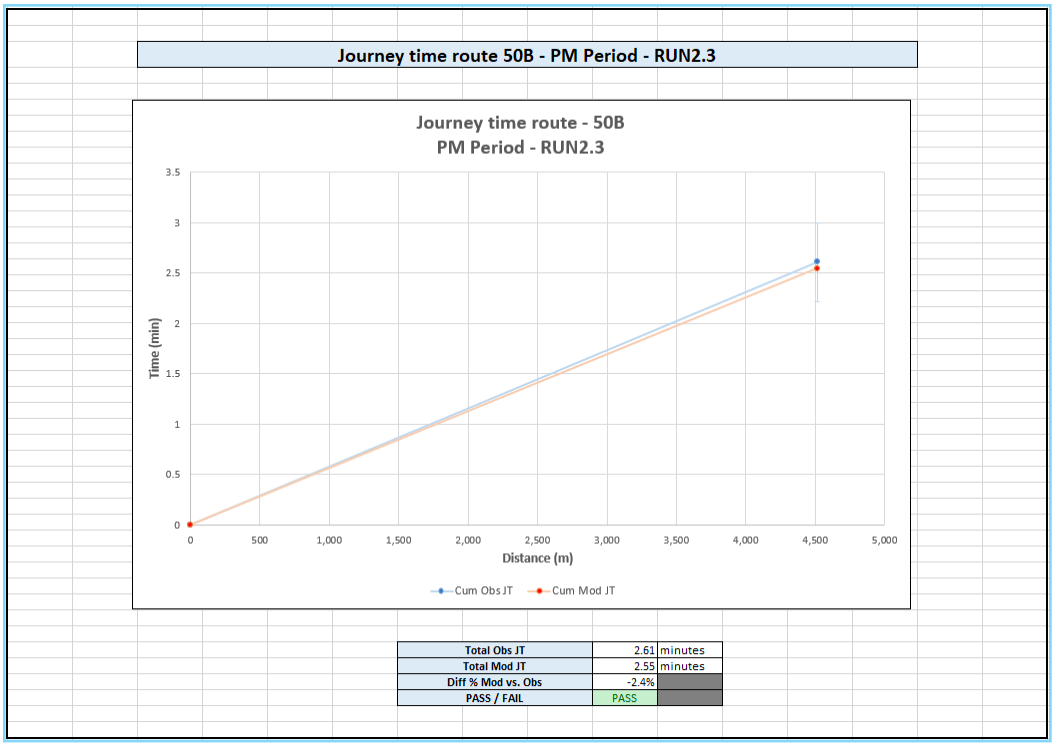


Figure 10-33 - JT Route 50, M5 J10 to J11 SB PM

10.6. Route Choice Validation

10.6.1. Throughout the network calibration and validation stages, reviews of route choice within the model were undertaken, focusing on key routes between urban centres and along strategic routes within Gloucestershire, comparing against Google Maps online journey planner. This was undertaken to ensure that the adopted paths were logical and that major routes were utilised where relevant. Version 2.3 of the GCTM demonstrated logical route choice patterns in the existing simulation area and so the focus of this analysis has been on movements to and from the extended areas of the model.

10.6.2. The analysis indicated that generally, paths predicted by the model were logical for each time period. Google Maps journey planner recommends an optimal route for each journey, while also offering alternative routes with similar journey times. Several routes were compared to Google Maps data, comparing AM and PM peak in both directions between a pair of locations. In all cases, the optimal route presented by the model was functionally equivalent to that suggested by Google Maps. In a number of cases, the alternative route suggested by the model was also equivalent to that suggested by Google Maps, suggesting that route choice validation has been achieved.

10.6.3. Appendix G provides diagrams for a selection of the routes analysed as follows:

- Gloucester to Evesham (main route uses A40, M5, A46 alternative routes use A38, A40, A435)
- Gloucester to Worcester (routes use A40 and M5)
- Cheltenham to Tewkesbury (main route uses A4019, A38; alternative routes use M5 and M50, or A435 and Stoke Road)
- Cheltenham to Worcester (main route uses A4019, M5; alternative route uses M50 and A38)

10.7. Assignment Convergence

10.7.1. The TAG criteria defined in Table 3-4 were used to assess the convergence of the base year highway assignment model. The GCTM has adopted a tighter set of criteria than specified by TAG, with SATURN ISTOP parameter increased from the default 98% to 100%. The convergence for post-ME assignments is summarised in Table 10-7 for the final four loops of each assignment. The results show that the model is well converged in all time periods.

Table 10-7 - Assignment Convergence

Time Period	Loop	%Flows	%Delays	%Gap
AM	27	99.6	99.8	0.0002
	28	99.6	99.8	0.0002
	29	99.7	99.8	0.0003
	30	99.5	99.8	0.0002
IP	13	99.6	99.9	0.0003
	14	99.6	99.9	0.0001
	15	99.8	99.9	0.0001
	16	99.9	99.9	0.0000
PM	21	99.7	99.5	0.0004
	22	99.7	99.5	0.0004
	23	99.7	99.7	0.0005
	24	99.7	99.6	0.0004

11. Variable Demand Model Setup

11.1. Introduction

11.1.1. This chapter provides details of the demand model setup for the GCTM v2.3 using the A417 demand model setup as a starting point, from which GCTM is developed. GCTM is specifically developed to test various schemes within Gloucestershire including M5J9 and M5J10, hence the same Variable Demand Model (VDM) setup can be used for both the studies. This section presents the methodology adopted for setting-up the VDM and undertaking the realism tests using the TAG Databook version 1.20.2 released in January 2023.

11.1.2. The work involved creating a VDM for the GCTM base model to be used in forecasting mode for testing future schemes, calibrating destination and mode choice parameters to arrive at elasticity value as per TAG guidance. For this exercise, A417 setup along with South West Regional Transport Model (SWRTM) OD to PA factors were used as start point. Key tasks included:

- VDM Structure: Creating GCTM VDM structure using A417 setup;
- OD to PA factors: Using SWRTM OD to PA factors to convert the GCTM base OD matrices to PA matrices;
- Base demand and skims: Refining validated GCTM base model to include the future development zones;
- Update Fitting on Factors (FoF): Updating FoF with new disaggregated zones for PA to OD conversion; and
- Calibrating Demand model setup: Checking realism results and updating parameters to validate demand model.

11.2. Methodology

11.2.1. Figure 11-1 shows the process followed for carrying out the realism tests for GCTM VDM. The process involves converting GCTM base validated matrices into various demand segments using ‘from home’, ‘to home’ factors, HB and NHB proportions using the information from SWRTM. PT demand segment and car fixed demand segments are derived from A417 setup by disaggregating to GCTM zoning using zone correspondence used in developing GCTM base from A417. Car fixed demand segments comprise of port and airport trips.

11.2.2. Version 2.3 VDM specification is consistent with ‘A417 Missing Link’ Stage 2 VDM setup. The section below provides detail of the software and other model parameters adopted for GCTM v2.3 VDM.

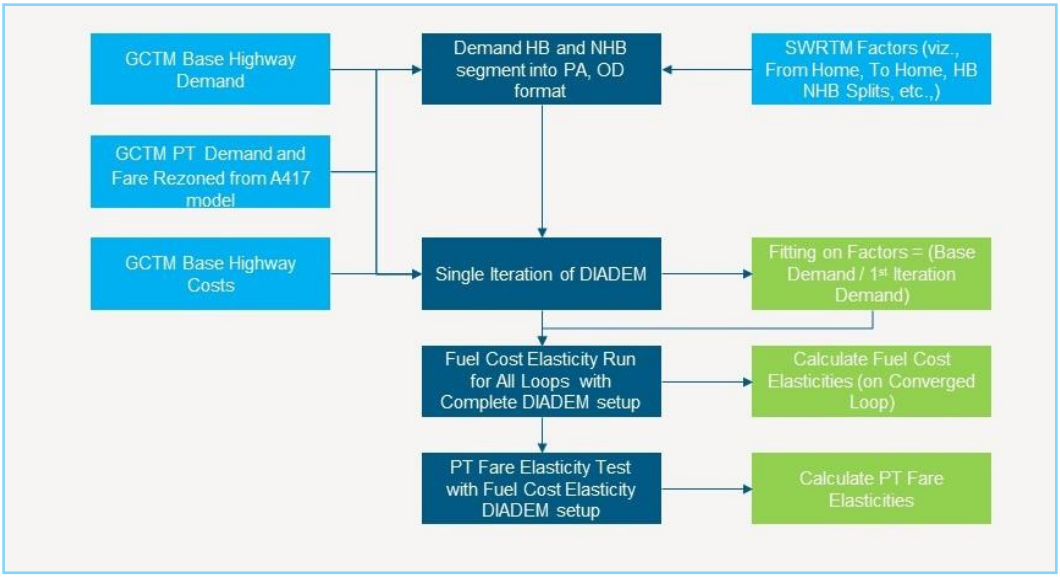


Figure 11-1 - GCTM v2.3 VDM Realism Testing Process

11.3. Software Used

11.3.1. The software required to run the VDM includes:

- SATURN version 11.4.07H – Highway Assignment Software; and
- DIADEM 7 – Variable Demand Model Software

11.4. Model Parameters

11.4.1. GCTM base model was developed and validated for AM average hour, IP average hour and PM average hour. An Off-peak (OP) model would be required to provide means of factoring modelled periods to daily level. Hence OP scenario demand was derived using an equivalent scaling ratio of IP and OP demand from the A417 model matrices and applied on GCTM v2.3 IP calibrated validated matrices. A wide range of model parameters and inputs to DIADEM have been prepared.

11.4.2. Table 11-1 and Table 11-2 contains a list of VDM segmentation and parameters.

11.4.3. Table 11-2 Shows the model type, model responses and hierarchy that has been adopted for VDM in line with donor model A417.

11.4.4. The mode choice between car and public transport (in this case only rail) was considered in the DIADEM model through modelling the Car Available portion of public transport demand. The impact of the proposed highway scheme on Non-Car Available (non-CA) demand would be through indirect mechanisms such as crowding on public transport services or changes in highway delay. Changes in the demand patterns of non-CA trips would not result in changes to highway demand. Therefore, these would not directly affect the design or assessment of a highway scheme. Consequently, the non-CA trips are not modelled.

11.4.5. The A417 model was based on the SWRTM model. This was built with a focus on inter-urban travel and hence it was deemed that rail travel was the main competitor to car travel and bus / coach need not be represented.

11.4.6. Data on rail services including routes, frequencies and fare information were taken from skims derived from the public transport component of the A417 model.

Table 11-1 - Variable Demand Modelling Segmentation

Parameter / Setting	Data Source	Notes

Modelled Time Slices	AM 07:00-10:00, IP 10:00-16:00, PM 16:00-19:00, OP 19:00-07:00	AM, IP, PM travel costs are derived from average peak hour calibrated assignment. OP travel costs derived from uncalibrated assignment of derived OP matrix to IP network to represent free flow conditions.	
Time period factors	AM=3, IP=6, PM=3, OP=12	Simple calculation consistent across all movements and purposes as average peak hours modelled.	
Assigned User classes	Car Employers Business, Car Commute, Car Other, Light Good Vehicles, Heavy Good Vehicles	From assignment models: GCTM Stage 3 Base Model.	
VDM Segments	Segment	Car Available	Fixed elements relate to 'special zones' which include unique travel patterns that are not subject to VDM response. This may be a port or airport where 'Other' (passengers) and Employers Business are not subject to VDM responses.
	Home Based Employers Business	1	
	Home Based Commute	2	
	Home Based Other	3	
	Non-Home-Based Employers Business	4	
	Non-Home Based Other	5	
	Fixed-Employers Business	6	
	Fixed-Commute	7	
	Fixed-Other	8	
	Light Good Vehicles	9	
	Heavy Good Vehicles	10	

Table 11-2 - Variable Demand Modelling Parameters

Parameter / Setting	Data Source		Notes
Model Type	Home Based	Incremental PA	
	Non-Home Based	Incremental OD	
	Goods	Fixed	
	Special Generators	Fixed	
Model Responses and Hierarchy	(Macro) Time of Day Choice Mode Choice Distribution		Distribution is singly constrained for Employers Business and Other, doubly constrained for Commute.
Distribution Intra-zonal cost calculation	DIADEM Default values (ρ=0.5, minimum cost=5)		
Cost coefficients (VOTs etc)	TAG with distance based VOT		
Occupancy factors	TAG		
Algorithm	Fixed Step Length (0.5 during Base Model Calibration)		

11.4.7.

11.4.8. Table 11-3 and Table 11-4 below shows the range of logit choice parameters by trip purpose as per TAG.

Table 11-3 - Destination Choice Parameters as per TAG guidance

Trip Purpose and Mode	Minimum	Median	Maximum
Car			
Home-based work	0.054	0.065	0.113
Home-based employers' business	0.038	0.067	0.106
Home-based other	0.074	0.090	0.160
Non-home-based employers' business	0.069	0.081	0.107
Non-home-based other	0.073	0.077	0.105
Public Transport			
Home-based work	0.023	0.033	0.043
Home-based employers' business	0.030	0.036	0.044
Home-based other	0.033	0.036	0.062
Non-home-based employers' business	0.038	0.042	0.045
Non-home-based other	0.032	0.033	0.035

Table 11-4 - Main Mode Choice Parameter as per TAG Guidance

Trip Purpose and Mode	Minimum	Median	Maximum
Home-based work	0.50	0.68	0.83
Home-based employers' business	0.26	0.45	0.65
Home-based other	0.27	0.53	1.0
Non-home-based employers' business	0.73	0.73	0.73
Non-home-based other	0.62	0.81	1.0

Source: Mode table 5.2 TAG unit M2

11.4.9. The assumed logit choice parameters for GCTM VDM calibration which yielded values within TAG specification is summarised (in units of generalised minutes) in Table 11-5.

Table 11-5 - Selected Logit Parameters in GCTM Demand setup

Trip Purpose	Car	PT	Mode, time choice
	Destination	Destination	
Home-based work	0.061	0.033	0.68
Home-based employers' business	0.057	0.036	0.45
Home-based other	0.080	0.036	0.53
Non-home-based employers' business	0.081	0.042	0.73
Non-home-based other	0.077	0.033	0.81

11.4.10. All Parameters other than Destination Choice parameter for Home-based work, Home-based Other and Home-based Employer's Business is as per median value from TAG guidance. However, Home-based work, Home-based Other and Home-based Employer's Business are also within TAG acceptable range of ±25% of the suggested median value. These choice parameter values were arrived in an iterative process while validating the VDM for the sensitivity tests as detailed in subsequent sections. Updated values for Destination Choice parameter were used to make fuel elasticity value consistent with A417 realism and SWRTM realism reported.

11.5. Cost Damping

11.5.1. In most models, using the generalised cost directly in mode split and distribution results in the model's elastic response to fuel price or car time changes being dominated by very long trips in a way that does not seem to accord with real observations. Other Value of Time experiments have shown, simultaneously, that the marginal influence of both cost and time seems to decrease for very long trips. It is therefore recommended in the demand modelling guidance (TAG unit M2, Section 3.3) that some form of cost damping to long trips may be required to reduce the elasticity of response and improve model realism.

11.5.2. GCTM demand model realism testing applied a cost damping function to all the purposes in a similar way as was applied to the A417 setup and in line with TAG guidance.

$$G^1 = \max\left(1, \left(\frac{d}{k}\right)^{-\alpha}\right) G$$

Where:

1. G1 is the damped generalised cost combining time and monetary cost
2. G is generalised cost

3. d is the trip distance
4. k is a distance cut off, 30Km
5. α is a parameter, 0.5

11.6. Fitting on Factors

11.6.1. A set of Fitting on Factors (FoF) were calculated by dividing original input calibrated base matrix by the first iteration output matrix from DIADEM as shown below.

$$f_{ijct}^{fof} = \frac{Base\ SATURN\ UFM_{ijct}}{Base\ DIADEM\ 1st\ Iteration\ UFM_{ijct}}$$

11.6.2. Fitting on factors are simply the ratios by which the initial base year DIADEM (Realism) UFMs produced via PA-to-OD conversion have to be multiplied in order to reproduce the validated base year SATURN UFMs.

11.7. Model Convergence

11.7.1. All variable demand models need to iterate between the demand model and the assignment (or supply) model. This is because the volume of demand affects travel times, which in turn affect the volume of demand and so on. As in any such modelling system, it is important to monitor the convergence of this iterative process. Poor convergence causes noise in the model, which in turn introduces errors into analyses such as economic appraisal, noise and air quality.

11.7.2. TAG requirements for VDM convergence are set out in section 6.3 of TAG Unit M2. This defines the demand/supply gap as the preferred measure of convergence and states that:

11.7.3. Tests indicate that gap values of less than 0.1% can be achieved in many cases, although in more problematic systems this may be nearer to 0.2%. Where the convergence level, as measured by the %GAP, is over 0.2% remedial steps should be taken to improve the convergence, by increasing the assignment accuracy. TAG also states that 'ideally the user benefits, as a percentage of network costs, should be at least 10 times the % Gap achieved in the Without-Scheme and With-Scheme scenarios. However, this relates to economic appraisal and forecasting and cannot be applied to base year realism testing.

11.7.4. Based on TAG guidance, and on practical experience in terms of what is achievable with the RTMs, the stopping criteria in DIADEM were set as: Whole-model gap < 0.1% AND subarea gap < 0.2%. Subarea is defined as an internal to internal movements.

11.7.5. Table 11-6 presents the gap values achieved during the realism testing, along with the number of demand assignment loops required. Table shows the GCTM realism test model runs have achieved a reasonably good convergence.

Table 11-6 - DIADEM Convergence Stats for Realism Tests

Test	Whole Model Gap	Sub-Area Gap	Number of Loops
Fuel Cost Realism Test	0.06	0.09	6
PT Fare Realism Test	0.07	0.13	4

11.8. Realism Test Results

Car Fuel Realism Test Elasticities

11.8.1. TAG guidance (unit M2.1, Section 6.4) suggests the following results should be achieved for the realism tests:

- Car fuel cost responses: in the range -0.25 to -0.35, with employer's business trips near to -0.1, discretionary trips near to -0.4, and commuting and education somewhere near the average in the region of -.3;
- Public transport fare responses: in the range -0.2 to -0.9, with lower values for non-discretionary purposes than discretionary purposes, and lower values in the Inter Peak than the peak periods; and
- Car journey-time responses: negative and smaller in magnitude than -2.0.

11.8.2. Table 11-7 below summarise the recommended elasticities that should be achieved by the realism tests.

Table 11-7 - Recommended Elasticities from Car Fuel Cost Realism Test

Attribute	High	Low
Average Fuel Cost (Kms)	-0.35	-0.25
PT Main Mode Fare (Trips)	-0.9	-0.2
Bus Fare (Trips)	-0.9	-0.7
Car Journey Time (Trips)	No Stronger than -2.0	

Source: Summary of recommended elasticity ranges table 6.2 TAG unit M2.1

11.8.3. Table 11-8 shows the fuel cost elasticity achieved for GCTM and compares it with A417 and SWRTM model realism test elasticities. GCTM VDM set-up is able to replicate the similar elasticities as the A417 model.

Table 11-8 - 24 Hr Car Fuel Cost Elasticity for GCTM by Purpose (Matrix Based, Sub-area)

Model	Business	Commute	Other	Total
GCTM	-0.25	-0.18	-0.47	-0.35
A417 Model	-0.25	-0.19	-0.47	-0.35
SWRTM	-0.25	-0.21	-0.53	-0.38

Public Transport Fare Realism Test Elasticities

11.8.4. TAG M2.1 quotes a public transport fare elasticity range of -0.2 to -0.9, i.e., a relatively wide range of values based on 2004 TRL work. The following Table 11-9 summarises the PT fare elasticities obtained for purpose group over 24-hour period for GCTM demand model.

Table 11-9 - PT Fare elasticities by User class

Purpose	Elasticities
Business	-0.46
Other	-0.21
Commuting	-0.86
All Purpose	-0.48

Car JT Elasticities

11.8.5. Car JT elasticities are calculated by comparing travel time and travel kilometres by user class and by time period from the final loop assignment and the first loop assignment from a converged fuel elasticity run using the method defined in section 8.1.3 of DIADEM user Manual v7.0. Table 11-10 below summarises the JT elasticities obtained for purpose group over each time period for GCTM demand model for the final loop assignments.

11.8.6. Table 11-11 presents JT elasticities obtained for purpose group over each time period for GCTM demand model for the first loop assignments. Both tables indicate that the Car JT elasticities are within the acceptable limits.

Table 11-10 - JT elasticities by User Class and Time Period for Final Converged Loop

Time Period	Car-Business	Car-Commute	Car-Other
AM (07-10)	-0.43	-0.45	-0.89
IP (10-16)	-0.38	-0.44	-0.81
PM (16-19)	-0.38	-0.48	-0.81
OP (19-07)	-0.67	-0.46	-0.90
Total	-0.45	-0.47	-0.86

Table 11-11 - JT elasticities by User Class and Time Period for First Loop

Time Period	Car-Business	Car-Commute	Car-Other
AM (07-10)	-0.01	-0.03	-0.02
IP (10-16)	-0.02	-0.03	-0.02
PM (16-19)	-0.01	-0.05	-0.03
OP (19-07)	-0.32	-0.03	-0.10
Total	-0.07	-0.04	-0.04

12. Summary of Model Development

12.1. Summary of Model

12.1.1. The GCTM Version 2.3 will support the stage 3 assessment and appraisal of the M5 Junction 10 Transport improvements scheme and testing of highway impacts associated with land use options for the Gloucester, Cheltenham and Tewkesbury Joint Core Strategy (JCS). Incremental updates (Version 2.0 followed by 2.1 & 2.2 and then 2.3) have involved extending and enhancing the fully modelled area, to provide an improved level of detail within the core study area for the M5 Junction 9 and M5 Junction 10 scheme. The original network and zone structure for the rest of the fully modelled area remains unaltered from Version 1.

12.1.2. The model represents a typical weekday in March 2015, calibrated and validated for three time periods; the AM Peak period average hour (07:00-10:00), an average inter-peak hour (10:00-16:00) and PM peak period average hour (16:00-19:00). An off-peak assignment has also been produced through simple factoring of the inter-peak assignment (but with no validation undertaken). The model has utilised newly collated data from a range of local and national sources, along with data used in the original GCTM Version 1.

12.1.3. This Model Package Report has described the development of the modelled network and demand matrix, along with the matrix estimation procedures undertaken. The calibration and validation of the model, and standards achieved, have also been set out.

12.2. Summary of Standards Achieved

12.2.1. Base model calibration has involved the application of matrix estimation to refine the prior matrices in line with observed traffic count data. Close monitoring of the changes brought about by the ME process at a demand matrix and trip length distribution level has ensured the scale of changes lie within the prescribed TAG ranges

12.2.2. The GCTM Version 2.3 has been tested against TAG calibration and validation criteria for:

- Links flows across selected screenlines and individual link/turning flows;
- Journey time comparison;
- Routing analysis; and
- Model convergence.

12.2.3. In terms of screenline and individual flow accuracy, the model performs strongly. Across all three time periods, the majority of screenlines are within the ±5% threshold defined in TAG criteria, with the remainder of screenlines close to the threshold and with low GEH values (less than 5.0). In terms of individual links and turns used either for calibration or validation, over 90% of all links considered in each time period meet the defined criteria. This demonstrates that the model achieves a good level of fit across the fully modelled area.

12.2.4. Additionally, recognising that the M5 Junction 9 and M5 Junction 10 scheme represents a key initial focus for the updated model, further analysis has demonstrated that the model achieves a high level of accuracy for individual sections along the length of the A46 corridor and around M5 Junction 9 and M5 Junction 10.

12.2.5. Modelled journey times across the model, and across all time periods, are very strong, with all modelled journey times within ±15% of the observed journey times, whilst also matching patterns of delay along the length of each route except for 2 routes. Routing analysis has demonstrated that modelled key strategic movements between urban centres across the fully modelled area are logical as verified by comparison with Google Maps online journey planning tool.

12.2.6. The base assignment model is stable for the three modelled time periods and meets the convergence criteria.

12.2.7. The variable demand model set-up is similar to the donor model A417 Missing Link. Realism testing of the VDM demonstrated the model responses are in line the TAG guidance.

12.2.8. Overall, having demonstrated the model performs strongly against the relevant TAG criteria, it is concluded that the model is applicable for the intended key usages as defined in Chapter 2.

Appendices

Appendix A. Speed Flow Curves

A.1 Speed Flow Curve Definitions

SFC ID	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (PCU/Hr)	N Factor	Description
1	113	81	11,650	2.8	Rural motorway D5
2	113	81	9,320	2.8	Rural motorway D4
3	113	81	6,990	2.8	Rural Motorway D3
4	100	75	9,320	4.7	Rural Motorway D3 + Dynamic Hard Shoulder 60mph
5	113	74	4,659	2.8	Rural Motorway D2
6	98	76	8,397	2.8	Rural all-purpose D4
7	80	62	6,298	2.2	Rural all-purpose D4 50mph
8	112	73	4,199	2.8	Rural all-purpose D3
9	80	62	4,199	2.8	Rural all-purpose D3 60mph
10	64	35	4,199	2.2	Rural all-purpose D3 50mph
11	93	55	1,686	2.8	Rural all-purpose D2
12	87	58	1,328	2.2	Rural all-purpose D2 50mph
13	64	35	4,199	1.6	Rural all-purpose 40mph
14	93	55	1,686	2.1	Rural WS2 10.0m A Road
15	87	58	1,328	1.1	Rural S2 7.3m A Road TD9/81
16	82	53	1,328	2.0	Rural S2 7.3m A Road older
17	64	35	1,328	2.4	Rural S2 A Road 40 mph
18	67	45	1,010	1.8	Rural S2 6.5m Poor
19	54	35	1,328	1.5	Rural S2 Other Road (slow)
20	82	53	950	2.1	Rural S2 Other Road (narrow carriageway)
21	54	35	1,328	1.5	Rural S2 Other Road (slow, narrow carriageway)
22	71	35	7,080	1.4	Suburban D4
23	71	35	5,310	1.4	Suburban D3
24	75	35	3,540	2.6	Suburban D2 Slight Development
25	71	35	3,540	1.4	Suburban D2 Typical Development
26	58	35	3,540	0.9	Suburban D2 Heavy Development
27	48	30	3,540	1.3	Suburban D2 (30mph)
28	54	25	3,400	2.0	Suburban S4 Slight Development
29	54	25	2,500	2.0	Suburban S4 Typical Development
30	71	35	1,680	1.5	Suburban S2 (50mph)
31	65	25	1,680	2.6	Suburban S2 Light Development
32	61	25	1,680	1.6	Suburban S2 Typical Development
33	58	25	1,680	1.0	Suburban S2 Heavy Development

SFC ID	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (PCU/Hr)	N Factor	Description
34	48	25	1,680	1.3	Suburban S2 (30mph)
35	48	30	896	2.2	Urban Non Central 50% Development
36	48	25	896	1.5	Urban Non Central 80% Development
37	46	25	896	1.2	Urban Non Central 90% Development
38	37	15	944	1.5	Urban Central INT = 2
39	33	15	944	1.2	Urban Central INT = 4.5
40	28	15	896	0.7	Urban Central INT = 9
41	63	32	1,344	2.9	Small Town 35% Development
42	56	30	1,344	2.4	Small Town 60% Development
43	46	30	1,344	1.3	Small Town 90% Development
44	80	64	5,580	2.6	Rural Motorway D3 + Roadworks
51	46	30	1,344	1.3	Dummy SFC
47	112	80	8,397	2.8	Rural All-Purpose D4 (70 mph)
50	100	75	6,990	4.7	Rural Motorway D2 + Dynamic Hard Shoulder 60mph
98	40	30	500	1.5	Rural S2 Other Road (very slow, very narrow carriageway)

Appendix B. Prior Matrix Assignment Screenline Results

Table B1. Prior Matrix Screenline Validation by Model Time Period

				AM				IP				PM			
Screenline	Dir	Cal / Val	Count Sites	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
A417_A	NB	Calibration	10	3,149	3,692	17.3%	9.3	2,559	2,540	-0.7%	0.4	3,266	3,466	6.1%	3.4
	SB	Calibration	10	3,333	3,689	10.7%	6.0	2,443	2,328	-4.7%	2.4	3,178	3,440	8.2%	4.6
A417_B	EB	Calibration	14	7,302	7,858	7.6%	6.4	5,103	4,717	-7.6%	5.6	6,769	6,595	-2.6%	2.1
	WB	Calibration	14	7,049	6,961	-1.3%	1.1	5,279	5,382	1.9%	1.3	7,961	8,246	3.6%	3.2
A417_E	EB	Calibration	4	2,194	2,626	19.7%	8.8	1,327	1,450	9.3%	3.2	1,594	1,697	6.5%	2.5
	WB	Calibration	4	1,522	1,747	14.8%	5.6	1,461	1,656	13.4%	4.9	2,105	2,464	17.0%	7.5
A417_G	EB	Calibration	6	1,445	1,511	4.6%	1.7	771	868	12.6%	3.2	1,011	1,241	22.7%	6.8
	WB	Calibration	6	803	1,121	39.6%	10.3	810	789	-2.6%	0.8	1,490	1,510	1.4%	0.5
A417_H	EB	Calibration	8	2,109	2,520	19.5%	8.5	1,295	1,634	26.2%	9.0	1,888	2,171	15.0%	6.3
	WB	Calibration	8	1,685	1,923	14.2%	5.6	1,242	1,451	16.8%	5.7	2,008	2,171	8.1%	3.6
A417_I	EB	Calibration	4	1,124	1,286	14.4%	4.7	785	905	15.2%	4.2	999	1,109	11.0%	3.4
	WB	Calibration	4	981	1,138	15.9%	4.8	862	1,074	24.5%	6.9	1,158	1,195	3.2%	1.1
Cirencester	IB	Calibration	9	5,862	6,502	10.9%	8.1	4,405	4,308	-2.2%	1.5	5,345	5,582	4.4%	3.2
	OB	Calibration	9	5,103	5,802	13.7%	9.5	4,307	4,362	1.3%	0.9	5,857	6,059	3.5%	2.6
J10_A	NB	Calibration	3	748	560	-25.1%	7.4	772	578	-25.1%	5.1	1,340	1,044	-22.1%	8.6
	SB	Calibration	3	1,402	1,158	-17.4%	6.8	814	620	-23.9%	4.7	873	708	-18.8%	5.8
J10_B	EB	Calibration	4	3,426	3,215	-6.2%	3.7	2,507	2,190	-12.7%	6.6	2,643	2,479	-6.2%	3.2
	WB	Calibration	4	2,499	2,866	14.7%	7.1	2,653	2,718	2.5%	1.2	3,884	3,963	2.0%	1.3
J10_C	NB	Calibration	4	1,437	1,376	-4.2%	1.6	1,457	1,312	-10.0%	2.0	2,101	1,910	-9.1%	4.3

				AM				IP				PM			
Screenline	Dir	Cal / Val	Count Sites	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
	SB	Calibration	4	1,877	1,942	3.4%	1.5	1,449	1,163	-19.7%	6.4	1,626	1,495	-8.1%	3.3
Stroud_A	EB	Calibration	6	895	721	-19.4%	6.1	676	581	-14.0%	3.8	721	707	-1.9%	0.5
	WB	Calibration	6	701	663	-5.4%	1.5	686	605	-11.8%	3.2	884	797	-9.7%	3.0
Stroud_B	EB	Calibration	7	2,353	1,943	-17.4%	8.9	1,737	1,459	-16.0%	6.9	2,462	2,355	-4.4%	2.2
	WB	Calibration	7	2,633	2,631	-0.1%	0.0	1,869	1,533	-18.0%	8.2	2,378	1,982	-16.7%	8.5
Stroud_C	EB	Validation	5	1,567	1,429	-8.8%	3.5	1,089	1,048	-3.8%	1.3	1,213	1,314	8.4%	2.9
	WB	Validation	5	1,189	1,434	20.6%	6.8	1,086	1,052	-3.1%	1.0	1,447	1,440	-0.5%	0.2
Stroud cordon	IB	Calibration	14	3,397	3,415	0.5%	0.3	2,879	2,461	-14.5%	8.1	4,064	4,112	1.2%	0.8
	OB	Calibration	14	4,071	4,473	9.9%	6.2	2,872	2,467	-14.1%	7.9	3,401	3,247	-4.5%	2.7
Stroud_D	NB	Calibration	5	710	705	-0.7%	0.2	693	536	-22.7%	6.3	997	790	-20.7%	6.9
	SB	Calibration	5	1,017	791	-22.2%	7.5	640	527	-17.8%	4.7	689	711	3.2%	0.8
Stroud_E	NB	Calibration	4	1,460	1,279	-12.4%	4.9	1,435	853	-40.6%	17.2	1,659	1,229	-25.9%	11.3
	SB	Calibration	4	1,594	1,183	-25.8%	11.0	1,335	828	-38.0%	15.4	1,433	1,155	-19.4%	7.7
Cheltenham	IB	Calibration	10	6,667	6,890	3.3%	2.7	4,726	4,297	-9.1%	5.8	6,115	5,886	-3.7%	3.0
	OB	Calibration	10	5,636	5,863	4.0%	3.0	4,722	4,153	-12.1%	7.6	6,857	6,952	1.4%	1.1
Gloucester	IB	Calibration	13	9,993	9,837	-1.6%	1.6	7,562	7,135	-5.6%	5.2	9,829	9,999	1.7%	1.7
	OB	Calibration	13	9,066	9,652	6.5%	6.1	7,476	7,049	-5.7%	5.2	9,996	10,039	0.4%	0.4
A417_C	NB	Validation	7	4,571	4,814	5.3%	3.5	2,870	2,967	3.4%	1.9	4,096	4,280	4.5%	2.8
	SB	Validation	7	4,091	4,414	7.9%	5.0	2,921	2,613	-10.5%	5.6	4,536	4,671	3.0%	2.0
A417_D	EB	Validation	4	2,202	2,442	10.9%	5.0	1,428	1,615	13.1%	4.8	1,942	2,081	7.2%	3.1
	WB	Validation	4	1,833	1,880	2.6%	1.1	1,526	1,719	12.7%	4.8	2,099	2,154	2.6%	1.2
A417_F	NB	Validation	9	2,638	3,115	18.1%	8.9	2,103	2,279	8.4%	3.8	2,847	3,060	7.5%	3.9
	SB	Validation	9	2,635	3,071	16.6%	8.2	1,914	2,024	5.7%	2.4	2,876	2,967	3.2%	1.7

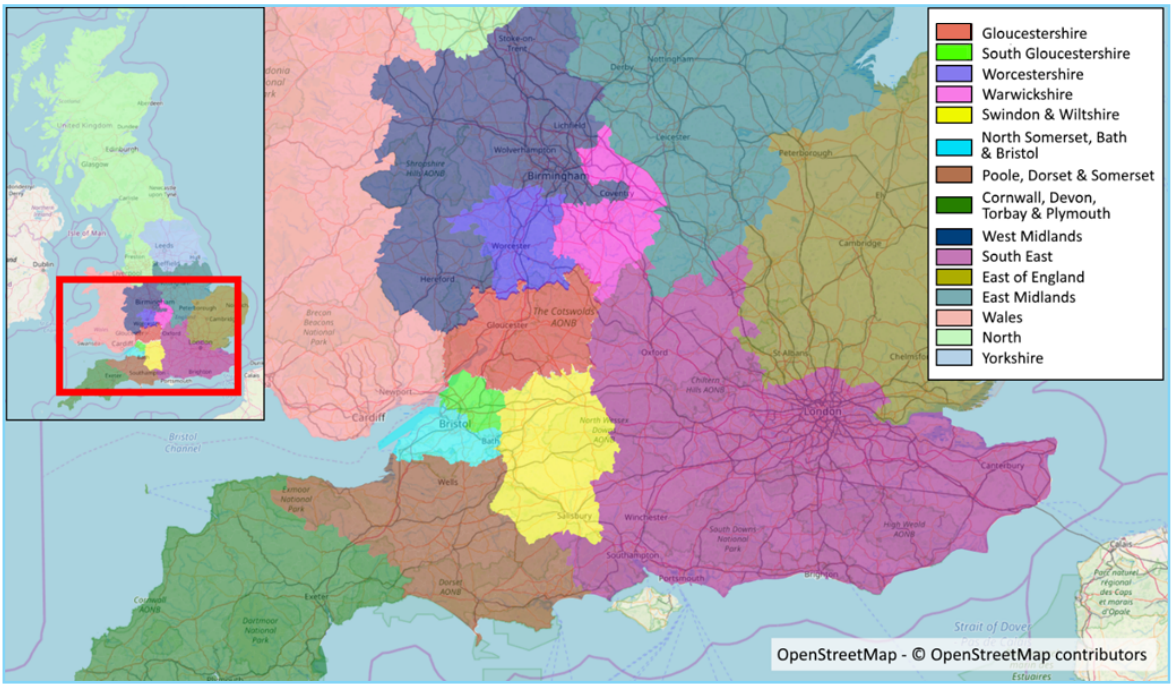
				AM				IP				PM			
Screenline	Dir	Cal / Val	Count Sites	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
Tewkesbury A46	IB	Calibration	9	8,509	7,772	-8.7%	8.2	7,267	6,061	-16.6%	14.8	8,448	7,134	-15.6%	14.9
	OB	Calibration	8	8,182	7,380	-9.8%	9.1	7,324	6,014	-17.9%	16.1	8,986	7,538	-16.1%	15.9

Appendix C. Prior vs Post Matrix Estimation (ME) Demand Sectors

C.1 Sector Key

The numbering system for the Matrix Estimation sector analysis is as follows:

1. Gloucestershire
2. South Gloucestershire
3. Worcestershire
4. Warwickshire
5. Swindon & Wiltshire
6. North Somerset, Bath & Bristol
7. Poole, Doreset & Somerset
8. Cornwall, Devon, Torquay and Plymouth
9. West Midlands
10. South East
11. East of England
12. East Midlands
13. Wales
14. North
15. Yorkshire



C.2 AM Peak Sector Changes

Table C-1 - AM Peak Prior Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	57,988	1,521	1,251	1,408	2,110	1,120	161	116	1,129	1,404	90	151	935	97	36	69,518
2	1,155	18,290	59	30	959	13,112	366	142	103	370	29	33	569	27	11	35,253
3	2,150	90	41,143	2,678	112	141	52	39	8,691	533	92	386	235	154	66	56,561
4	1,137	30	1,342	34,763	67	49	26	20	11,324	1,480	296	4,347	108	218	149	55,357
5	2,050	827	61	63	65,656	3,213	1,741	152	139	5,742	121	94	180	60	30	80,127
6	838	9,066	85	39	2,055	69,024	3,443	443	174	550	69	62	688	68	31	86,635
7	181	368	40	29	2,383	3,723	131,903	3,191	96	5,290	95	55	204	49	23	147,629
8	121	140	42	24	177	430	2,728	175,846	102	410	82	63	176	81	33	180,457
9	1,665	155	7,708	10,505	181	258	101	74	366,743	1,742	582	8,086	2,362	6,122	617	406,900
10	1,190	301	276	1,046	4,590	479	3,130	307	1,587	1,166,702	35,193	4,850	425	885	509	1,221,469
11	95	34	70	309	126	75	67	31	639	52,127	482,064	5,785	90	401	366	542,281
12	201	48	376	4,623	117	85	66	46	9,383	8,854	9,366	387,553	248	4,553	12,802	438,320
13	894	869	230	116	371	1,252	199	155	2,872	599	101	247	277,521	6,825	156	292,408
14	86	29	143	267	48	61	34	32	5,138	894	408	2,561	5,171	1,180,099	10,277	1,205,249
15	40	12	87	194	26	36	17	13	729	518	439	9,746	161	10,591	408,622	431,231
Total	69,792	31,780	52,914	56,093	78,978	93,059	144,033	180,607	408,848	1,247,216	529,028	424,020	289,070	1,210,229	433,729	5,249,396

