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Cambridge Sub-Regional Model 2

F-Series Highway Local Model Validation Report (LMVR)

Cambridgeshire County Council

May 2022

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Client signoff

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Glossary

ATC	Automatic Traffic Count
CCC	Cambridgeshire County Council
CHUMMS	Cambridge to Huntingdon Multi-Modal Study
CSRM	Cambridge Sub-Regional Model
CSRM1	2006 Validated Base Year Cambridge Sub-Regional Model
CSRM2	2015 Validated Base Year Cambridge Sub-Regional Model
D2AP	Dual 2 All Purpose (Road)
DfT	Department for Transport
DIADEM	Dynamic Integrated Assignment and Demand Modelling
EB	Employers Business
Ed	Education
GCP	Greater Cambridge Partnership
GEH	Geoffrey E. Havers Statistic: Measures the difference between modelled traffic flow and observed traffic flow
HAM	Highway Assignment Model
HBW	Home Based Work
HGV	Heavy Goods Vehicle (also known as OGV) – Goods carrying vehicle over 3,500 kg design gross weight
Heavy vehicle	Same as HGV
ij pair	Short hand notation for a notional origin and destination pair within a matrix
ITN	Integrated Transport Network produced by Ordnance Survey
JTW	Journey to Work
LGV	Light Goods Vehicle – Goods vehicle not exceeding 3,500 kg design gross weight
Light vehicle	All light vehicle types including motorcycles, cars and LGVs
LMVR	Local Model Validation Report
LU	Land Use
MC	Motorcycle
MCC	Manual Classified Count
MDVR	Model Development and Validation Report
ME	Matrix Estimation
MPD	Mobile Phone Data
MSBC	Major Scheme Business Case
MSOA	Middle Super Output Area
NIAB	National Institute of Agricultural Botany
O-D	Origin-Destination
OGV1	Other Goods Vehicle 1 - All larger rigid vehicles with two or three axles including larger ambulances with double rear wheels, tractors (without trailers), road rollers for tarmac pressing, box vans, similar large vans and middle-sized trucks which have double rear wheels (if the rear wheels are single, the vehicle should be classified as LGV)
OGV2	Other Goods Vehicle 2 - Includes all rigid vehicles with four or more axles and all articulated vehicles. Also included in this class are OGV1 goods vehicles towing a caravan or trailer

ONS	Office for National Statistics
PASSQ	Pass Queue: Traffic volumes passed from previous time period assignment
PCU	Passenger Car Unit – representing the amount of road space a vehicle occupies on the road network (1 car = 1 PCU)
PT	Public Transport
RSI	Road Side Interview – a surveying technique where drivers are interviewed to determine journey and purpose details
RTM	Highways England Regional Transport Model
SATME2	SATURN based matrix estimation procedure
SATPIJA	SATURN process examining origins and destinations on specific links, integral part of SATME2
SATURN	Simulation and Assignment of Traffic in Urban Road Networks – A suite of computer programmes designed to store traffic and road based information, route the traffic through the road network (assignment), and analyse the operational capabilities of the junctions (simulation)
SFC	Speed Flow Curves
SLA	Select Link Analysis
TDM	Transport Demand Model
TRADS	Highways Agency Trunk Road Information System – A database of flow information for all trunk roads – now superseded by WebTRIS
TUBA	Transport Users Benefit Appraisal software
TAG	Transport Analysis Guidance – A series of Department for Transport advisory documents available through the Internet
WebTRIS	Highway England's Traffic Information Database – a database of flow information for trunk roads

1. Introduction

1.1. Background

The original Cambridge Sub-Regional Model (CSRM1) was developed between 2006 and 2009 by WSP and Atkins, on behalf of Cambridgeshire County Council (CCC) and the Highways Agency. The model was originally designed to support both the A14 upgrade and the Transport Innovation Fund (TIF) work for CCC. As such, the model was designed to be a fully integrated multi-modal transport model, compliant with the Department for Transport's (DfT's) Transport Analysis Guidance (TAG) with respect to those schemes assessed, including major scheme business case development for multi-modal schemes.

In early 2015, it was recognised that the 2006 Base Year validation of CSRM1 made it less suitable for work going forward, and it was agreed that a complete model refresh should take place. Following preliminary scoping work by WSP and Atkins (Phase 1 of model development), CCC commissioned Atkins to carry out an update and re-validation of CSRM1, to provide a refreshed model which is termed CSRM2 and has a base year of 2015.

The motivation for the CSRM2 update was that CCC required an up-to-date model developed using best practice as set out in TAG, to carry out testing and development of the Greater Cambridge Partnership (GCP) transport schemes, together with more general strategic planning and business case work, major site development and other transport scheme / transport strategy development. The main changes addressed during the refresh can be summarised as follows:

- The Land Use model previously part of CSRM1 has been removed, and replaced with a more standard approach of developing the trip ends by purpose externally from the model based on planning data as set out in Chapter 5 of the Model Development and Validation Report (MDVR[1]);
- The network for the SATURN Highway Assignment Model (HAM) has been substantially reviewed, re-built and re-validated, using traffic counts, mobile phone data, traffic signal settings, network surveys and Trafficmaster travel time data. This process is described in this Local Model Validation Report (LMVR);
- Elements of the transport demand and public transport model have been improved where possible, particularly the modelling of Park & Ride (P&R) site choice as summarised in Section 2.9 of the MDVR;
- The public transport services for bus, guided bus, rail and P&R have been fully updated and more explicitly linked to published electronic timetables. Walk and cycle networks have also been refreshed, with detail added and improved representation of footpaths and cycleways;
- P&R modelling was further refined to extend the modelling of P&R beyond services to and from Cambridge City centre; and
- Following the above changes, the variable demand model (VDM) calibration, public transport and active mode assignment have been validated against observed data, as described in the MDVR.

CSRM2 has been developed with a base year of 2015, which applies to the data collection, transport network and public transport services. Approximately annually, a new version of the base model is released, which incorporates updates to coding (including additional detail, if appropriate, in areas that have been the subject of specific studies) and TAG sourced parameters. These model versions are denoted by letters:

- the A-series was used in autumn 2016;
- the B-series was released in summer 2017;
- the C-series was released in December 2017;
- the D-series was released in winter 2018;
- the E-series was released in winter 2019; and
- the F-series was released in summer 2021.

The CSRM2 F-series was developed in 2020-2021 to enhance the representation of cycling in the model with differentiated cycling facilities impacting travellers' choices of mode and route; and extending the modelling of P&R to enable users to park and continue their journey by bus or by active modes (walk and cycle) – this is termed "Park & Active" (P&A). The F-series also improved the level of detail in areas that are the focus of current transport scheme projects, and added a 2019 Present Year Validation (PYV) to extend the life of the model until such time as a whole new base year can be created (once the disruption to travel behaviour and patterns caused by the COVID-19 pandemic has settled to a "new normal" state).

[1] 'Cambridge Sub-Regional Model 2: F-Series Transport Demand and Public Transport Model Development and Validation Report', CSRM2_F-Series_TDM_MDVR_v5.0.pdf (Atkins, September 2021)

Throughout this report, the original CSRM is referred to as CSRM1, and the refreshed model as CSRM2.

1.2. Key Model Design Considerations

CSRM2 retains many of the design principles and considerations of the original CSRM1, the design of which was informed by the need for major scheme business cases to be developed for the A14 upgrade and Transport Innovation Fund (TIF) programme of the time. The software also remains the same, though updated to the latest versions: namely, a combination of MEPLAN (for the VDM and PT/active mode assignments) and SATURN (for the HAM), stitched together with scripts written in Batch, Python and Perl. With this in mind, the model has the following key design features:

- Integration of a synthetic VDM for personal travel with a validated highway model, implemented incrementally;
- Inclusion in the VDM of trips covering all purposes, modes and trip lengths, to allow a full range of demand responses to be considered;
- Future growth in trip ends informed by detailed assessments of land use change, demographics and development areas;
- Modelling of private, public and active transport modes including explicit representation of journey stages and costs, and local sub-modes such as P&R, P&A and the Cambridgeshire Guided Busway (CGB);
- Modelling of cycling commensurate with the higher-than-average use of this mode in and around Cambridge;
- A separately validated HAM, using the SATURN software to include modelling of queues and junction delays at a strategic level so that changes to the highway network can be fed through in more detail than if the whole model were solely in MEPLAN;
- Segmentation of the travel demand in the VDM and HAM sufficient to represent variations in value of time (VoT) by travel purpose, and traveller type including income;
- Impacts of traffic congestion on private vehicles and (where relevant) public transport journey times; and
- Use of TAG default VDM structures and parameters, adjusted appropriately to local calibration data where this is available.

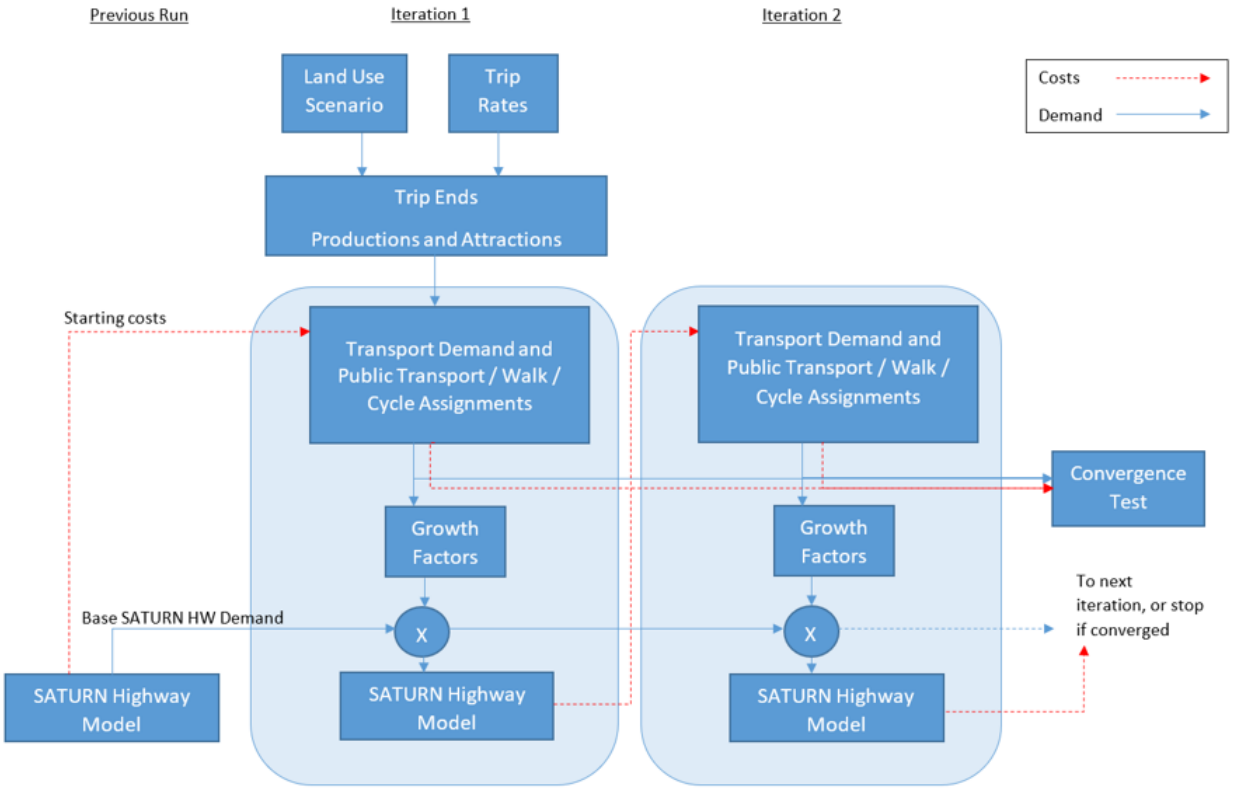
1.2.1. How the highway model fits into the wider CSRM2

As part of the network build specification, the highway model zone system and node structure seamlessly integrate with the public transport and walk/cycle networks underpinned with a fully compatible numbering system. The HAM has been developed using the industry standard SATURN software package. The network model coding for highway links forms the underlying structure of all other modes with other link types superimposed (for rail and walk/cycle). All bus and guided bus services use a SATURN based network with fixed predefined paths. The bus routes pick up congestion by reading in congested highway link times except in instances where there are bus lanes or segregated bus ways (guided bus services) in which case the speed is fixed and aligned to timetabled journey times.

1.2.2. Treatment of travel costs

As shown in Figure 1-1, the SATURN highway model becomes a pivotal part of generating travel costs. The SATURN model sits within the integrated transport model although the level of initial interaction in the base year is comparatively free standing.

Figure 1-1 Model Structure Schematic



1.2.3. Major Scheme Business Case (MSBC) submissions

The key considerations for developing a TAG compliant CSRM are to provide an evidence base for the planning and development mitigation as well as the appraisal of major highway and public transport schemes. The major interventions are principally around Cambridge.

The principal objective of the CSRM2 is to appropriately represent travel conditions on the highway transport network for the appraisal of various proposed transport schemes. The highway model must also provide cost skims to the wider Transport Demand Model (TDM) component of CSRM2.

The CSRM2 HAM will provide:

- Changes in the travel cost between the base year and forecast years for input to the Demand Model;
- Changes in traffic flows for input to the environmental appraisal of a scheme; and
- Changes in travel costs for input to the economic appraisal.

The potential interventions for appraisal will relate to major highway improvements, large traffic management schemes, or large scale complex public transport schemes. The CSRM2 should have the following capabilities:

- Reflecting the impact of changes in land use policies, economic conditions and interventions on travel demand;
- Testing for scenario development using strategic level modelling; and
- Testing of schemes using more detailed modelling to be put forward for inclusion in funding programmes.

1.3. Proposed Uses of the Model

The primary proposed use of CSRM2 is to support the assessment of transport schemes, taking account of all modes of transport and the interaction between transport supply and travel demand, including the influence of land use change. With high growth expectations in both housing and employment in Cambridgeshire, it is critical to have evaluation frameworks of a size capable of capturing change and the longer-term equilibrium of the sub-region. Funding required to support schemes being considered in the sub-region are at such a scale that almost all schemes would be classed as “Major Schemes” with associated higher-level business case requirements.

With explicit representation of public transport supply and demand, CSRM2 can capture and evaluate the benefits of new infrastructure (highway, Public Transport (PT) and sustainable modes) as well as modified service patterns (PT) and active modes (walk and cycle). Trends in land use can be taken into account, including housing and employment, as well as demographic shifts and levels of in- and out-commuting.

In order to support the development of business cases for major schemes, forecasts conducted need to be able to project sufficiently far into the future to capture the severity of growing congestion through time.

The four key districts within CSRM2 (Cambridge City, South Cambridgeshire, Huntingdonshire and East Cambridgeshire) all have ambitious growth aspirations and CSRM2 can be used to assess the transport impacts of alternative development options to inform updates to the Local Plans.

1.3.1. Greater Cambridge Partnership

Greater Cambridge Partnership (GCP) status was agreed with central government in June 2014, supporting the creation of 45,000 jobs and a combination of private and public funding totalling £5 billion, with £1 billion directed towards transport infrastructure projects. The transport schemes being considered are a mix of public transport, highway network capacity management/re-allocation and other demand management such as workplace parking levies.

CSRM2 is specifically tailored to cover the GCP initiatives which radiate out from Cambridge City through into South Cambridgeshire district. The overall strategic impact of schemes in terms of corridor-based changes in demand, traffic assignment and consequential impact on journey times can be examined using CSRM2, subject to localised benchmarking validation checks. More localised assessments, such as individual junctions, could require use of local modelling informed by CSRM2. Outputs from CSRM2 can be passed through the DfT's economic appraisal software TUBA, allowing long term economic cost benefit analysis to be performed.

CSRM2's enhanced representation of cycling in the F-series, including the concept of P&A using the city's existing P&R sites, is tailored towards the types of scheme that GCP are working on.

1.3.2. Local Authority Districts

The internal area of CSRM2 covers the Local Authority Districts (LADs) of Cambridge City, South Cambridgeshire, Huntingdonshire and East Cambridgeshire. As with CSRM1, the model has been designed for the purpose of modelling transport and land use changes in each of the four LADs. The assessment of Local Plans was particularly considered in this respect, and work on the Huntingdonshire Local Plan was undertaken using the CSRM2 A-series in December 2016, whilst the F-series is being used for the Greater Cambridge (Cambridge City and South Cambridgeshire) Local Plan.

1.3.3. Cambridgeshire and Peterborough Combined Authority

The Cambridgeshire and Peterborough Combined Authority (CPCA) is a combined authority covering the ceremonial county of Cambridgeshire. The authority was established on 3 March 2017 and it includes the following local councils: Cambridgeshire County Council, Peterborough City Council, Cambridge City Council, East Cambridgeshire District Council, Fenland District Council, Huntingdonshire District Council and South Cambridgeshire District Council. Key ambitions for the CPCA include doubling the size of the local economy, accelerating house building rates to meet local and UK need and delivering connectivity in terms of transport and digital links.

Although the CSRM2 study area does not cover the whole CPCA administrative boundary, the model can forecast many of the impacts that wider regional transport schemes would have within the sub-region. The areas covered by the combined authority lying outside the CSRM2 study area are represented by external zones in more detail than more distant areas as outlined in Section 1.3.4.

1.3.4. External areas

As the model considers only four LADs of Cambridgeshire (excluding Fenland District) as internal areas, there is some limitation in the dynamic predictions of travel to and from adjacent areas. Trips from these areas into and out of the internal study area are considered for external zones, which include Peterborough, Newmarket and Royston, as well as adjacent areas of Essex, Norfolk, Suffolk, Bedfordshire and Fenland itself. More detail was added in external areas near Mildenhall and Tempsford to improve the representation of potential strategic transport schemes such as the Cambridge Autonomous Metro (CAM) and East West Rail.

For these external areas, the level and nature of interaction with the internal area follows growth trajectories rather than any dynamic predictions of demand activity, and, while still informative, should be considered as an exogenous assumption in the model.

1.3.5. Developer and other applications

Historically, CSRM1 was used for the impact assessments of larger proposed development sites such as the National Institute of Agricultural Botany (NIAB), Cambridge North West, Northstowe, Alconbury Weald and Cambourne West. Whilst the expectation that the base model would be able to match observations of individual movements at junctions may be unrealistic, localised modelling informed by strategic assessments using CSRM2 can be appropriate for modelling the impact of individual developments. It is anticipated that CSRM2 F-series will be used for developer testing in the wake of the modelling work for the Greater Cambridge Local Plan.

1.4. Purpose of Report

The LMVR sets out the detail of the CSRM2 HAM: its design, development, calibration and validation with reference to the DfT's TAG.

This version of the LMVR has been updated for the F-series of CSRM2, which incorporated further network and zoning detail in GCP corridors (specifically Cambourne to Cambridge, Cambridge South-West, Cambridge South-East, Waterbeach to Cambridge and Eastern Access), as well as around Ely and St Neots rail stations and the near-external areas of Mildenhall and Sandy/Bedford; and enhancements to the modelling of cycling. The CSRM2 F-series was commissioned in late 2020.

The F-series also includes a re-estimation of the base year highway matrix following the network enhancements, as well as an update of the 2015 TAG parameters from the most up to date TAG databook (v1.13.1 July 2020).

In addition, a 2019 Present Year Validation has been undertaken to ensure that the model would still be valid for testing the impacts of forecast year schemes, despite the 2015 base year model exceeding the five years from the current year, recommended by the TAG guidelines. This involved setting up a 2019 forecast year with updated highway networks (and other inputs as reported in the MDVR) and comparing its outputs against 2019 observed data.

Due to the COVID-19 pandemic which caused the distortion of the current traffic situation, it was not considered appropriate to collect data with the purpose of having a new 2020 base year model or a 2020 PYV. Moreover, the previous years' traffic conditions have been affected by the A14 roadworks and this would have produced distorted results when calibrating a highway model.

Therefore, the present year validation exercise has been based on the available data collected and observed before the COVID-19 pandemic, i.e. 2019, and the base year highway network has been edited to represent the temporary state with A14 roadworks in place by October 2019 as well as known highway schemes which were completed by that time.

1.5. Report Structure

Following this introduction, the report is structured as follows:

- Section 2 defines the standards against which the model will be validated;
- Section 3 describes the key features of the model;
- Section 4 summarises the observed data used for model calibration and validation in 2015 and 2019;
- Section 5 describes the matrix development;
- Section 6 describes the matrix calibration and validation;
- Section 7 presents the network, route choice and assignment calibration and validation results; and
- Section 8 summarises the model performance in both 2015 and 2019.