Table C-2 - AM Peak Post-ME Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	58,476	1,685	1,527	1,450	1,908	1,154	160	151	1,095	1,418	62	148	918	101	42	70,296
2	1,197	15,926	77	31	785	11,006	281	130	89	416	27	24	362	21	9	30,382
3	2,324	117	41,267	2,612	84	167	54	53	8,223	486	83	383	220	143	63	56,279
4	1,053	39	1,265	34,730	47	51	27	26	11,313	1,417	295	4,366	81	219	150	55,079
5	1,715	869	73	44	62,909	2,411	1,846	170	115	5,428	104	64	215	50	18	76,030
6	991	8,915	116	43	1,989	66,891	3,191	464	170	709	92	53	634	61	28	84,346
7	190	368	54	33	2,476	3,527	137,131	2,818	97	5,628	105	56	167	50	24	152,726
8	130	123	61	31	154	328	2,470	170,324	95	329	51	52	119	73	31	174,373
9	1,687	146	7,411	10,499	108	228	88	90	366,699	1,714	576	8,081	2,306	6,119	614	406,367
10	975	399	304	1,034	4,401	544	3,877	258	1,602	1,150,942	35,217	4,874	572	907	514	1,206,420
11	56	37	60	306	116	84	82	26	637	52,142	482,064	5,785	62	401	366	542,225
12	176	41	360	4,625	85	67	73	42	9,390	8,802	9,366	387,553	214	4,553	12,802	438,150
13	838	584	235	86	298	1,003	159	163	2,774	667	86	183	277,521	6,788	139	291,526
14	101	25	142	267	36	51	28	36	5,139	900	408	2,561	5,160	1,180,099	10,277	1,205,230
15	51	10	92	195	12	29	18	16	731	518	439	9,746	156	10,591	408,622	431,224
Total	69,960	29,285	53,043	55,987	75,408	87,541	149,487	174,768	408,168	1,231,516	528,977	423,930	288,706	1,210,177	433,698	5,220,652

Table C-3 - AM Prior vs Post ME Matrix Percentage Differences

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	1%	11%	22%	3%	-10%	3%	0%	31%	-3%	1%	-31%	-2%	-2%	3%	17%	1%
2	4%	-13%	29%	4%	-18%	-16%	-23%	-8%	-13%	12%	-7%	-27%	-36%	-21%	-18%	-14%
3	8%	30%	0%	-2%	-25%	18%	4%	35%	-5%	-9%	-9%	-1%	-6%	-7%	-5%	0%
4	-7%	29%	-6%	0%	-30%	3%	6%	29%	0%	-4%	0%	0%	-25%	0%	1%	-1%
5	-16%	5%	19%	-31%	-4%	-25%	6%	12%	-17%	-5%	-14%	-32%	20%	-15%	-41%	-5%
6	18%	-2%	37%	10%	-3%	-3%	-7%	5%	-2%	29%	33%	-15%	-8%	-11%	-11%	-3%
7	5%	0%	35%	15%	4%	-5%	4%	-12%	1%	6%	11%	4%	-18%	2%	7%	3%
8	7%	-12%	44%	31%	-13%	-24%	-9%	-3%	-7%	-20%	-38%	-17%	-32%	-10%	-9%	-3%
9	1%	-6%	-4%	0%	-40%	-12%	-13%	21%	0%	-2%	-1%	0%	-2%	0%	0%	0%
10	-18%	32%	10%	-1%	-4%	14%	24%	-16%	1%	-1%	0%	0%	35%	3%	1%	-1%
11	-41%	9%	-14%	-1%	-8%	11%	22%	-16%	0%	0%	0%	0%	-31%	0%	0%	0%
12	-13%	-13%	-4%	0%	-27%	-21%	11%	-8%	0%	-1%	0%	0%	-14%	0%	0%	0%
13	-6%	-33%	2%	-26%	-20%	-20%	-20%	5%	-3%	11%	-15%	-26%	0%	-1%	-11%	0%
14	17%	-13%	-1%	0%	-26%	-18%	-19%	15%	0%	1%	0%	0%	0%	0%	0%	0%
15	27%	-19%	5%	0%	-55%	-20%	5%	24%	0%	0%	0%	0%	-3%	0%	0%	0%
Total	0%	-8%	0%	0%	-5%	-6%	4%	-3%	0%	-1%	0%	0%	0%	0%	0%	-1%

C.3 Inter-peak Sector Changes

Table C-4 - Inter-peak Prior Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	47,184	813	1,113	1,094	1,255	517	125	90	998	931	87	155	700	94	44	55,199
2	829	14,482	52	23	467	7,078	242	114	100	239	38	42	620	35	15	24,377
3	1,072	46	37,100	1,236	56	84	46	43	5,288	289	69	307	218	155	79	46,088
4	1,082	21	1,390	30,825	39	36	28	24	7,535	853	267	2,913	109	251	165	45,536
5	1,232	504	71	49	55,620	1,644	1,613	157	146	3,451	133	110	247	68	33	65,077
6	552	7,405	92	39	1,652	51,824	2,859	348	197	479	77	84	774	85	37	66,503
7	119	228	51	26	1,520	2,771	107,395	2,269	112	3,430	93	66	174	56	24	118,332
8	109	119	60	29	149	358	2,263	164,356	126	513	78	76	178	69	28	168,510
9	926	93	5,413	6,842	120	168	107	104	362,107	1,508	609	6,151	2,142	4,145	723	391,158
10	1,084	272	414	941	3,705	528	3,706	479	1,767	987,342	32,430	4,992	599	944	557	1,039,760
11	89	35	94	279	125	76	95	59	635	26,928	414,265	5,470	103	428	446	449,127
12	142	36	308	2,837	85	76	64	58	5,931	4,042	4,944	360,444	244	2,755	8,486	390,451
13	647	614	222	103	219	739	187	179	2,143	540	115	277	250,724	4,530	182	261,419
14	91	29	153	248	59	74	44	50	4,247	864	443	2,861	4,459	1,136,135	8,749	1,158,507
15	40	13	87	163	31	41	23	24	701	523	437	8,366	164	8,778	403,446	422,837
Total	55,195	24,711	46,619	44,733	65,102	66,013	118,798	168,353	392,032	1,031,932	454,086	392,313	261,453	1,158,528	423,013	4,702,881

Table C-5 - Inter-peak Post-ME Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	49,789	917	1,386	1,276	1,243	622	150	132	988	1,004	75	144	725	107	51	58,610
2	907	12,938	66	26	462	6,312	210	104	87	282	38	30	625	31	14	22,129
3	1,267	58	37,363	1,190	51	112	63	68	5,019	313	62	291	207	132	73	46,270
4	1,196	29	1,356	30,843	36	52	40	44	7,515	859	267	2,928	84	251	167	45,668
5	1,238	492	83	42	55,926	1,588	1,757	164	128	3,528	109	84	269	75	25	65,508
6	594	6,874	123	47	1,501	50,764	2,722	322	202	597	85	69	748	88	39	64,775
7	133	211	71	35	1,675	2,711	113,032	2,214	131	4,234	99	78	137	67	32	124,860
8	139	125	106	48	184	354	2,255	164,986	169	452	53	78	137	102	40	169,227
9	1,009	92	5,320	6,820	96	182	124	140	362,079	1,555	607	6,139	2,089	4,139	719	391,109
10	1,020	329	442	923	3,685	671	4,292	452	1,775	983,685	32,454	5,014	723	971	569	1,037,004
11	52	34	88	278	111	91	112	51	631	26,942	414,265	5,470	72	428	446	449,072
12	143	29	331	2,844	69	67	77	61	5,943	4,060	4,944	360,444	202	2,755	8,486	390,455
13	675	491	210	78	222	632	140	131	2,047	634	102	206	250,724	4,484	165	260,940
14	112	24	160	248	50	71	46	66	4,248	882	443	2,861	4,441	1,136,135	8,749	1,158,536
15	54	11	91	164	19	36	28	31	703	532	437	8,366	155	8,778	403,446	422,851
Total	58,327	22,654	47,197	44,859	65,331	64,266	125,048	168,968	391,664	1,029,557	454,039	392,201	261,338	1,158,543	423,021	4,707,015

Table C-6 - Inter-peak Prior vs Post ME Matrix Percentage Differences

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	6%	13%	25%	17%	-1%	20%	19%	48%	-1%	8%	-14%	-7%	4%	14%	17%	6%
2	9%	-11%	25%	13%	-1%	-11%	-13%	-9%	-13%	18%	-2%	-29%	1%	-11%	-11%	-9%
3	18%	25%	1%	-4%	-8%	34%	37%	59%	-5%	8%	-10%	-5%	-5%	-15%	-8%	0%
4	11%	37%	-2%	0%	-8%	47%	46%	86%	0%	1%	0%	1%	-23%	0%	1%	0%
5	1%	-2%	17%	-14%	1%	-3%	9%	5%	-12%	2%	-18%	-23%	9%	10%	-25%	1%
6	8%	-7%	34%	21%	-9%	-2%	-5%	-8%	3%	25%	10%	-18%	-3%	4%	5%	-3%
7	11%	-7%	41%	36%	10%	-2%	5%	-2%	16%	23%	7%	19%	-21%	19%	32%	6%
8	28%	5%	75%	67%	24%	-1%	0%	0%	34%	-12%	-32%	2%	-23%	48%	46%	0%
9	9%	-2%	-2%	0%	-20%	8%	16%	35%	0%	3%	0%	0%	-2%	0%	0%	0%
10	-6%	21%	7%	-2%	-1%	27%	16%	-6%	0%	0%	0%	0%	21%	3%	2%	0%
11	-41%	-3%	-6%	0%	-11%	20%	18%	-13%	-1%	0%	0%	0%	-30%	0%	0%	0%
12	1%	-19%	7%	0%	-19%	-11%	20%	6%	0%	0%	0%	0%	-17%	0%	0%	0%
13	4%	-20%	-5%	-25%	1%	-14%	-25%	-27%	-4%	17%	-11%	-26%	0%	-1%	-9%	0%
14	23%	-16%	4%	0%	-15%	-3%	5%	31%	0%	2%	0%	0%	0%	0%	0%	0%
15	34%	-15%	5%	0%	-40%	-12%	22%	31%	0%	2%	0%	0%	-5%	0%	0%	0%
Total	6%	-8%	1%	0%	0%	-3%	5%	0%	0%	0%	0%	0%	0%	0%	0%	0%

C.4 PM Sector Changes

Table C-7 - PM Prior Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	60,743	1,198	2,237	1,338	1,977	804	126	81	1,719	1,133	87	171	896	81	36	72,628
2	1,420	18,679	76	21	745	10,681	310	107	114	225	27	31	988	22	8	33,455
3	1,232	59	45,873	1,434	58	82	50	43	8,137	252	54	303	216	107	50	57,951
4	1,572	31	2,646	38,893	58	43	48	28	11,820	967	274	4,441	89	189	128	61,226
5	2,053	820	93	41	70,011	2,262	2,312	112	115	4,501	102	83	276	47	19	82,846
6	994	12,398	119	37	2,898	71,739	3,767	343	190	482	63	57	1,237	61	26	94,411
7	119	313	33	21	1,802	3,761	128,985	2,768	76	3,601	63	46	178	34	17	141,817
8	84	94	40	20	106	385	2,839	189,740	89	374	53	47	164	46	22	194,102
9	1,079	103	8,726	11,242	146	196	119	118	455,841	1,498	555	9,431	2,808	4,848	582	497,293
10	1,346	303	479	1,457	5,795	523	5,846	403	1,723	1,277,281	51,287	8,450	485	786	469	1,356,634
11	88	35	64	261	128	69	91	68	522	39,038	548,120	8,922	69	310	329	598,115
12	144	45	327	4,347	85	79	63	61	8,124	4,969	6,052	460,727	183	2,422	10,446	498,073
13	881	561	168	71	203	743	205	178	2,294	435	82	195	314,077	5,389	105	325,586
14	88	32	122	191	53	65	50	69	6,054	770	353	4,088	6,978	1,402,900	9,887	1,431,698
15	40	15	65	132	30	40	25	23	570	467	332	12,839	110	10,213	493,714	518,614
Total	71,884	34,687	61,068	59,507	84,097	91,471	144,836	194,141	497,388	1,335,993	607,504	509,831	328,754	1,427,454	515,838	5,964,451

Table C-8 - PM Post-ME Matrix Sector Values

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	62,007	1,350	2,424	1,399	1,804	911	136	113	1,666	1,145	63	172	881	84	38	74,194
2	1,531	16,375	111	24	796	9,216	284	114	110	357	32	29	632	21	7	29,638
3	1,520	85	46,318	1,394	60	104	69	79	7,638	281	51	291	246	96	47	58,279
4	1,359	34	2,436	38,874	48	47	66	46	11,774	983	273	4,448	76	188	129	60,782
5	1,818	804	126	37	68,977	2,033	2,318	132	116	4,439	88	66	319	65	15	81,353
6	1,025	11,126	158	43	2,452	69,194	3,494	330	203	637	74	50	1,068	70	31	89,955
7	135	291	54	31	1,926	3,503	134,221	2,630	97	4,632	71	57	184	47	23	147,902
8	114	112	84	40	154	383	2,716	184,579	143	415	59	61	175	77	37	189,148
9	1,107	110	8,375	11,218	127	192	129	165	455,833	1,589	553	9,426	2,799	4,847	581	497,050
10	1,407	430	504	1,411	5,644	665	5,835	457	1,757	1,261,436	51,283	8,474	742	820	485	1,341,350
11	44	40	61	261	117	84	109	67	519	39,043	548,120	8,922	57	310	329	598,082
12	128	42	339	4,346	70	67	80	75	8,135	5,024	6,052	460,727	168	2,422	10,446	498,120
13	754	297	174	54	208	530	152	152	2,249	580	77	155	314,077	5,369	99	324,928
14	94	33	127	191	40	62	56	98	6,055	809	353	4,088	6,979	1,402,900	9,887	1,431,772
15	47	16	71	132	24	38	33	33	571	493	332	12,839	109	10,213	493,714	518,662
Total	73,089	31,145	61,361	59,454	82,447	87,027	149,695	189,071	496,867	1,321,862	607,480	509,807	328,512	1,427,529	515,868	5,941,214

Table C-9 - PM Prior vs Post ME Matrix Percentage Differences

Sector	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	Total
1	2%	13%	8%	5%	-9%	13%	8%	39%	-3%	1%	-28%	1%	-2%	4%	5%	2%
2	8%	-12%	45%	16%	7%	-14%	-9%	7%	-4%	58%	19%	-7%	-36%	-5%	-7%	-11%
3	23%	45%	1%	-3%	3%	27%	38%	84%	-6%	11%	-7%	-4%	14%	-10%	-6%	1%
4	-14%	10%	-8%	0%	-18%	9%	40%	62%	0%	2%	0%	0%	-14%	0%	0%	-1%
5	-11%	-2%	37%	-10%	-1%	-10%	0%	18%	1%	-1%	-14%	-20%	16%	37%	-20%	-2%
6	3%	-10%	33%	14%	-15%	-4%	-7%	-4%	7%	32%	18%	-12%	-14%	16%	20%	-5%
7	13%	-7%	66%	46%	7%	-7%	4%	-5%	28%	29%	11%	25%	3%	39%	34%	4%
8	35%	19%	109%	99%	45%	-1%	-4%	-3%	62%	11%	12%	29%	7%	68%	65%	-3%
9	3%	7%	-4%	0%	-13%	-2%	8%	40%	0%	6%	-1%	0%	0%	0%	0%	0%
10	5%	42%	5%	-3%	-3%	27%	0%	13%	2%	-1%	0%	0%	53%	4%	3%	-1%
11	-50%	12%	-6%	0%	-8%	21%	20%	-2%	-1%	0%	0%	0%	-17%	0%	0%	0%
12	-11%	-7%	4%	0%	-18%	-15%	25%	23%	0%	1%	0%	0%	-8%	0%	0%	0%
13	-14%	-47%	3%	-24%	3%	-29%	-26%	-15%	-2%	33%	-5%	-20%	0%	0%	-6%	0%
14	7%	3%	5%	0%	-26%	-4%	11%	43%	0%	5%	0%	0%	0%	0%	0%	0%
15	17%	5%	9%	0%	-21%	-6%	29%	43%	0%	6%	0%	0%	-1%	0%	0%	0%
Total	2%	-10%	0%	0%	-2%	-5%	3%	-3%	0%	-1%	0%	0%	0%	0%	0%	0%

Appendix D. Screenline Calibration/Validation Results for Cars

D.1 Summary of Screenlines Post ME (Cars)

Table D-1 - Summary of Flow Calibration Screenlines Post ME (Cars)

Screenline	Direction	Cal/Val	Count Sites	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
A417_A	NB	Calibration	10	2,545	2,497	-1.9%	0.9	1,983	1,984	0.1%	0.0	2,811	2,825	0.5%	0.2
	SB	Calibration	10	2,669	2,669	0.0%	0.0	1,898	1,908	0.5%	0.2	2,742	2,732	-0.4%	0.2
A417_B	EB	Calibration	14	5,915	6,004	1.5%	1.2	3,972	3,886	-2.2%	1.4	5,877	5,758	-2.0%	1.6
	WB	Calibration	14	5,712	5,522	-3.3%	2.5	4,085	4,100	0.4%	0.2	6,799	6,689	-1.6%	1.3
A417_C	NB	Validation	7	3,883	3,830	-1.4%	0.9	2,359	2,365	0.3%	0.1	3,656	3,723	1.8%	1.1
	SB	Validation	7	3,477	3,490	0.4%	0.2	2,394	2,359	-1.5%	0.7	4,030	3,955	-1.9%	1.2
A417_D	EB	Validation	4	1,640	1,597	-2.6%	1.0	1,038	1,036	-0.2%	0.1	1,665	1,617	-2.8%	1.2
	WB	Validation	4	1,446	1,409	-2.6%	1.0	1,082	1,093	1.0%	0.3	1,672	1,697	1.5%	0.6
A417_E	EB	Calibration	4	1,724	1,704	-1.2%	0.5	995	1,004	0.9%	0.3	1,356	1,365	0.7%	0.2
	WB	Calibration	4	1,191	1,192	0.0%	0.0	1,094	1,100	0.5%	0.2	1,797	1,824	1.5%	0.6
A417_F	NB	Validation	9	2,112	2,143	1.4%	0.7	1,577	1,509	-4.3%	1.7	2,408	2,286	-5.1%	2.5
	SB	Validation	9	2,054	1,987	-3.2%	1.5	1,465	1,417	-3.3%	1.3	2,489	2,320	-6.8%	3.4
A417_G	EB	Calibration	6	1,222	1,161	-5.0%	1.8	642	640	-0.3%	0.1	893	969	8.5%	2.5
	WB	Calibration	6	672	687	2.3%	0.6	663	656	-1.0%	0.3	1,293	1,303	0.8%	0.3
A417_H	EB	Calibration	8	1,713	1,742	1.7%	0.7	1,039	1,063	2.3%	0.7	1,708	1,704	-0.3%	0.1
	WB	Calibration	8	1,449	1,479	2.1%	0.8	1,000	1,027	2.7%	0.9	1,729	1,801	4.1%	1.7

Screenline	Direction	Cal/Val	Count Sites	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
A417_I	EB	Calibration	4	904	900	-0.4%	0.1	614	616	0.2%	0.1	857	855	-0.2%	0.1
	WB	Calibration	4	791	791	0.0%	0.0	674	675	0.1%	0.0	996	997	0.1%	0.0
Cirencester	IB	Calibration	9	4,606	4,566	-0.9%	0.6	3,414	3,404	-0.3%	0.2	4,539	4,521	-0.4%	0.3
	OB	Calibration	9	3,971	3,959	-0.3%	0.2	3,351	3,348	-0.1%	0.1	5,070	5,050	-0.4%	0.3
J10_A	NB	Calibration	3	597	541	-9.3%	2.3	607	617	1.6%	0.4	1,157	1,080	-6.6%	2.3
	SB	Calibration	3	1,121	1,117	-0.4%	0.1	641	663	3.4%	0.9	753	687	-8.8%	2.5
J10_B	EB	Calibration	4	2,863	2,827	-1.3%	0.7	2,031	2,013	-0.9%	0.4	2,298	2,354	2.5%	1.2
	WB	Calibration	4	2,058	2,121	3.1%	1.4	2,176	2,176	0.0%	0.0	3,439	3,447	0.2%	0.1
J10_C	NB	Calibration	4	1,171	1,172	0.1%	0.0	1,190	1,189	-0.1%	0.0	1,856	1,856	0.0%	0.0
	SB	Calibration	4	1,536	1,547	0.7%	0.3	1,181	1,182	0.0%	0.0	1,437	1,433	-0.2%	0.1
Stroud_A	EB	Calibration	6	692	714	3.2%	0.8	505	500	-1.0%	0.2	616	620	0.8%	0.2
	WB	Calibration	6	546	538	-1.4%	0.3	512	520	1.4%	0.3	753	749	-0.6%	0.2
Stroud_B	EB	Calibration	7	1,862	1,746	-6.2%	2.7	1,304	1,306	0.2%	0.1	2,138	2,151	0.6%	0.3
	WB	Calibration	7	2,077	2,071	-0.3%	0.1	1,400	1,407	0.5%	0.2	2,063	2,042	-1.0%	0.5
Stroud_C	EB	Validation	5	1,246	1,259	1.1%	0.4	825	882	6.9%	1.9	1,062	1,098	3.4%	1.1
	WB	Validation	5	947	998	5.4%	1.6	824	879	6.6%	1.9	1,264	1,248	-1.3%	0.4
Stroud cordon	IB	Calibration	14	2,772	2,749	-0.8%	0.4	2,326	2,305	-0.9%	0.4	3,539	3,515	-0.7%	0.4
	OB	Calibration	14	3,324	3,294	-0.9%	0.5	2,320	2,298	-1.0%	0.5	2,963	2,933	-1.0%	0.5
Stroud_D	NB	Calibration	5	566	567	0.3%	0.1	534	539	0.8%	0.2	865	840	-2.8%	0.8
	SB	Calibration	5	809	775	-4.2%	1.2	494	484	-2.1%	0.5	598	600	0.4%	0.1
Stroud_E	NB	Calibration	4	1,148	1,149	0.0%	0.0	1,093	1,093	0.0%	0.0	1,436	1,434	-0.2%	0.1
	SB	Calibration	4	1,255	1,255	0.0%	0.0	1,017	1,017	0.0%	0.0	1,241	1,241	0.0%	0.0

Screenline	Direction	Cal/Val	Count Sites	AM				IP				PM			
				Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH	Obs	Mod	% Diff	GEH
Cheltenham	IB	Calibration	10	5,541	5,518	-0.4%	0.3	3,852	3,798	-1.4%	0.9	5,405	5,345	-1.1%	0.8
	OB	Calibration	10	4,696	4,688	-0.2%	0.1	3,859	3,796	-1.6%	1.0	6,048	5,994	-0.9%	0.7
Gloucester	IB	Calibration	13	8,258	8,148	-1.3%	1.2	6,014	5,873	-2.3%	1.8	8,519	8,377	-1.7%	1.5
	OB	Calibration	13	7,376	7,330	-0.6%	0.5	5,998	5,782	-3.6%	2.8	8,843	8,704	-1.6%	1.5
Tewkesbury A46	IB	Calibration	9	6,257	6,375	1.9%	1.5	5,150	5,258	2.1%	1.5	6,704	6,829	1.9%	1.5
	OB	Calibration	8	6,221	6,257	0.6%	0.5	5,440	5,520	1.5%	1.1	7,478	7,581	1.4%	1.2

Appendix E. Screenline Link Calibration / Validation Results

Table E-1 - AM Peak Screenline Link Results

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28210-28039	B	A417_A	NB	C	297	301	1.5%	0.3	PASS
27386-26006	U	A417_A	NB	C	133	206	55.4%	5.6	PASS
27384-60090	A	A417_A	NB	C	615	550	-10.6%	2.7	PASS
65897-26066	B	A417_A	NB	C	85	74	-14.0%	1.3	PASS
26001-26071	U	A417_A	NB	C	243	246	1.3%	0.2	PASS
65380-26018	U	A417_A	NB	C	61	53	-13.2%	1.1	PASS
65674-26010	U	A417_A	NB	C	162	177	9.3%	1.2	PASS
27592-26067	A	A417_A	NB	C	220	160	-27.1%	4.3	PASS
65470-60540	A	A417_A	NB	C	1032	997	-3.5%	1.1	PASS
60536-68010	A	A417_A	NB	C	300	337	12.3%	2.1	PASS
28039-28210	B	A417_A	SB	C	350	349	-0.2%	0.0	PASS
26006-27386	U	A417_A	SB	C	101	102	0.4%	0.0	PASS
60090-27384	A	A417_A	SB	C	586	580	-1.0%	0.3	PASS
26066-65897	B	A417_A	SB	C	63	66	4.9%	0.4	PASS
26071-26001	U	A417_A	SB	C	121	125	2.9%	0.3	PASS
26018-65380	U	A417_A	SB	C	56	28	-50.4%	4.4	PASS
26010-65674	U	A417_A	SB	C	161	210	30.4%	3.6	PASS
26067-27592	A	A417_A	SB	C	242	230	-4.8%	0.8	PASS
65471-60529	A	A417_A	SB	C	1355	1325	-2.2%	0.8	PASS
68010-60536	A	A417_A	SB	C	298	333	11.5%	1.9	PASS
60493-60317	B	A417_B	EB	C	547	642	17.4%	3.9	PASS
66709-60304	A	A417_B	EB	C	1514	1520	0.4%	0.2	PASS
27531-26049	U	A417_B	EB	C	465	443	-4.6%	1.0	PASS
65417-65419	U	A417_B	EB	C	112	133	18.7%	1.9	PASS
66701-27324	A	A417_B	EB	C	1212	1215	0.3%	0.1	PASS
65416-26092	U	A417_B	EB	C	489	589	20.5%	4.3	PASS
26047-65966	U	A417_B	EB	C	496	385	-22.4%	5.3	FAIL
26046-26044	U	A417_B	EB	C	119	84	-29.9%	3.5	PASS
26045-26044	U	A417_B	EB	C	46	128	175.2%	8.7	PASS
26017-65413	B	A417_B	EB	C	226	181	-20.1%	3.2	PASS
26014-26015	U	A417_B	EB	C	187	332	77.8%	9.0	FAIL
60119-60118	A	A417_B	EB	C	356	206	-42.3%	9.0	FAIL
28047-28046	U	A417_B	EB	C	77	82	6.8%	0.6	PASS
27304-65109	B	A417_B	EB	C	1456	1464	0.6%	0.2	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
60317-60493	B	A417_B	WB	C	476	432	-9.4%	2.1	PASS
65490-26086	A	A417_B	WB	C	1500	1463	-2.4%	1.0	PASS
26049-27531	U	A417_B	WB	C	165	194	17.2%	2.1	PASS
65419-65417	U	A417_B	WB	C	118	83	-29.4%	3.5	PASS
27322-26084	A	A417_B	WB	C	1699	1626	-4.3%	1.8	PASS
26092-65416	U	A417_B	WB	C	370	351	-5.1%	1.0	PASS
65966-26047	U	A417_B	WB	C	244	133	-45.2%	8.0	FAIL
26044-26046	U	A417_B	WB	C	125	66	-47.4%	6.1	PASS
26044-26045	U	A417_B	WB	C	54	55	0.9%	0.1	PASS
65413-26017	B	A417_B	WB	C	216	278	29.0%	4.0	PASS
26015-26014	U	A417_B	WB	C	171	258	51.0%	6.0	PASS
60117-60119	A	A417_B	WB	C	409	273	-33.2%	7.4	FAIL
28046-28047	U	A417_B	WB	C	117	166	41.5%	4.1	PASS
65110-27309	B	A417_B	WB	C	1385	1387	0.1%	0.0	PASS
65390-65391	U	A417_E	EB	C	81	69	-15.5%	1.5	PASS
26010-65674	U	A417_E	EB	C	161	210	30.4%	3.6	PASS
65877-27341	A	A417_E	EB	C	596	596	0.0%	0.0	PASS
65471-60529	A	A417_E	EB	C	1355	1325	-2.2%	0.8	PASS
65391-65390	U	A417_E	WB	C	63	63	-0.3%	0.0	PASS
65674-26010	U	A417_E	WB	C	162	177	9.3%	1.2	PASS
27341-65877	A	A417_E	WB	C	264	295	11.8%	1.9	PASS
65470-60540	A	A417_E	WB	C	1032	997	-3.5%	1.1	PASS
60262-60266	A	A417_G	EB	C	988	932	-5.7%	1.8	PASS
26024-26064	B	A417_G	EB	C	18	13	-31.0%	1.4	PASS
65894-60289	B	A417_G	EB	C	363	358	-1.4%	0.3	PASS
26030-26031	U	A417_G	EB	C	37	53	41.9%	2.3	PASS
26069-26028	U	A417_G	EB	C	34	23	-30.6%	1.9	PASS
26019-26068	U	A417_G	EB	C	5	3	-33.3%	0.8	PASS
27581-60262	A	A417_G	WB	C	546	558	2.2%	0.5	PASS
26064-26024	B	A417_G	WB	C	17	14	-21.6%	1.0	PASS
60289-65894	B	A417_G	WB	C	186	203	9.1%	1.2	PASS
26031-26030	U	A417_G	WB	C	17	19	12.3%	0.5	PASS
26028-26069	U	A417_G	WB	C	29	29	-2.3%	0.1	PASS
26068-26019	U	A417_G	WB	C	6	6	-3.8%	0.1	PASS
27583-26026	A	A417_H	EB	C	975	939	-3.6%	1.1	PASS
26024-26064	U	A417_H	EB	C	18	13	-31.0%	1.4	PASS
26080-27589	U	A417_H	EB	C	409	428	4.8%	1.0	PASS
26080-26060	A	A417_H	EB	C	585	581	-0.7%	0.2	PASS
26034-26035	U	A417_H	EB	C	5	1	-78.7%	2.2	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26032-26035	U	A417_H	EB	C	5	9	85.2%	1.6	PASS
26032-26033	U	A417_H	EB	C	6	2	-76.0%	2.5	PASS
65411-26059	U	A417_H	EB	C	106	150	40.8%	3.8	PASS
26026-27583	A	A417_H	WB	C	822	846	3.0%	0.9	PASS
26064-26024	U	A417_H	WB	C	17	14	-21.6%	1.0	PASS
27589-26080	U	A417_H	WB	C	220	253	15.1%	2.2	PASS
26060-26080	A	A417_H	WB	C	423	430	1.6%	0.3	PASS
26035-26034	U	A417_H	WB	C	4	0	-100.0%	2.6	PASS
26035-26032	U	A417_H	WB	C	1	5	318.7%	2.2	PASS
26033-26032	U	A417_H	WB	C	10	3	-70.8%	2.7	PASS
26059-65411	U	A417_H	WB	C	188	191	1.7%	0.2	PASS
26040-60550	A	A417_I	EB	C	379	370	-2.2%	0.4	PASS
26063-26039	U	A417_I	EB	C	19	50	158.6%	5.2	PASS
27112-60546	A	A417_I	EB	C	466	454	-2.5%	0.5	PASS
65675-65391	A	A417_I	EB	C	259	253	-2.5%	0.4	PASS
60550-26040	A	A417_I	WB	C	388	351	-9.5%	1.9	PASS
26039-26063	U	A417_I	WB	C	34	76	122.9%	5.6	PASS
60546-27112	A	A417_I	WB	C	375	371	-1.1%	0.2	PASS
65391-65675	A	A417_I	WB	C	184	185	0.3%	0.0	PASS
65471-60529	A	Cirencester	IB	C	1355	1325	-2.2%	0.8	PASS
60536-60535	A	Cirencester	IB	C	474	571	20.4%	4.2	PASS
60558-27573	A	Cirencester	IB	C	293	195	-33.3%	6.2	PASS
62962-60530	A	Cirencester	IB	C	1095	1095	0.0%	0.0	PASS
62782-60515	A	Cirencester	IB	C	607	592	-2.5%	0.6	PASS
27524-65370	U	Cirencester	IB	C	160	175	9.4%	1.2	PASS
60514-27552	A	Cirencester	IB	C	627	626	-0.1%	0.0	PASS
65877-27341	A	Cirencester	IB	C	596	596	0.0%	0.0	PASS
65388-65944	A	Cirencester	IB	C	655	651	-0.6%	0.2	PASS
65470-60540	A	Cirencester	OB	C	1032	997	-3.5%	1.1	PASS
60535-60536	A	Cirencester	OB	C	526	593	12.7%	2.8	PASS
27573-60558	A	Cirencester	OB	C	270	201	-25.4%	4.5	PASS
65469-62963	A	Cirencester	OB	C	1291	1292	0.1%	0.0	PASS
60515-62782	A	Cirencester	OB	C	644	525	-18.5%	4.9	PASS
65370-27524	U	Cirencester	OB	C	98	218	122.0%	9.5	FAIL
27552-60514	A	Cirencester	OB	C	540	540	0.1%	0.0	PASS
27341-65877	A	Cirencester	OB	C	264	295	11.8%	1.9	PASS
65944-65388	A	Cirencester	OB	C	438	438	0.0%	0.0	PASS
28117-28118	U	J10_A	NB	C	31	3	-89.8%	6.8	PASS
28122-28123	U	J10_A	NB	C	129	155	19.8%	2.2	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
65948-60390	A	J10_A	NB	C	587	473	-19.5%	5.0	PASS
28118-28117	U	J10_A	SB	C	77	55	-28.0%	2.6	PASS
28123-28122	U	J10_A	SB	C	252	275	8.9%	1.4	PASS
60390-65948	A	J10_A	SB	C	1073	1020	-4.9%	1.6	PASS
60217-60216	A	J10_B	EB	C	1490	1457	-2.2%	0.9	PASS
27252-27240	A	J10_B	EB	C	1194	1228	2.8%	1.0	PASS
65681-60406	B	J10_B	EB	C	280	279	-0.2%	0.0	PASS
60436-60414	A	J10_B	EB	C	462	439	-4.9%	1.1	PASS
60216-27452	A	J10_B	WB	C	1138	1070	-5.9%	2.0	PASS
27240-27252	A	J10_B	WB	C	871	939	7.8%	2.2	PASS
60406-65681	B	J10_B	WB	C	121	121	0.2%	0.0	PASS
60414-60436	A	J10_B	WB	C	369	425	15.2%	2.8	PASS
60395-60398	A	J10_C	NB	C	410	559	36.4%	6.8	FAIL
65432-56435	U	J10_C	NB	C	219	74	-66.3%	12.0	FAIL
27142-27156	A	J10_C	NB	C	461	454	-1.5%	0.3	PASS
27066-27067	B	J10_C	NB	C	347	354	2.0%	0.4	PASS
60398-60395	A	J10_C	SB	C	747	916	22.5%	5.8	FAIL
56435-65432	U	J10_C	SB	C	195	38	-80.3%	14.5	FAIL
27156-27142	A	J10_C	SB	C	472	595	26.1%	5.3	FAIL
27067-27066	B	J10_C	SB	C	463	341	-26.4%	6.1	FAIL
28202-60057	B	Stroud_A	EB	C	235	235	0.2%	0.0	PASS
28172-28170	U	Stroud_A	EB	C	104	104	0.4%	0.0	PASS
28108-28107	U	Stroud_A	EB	C	157	158	0.6%	0.1	PASS
28003-62401	B	Stroud_A	EB	C	196	174	-11.1%	1.6	PASS
28003-28004	U	Stroud_A	EB	C	169	181	7.7%	1.0	PASS
28001-28000	U	Stroud_A	EB	C	35	56	61.3%	3.2	PASS
60057-28202	B	Stroud_A	WB	C	168	168	0.0%	0.0	PASS
28171-28172	U	Stroud_A	WB	C	112	111	-0.5%	0.1	PASS
28107-28108	U	Stroud_A	WB	C	101	102	1.0%	0.1	PASS
62401-28003	B	Stroud_A	WB	C	155	141	-8.8%	1.1	PASS
28004-28003	U	Stroud_A	WB	C	125	123	-1.9%	0.2	PASS
28000-28001	U	Stroud_A	WB	C	40	45	14.4%	0.9	PASS
28061-28063	U	Stroud_B	EB	C	237	173	-26.9%	4.5	PASS
27421-27417	A	Stroud_B	EB	C	769	765	-0.5%	0.2	PASS
28037-28036	U	Stroud_B	EB	C	269	221	-17.9%	3.1	PASS
28105-28026	A	Stroud_B	EB	C	281	301	7.4%	1.2	PASS
60015-28176	B	Stroud_B	EB	C	194	177	-8.7%	1.2	PASS
28015-28016	U	Stroud_B	EB	C	21	35	63.9%	2.6	PASS
62389-28167	B	Stroud_B	EB	C	582	583	0.1%	0.0	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28063-28061	U	Stroud_B	WB	C	11	0	-100.0%	4.7	PASS
27417-27421	A	Stroud_B	WB	C	831	888	7.0%	2.0	PASS
28036-28037	U	Stroud_B	WB	C	145	98	-32.6%	4.3	PASS
28026-28105	A	Stroud_B	WB	C	544	515	-5.2%	1.2	PASS
28176-60015	B	Stroud_B	WB	C	290	284	-2.1%	0.4	PASS
28016-28015	U	Stroud_B	WB	C	15	39	162.7%	4.7	PASS
28167-62389	B	Stroud_B	WB	C	798	793	-0.7%	0.2	PASS
60050-28094	A	Stroud_C	EB	V	681	703	3.2%	0.8	PASS
28021-28022	U	Stroud_C	EB	V	60	70	17.5%	1.3	PASS
65683-27506	B	Stroud_C	EB	V	162	146	-9.8%	1.3	PASS
62455-62408	A	Stroud_C	EB	V	411	345	-15.9%	3.4	PASS
28152-28174	A	Stroud_C	EB	V	253	287	13.2%	2.0	PASS
28094-60050	A	Stroud_C	WB	V	495	546	10.3%	2.2	PASS
28022-28021	U	Stroud_C	WB	V	68	82	20.3%	1.6	PASS
27506-65683	B	Stroud_C	WB	V	93	93	0.0%	0.0	PASS
62408-62455	A	Stroud_C	WB	V	262	236	-9.8%	1.6	PASS
28174-28152	A	Stroud_C	WB	V	270	301	11.7%	1.9	PASS
26006-27386	U	Stroud_cordon	IB	C	101	102	0.4%	0.0	PASS
60090-27384	A	Stroud_cordon	IB	C	586	580	-1.0%	0.3	PASS
26066-65897	B	Stroud_cordon	IB	C	63	66	4.9%	0.4	PASS
26071-26001	U	Stroud_cordon	IB	C	121	125	2.9%	0.3	PASS
65380-28078	A	Stroud_cordon	IB	C	326	325	-0.3%	0.1	PASS
28082-28106	U	Stroud_cordon	IB	C	138	111	-19.5%	2.4	PASS
27350-27349	B	Stroud_cordon	IB	C	59	87	47.1%	3.3	PASS
27353-27352	A	Stroud_cordon	IB	C	229	198	-13.4%	2.1	PASS
27358-27357	B	Stroud_cordon	IB	C	264	264	0.0%	0.0	PASS
65683-27506	B	Stroud_cordon	IB	C	162	146	-9.8%	1.3	PASS
65405-27505	U	Stroud_cordon	IB	C	156	171	9.8%	1.2	PASS
28030-28138	U	Stroud_cordon	IB	C	68	68	0.0%	0.0	PASS
60074-27370	A	Stroud_cordon	IB	C	852	841	-1.3%	0.4	PASS
27393-60072	B	Stroud_cordon	IB	C	271	282	4.1%	0.7	PASS
27386-26006	U	Stroud_cordon	OB	C	133	206	55.4%	5.6	PASS
27384-60090	A	Stroud_cordon	OB	C	615	550	-10.6%	2.7	PASS
65897-26066	B	Stroud_cordon	OB	C	85	74	-14.0%	1.3	PASS
26001-26071	U	Stroud_cordon	OB	C	243	246	1.3%	0.2	PASS
28078-65380	A	Stroud_cordon	OB	C	658	654	-0.7%	0.2	PASS
28106-28082	U	Stroud_cordon	OB	C	122	145	18.8%	2.0	PASS
27349-27350	B	Stroud_cordon	OB	C	67	44	-34.6%	3.1	PASS
27352-27353	A	Stroud_cordon	OB	C	307	267	-13.0%	2.3	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
27357-27358	B	Stroud_cordon	OB	C	282	282	-0.1%	0.0	PASS
27506-65683	B	Stroud_cordon	OB	C	93	93	0.0%	0.0	PASS
27505-65405	U	Stroud_cordon	OB	C	197	200	1.7%	0.2	PASS
28138-28030	U	Stroud_cordon	OB	C	58	57	-1.4%	0.1	PASS
27370-60074	A	Stroud_cordon	OB	C	820	815	-0.6%	0.2	PASS
60072-27393	B	Stroud_cordon	OB	C	391	389	-0.4%	0.1	PASS
28000-28001	U	Stroud_D	NB	C	40	45	14.4%	0.9	PASS
28088-28089	A	Stroud_D	NB	C	307	284	-7.6%	1.4	PASS
28016-28015	U	Stroud_D	NB	C	15	39	162.7%	4.7	PASS
28204-28205	B	Stroud_D	NB	C	163	163	0.0%	0.0	PASS
28208-62455	B	Stroud_D	NB	C	185	185	0.4%	0.1	PASS
28001-28000	U	Stroud_D	SB	C	35	56	61.3%	3.2	PASS
28089-28088	A	Stroud_D	SB	C	511	496	-3.1%	0.7	PASS
28015-28016	U	Stroud_D	SB	C	21	35	63.9%	2.6	PASS
28205-28204	B	Stroud_D	SB	C	231	175	-24.2%	3.9	PASS
62455-28208	B	Stroud_D	SB	C	218	220	0.6%	0.1	PASS
28143-27347	A	Stroud_E	NB	C	601	663	10.5%	2.5	PASS
28146-28080	U	Stroud_E	NB	C	188	204	8.9%	1.2	PASS
28188-28187	U	Stroud_E	NB	C	91	37	-59.0%	6.7	PASS
65902-27342	A	Stroud_E	NB	C	581	556	-4.3%	1.1	PASS
27347-28143	A	Stroud_E	SB	C	614	681	10.9%	2.6	PASS
28080-28146	U	Stroud_E	SB	C	292	284	-2.8%	0.5	PASS
28187-28188	U	Stroud_E	SB	C	60	94	57.0%	3.9	PASS
27342-65902	A	Stroud_E	SB	C	627	533	-15.0%	3.9	PASS
27156-27142	A	Cheltenham	IB	C	472	595	26.1%	5.3	FAIL
27067-27066	B	Cheltenham	IB	C	463	341	-26.4%	6.1	FAIL
60550-26040	A	Cheltenham	IB	C	388	351	-9.5%	1.9	PASS
27110-27109	A	Cheltenham	IB	C	372	333	-10.6%	2.1	PASS
26058-27054	U	Cheltenham	IB	C	326	337	3.3%	0.6	PASS
27106-27104	A	Cheltenham	IB	C	619	593	-4.1%	1.0	PASS
65492-27088	A	Cheltenham	IB	C	2091	2130	1.9%	0.9	PASS
27039-27077	B	Cheltenham	IB	C	482	511	6.1%	1.3	PASS
28122-27192	B	Cheltenham	IB	C	381	397	4.1%	0.8	PASS
60390-65948	A	Cheltenham	IB	C	1073	1020	-4.9%	1.6	PASS
27142-27156	A	Cheltenham	OB	C	461	454	-1.5%	0.3	PASS
27066-27067	B	Cheltenham	OB	C	347	354	2.0%	0.4	PASS
26040-60550	A	Cheltenham	OB	C	379	370	-2.2%	0.4	PASS
27109-27110	A	Cheltenham	OB	C	429	388	-9.6%	2.0	PASS
27054-26058	U	Cheltenham	OB	C	293	304	3.9%	0.7	PASS