2. Model Standards

The HAM has been developed following the guidance in TAG unit M3.1, Highway Assignment Modelling[2].

2.1. Validation Criteria and Acceptability Guidelines

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

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.*

2.2. Trip Matrix Validation

For trip matrix validation, the measure which should be used 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 2-1.

Table 2-1 Screenline Flow Validation Criterion and Acceptability Guideline

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

TAG goes on to say that regarding screenline validation, the following should be noted:

- *Screenlines should normally be made up of five 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 (a) where data were used to inform matrix development, (b) for 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 goods vehicles); and*
- *The comparisons should be presented separately for each modelled period.*

2.3. Link Flow Validation

Two measures are used for individual link validation: flow difference; and GEH. The flow measure is based on the relative flow difference between modelled flows and observed counts, with three different criteria set depending on the scale of observed flows.

The GEH measure uses the GEH statistic as defined below:

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

Where: GEH is the GEH statistic;
M is the modelled flow; and
C is the observed flow.

[2] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/938864/tag-m3-1-highway-assignment-modelling.pdf

TAG Unit M3.1 describes the Link Flow and Turning Movements Validation Criteria and Acceptability Guidelines as shown in Table 2-2.

Table 2-2 Link Flow and Turning Movement Validation Criteria and Acceptability Guidelines

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

Regarding flow validation, the following should be noted:

- *The above criteria should be applied to both link flows and turning movements;*
- *The guideline may be difficult to achieve for turning movements* (especially given the strategic nature of CSRM covering much of the County);
- *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.*

2.4. Journey Time Validation

Journey time validation is measured using the percentage difference between modelled and observed journey times, subject to an absolute maximum difference. TAG Unit M3.1 describes the criteria and guidelines as shown in Table 2-3.

Table 2-3 Journey Time Validation Criterion and Acceptability Guideline

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

Regarding the journey time validation, the comparisons should be presented separately for each modelled period.

2.5. Convergence Criteria and Standards

The advice on model convergence is set out in TAG Unit M3.1 and is reproduced below in Table 2-4.

Table 2-4 Summary of Convergence Measures and Base Model Acceptable Values

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% (SUE only)

2.6. Impact of Matrix Estimation

Tag Unit M3.1 states that the changes brought about by Matrix Estimation (ME) should be carefully monitored by the following means:

- *Scatter plots of matrix zonal cell values, prior to and post matrix estimation, with regression statistics (slopes, intercepts and R^2 values);*
- *Scatter plots of zonal trip ends, prior to and post matrix estimation, with regression statistics (slopes, intercepts and R^2 values);*
- *Trip length distributions, prior to and post matrix estimation, with means and standard deviations; and*
- *Sector-to-sector level matrices, prior to and post matrix estimation, with absolute and percentage changes.*

The changes introduced by the application of ME should be understood and may be assessed using TAG Unit M3.1, as shown in Table 2-5 below.

Table 2-5 Significance of Matrix Estimation Changes

Measure	Significance Criteria
Matrix zonal cell levels	Slope within 0.98<Slope<1.02 Intercept near zero R^2 in excess of 0.95pe within 0.98<Slope<1.02
Matrix zonal trip ends	Slope within 0.99<Slope<1.01 Intercept near zero R^2 in excess of 0.98
Trip length distributions	Means within 5% Standard deviations within 5
Sector-to-sector level matrices	Differences within 5%

The unit states that it is important that the fidelity of the underlying trip matrices is not compromised to meet the validation standards. All exceptions to these criteria should be examined and assessed for their importance for the accuracy of the matrices in the Fully Modelled Area.

The comparisons should be presented by vehicle type (preferably cars, light goods vehicles and other goods vehicles). The comparisons should also be presented separately for each modelled period or hour.

2.7. Present Year Validation

Given that CSRM2 is now more than 5 years old, a Present Year Validation (PYV) has been carried out, as suggested by TAG. Due to the arrival of the COVID-19 pandemic, it was not possible to collect new data in 2020 and so the PYV has been based on as much data as was available for the last neutral period: autumn 2019. A full set of journey time data was available for the same routes as used in the 2015 base, but the traffic count data is more patchy. This report sets out the ways in which the best use has been made of available data, to give confidence in the continued use of CSRM2 in 2021 and beyond.

2.8. Interpretation of the Guidelines

TAG Unit M3.1 states that the achievement of the base year validation acceptability guidelines specified in Table 1, Table 2 and Table 3 (of TAG Unit M3.1) as replicated in Table 2-1, Table 2-2, and Table 2-3 above does not guarantee that a model is 'fit for purpose' and likewise a failure to meet the specified validation standards does not mean that a model is not 'fit for purpose'.

Furthermore, in some models, particularly models of large congested areas, it may be difficult to achieve the link flow and journey time validation acceptability guidelines set out in Table 2 and Table 3 (of TAG Unit M3.1) without ME bringing about changes greater than the limits shown in Table 5 (of TAG Unit M3.1). In these cases, the limits set out in Table 5 (of TAG Unit M3.1) should be respected, the impacts of ME should be reduced so that they do not become significant, and a lower standard of validation reported. In other words, ME should not be allowed to make significant changes to the prior matrices in order that the validation standards are met.

3. Key Features of the Model

3.1. Model Base Year

CSRM2 has been developed with a base year of 2015. The data collected to inform the matrix development was collected in November 2015, with transport networks and public transport timetables reflecting the current situation as of 2015.

3.2. Present Year Validation Year

As part of the F-series model refresh, CSRM2 has been subject to a present year validation to confirm that the model is still able to be used for forecast year schemes despite its base year being older than five years. Due to the COVID-19 pandemic and the impossibility of conducting surveys whose results might have produced a distorted representation of the traffic conditions, 2019 has been chosen and the observed data already available have been used.

3.3. Modelling Software

The CSRM2 F-series HAM has been developed and validated using SATURN Version 11.5.05H. SATURN is the industry standard strategic highway modelling software and the CSRM has been upgraded to the latest version to make use of recent software improvements and added functionality.

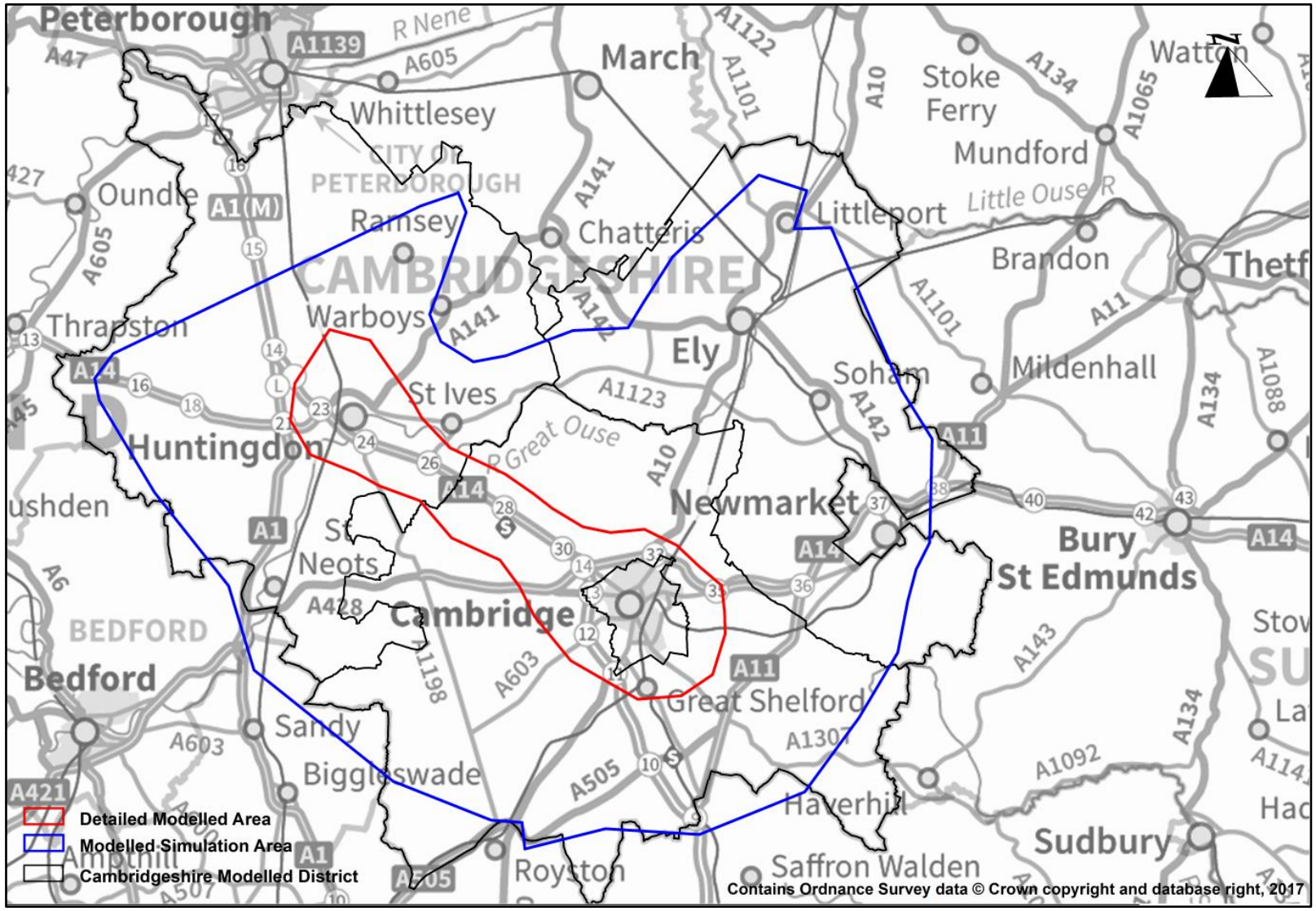
3.4. Fully Modelled Area and External Area

TAG Unit M3.1 states that the geographic coverage of highway assignment models generally needs to: allow for the strategic re-routeing impacts of interventions; ensure that areas outside the main area of interest, which are potential alternative destinations, are properly represented; and ensure that the full lengths of trips are represented for deriving costs. The modelled area therefore needs to be large enough to include these elements, but within the modelled area the level of detail should vary as follows:

- **Fully Modelled Area**: the area over which proposed interventions have influence, and in which junctions are in SATURN simulation, is further subdivided as:
  - **Area of Detailed Modelling –** the area over which significant impacts of interventions are certain and the modelling detail in this area would be characterised by: representation of all trip movements; small zones; very detailed networks; and junction modelling (including flow metering and blocking back).
  - **Rest of the Fully Modelled Area –** the area over which the impacts of interventions are quite likely but relatively weak in magnitude and would be characterised by: representation of all trip movements; somewhat larger zones and less network detail than for the Area of Detailed Modelling; and speed/flow modelling (primarily link-based but possibly also including a representation of strategically important junctions).
- **External Area:** the area where impacts of interventions would be so small as to be reasonably assumed to be negligible and would be characterised by: a SATURN buffer network representing a large proportion of the rest of Great Britain, a partial representation of demand (trips to, from and across the Fully Modelled Area); large zones; skeletal networks and simple speed/flow relationships or fixed speed modelling.

The CSRM2 covers the Cambridgeshire districts of Cambridge, South Cambridgeshire, East Cambridgeshire, and Huntingdonshire. The area of detailed simulation modelling covers Cambridge and Huntingdon, including the A14 and M11 as shown in Figure 3-1. The external area covers the rest of Great Britain in a skeletal form including the Fenland district.

Figure 3-1 Extent of Modelled Area



3.5. Zoning System

A complete review of the CSRM1 zoning system was undertaken as part of the model refresh, with changes made to ensure compatibility with UK Census Output Areas and district boundaries. The new zone system also includes increased granularity in and around the satellite market towns. The HAM zoning system in CSRM2 is now consistent with the wider CSRM TDM.

For the F-series, a further review was undertaken to identify areas that would benefit from more detail to better capture upcoming scheme testing, building on work carried out for a number of GCP schemes as well as incorporating new near external zones for East-West Rail (EWR) and the Cambridge Autonomous Metro (CAM) which were being proposed at the time. The new zones added were:

- Two in the Grange Road area of Cambridge, to improve the detail in the area where the Cambourne to Cambridge GCP scheme reaches the city centre;
- One for the John Lewis depot in Trumpington, so that its traffic movements could be separated from P&R demand and the rest of the surrounding area;
- The Milton village zone was split into two (east and west) to allow more scope for capturing the variations between potential routes of the Waterbeach to Cambridge PT corridor scheme;
- The division between Landbeach and Waterbeach was realigned along the A10 and a new zone was added for the Cambridge Research Park to allow its future expansion to be better represented;
- Granta Park and the Babraham Research Campus were separated from their respective residential zones, to improve the level of detail in the corridor of the Cambridge South East Transport Study;
- Mildenhall was separated from the Norfolk zone to allow better representation of CAM; and
- Bedford was separated from the Sandy/Tempsford area to allow better representation of EWR.

Zones are numbered by the district that they lie within, with the first digit representing the district number (1xx for Cambridge, 2xx for South Cambridgeshire, etc.). All existing P&R sites, including Cambridge Guided Busway P&R, have an allocated zone in the 9xx series.

A pool of 99 development zones (6xx series) are included in the base matrix. These zones have zero trips in the base and are reserved for activation as required during forecasting. Details of the zone numbering system and quantity of zones by district are shown below in Table 3-1.

Table 3-1 Zone Details

District / Area	Number of Zones	Zone Number Range
Cambridge	81	101-181
South Cambridgeshire	101	201-302
East Cambridgeshire	23	401-423
Huntingdonshire	99	501-599
Total Internal	**304**	**101-599**
Future Development Zones	99	601-699
External	34	701-742
Park & Ride	28	971-998
Grand Total	**465**	**101-998**

Figure 3-2 below shows the extent of the external zoning system, whilst Figure 3-3 shows the zoning system for the CSRM2 study area. Figure 3-4 to Figure 3-9 go on to provide more detailed zone plans for the following areas: Cambridge; Huntingdon; Ely; St. Ives; St. Neots; and Northstowe.

The locations of zone centroids are population-weighted where the zone contains resident population, and otherwise have been positioned according to the geometric centroid of the zone.