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27104-27106	A	Cheltenham	OB	C	616	542	-12.0%	3.1	PASS
27084-60315	A	Cheltenham	OB	C	1890	1959	3.7%	1.6	PASS
27077-27039	B	Cheltenham	OB	C	388	489	26.0%	4.8	PASS
27192-28122	B	Cheltenham	OB	C	246	260	5.7%	0.9	PASS
65948-60390	A	Cheltenham	OB	C	587	473	-19.5%	5.0	PASS
60317-60493	B	Gloucester	IB	C	476	432	-9.4%	2.1	PASS
65490-26086	A	Gloucester	IB	C	1500	1463	-2.4%	1.0	PASS
26048-65969	U	Gloucester	IB	C	273	267	-2.3%	0.4	PASS
60256-27321	A	Gloucester	IB	C	1370	1413	3.1%	1.2	PASS
26091-27323	U	Gloucester	IB	C	413	391	-5.3%	1.1	PASS
26092-65416	U	Gloucester	IB	C	370	351	-5.1%	1.0	PASS
65413-26017	B	Gloucester	IB	C	216	278	29.0%	4.0	PASS
60117-60119	A	Gloucester	IB	C	409	273	-33.2%	7.4	FAIL
65110-27309	B	Gloucester	IB	C	1385	1387	0.1%	0.0	PASS
60091-27307	A	Gloucester	IB	C	495	492	-0.6%	0.1	PASS
60217-60216	A	Gloucester	IB	C	1490	1457	-2.2%	0.9	PASS
27252-27240	A	Gloucester	IB	C	1194	1228	2.8%	1.0	PASS
60395-28137	A	Gloucester	IB	C	402	459	14.4%	2.8	PASS
60493-60317	B	Gloucester	OB	C	547	642	17.4%	3.9	PASS
66709-60304	A	Gloucester	OB	C	1514	1520	0.4%	0.2	PASS
65969-26048	U	Gloucester	OB	C	263	261	-0.6%	0.1	PASS
60257-60260	A	Gloucester	OB	C	905	993	9.7%	2.9	PASS
27323-26091	U	Gloucester	OB	C	358	400	11.8%	2.2	PASS
65416-26092	U	Gloucester	OB	C	489	589	20.5%	4.3	PASS
26017-65413	B	Gloucester	OB	C	226	181	-20.1%	3.2	PASS
60119-60118	A	Gloucester	OB	C	356	206	-42.3%	9.0	FAIL
27304-65109	B	Gloucester	OB	C	1456	1464	0.6%	0.2	PASS
27307-60091	A	Gloucester	OB	C	405	397	-1.9%	0.4	PASS
60216-27452	A	Gloucester	OB	C	1138	1070	-5.9%	2.0	PASS
27240-27252	A	Gloucester	OB	C	871	939	7.8%	2.2	PASS
28137-60395	A	Gloucester	OB	C	538	441	-17.9%	4.4	PASS
65492-27088	A	A417_C	NB	V	2091	2130	1.9%	0.9	PASS
27531-26049	U	A417_C	NB	V	465	443	-4.6%	1.0	PASS
27588-26050	A	A417_C	NB	V	895	903	0.9%	0.3	PASS
26058-27054	U	A417_C	NB	V	326	337	3.3%	0.6	PASS
27110-27109	A	A417_C	NB	V	372	333	-10.6%	2.1	PASS
26039-26063	U	A417_C	NB	V	34	76	122.9%	5.6	PASS
60550-26040	A	A417_C	NB	V	388	351	-9.5%	1.9	PASS
27084-60315	A	A417_C	SB	V	1890	1959	3.7%	1.6	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26049-27531	U	A417_C	SB	V	165	194	17.2%	2.1	PASS
26050-27588	A	A417_C	SB	V	916	884	-3.5%	1.1	PASS
27054-26058	U	A417_C	SB	V	293	304	3.9%	0.7	PASS
27109-27110	A	A417_C	SB	V	429	388	-9.6%	2.0	PASS
26063-26039	U	A417_C	SB	V	19	50	158.6%	5.2	PASS
26040-60550	A	A417_C	SB	V	379	370	-2.2%	0.4	PASS
27108-26053	U	A417_D	EB	V	249	231	-7.2%	1.2	PASS
60292-26075	A	A417_D	EB	V	1657	1679	1.3%	0.5	PASS
26024-26023	U	A417_D	EB	V	266	257	-3.4%	0.6	PASS
26070-26022	U	A417_D	EB	V	30	16	-47.7%	3.0	PASS
26053-27108	U	A417_D	WB	V	273	265	-3.1%	0.5	PASS
26075-60292	A	A417_D	WB	V	1262	1221	-3.2%	1.1	PASS
26023-26024	U	A417_D	WB	V	276	273	-1.2%	0.2	PASS
26022-26070	U	A417_D	WB	V	21	15	-28.8%	1.4	PASS
65959-26012	A	A417_F	NB	V	498	521	4.8%	1.1	PASS
27594-27507	B	A417_F	NB	V	80	138	73.2%	5.6	PASS
27595-26021	A	A417_F	NB	V	350	305	-12.9%	2.5	PASS
26022-26070	U	A417_F	NB	V	21	15	-28.8%	1.4	PASS
26022-65895	B	A417_F	NB	V	334	332	-0.4%	0.1	PASS
26030-26025	U	A417_F	NB	V	21	19	-10.4%	0.5	PASS
26034-60286	A	A417_F	NB	V	1016	1010	-0.6%	0.2	PASS
26032-26035	U	A417_F	NB	V	5	9	85.2%	1.6	PASS
65412-26036	A	A417_F	NB	V	314	287	-8.5%	1.5	PASS
26012-65959	A	A417_F	SB	V	368	405	10.1%	1.9	PASS
27507-27594	B	A417_F	SB	V	108	107	-1.4%	0.1	PASS
26021-27595	A	A417_F	SB	V	271	229	-15.5%	2.7	PASS
26070-26022	U	A417_F	SB	V	30	16	-47.7%	3.0	PASS
65895-26022	B	A417_F	SB	V	164	169	3.1%	0.4	PASS
26025-26030	U	A417_F	SB	V	25	19	-23.5%	1.3	PASS
60286-26034	A	A417_F	SB	V	1247	1260	1.0%	0.4	PASS
26035-26032	U	A417_F	SB	V	1	5	318.7%	2.2	PASS
26036-65412	A	A417_F	SB	V	420	391	-6.9%	1.4	PASS

Table E-2 - IP Peak Screenline Link Results

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28210-28039	B	A417_A	NB	C	276	279	1.0%	0.2	PASS
27386-26006	U	A417_A	NB	C	79	99	25.8%	2.2	PASS
27384-60090	A	A417_A	NB	C	452	446	-1.3%	0.3	PASS
65897-26066	B	A417_A	NB	C	61	49	-18.6%	1.5	PASS
26001-26071	U	A417_A	NB	C	113	111	-1.9%	0.2	PASS
65380-26018	U	A417_A	NB	C	33	23	-32.4%	2.0	PASS
65674-26010	U	A417_A	NB	C	135	151	11.8%	1.3	PASS
27592-26067	A	A417_A	NB	C	161	151	-6.1%	0.8	PASS
65470-60540	A	A417_A	NB	C	975	945	-3.1%	1.0	PASS
60536-68010	A	A417_A	NB	C	274	309	12.5%	2.0	PASS
28039-28210	B	A417_A	SB	C	297	297	0.1%	0.0	PASS
26006-27386	U	A417_A	SB	C	73	66	-8.9%	0.8	PASS
60090-27384	A	A417_A	SB	C	442	469	6.1%	1.3	PASS
26066-65897	B	A417_A	SB	C	64	61	-4.8%	0.4	PASS
26071-26001	U	A417_A	SB	C	115	99	-14.0%	1.6	PASS
26018-65380	U	A417_A	SB	C	36	21	-41.7%	2.8	PASS
26010-65674	U	A417_A	SB	C	114	139	22.4%	2.3	PASS
26067-27592	A	A417_A	SB	C	156	150	-4.1%	0.5	PASS
65471-60529	A	A417_A	SB	C	877	831	-5.3%	1.6	PASS
68010-60536	A	A417_A	SB	C	269	315	17.0%	2.7	PASS
60493-60317	B	A417_B	EB	C	431	426	-1.1%	0.2	PASS
66709-60304	A	A417_B	EB	C	1101	1101	-0.1%	0.0	PASS
27531-26049	U	A417_B	EB	C	155	187	20.8%	2.5	PASS
65417-65419	U	A417_B	EB	C	84	53	-36.7%	3.7	PASS
66701-27324	A	A417_B	EB	C	997	987	-1.0%	0.3	PASS
65416-26092	U	A417_B	EB	C	418	341	-18.4%	3.9	PASS
26047-65966	U	A417_B	EB	C	248	205	-17.5%	2.9	PASS
26046-26044	U	A417_B	EB	C	102	59	-42.2%	4.8	PASS
26045-26044	U	A417_B	EB	C	48	115	141.4%	7.5	PASS
26017-65413	B	A417_B	EB	C	184	162	-12.2%	1.7	PASS
26014-26015	U	A417_B	EB	C	90	142	57.0%	4.8	PASS
60119-60118	A	A417_B	EB	C	284	193	-32.2%	5.9	PASS
28047-28046	U	A417_B	EB	C	51	93	83.4%	5.0	PASS
27304-65109	B	A417_B	EB	C	910	939	3.2%	1.0	PASS
60317-60493	B	A417_B	WB	C	440	445	1.1%	0.2	PASS
65490-26086	A	A417_B	WB	C	1071	1072	0.1%	0.0	PASS
26049-27531	U	A417_B	WB	C	177	173	-2.3%	0.3	PASS
65419-65417	U	A417_B	WB	C	78	82	4.1%	0.4	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
27322-26084	A	A417_B	WB	C	1028	1097	6.7%	2.1	PASS
26092-65416	U	A417_B	WB	C	440	354	-19.5%	4.3	PASS
65966-26047	U	A417_B	WB	C	281	233	-17.1%	3.0	PASS
26044-26046	U	A417_B	WB	C	104	60	-42.0%	4.8	PASS
26044-26045	U	A417_B	WB	C	56	62	10.6%	0.8	PASS
65413-26017	B	A417_B	WB	C	172	211	22.7%	2.8	PASS
26015-26014	U	A417_B	WB	C	96	181	88.7%	7.2	PASS
60117-60119	A	A417_B	WB	C	303	184	-39.2%	7.6	FAIL
28046-28047	U	A417_B	WB	C	45	79	75.3%	4.3	PASS
65110-27309	B	A417_B	WB	C	987	1057	7.0%	2.2	PASS
65390-65391	U	A417_E	EB	C	35	35	-0.4%	0.0	PASS
26010-65674	U	A417_E	EB	C	114	139	22.4%	2.3	PASS
65877-27341	A	A417_E	EB	C	301	327	8.8%	1.5	PASS
65471-60529	A	A417_E	EB	C	877	831	-5.3%	1.6	PASS
65391-65390	U	A417_E	WB	C	31	32	2.9%	0.2	PASS
65674-26010	U	A417_E	WB	C	135	151	11.8%	1.3	PASS
27341-65877	A	A417_E	WB	C	319	358	12.0%	2.1	PASS
65470-60540	A	A417_E	WB	C	975	945	-3.1%	1.0	PASS
60262-60266	A	A417_G	EB	C	574	567	-1.1%	0.3	PASS
26024-26064	B	A417_G	EB	C	13	10	-23.0%	0.9	PASS
65894-60289	B	A417_G	EB	C	151	151	-0.2%	0.0	PASS
26030-26031	U	A417_G	EB	C	7	13	83.2%	1.9	PASS
26069-26028	U	A417_G	EB	C	21	18	-14.0%	0.7	PASS
26019-26068	U	A417_G	EB	C	5	2	-51.6%	1.3	PASS
27581-60262	A	A417_G	WB	C	519	518	-0.1%	0.0	PASS
26064-26024	B	A417_G	WB	C	17	11	-35.3%	1.6	PASS
60289-65894	B	A417_G	WB	C	230	222	-3.4%	0.5	PASS
26031-26030	U	A417_G	WB	C	23	17	-26.1%	1.3	PASS
26028-26069	U	A417_G	WB	C	17	25	43.9%	1.7	PASS
26068-26019	U	A417_G	WB	C	5	4	-18.5%	0.4	PASS
27583-26026	A	A417_H	EB	C	617	617	0.1%	0.0	PASS
26024-26064	U	A417_H	EB	C	13	10	-23.0%	0.9	PASS
26080-27589	U	A417_H	EB	C	201	209	4.0%	0.6	PASS
26080-26060	A	A417_H	EB	C	388	383	-1.4%	0.3	PASS
26034-26035	U	A417_H	EB	C	3	2	-44.5%	0.9	PASS
26032-26035	U	A417_H	EB	C	3	4	39.5%	0.6	PASS
26032-26033	U	A417_H	EB	C	3	3	-7.7%	0.1	PASS
65411-26059	U	A417_H	EB	C	66	90	35.0%	2.6	PASS
26026-27583	A	A417_H	WB	C	561	562	0.3%	0.1	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26064-26024	U	A417_H	WB	C	17	11	-35.3%	1.6	PASS
27589-26080	U	A417_H	WB	C	184	188	2.0%	0.3	PASS
26060-26080	A	A417_H	WB	C	422	421	-0.1%	0.0	PASS
26035-26034	U	A417_H	WB	C	3	1	-60.3%	1.3	PASS
26035-26032	U	A417_H	WB	C	1	4	353.3%	2.1	PASS
26033-26032	U	A417_H	WB	C	11	1	-91.1%	4.1	PASS
26059-65411	U	A417_H	WB	C	44	77	72.9%	4.2	PASS
26040-60550	A	A417_I	EB	C	303	272	-10.4%	1.9	PASS
26063-26039	U	A417_I	EB	C	25	58	131.8%	5.1	PASS
27112-60546	A	A417_I	EB	C	333	334	0.3%	0.0	PASS
65675-65391	A	A417_I	EB	C	124	124	-0.1%	0.0	PASS
60550-26040	A	A417_I	WB	C	343	287	-16.3%	3.2	PASS
26039-26063	U	A417_I	WB	C	24	57	134.9%	5.2	PASS
60546-27112	A	A417_I	WB	C	369	393	6.6%	1.2	PASS
65391-65675	A	A417_I	WB	C	126	126	0.1%	0.0	PASS
65471-60529	A	Cirencester	IB	C	877	831	-5.3%	1.6	PASS
60536-60535	A	Cirencester	IB	C	444	526	18.4%	3.7	PASS
60558-27573	A	Cirencester	IB	C	250	169	-32.6%	5.6	PASS
62962-60530	A	Cirencester	IB	C	965	981	1.7%	0.5	PASS
62782-60515	A	Cirencester	IB	C	542	447	-17.6%	4.3	PASS
27524-65370	U	Cirencester	IB	C	139	234	68.6%	7.0	PASS
60514-27552	A	Cirencester	IB	C	472	472	0.0%	0.0	PASS
65877-27341	A	Cirencester	IB	C	301	327	8.8%	1.5	PASS
65388-65944	A	Cirencester	IB	C	415	415	0.1%	0.0	PASS
65470-60540	A	Cirencester	OB	C	975	945	-3.1%	1.0	PASS
60535-60536	A	Cirencester	OB	C	434	513	18.1%	3.6	PASS
27573-60558	A	Cirencester	OB	C	223	144	-35.2%	5.8	PASS
65469-62963	A	Cirencester	OB	C	815	836	2.6%	0.7	PASS
60515-62782	A	Cirencester	OB	C	515	435	-15.5%	3.7	PASS
65370-27524	U	Cirencester	OB	C	103	183	77.7%	6.7	PASS
27552-60514	A	Cirencester	OB	C	481	481	0.0%	0.0	PASS
27341-65877	A	Cirencester	OB	C	319	358	12.0%	2.1	PASS
65944-65388	A	Cirencester	OB	C	441	442	0.2%	0.0	PASS
28117-28118	U	J10_A	NB	C	37	7	-80.5%	6.4	PASS
28122-28123	U	J10_A	NB	C	108	140	29.2%	2.8	PASS
65948-60390	A	J10_A	NB	C	626	581	-7.2%	1.8	PASS
28118-28117	U	J10_A	SB	C	34	21	-38.2%	2.5	PASS
28123-28122	U	J10_A	SB	C	110	123	12.2%	1.2	PASS
60390-65948	A	J10_A	SB	C	670	650	-3.0%	0.8	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
60217-60216	A	J10_B	EB	C	1143	1029	-10.0%	3.5	PASS
27252-27240	A	J10_B	EB	C	894	1008	12.8%	3.7	PASS
65681-60406	B	J10_B	EB	C	111	111	0.2%	0.0	PASS
60436-60414	A	J10_B	EB	C	359	350	-2.6%	0.5	PASS
60216-27452	A	J10_B	WB	C	1272	1167	-8.2%	3.0	PASS
27240-27252	A	J10_B	WB	C	895	1002	11.9%	3.5	PASS
60406-65681	B	J10_B	WB	C	121	121	0.2%	0.0	PASS
60414-60436	A	J10_B	WB	C	365	337	-7.8%	1.5	PASS
60395-60398	A	J10_C	NB	C	467	561	19.9%	4.1	PASS
65432-56435	U	J10_C	NB	C	127	34	-73.3%	10.4	PASS
27142-27156	A	J10_C	NB	C	523	466	-11.0%	2.6	PASS
27066-27067	B	J10_C	NB	C	339	397	17.0%	3.0	PASS
60398-60395	A	J10_C	SB	C	445	552	24.2%	4.8	PASS
56435-65432	U	J10_C	SB	C	129	22	-83.0%	12.3	FAIL
27156-27142	A	J10_C	SB	C	560	512	-8.6%	2.1	PASS
27067-27066	B	J10_C	SB	C	315	364	15.5%	2.7	PASS
28202-60057	B	Stroud_A	EB	C	189	171	-9.5%	1.3	PASS
28172-28170	U	Stroud_A	EB	C	95	95	0.0%	0.0	PASS
28108-28107	U	Stroud_A	EB	C	99	99	0.5%	0.1	PASS
28003-62401	B	Stroud_A	EB	C	168	144	-14.3%	1.9	PASS
28003-28004	U	Stroud_A	EB	C	100	123	23.2%	2.2	PASS
28001-28000	U	Stroud_A	EB	C	25	44	74.3%	3.2	PASS
60057-28202	B	Stroud_A	WB	C	197	196	-0.1%	0.0	PASS
28171-28172	U	Stroud_A	WB	C	94	106	12.3%	1.2	PASS
28107-28108	U	Stroud_A	WB	C	99	99	0.6%	0.1	PASS
62401-28003	B	Stroud_A	WB	C	162	140	-13.4%	1.8	PASS
28004-28003	U	Stroud_A	WB	C	108	105	-2.7%	0.3	PASS
28000-28001	U	Stroud_A	WB	C	27	31	16.8%	0.8	PASS
28061-28063	U	Stroud_B	EB	C	74	100	34.7%	2.8	PASS
27421-27417	A	Stroud_B	EB	C	609	588	-3.5%	0.9	PASS
28037-28036	U	Stroud_B	EB	C	122	117	-4.4%	0.5	PASS
28105-28026	A	Stroud_B	EB	C	310	333	7.2%	1.2	PASS
60015-28176	B	Stroud_B	EB	C	199	177	-11.2%	1.6	PASS
28015-28016	U	Stroud_B	EB	C	14	17	26.8%	0.9	PASS
62389-28167	B	Stroud_B	EB	C	408	408	0.0%	0.0	PASS
28063-28061	U	Stroud_B	WB	C	15	0	-100.0%	5.4	PASS
27417-27421	A	Stroud_B	WB	C	720	726	0.9%	0.2	PASS
28036-28037	U	Stroud_B	WB	C	133	134	0.9%	0.1	PASS
28026-28105	A	Stroud_B	WB	C	385	400	3.8%	0.7	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28176-60015	B	Stroud_B	WB	C	188	170	-9.7%	1.4	PASS
28016-28015	U	Stroud_B	WB	C	16	40	143.1%	4.4	PASS
28167-62389	B	Stroud_B	WB	C	412	404	-1.9%	0.4	PASS
60050-28094	A	Stroud_C	EB	V	499	595	19.2%	4.1	PASS
28021-28022	U	Stroud_C	EB	V	60	56	-6.5%	0.5	PASS
65683-27506	B	Stroud_C	EB	V	107	90	-15.4%	1.7	PASS
62455-62408	A	Stroud_C	EB	V	238	183	-23.1%	3.8	PASS
28152-28174	A	Stroud_C	EB	V	186	206	10.9%	1.5	PASS
28094-60050	A	Stroud_C	WB	V	490	593	21.0%	4.4	PASS
28022-28021	U	Stroud_C	WB	V	61	61	0.5%	0.0	PASS
27506-65683	B	Stroud_C	WB	V	108	108	0.2%	0.0	PASS
62408-62455	A	Stroud_C	WB	V	245	191	-22.1%	3.7	PASS
28174-28152	A	Stroud_C	WB	V	181	189	4.6%	0.6	PASS
26006-27386	U	Stroud_cordon	IB	C	73	66	-8.9%	0.8	PASS
60090-27384	A	Stroud_cordon	IB	C	442	469	6.1%	1.3	PASS
26066-65897	B	Stroud_cordon	IB	C	64	61	-4.8%	0.4	PASS
26071-26001	U	Stroud_cordon	IB	C	115	99	-14.0%	1.6	PASS
65380-28078	A	Stroud_cordon	IB	C	355	355	-0.1%	0.0	PASS
28082-28106	U	Stroud_cordon	IB	C	94	89	-5.0%	0.5	PASS
27350-27349	B	Stroud_cordon	IB	C	64	70	9.2%	0.7	PASS
27353-27352	A	Stroud_cordon	IB	C	195	170	-12.6%	1.8	PASS
27358-27357	B	Stroud_cordon	IB	C	199	200	0.3%	0.0	PASS
65683-27506	B	Stroud_cordon	IB	C	107	90	-15.4%	1.7	PASS
65405-27505	U	Stroud_cordon	IB	C	106	121	14.5%	1.4	PASS
28030-28138	U	Stroud_cordon	IB	C	53	51	-3.0%	0.2	PASS
60074-27370	A	Stroud_cordon	IB	C	727	721	-0.8%	0.2	PASS
27393-60072	B	Stroud_cordon	IB	C	284	290	2.0%	0.3	PASS
27386-26006	U	Stroud_cordon	OB	C	79	99	25.8%	2.2	PASS
27384-60090	A	Stroud_cordon	OB	C	452	446	-1.3%	0.3	PASS
65897-26066	B	Stroud_cordon	OB	C	61	49	-18.6%	1.5	PASS
26001-26071	U	Stroud_cordon	OB	C	113	111	-1.9%	0.2	PASS
28078-65380	A	Stroud_cordon	OB	C	334	334	0.0%	0.0	PASS
28106-28082	U	Stroud_cordon	OB	C	95	94	-1.6%	0.2	PASS
27349-27350	B	Stroud_cordon	OB	C	61	63	3.3%	0.3	PASS
27352-27353	A	Stroud_cordon	OB	C	190	160	-16.0%	2.3	PASS
27357-27358	B	Stroud_cordon	OB	C	181	180	-0.5%	0.1	PASS
27506-65683	B	Stroud_cordon	OB	C	108	108	0.2%	0.0	PASS
27505-65405	U	Stroud_cordon	OB	C	114	121	5.8%	0.6	PASS
28138-28030	U	Stroud_cordon	OB	C	50	49	-1.2%	0.1	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
27370-60074	A	Stroud_cordon	OB	C	800	778	-2.8%	0.8	PASS
60072-27393	B	Stroud_cordon	OB	C	235	257	9.5%	1.4	PASS
28000-28001	U	Stroud_D	NB	C	27	31	16.8%	0.8	PASS
28088-28089	A	Stroud_D	NB	C	334	305	-8.7%	1.6	PASS
28016-28015	U	Stroud_D	NB	C	16	40	143.1%	4.4	PASS
28204-28205	B	Stroud_D	NB	C	166	166	-0.1%	0.0	PASS
28208-62455	B	Stroud_D	NB	C	150	150	0.2%	0.0	PASS
28001-28000	U	Stroud_D	SB	C	25	44	74.3%	3.2	PASS
28089-28088	A	Stroud_D	SB	C	312	308	-1.3%	0.2	PASS
28015-28016	U	Stroud_D	SB	C	14	17	26.8%	0.9	PASS
28205-28204	B	Stroud_D	SB	C	151	128	-15.4%	2.0	PASS
62455-28208	B	Stroud_D	SB	C	139	139	0.5%	0.1	PASS
28143-27347	A	Stroud_E	NB	C	584	682	16.7%	3.9	PASS
28146-28080	U	Stroud_E	NB	C	194	216	11.6%	1.6	PASS
28188-28187	U	Stroud_E	NB	C	88	17	-81.0%	9.9	PASS
65902-27342	A	Stroud_E	NB	C	569	520	-8.5%	2.1	PASS
27347-28143	A	Stroud_E	SB	C	523	604	15.6%	3.4	PASS
28080-28146	U	Stroud_E	SB	C	205	211	2.8%	0.4	PASS
28187-28188	U	Stroud_E	SB	C	64	88	36.6%	2.7	PASS
27342-65902	A	Stroud_E	SB	C	543	432	-20.4%	5.0	FAIL
27156-27142	A	Cheltenham	IB	C	560	512	-8.6%	2.1	PASS
27067-27066	B	Cheltenham	IB	C	315	364	15.5%	2.7	PASS
60550-26040	A	Cheltenham	IB	C	343	287	-16.3%	3.2	PASS
27110-27109	A	Cheltenham	IB	C	237	194	-18.2%	2.9	PASS
26058-27054	U	Cheltenham	IB	C	218	225	2.9%	0.4	PASS
27106-27104	A	Cheltenham	IB	C	490	427	-12.9%	3.0	PASS
65492-27088	A	Cheltenham	IB	C	1271	1333	4.9%	1.7	PASS
27039-27077	B	Cheltenham	IB	C	385	349	-9.4%	1.9	PASS
28122-27192	B	Cheltenham	IB	C	236	293	24.0%	3.5	PASS
60390-65948	A	Cheltenham	IB	C	670	650	-3.0%	0.8	PASS
27142-27156	A	Cheltenham	OB	C	523	466	-11.0%	2.6	PASS
27066-27067	B	Cheltenham	OB	C	339	397	17.0%	3.0	PASS
26040-60550	A	Cheltenham	OB	C	303	272	-10.4%	1.9	PASS
27109-27110	A	Cheltenham	OB	C	207	145	-30.1%	4.7	PASS
27054-26058	U	Cheltenham	OB	C	203	192	-5.4%	0.8	PASS
27104-27106	A	Cheltenham	OB	C	495	433	-12.6%	2.9	PASS
27084-60315	A	Cheltenham	OB	C	1427	1489	4.4%	1.6	PASS
27077-27039	B	Cheltenham	OB	C	332	410	23.5%	4.1	PASS
27192-28122	B	Cheltenham	OB	C	267	235	-12.0%	2.0	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
65948-60390	A	Cheltenham	OB	C	626	581	-7.2%	1.8	PASS
60317-60493	B	Gloucester	IB	C	440	445	1.1%	0.2	PASS
65490-26086	A	Gloucester	IB	C	1071	1072	0.1%	0.0	PASS
26048-65969	U	Gloucester	IB	C	175	174	-0.5%	0.1	PASS
60256-27321	A	Gloucester	IB	C	824	911	10.6%	3.0	PASS
26091-27323	U	Gloucester	IB	C	287	287	0.1%	0.0	PASS
26092-65416	U	Gloucester	IB	C	440	354	-19.5%	4.3	PASS
65413-26017	B	Gloucester	IB	C	172	211	22.7%	2.8	PASS
60117-60119	A	Gloucester	IB	C	303	184	-39.2%	7.6	FAIL
65110-27309	B	Gloucester	IB	C	987	1057	7.0%	2.2	PASS
60091-27307	A	Gloucester	IB	C	485	417	-14.1%	3.2	PASS
60217-60216	A	Gloucester	IB	C	1143	1029	-10.0%	3.5	PASS
27252-27240	A	Gloucester	IB	C	894	1008	12.8%	3.7	PASS
60395-28137	A	Gloucester	IB	C	340	334	-1.7%	0.3	PASS
60493-60317	B	Gloucester	OB	C	431	426	-1.1%	0.2	PASS
66709-60304	A	Gloucester	OB	C	1101	1101	-0.1%	0.0	PASS
65969-26048	U	Gloucester	OB	C	180	179	-0.8%	0.1	PASS
60257-60260	A	Gloucester	OB	C	733	792	8.0%	2.1	PASS
27323-26091	U	Gloucester	OB	C	296	296	0.0%	0.0	PASS
65416-26092	U	Gloucester	OB	C	418	341	-18.4%	3.9	PASS
26017-65413	B	Gloucester	OB	C	184	162	-12.2%	1.7	PASS
60119-60118	A	Gloucester	OB	C	284	193	-32.2%	5.9	PASS
27304-65109	B	Gloucester	OB	C	910	939	3.2%	1.0	PASS
27307-60091	A	Gloucester	OB	C	451	422	-6.4%	1.4	PASS
60216-27452	A	Gloucester	OB	C	1272	1167	-8.2%	3.0	PASS
27240-27252	A	Gloucester	OB	C	895	1002	11.9%	3.5	PASS
28137-60395	A	Gloucester	OB	C	320	303	-5.5%	1.0	PASS
65492-27088	A	A417_C	NB	V	1271	1333	4.9%	1.7	PASS
27531-26049	U	A417_C	NB	V	155	187	20.8%	2.5	PASS
27588-26050	A	A417_C	NB	V	621	642	3.3%	0.8	PASS
26058-27054	U	A417_C	NB	V	218	225	2.9%	0.4	PASS
27110-27109	A	A417_C	NB	V	237	194	-18.2%	2.9	PASS
26039-26063	U	A417_C	NB	V	24	57	134.9%	5.2	PASS
60550-26040	A	A417_C	NB	V	343	287	-16.3%	3.2	PASS
27084-60315	A	A417_C	SB	V	1427	1489	4.4%	1.6	PASS
26049-27531	U	A417_C	SB	V	177	173	-2.3%	0.3	PASS
26050-27588	A	A417_C	SB	V	579	584	0.9%	0.2	PASS
27054-26058	U	A417_C	SB	V	203	192	-5.4%	0.8	PASS
27109-27110	A	A417_C	SB	V	207	145	-30.1%	4.7	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26063-26039	U	A417_C	SB	V	25	58	131.8%	5.1	PASS
26040-60550	A	A417_C	SB	V	303	272	-10.4%	1.9	PASS
27108-26053	U	A417_D	EB	V	157	159	1.3%	0.2	PASS
60292-26075	A	A417_D	EB	V	1159	1155	-0.3%	0.1	PASS
26024-26023	U	A417_D	EB	V	98	97	-1.3%	0.1	PASS
26070-26022	U	A417_D	EB	V	14	10	-25.6%	1.0	PASS
26053-27108	U	A417_D	WB	V	157	162	3.5%	0.4	PASS
26075-60292	A	A417_D	WB	V	1171	1177	0.5%	0.2	PASS
26023-26024	U	A417_D	WB	V	181	178	-1.7%	0.2	PASS
26022-26070	U	A417_D	WB	V	18	11	-37.5%	1.7	PASS
65959-26012	A	A417_F	NB	V	448	348	-22.4%	5.0	FAIL
27594-27507	B	A417_F	NB	V	83	113	35.2%	3.0	PASS
27595-26021	A	A417_F	NB	V	220	194	-12.1%	1.9	PASS
26022-26070	U	A417_F	NB	V	18	11	-37.5%	1.7	PASS
26022-65895	B	A417_F	NB	V	152	156	3.2%	0.4	PASS
26030-26025	U	A417_F	NB	V	22	17	-21.1%	1.0	PASS
26034-60286	A	A417_F	NB	V	977	991	1.5%	0.5	PASS
26032-26035	U	A417_F	NB	V	3	4	39.5%	0.6	PASS
65412-26036	A	A417_F	NB	V	181	186	2.7%	0.4	PASS
26012-65959	A	A417_F	SB	V	379	323	-15.0%	3.0	PASS
27507-27594	B	A417_F	SB	V	81	92	13.4%	1.2	PASS
26021-27595	A	A417_F	SB	V	218	201	-7.7%	1.2	PASS
26070-26022	U	A417_F	SB	V	14	10	-25.6%	1.0	PASS
65895-26022	B	A417_F	SB	V	149	155	4.2%	0.5	PASS
26025-26030	U	A417_F	SB	V	8	15	72.7%	1.8	PASS
60286-26034	A	A417_F	SB	V	900	889	-1.3%	0.4	PASS
26035-26032	U	A417_F	SB	V	1	4	353.3%	2.1	PASS
26036-65412	A	A417_F	SB	V	163	164	0.1%	0.0	PASS

Table E-3 - PM Peak Screenline Link Results

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28210-28039	B	A417_A	NB	C	295	318	7.8%	1.3	PASS
27386-26006	U	A417_A	NB	C	110	144	31.8%	3.1	PASS
27384-60090	A	A417_A	NB	C	602	579	-3.7%	0.9	PASS
65897-26066	B	A417_A	NB	C	66	45	-31.0%	2.7	PASS
26001-26071	U	A417_A	NB	C	119	127	6.9%	0.7	PASS
65380-26018	U	A417_A	NB	C	47	30	-35.8%	2.7	PASS
65674-26010	U	A417_A	NB	C	186	205	10.3%	1.4	PASS
27592-26067	A	A417_A	NB	C	255	235	-8.1%	1.3	PASS
65470-60540	A	A417_A	NB	C	1277	1316	3.1%	1.1	PASS
60536-68010	A	A417_A	NB	C	310	285	-8.0%	1.4	PASS
28039-28210	B	A417_A	SB	C	335	337	0.6%	0.1	PASS
26006-27386	U	A417_A	SB	C	124	126	1.8%	0.2	PASS
60090-27384	A	A417_A	SB	C	599	590	-1.6%	0.4	PASS
26066-65897	B	A417_A	SB	C	85	86	0.2%	0.0	PASS
26071-26001	U	A417_A	SB	C	210	219	4.2%	0.6	PASS
26018-65380	U	A417_A	SB	C	61	58	-4.4%	0.3	PASS
26010-65674	U	A417_A	SB	C	156	184	18.0%	2.2	PASS
26067-27592	A	A417_A	SB	C	210	167	-20.4%	3.1	PASS
65471-60529	A	A417_A	SB	C	1090	1051	-3.6%	1.2	PASS
68010-60536	A	A417_A	SB	C	307	346	12.7%	2.2	PASS
60493-60317	B	A417_B	EB	C	453	479	5.8%	1.2	PASS
66709-60304	A	A417_B	EB	C	1425	1423	-0.2%	0.1	PASS
27531-26049	U	A417_B	EB	C	176	242	37.2%	4.5	PASS
65417-65419	U	A417_B	EB	C	128	62	-51.3%	6.7	PASS
66701-27324	A	A417_B	EB	C	1501	1477	-1.6%	0.6	PASS
65416-26092	U	A417_B	EB	C	476	425	-10.8%	2.4	PASS
26047-65966	U	A417_B	EB	C	334	221	-33.7%	6.8	FAIL
26046-26044	U	A417_B	EB	C	135	56	-58.7%	8.1	PASS
26045-26044	U	A417_B	EB	C	55	133	144.1%	8.1	PASS
26017-65413	B	A417_B	EB	C	227	229	0.7%	0.1	PASS
26014-26015	U	A417_B	EB	C	186	228	22.6%	2.9	PASS
60119-60118	A	A417_B	EB	C	365	267	-26.9%	5.5	PASS
28047-28046	U	A417_B	EB	C	119	175	47.0%	4.6	PASS
27304-65109	B	A417_B	EB	C	1189	1209	1.7%	0.6	PASS
60317-60493	B	A417_B	WB	C	553	601	8.7%	2.0	PASS
65490-26086	A	A417_B	WB	C	1525	1527	0.1%	0.1	PASS
26049-27531	U	A417_B	WB	C	427	365	-14.6%	3.1	PASS
65419-65417	U	A417_B	WB	C	129	147	14.3%	1.6	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
27322-26084	A	A417_B	WB	C	1305	1342	2.8%	1.0	PASS
26092-65416	U	A417_B	WB	C	634	605	-4.6%	1.2	PASS
65966-26047	U	A417_B	WB	C	573	427	-25.5%	6.5	FAIL
26044-26046	U	A417_B	WB	C	130	71	-45.6%	5.9	PASS
26044-26045	U	A417_B	WB	C	65	90	39.0%	2.9	PASS
65413-26017	B	A417_B	WB	C	240	274	14.5%	2.2	PASS
26015-26014	U	A417_B	WB	C	243	382	57.2%	7.9	FAIL
60117-60119	A	A417_B	WB	C	425	262	-38.2%	8.8	FAIL
28046-28047	U	A417_B	WB	C	95	116	22.8%	2.1	PASS
65110-27309	B	A417_B	WB	C	1617	1638	1.3%	0.5	PASS
65390-65391	U	A417_E	EB	C	61	58	-5.0%	0.4	PASS
26010-65674	U	A417_E	EB	C	156	184	18.0%	2.2	PASS
65877-27341	A	A417_E	EB	C	287	300	4.7%	0.8	PASS
65471-60529	A	A417_E	EB	C	1090	1051	-3.6%	1.2	PASS
65391-65390	U	A417_E	WB	C	66	66	0.6%	0.0	PASS
65674-26010	U	A417_E	WB	C	186	205	10.3%	1.4	PASS
27341-65877	A	A417_E	WB	C	577	575	-0.3%	0.1	PASS
65470-60540	A	A417_E	WB	C	1277	1316	3.1%	1.1	PASS
60262-60266	A	A417_G	EB	C	802	878	9.6%	2.7	PASS
26024-26064	B	A417_G	EB	C	24	14	-39.7%	2.2	PASS
65894-60289	B	A417_G	EB	C	147	147	0.1%	0.0	PASS
26030-26031	U	A417_G	EB	C	5	14	167.2%	2.9	PASS
26069-26028	U	A417_G	EB	C	27	25	-5.2%	0.3	PASS
26019-26068	U	A417_G	EB	C	7	3	-62.0%	2.0	PASS
27581-60262	A	A417_G	WB	C	851	834	-1.9%	0.6	PASS
26064-26024	B	A417_G	WB	C	29	14	-51.3%	3.2	PASS
60289-65894	B	A417_G	WB	C	475	552	16.1%	3.4	PASS
26031-26030	U	A417_G	WB	C	100	35	-65.4%	8.0	PASS
26028-26069	U	A417_G	WB	C	30	59	97.5%	4.4	PASS
26068-26019	U	A417_G	WB	C	5	9	70.6%	1.4	PASS
27583-26026	A	A417_H	EB	C	886	875	-1.3%	0.4	PASS
26024-26064	U	A417_H	EB	C	24	14	-39.7%	2.2	PASS
26080-27589	U	A417_H	EB	C	247	261	5.7%	0.9	PASS
26080-26060	A	A417_H	EB	C	455	463	1.9%	0.4	PASS
26034-26035	U	A417_H	EB	C	5	2	-65.4%	1.8	PASS
26032-26035	U	A417_H	EB	C	5	9	76.5%	1.4	PASS
26032-26033	U	A417_H	EB	C	5	9	85.7%	1.6	PASS
65411-26059	U	A417_H	EB	C	262	258	-1.6%	0.3	PASS
26026-27583	A	A417_H	WB	C	1016	999	-1.7%	0.5	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26064-26024	U	A417_H	WB	C	29	14	-51.3%	3.2	PASS
27589-26080	U	A417_H	WB	C	248	320	29.0%	4.3	PASS
26060-26080	A	A417_H	WB	C	560	574	2.6%	0.6	PASS
26035-26034	U	A417_H	WB	C	11	1	-90.7%	4.0	PASS
26035-26032	U	A417_H	WB	C	4	18	337.4%	4.2	PASS
26033-26032	U	A417_H	WB	C	62	3	-94.6%	10.3	PASS
26059-65411	U	A417_H	WB	C	77	152	96.7%	7.0	PASS
26040-60550	A	A417_I	EB	C	397	373	-5.8%	1.2	PASS
26063-26039	U	A417_I	EB	C	35	63	79.1%	4.0	PASS
27112-60546	A	A417_I	EB	C	390	386	-1.1%	0.2	PASS
65675-65391	A	A417_I	EB	C	177	176	-0.6%	0.1	PASS
60550-26040	A	A417_I	WB	C	427	387	-9.4%	2.0	PASS
26039-26063	U	A417_I	WB	C	27	74	169.3%	6.5	PASS
60546-27112	A	A417_I	WB	C	459	464	1.1%	0.2	PASS
65391-65675	A	A417_I	WB	C	245	238	-2.9%	0.5	PASS
65471-60529	A	Cirencester	IB	C	1090	1051	-3.6%	1.2	PASS
60536-60535	A	Cirencester	IB	C	546	631	15.5%	3.5	PASS
60558-27573	A	Cirencester	IB	C	277	191	-30.9%	5.6	PASS
62962-60530	A	Cirencester	IB	C	1305	1307	0.2%	0.1	PASS
62782-60515	A	Cirencester	IB	C	671	560	-16.6%	4.5	PASS
27524-65370	U	Cirencester	IB	C	151	261	73.0%	7.7	FAIL
60514-27552	A	Cirencester	IB	C	546	546	0.1%	0.0	PASS
65877-27341	A	Cirencester	IB	C	287	300	4.7%	0.8	PASS
65388-65944	A	Cirencester	IB	C	472	474	0.5%	0.1	PASS
65470-60540	A	Cirencester	OB	C	1277	1316	3.1%	1.1	PASS
60535-60536	A	Cirencester	OB	C	482	570	18.3%	3.8	PASS
27573-60558	A	Cirencester	OB	C	275	187	-32.0%	5.8	PASS
65469-62963	A	Cirencester	OB	C	1095	1095	0.0%	0.0	PASS
60515-62782	A	Cirencester	OB	C	663	580	-12.6%	3.3	PASS
65370-27524	U	Cirencester	OB	C	137	220	60.8%	6.2	PASS
27552-60514	A	Cirencester	OB	C	675	674	-0.2%	0.0	PASS
27341-65877	A	Cirencester	OB	C	577	575	-0.3%	0.1	PASS
65944-65388	A	Cirencester	OB	C	676	660	-2.3%	0.6	PASS
28117-28118	U	J10_A	NB	C	63	29	-54.8%	5.1	PASS
28122-28123	U	J10_A	NB	C	177	212	19.4%	2.5	PASS
65948-60390	A	J10_A	NB	C	1099	952	-13.3%	4.6	PASS
28118-28117	U	J10_A	SB	C	29	7	-74.1%	5.0	PASS
28123-28122	U	J10_A	SB	C	117	138	18.1%	1.9	PASS
60390-65948	A	J10_A	SB	C	727	622	-14.5%	4.0	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
60217-60216	A	J10_B	EB	C	1058	1051	-0.6%	0.2	PASS
27252-27240	A	J10_B	EB	C	1082	1088	0.6%	0.2	PASS
65681-60406	B	J10_B	EB	C	114	114	0.2%	0.0	PASS
60436-60414	A	J10_B	EB	C	389	465	19.6%	3.7	PASS
60216-27452	A	J10_B	WB	C	1930	1839	-4.7%	2.1	PASS
27240-27252	A	J10_B	WB	C	1208	1306	8.1%	2.8	PASS
60406-65681	B	J10_B	WB	C	261	260	-0.3%	0.0	PASS
60414-60436	A	J10_B	WB	C	485	478	-1.5%	0.3	PASS
60395-60398	A	J10_C	NB	C	652	828	27.0%	6.5	FAIL
65432-56435	U	J10_C	NB	C	224	49	-78.2%	15.0	FAIL
27142-27156	A	J10_C	NB	C	746	606	-18.8%	5.4	FAIL
27066-27067	B	J10_C	NB	C	479	620	29.4%	6.0	FAIL
60398-60395	A	J10_C	SB	C	491	631	28.6%	5.9	FAIL
56435-65432	U	J10_C	SB	C	176	35	-80.3%	13.8	FAIL
27156-27142	A	J10_C	SB	C	594	569	-4.2%	1.0	PASS
27067-27066	B	J10_C	SB	C	366	389	6.3%	1.2	PASS
28202-60057	B	Stroud_A	EB	C	176	176	0.0%	0.0	PASS
28172-28170	U	Stroud_A	EB	C	105	105	0.5%	0.0	PASS
28108-28107	U	Stroud_A	EB	C	96	96	-0.2%	0.0	PASS
28003-62401	B	Stroud_A	EB	C	187	174	-6.7%	0.9	PASS
28003-28004	U	Stroud_A	EB	C	114	127	11.5%	1.2	PASS
28001-28000	U	Stroud_A	EB	C	43	55	28.0%	1.7	PASS
60057-28202	B	Stroud_A	WB	C	238	239	0.4%	0.1	PASS
28171-28172	U	Stroud_A	WB	C	95	95	-0.2%	0.0	PASS
28107-28108	U	Stroud_A	WB	C	150	149	-0.6%	0.1	PASS
62401-28003	B	Stroud_A	WB	C	202	182	-9.6%	1.4	PASS
28004-28003	U	Stroud_A	WB	C	162	159	-1.3%	0.2	PASS
28000-28001	U	Stroud_A	WB	C	37	48	27.9%	1.6	PASS
28061-28063	U	Stroud_B	EB	C	88	100	13.6%	1.2	PASS
27421-27417	A	Stroud_B	EB	C	786	780	-0.7%	0.2	PASS
28037-28036	U	Stroud_B	EB	C	155	149	-3.8%	0.5	PASS
28105-28026	A	Stroud_B	EB	C	425	445	4.8%	1.0	PASS
60015-28176	B	Stroud_B	EB	C	329	310	-5.8%	1.1	PASS
28015-28016	U	Stroud_B	EB	C	14	31	127.0%	3.7	PASS
62389-28167	B	Stroud_B	EB	C	666	667	0.0%	0.0	PASS
28063-28061	U	Stroud_B	WB	C	19	0	-100.0%	6.1	PASS
27417-27421	A	Stroud_B	WB	C	992	1033	4.1%	1.3	PASS
28036-28037	U	Stroud_B	WB	C	173	104	-40.0%	5.9	PASS
28026-28105	A	Stroud_B	WB	C	371	389	4.8%	0.9	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
28176-60015	B	Stroud_B	WB	C	206	195	-5.8%	0.8	PASS
28016-28015	U	Stroud_B	WB	C	22	49	120.6%	4.5	PASS
28167-62389	B	Stroud_B	WB	C	594	592	-0.3%	0.1	PASS
60050-28094	A	Stroud_C	EB	V	540	635	17.5%	3.9	PASS
28021-28022	U	Stroud_C	EB	V	57	70	22.8%	1.6	PASS
65683-27506	B	Stroud_C	EB	V	94	90	-4.4%	0.4	PASS
62455-62408	A	Stroud_C	EB	V	252	229	-8.9%	1.5	PASS
28152-28174	A	Stroud_C	EB	V	269	242	-10.0%	1.7	PASS
28094-60050	A	Stroud_C	WB	V	700	684	-2.2%	0.6	PASS
28022-28021	U	Stroud_C	WB	V	48	89	86.1%	5.0	PASS
27506-65683	B	Stroud_C	WB	V	136	136	0.0%	0.0	PASS
62408-62455	A	Stroud_C	WB	V	356	272	-23.5%	4.7	PASS
28174-28152	A	Stroud_C	WB	V	208	261	25.9%	3.5	PASS
26006-27386	U	Stroud_cordon	IB	C	124	126	1.8%	0.2	PASS
60090-27384	A	Stroud_cordon	IB	C	599	590	-1.6%	0.4	PASS
26066-65897	B	Stroud_cordon	IB	C	85	86	0.2%	0.0	PASS
26071-26001	U	Stroud_cordon	IB	C	210	219	4.2%	0.6	PASS
65380-28078	A	Stroud_cordon	IB	C	609	606	-0.5%	0.1	PASS
28082-28106	U	Stroud_cordon	IB	C	127	135	6.2%	0.7	PASS
27350-27349	B	Stroud_cordon	IB	C	60	53	-12.2%	1.0	PASS
27353-27352	A	Stroud_cordon	IB	C	301	289	-3.9%	0.7	PASS
27358-27357	B	Stroud_cordon	IB	C	268	268	0.0%	0.0	PASS
65683-27506	B	Stroud_cordon	IB	C	94	90	-4.4%	0.4	PASS
65405-27505	U	Stroud_cordon	IB	C	176	180	2.3%	0.3	PASS
28030-28138	U	Stroud_cordon	IB	C	76	62	-18.9%	1.7	PASS
60074-27370	A	Stroud_cordon	IB	C	934	916	-1.9%	0.6	PASS
27393-60072	B	Stroud_cordon	IB	C	400	417	4.2%	0.8	PASS
27386-26006	U	Stroud_cordon	OB	C	110	144	31.8%	3.1	PASS
27384-60090	A	Stroud_cordon	OB	C	602	579	-3.7%	0.9	PASS
65897-26066	B	Stroud_cordon	OB	C	66	45	-31.0%	2.7	PASS
26001-26071	U	Stroud_cordon	OB	C	119	127	6.9%	0.7	PASS
28078-65380	A	Stroud_cordon	OB	C	318	318	0.0%	0.0	PASS
28106-28082	U	Stroud_cordon	OB	C	125	118	-5.2%	0.6	PASS
27349-27350	B	Stroud_cordon	OB	C	65	72	10.8%	0.8	PASS
27352-27353	A	Stroud_cordon	OB	C	221	182	-17.4%	2.7	PASS
27357-27358	B	Stroud_cordon	OB	C	225	225	-0.1%	0.0	PASS
27506-65683	B	Stroud_cordon	OB	C	136	136	0.0%	0.0	PASS
27505-65405	U	Stroud_cordon	OB	C	167	171	2.4%	0.3	PASS
28138-28030	U	Stroud_cordon	OB	C	69	69	0.3%	0.0	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
27370-60074	A	Stroud_cordon	OB	C	910	886	-2.6%	0.8	PASS
60072-27393	B	Stroud_cordon	OB	C	269	291	8.4%	1.3	PASS
28000-28001	U	Stroud_D	NB	C	37	48	27.9%	1.6	PASS
28088-28089	A	Stroud_D	NB	C	505	479	-5.3%	1.2	PASS
28016-28015	U	Stroud_D	NB	C	22	49	120.6%	4.5	PASS
28204-28205	B	Stroud_D	NB	C	235	199	-15.1%	2.4	PASS
28208-62455	B	Stroud_D	NB	C	197	197	0.1%	0.0	PASS
28001-28000	U	Stroud_D	SB	C	43	55	28.0%	1.7	PASS
28089-28088	A	Stroud_D	SB	C	297	280	-5.5%	1.0	PASS
28015-28016	U	Stroud_D	SB	C	14	31	127.0%	3.7	PASS
28205-28204	B	Stroud_D	SB	C	162	159	-1.7%	0.2	PASS
62455-28208	B	Stroud_D	SB	C	174	173	-0.2%	0.0	PASS
28143-27347	A	Stroud_E	NB	C	652	754	15.7%	3.9	PASS
28146-28080	U	Stroud_E	NB	C	250	268	7.0%	1.1	PASS
28188-28187	U	Stroud_E	NB	C	106	44	-58.6%	7.2	PASS
65902-27342	A	Stroud_E	NB	C	651	590	-9.4%	2.5	PASS
27347-28143	A	Stroud_E	SB	C	543	605	11.5%	2.6	PASS
28080-28146	U	Stroud_E	SB	C	228	250	9.4%	1.4	PASS
28187-28188	U	Stroud_E	SB	C	102	99	-3.2%	0.3	PASS
27342-65902	A	Stroud_E	SB	C	560	479	-14.5%	3.6	PASS
27156-27142	A	Cheltenham	IB	C	594	569	-4.2%	1.0	PASS
27067-27066	B	Cheltenham	IB	C	366	389	6.3%	1.2	PASS
60550-26040	A	Cheltenham	IB	C	427	387	-9.4%	2.0	PASS
27110-27109	A	Cheltenham	IB	C	502	451	-10.1%	2.3	PASS
26058-27054	U	Cheltenham	IB	C	314	315	0.4%	0.1	PASS
27106-27104	A	Cheltenham	IB	C	711	614	-13.7%	3.8	PASS
65492-27088	A	Cheltenham	IB	C	1735	1830	5.5%	2.3	PASS
27039-27077	B	Cheltenham	IB	C	426	509	19.6%	3.9	PASS
28122-27192	B	Cheltenham	IB	C	314	339	7.9%	1.4	PASS
60390-65948	A	Cheltenham	IB	C	727	622	-14.5%	4.0	PASS
27142-27156	A	Cheltenham	OB	C	746	606	-18.8%	5.4	FAIL
27066-27067	B	Cheltenham	OB	C	479	620	29.4%	6.0	FAIL
26040-60550	A	Cheltenham	OB	C	397	373	-5.8%	1.2	PASS
27109-27110	A	Cheltenham	OB	C	343	302	-12.0%	2.3	PASS
27054-26058	U	Cheltenham	OB	C	265	254	-4.1%	0.7	PASS
27104-27106	A	Cheltenham	OB	C	627	609	-2.9%	0.7	PASS
27084-60315	A	Cheltenham	OB	C	2171	2183	0.6%	0.3	PASS
27077-27039	B	Cheltenham	OB	C	366	477	30.3%	5.4	FAIL
27192-28122	B	Cheltenham	OB	C	365	403	10.3%	1.9	PASS

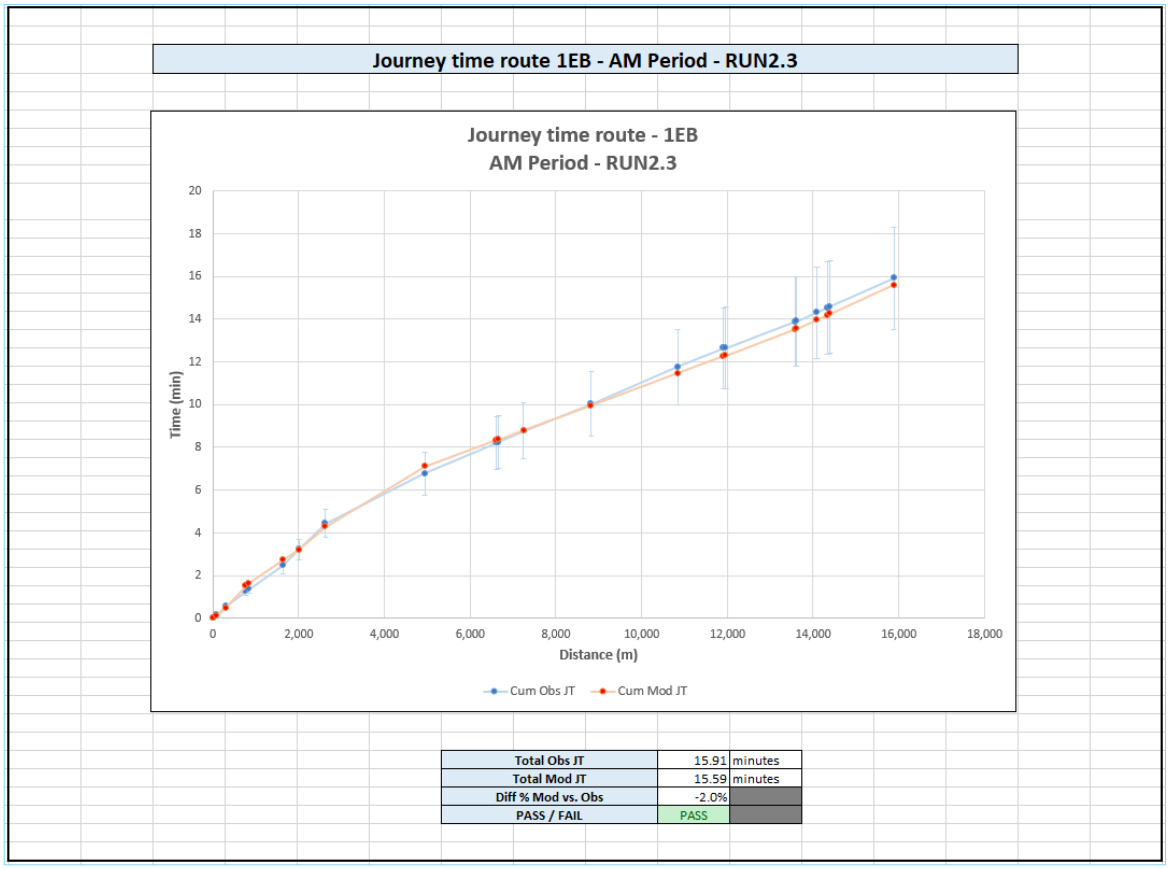
LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
65948-60390	A	Cheltenham	OB	C	1099	952	-13.3%	4.6	PASS
60317-60493	B	Gloucester	IB	C	553	601	8.7%	2.0	PASS
65490-26086	A	Gloucester	IB	C	1525	1527	0.1%	0.1	PASS
26048-65969	U	Gloucester	IB	C	234	234	0.0%	0.0	PASS
60256-27321	A	Gloucester	IB	C	1080	1172	8.5%	2.7	PASS
26091-27323	U	Gloucester	IB	C	374	374	-0.1%	0.0	PASS
26092-65416	U	Gloucester	IB	C	634	605	-4.6%	1.2	PASS
65413-26017	B	Gloucester	IB	C	240	274	14.5%	2.2	PASS
60117-60119	A	Gloucester	IB	C	425	262	-38.2%	8.8	FAIL
65110-27309	B	Gloucester	IB	C	1617	1638	1.3%	0.5	PASS
60091-27307	A	Gloucester	IB	C	475	454	-4.3%	1.0	PASS
60217-60216	A	Gloucester	IB	C	1058	1051	-0.6%	0.2	PASS
27252-27240	A	Gloucester	IB	C	1082	1088	0.6%	0.2	PASS
60395-28137	A	Gloucester	IB	C	533	483	-9.4%	2.2	PASS
60493-60317	B	Gloucester	OB	C	453	479	5.8%	1.2	PASS
66709-60304	A	Gloucester	OB	C	1425	1423	-0.2%	0.1	PASS
65969-26048	U	Gloucester	OB	C	211	211	0.1%	0.0	PASS
60257-60260	A	Gloucester	OB	C	1126	1195	6.2%	2.0	PASS
27323-26091	U	Gloucester	OB	C	484	486	0.3%	0.1	PASS
65416-26092	U	Gloucester	OB	C	476	425	-10.8%	2.4	PASS
26017-65413	B	Gloucester	OB	C	227	229	0.7%	0.1	PASS
60119-60118	A	Gloucester	OB	C	365	267	-26.9%	5.5	PASS
27304-65109	B	Gloucester	OB	C	1189	1209	1.7%	0.6	PASS
27307-60091	A	Gloucester	OB	C	470	448	-4.7%	1.0	PASS
60216-27452	A	Gloucester	OB	C	1930	1839	-4.7%	2.1	PASS
27240-27252	A	Gloucester	OB	C	1208	1306	8.1%	2.8	PASS
28137-60395	A	Gloucester	OB	C	431	407	-5.6%	1.2	PASS
65492-27088	A	A417_C	NB	V	1735	1830	5.5%	2.3	PASS
27531-26049	U	A417_C	NB	V	176	242	37.2%	4.5	PASS
27588-26050	A	A417_C	NB	V	915	915	0.0%	0.0	PASS
26058-27054	U	A417_C	NB	V	314	315	0.4%	0.1	PASS
27110-27109	A	A417_C	NB	V	502	451	-10.1%	2.3	PASS
26039-26063	U	A417_C	NB	V	27	74	169.3%	6.5	PASS
60550-26040	A	A417_C	NB	V	427	387	-9.4%	2.0	PASS
27084-60315	A	A417_C	SB	V	2171	2183	0.6%	0.3	PASS
26049-27531	U	A417_C	SB	V	427	365	-14.6%	3.1	PASS
26050-27588	A	A417_C	SB	V	899	944	5.0%	1.5	PASS
27054-26058	U	A417_C	SB	V	265	254	-4.1%	0.7	PASS
27109-27110	A	A417_C	SB	V	343	302	-12.0%	2.3	PASS

LinkID	Road Type	Screenline	SL Dir	Cal /Val	Obs	Mod	% Diff	GEH	Pass
26063-26039	U	A417_C	SB	V	35	63	79.1%	4.0	PASS
26040-60550	A	A417_C	SB	V	397	373	-5.8%	1.2	PASS
27108-26053	U	A417_D	EB	V	232	181	-21.6%	3.5	PASS
60292-26075	A	A417_D	EB	V	1496	1504	0.6%	0.2	PASS
26024-26023	U	A417_D	EB	V	197	195	-0.9%	0.1	PASS
26070-26022	U	A417_D	EB	V	18	14	-18.6%	0.8	PASS
26053-27108	U	A417_D	WB	V	280	348	24.2%	3.8	PASS
26075-60292	A	A417_D	WB	V	1337	1307	-2.3%	0.8	PASS
26023-26024	U	A417_D	WB	V	446	430	-3.8%	0.8	PASS
26022-26070	U	A417_D	WB	V	35	15	-56.2%	3.9	PASS
65959-26012	A	A417_F	NB	V	569	533	-6.3%	1.5	PASS
27594-27507	B	A417_F	NB	V	112	131	17.1%	1.7	PASS
27595-26021	A	A417_F	NB	V	291	219	-24.6%	4.5	PASS
26022-26070	U	A417_F	NB	V	35	15	-56.2%	3.9	PASS
26022-65895	B	A417_F	NB	V	174	164	-5.8%	0.8	PASS
26030-26025	U	A417_F	NB	V	81	19	-76.4%	8.7	PASS
26034-60286	A	A417_F	NB	V	1147	1239	8.0%	2.7	PASS
26032-26035	U	A417_F	NB	V	5	9	76.5%	1.4	PASS
65412-26036	A	A417_F	NB	V	433	443	2.3%	0.5	PASS
26012-65959	A	A417_F	SB	V	631	452	-28.3%	7.7	FAIL
27507-27594	B	A417_F	SB	V	91	110	19.8%	1.8	PASS
26021-27595	A	A417_F	SB	V	386	322	-16.5%	3.4	PASS
26070-26022	U	A417_F	SB	V	18	14	-18.6%	0.8	PASS
65895-26022	B	A417_F	SB	V	335	338	0.8%	0.1	PASS
26025-26030	U	A417_F	SB	V	12	20	65.7%	2.0	PASS
60286-26034	A	A417_F	SB	V	1114	1118	0.3%	0.1	PASS
26035-26032	U	A417_F	SB	V	4	18	337.4%	4.2	PASS
26036-65412	A	A417_F	SB	V	285	292	2.3%	0.4	PASS

Appendix F. Journey Time Validation

F.1 Journey Time Route Graphs

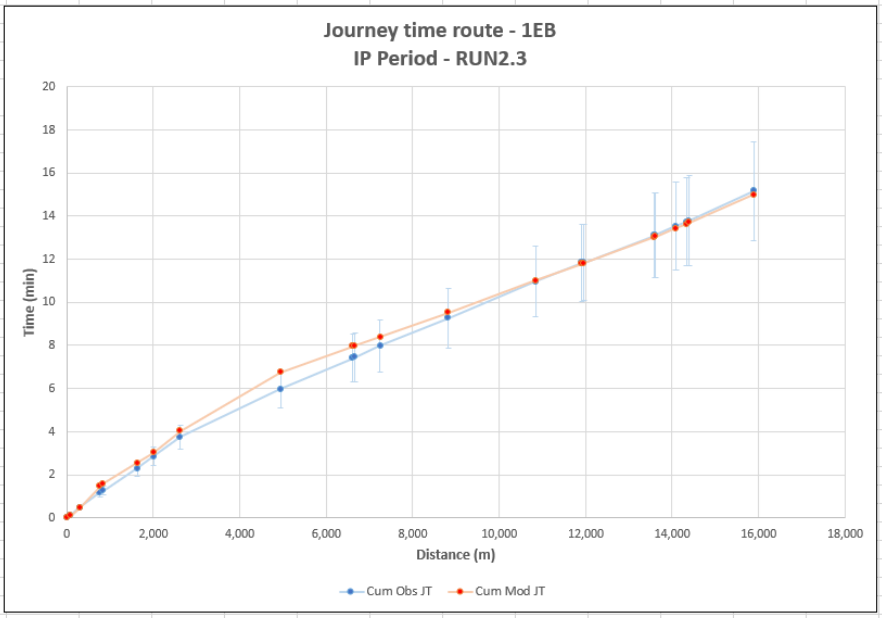
F.1.1 A46 EB - AM



Total Obs JT	15.91	minutes
Total Mod JT	15.59	minutes
Diff % Mod vs. Obs	-2.0%	
PASS / FAIL	PASS	

F.1.2 A46 EB – IP

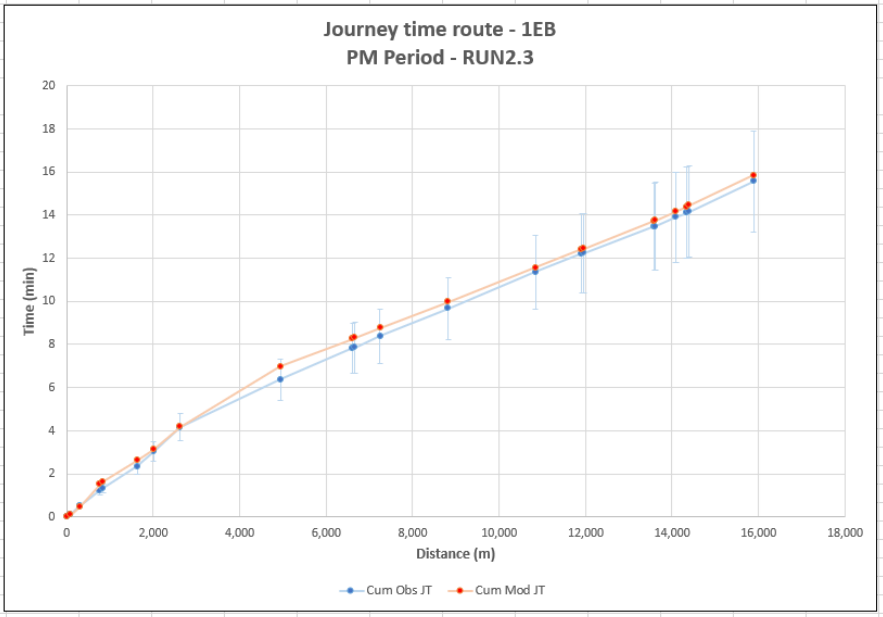
Journey time route 1EB - IP Period - RUN2.3



Total Obs JT	15.15	minutes
Total Mod JT	14.99	minutes
Diff % Mod vs. Obs	-1.0%	
PASS / FAIL	PASS	

F.1.3 A46 EB – PM

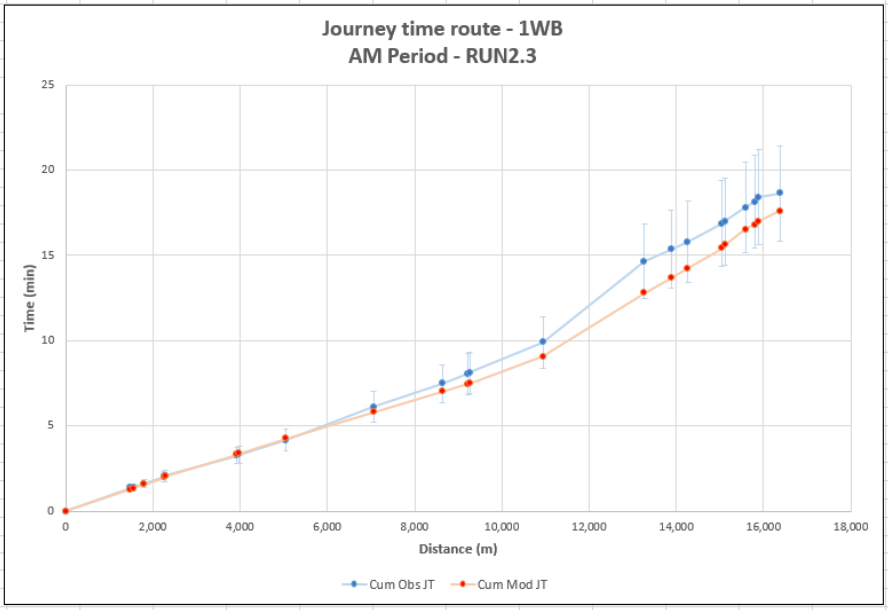
Journey time route 1EB - PM Period - RUN2.3



Total Obs JT	15.55	minutes
Total Mod JT	15.83	minutes
Diff % Mod vs. Obs	1.8%	
PASS / FAIL	PASS	

F.1.4 A46 WB – AM

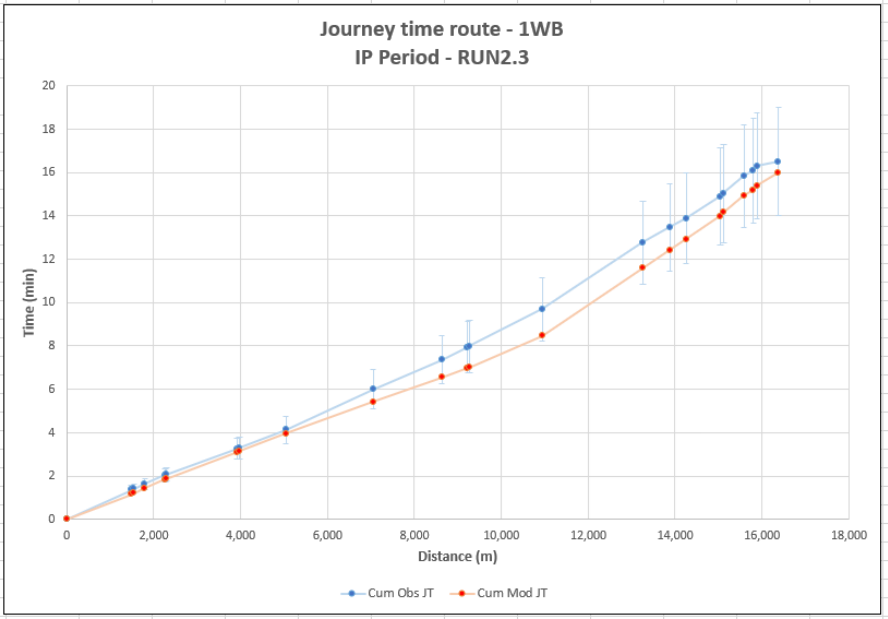
Journey time route 1WB - AM Period - RUN2.3



Total Obs JT	18.64	minutes
Total Mod JT	17.62	minutes
Diff % Mod vs. Obs	-5.5%	
PASS / FAIL	PASS	

F.1.5 A46 WB – IP

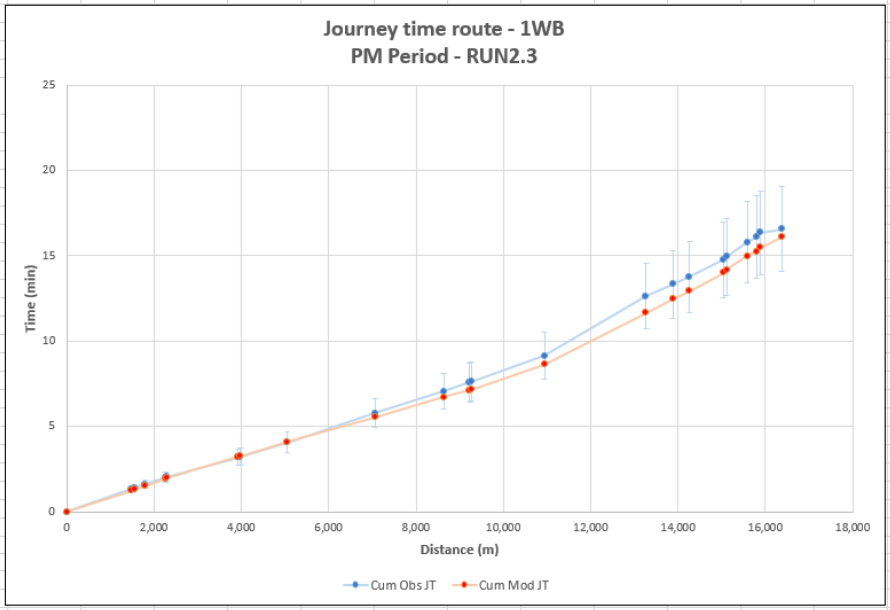
Journey time route 1WB - IP Period - RUN2.3



Total Obs JT	16.50	minutes
Total Mod JT	15.98	minutes
Diff % Mod vs. Obs	-3.2%	
PASS / FAIL	PASS	

F.1.6 A46 WB – PM

Journey time route 1WB - PM Period - RUN2.3



Total Obs JT	16.57	minutes
Total Mod JT	16.07	minutes
Diff % Mod vs. Obs	-3.0%	
PASS / FAIL	PASS	

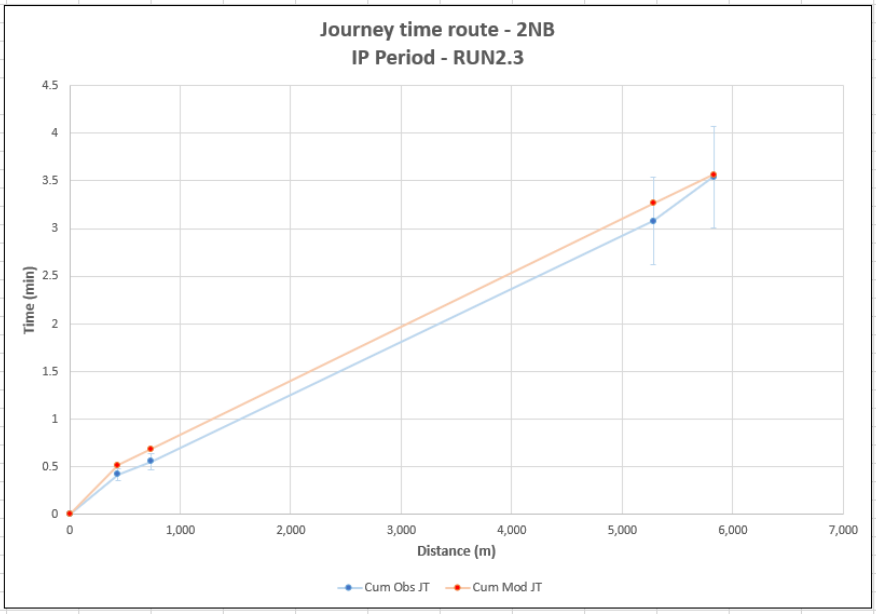
F.1.7 M5 J9J8 NB – AM

Journey time route 2NB - AM Period - RUN2.3

Total Obs JT	3.46	minutes
Total Mod JT	3.49	minutes
Diff % Mod vs. Obs	0.9%	
PASS / FAIL	PASS	