Figure 3-2 Zone Plan: External

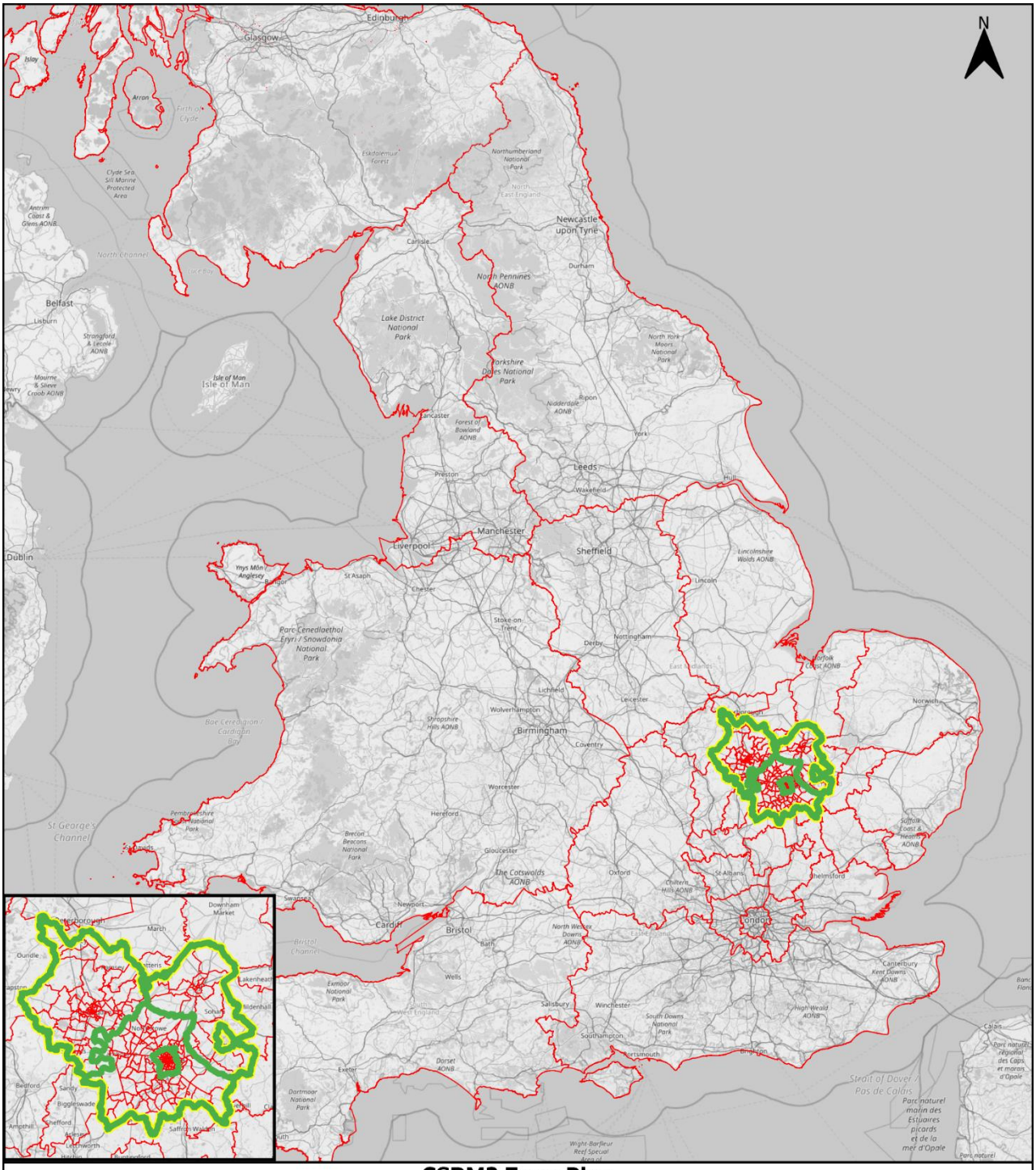


Figure 3-3 Zone Plan: Study Area

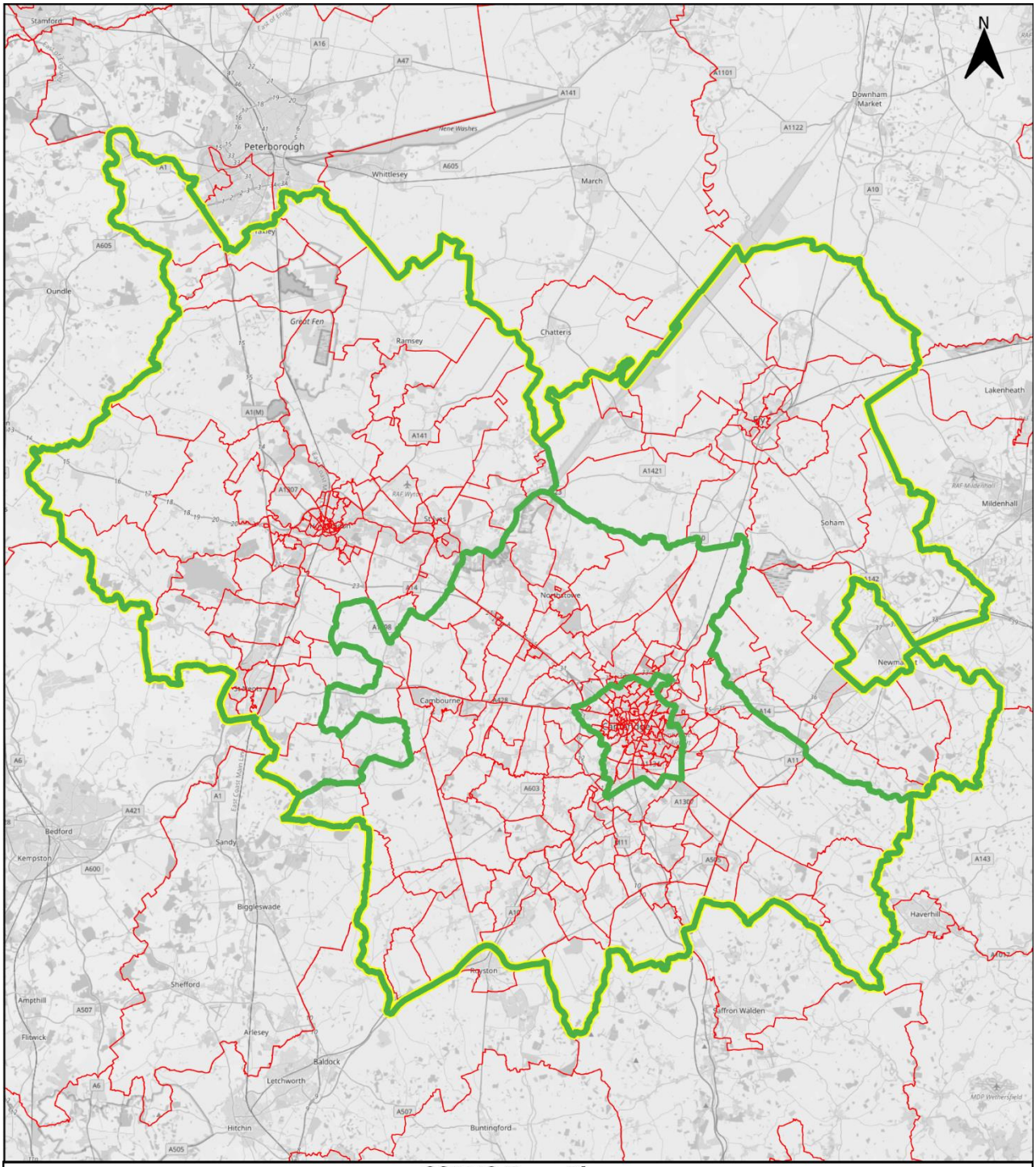


Figure 3-4 Zone Plan: Cambridge

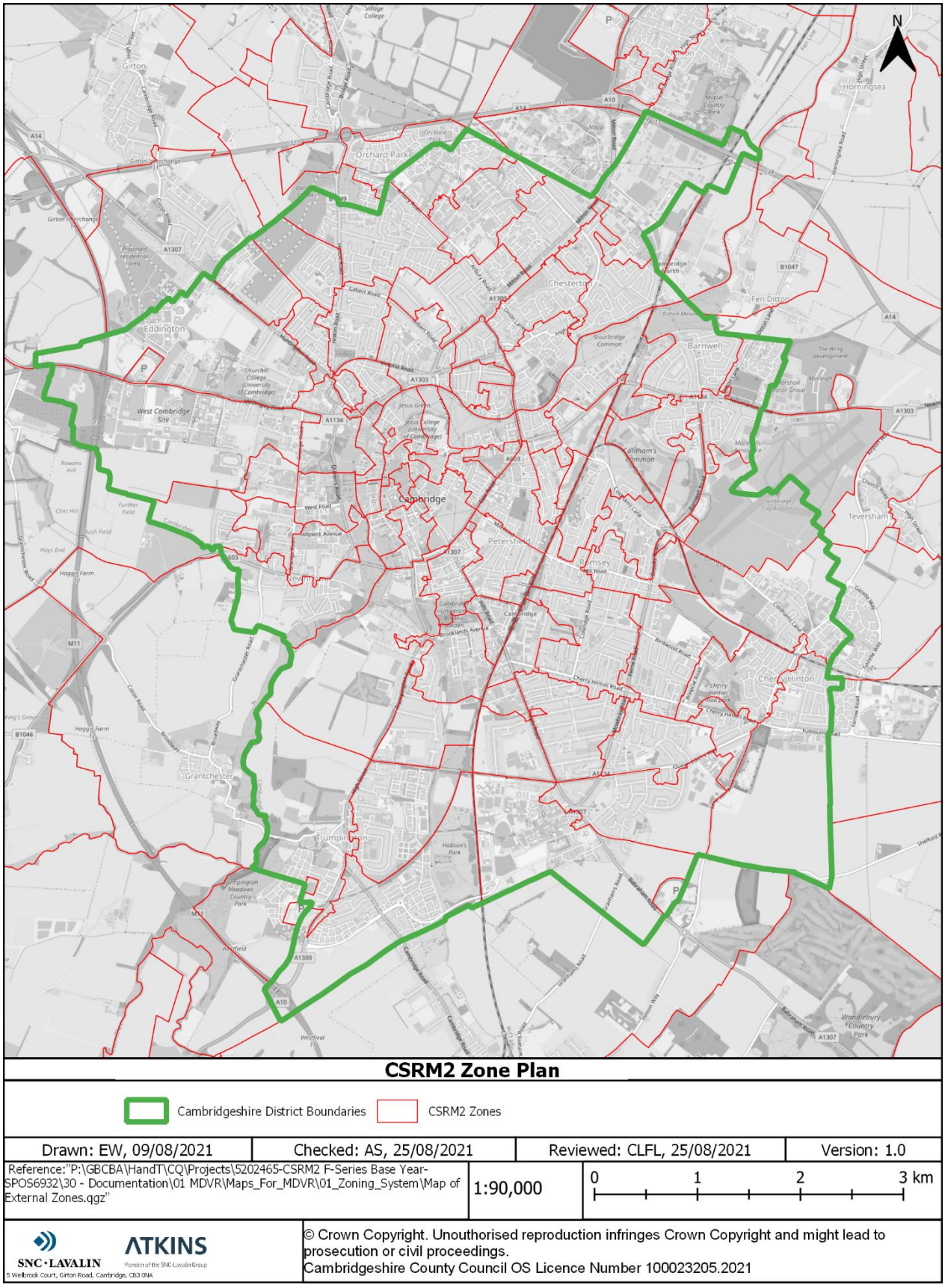


Figure 3-5 Huntingdon Zone Detail

Figure 3-6 Ely Zone Detail

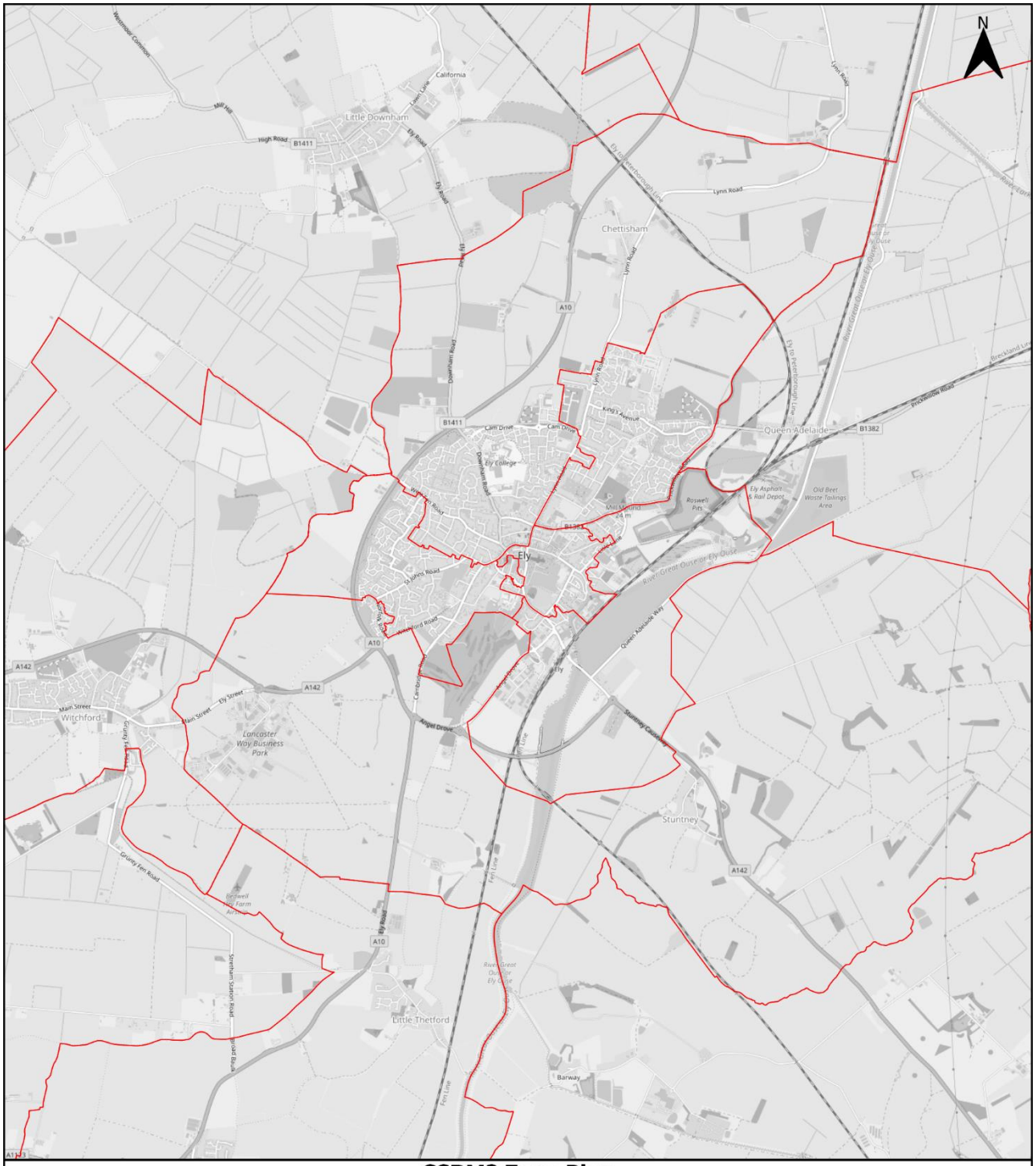


Figure 3-7 St Ives Zone Detail

CSRM2 Zone Plan

CSRM2 Zones

Drawn: EW, 09/08/2021	Checked: AS, 25/08/2021	Reviewed: CLFL, 25/08/2021	Version: 1.0

Reference:"P:\GBCBA\HandT\CQ\Projects\5202465-CSRM2 F-Series Base Year-SPOS6932\30 - Documentation\01 MDVR\Maps_For_MDVR\01_Zoning_System\Map of External Zones.qgz"

1:40,000

0 0.5 1 km

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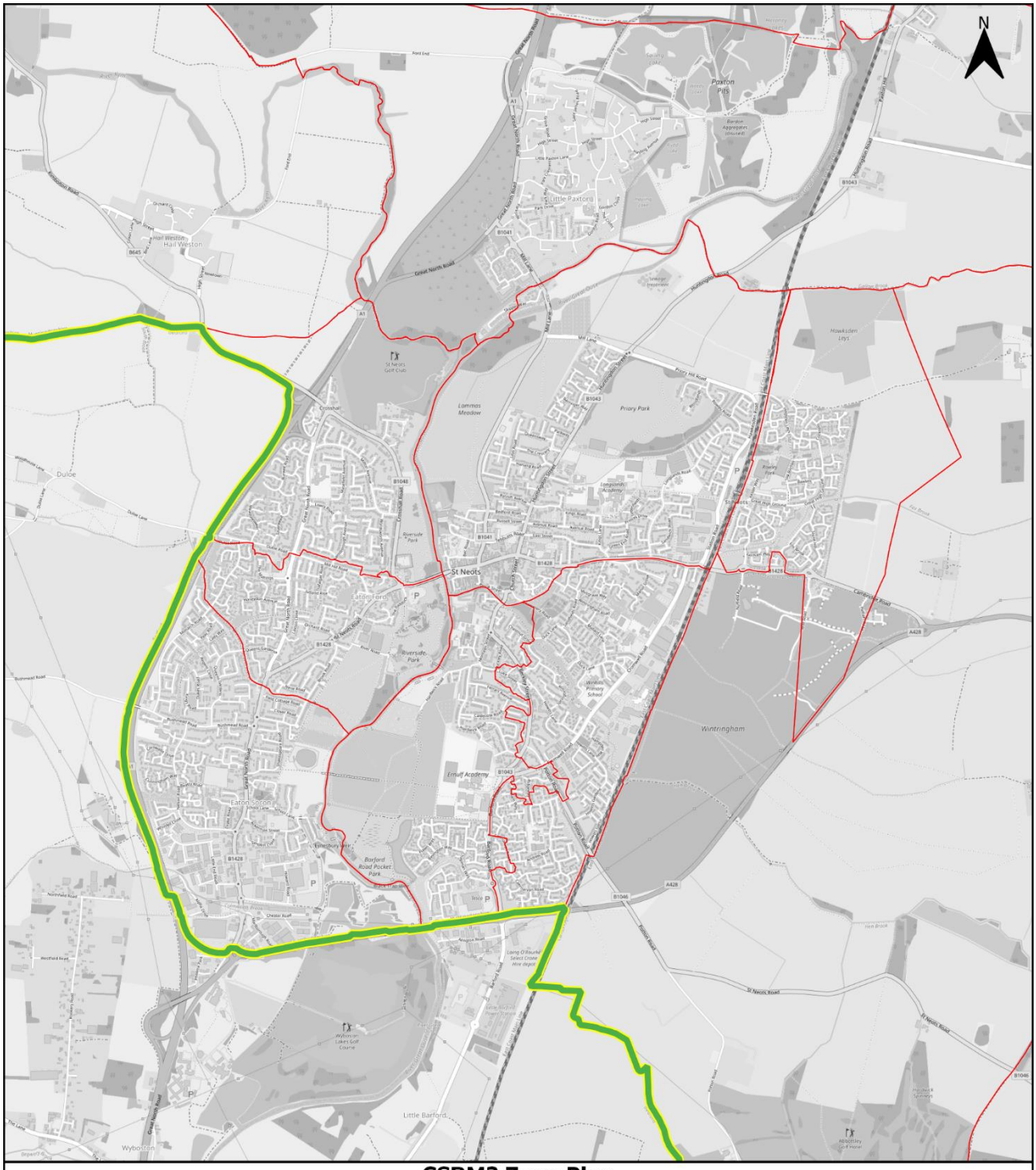
Figure 3-8 St Neots Zone Detail



CSRM2 Zone Plan

Cambridgeshire District Boundaries | LAD Boundaries 02 | CSRM2 Zones

Drawn: EW, 09/08/2021	Checked: AS, 25/08/2021	Reviewed: CLFL, 25/08/2021	Version: 1.0

Reference:"P:\GBCBA\HandT\CQ\Projects\5202465-CSRM2 F-Series Base Year-SPOS6932\30 - Documentation\01 MDVR\Maps_For_MDVR\01_Zoning_System\Map of External Zones.qgz"

1:60,000

0 2 km

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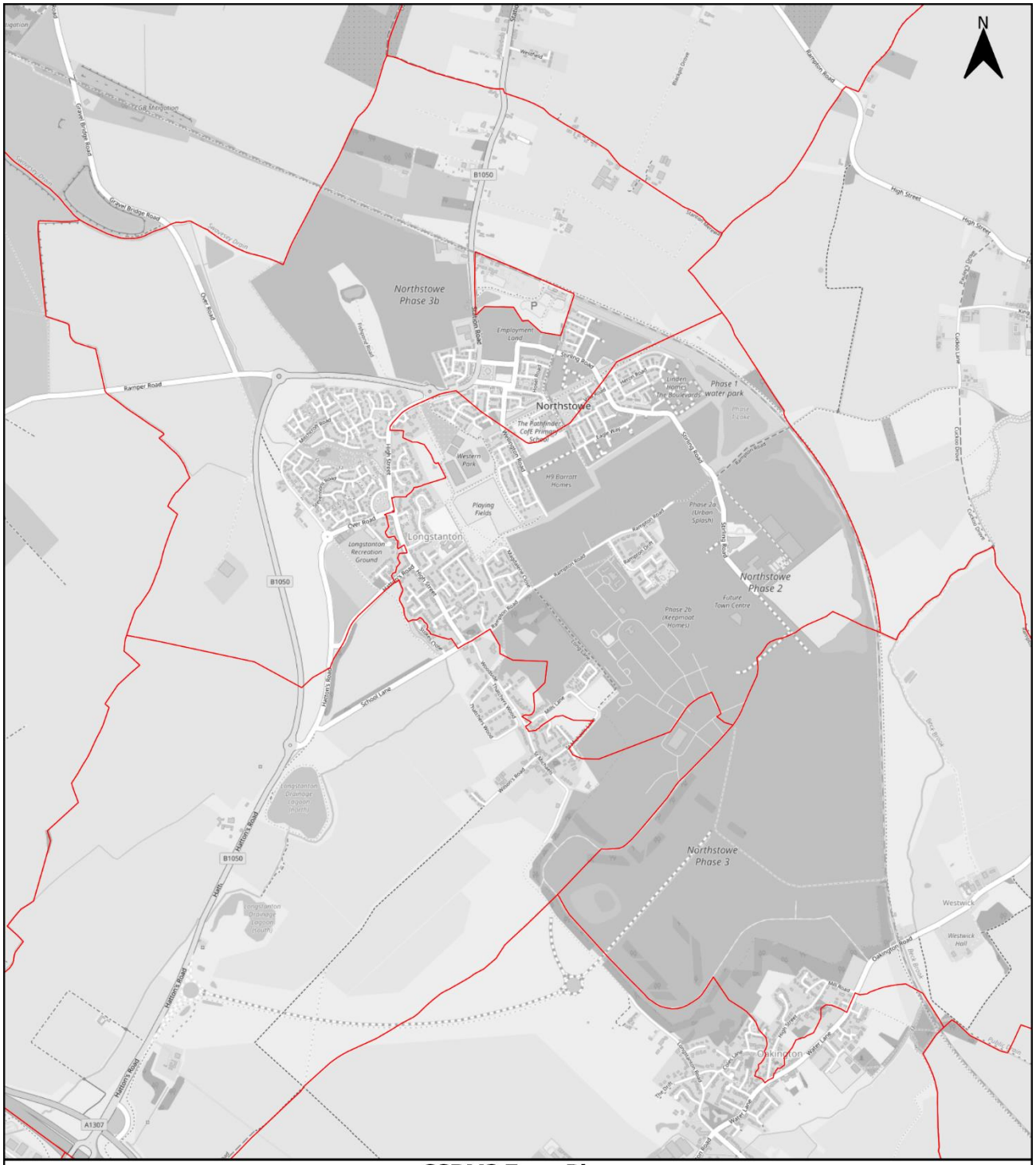
Figure 3-9 Northstowe Zone Detail



3.6. Sector System

During the development of the CSRM2, sector systems were developed to assist with matrix manipulation analysis and comparison at a more aggregated level. Sectors are at a greater level of aggregation in the external areas, becoming more disaggregate in the core study areas and are compatible with MSOA and district boundaries.

Figure 3-10 and Figure 3-11 provide a visual representation of two “standard” sectoring systems.