F.1.8 M5 J9J8 NB – IP

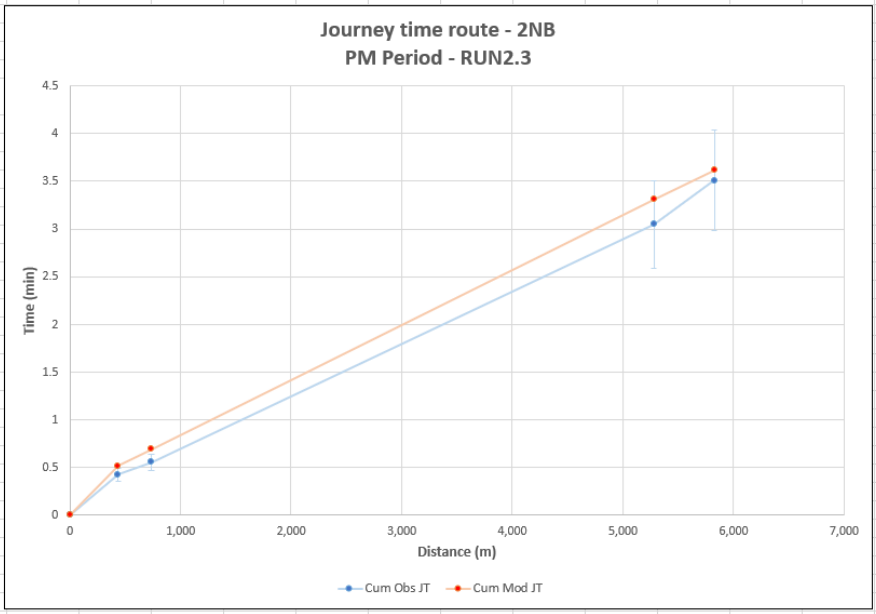
Journey time route 2NB - IP Period - RUN2.3



Total Obs JT	3.54	minutes
Total Mod JT	3.56	minutes
Diff % Mod vs. Obs	0.7%	
PASS / FAIL	PASS	

F.1.9 M5 J9J8 NB – PM

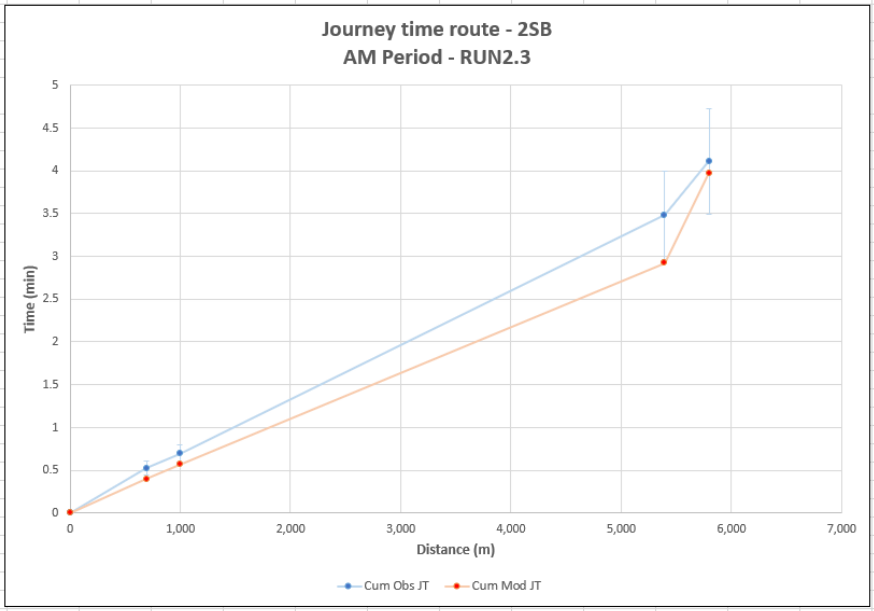
Journey time route 2NB - PM Period - RUN2.3



Total Obs JT	3.51	minutes
Total Mod JT	3.61	minutes
Diff % Mod vs. Obs	3.0%	
PASS / FAIL	PASS	

F.1.10 M5 J8J9 SB – AM

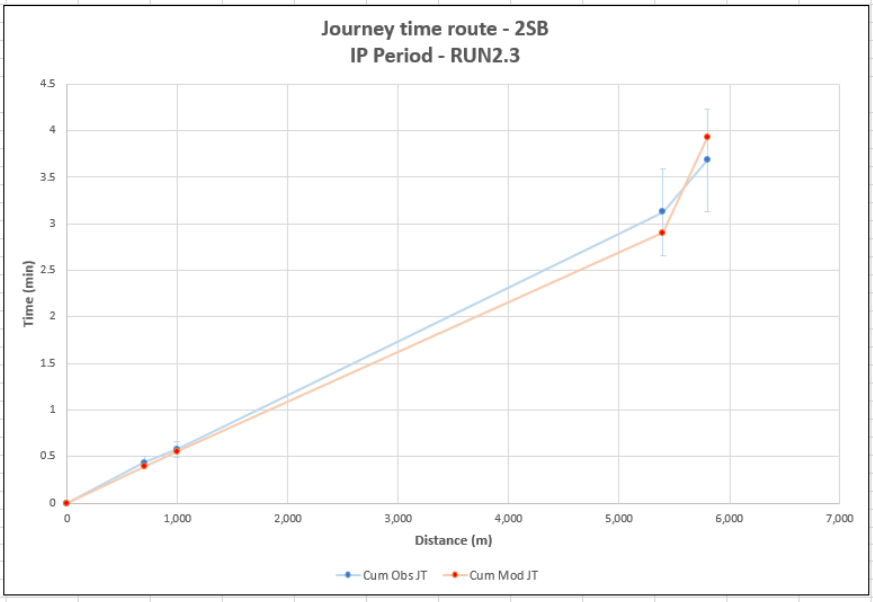
Journey time route 2SB - AM Period - RUN2.3



Total Obs JT	4.11	minutes
Total Mod JT	3.97	minutes
Diff % Mod vs. Obs	-3.4%	
PASS / FAIL	PASS	

F.1.11 M5 J8J9 SB – IP

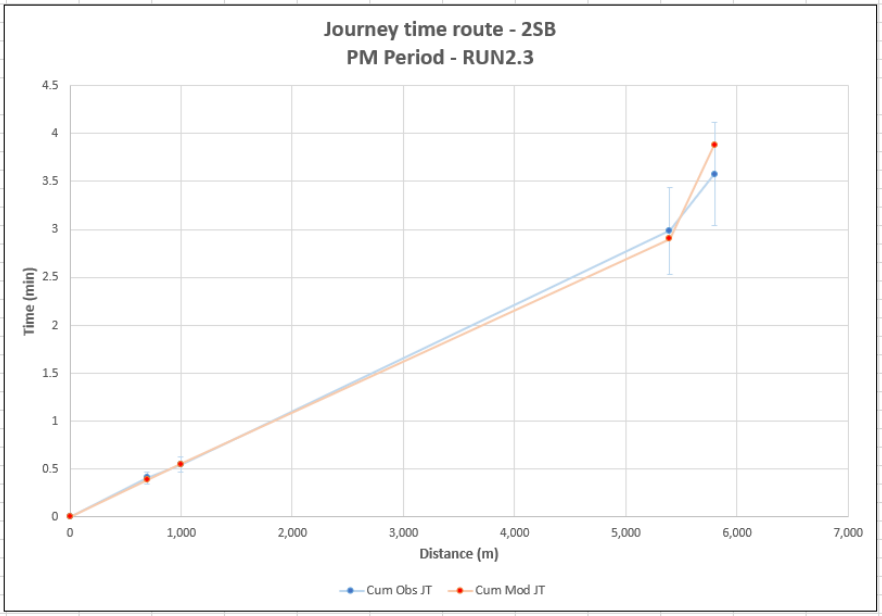
Journey time route 2SB - IP Period - RUN2.3



Total Obs JT	3.68	minutes
Total Mod JT	3.93	minutes
Diff % Mod vs. Obs	6.6%	
PASS / FAIL	PASS	

F.1.12 M5 J8J9 SB – PM

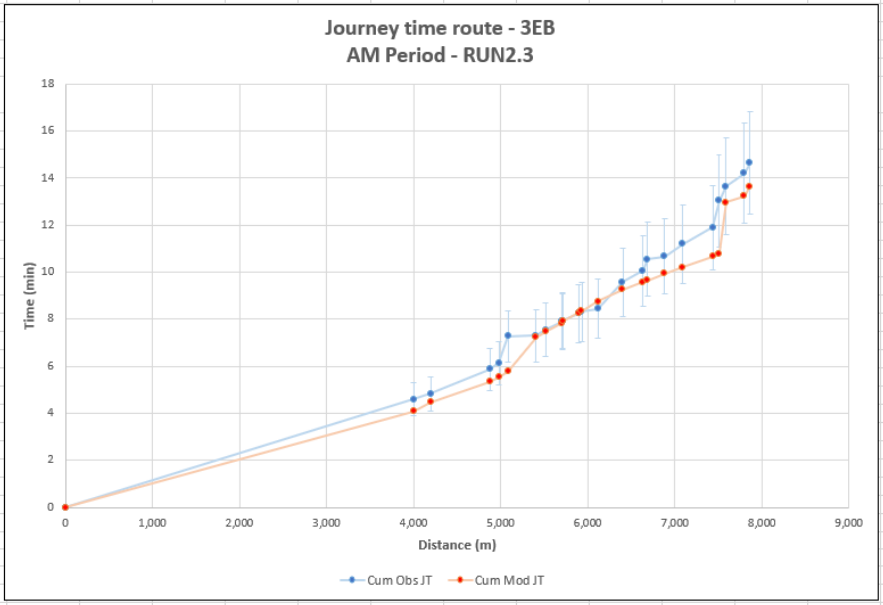
Journey time route 2SB - PM Period - RUN2.3



Total Obs JT	3.57	minutes
Total Mod JT	3.88	minutes
Diff % Mod vs. Obs	8.5%	
PASS / FAIL	PASS	

F.1.13 A438 EB - AM

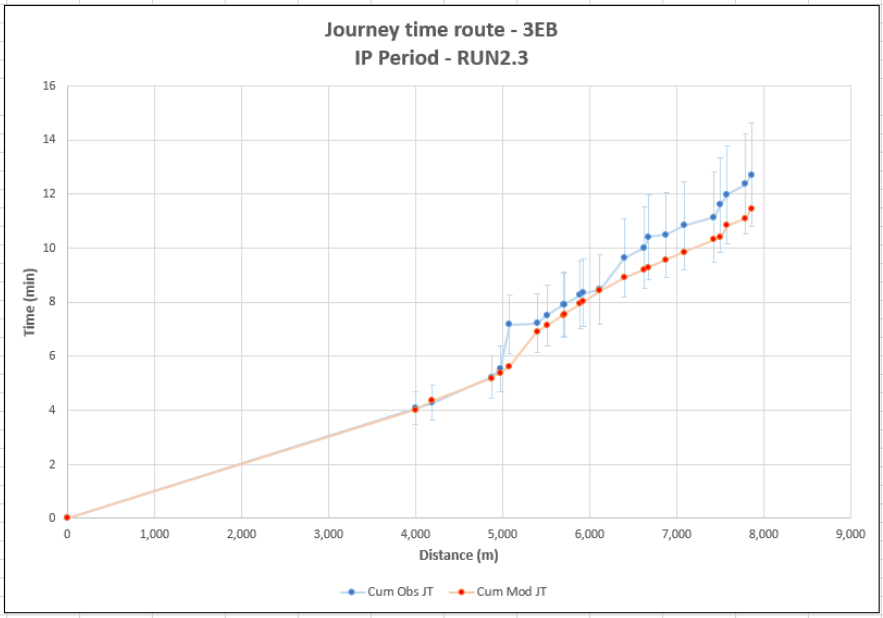
Journey time route 3EB - AM Period - RUN2.3



Total Obs JT	14.65	minutes
Total Mod JT	13.65	minutes
Diff % Mod vs. Obs	-6.8%	
PASS / FAIL	PASS	

F.1.14 A438 EB – IP

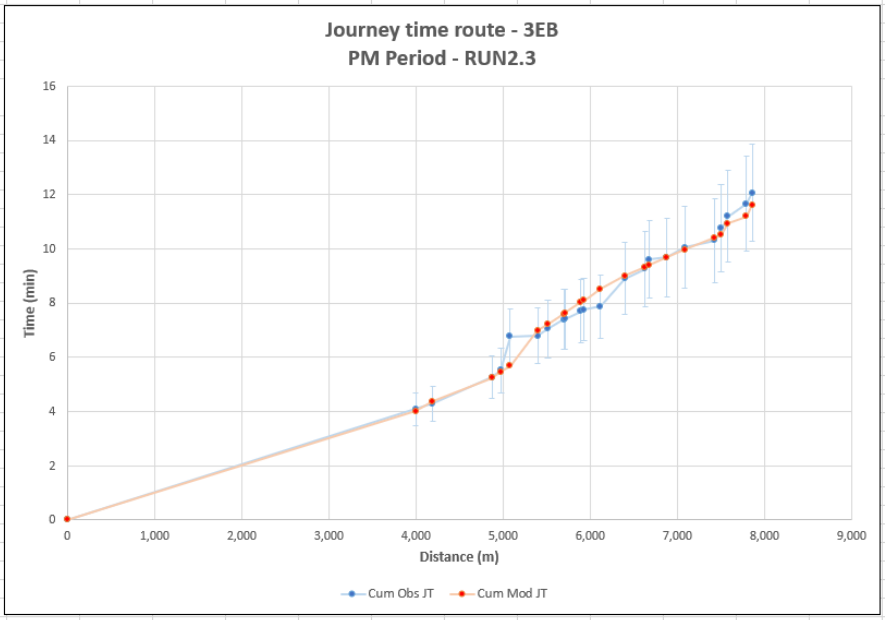
Journey time route 3EB - IP Period - RUN2.3



Total Obs JT	12.71	minutes
Total Mod JT	11.46	minutes
Diff % Mod vs. Obs	-9.9%	
PASS / FAIL	PASS	

F.1.15 A438 EB – PM

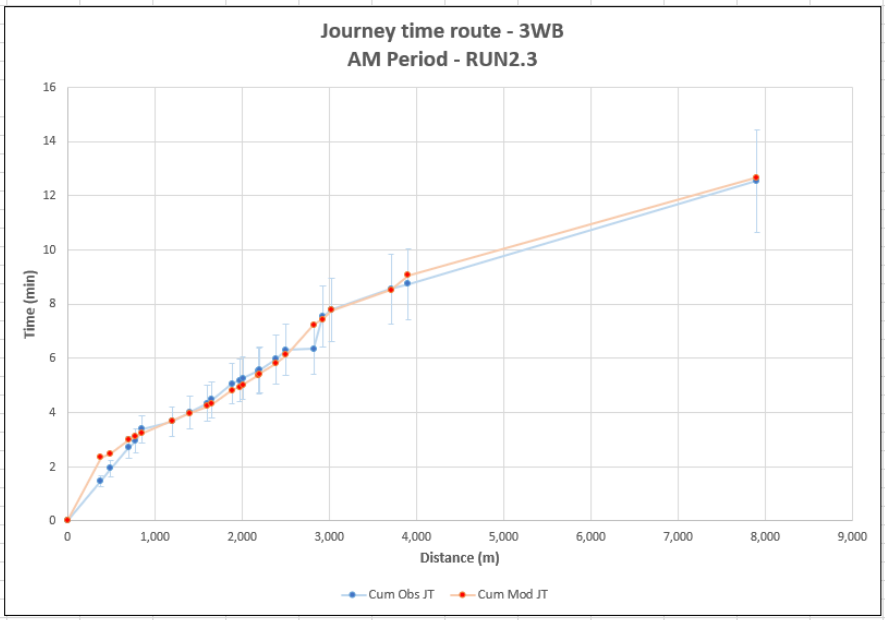
Journey time route 3EB - PM Period - RUN2.3



Total Obs JT	12.08	minutes
Total Mod JT	11.62	minutes
Diff % Mod vs. Obs	-3.8%	
PASS / FAIL	PASS	

F.1.16 A438 WB – AM

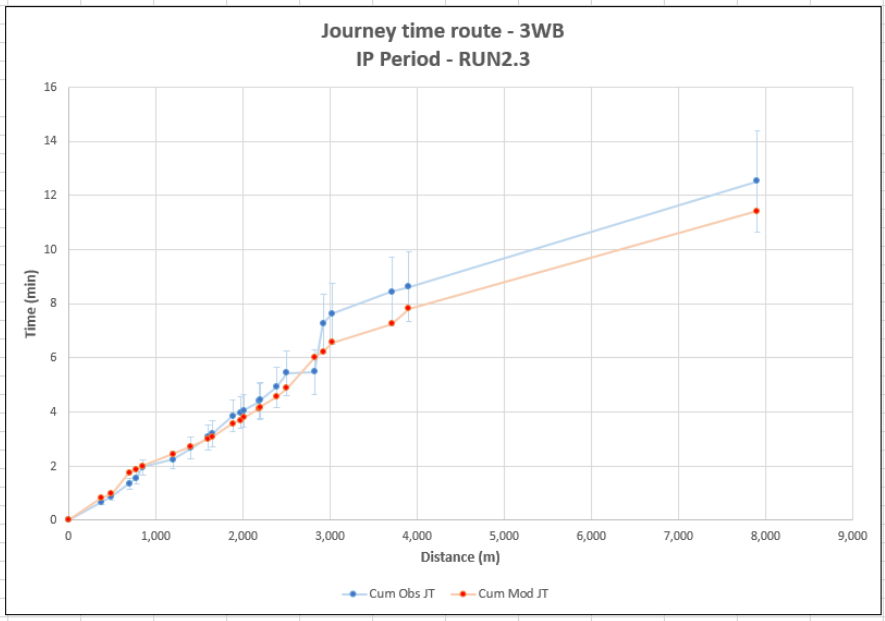
Journey time route 3WB - AM Period - RUN2.3



Total Obs JT	12.54	minutes
Total Mod JT	12.66	minutes
Diff % Mod vs. Obs	0.9%	
PASS / FAIL	PASS	

F.1.17 A438 WB – IP

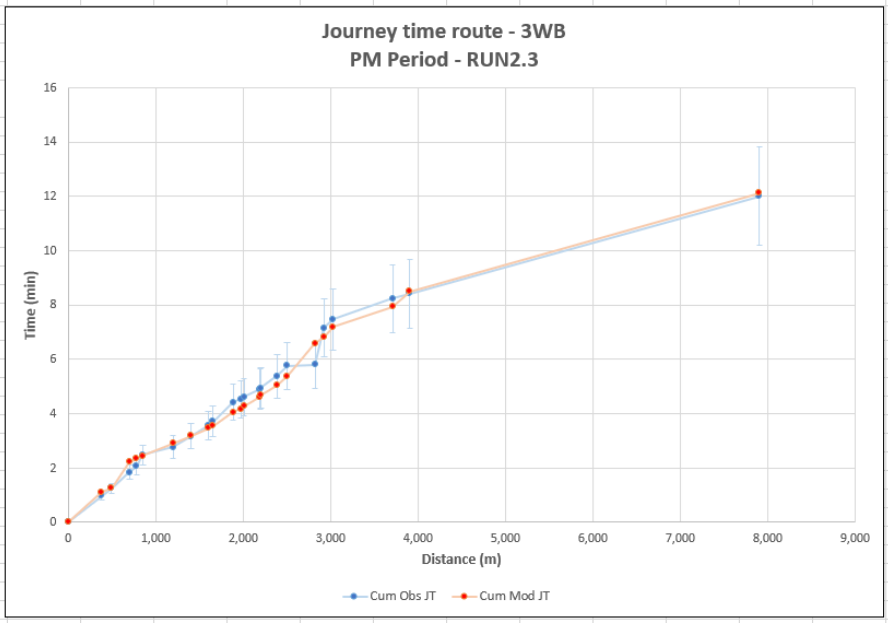
Journey time route 3WB - IP Period - RUN2.3



Total Obs JT	12.53	minutes
Total Mod JT	11.42	minutes
Diff % Mod vs. Obs	-8.8%	
PASS / FAIL	PASS	

F.1.18 A438 WB – PM

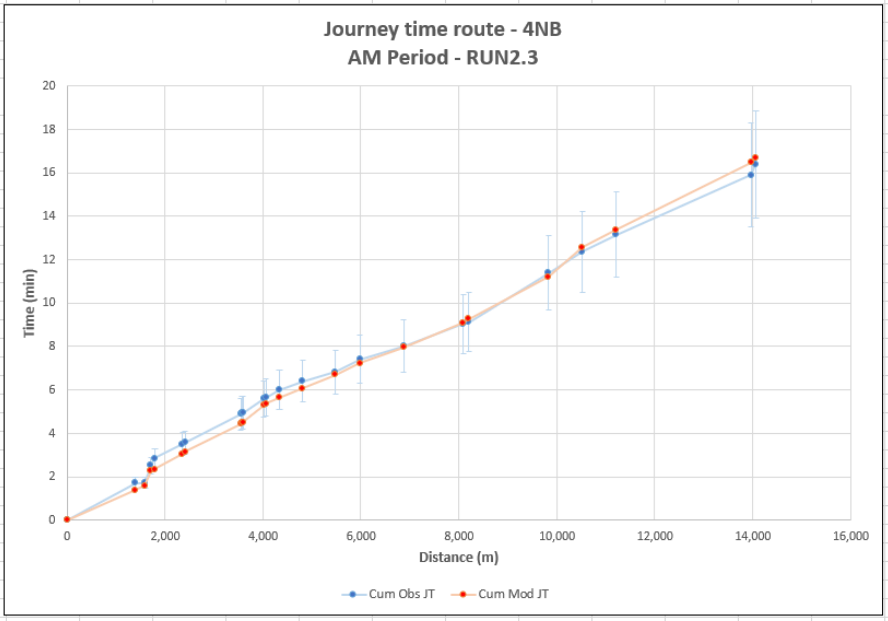
Journey time route 3WB - PM Period - RUN2.3



Total Obs JT	12.01	minutes
Total Mod JT	12.12	minutes
Diff % Mod vs. Obs	0.9%	
PASS / FAIL	PASS	

F.1.19 A435/B4079 NB - AM

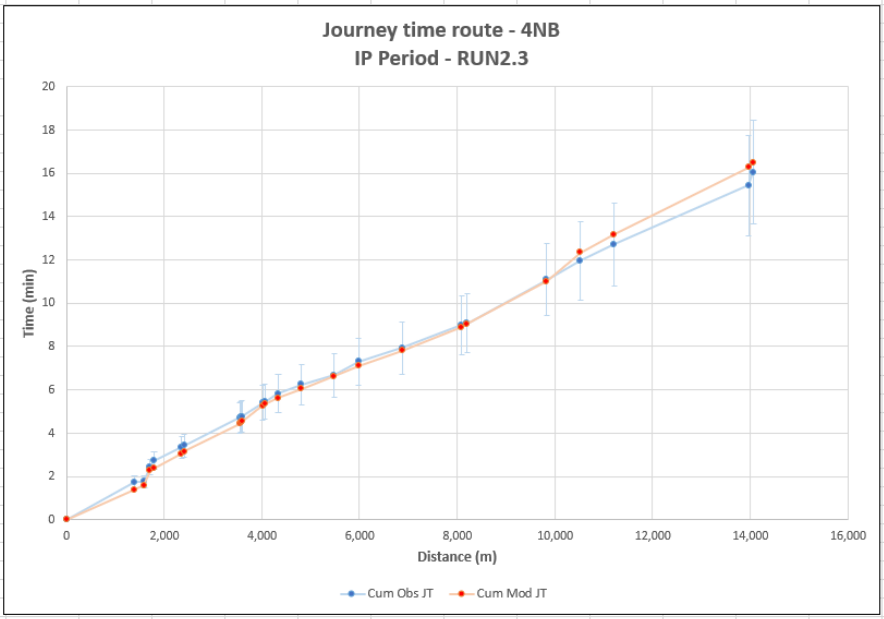
Journey time route 4NB - AM Period - RUN2.3



Total Obs JT	16.37	minutes
Total Mod JT	16.69	minutes
Diff % Mod vs. Obs	2.0%	
PASS / FAIL	PASS	

F.1.20 A435/B4079 NB – IP

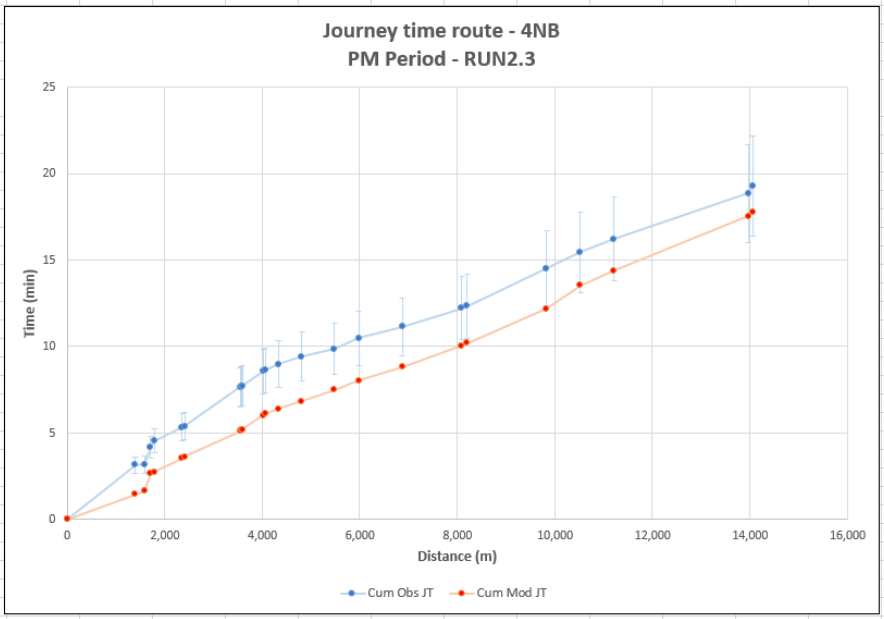
Journey time route 4NB - IP Period - RUN2.3



Total Obs JT	16.05	minutes
Total Mod JT	16.49	minutes
Diff % Mod vs. Obs	2.8%	
PASS / FAIL	PASS	

F.1.21 A435/B4079 NB – PM

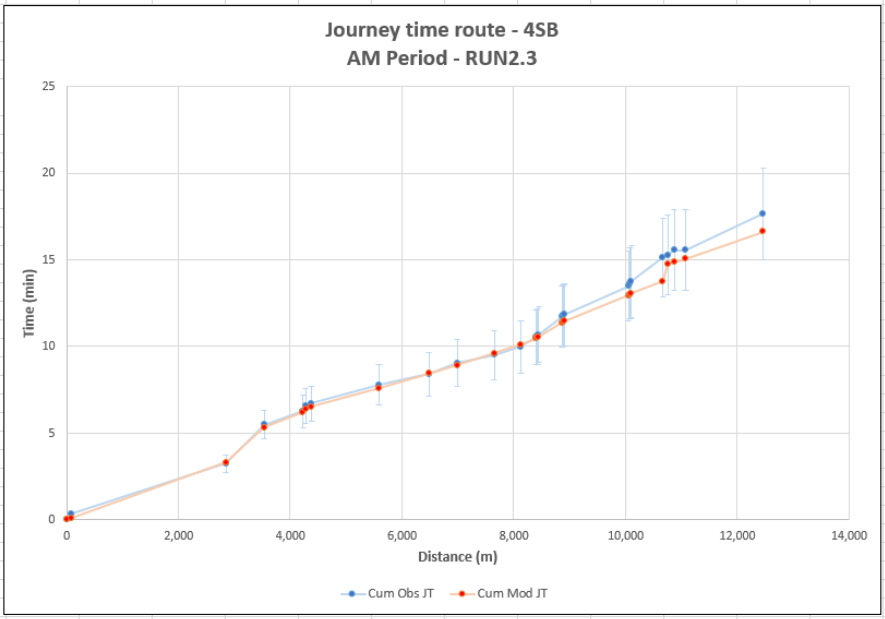
Journey time route 4NB - PM Period - RUN2.3



Total Obs JT	19.29	minutes
Total Mod JT	17.74	minutes
Diff % Mod vs. Obs	-8.0%	
PASS / FAIL	PASS	

F.1.22 A435/B4079 SB – AM

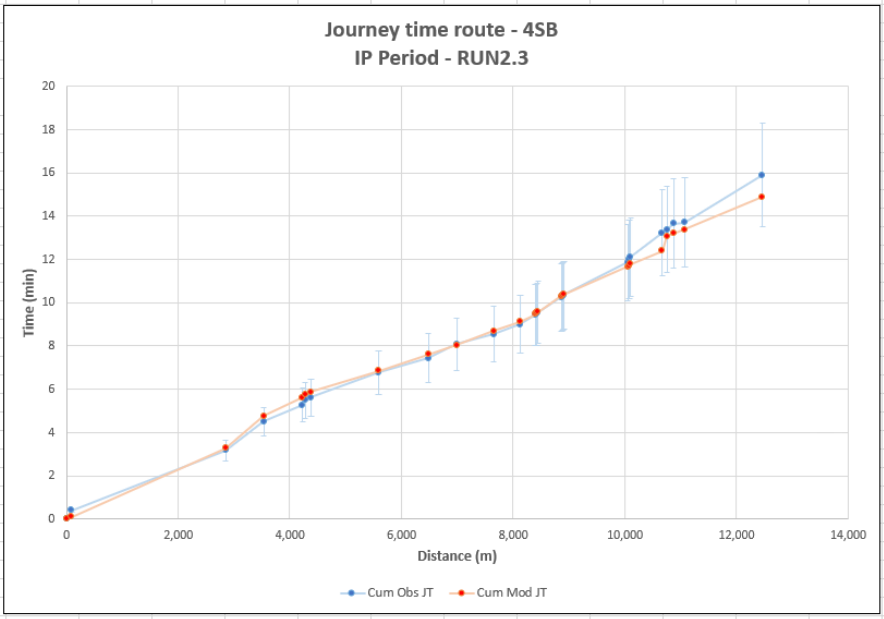
Journey time route 4SB - AM Period - RUN2.3



Total Obs JT	17.64	minutes
Total Mod JT	16.61	minutes
Diff % Mod vs. Obs	-5.8%	
PASS / FAIL	PASS	

F.1.23 A435/B4079 SB – IP

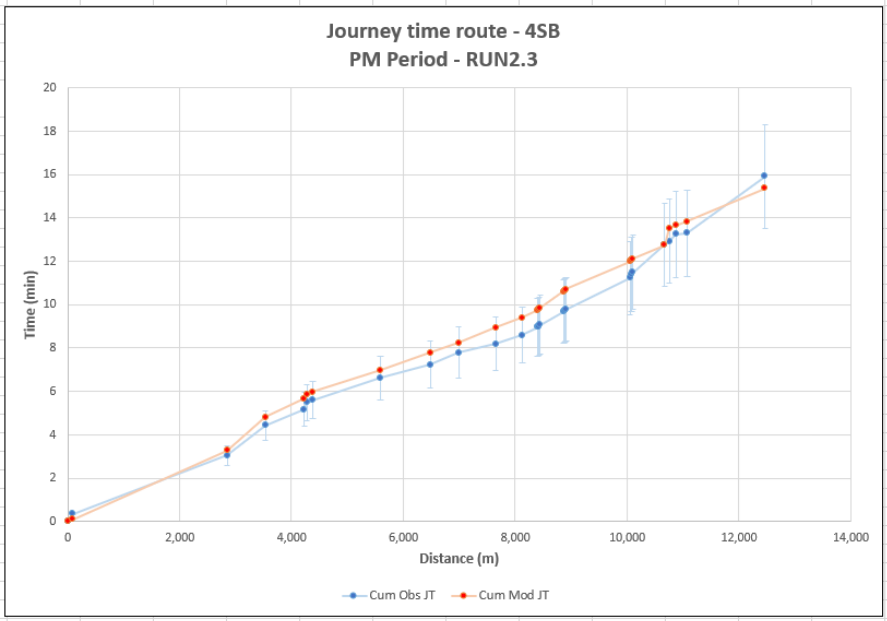
Journey time route 4SB - IP Period - RUN2.3



Total Obs JT	15.89	minutes
Total Mod JT	14.88	minutes
Diff % Mod vs. Obs	-6.3%	
PASS / FAIL	PASS	

F.1.24 A435/B4079 SB – PM

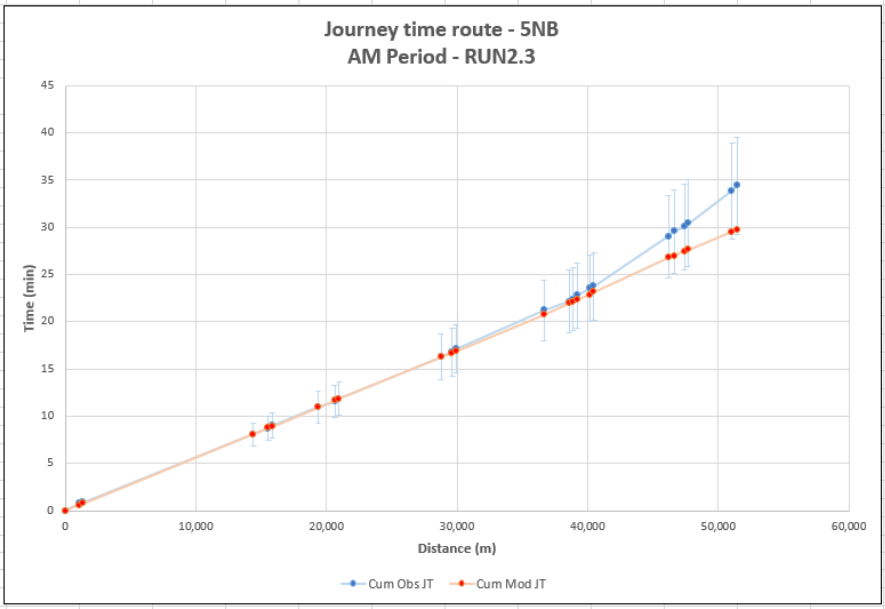
Journey time route 4SB - PM Period - RUN2.3



Total Obs JT	15.92	minutes
Total Mod JT	15.36	minutes
Diff % Mod vs. Obs	-3.5%	
PASS / FAIL	PASS	

F.1.25 M5/M42 NB – AM

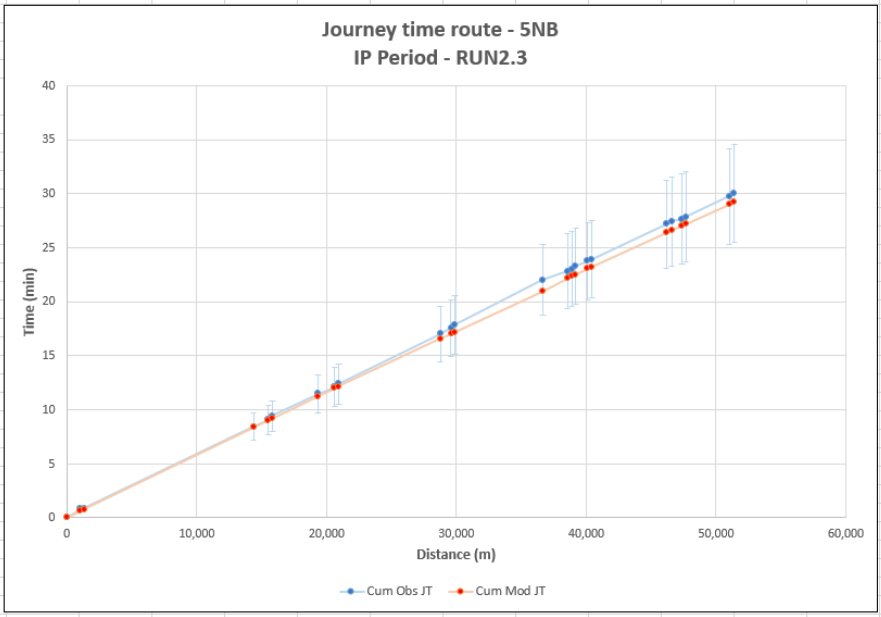
Journey time route 5NB - AM Period - RUN2.3



Total Obs JT	34.41	minutes
Total Mod JT	29.74	minutes
Diff % Mod vs. Obs	-13.6%	
PASS / FAIL	PASS	

F.1.26 M5/M42 NB – IP

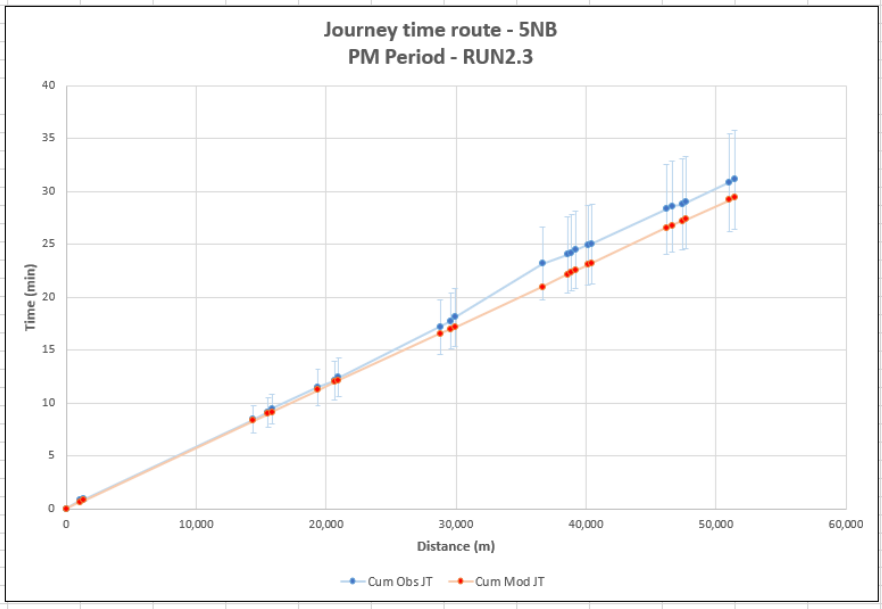
Journey time route 5NB - IP Period - RUN2.3



Total Obs JT	30.02	minutes
Total Mod JT	29.21	minutes
Diff % Mod vs. Obs	-2.7%	
PASS / FAIL	PASS	