Figure 3-10 13 Sector System

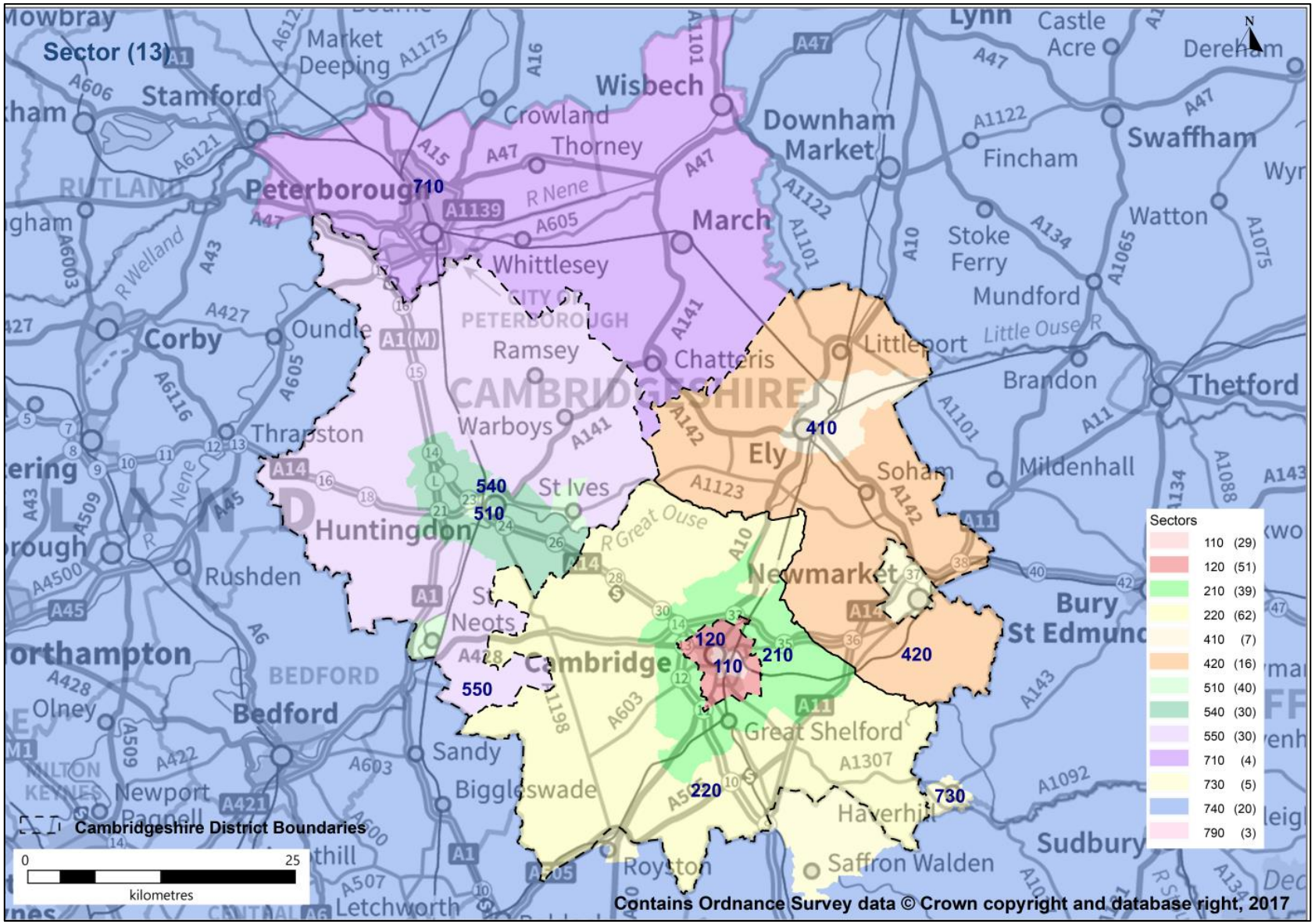
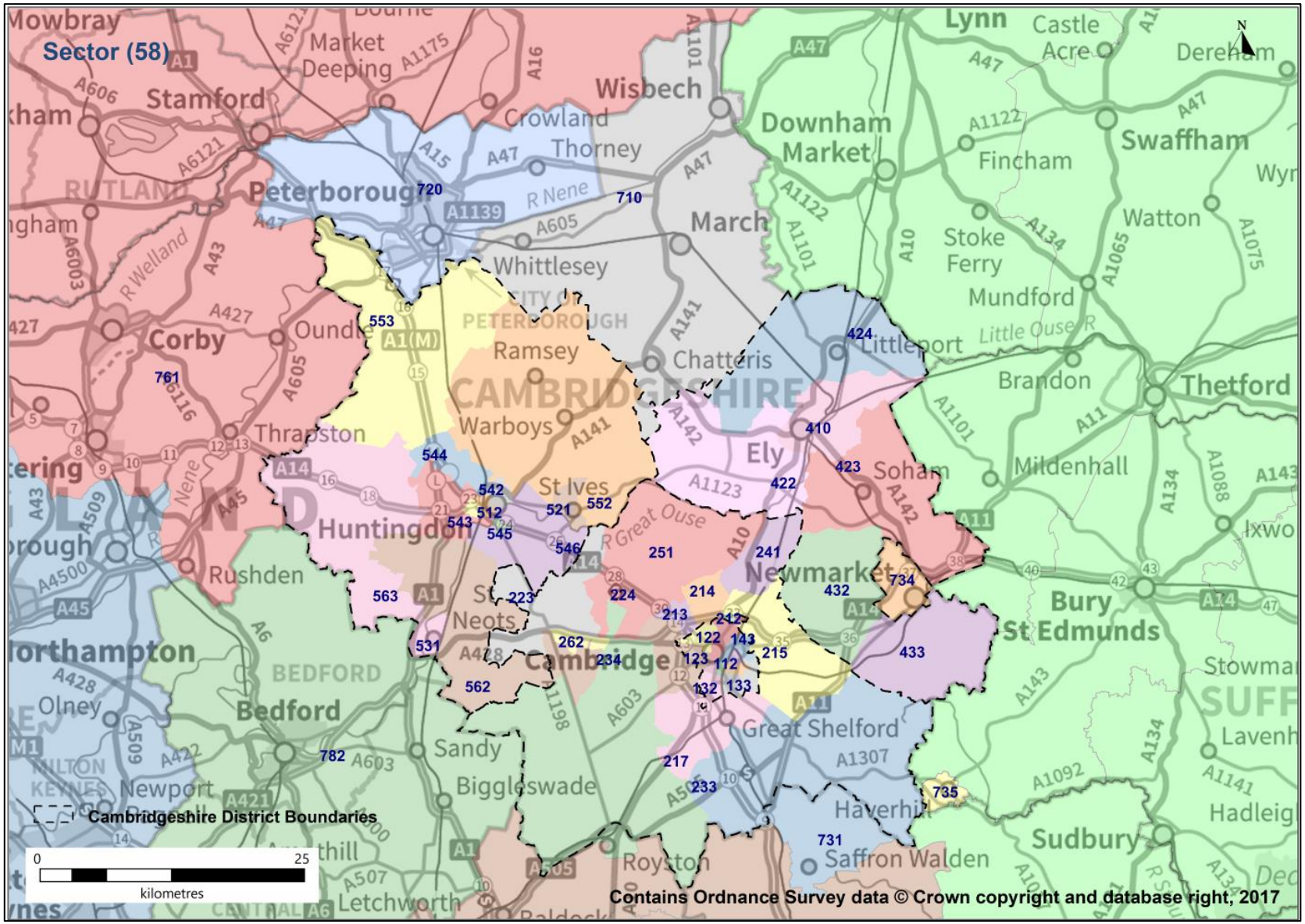


Figure 3-11 58 Sector System



3.7. Network Structure

The CSRM2 highway network structure is based on the existing CSRM1 network. The network has been refreshed to represent the 2015 base year conditions, with increased detail added in the market towns of Ely and St Neots.

For the D-series version of CSRM2 (2018), detailed network coding from the A10 Ely to Cambridge base model was added in the area to the north of Cambridge, between the B1049 and A142. In addition, network coding changes made as part of the A1307 corridor study were included to add further detail to the D-series network.

For the F-series update, much of the additional network detail was focussed around the new zones described in Section 3.5. Further improvements, which had been identified during earlier rounds of work on the GCP schemes, were also incorporated at this stage. These included enhancements to detail in:

- Cambourne;
- West Cambridge;
- St Neots station area;
- Ely station area;
- The A14 Stow-cum-Quy interchange; and
- Adjustments to the positioning of zone connectors in the south of South Cambridgeshire.

The density of the network structure differs between the simulation area and the external area as follows:

- Within the simulation area, all major A-roads, B-roads and motorway links are represented, in addition to the main residential roads and access roads to major developments and car parks; whereas
- The external area only includes major A-roads, B-roads and motorway networks, with reduced detail further away from the simulation area.

The simulation area is coded in the SATURN simulation network (with explicit junction modelling) whilst the external area is coded in SATURN buffer network. The level of network detail decreases as progression is made from the simulation area to the external area. Figure 3-12 to Figure 3-14 detail the network structure in Cambridge, the simulation area and the external area.

3.7.1. Centroid Connectors

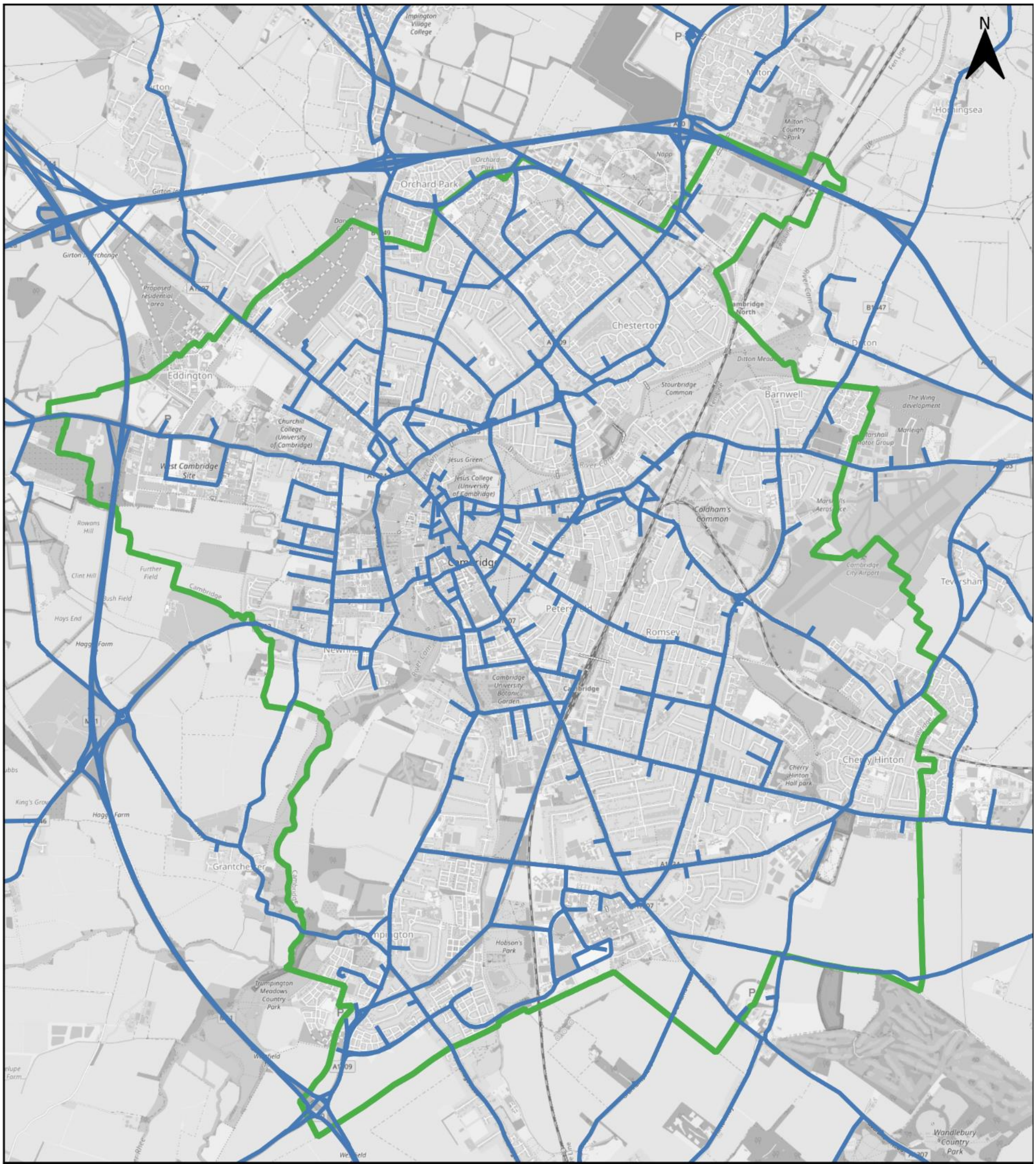
Centroid connectors provide connectivity between zones and the highway link network. The centroid connectors are coded with:

- Specific entry / exit junctions from local access roads onto the main road network from self-contained residential areas, business parks, retail areas and car parks for example; or
- Selected junctions representing multiple access points (i.e. removing the need to explicitly code every junction on each link).

Judgement was used to determine the number of centroid connectors required from each zone to represent locations where the traffic from the zones was likely to load, using as many zone connectors as was considered appropriate.

Zone connectors have been coded with a length of crow-fly distance between the zone centroid and connecting highway node multiplied by 1.1 for external zones and 1.4 for all other zones to represent non-linear connectivity.

Figure 3-12 Network Structure - Cambridge



CSRM2 Highway Network Structure

2015 Highway Network — Cambridge District Boundary

Drawn: EW, 09/08/2021	Checked: AS, 25/08/2021	Reviewed: CLFL, 25/08/2021	Version: 1.0
Reference:"P:\GBCBA\HandT\CQ\Projects\5202465-CSRM2 F-Series Base Year-SPOS6932\30 - Documentation\01 MDVR\Maps_For_MDVR\01_Zoning_System\Map of External Zones.qgz"	1:90,000	0 1 2 km	

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Figure 3-13 Network Structure - Simulation Area

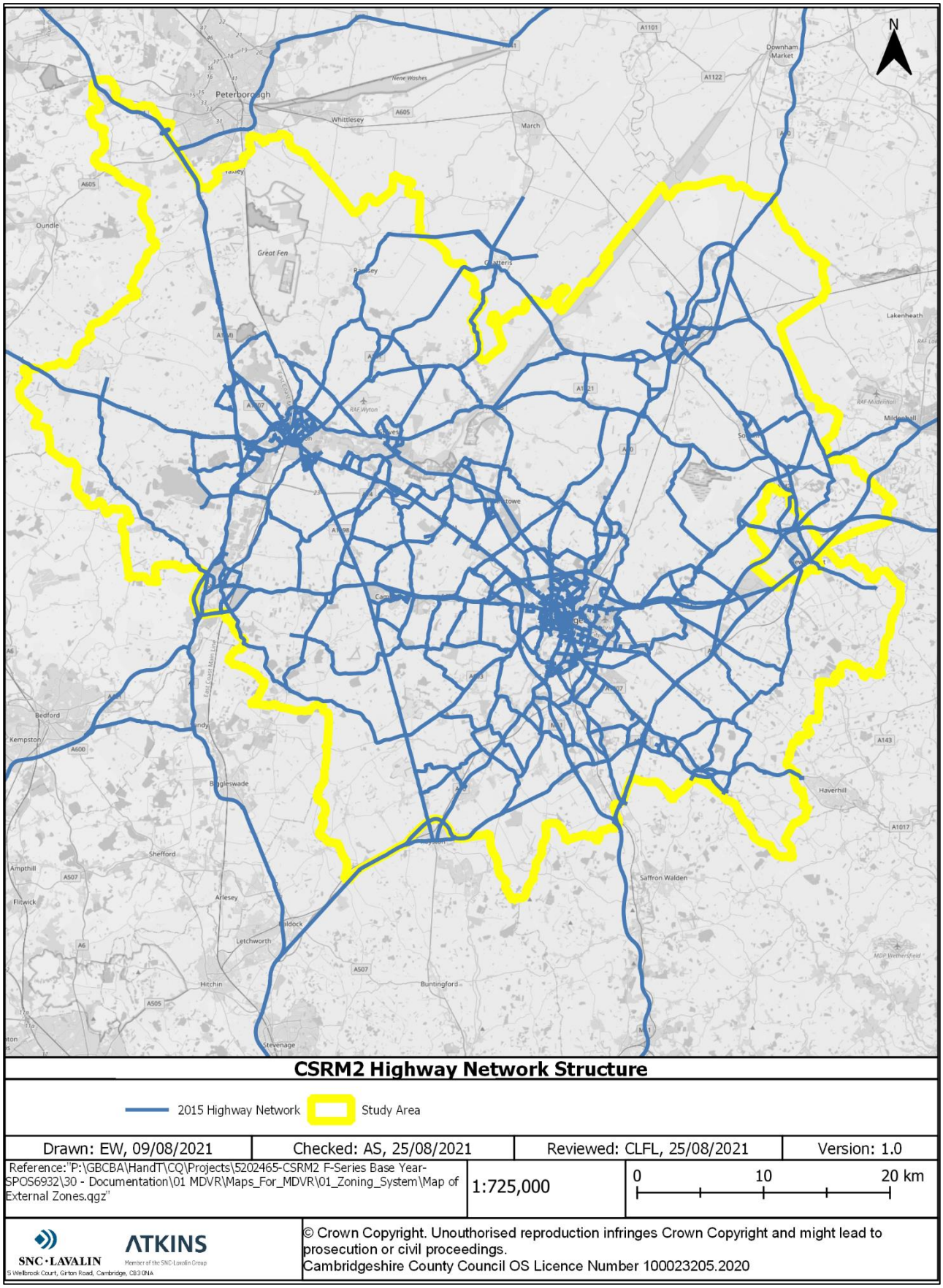
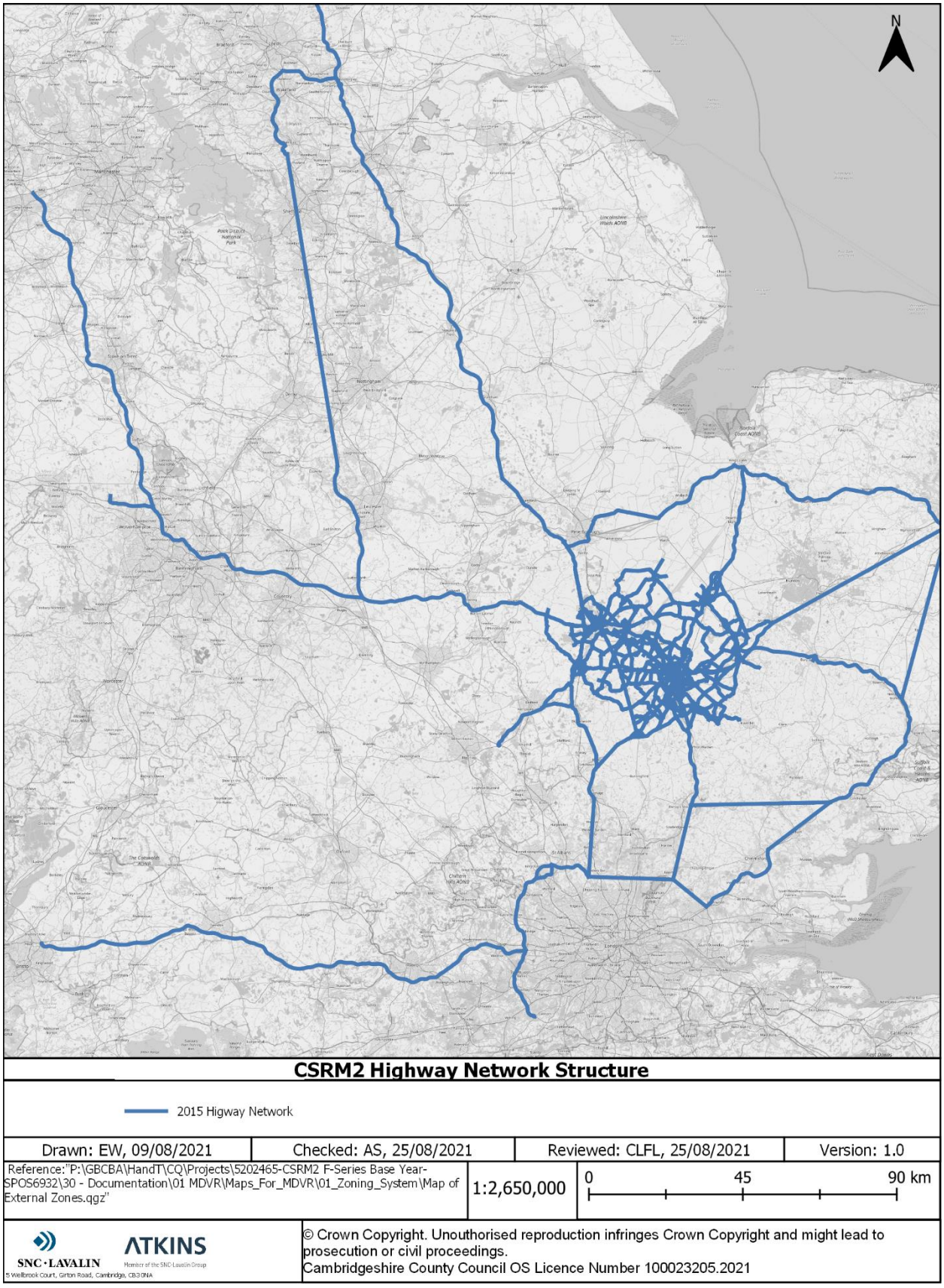


Figure 3-14 Network Structure - External Area



3.7.2. Link Coding

Link coding includes link length and road type classification. Link lengths are based on measurements taken from online mapping. Road type classification consists of link saturation flow and link speed, coded values for which were verified based on local knowledge of the highway network and site observations.

The network for CSRM2 was updated to include the dedicated Guided Busway from St. Ives to Cambridge Science Park, and from Cambridge Railway Station to Trumpington P&R.

In the F-series, information about cycling facilities has been associated to the coded SATURN links in a "knobs" file (a file which allows arbitrary additional information to be stored alongside the standard highway link data). In this case, it classifies the SATURN links to include information about segregated, painted or on-road (shared with cars) cycle infrastructure. This has no impact on the highway assignments, but is fed through to the multi-modal CSRM2 network from here.

3.7.3. Saturation Flow

The saturation flows used in CSRM2 are based on the Highways England Regional Transport Model (RTM) coding manual[3], which suggests saturation flows based on road and junction type. Saturation flows have been applied at the individual turn level in the area of detailed simulation coding. Calibration of the saturation flows, particularly in Cambridge where there are more cyclists than average, was undertaken at a later stage of model development (see section 7.1.1).

3.7.4. Link Speeds

The coded link speeds are taken from the Ordnance Survey based Integrated Transport Network (ITN) layer, which includes the speed based on road type. Care was taken in the Cambridge urban area as some of the streets have had a 20mph speed limit imposed. Calibration of these link speeds was undertaken at a later stage of model development (see section 7.1.2).

3.7.5. Signal Timings

CCC provided details for 2015 of all signal-controlled junctions within the detailed simulation study area that had been subject to change post development of CSRM1 in 2006. Signal cycle times, phasing and timings at these junctions were updated to reflect the typical on-site settings for each time-period. All other signalised junctions retain timings from CSRM1 with the performance of these junctions checked to confirm the timing remained appropriate.

The CSRM2 network was enhanced with approximately 150 additional signalised pedestrian crossings, which were not in the previous network.

3.7.6. 2019 Highway network changes

The 2015 Base Year SATURN network has been modified to incorporate changes to the highway network following the full completion of highway interventions around the modelled area as well as the A14 roadworks, as at October 2019, to assess the effect of congestion on the A14 following its partial completion. In addition, development zones active in 2019 and their relevant connections to the highway network have been added. A full list of the schemes captured is listed in Table 3-2, while Figure 3-15 shows the changes in the highway network from the 2015 Base Year.

[3] Highways England 2015 Regional Traffic Models Network Coding Manual v0.7

Figure 3-15 2015 to 2019 Highway Network changes

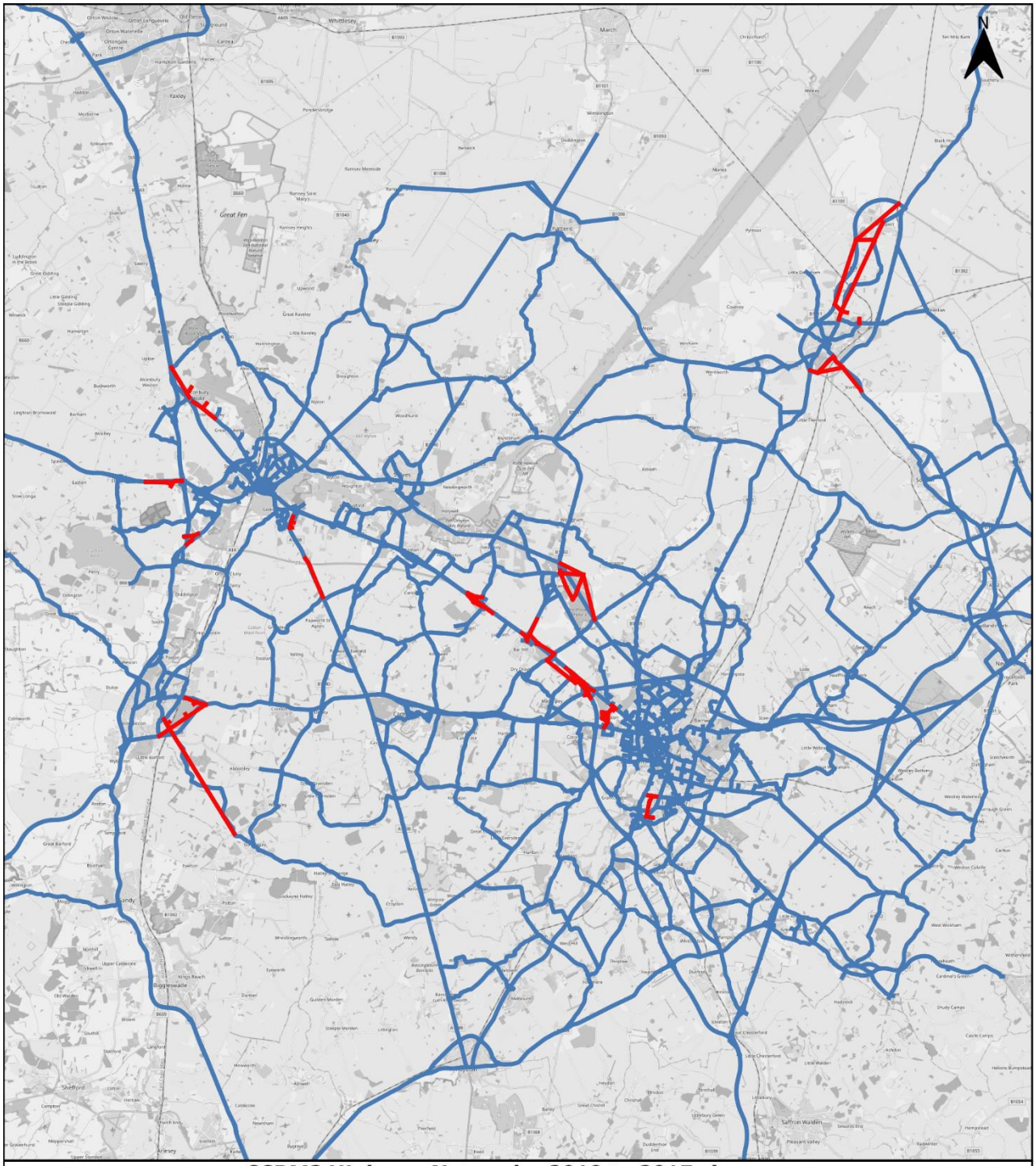


Table 3-2 2019 coded schemes

Scheme	Comment
Ely Southern Bypass	Opened in February 2019
Cambridge North Station access	Opened in May 2018
Car access provisions at Northstowe development site	Two new signalised junctions on the B1050 immediately south of the Guided Busway
Car access provisions at Clay Farm, Trumpington Meadows and Great Kneighton development sites	All accesses complete by 2019
Car access provisions at Alconbury Weald development site	Only northern accesses onto Ermine Street
Car access provisions at Darwin Green development site	Only connection to Huntington Road
Car access provisions at Loves Farm development site	All accesses complete by 2019
Car access provisions at Grange Lane (Littleport) development site	All accesses complete by 2019
Car access provisions at North Ely development site	All accesses complete by 2019
Car access provisions at Bearscroft Farm development site	All accesses complete by 2019
Car access provisions at Eddington development site	All accesses complete by 2019
A14 Roadworks	A14 status as at October 2019

Signal timings for 2019 were retained at their 2015 settings (except where signalised junctions were created or altered as a result of one of the schemes above).

3.8. Time Periods

The HAM represents three single hour time periods, see Table 3-3 below. They represent the morning and evening peak hours and an average inter-peak hour.

Table 3-3 Time Periods

Model Time-Period	Temporal Coverage
AM Peak Hour	08:00 – 09:00
Average Inter Peak Hour	Average hour 10:00 – 16:00
PM Peak Hour	17:00 – 18:00

For the morning and evening peak hours, a previous shoulder period is also modelled (although this is not separately validated), and queues which build up during this period are carried over to the start of the peak hour using the SATURN PASSQ feature.

3.9. User Classes / Vehicle Types

The HAM matrices are built up of 12 separate user classes as described below in Table 3-4. The model has ten user classes for light vehicles including two for LGV's. HGV's are split across two user classes to aid calibration of the model and reflect local HGV restrictions in Huntingdon as discussed in Section 7.1.3 of this report.

All local bus services, including the Cambridgeshire Guided Busway services, are coded in the base year model as fixed routes and frequencies per the published November 2015 timetables.

Table 3-4 User Class Definitions

User Class	Vehicle Type	Purpose	Income	Identifier
1	MC, Car	Home-Based Work	Low	HBW Low Income
2	MC, Car	Home-Based Work	Medium	HBW Medium Income
3	MC, Car	Home-Based Work	High	HBW High Income
4	MC, Car	Education	N/A	Education
5	MC, Car	Employers Business	N/A	EB
6	MC, Car	Other	Low	Other Low Income
7	MC, Car	Other	Medium	Other Medium Income
8	MC, Car	Other	High	Other High Income
9	HGV	HGV	N/A	HGV
10	HGV	HGV (Huntingdon)	N/A	HGV (Huntingdon)
11	LGV	Home-Based Work, Education and Other	All	HBW + Ed + Other (all income groups)
12	LGV	Employers Business	N/A	EB

3.9.1. PCU Factors

Passenger car units (PCU) rather than vehicles are used as the standard unit in SATURN for demand and capacities. This allows the effect of longer/slower vehicles that occupy more road space and take longer to clear junctions to be represented within the model. Motorcycles have been combined with car given the small proportion of vehicles they represent. The vehicle to PCU conversion factors used for the various vehicle types in CSRM2 are given below in Table 3-5.

Table 3-5 PCU Factors

Vehicle Type	Description	PCU Factor
Motorcycle, Car	Private motorcycle or car	1
Light Goods Vehicle	Goods vehicle up to 3,500kg	1
Heavy Goods Vehicle	OGV1 and OGV2	2.3
Bus	Scheduled coach and local bus services[4]	2.5 (0.47)

3.10. Assignment Methodology

SATURN assigns the user class matrices to the network in accordance with Wardrop's First Principle of Traffic Equilibrium, using the Frank-Wolfe algorithm.

3.11. Generalised Cost Formulations and Parameter Values

Route choice within a highway assignment model is calculated using the generalised cost of travel time, vehicle operating cost, and any tolling and/or congestion charging in accordance with the TAG Unit A1.3. The coefficients for the individual components of generalised costs were calculated using TAG Unit A1.3 and are consistent with those used by the wider CSRM2 TDM.

Generalised cost parameters per vehicle have been derived using 2015 and 2019 values from v1.13.1 of the WebTAG data book. Table 3-6 and Table 3-7 present the calculated values of time and vehicle operating

[4] Bus frequencies must be integers in SATURN. To avoid the need of using decimal frequencies for services whose frequency is less than one bus per hour, the frequency in the 66666 SATURN card has been multiplied by 6 and the PCU factor of 2.5 has therefore been divided by 6.

costs used in the base year HAM, while Table 3-8 and Table 3-9 show the equivalent 2019 figures used in the PYV.

Table 3-6 2015 Values of Time (Pence per Minute)

User Class	Definition	AM Peak	Inter Peak	PM Peak
1	Car: HBW Low Income	9.03	8.90	8.98
2	Car: HBW Medium Income	15.24	15.02	15.15
3	Car: HBW High Income	27.75	27.35	27.59
4	Car: Education	14.63	14.40	14.92
5	Car: EB	34.15	34.13	33.34
6	Car: Other Low Income	7.24	7.12	7.38
7	Car: Other Medium Income	12.24	12.05	12.48
8	Car: Other High Income	20.30	19.98	20.70
9	HGV 1	46.64	46.64	46.64
10	HGV 2	46.64	46.64	46.64
11	LGV: HBW + Ed + Other	19.88	21.64	20.61
12	LGV: EB	24.17	24.15	23.60

Table 3-7 2015 Vehicle Operating Costs (Pence per Kilometre)

User Class	Definition	AM Peak	Inter Peak	PM Peak
1	Car: HBW Low Income	6.92	6.73	6.88
2	Car: HBW Medium Income	6.92	6.73	6.88
3	Car: HBW High Income	6.92	6.73	6.88
4	Car: Education	6.92	6.73	6.88
5	Car: EB	13.77	13.36	13.68
6	Car: Other Low Income	6.92	6.73	6.88
7	Car: Other Medium Income	6.92	6.73	6.88
8	Car: Other High Income	6.92	6.73	6.88
9	HGV 1	41.25	40.59	41.07
10	HGV 2	41.25	40.59	41.07
11	LGV: HBW + Ed + Other	8.47	8.37	8.44
12	LGV: EB	15.78	15.60	15.73

Table 3-8 2019 Values of Time (Pence per Minute)

User Class	Definition	AM Peak	Inter Peak	PM Peak
1	Car: HBW Low Income	9.39	9.25	9.33
2	Car: HBW Medium Income	15.84	15.62	15.75
3	Car: HBW High Income	28.85	28.44	28.69
4	Car: Education	15.21	14.97	15.51
5	Car: EB	35.51	35.48	34.67
6	Car: Other Low Income	7.52	7.40	7.67
7	Car: Other Medium Income	12.73	12.52	12.98
8	Car: Other High Income	21.10	20.77	21.52
9	HGV 1	48.49	48.49	48.49
10	HGV 2	48.49	48.49	48.49
11	LGV: HBW + Ed + Other	20.67	22.50	21.43
12	LGV: EB	25.13	25.11	24.53

Table 3-9 2019 Vehicle Operating Costs (Pence per Kilometre)

User Class	Definition	AM Peak	Inter Peak	PM Peak
1	Car: HBW Low Income	6.58	6.40	6.54
2	Car: HBW Medium Income	6.58	6.40	6.54
3	Car: HBW High Income	6.58	6.40	6.54
4	Car: Education	6.58	6.40	6.54
5	Car: EB	13.46	13.05	13.37
6	Car: Other Low Income	6.58	6.40	6.54
7	Car: Other Medium Income	6.58	6.40	6.54
8	Car: Other High Income	6.58	6.40	6.54
9	HGV 1	42.16	41.49	41.98
10	HGV 2	42.16	41.49	41.98
11	LGV: HBW + Ed + Other	8.68	8.57	8.65
12	LGV: EB	15.94	15.77	15.90

3.12. Capacity Restraint Mechanisms

Capacity restraint is modelled in the simulation area through detailed junction modelling. All modelled junctions in the simulation area are allocated a junction type, turn capacities, lane allocations and traffic signal timings for signalised junctions. Detailed simulation coding of links and junctions considers stacking capacity, length of flare and merging characteristics. Where dedicated bus lanes remove capacity from links this is reflected in the coding. Roundabouts, signalised junctions and pedestrian crossings have been coded to reflect on-street capacity conditions.

4. Calibration and Validation Data

4.1. Introduction

As part of the CSRM refresh, a large amount of data was collected to build, calibrate and validate the base year model. A special data collection exercise was not appropriate for the PYV hence best use was made of existing data. This section summarises the data used in the calibration and validation of the CSRM2 base year and 2019 PYV.

4.2. Calibration / Validation Traffic Counts

A large amount of data was required to inform and calibrate the CSRM2 base year model. Data was also required to validate the model to ensure it could independently predict key metrics that were not direct model inputs. Due to the COVID-19 pandemic, it has been impossible to commission surveys to collect further data specifically for the PYV. Therefore the 2019 data used was limited to available data already collected by CCC in October and November 2019. It is noted that the major A14 roadworks were ongoing during this time, and this has been accounted for through the PYV process.

The data used in the calibration / validation of CSRM2 mainly focuses on Cambridge, Huntingdon and the A14 corridor, whilst also considering key satellite market towns of Ely, St. Ives and St. Neots. Traffic count data was made available by CCC from previous data collection exercises as well as new data being collected specifically for the CSRM2 refresh. Three types of data were used: Automatic Traffic Counts (ATC); Manual Classified Counts (MCC); and WebTRIS data for the trunk road network.

ATCs are specifically commissioned for a limited duration (typically less than 2 weeks) using pneumatic tubes to count axle pairs by direction. ATCs can only classify the vehicle type using specific axle pair configurations. MCCs are typically single day counts but classify vehicle types accurately using a visual identification. WebTRIS sites are typically long term permanent induction loop site installations, classifying vehicles according to length.

Figure 4-1 to Figure 4-4 show the location and type of the data counts used in the calibration and those withheld for independent validation of CSRM2 in 2015, while Figure 4-5 shows the data counts available in 2019.

Figure 4-1 Calibration Count Sites (2015)