F.1.27 M5/M42 NB – PM

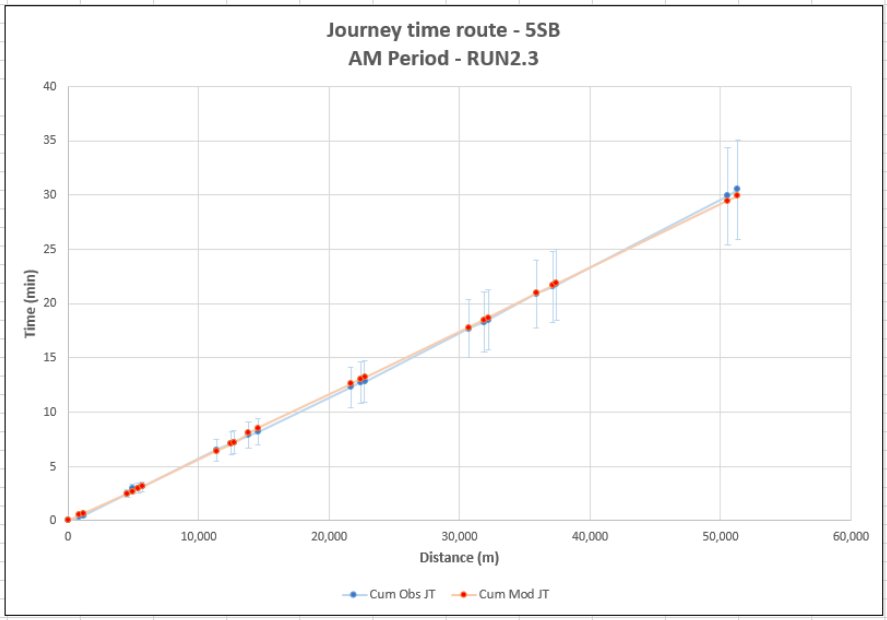
Journey time route 5NB - PM Period - RUN2.3



Total Obs JT	31.13	minutes
Total Mod JT	29.39	minutes
Diff % Mod vs. Obs	-5.6%	
PASS / FAIL	PASS	

F.1.28 M5/M42 SB – AM

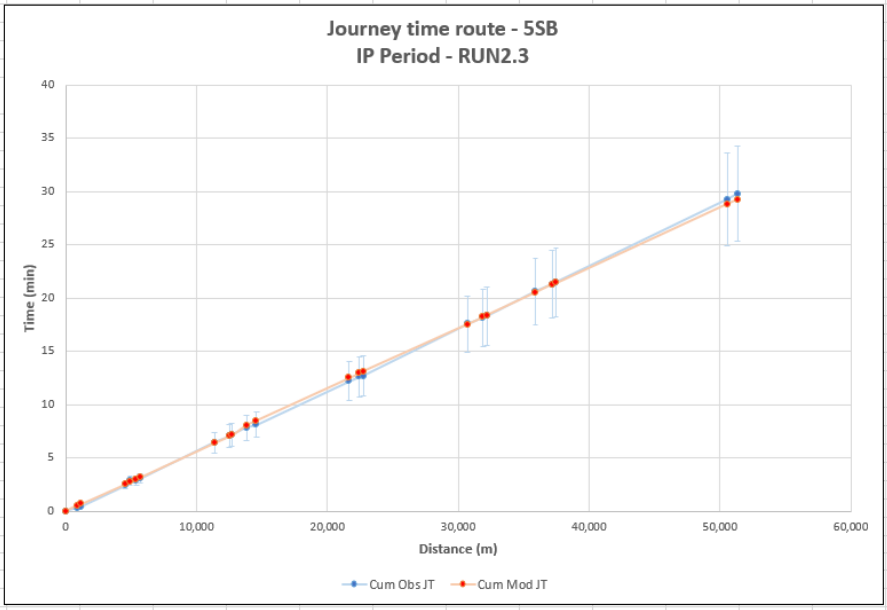
Journey time route 5SB - AM Period - RUN2.3



Total Obs JT	30.51	minutes
Total Mod JT	29.92	minutes
Diff % Mod vs. Obs	-1.9%	
PASS / FAIL	PASS	

F.1.29 M5/M42 SB - IP

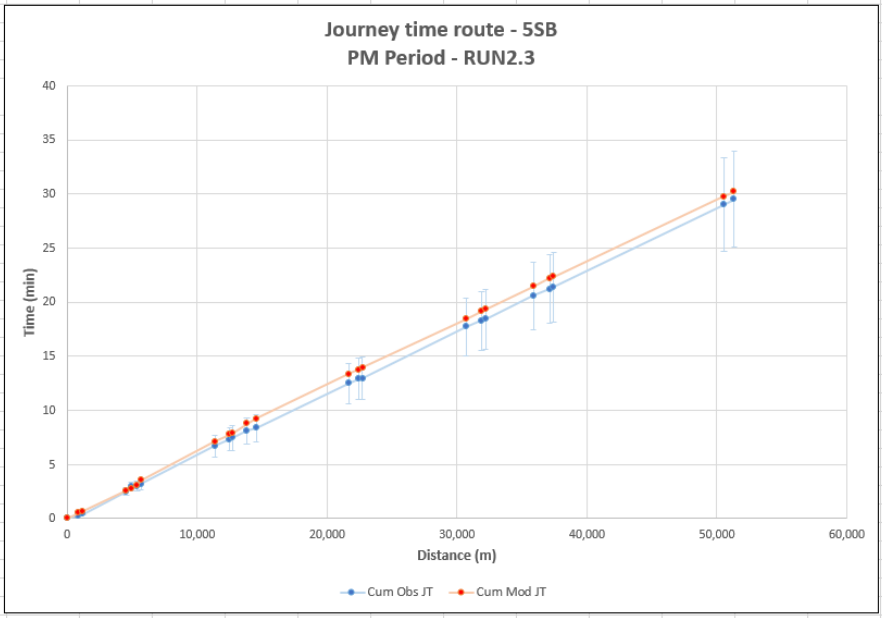
Journey time route 5SB - IP Period - RUN2.3



Total Obs JT	29.77	minutes
Total Mod JT	29.25	minutes
Diff % Mod vs. Obs	-1.7%	
PASS / FAIL	PASS	

F.1.30 M5/M42 SB – PM

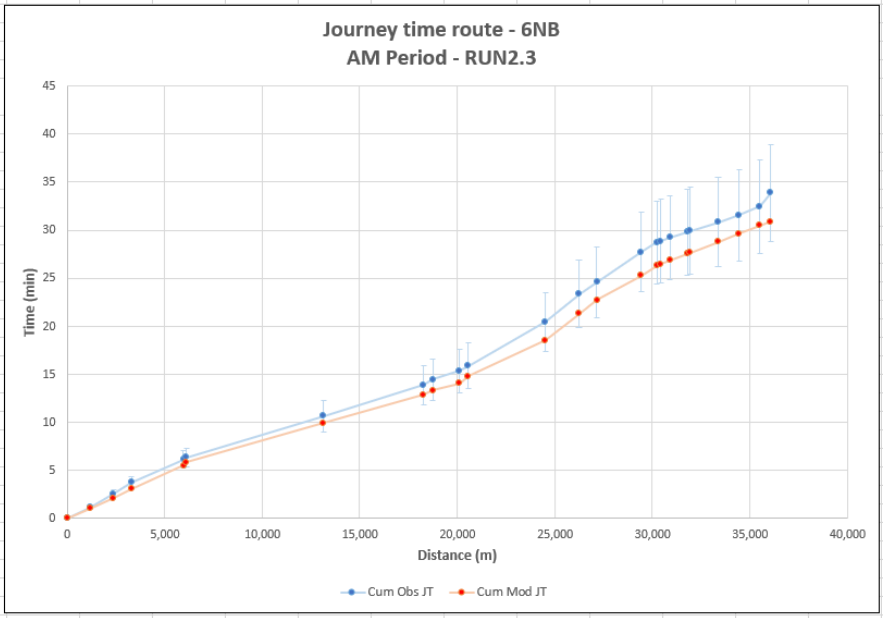
Journey time route 5SB - PM Period - RUN2.3



Total Obs JT	29.52	minutes
Total Mod JT	30.21	minutes
Diff % Mod vs. Obs	2.3%	
PASS / FAIL	PASS	

F.1.31 A435/A46 NB – AM

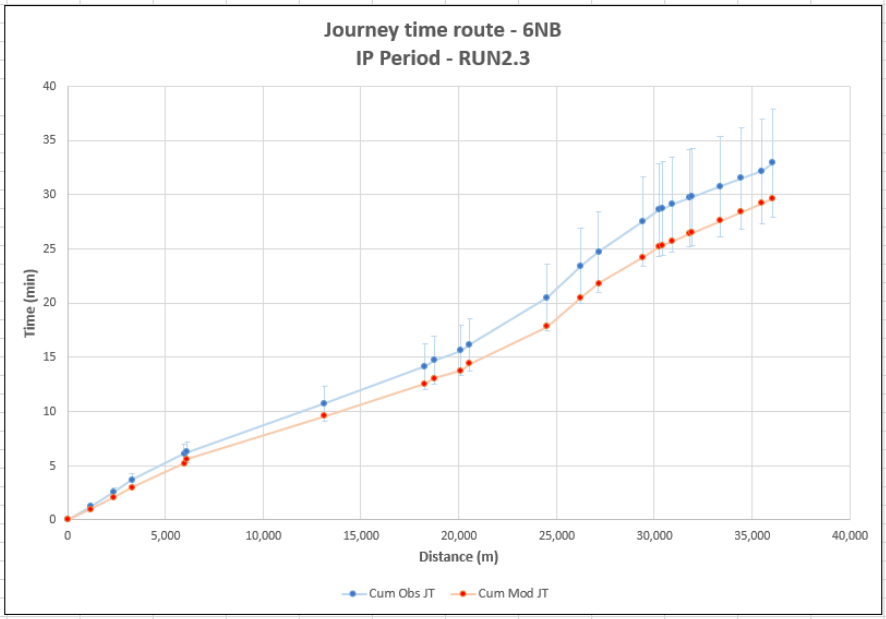
Journey time route 6NB - AM Period - RUN2.3



Total Obs JT	33.86	minutes
Total Mod JT	30.90	minutes
Diff % Mod vs. Obs	-8.7%	
PASS / FAIL	PASS	

F.1.32 A435/A46 NB – IP

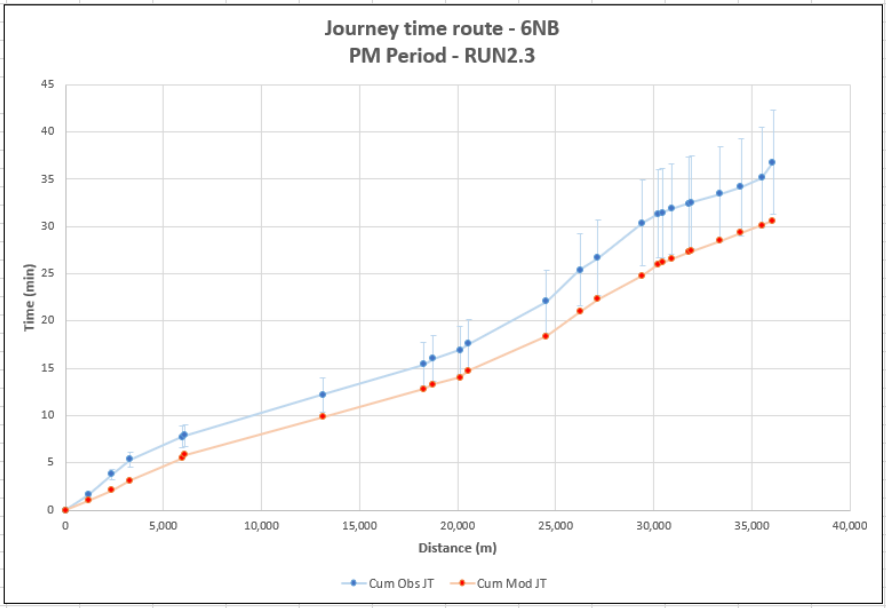
Journey time route 6NB - IP Period - RUN2.3



Total Obs JT	32.91	minutes
Total Mod JT	29.64	minutes
Diff % Mod vs. Obs	-9.9%	
PASS / FAIL	PASS	

F.1.33 A435/A46 NB – PM

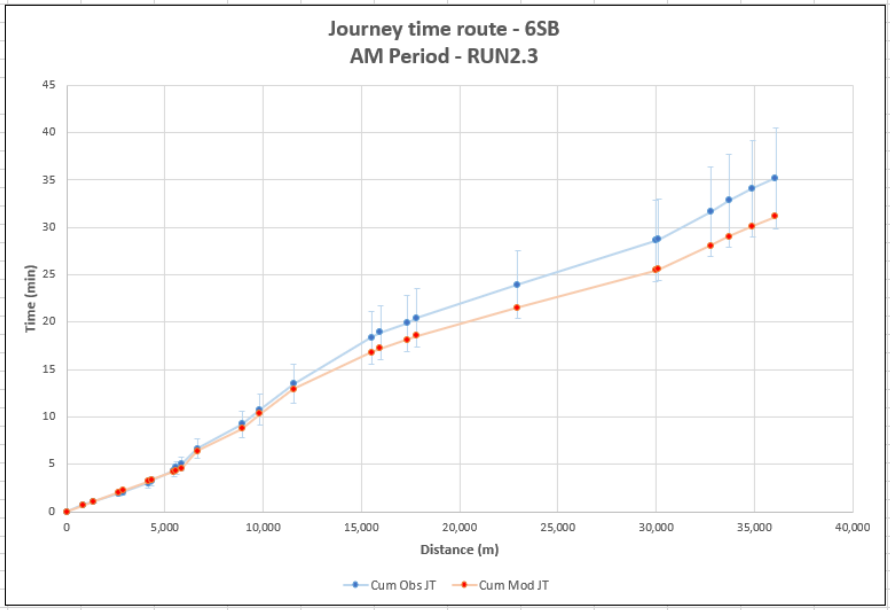
Journey time route 6NB - PM Period - RUN2.3



Total Obs JT	36.77	minutes
Total Mod JT	30.56	minutes
Diff % Mod vs. Obs	-16.9%	
PASS / FAIL	FAIL	

F.1.34 A435/A46 SB – AM

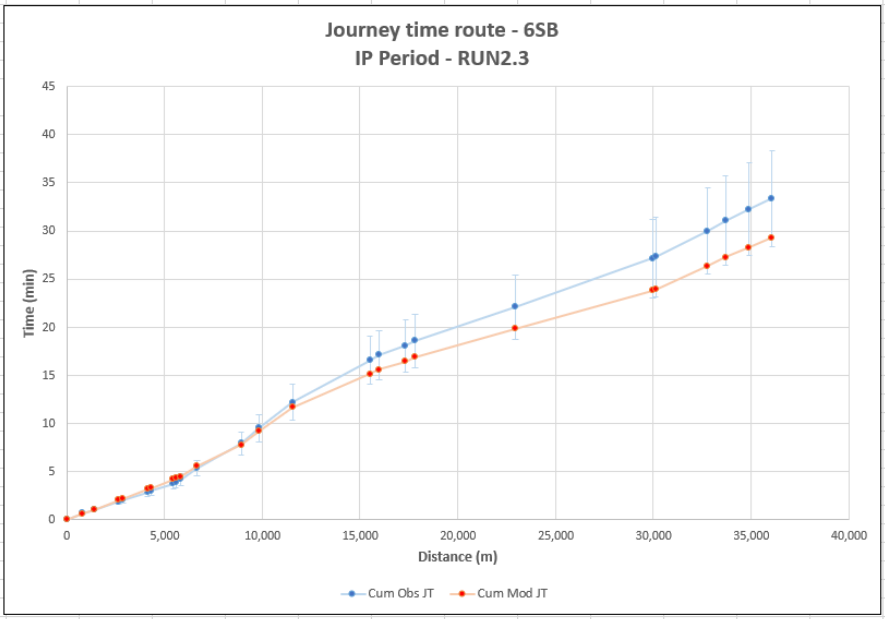
Journey time route 6SB - AM Period - RUN2.3



Total Obs JT	35.17	minutes
Total Mod JT	31.12	minutes
Diff % Mod vs. Obs	-11.5%	
PASS / FAIL	PASS	

F.1.35 A435/A46 SB – IP

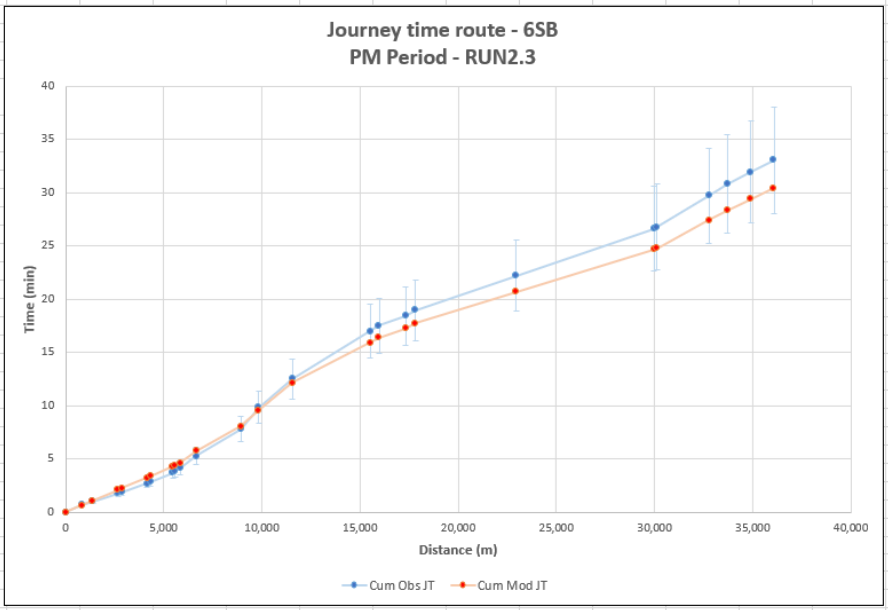
Journey time route 6SB - IP Period - RUN2.3



Total Obs JT	33.35	minutes
Total Mod JT	29.28	minutes
Diff % Mod vs. Obs	-12.2%	
PASS / FAIL	PASS	

F.1.36 A435/A46 SB – PM

Journey time route 6SB - PM Period - RUN2.3



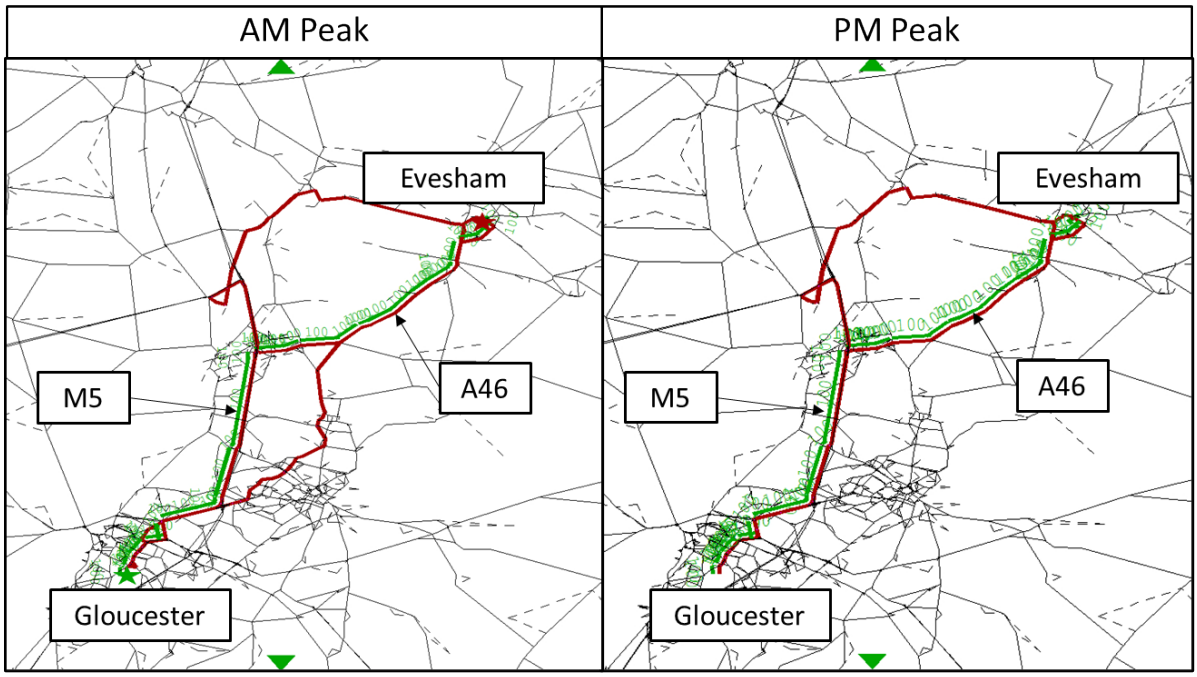
Total Obs JT	33.04	minutes
Total Mod JT	30.43	minutes
Diff % Mod vs. Obs	-7.9%	
PASS / FAIL	PASS	

Appendix G. Route Validation Comparisons

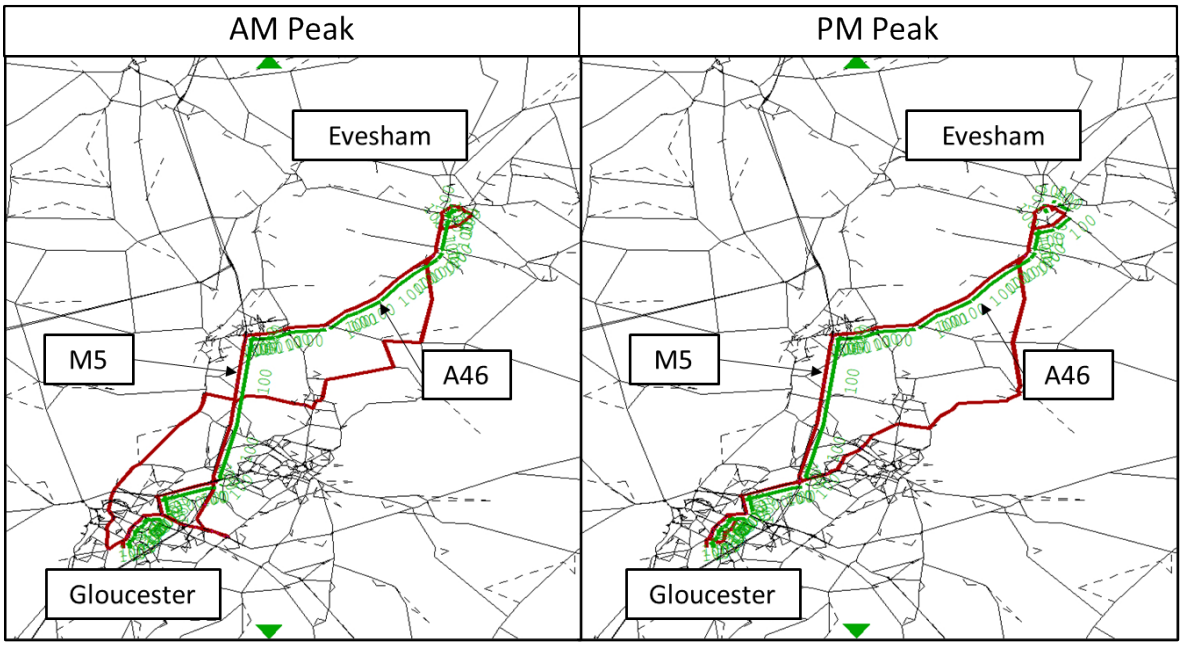
The following diagrams show the routes that traffic takes between selected key locations within the traffic model. All routes were compared against Google Maps journey time planner as an additional validation check. Diagrams displayed are routes selected by the car commuter user class, but checks were also undertaken using the HGV user class.

G.1 Gloucester/Evesham

G.1.1 Gloucester to Evesham

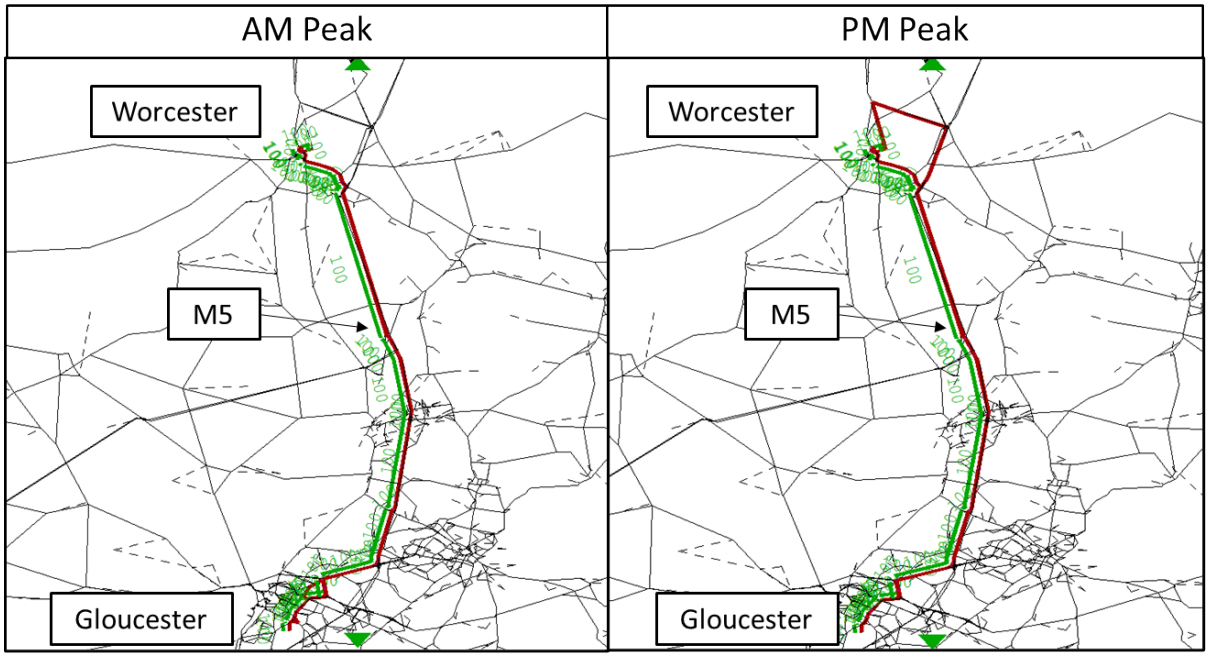


G.1.2 Evesham to Gloucester

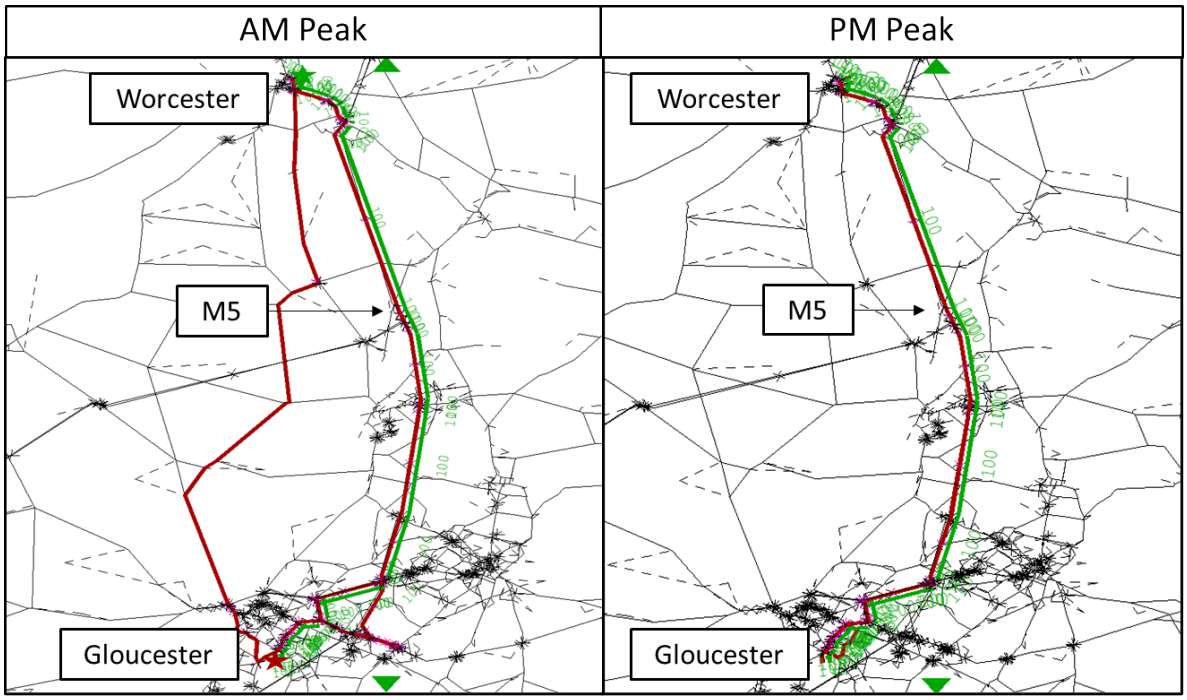


G.2 Gloucester/Worcester

G.2.1 Gloucester to Worcester

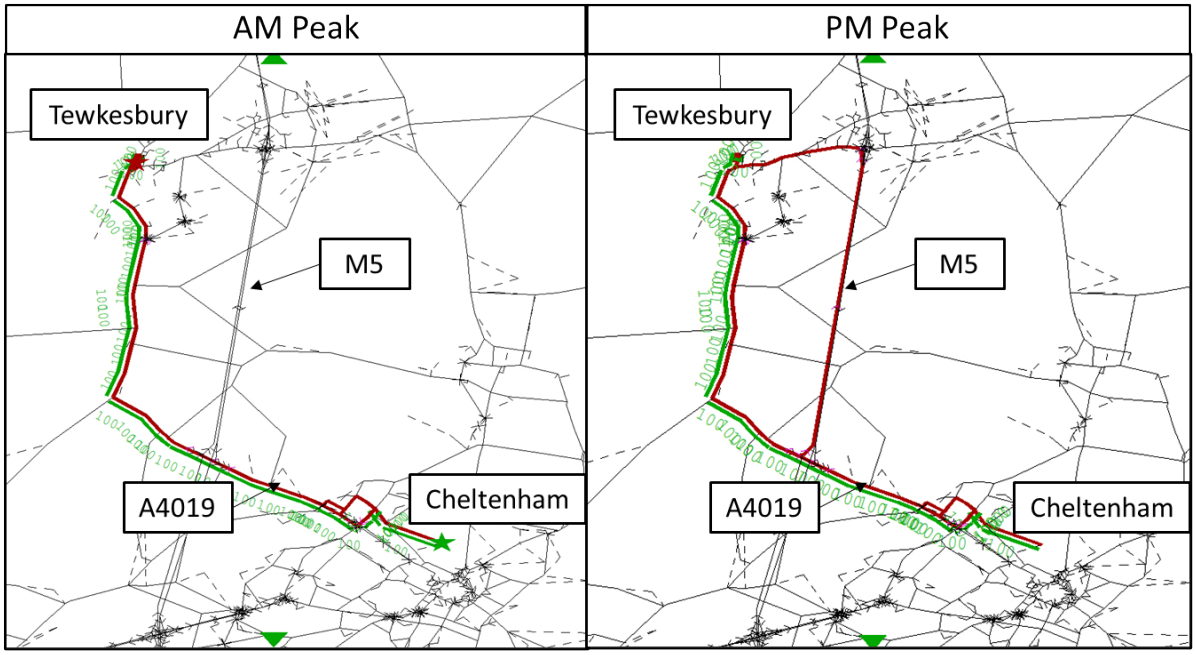


G.2.2 Worcester to Gloucester

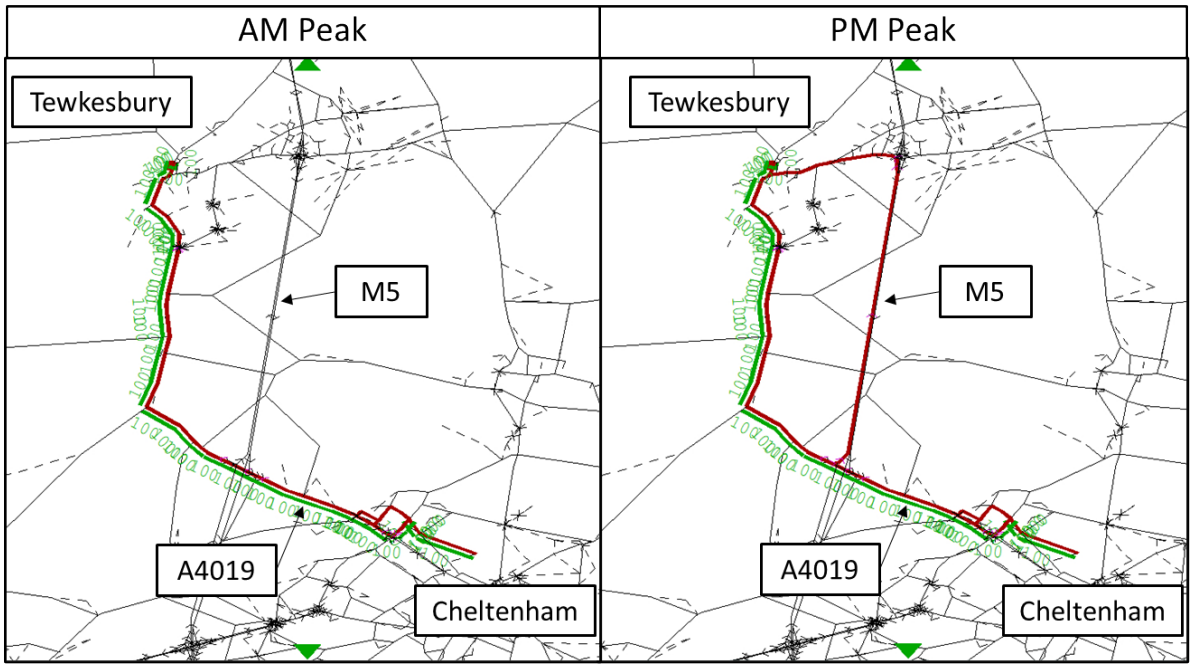


G.3 Cheltenham/Tewkesbury

G.3.1 Cheltenham to Tewkesbury

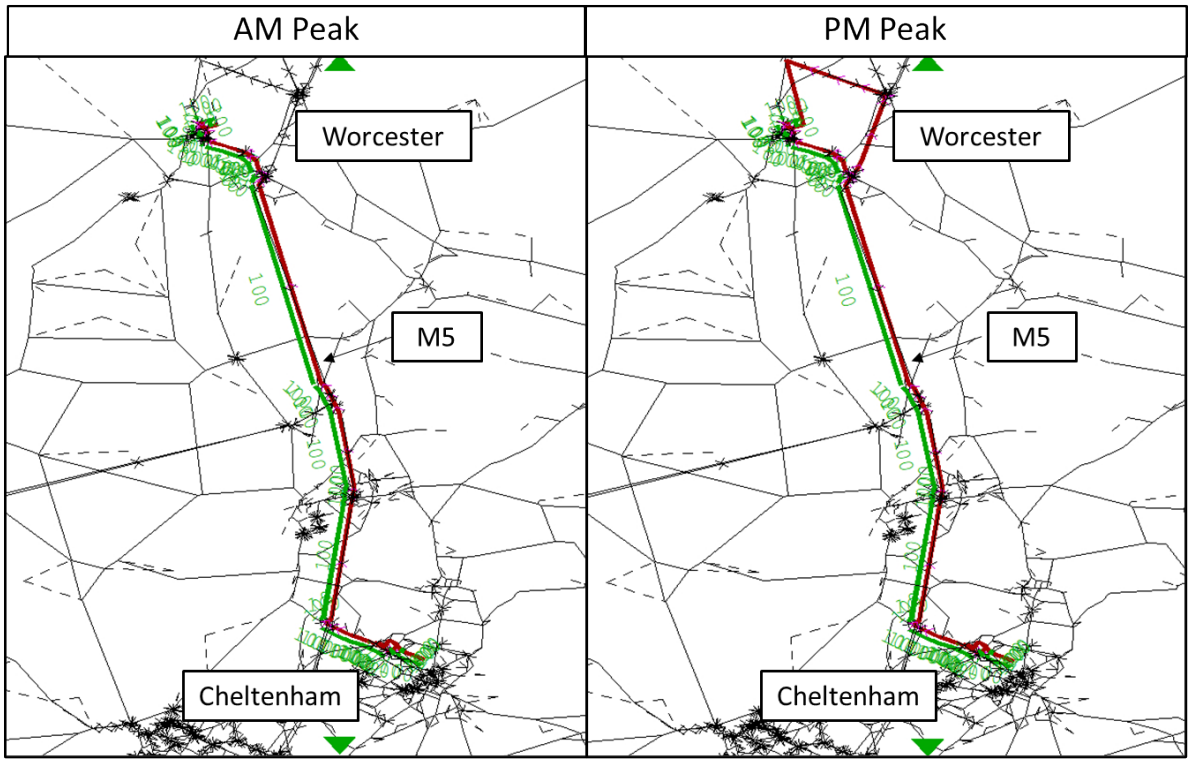


G.3.2 Tewkesbury to Cheltenham

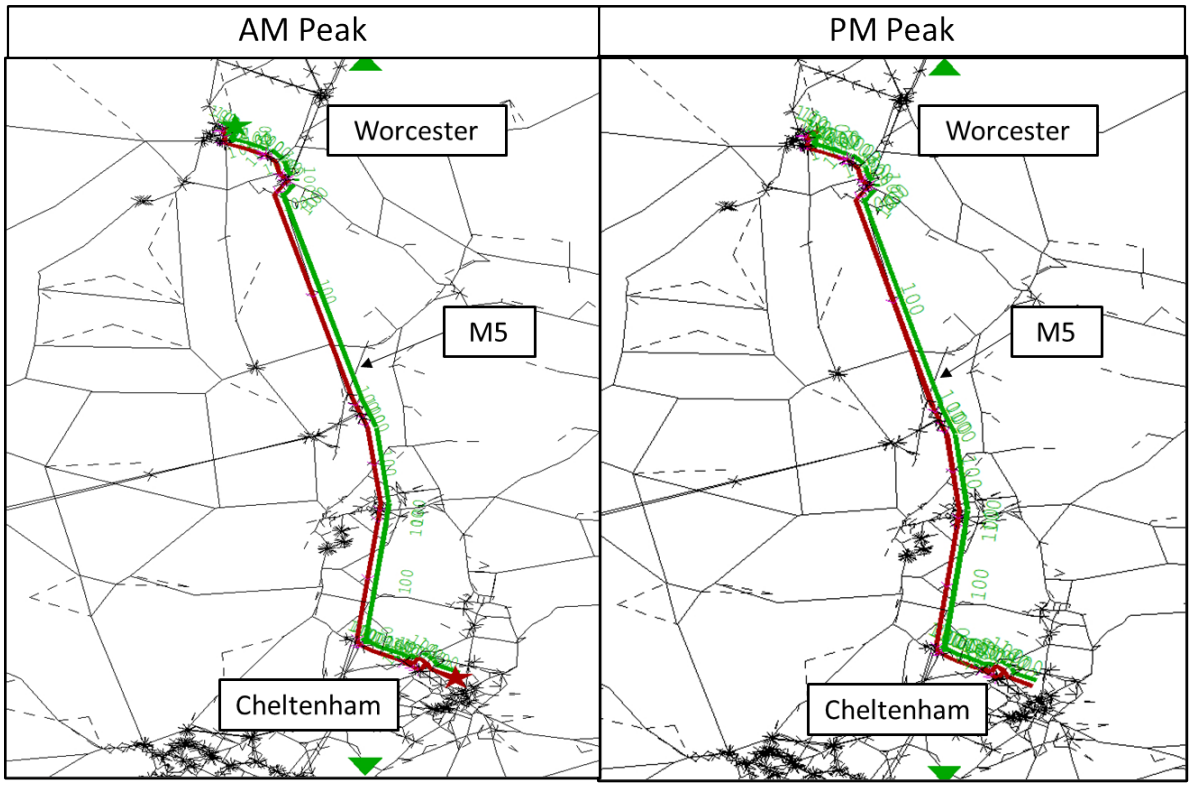


G.4 Cheltenham/Worcester

G.4.1 Cheltenham to Worcester



G.4.2 Worcester to Cheltenham



Appendix H. Operational Modelling Local Model Validation Report (LMVR)

M5 J10 Improvement Scheme

Operational Modelling – Local Model Validation Report

02 February 2021

Notice

This document and its contents have been prepared and are intended solely as information for and use in relation to M5 J10 Operational Modelling: Stage 3.

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

Document history

Document title: M5J10 Paramics Local Model Validation Report

Document reference:

Revision	Purpose description	Originated	Checked	Reviewed	Authorised	Date
Rev 2.0	Draft	EM	LB	DG	JL	02/02/2021

Client signoff

Client	Gloucestershire County Council
Project	M5J10 Improvements Scheme
Job number	5197035.350
Client signature/date	

Contents

Tables

Figures

13. 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. To assess the appropriate design solution at M5 J10 and A4019 corridor, a traffic modelling assessment was proposed. This report documents the development of the Paramics Discovery microsimulation base model for use in the operational traffic modelling assessment of the scheme. The model will provide a basis for 2041 forecasting to ascertain the impact of the proposed scheme on the strategic and local highway networks surrounding the M5 J10.

Atkins has developed 2017 AM and PM peak period micro-simulation models for use in the operational assessment. Each base model is representative of a 3-hour time period with a one hour warm up period, one-hour peak evaluation period and one hour cool down period. The AM model is representative of 07:00 – 10:00 with a peak hour of 08:00 – 09:00. The PM model is representative of 16:00 – 19:00 with a peak hour of 17:00 – 18:00.

13.1. Report Scope and Structure

This report documents the development of the M5 J10 Paramics model to a base year of 2017, and is structured as follows:

- Chapter 17 – outlines the model standards from TAG Unit M3.1;
- Chapter 18 – summarises all data used in the development and validation of the model;
- Chapter 19 – outlines the development of the model network;
- Chapter 20 – describes the development/adjustment of the model demand matrices;
- Chapter 21 – draws together the validation statistics for flows and journey times;
- Chapter 22 – provides a summary of the report; and
- Detailed tables and graphs of the validation results for the AM and PM peak hours are provided in the Appendices.

14. Model Standards

The M5 J10 Paramics model has been developed following guidance as set out in the Department for Transport (DfT) TAG Unit M3.1: Highway Assignment Modelling[10]. In this, validation of a highway assignment model should include the following:

- Assigned flows and counts on individual links and turning movements at junctions as a check on the quality of the assignment and trip matrices; and
- Modelled and observed journey times along key routes as a check on the network and assignment quality.

14.1. Link Flow Validation

There are two measures used to quantify individual link validation: flow difference and GEH. Flow difference is the relative difference in flow between modelled flows and observed counts, with different criteria set out in TAG Unit M3.1 depending on the scale of the observed data, illustrated in Table 14.1.

The GEH measure uses the GEH statistic as defined below:

$$\mathrm{GEH} = \sqrt{\frac{(M-C)^2}{(M+C)/2}}$$

Where: M is the modelled flow; and

C is the observed flow

Table 14.1 - Link Flow and Turning Movement Validation Criteria (TAG Unit 3.1: Table 2)

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

Regarding flow validation, the following should be noted:

- The above criteria should be applied to both link flows and turning movements;
- The comparisons should be presented for cars and all vehicles but not for light and other goods vehicles unless sufficiently accurate link counts have been obtained;
- The comparisons should be presented separately for each modelled period; and
- It is recommended that comparisons using both measures are reported in the model validation report.

14.2. Journey Time Validation

Journey time validation is a measure of the absolute and/or percentage travel time difference between modelled and observed journey times, subject to an absolute maximum difference. TAG Unit M3.1 sets out the guidelines and criteria for this, illustrated in Table 14.2 below.

Table 14.2 - Journey Time Validation and Acceptability Guidelines

Criteria	Guideline
Modelled times along routes should be within 15% of surveyed times (or 1 minute if higher than 15%)	>85% of all routes

[10] https://www.gov.uk/government/publications/TAG-tag-unit-m3-1-highway-assignment-modelling

14.3. Convergence Criteria and Standards

The TAG Unit M3.1 guidance on model convergence is not applicable to micro-simulation models which do not iterate to achieve convergence. Micro-simulation models do however require output results to be taken as an average of multiple random seed values which determine vehicle release rates from zones. In this case, 10 random seed runs were considered a statistically appropriate number of seeds to account for variance in model performance to calculate the average for each modelled period individually.

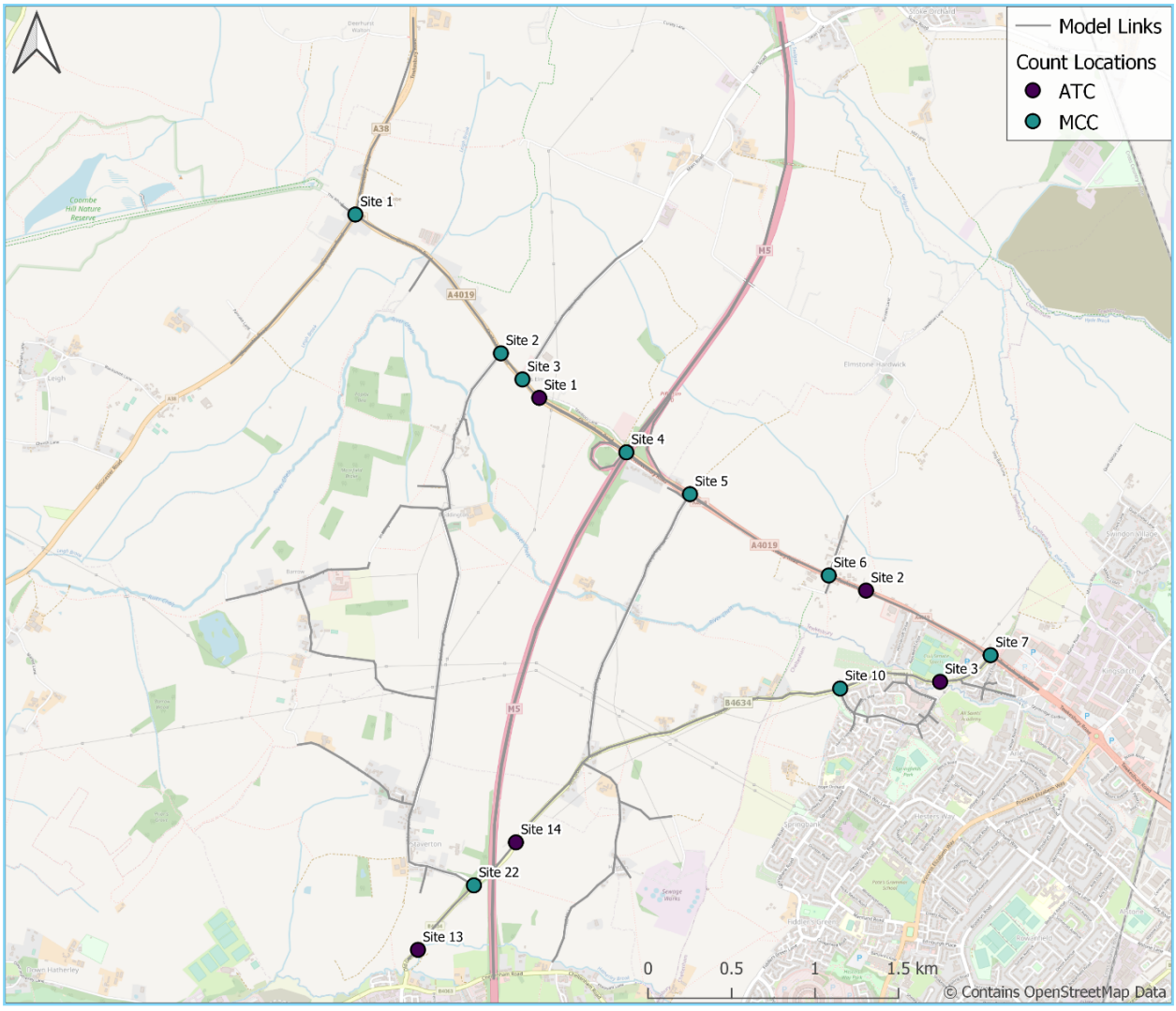
15. Data Sources

This chapter presents a brief summary of the data used in developing the M5 J10 Paramics model. Further details of the data used can be found in the Transport Data Package Report[11].

15.1. Turning and Link Counts

Traffic count data was collected for both link and turning flows across the study area in November 2017. These surveys were undertaken in the form of single-day Manual Classified Counts (MCC) at junctions, and two-week Automatic Traffic Counts (ATC) on links. The locations of the MCC's and ATC's are shown below in Figure 15-1.

Figure 15-1 - Location of ATC and MCC Surveys used for Calibrating and Validating the Base Model



15.2. Journey Time Data

Data from the TrafficMaster database was collected to provide information relating to journey times and speeds on highway links in the study area. This data was obtained for the March 2018 period, as it was the next available neutral month data from the existing traffic count data (November 2017) used to develop the model matrices, where only school-day data on neutral weekdays (Tuesday, Wednesday and Thursday) was used.

[11] GCCM5J10-ATK-HTA-ZZ-RP-TR-000002.PDF

16. Base Model Network Development

This chapter outlines the key features of the model, providing a summary of the methodology used for each stage of the M5 J10 Paramics model development.

An existing 2017 base-year Paramics Discovery (version 19.0) model was developed by Jacobs on behalf of Highways England, which includes the M5 Junction 10 and surrounding highway network. As part of the West Cheltenham Transport Improvement Scheme (WCTIS), this model was reviewed and updated by Atkins for use in modelling the Cyber Business Parks Phase 1-4 schemes. It was therefore considered to cover a sufficient area and an appropriate level of detail for use in the M5 J10 study.

16.1. Modelling Software

Given that the existing 2017 micro-simulation model was developed in Paramics Discovery version 19, the latest version of the software issued by Systra at the time of the model build, it was agreed with Highways England that it should be updated to the latest version for use in this scheme. For this reason, Paramics Discovery v22.0.1 has been used to develop the model for this scheme assessment.

16.2. Existing Model Review

The existing Paramics Discovery model was reviewed to ensure the development of an accurate base model in line with modelling best practice guidelines. Existing sections of the model network have been checked against Google Street View imagery, and a site visit was undertaken to confirm the current operation of key areas of the network. Based on this review, some minor updates to the model parameters were required, listed in Table 16.1 below.

16.3. Network Extent

As the purpose of the operational modelling is to support the detailed operation of the M5 junction 10 major junction improvement scheme, enable design refinement and ensure the scheme does not have a detrimental impact on the SRN under forecast year conditions; it was agreed with Highways England during scoping discussions that the M5 J10 operational modelling would be undertaken over a smaller localised extent.

As the operational traffic modelling is supported by the higher tier strategic SATURN model, the need to consider the wider traffic re-assignment impact of the scheme outside of the core operational modelling extent can be undertaken in SATURN to provide a traffic evidence base.

To reduce noise in the model from operational traffic issues that may occur as a result of schemes other than the core M5 J10 scheme proposals, the existing Paramics model was cordoned down to a smaller extent while still covering a sufficient study area for analysis of the traffic impact of proposed design solutions. This was undertaken by removing external regions of the highway network to the south and east of M5 J10, including M5 J11 and west Cheltenham, whilst keeping the coding consistent with the existing model. The revised model extent is shown in Figure 16-1.

Table 16.1 - Parameter Changes to the Existing Base Paramics Model

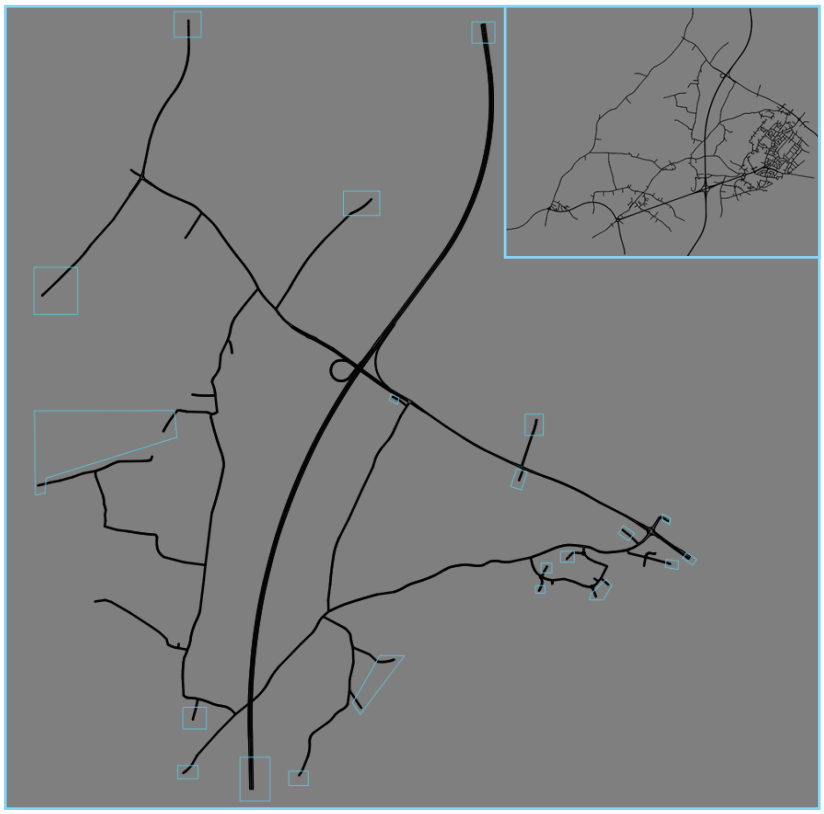
Parameter	Change	Justification
Software Version	The original base model was developed in Paramics Discovery version 19, however newer versions of the software have been released since its development. The model has been upgraded to version 22.0.1.	New features such as variable speed limits and pedestrian signals may improve the accuracy of the scheme modelling.
Bus Frequency	The Stagecoach 41 service running between Cheltenham and Northway was operating at every 30 minutes rather than 20 minutes which is accurate as of the modelled year. The frequency has been updated to every 20 minutes.	The frequency of buses may have an impact in delay and journey times in a model.
Speed Limits	Vehicle speeds unrealistically higher than the designated speed limits resulting in too fast journey times. Speeds reduced by 5mph on key roads in the model with fast journey times, including the A4019, M5 and B4634. Post-change observations showed	The Paramics software factors in random variation of speeds above and below the speed limit using a standard

	vehicles still travel at or slightly above the designated speed limits.	deviation, however in some cases this can be unrealistic.
Journey Visibility	M5 Junction 10 southbound off-slip onto the A4019 eastbound operating too slowly and queuing back to the M5. Increased visibility of merging vehicles to 25-metres so that they can see oncoming traffic more easily and are more likely to merge.	Original visibility set to 20-metres whereas map imagery suggests drivers merging can see oncoming traffic from further than this.
Signal Timings	Unreleased vehicles at zone 205 (Gallagher Retail Park exit at Tewkesbury Road junction) in the PM peak. Minor increase in signal timings to allow more vehicles to exit at this junction.	Minor changes to traffic signal timings acceptable to account for slight differences in modelled and observed vehicle arrival patterns.

The model has been developed to accurately capture and represent the following network features, which have been checked and reviewed to ensure they are appropriate for use in the M5 J10 study:

- Number of lanes;
- Classifications of links (major/minor, urban/highway);
- Lane markings including position of stop lines;
- Trajectories (i.e. the typical path a vehicle would take on a link or turn);
- Speed limits;
- Junction visibility (i.e. how far vehicles at junctions can see oncoming traffic);
- Method of control at junctions (signalised/priority);
- Bus stop locations and type (on-street/laybys); and
- Formal pedestrian crossing locations.

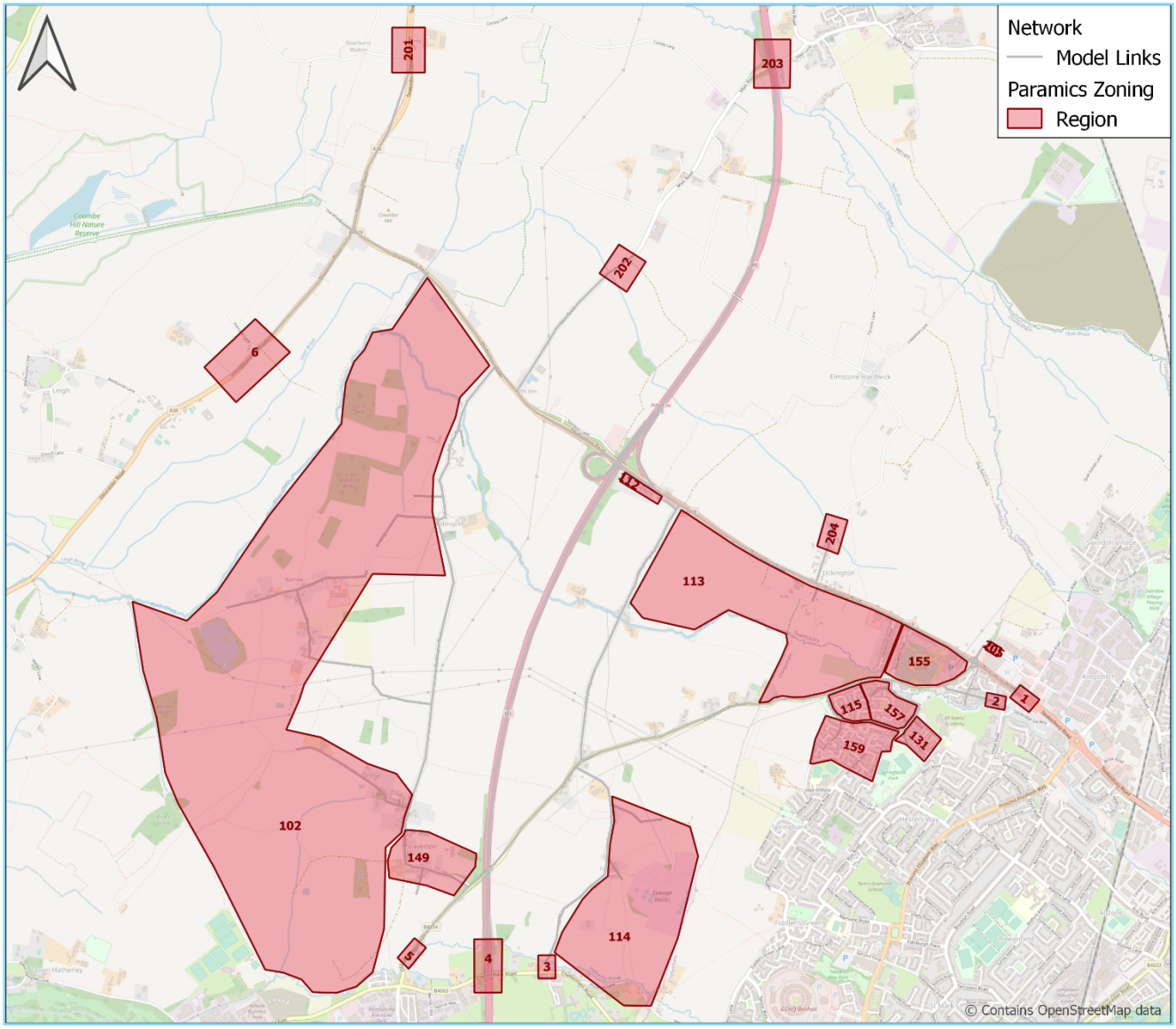
Figure 16-1 - Cordoned M5 J10 Paramics Model Extent



16.4. Zone System

The zoning structure for the M5 J10 model was derived from the existing wider 2017 Paramics model, incorporating all existing zones in the modelled area and additional new zones created where the existing network extent was cordoned. The model zones are depicted in Figure 16-2, where the triple-digit zones represent the existing model zones and single-digit zones are the new zones. A complete list of all 21 zones alongside a description of their coverage has been provided in 0.

Figure 16-2 - M5 J10 Paramics Model Zone Structure



16.5. Traffic Signals

Signal controller information for the existing model was obtained from Gloucestershire County Council. The majority of signals were either demand actuated or MOVA (Microprocessor Optimised Vehicle Actuation) operated. In the absence of PCMOVA linkage in Paramics Discovery, these were coded with fixed timings to represent the average conditions in the peak periods. Phases and stages were retained from the controller specification. During model calibration, some of these timings were adjusted to replicate the appropriate level of delay observed in the journey time data.

16.6. Bus Routes and Frequencies

Bus routes from the existing 2017 base model were maintained. To replicate typical boarding and alighting times, the 30-second stopping dwell time was maintained across all routes and time periods.

17. Base Model Demand Matrix Development

17.1. Model Parameters

The model has been developed to represent network conditions for a typical neutral weekday (Tuesday to Thursday) during the morning and evening peak periods in 2017. Table 17.1 below sets out the modelled peak periods, identifying the single hours that have been validated against the TAG criteria.

The model network was preloaded with vehicles prior to the start of the AM and PM peak hours using a one-hour 'warm-up' period. This ensures that any delays and queues are accurately represented at the start of the peak hour being evaluated. In addition, a one-hour 'cool-down' period after the peak hour allows for potential congestion and queues to clear so that vehicles can complete their journeys and all trips starting in the peak hour can be accounted for.

Table 17.1 - Modelled Time Periods

Time Period	Description	Modelled Time
AM Peak Period (07:00 – 10:00)	AM 'warm up' hour	07:00 – 08:00
	AM peak hour	08:00 – 09:00
	AM 'cool down' hour	09:00 – 10:00
PM Peak Period (16:00 – 19:00)	PM 'warm up' hour	16:00 – 17:00
	PM peak hour	17:00 – 18:00
	PM 'cool down' hour	18:00 – 19:00

17.2. Matrix Cordon

Cordon matrices were derived from the existing 2017 base Paramics model for the AM and PM peak period. In this, the Origin-Destination (OD) movements from existing zones were maintained. To derive OD movements for new zones where the network was cut by the cordon, average link flows were calculated from 10 random seed runs of the existing un-cordoned Paramics model for both the AM and PM peaks individually. New zonal movements were then extracted using the built-in Paramics Select Link Analysis function. To check this process was carried out correctly, origin and destination trips from zones existing in both the prior and post cordoned models were compared and had on average a minimum accuracy of 99%.

17.3. Matrix Development

There are three demand matrix levels in the M5 J10 Paramics model:

- Matrix Level 1 – Cars;
- Matrix Level 2 – Light Goods Vehicles (LGV); and
- Matrix Level 3 – Heavy Goods Vehicles (HGV) consisting of Other Goods Vehicle 1 (OGV1) and Other Goods Vehicle 2 (OGV2).

Modelled flows were compared against the observed turning and link count data to understand the level of validation of the existing matrices. Due to the high level of validation of the existing matrices, matrix estimation was not considered necessary. Instead, minor matrix adjustments based on the count validation results were applied to individual origin to destination pairs to best match the observations.

17.4. Model Assignment Parameters

Route choice was calculated using generalised cost, which combines the weighted component of travel time and vehicle operating cost. The routeing parameters from the existing model were defined individually for each vehicle type and were maintained for the M5 J10 model. The cost factors are summarised in Table 17.2.

Perturbation applies variance to the cost when choosing the route a vehicle should take. In Paramics Discovery, the percentage perturbation algorithm has been employed with the default perturbation level of 5, which provides a variance of ± 5% from the generalised cost. Dynamic feedback calculates the true cost of congested links by

including the delay encountered by vehicles already on the network at fixed time intervals in a continually updated cost equation. The feedback interval is set to 2 minutes and the smoothing factor applied to combine the delay from the last interval is set to 0.5 (50%).

The Paramics modelling software includes road hierarchies, where links can be classed as either minor or major, see Figure 17-1. Major links are assumed to be signposted with the cost known by both familiar and unfamiliar drivers. Minor roads are assumed to be un-signposted residential streets or C-roads where only familiar drivers know the cost. Unfamiliar drivers have less awareness of minor roads and perceive them to have twice the cost to travel than major links, making rerouting along these roads less likely.

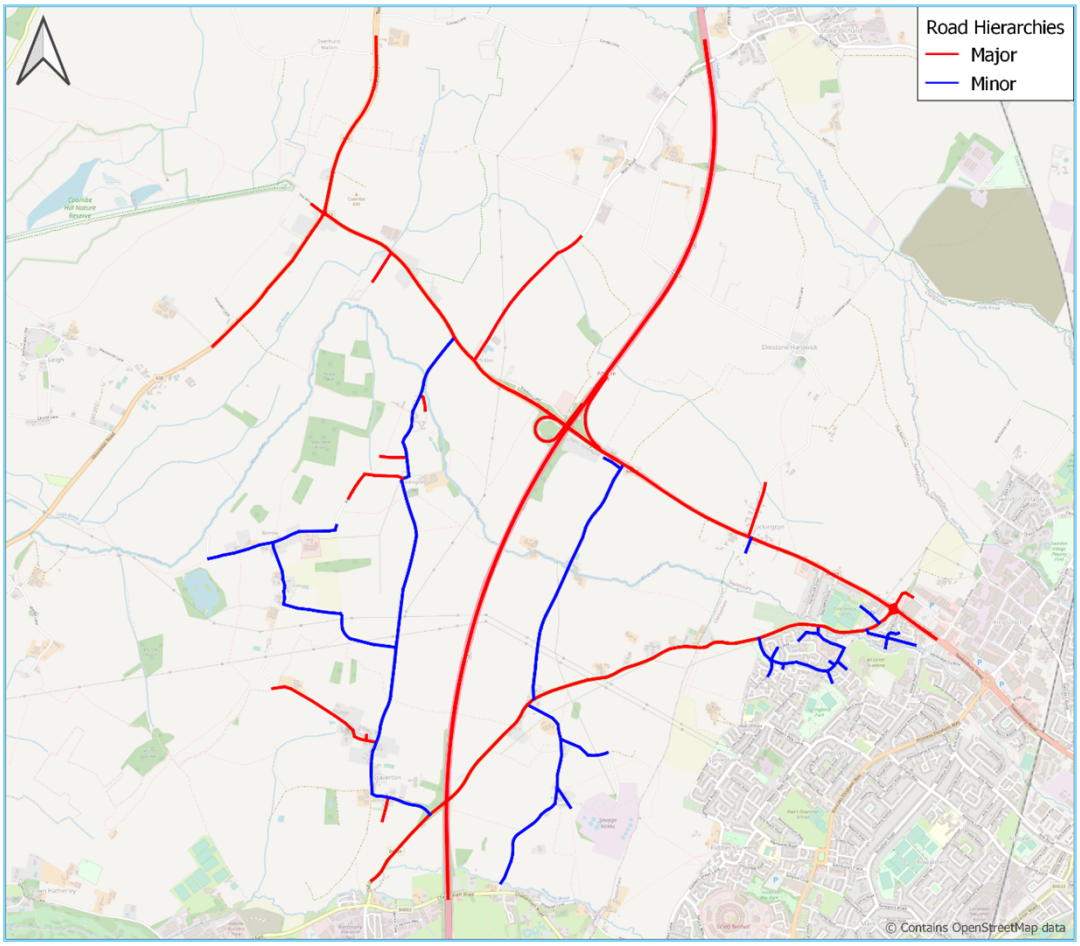
The level of familiarity of each vehicle type has a fundamental impact on route choice in the model. The familiarity settings from the existing model were carried over, which are as follows:

- Car and LGV – 50%;
- HGV – 10%; and
- Bus / Coach – 0%.

Table 17.2 - Generalised Cost Parameters by Individual Vehicle Type

Type	Description	Time (a)	Distance (b)
1	Car	1.0	0.4
2	Light Goods Vehicle	1.0	0.7
3	Medium Goods Vehicle	1.0	2.1
4	Heavy Goods Vehicle	1.0	2.1
5	Coach / Bus	1.0	2.1

Figure 17-1 - Road Hierarchical Structure



18. Calibration and Validation

18.1. Network and Matrix Calibration

The existing base model was calibrated to represent any regular disruption that may lead to changes in journey time, such as parked cars, chicanes or prolonged bus dwell times, which can all reduce the available vehicle capacity. In this, journey times for the model were originally calibrated using 2015 Traffic Master data, therefore some additional adjustments were necessary as part of the M5 J10 model development to ensure the journey times calibrate to a 2017 base year, coinciding with the observed count data. The following calibration checks and adjustments have been made:

- **Visibility** – Paramics best practice guidelines published by Systra suggest a default of 30 metres at approaches to roundabouts or junctions unless where visibility is restricted. The M5 J10 southbound off slip onto the A4019 was originally coded at only 23-metres, and therefore was increased to represent more realistic merging behaviour.
- **Junction Delay and Journey Times** – differences between observed and modelled journey times were investigated, helping to inform appropriate network adjustments. Some minor modifications to traffic signal timings to better replicate the observed levels of delay were carried out. In addition, observations showed unreleased vehicles at zone 205, Gallagher Retail Park exit at the Tewkesbury Road signalised junction, therefore additional time was given to allow these onto the network.
- **Flow Disparity** – differences between observed and modelled flow were identified and investigated to understand if traffic was being restricted, a competing route had a lower perceived cost, or whether the demand matrices were too light. The A4019 was observed to be light in flow and therefore journey time for both directions. Turning movements from some zones onto the A4019 were also observed to be too light, therefore corresponding OD movements were increased slightly whilst ensuring the number of trips were still appropriate.

18.2. Base Model Calibration and Validation

The model was built following TAG guidance, with the aim of achieving relevant validation standards to give confidence in the demand data and resulting model performance. The following comparisons were made to check the quality of the network and assignment, as required by TAG and outlined earlier in Chapter 2:

- Modelled and observed traffic flows compared by light (car + LGV) and all vehicles for both time periods individually; and
- Validation of modelled and observed mean journey times along selected routes.

In this case, vehicles have been compared for light vehicles rather than car as specified by the TAG guidance due to limitations in the accuracy of ATC classifications of car and LGV's.

Paramics Discovery uses a random seed value in conjunction with vehicle release profiles to determine the vehicle release rate from each modelled zone. Assignment results reported below are an average of ten random seed value runs to ensure a robust average of modelled traffic conditions.

18.2.1. Traffic Flows

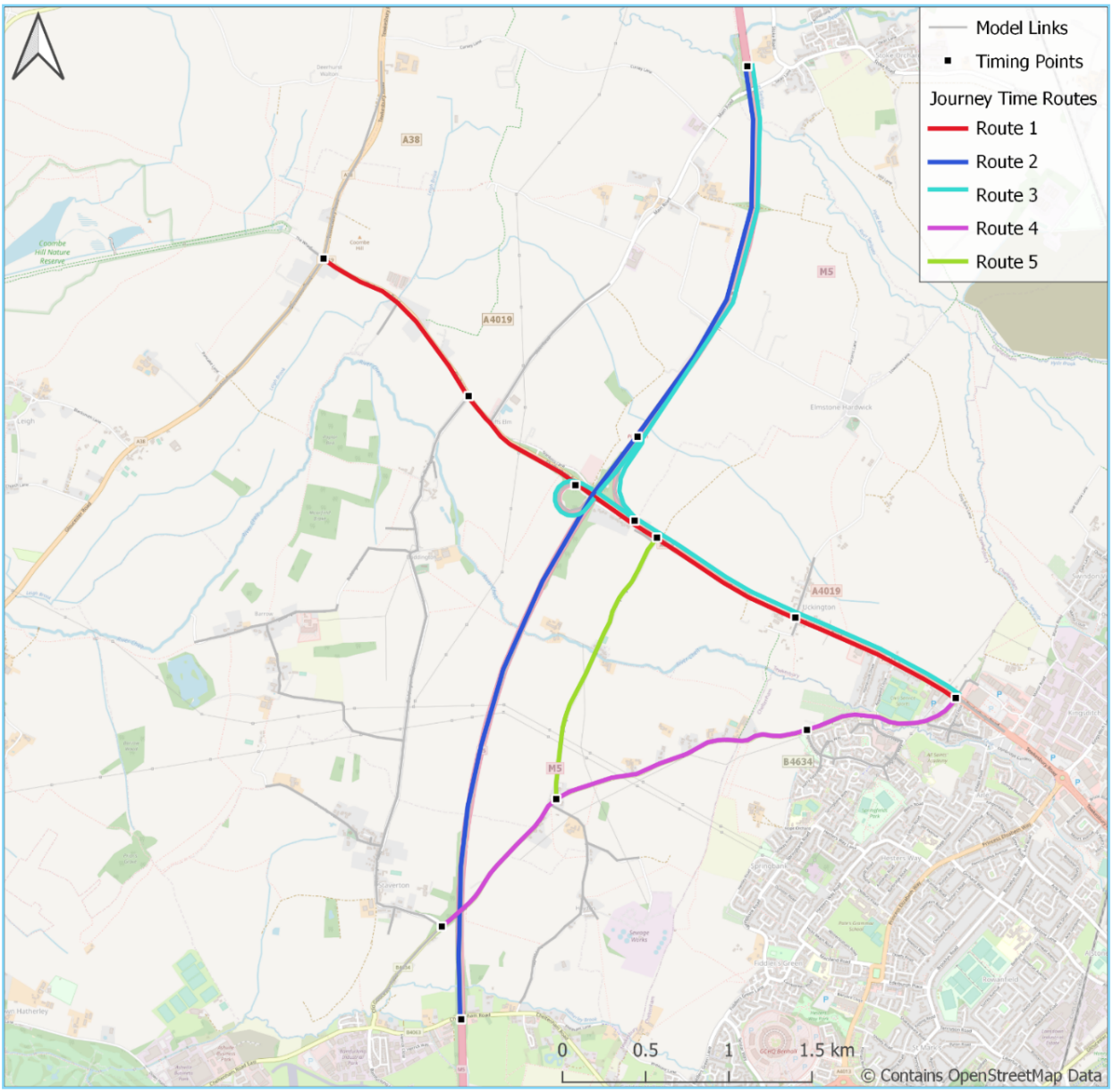
As no matrix estimation was carried out, all of the observed counts were used for flow validation. Due to the availability and coverage of the count data, screenlines were not used as part of the validation analysis.

18.2.2. Journey Times

Journey time routes covering key routes in the model area were selected. The five routes are illustrated in Figure 18-1 and are as follows:

- Route 1 – A4019 Tewkesbury Road between Coombe Hill and Gallagher Retail Park junction;
- Route 2 – M5 between Junction 9 and 11;
- Route 3 – M5 North to A4019 East;
- Route 4 – B4634 Old Gloucester Road from Tewkesbury Road to Staverton; and
- Route 5 – Withybridge Lane.

Figure 18-1 - Journey Time Routes for Base Model Validation



18.3. Flow Validation Results

A summary of the traffic flow validation results is shown in Table 18.1 for a total of 68 observed counts, of which 10 are link counts (ATCs) and 58 are turn counts (MCCs). A link or turning movement that meets the TAG flow or GEH criteria is considered to pass. The tables are structured to show results for both 'light vehicles' and 'all vehicles'. A full breakdown of the results at link level is provided in 0.

The table shows that the flow results are of an excellent standard, with almost all counts passing for all vehicles in both the AM and PM peak hours.

During the AM peak hour, it is the same link count that fails in both the 'light vehicles' and 'all vehicles' categories. This link count is the '*ATC 1 – A4019 nr. Elmstone Hardwicke NB*' which has a GEH of 6.30 and 6.08 for the 'light vehicles' and 'all vehicles' categories respectively, which are both only marginally over the GEH threshold of 5.0.

For the PM peak hour, there is one link count that fails in the 'all vehicles' category. This link count is the '*ATC 14 – B4364 Old Gloucester Road (upper) NB*' which has a GEH of 5.07 which again is only marginally over the GEH threshold of 5.0.

It is therefore deemed that these minor breaches of the GEH threshold on the two aforementioned link counts do not impact on the overall integrity of the base model, particularly when 90% of all link counts pass, in keeping with modelling guidelines.

Table 18.1 - Link and Turn Count Validation Summary

	AM Peak (08:00 – 09:00)		PM Peak (17:00 – 18:00)	
	Lights	All Vehicles	Lights	All Vehicles
Percentage of Link Counts Passing	90% (9/10)	90% (9/10)	100% (10/10)	90% (9/10)
Percentage of Turn Counts Passing	100% (58/58)	100% (58/58)	100% (58/58)	100% (58/58)

18.4. Journey Time Validation

Results for the five bi-directional routes monitored for journey time validation are presented in Table 18.2 and Table 18.3 below, with their respective whisker plots given in Figure 18-2 and Figure 18-3.

The results presented in the tables and figures show that all journey time routes in both the AM and PM peak hours pass the TAG criteria for journey time validation, however it is noted that the Route 5 distances do not meet the TAG minimum journey time distance of 3 km. The Route 5 (Withybridge Lane) journey time has been included as it is deemed important for the future scenarios. Despite this, the journey time validation demonstrates that the base model is robust at replicating real traffic conditions.