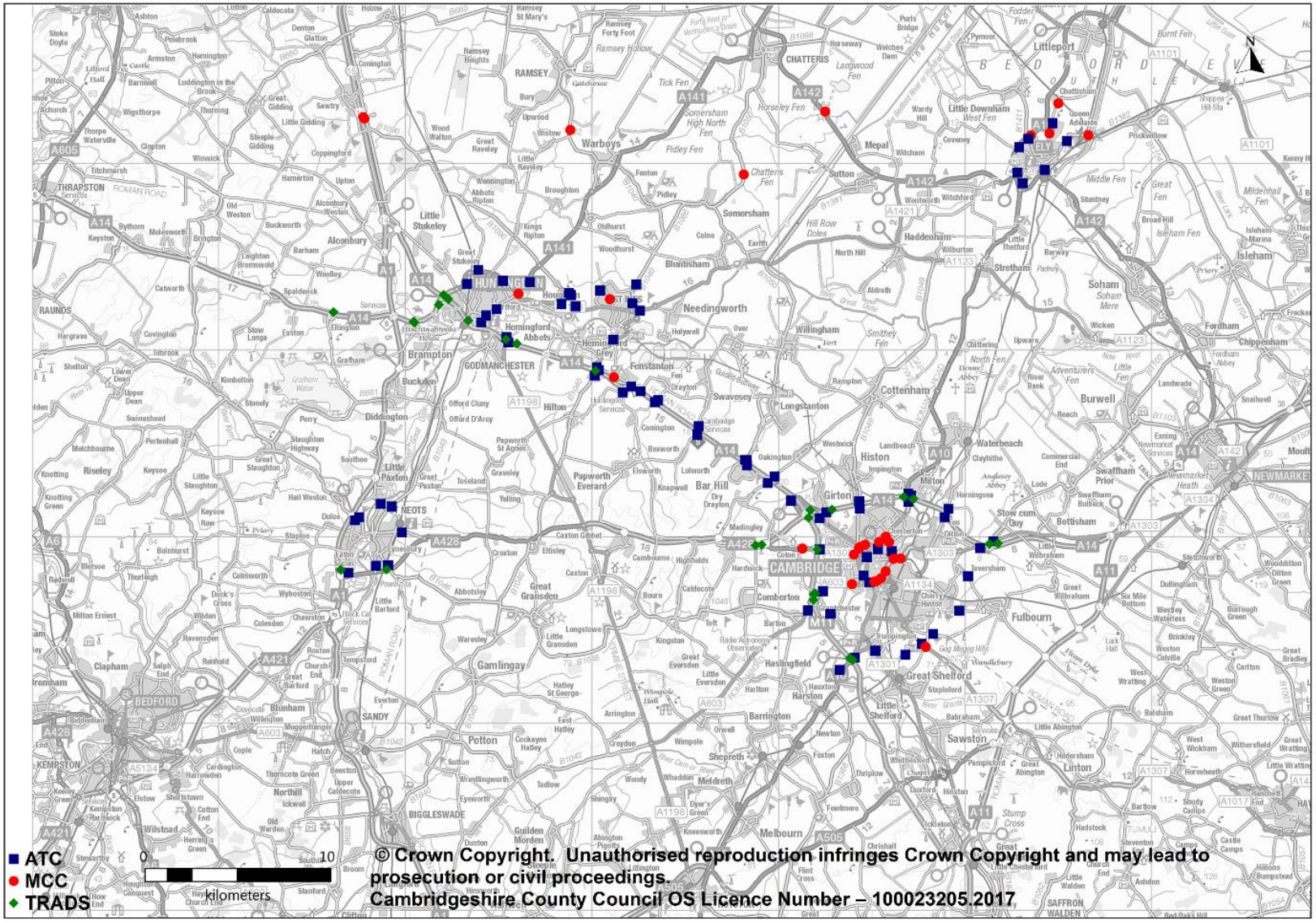


Figure 4-2 Calibration Count Sites (2015) – Cambridge, Huntingdon & A14

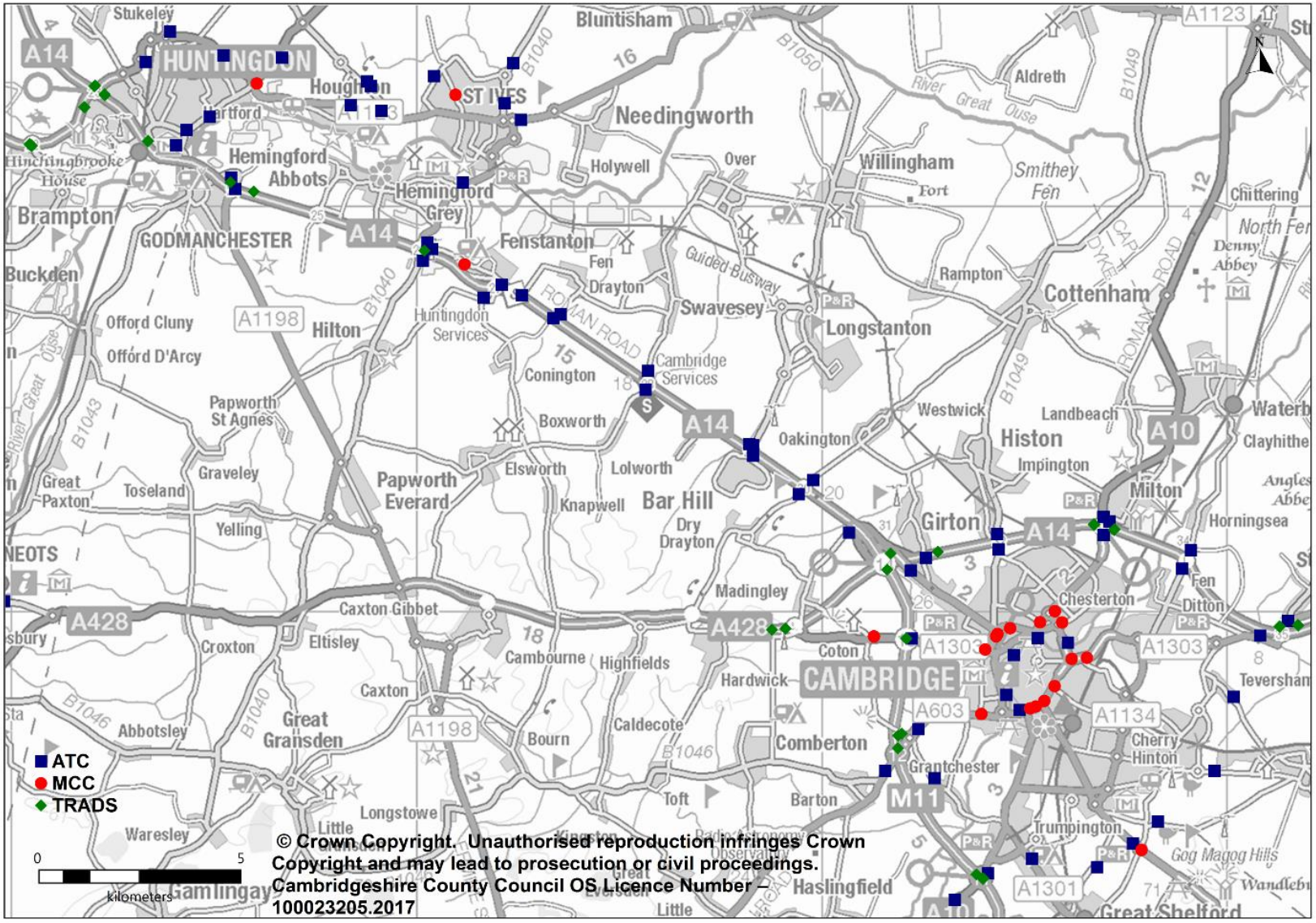


Figure 4-3 Calibration Count Sites (2015) – Cambridge

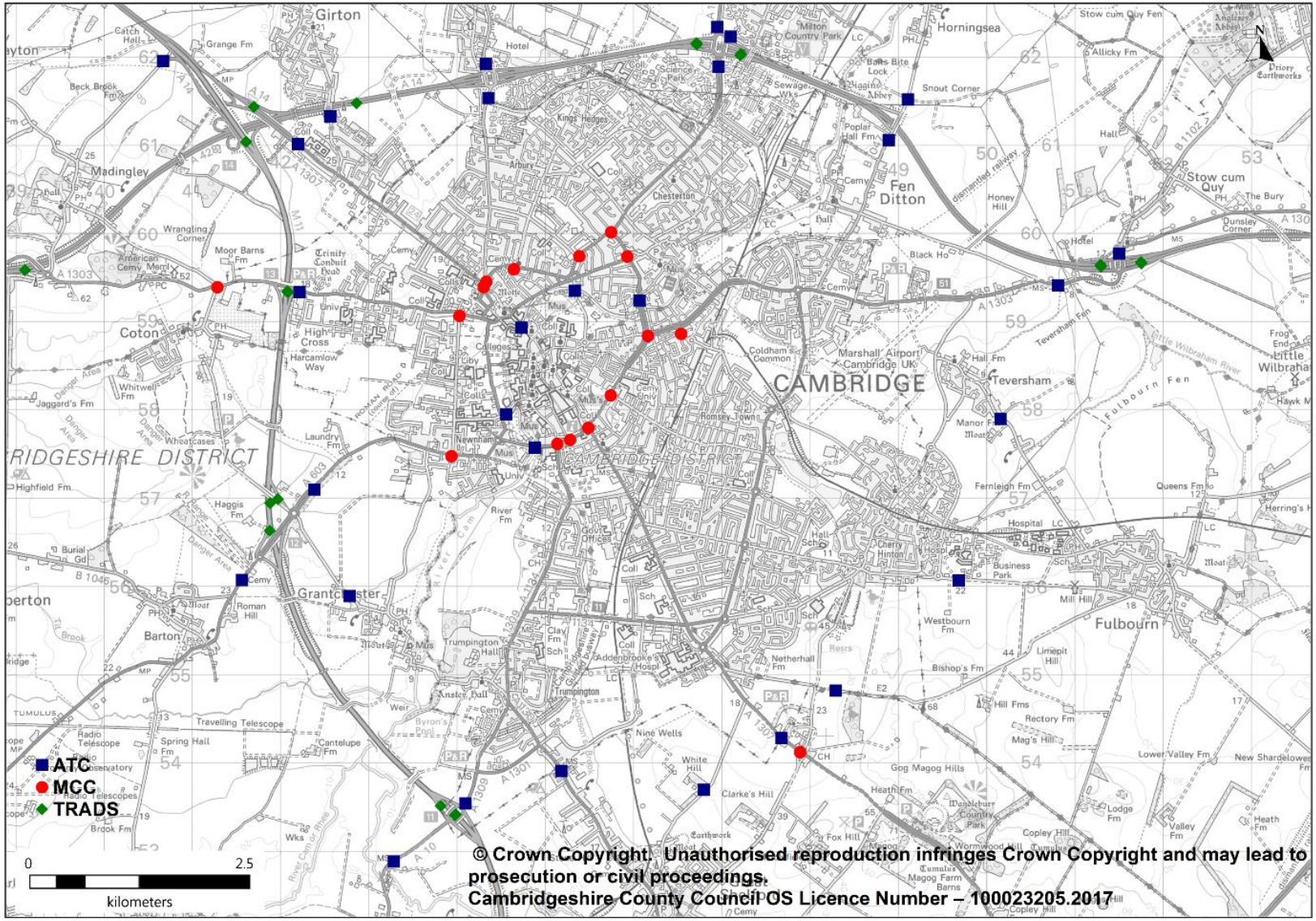


Figure 4-4 Validation Count Sites (2015)

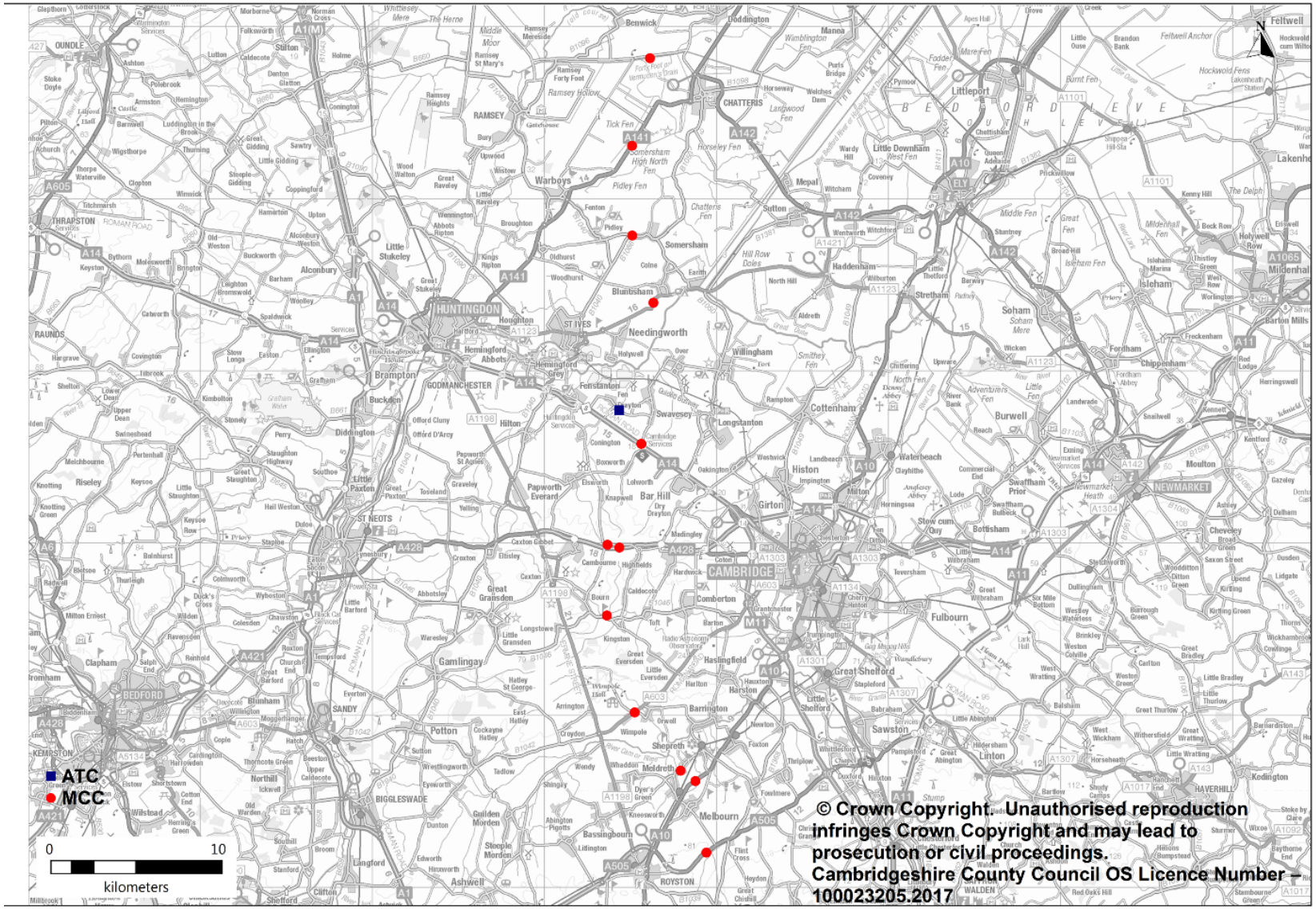
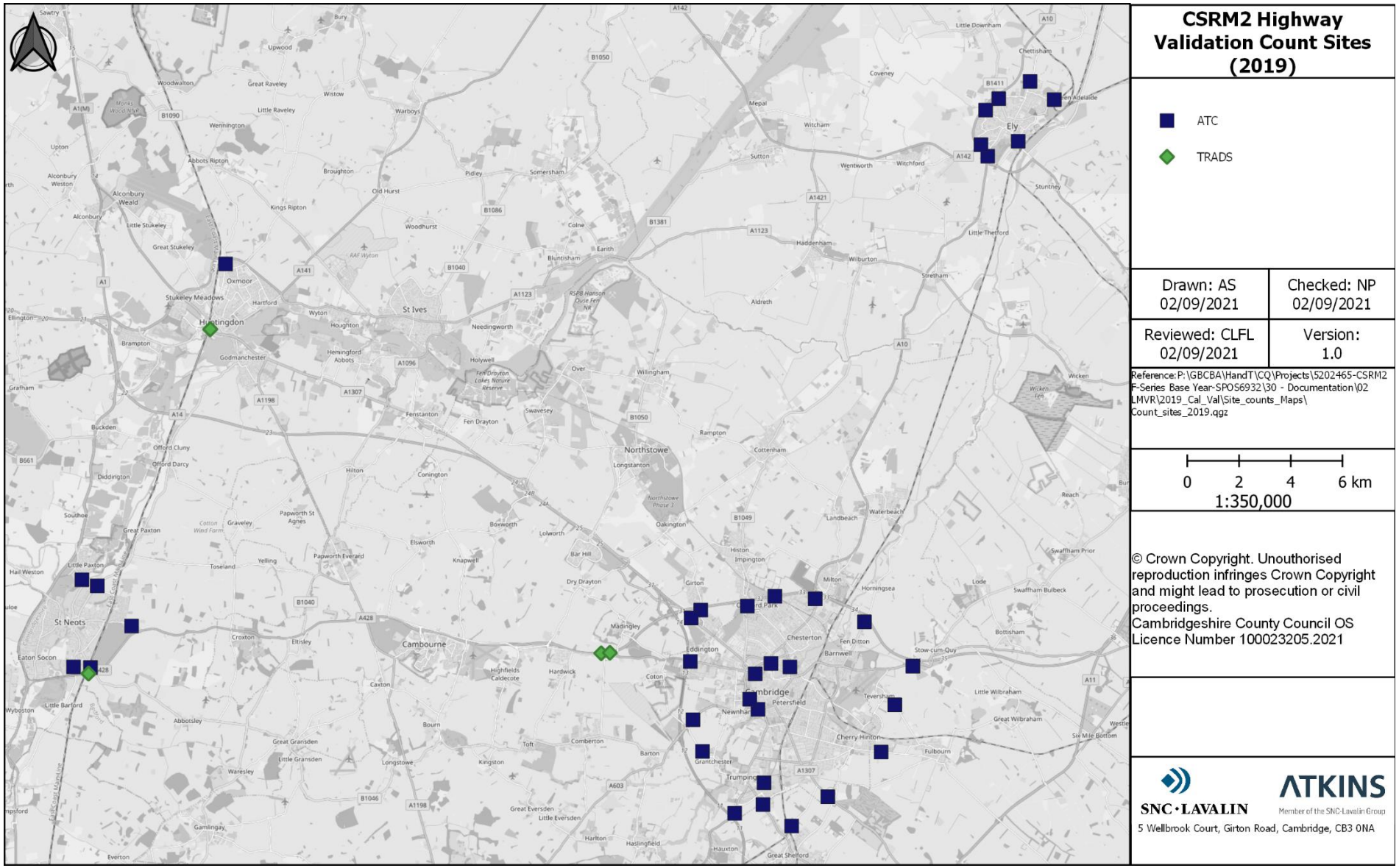


Figure 4-5 Validation Count Sites (2019)



4.2.1. Annual Monitoring Data

This dataset comprises of a series of annual monitoring traffic surveys conducted by CCC at the same locations each year and has been used for both 2015 and 2019. These data include a mixture of ATCs and MCCs. The annual monitoring surveys used in CSRM2 were as follows:

- County Screenline (MCC, 14 sites, 2015 only);
- River Cam Screenline (ATC, 5 sites); and
- Cambridge Radial Cordon (ATC, 16 sites).

4.2.2. Market Town Survey Data

This dataset comprises of a series of annual single day ATCs conducted by CCC in the same locations each year. Market town ATC data was used in CSRM2 for Ely (7 sites), Huntingdon (1 sites), and St. Neots (5 sites). This dataset is also available for 2019.

4.2.3. CSRM 2015 Survey Data

This dataset comprises of additional ATC data collected to fill notable voids in the existing data. The focus of the 2015 CSRM ATC surveys concentrated on Cambridge (7 sites) and St. Neots (5 sites).

4.2.4. Ad-hoc Count Data

This dataset comprises of a series of 'ad-hoc' data counts from 2014 and 2015, provided by CCC to plug notable gaps in data coverage. These data counts include a mixture of ATCs and MCCs. The following ad-hoc counts were used in the calibration / validation of CSRM2:

- A14 (ATC, 2015);
- A428 (MCC, 2014);
- Fen Causeway (MCC, 2015);
- Lynn Road, Ely (MCC, 2008);
- Newmarket Road, Cambridge (MCC, 2008); and
- Northstowe (ATC, 2014).

4.2.5. A14 RSI Data

This dataset comprises of 2013 RSI data conducted by CCC as part of a previous A14 study (20 sites). These were used to calibrate traffic volumes either side of the A14 between Cambridge and Huntingdon.

4.2.6. Development Count Data

This dataset comprises of data counts used for previous development studies. These were provided by CCC to plug notable gaps in data coverage. The following development counts were used in the calibration / validation of CSRM2:

- Wyton (ATC, 2015); and
- St. Ives (ATC, 2013).

4.2.7. WebTRIS Data

WebTRIS data (Highways England's Traffic Information Database), formerly known as TRADS data, comprises of a series of permanent ATC sites located on trunk roads across England and Wales. A selection of 2015 and 2019 highway data for the strategic road network was sourced from WebTRIS to be used in the calibration / validation of CSRM2 (6 sites in 2015; 3 in 2019). Data counts of this type were used for the A1, A14 and A428.

4.3. Normalisation of Base Calibration / Validation Traffic Counts

The modelled period in CSRM2 is an average weekday (average of Tuesday, Wednesday and Thursday) in November 2015. Due to gaps in count data coverage, not all counts used for calibration / validation were from 2015. Some of the counts used for calibration / validation were for a different year, whilst many MCCs only represent a single day. Therefore, to create a 2015 base year model, these counts had to be normalised to represent an average 2015 weekday.

Annual factors were derived from observed single-day traffic counts collected at the same site annually by CCC. These factors were then applied to count data dependent on the calibration/validation screenline that count was located on. Various annual datasets were used in the derivation of a set of factors to normalise all counts to a 2015 base. Annually monitored Market Town Survey data (Ely, Huntingdon & St. Ives) and Annual Monitoring data (County, Radial & River) was used to derive the scaling factors. Table 4-1 below shows the scaling factors used to normalise counts to a 2015 base.

Table 4-1 Traffic Count Growth Factors

Factor	Time-Period	County	Radial	River	County		
					Huntingdon	St. Ives	Ely
2008 to 2015	AM	-	-	-	-	-	1.02
	IP	-	-	-	-	-	1.10
	PM	-	-	-	-	-	1.12
2011 to 2015	AM	-	0.97	-	-	-	-
	IP	-	1.11	-	-	-	-
	PM	-	1.00	-	-	-	-
2013 to 2015	AM	0.97	0.99	0.91	0.96	1.03	-
	IP	1.05	1.11	0.99	1.09	1.06	-
	PM	1.00	1.00	0.91	1.00	1.10	-
2014 to 2015	AM	0.97	0.96	0.96	0.97	1.01	-
	IP	1.02	1.01	0.99	1.03	1.03	-
	PM	0.95	0.98	0.98	1.01	1.03	-

The annual variance of counts used in the calibration/validation of the CSRM2 was investigated to instil confidence that the counts used were representative of reality. Recognising that short-term counts and MCCs are less statistically reliable than long term ATCs and with little available ATC data, checks were undertaken to ensure the reliability of the 2015 datasets through comparisons with previous years. The analysis concluded the counts used in the calibration / validation of the CSRM2 model were representative.

4.4. Journey Time Surveys

To ensure that the model accurately reflects observed travel times across the study area, TrafficMaster journey time data for November 2015 and October 2019 was obtained from the Department for Transport (DfT) for the entire Cambridgeshire highway network.

As part of the model validation process, observed TrafficMaster neutral weekday journey times were compared against modelled journey times. The results of this exercise are included in Section 7.3.2 of this report. The journey time routes used in the validation of the CSRM2 base year model focus on Cambridge radial routes, the A14, Ely, St. Ives and St. Neots. Figure 4-6 and Figure 4-7 give an illustration of the journey time routes, whilst Table 4-2 provides a description of each route. The journey times for these routes have been extracted for both 2015 and 2019 years.

Figure 4-6 Journey Time Validation Routes

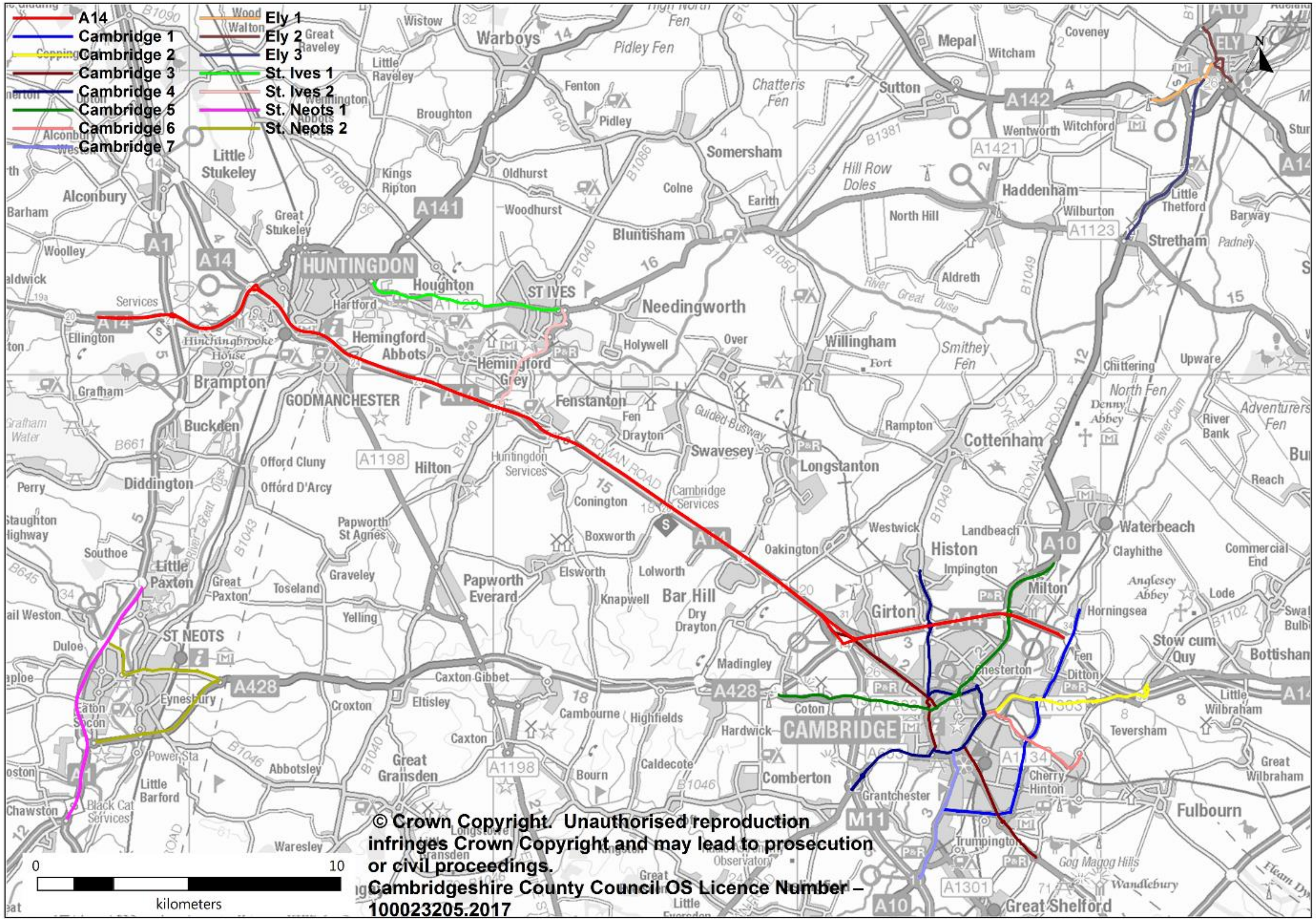


Figure 4-7 Journey Time Validation Routes – Cambridge

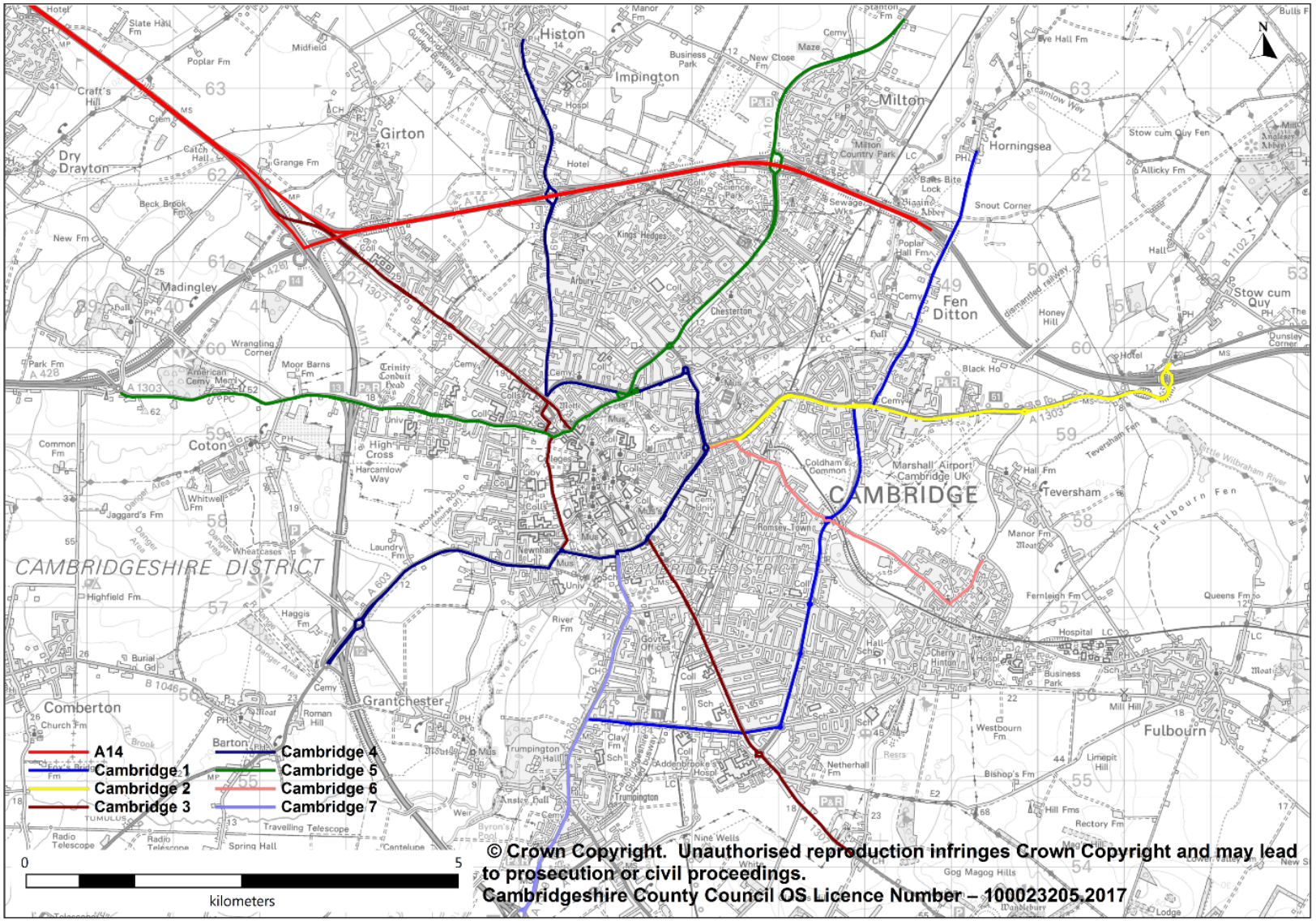


Table 4-2 Journey Time Validation Routes – Descriptions

Route ID	Route Name	Direction	Route Description
C-1	Cambridge 1	NB	Trumpington Road (Cambridge) to Priory Road (Horningsea)
C-2		SB	Priory Road (Horningsea) to Trumpington Road (Cambridge)
C-3	Cambridge 2	EB	Barnwell Road / Wadloes Road (Cambridge) to High Ditch Road (Fen Ditton)
C-4		WB	High Ditch Road (Fen Ditton) to Barnwell Road / Wadloes Road (Cambridge)
C-5	Cambridge 3	SB	Oakington Road (Dry Drayton) to Fendon Road (Cambridge)
C-6		NB	Fendon Road (Cambridge) to Oakington Road (Dry Drayton)
C-7	Cambridge 4	SB	Impington Lane (Impington) to M11 (Junction 12)
C-8		NB	M11 (Junction 12) to Impington Lane (Impington)
C-9	Cambridge 5	EB	A428 / A1303 to Milton Village
C-10		WB	Milton Village to A428 / A1303
C-11	Cambridge 6	EB	Elizabeth Way (Cambridge) to Teversham Drift (Cambridge)
C-12		WB	Teversham Drift (Cambridge) to Elizabeth Way (Cambridge)
C-13	Cambridge 7	EB	M11 (Junction 11) to Lensfield Road (Cambridge)
C-14		WB	Lensfield Road (Cambridge) to M11 (Junction 11)
A14-1	A14	EB	A14 (Junction 20) to A14 (Junction 34)
A14-2		WB	A14 (Junction 34) to A14 (Junction 20)
SI-1	St Ives 1	EB	A141 / B1514 (Hartford) to A1123 / B1040 (St. Ives)
SI-2		WB	A1123 / B1040 (St. Ives) to A141 / B1514 (Hartford)
SI-3	St Ives 2	NB	A14 / A1096 (Fenstanton) to A1123 / A1096 (St. Ives)
SI-4		SB	A1123 / A1096 (St. Ives) to A14 / A1096 (Fenstanton)
E-1	Ely 1	EB	A142 / Witchford Road (Witchford) to St Mary's Street / Lynn Road (Ely)
E-2		WB	St Mary's Street / Lynn Road (Ely) to A142 / Witchford Road (Witchford)
E-3	Ely 2	SB	A10 / B1411 (Ely) to A142 / Station Road (Ely)
E-4		NB	A142 / Station Road (Ely) to A10 / B1411 (Ely)
E-5	Ely 3	NB	A10 / Wilburton Road (Stretham) to Cambridge Road / Witchford Road (Ely)
E-6		SB	Cambridge Road / Witchford Road (Ely) to A10 / Wilburton Road (Stretham)
SN-1	St Neots 1	SB	A1 (Little Paxton) to A421 (Chawston)
SN-2		NB	A421 (Chawston) to A1 (Little Paxton)
SN-3	St Neots 2	EB	A1 / A428 (Wyboston) to A1 / B465 (St. Neots) via Cambridge Road
SN-4		WB	A1 / B465 (St. Neots) to A1 / A428 (Wyboston) via Cambridge Road

5. Base Prior Trip Matrix Development

5.1. Introduction

This section describes the methodology adopted for the development of the base year highway demand prior matrices. The matrix development process can be broken down into the following sections:

Partial Trip Matrices

The development of the partial trip matrices consisted of the collation, cleaning and expansion of the following discrete travel demand datasets:

- Atkins/EE mobile phone data (MPD);
- Intercept Roadside Interview (RSI) survey data at sites in Cambridge;
- TrafficMaster Heavy Goods Vehicle (HGV) origin-destination data;
- P&R origin-destination surveys; and
- Synthetic highway matrices.

Data Fusion

- Assembly of partial trip matrices for car, Light Goods Vehicles (LGVs) and Heavy Goods Vehicles (HGVs); and
- Adjustments to the prior trip matrices in the light of the comparisons between modelled flows and counts across screenlines and cordons.

5.2. Partial Trip Matrices

Partial trip matrices from several sources have been fused to produce prior single hour highway trip matrices. This section summarises the data sources used.

5.2.1. Mobile Phone Data

CCC commissioned the collection of MPD through the Atkins/EE partnership. The specification criteria of the dataset are as follows:

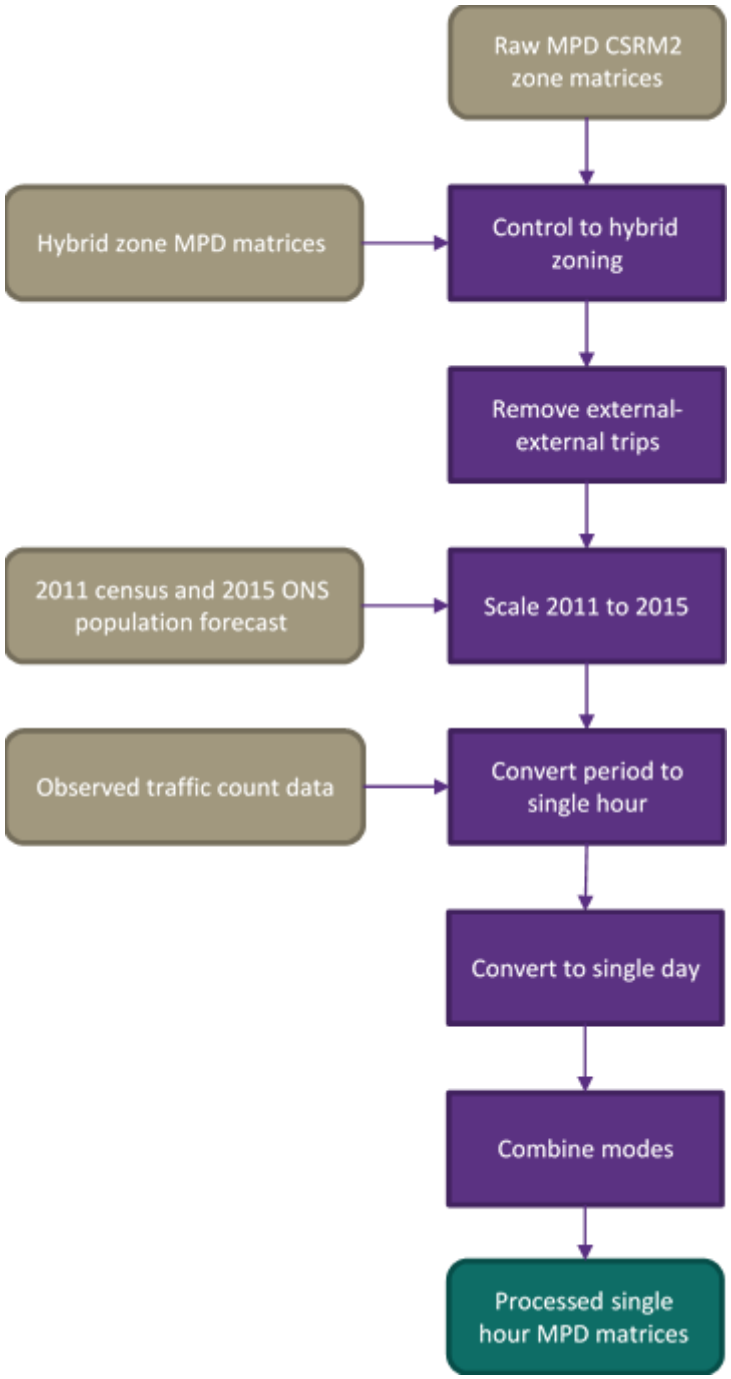
- All devices recorded as moving within, entering, exiting or crossing the CSRM2 study area;
- The area for movements is based on the administrative boundaries of South Cambridgeshire, East Cambridgeshire and Huntingdonshire Districts within Cambridgeshire, including Cambridge City. Some extensions to those boundaries have been made to produce a more regular boundary covering all key movements;
- Zonal trip ends (origins and destinations) by mode and time of day;
- O-D matrices by mode and time of day;
- Trip end and O-D matrices provided at the following zoning levels;
  - Middle Super Output Area (MSOA)
  - CSRM2 zone
  - Hybrid zoning system – a combination of MSOA and CSRM2 zones where the larger of the two areas is taken;
- Time periods defined as the time a device is recorded as entering or moving within the study area:
  - AM peak (0700-1000)
  - Inter-peak (1000-1600)
  - PM peak (1600-1900);
- Mode is classified as highway (all movements by motorised vehicle on roads), non-highway (pedestrian and cycle), rail or rail+ (trips using rail plus another mode such as walk). A pilot test was conducted for this project to disaggregate bus movements from the highway matrices, but proved to be unsuccessful.
- EE has a ~40% share of the mobile device market. The device sample recorded by EE is scaled to Office for National Statistics (ONS) population data for 2011 based on the demographic of their customer base;
- Trip ends or individual O-D movements of between 1 and 10 will be reported as 10. This approach is used to protect the privacy of EE's customer base and is referred to as "trip capping" in this report; and

- Trip ends and individual O-D movements are reported in bands of 5 trips. The trips recorded are rounded up to the nearest 5, so 11 becomes 15, 16 becomes 20 and so on.

5.2.1.1. Mobile Phone Data Processing

The raw data provided by Atkins/EE underwent a series of refinements to prepare the matrices for the data fusion process. The processing stages are shown in Figure 5-1 in described in the following sections below.

Figure 5-1 Mobile Phone Data Processing



Control to Hybrid

To mitigate against the impact of trip capping and rounding that is applied to protect the privacy of EE's customers, MPD matrices were provided at both a CSRM2 zoning level and a more aggregate hybrid zone level. The SATURN/MSOA hybrid zoning is defined as: the larger of the two zoning systems for each area. Therefore, in the centre off Cambridge where there are many small SATURN zones, the larger MSOA zones are used. Externally, where there are many MSOA's covering (for instance) the north of England and

Scotland the single SATURN model zone is used which covers the whole area. The larger hybrid zone totals were used to control the finer distribution provided at the CSRM2 level.

Remove extraneous External to External Trips

The MPD matrices include trips for all devices that pass in proximity to the study area. As such devices recognised on the fringes of the study area may not use links coded in the HAM. A number of these inappropriate movements were identified and those trips removed from the MPD matrices. One example of this was a significant volume of movements between South West England and Wales, which were considered to be long distance freight trips with very short dwell times at a delivery point within or beyond the CSRM study area (e.g. East Coast Ports). It was considered these trips were being disproportionately scaled due to the small sample which was distorting the trip patterns and exaggerating the true volume making the movement.

Scale 2011 to 2015

The MPD provided by Atkins/EE was a sample collected during the month of November 2015, then scaled using EE customer demographic data to the 2011 Census population. A scaling process was therefore necessary to convert the matrix from 2011 to 2015 values representative of the base year.

Scaling factors were derived at a district level between 2011 Census population data and 2015 Office for National Statistics (ONS) forecast population data. This compared the ONS 2015 population by district against the 2011 Census totals. The resulting scaling factors are presenting below in Table 5-1.

Table 5-1 District Level Population Scaling Factors (2011 to 2015)

CSRM2 District	Factor (2011-2015)
Cambridge	4.8%
South Cambridgeshire	4.2%
East Cambridgeshire	4.5%
Huntingdonshire	3.2%
Fenland	3.1%
External	3.1%

Convert Period to Single Model Hour

The MPD matrices were converted into single hour time periods suitable for the SATURN highway model assignment. The MPD matrices covered the time periods listed below to maximise sample size and minimise the impact of rounding:

- AM: 07:00-10:00;
- IP: 10:00-16:00; and
- PM: 16:00-19:00.

Analysis of traffic data across the modelled area revealed that the relationship between peak period and peak hour traffic varied by geographic location. To reflect this variation, it was decided to use differential factors across the matrix per the observed profile between the peak period and peak hour. 2015 directional totals for the County, Radial and River Cam ATC programmes were used in the derivation of period to single hour factors. Factors were applied based on the origin and destination of each ij pairing within the matrices. The IP was calculated as an hourly average between 10:00 and 16:00. Factors used for the AM and PM peak hour are shown below in Table 5-2.

Table 5-2 Peak Period to Peak Hour Factor

Trip Type	Count Type	Direction	AM	PM
County to County	County Screenline	-	0.354	0.375
County to Cambridge	Radial Cordon	Inbound	0.351	0.362
Cambridge to County	Radial Cordon	Outbound	0.381	0.350
Cambridge to Cambridge	River Screenline	-	0.347	0.340

Convert to Average Single Day

The MPD provided by Atkins/EE was aggregated to include all neutral weekdays in November 2015 (Tuesday, Wednesday and Thursday). A process was undertaken to convert aggregated MPD (11 days) to give a single average day - this simply involved dividing the total neutral weekday sample through by the number of days. This process reduced the impact of the capping in the mobile phone data.

Combine Modes

The MPD provided by Atkins/EE was split into matrices classifying trips as 'highway' and 'non-highway'. Recognising the difficulty of classifying trips, particularly in congested built-up urban environments where it is technically difficult to classify different motorised trips by applying a speed cut-off, all modes were combined to then be split out using separate reliable data sources described later in this chapter in Section 5.3.2.