Table 18.2 - Base Model Journey Time Validation (AM)

Route	Direction	Distance (km)	Observed Mean (mm:ss)	Modelled Mean (mm:ss)	Absolute Difference (mm:ss)	% Difference	Pass / Fail
Route 1	Eastbound	4.68	06:18	05:28	-00:50	-13%	✓
	Westbound	4.67	04:39	05:24	00:45	16%	✓
Route 2	Northbound	5.99	03:07	03:15	00:07	4%	✓
	Southbound	5.99	04:22	03:23	-00:59	-23%	✓
Route 3	Eastbound	5.05	08:03	07:06	-00:57	-12%	✓
	Westbound	5.72	04:22	04:41	00:19	7%	✓
Route 4	Northbound	3.56	04:02	03:32	-00:30	-12%	✓
	Southbound	3.56	03:54	03:19	-00:35	-15%	✓
Route 5	Northbound	1.70	01:40	02:28	00:48	48%	✓
	Southbound	1.70	02:10	01:37	-00:33	-25%	✓

Figure 18-2 - Journey Time Results - AM Peak (08:00 - 09:00)

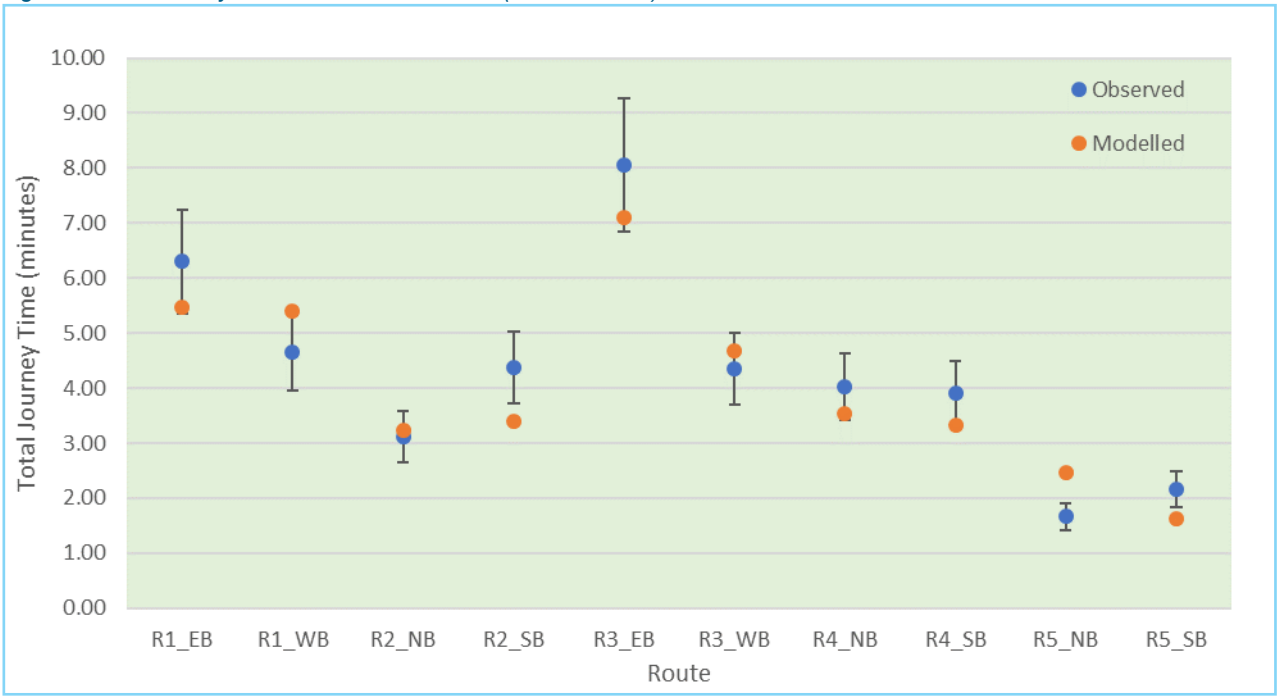
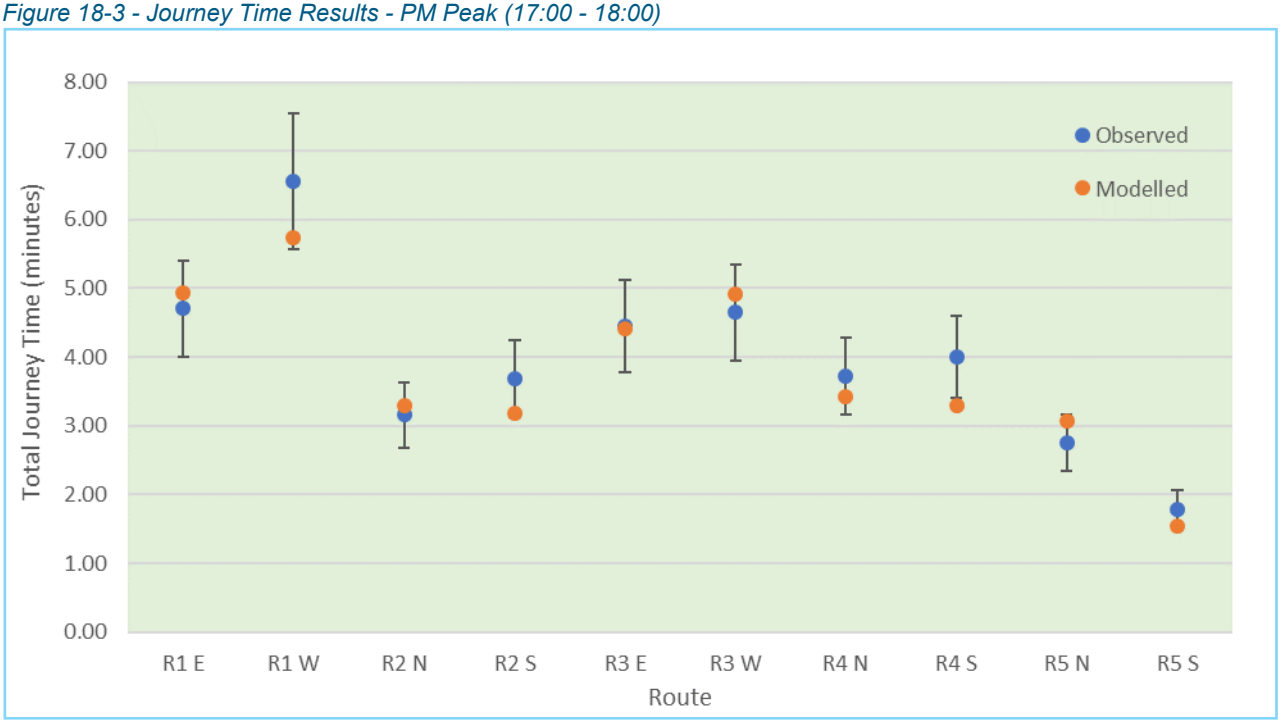


Table 18.3 - Base Model Journey Time Validation (PM)

Route	Direction	Distance (km)	Observed Mean (mm:ss)	Modelled Mean (mm:ss)	Absolute Difference (mm:ss)	% Difference	Pass / Fail
Route 1	Eastbound	4.68	04:42	04:56	00:14	5%	✓
	Westbound	4.67	06:33	05:44	-00:49	-13%	✓
Route 2	Northbound	5.99	03:10	03:18	00:08	4%	✓
	Southbound	5.99	03:41	03:11	-00:30	-13%	✓
Route 3	Eastbound	5.05	04:27	04:25	-00:02	-1%	✓
	Westbound	5.72	04:39	04:55	00:16	6%	✓
Route 4	Northbound	3.56	03:43	03:26	-00:17	-8%	✓
	Southbound	3.56	04:00	03:18	-00:42	-17%	✓
Route 5	Northbound	1.70	02:45	03:04	00:19	12%	✓
	Southbound	1.70	01:47	01:33	-00:14	-14%	✓

Figure 18-3 - Journey Time Results - PM Peak (17:00 - 18:00)



18.5. 2017 Base Validation Summary

A summary of the base model validation is illustrated in Table 18.4 and Table 18.5 below. The results indicate that the AM and PM base model has been developed in compliance with DfT TAG criteria in terms of link, turn and journey time validation.

Table 18.4 - AM Base Validation Summary

2017 AM Base (08:00 – 09:00)			**Criteria % Pass Rate**		
Cal / Val Measure	Volume	Source	GEH <5	Flows	<15% or <60s
Link Validation	10 ATCs	2017 ATCs	90%	90%	-
Turn Validation	58 MCCs	2017 MCCs	93%	100%	-
Journey Time Validation	5 routes	2018 TM Data	-	-	100%

Table 18.5 - PM Base Validation Summary

2017 PM Base (17:00 – 18:00)			**Criteria % Pass Rate**		
Cal / Val Measure	Volume	Source	GEH <5	Flows	<15% or <60s
Link Validation	10 ATCs	2017 ATCs	90%	90%	-
Turn Validation	58 MCCs	2017 MCCs	93%	100%	-
Journey Time Validation	5 routes	2018 TM Data	-	-	100%

18.6. Queue Lengths

The cordoned base model network includes three signalised junctions with the remaining junctions being made up of priority give-ways or merges. During base model runs, pockets of queuing around these junctions occur with more notable queuing intermittently present at the signalised junctions and the M5 J10 southbound off-slip. This modelled queuing simulated in the base model runs correlates with the AM and PM peak journey time validation exercise undertaken in Section 6.4 (i.e. longer journey times occur on sections of the network with more notable queuing).

19. Summary

The M5 J10 Paramics Discovery model has been built upon a cordon of an existing 2017 Paramics micro-simulation model developed by Jacobs for Highways England. The purpose of this model is to provide a basis for modelling and optimising the scheme design under a 2041 forecast year.

The model represents a neutral weekday (Tuesday, Wednesday and Thursday) within school term time for 2017, covering the AM and PM peak hours (08:00-09:00 and 17:00-18:00 respectively). The model has been validated for flows using observed traffic counts collected in November 2017 following the DfT TAG Unit M3.1 guidelines. Both modelled time periods have demonstrated a good correlation with observed flows, as more than 98% of the 68 individual link and turn counts passed the TAG criteria for the AM and PM peaks.

The modelled journey times also provided a reasonable representation of delay across the modelled network, with all journey time routes passing within the criteria.

It has therefore been determined that the AM and PM base M5 J10 Paramics Discovery modelling is an appropriate representation of the existing situation and suitable for the testing of future schemes.

Appendices

Zones

Zone ID	Type	Description
1	External	A4019 link to/from Cheltenham
2	External	Hayden Road to/from west Cheltenham and local area
3	External	Hayden Lane to/from B4063 towards the A40
4	External	M5 to/from Junction 11
5	External	B4364 to/from Staverton Bridge and B4063
6	External	A38 to/from Prior's Norton and onwards to Gloucester
102	Internal	Area covering Barrow, Boddington and north of Staverton
112	Internal	Residential development at Withybridge Gardens
113	Internal	Uckington south of the A4019 including Homecroft Drive and Cheltenham West Community Fire Station
114	Internal	Land east of Hayden Lane, including Hayden and the Sewage Treatment Works
115	Internal	Residential development along Bushy Way and associated roads via Pilgrove Way
131	Internal	Residential development along Grenadier Road and associated roads via Pilgrove Way
149	Internal	Staverton
155	Internal	Cheltenham Civil Service FC, Aldi, car dealership and residential development along Appleyard Close
157	Internal	Residential development along Rosebay Gardens and associated roads via Pilgrove Way
159	Internal	Springbank residential area south of Pilgrove Way, including Harry Yates Way
201	External	A38 Tewkesbury Road to/from Tewkesbury
202	External	Main Road to/from Hardwicke and Stoke Orchard
203	External	M5 to/from Junction 9
204	External	Uckington north of the A4019 and to/from Elmstone Hardwick and connecting roads to the north
205	External	To/from Gallagher Retail Park and connecting roads

Link Flow Validation

AM Validation Counts – Light Vehicles

Count Description / ID	AM (08:00 – 09:00) Light Vehicles Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 1_1 - A38 N to A4019 E	555	513	-42	-0.08	1.83	✓	✓	✓
Site 1_2 - A38 N to A38 S	373	403	30	0.08	1.53	✓	✓	✓
Site 1_4 - A4019 E to A38 S	142	186	44	0.31	3.43	✓	✓	✓
Site 1_6 - A4019 E to A38 N	374	374	0	0.00	0.02	✓	✓	✓
Site 1_8 - A38 S to A38 N	421	433	12	0.03	0.60	✓	✓	✓
Site 1_8 - A38 S to A4019 E	371	351	-20	-0.05	1.07	✓	✓	✓
Site 2_4 - A4019 E to Piffs Elm Road S	57	5	-53	-0.92	9.47	×	✓	✓
Site 2_5 - A4019 E to A4019 W	469	523	54	0.11	2.40	✓	✓	✓
Site 2_7 - Piffs Elm Road S to A4019 W	31	35	4	0.12	0.66	✓	✓	✓
Site 2_9 - Piffs Elm Road S to A4019 E	14	34	20	1.46	4.15	✓	✓	✓
Site 2_11 - A4019 W to A4019 E	830	808	-22	-0.03	0.78	✓	✓	✓
Site 2_12 - A4019 W to Piffs Elm Road S	102	57	-45	-0.44	5.07	×	✓	✓
Site 3_1 - Elmstone Hardwicke N to A4019 E	252	223	-29	-0.11	1.86	✓	✓	✓
Site 3_3 - Elmstone Hardwicke N to A4019 W	93	139	46	0.50	4.30	✓	✓	✓
Site 3_5 - A4019 E to A4019 W	420	386	-34	-0.08	1.68	✓	✓	✓
Site 3_6 - A4019 E to Elmstone Hardwicke N	162	152	-10	-0.06	0.80	✓	✓	✓
Site 3_10 - A4019 W to Elmstone Hardwicke N	174	191	17	0.10	1.27	✓	✓	✓
Site 3_11 - A4019 W to A4019 E	667	652	-16	-0.02	0.60	✓	✓	✓
Site 4_1 - M5 N to A4019 E	445	438	-7	-0.02	0.33	✓	✓	✓
Site 4_5 - A4019 E to A4019 W	587	540	-47	-0.08	1.98	✓	✓	✓
Site 4_6 - A4019 E to M5 N	289	283	-6	-0.02	0.34	✓	✓	✓

Count Description / ID	AM (08:00 – 09:00)							
	Light Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 4_11 - A4019 W to A4019 E	924	875	-50	-0.05	1.65	✓	✓	✓
Site 5_4 - A4019 E to Withybridge Lane S	24	67	43	1.81	6.42	×	✓	✓
Site 5_5 - A4019 E to A4019 W	632	615	-17	-0.03	0.69	✓	✓	✓
Site 5_7 - Withybridge Lane S to A4019 W	230	203	-27	-0.12	1.82	✓	✓	✓
Site 5_9 - Withybridge Lane S to A4019 E	8	38	30	3.71	6.21	×	✓	✓
Site 5_11 - A4019 W to A4019 E	1053	989	-64	-0.06	2.02	✓	✓	✓
Site 5_12 - A4019 W to Withybridge Lane S	313	320	7	0.02	0.42	✓	✓	✓
Site 6_1 - The Green N to A4019 E	205	197	-8	-0.04	0.54	✓	✓	✓
Site 6_2 - The Green N to A4019 W	12	9	-3	-0.22	0.79	✓	✓	✓
Site 6_5 - A4019 E to A4019 W	659	678	19	0.03	0.73	✓	✓	✓
Site 6_6 - A4019 E to The Green N	15	10	-5	-0.30	1.28	✓	✓	✓
Site 6_10 - A4019 W to The Green N	5	2	-3	-0.60	1.60	✓	✓	✓
Site 6_11 - A4019 W to A4019 E	1027	1026	-1	0.00	0.03	✓	✓	✓
Site 7_1 - Gallagher Retail Park N to A4019 E	7	12	5	0.67	1.54	✓	✓	✓
Site 7_2 - Gallagher Retail Park N toB4634 S	77	86	9	0.12	1.04	✓	✓	✓
Site 7_3 - Gallagher Retail Park N to A4019 W	103	81	-22	-0.21	2.26	✓	✓	✓
Site 7_4 - A4019 E to B4634 S	101	134	33	0.33	3.07	✓	✓	✓
Site 7_5 - A4019 E to A4019 W	449	459	10	0.02	0.46	✓	✓	✓
Site 7_6 - A4019 E to Gallagher Retail Park N	2	10	8	3.90	3.21	✓	✓	✓
Site 7_7 - B4634 S to A4019 W	104	174	70	0.68	5.96	×	✓	✓
Site 7_8 - B4634 S to Gallagher Retail Park N	190	225	35	0.18	2.42	✓	✓	✓
Site 7_9 - B4634 S to A4019 E	172	145	-27	-0.15	2.11	✓	✓	✓
Site 7_10 - A4019 W to Gallagher Retail Park N	245	254	9	0.04	0.56	✓	✓	✓
Site 7_11 - A4019 W to A4019 E	970	883	-87	-0.09	2.84	✓	✓	✓
Site 7_12 - A4019 W to B4634 S	61	99	38	0.63	4.28	✓	✓	✓

Count Description / ID	AM (08:00 – 09:00)							
	Light Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 10_4 - B4634 E to Pilgrove Way S	31	28	-3	-0.09	0.53	✓	✓	✓
Site 10_5 - B4634 E to B4634 W	225	197	-28	-0.13	1.96	✓	✓	✓
Site 10_7 - Pilgrove Way S to B4634 W	53	81	28	0.53	3.43	✓	✓	✓
Site 10_9 - Pilgrove Way S to B4634 E	111	106	-5	-0.04	0.47	✓	✓	✓
Site 10_11 - B4634 W to B4634 E	380	321	-59	-0.16	3.17	✓	✓	✓
Site 10_12 - B4634 W to Pilgrove Way S	25	29	4	0.17	0.83	✓	✓	✓
Site 22_2 - B4634 N to B4634 S	350	314	-36	-0.10	1.98	✓	✓	✓
Site 22_3 - B4634 N to Unnamed Road W	23	20	-3	-0.12	0.58	✓	✓	✓
Site 22_7 - B4634 S to Unnamed Road W	91	71	-20	-0.22	2.20	✓	✓	✓
Site 22_8 - B4634 S to B4634 N	469	422	-47	-0.10	2.25	✓	✓	✓
Site 22_10 - Unnamed Road W to B4634 N	26	37	11	0.43	1.99	✓	✓	✓
Site 22_12 - Unnamed Road W to B4634 S	103	129	26	0.26	2.45	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke NB	401	538	137	0.34	6.30	×	×	×
ATC 1 - A4019 nr. Elmstone Hardwicke SB	869	874	4	0.01	0.15	✓	✓	✓
ATC 2 - A4019 nr. Uckington EB	1182	1228	46	0.04	1.32	✓	✓	✓
ATC 2 - A4019 nr. Uckington WB	622	715	92	0.15	3.57	✓	✓	✓
ATC 3 - B4364 Hayden Road	654	561	-93	-0.14	3.79	✓	✓	✓
ATC 3 - B4364 Hayden Road	370	308	-63	-0.17	3.40	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) NB	495	493	-2	0.00	0.11	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) SB	427	444	17	0.04	0.83	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) NB	427	458	31	0.07	1.45	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) SB	384	334	-49	-0.13	2.61	✓	✓	✓

AM Validation Counts – All Vehicles

Count Description / ID	AM (08:00 – 09:00) All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 1_1 - A38 N to A4019 E	563	518	-45	-0.08	1.91	✓	✓	✓
Site 1_2 - A38 N to A38 S	382	407	25	0.07	1.25	✓	✓	✓
Site 1_4 - A4019 E to A38 S	146	188	42	0.29	3.25	✓	✓	✓
Site 1_6 - A4019 E to A38 N	384	389	5	0.01	0.25	✓	✓	✓
Site 1_8 - A38 S to A38 N	441	446	5	0.01	0.25	✓	✓	✓
Site 1_8 - A38 S to A4019 E	379	358	-21	-0.05	1.08	✓	✓	✓
Site 2_4 - A4019 E to Piffs Elm Road S	57	5	-53	-0.92	9.47	×	✓	✓
Site 2_5 - A4019 E to A4019 W	484	538	54	0.11	2.40	✓	✓	✓
Site 2_7 - Piffs Elm Road S to A4019 W	32	36	4	0.12	0.65	✓	✓	✓
Site 2_9 - Piffs Elm Road S to A4019 E	14	37	23	1.62	4.51	✓	✓	✓
Site 2_11 - A4019 W to A4019 E	846	820	-26	-0.03	0.91	✓	✓	✓
Site 2_12 - A4019 W to Piffs Elm Road S	102	59	-43	-0.42	4.82	✓	✓	✓
Site 3_1 - Elmstone Hardwicke N to A4019 E	258	227	-31	-0.12	2.00	✓	✓	✓
Site 3_3 - Elmstone Hardwicke N to A4019 W	96	141	45	0.47	4.17	✓	✓	✓
Site 3_5 - A4019 E to A4019 W	431	401	-30	-0.07	1.48	✓	✓	✓
Site 3_6 - A4019 E to Elmstone Hardwicke N	166	155	-11	-0.06	0.84	✓	✓	✓
Site 3_10 - A4019 W to Elmstone Hardwicke N	178	193	15	0.08	1.11	✓	✓	✓
Site 3_11 - A4019 W to A4019 E	682	665	-17	-0.03	0.66	✓	✓	✓
Site 4_1 - M5 N to A4019 E	471	468	-3	-0.01	0.12	✓	✓	✓
Site 4_5 - A4019 E to A4019 W	602	557	-45	-0.08	1.88	✓	✓	✓
Site 4_6 - A4019 E to M5 N	303	293	-10	-0.03	0.60	✓	✓	✓
Site 4_11 - A4019 W to A4019 E	942	891	-51	-0.05	1.69	✓	✓	✓
Site 5_4 - A4019 E to Withybridge Lane S	24	71	47	1.94	6.77	×	✓	✓
Site 5_5 - A4019 E to A4019 W	652	635	-17	-0.03	0.67	✓	✓	✓

Count Description / ID	AM (08:00 – 09:00)							
	All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 5_7 - Withybridge Lane S to A4019 W	239	209	-30	-0.12	1.98	✓	✓	✓
Site 5_9 - Withybridge Lane S to A4019 E	8	41	33	4.09	6.63	×	✓	✓
Site 5_11 - A4019 W to A4019 E	1085	1027	-58	-0.05	1.79	✓	✓	✓
Site 5_12 - A4019 W to Withybridge Lane S	323	330	7	0.02	0.36	✓	✓	✓
Site 6_1 - The Green N to A4019 E	206	197	-9	-0.04	0.61	✓	✓	✓
Site 6_2 - The Green N to A4019 W	12	9	-3	-0.22	0.79	✓	✓	✓
Site 6_5 - A4019 E to A4019 W	677	701	24	0.03	0.90	✓	✓	✓
Site 6_6 - A4019 E to The Green N	15	10	-5	-0.30	1.28	✓	✓	✓
Site 6_10 - A4019 W to The Green N	6	2	-4	-0.67	2.00	✓	✓	✓
Site 6_11 - A4019 W to A4019 E	1057	1067	10	0.01	0.30	✓	✓	✓
Site 7_1 - Gallagher Retail Park N to A4019 E	7	14	7	1.06	2.26	✓	✓	✓
Site 7_2 - Gallagher Retail Park N toB4634 S	78	86	8	0.11	0.93	✓	✓	✓
Site 7_3 - Gallagher Retail Park N to A4019 W	104	82	-22	-0.21	2.25	✓	✓	✓
Site 7_4 - A4019 E to B4634 S	106	142	36	0.34	3.20	✓	✓	✓
Site 7_5 - A4019 E to A4019 W	477	479	2	0.00	0.08	✓	✓	✓
Site 7_6 - A4019 E to Gallagher Retail Park N	2	12	10	5.15	3.85	✓	✓	✓
Site 7_7 - B4634 S to A4019 W	108	177	69	0.64	5.81	×	✓	✓
Site 7_8 - B4634 S to Gallagher Retail Park N	193	227	34	0.18	2.35	✓	✓	✓
Site 7_9 - B4634 S to A4019 E	177	152	-25	-0.14	1.98	✓	✓	✓
Site 7_10 - A4019 W to Gallagher Retail Park N	248	257	9	0.03	0.54	✓	✓	✓
Site 7_11 - A4019 W to A4019 E	990	920	-70	-0.07	2.27	✓	✓	✓
Site 7_12 - A4019 W to B4634 S	63	103	40	0.64	4.41	✓	✓	✓
Site 10_4 - B4634 E to Pilgrove Way S	31	31	0	-0.01	0.04	✓	✓	✓
Site 10_5 - B4634 E to B4634 W	233	203	-30	-0.13	2.05	✓	✓	✓
Site 10_7 - Pilgrove Way S to B4634 W	53	84	31	0.59	3.77	✓	✓	✓

Count Description / ID	AM (08:00 – 09:00) All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 10_9 - Pilgrove Way S to B4634 E	112	109	-3	-0.02	0.24	✓	✓	✓
Site 10_11 - B4634 W to B4634 E	387	324	-63	-0.16	3.34	✓	✓	✓
Site 10_12 - B4634 W to Pilgrove Way S	26	30	4	0.17	0.81	✓	✓	✓
Site 22_2 - B4634 N to B4634 S	367	331	-36	-0.10	1.93	✓	✓	✓
Site 22_3 - B4634 N to Unnamed Road W	23	20	-3	-0.12	0.58	✓	✓	✓
Site 22_7 - B4634 S to Unnamed Road W	94	73	-21	-0.22	2.27	✓	✓	✓
Site 22_8 - B4634 S to B4634 N	480	429	-51	-0.11	2.38	✓	✓	✓
Site 22_10 - Unnamed Road W to B4634 N	26	40	14	0.53	2.42	✓	✓	✓
Site 22_12 - Unnamed Road W to B4634 S	103	131	28	0.28	2.62	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke NB	421	555	134	0.32	6.08	×	×	×
ATC 1 - A4019 nr. Elmstone Hardwicke SB	896	890	-6	-0.01	0.19	✓	✓	✓
ATC 2 - A4019 nr. Uckington EB	1237	1269	33	0.03	0.92	✓	✓	✓
ATC 2 - A4019 nr. Uckington WB	651	737	87	0.13	3.28	✓	✓	✓
ATC 3 - B4364 Hayden Road	672	571	-102	-0.15	4.08	✓	×	✓
ATC 3 - B4364 Hayden Road	380	318	-62	-0.16	3.32	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) NB	518	501	-17	-0.03	0.75	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) SB	452	462	10	0.02	0.45	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) NB	448	466	19	0.04	0.87	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) SB	401	351	-49	-0.12	2.55	✓	✓	✓

PM Validation Counts – Light Vehicles

Count Description / ID	PM (17:00 – 18:00) Light Vehicles Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 1_1 - A38 N to A4019 E	254	229	-26	-0.10	1.64	✓	✓	✓
Site 1_2 - A38 N to A38 S	327	405	78	0.24	4.10	✓	✓	✓
Site 1_4 - A4019 E to A38 S	308	236	-72	-0.23	4.39	✓	✓	✓
Site 1_6 - A4019 E to A38 N	522	471	-51	-0.10	2.30	✓	✓	✓
Site 1_8 - A38 S to A38 N	221	223	2	0.01	0.12	✓	✓	✓
Site 1_8 - A38 S to A4019 E	237	242	5	0.02	0.32	✓	✓	✓
Site 2_4 - A4019 E to Piffs Elm Road S	14	27	13	0.91	2.81	✓	✓	✓
Site 2_5 - A4019 E to A4019 W	737	669	-68	-0.09	2.56	✓	✓	✓
Site 2_7 - Piffs Elm Road S to A4019 W	63	35	-28	-0.45	4.08	✓	✓	✓
Site 2_9 - Piffs Elm Road S to A4019 E	33	23	-10	-0.30	1.88	✓	✓	✓
Site 2_11 - A4019 W to A4019 E	478	441	-38	-0.08	1.75	✓	✓	✓
Site 2_12 - A4019 W to Piffs Elm Road S	20	30	10	0.52	2.06	✓	✓	✓
Site 3_1 - Elmstone Hardwicke N to A4019 E	117	100	-17	-0.15	1.66	✓	✓	✓
Site 3_3 - Elmstone Hardwicke N to A4019 W	94	110	16	0.17	1.62	✓	✓	✓
Site 3_5 - A4019 E to A4019 W	640	586	-54	-0.08	2.19	✓	✓	✓
Site 3_6 - A4019 E to Elmstone Hardwicke N	129	113	-16	-0.12	1.42	✓	✓	✓
Site 3_10 - A4019 W to Elmstone Hardwicke N	137	144	7	0.05	0.60	✓	✓	✓
Site 3_11 - A4019 W to A4019 E	365	319	-46	-0.13	2.50	✓	✓	✓
Site 4_1 - M5 N to A4019 E	507	522	15	0.03	0.66	✓	✓	✓
Site 4_5 - A4019 E to A4019 W	733	697	-36	-0.05	1.33	✓	✓	✓
Site 4_6 - A4019 E to M5 N	628	693	65	0.10	2.51	✓	✓	✓
Site 4_11 - A4019 W to A4019 E	487	419	-69	-0.14	3.22	✓	✓	✓
Site 5_4 - A4019 E to Withybridge Lane S	16	53	37	2.29	6.26	✗	✓	✓
Site 5_5 - A4019 E to A4019 W	1197	1196	-1	0.00	0.03	✓	✓	✓

Count Description / ID	PM (17:00 – 18:00)							
	Light Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 5_7 - Withybridge Lane S to A4019 W	178	176	-2	-0.01	0.16	✓	✓	✓
Site 5_9 - Withybridge Lane S to A4019 E	4	73	69	17.25	11.12	×	✓	✓
Site 5_11 - A4019 W to A4019 E	869	761	-108	-0.12	3.78	✓	✓	✓
Site 5_12 - A4019 W to Withybridge Lane S	109	169	60	0.55	5.12	×	✓	✓
Site 6_1 - The Green N to A4019 E	12	13	1	0.08	0.28	✓	✓	✓
Site 6_2 - The Green N to A4019 W	5	2	-3	-0.69	1.90	✓	✓	✓
Site 6_5 - A4019 E to A4019 W	1229	1255	26	0.02	0.73	✓	✓	✓
Site 6_6 - A4019 E to The Green N	14	13	-1	-0.05	0.19	✓	✓	✓
Site 6_10 - A4019 W to The Green N	6	4	-2	-0.35	0.94	✓	✓	✓
Site 6_11 - A4019 W to A4019 E	862	830	-32	-0.04	1.10	✓	✓	✓
Site 7_1 - Gallagher Retail Park N to A4019 E	22	35	13	0.58	2.39	✓	✓	✓
Site 7_2 - Gallagher Retail Park N toB4634 S	168	210	42	0.25	3.07	✓	✓	✓
Site 7_3 - Gallagher Retail Park N to A4019 W	242	339	97	0.40	5.69	×	✓	✓
Site 7_4 - A4019 E to B4634 S	169	180	11	0.06	0.80	✓	✓	✓
Site 7_5 - A4019 E to A4019 W	788	715	-73	-0.09	2.66	✓	✓	✓
Site 7_6 - A4019 E to Gallagher Retail Park N	4	7	3	0.78	1.32	✓	✓	✓
Site 7_7 - B4634 S to A4019 W	178	239	61	0.34	4.19	✓	✓	✓
Site 7_8 - B4634 S to Gallagher Retail Park N	164	123	-41	-0.25	3.44	✓	✓	✓
Site 7_9 - B4634 S to A4019 E	199	175	-24	-0.12	1.79	✓	✓	✓
Site 7_10 - A4019 W to Gallagher Retail Park N	207	223	16	0.08	1.11	✓	✓	✓
Site 7_11 - A4019 W to A4019 E	571	539	-32	-0.06	1.35	✓	✓	✓
Site 7_12 - A4019 W to B4634 S	106	121	15	0.14	1.37	✓	✓	✓
Site 10_4 - B4634 E to Pilgrove Way S	130	95	-36	-0.27	3.35	✓	✓	✓
Site 10_5 - B4634 E to B4634 W	366	307	-59	-0.16	3.19	✓	✓	✓
Site 10_7 - Pilgrove Way S to B4634 W	19	48	29	1.50	4.94	✓	✓	✓

Count Description / ID	PM (17:00 – 18:00)							
	Light Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 10_9 - Pilgrove Way S to B4634 E	60	86	26	0.43	3.03	✓	✓	✓
Site 10_11 - B4634 W to B4634 E	359	303	-56	-0.16	3.07	✓	✓	✓
Site 10_12 - B4634 W to Pilgrove Way S	43	44	1	0.03	0.21	✓	✓	✓
Site 22_2 - B4634 N to B4634 S	384	346	-38	-0.10	2.00	✓	✓	✓
Site 22_3 - B4634 N to Unnamed Road W	14	14	0	-0.02	0.07	✓	✓	✓
Site 22_7 - B4634 S to Unnamed Road W	80	102	22	0.27	2.29	✓	✓	✓
Site 22_8 - B4634 S to B4634 N	445	376	-69	-0.16	3.43	✓	✓	✓
Site 22_10 - Unnamed Road W to B4634 N	46	20	-26	-0.57	4.57	✓	✓	✓
Site 22_12 - Unnamed Road W to B4634 S	69	52	-17	-0.25	2.24	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke NB	760	699	-61	-0.08	2.25	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke SB	506	419	-87	-0.17	4.05	✓	✓	✓
ATC 2 - A4019 nr. Uckington EB	854	873	19	0.02	0.66	✓	✓	✓
ATC 2 - A4019 nr. Uckington WB	1161	1278	116	0.10	3.33	✓	✓	✓
ATC 3 - B4364 Hayden Road	492	503	11	0.02	0.50	✓	✓	✓
ATC 3 - B4364 Hayden Road	598	564	-34	-0.06	1.39	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) NB	544	477	-67	-0.12	2.97	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) SB	460	398	-62	-0.14	3.00	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) NB	498	394	-104	-0.21	4.92	✓	×	✓
ATC 14 - B4364 Old Gloucester Road (upper) SB	402	359	-43	-0.11	2.23	✓	✓	✓

PM Validation Counts – All Vehicles

Count Description / ID	PM (17:00 – 18:00)							
	All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 1_1 - A38 N to A4019 E	255	232	-23	-0.09	1.47	✓	✓	✓
Site 1_2 - A38 N to A38 S	327	409	82	0.25	4.27	✓	✓	✓
Site 1_4 - A4019 E to A38 S	308	238	-70	-0.23	4.26	✓	✓	✓
Site 1_6 - A4019 E to A38 N	522	474	-48	-0.09	2.17	✓	✓	✓
Site 1_8 - A38 S to A38 N	224	225	1	0.01	0.08	✓	✓	✓
Site 1_8 - A38 S to A4019 E	237	242	5	0.02	0.32	✓	✓	✓
Site 2_4 - A4019 E to Piffs Elm Road S	14	29	15	1.05	3.18	✓	✓	✓
Site 2_5 - A4019 E to A4019 W	739	673	-66	-0.09	2.49	✓	✓	✓
Site 2_7 - Piffs Elm Road S to A4019 W	63	35	-28	-0.45	4.08	✓	✓	✓
Site 2_9 - Piffs Elm Road S to A4019 E	33	23	-10	-0.30	1.88	✓	✓	✓
Site 2_11 - A4019 W to A4019 E	479	444	-35	-0.07	1.62	✓	✓	✓
Site 2_12 - A4019 W to Piffs Elm Road S	20	30	10	0.52	2.06	✓	✓	✓
Site 3_1 - Elmstone Hardwicke N to A4019 E	118	100	-18	-0.16	1.75	✓	✓	✓
Site 3_3 - Elmstone Hardwicke N to A4019 W	94	110	16	0.17	1.62	✓	✓	✓
Site 3_5 - A4019 E to A4019 W	642	590	-52	-0.08	2.09	✓	✓	✓
Site 3_6 - A4019 E to Elmstone Hardwicke N	131	113	-18	-0.13	1.59	✓	✓	✓
Site 3_10 - A4019 W to Elmstone Hardwicke N	138	146	8	0.06	0.68	✓	✓	✓
Site 3_11 - A4019 W to A4019 E	365	322	-43	-0.12	2.32	✓	✓	✓
Site 4_1 - M5 N to A4019 E	511	536	25	0.05	1.08	✓	✓	✓
Site 4_5 - A4019 E to A4019 W	737	702	-35	-0.05	1.31	✓	✓	✓
Site 4_6 - A4019 E to M5 N	639	700	61	0.10	2.37	✓	✓	✓
Site 4_11 - A4019 W to A4019 E	488	422	-66	-0.14	3.11	✓	✓	✓
Site 5_4 - A4019 E to Withybridge Lane S	16	53	37	2.29	6.26	✗	✓	✓
Site 5_5 - A4019 E to A4019 W	1208	1208	0	0.00	0.01	✓	✓	✓

Count Description / ID	PM (17:00 – 18:00)							
	All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 5_7 - Withybridge Lane S to A4019 W	180	178	-2	-0.01	0.16	✓	✓	✓
Site 5_9 - Withybridge Lane S to A4019 E	4	73	69	17.25	11.12	×	✓	✓
Site 5_11 - A4019 W to A4019 E	874	773	-101	-0.12	3.51	✓	✓	✓
Site 5_12 - A4019 W to Withybridge Lane S	109	173	64	0.59	5.40	×	✓	✓
Site 6_1 - The Green N to A4019 E	12	13	1	0.08	0.28	✓	✓	✓
Site 6_2 - The Green N to A4019 W	5	2	-3	-0.69	1.90	✓	✓	✓
Site 6_5 - A4019 E to A4019 W	1234	1266	32	0.03	0.92	✓	✓	✓
Site 6_6 - A4019 E to The Green N	14	13	-1	-0.05	0.19	✓	✓	✓
Site 6_10 - A4019 W to The Green N	6	4	-2	-0.35	0.94	✓	✓	✓
Site 6_11 - A4019 W to A4019 E	868	843	-25	-0.03	0.87	✓	✓	✓
Site 7_1 - Gallagher Retail Park N to A4019 E	22	37	15	0.67	2.71	✓	✓	✓
Site 7_2 - Gallagher Retail Park N toB4634 S	168	210	42	0.25	3.07	✓	✓	✓
Site 7_3 - Gallagher Retail Park N to A4019 W	243	341	98	0.40	5.74	×	✓	✓
Site 7_4 - A4019 E to B4634 S	169	183	14	0.08	1.03	✓	✓	✓
Site 7_5 - A4019 E to A4019 W	798	726	-72	-0.09	2.62	✓	✓	✓
Site 7_6 - A4019 E to Gallagher Retail Park N	4	7	3	0.78	1.32	✓	✓	✓
Site 7_7 - B4634 S to A4019 W	179	242	63	0.35	4.31	✓	✓	✓
Site 7_8 - B4634 S to Gallagher Retail Park N	164	123	-41	-0.25	3.44	✓	✓	✓
Site 7_9 - B4634 S to A4019 E	199	178	-21	-0.11	1.57	✓	✓	✓
Site 7_10 - A4019 W to Gallagher Retail Park N	208	225	17	0.08	1.18	✓	✓	✓
Site 7_11 - A4019 W to A4019 E	574	550	-25	-0.04	1.03	✓	✓	✓
Site 7_12 - A4019 W to B4634 S	106	123	17	0.16	1.62	✓	✓	✓
Site 10_4 - B4634 E to Pilgrove Way S	130	95	-36	-0.27	3.35	✓	✓	✓
Site 10_5 - B4634 E to B4634 W	367	310	-57	-0.16	3.10	✓	✓	✓
Site 10_7 - Pilgrove Way S to B4634 W	19	48	29	1.50	4.94	✓	✓	✓

Count Description / ID	PM (17:00 – 18:00)							
	All Vehicles							
	Observed	Modelled	Absolute Diff	% Diff	GEH	TAG GEH	TAG Flow	Pass/Fail
Site 10_9 - Pilgrove Way S to B4634 E	60	86	26	0.43	3.03	✓	✓	✓
Site 10_11 - B4634 W to B4634 E	359	306	-53	-0.15	2.90	✓	✓	✓
Site 10_12 - B4634 W to Pilgrove Way S	43	44	1	0.03	0.21	✓	✓	✓
Site 22_2 - B4634 N to B4634 S	385	351	-34	-0.09	1.79	✓	✓	✓
Site 22_3 - B4634 N to Unnamed Road W	14	14	0	-0.02	0.07	✓	✓	✓
Site 22_7 - B4634 S to Unnamed Road W	80	102	22	0.27	2.29	✓	✓	✓
Site 22_8 - B4634 S to B4634 N	448	379	-69	-0.15	3.40	✓	✓	✓
Site 22_10 - Unnamed Road W to B4634 N	46	20	-26	-0.57	4.57	✓	✓	✓
Site 22_12 - Unnamed Road W to B4634 S	70	52	-18	-0.26	2.36	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke NB	776	704	-72	-0.09	2.66	✓	✓	✓
ATC 1 - A4019 nr. Elmstone Hardwicke SB	518	422	-96	-0.18	4.41	✓	✓	✓
ATC 2 - A4019 nr. Uckington EB	875	886	10	0.01	0.35	✓	✓	✓
ATC 2 - A4019 nr. Uckington WB	1189	1289	100	0.08	2.85	✓	✓	✓
ATC 3 - B4364 Hayden Road	498	505	7	0.01	0.32	✓	✓	✓
ATC 3 - B4364 Hayden Road	607	569	-38	-0.06	1.57	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) NB	554	480	-73	-0.13	3.23	✓	✓	✓
ATC 13 - B4364 Old Gloucester Road (lower) SB	469	403	-66	-0.14	3.16	✓	✓	✓
ATC 14 - B4364 Old Gloucester Road (upper) NB	505	397	-108	-0.21	5.07	×	×	×
ATC 14 - B4364 Old Gloucester Road (upper) SB	408	364	-44	-0.11	2.26	✓	✓	✓

ATKINS
Member of the SNC-Lavalin Group

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