5.2.2. Roadside Interview Surveys

In June 2013, a programme of RSI surveys was undertaken in Cambridge at the locations as described in Table 5-3.

Table 5-3 Cambridge RSI Site Description

RSI Site ID	Description
C1	Barton Road
C2	Madingley Road A1303
C3	Huntingdon Road A1307
C4	Histon Road (B1049)
C5	King's Hedges Road
C6	Milton Road (A1309)
C7	Milton Road Off-Slip (A1309)
C7n	Cambridge Science Park (North)
C7s	Cambridge Science Park (South)
C8	Ditton Lane (B1047)
C9	Newmarket Road (A1303)
C10	Cambridge Road
C11	Hinton Way
C12	Babraham Road (A1307)
C13a	Shelford Road (A1301)
C13b	Addenbrooke's Road
C14	Hauxton Road (A1309)

The RSI data collected only provides inbound interview survey data, therefore AM and PM peak interview data was transposed and expanded to outbound counts in the opposing direction and time period (e.g. inbound records in the AM peak were transposed to give outbound trip information in the PM peak), whilst outbound trip patterns in the IP were transposed averages of the inbound IP interview data.

For each RSI site location, scaling factors were derived to convert single day MCC data collected on the same day of the RSI to a neutral weekday using the ATC data. An expansion factor was then calculated between the RSI sample data and the scaled MCC data in order to expand the RSI survey responses. A relevant expansion factor was attached to each RSI survey response based on site location, traffic direction, time period and mode.

Each RSI survey response was assigned a CSRM2 origin and destination zone. Partial RSI matrices were populated using the correspondence between the expanded RSI survey response data and the CSRM2 zoning system. These RSI matrices were scaled to 2015 values using Cambridge radial count data to generate 2013-2015 growth factors given below in Table 5-4.

Table 5-4 Cambridge Radial 2013 to 2015 Growth Factors

Time Period	Growth Factor
AM	0.99
IP	1.11
PM	1.00

5.2.3. Heavy Goods Vehicles

The MPD captures physical mobile devices and as such the provided dataset includes an element of HGV trips. It is not however possible to identify which trips from the MPD dataset are HGV, so a separate method of capturing HGV trips was required. HGV matrices for CSRM2 were separately derived from the following data sources:

- TrafficMaster origin-destination data provided by the DfT for all trips that intercept the same area used for the MPD; and
- Existing CSRM1 HGV matrices.

The TrafficMaster data for HGV movements is a sample that requires expanding to reflect the full volume of HGV traffic in the study area (because TrafficMaster devices are only fitted to a subset of HGVs). The distribution pattern of HGV movements was therefore taken from the TrafficMaster data and scaled to CSRM1 HGV district-district totals as the best available source of overall HGV trip volumes.

Although the TrafficMaster data provides a reasonable sample, it does not fully capture all movements so therefore an element of HGV distribution patterns was also taken from the existing CSRM1 matrices. Weighting factors were applied to the raw TrafficMaster matrices and the existing CSRM1 HGV matrices to reflect the higher confidence in the TrafficMaster data. The weights applied to each data source were TrafficMaster 0.9, CSRM1 0.1. The resulting two matrices were then combined to give an initial distribution pattern.

A district-district factor was then derived between the weighted distribution matrices and the existing CSRM1 HGV matrices. These factors were applied to each CSRM2 model zone OD pair to give AM, IP and PM single hour HGV matrices.

ME was then used to refine the HGV matrices to observed traffic count data on individual highway links as described later in Section 6 of this report.

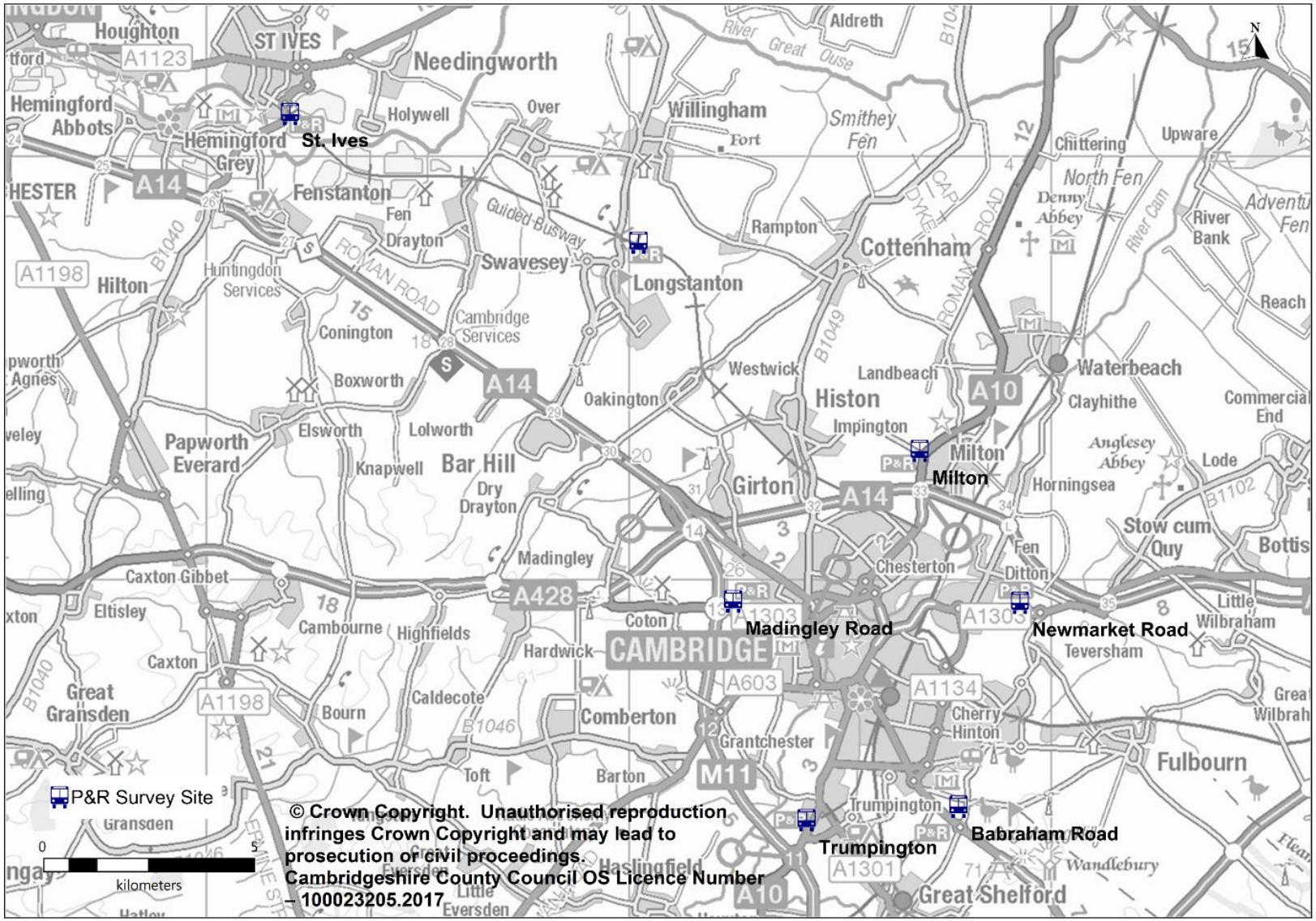
5.2.4. Park & Ride Trips

Separate partial highway trip matrices were derived for each of the seven P&R sites within the study area. Matrices were derived by distributing observed incoming and outgoing vehicle trip ends at the sites using patterns taken from the synthetic highway matrices described below in Section 5.2.5. Cambridge P&R site locations and services are shown in Figure 5-2 and described in Table 5-5. This process was undertaken to ensure P&R traffic volumes were correct, recognising that the minor localised diversion could not be fully captured in the model. Trips diverting through the P&R site will be captured in the matrices as their true origin and destination.

Table 5-5 CSRM2 P&R Zones

CSRM2 Zone	P&R Site
971	Babraham Road
972	Trumpington
973	Madingley Road
974	Milton
975	Newmarket Road
976	Longstanton
977	St. Ives

Figure 5-2 Cambridge P&R Survey Sites



The observed count at Trumpington P&R has been scaled down in all time periods due to the observed count being considered abnormally high. High incoming and outgoing vehicle counts at Trumpington P&R were identified to be the result of the site doubling up as a car park for John Lewis collection customers, and also due to vehicles rat-running in the AM peak to avoid congestion on Hauxton Road, albeit to a lesser extent.

To reduce the unrepresentatively high vehicle volumes at Trumpington P&R, a process was undertaken to recalculate incoming and outgoing vehicle volumes at the P&R site. A ratio between observed incoming vehicles and P&R passenger numbers was established for all P&R sites. P&R passenger numbers were taken from ticket sale data by P&R site, time of day and neutral weekday.

The incoming vehicle / P&R passenger ratio for Babraham P&R was applied to Trumpington P&R passengers to give a recalculated incoming vehicle count for Trumpington. Babraham P&R was chosen due to its proximity to Trumpington and being in a similar location to the south of Cambridge. The difference between the observed and the recalculated incoming vehicle count was subtracted from the observed.

This process was undertaken to ensure P&R traffic volumes were correct, recognising that the minor localised diversion could not be fully captured in the model. Trips diverting through the P&R site will be captured in the matrices as their true origin and destination.

In the F-series model, where an additional zone has been created to represent the John Lewis depot separately, the trips removed from the Trumpington P&R count through the process described above have been assigned to the new zone instead.

5.2.5. Synthetic Highway Trip Matrices

Synthetic car matrices were taken from the wider CSRM2 integrated transport model for each of the HAM modelled hours to be incorporated into the matrix build. The process by which these matrices were produced is documented in the CSRM2 MDVR.

5.3. Data Fusion

This section describes how the partial trip matrices have been ‘fused’ to provide prior highway assignment matrices. The process is summarised in Figure 5-3 and detailed in the following sections.

5.3.1. Remove HGVs

The first step in the process was to remove HGV trips from the MPD matrices. The single hour HGV matrices generated from TrafficMaster data were subtracted from the MPD matrices. These HGV matrices were then re-fused into the matrix at a later stage of the build as a separate user class once processing of the light vehicle classes is complete, see Section 5.3.9.

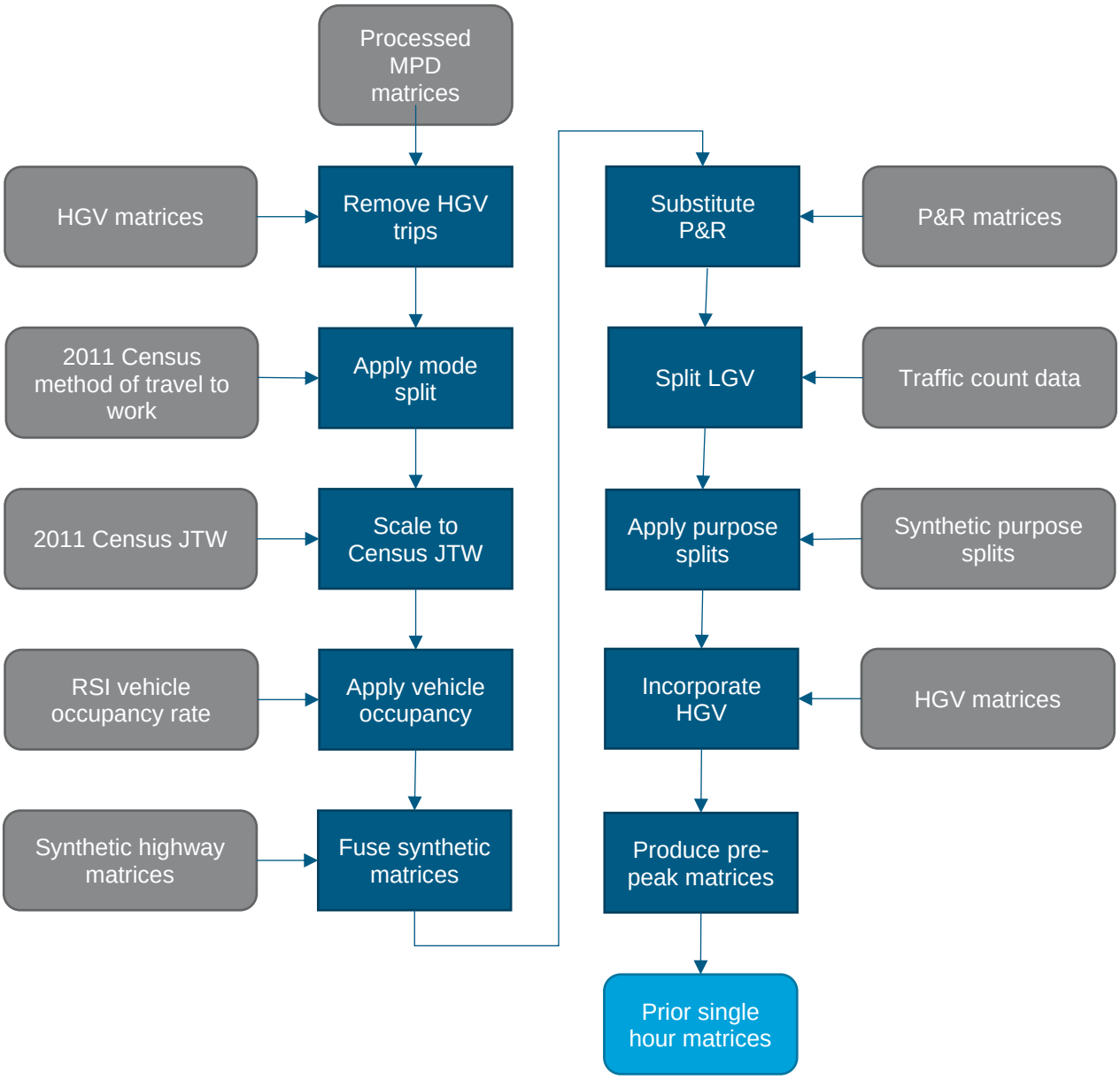
5.3.2. Mode Split

MPD matrices were split into ‘highway’ and ‘non-highway’ trips using information from the 2011 Census. The method of travel to work Census table (QS701EW) was used to identify modal splits by distance bands for each of the Cambridgeshire districts in the study area (Cambridge, East Cambridgeshire, Fenland, Huntingdonshire and South Cambridgeshire). OD pairs of the full MPD matrix were categorised into the following distance bands:

- <2 km;
- 2-5 km;
- 5-10 km;
- 10-20 km;
- 20-30 km;
- 30-40 km;
- 40-60 km; and
- 60+ km.

Mode splits were then applied to the MPD matrix based on the distance between OD pairs and their origin district, removing non-highway trips from the matrices.

Figure 5-3 Data Fusion Process



5.3.3. Scale to Census Journey to Work

To ensure the total volume of trips in the MPD matrices were of the appropriate scale, the MPD matrices were scaled using 2011 Census Journey to Work (JTW) data. This process proportionally scaled the more remote areas of the model to reflect the poorer quality sample obtained in the MPD.

Before a scaling factor could be produced, the JTW data needed to be processed to represent trips of all purposes for each modelled peak hour. The Census JTW data provides outbound data only (Production – Attraction), therefore the data needed to be transposed and added to the original (outbound) JTW data to also give return trips.

The dataset includes all Home-based Work (HBW) trips throughout the day, and is thus not defined by time-period. To get an estimate of HBW trips originating and returning within each time-period, the time slice proportions from the Dynamic Integrated Assignment and Demand Modelling (DIADEM) user manual[5] were utilised (Table 5-6).

[5] DIADEM user manual v5.0, Appendix C, page 94.

Table 5-6 DIADEM HBW Trip Proportions

		Return time				
		AM	IP	PM	OP	Total
Outbound time	AM	2.50%	13.56%	45.18%	5.64%	**66.88%**
	IP	0.00%	3.79%	7.03%	3.39%	**14.21%**
	PM	0.18%	0.10%	3.01%	3.30%	**6.59%**
	OP	1.59%	4.02%	3.05%	3.66%	**12.32%**
	Total	**4.27%**	**21.47%**	**58.27%**	**15.99%**	**100.00%**

Using the DIADEM trip proportions presented in Table 5-6, the AM, IP and PM peak periods were isolated from the full-day JTW data as follows:

- AM = (JTW * 66.88%) + (JTW Transposed * 4.27%);
- IP = (JTW * 14.21%) + (JTW Transposed * 21.47%); and
- PM = (JTW * 6.59%) + (JTW Transposed * 58.27%).

This method only gives HBW (and returning HBW) trips (commuter trips). Therefore 2013 Cambridge RSI data was used to derive a factor between HBW commuter trips and all trip purposes (Table 5-7).

Table 5-7 RSI HBW to All Trip Purposes Factors

Time-Period	Factor
AM	1.64
IP	4.69
PM	2.01

The final step in processing the JTW data involved converting the dataset to represent the modelled peak hours. The factors which were derived from the 2013 Cambridge RSI data are presented in Table 5-8 and were used to convert the JTW data into a peak hour dataset.

Table 5-8 RSI Period to Single Hour Factors

Time-Period	Factor
AM	0.31
IP	0.17
PM	0.37

An important comparison to make is to compare the MPD demand to the JTW data. Figure 5-4 to Figure 5-6 show that trip origins (by previously defined 13-sector system) in the MPD were much lighter than the processed JTW data, especially in more rural areas. These comparisons highlight the underrepresentation of trips in the MPD, and the subsequent need to scale MPD trips to JTW totals at a sector level.

Figure 5-4 MPD vs. JTW Trip Origins - AM

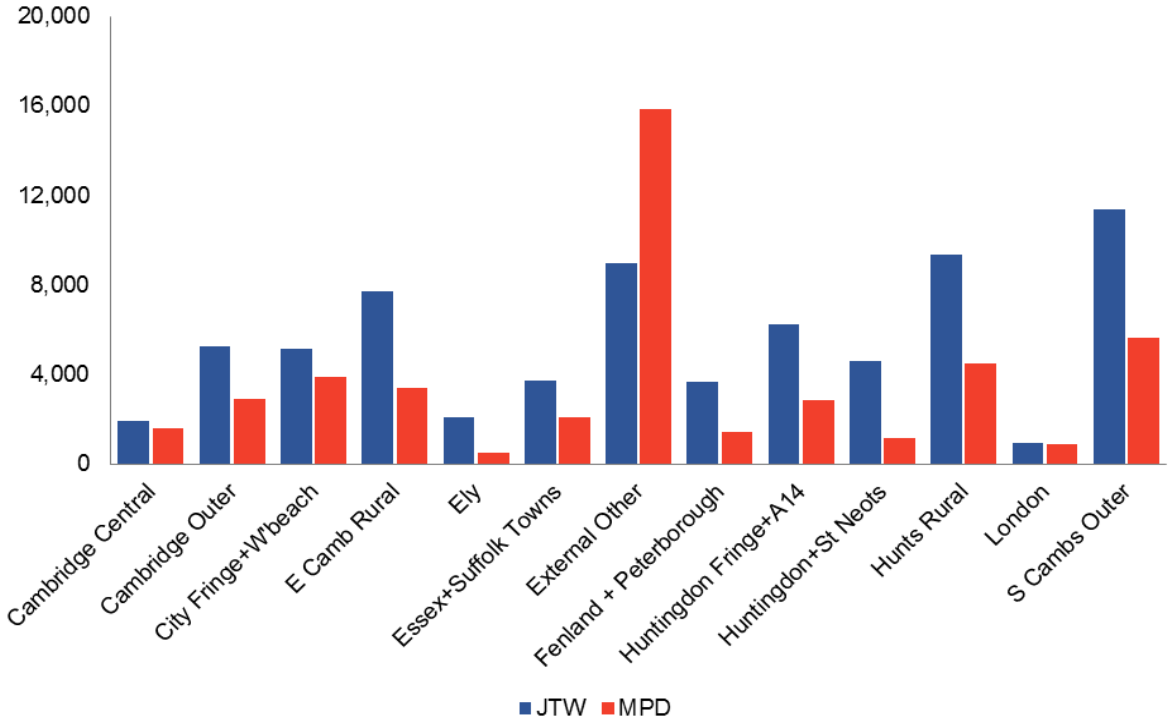


Figure 5-5 MPD vs. JTW Trip Origins - IP

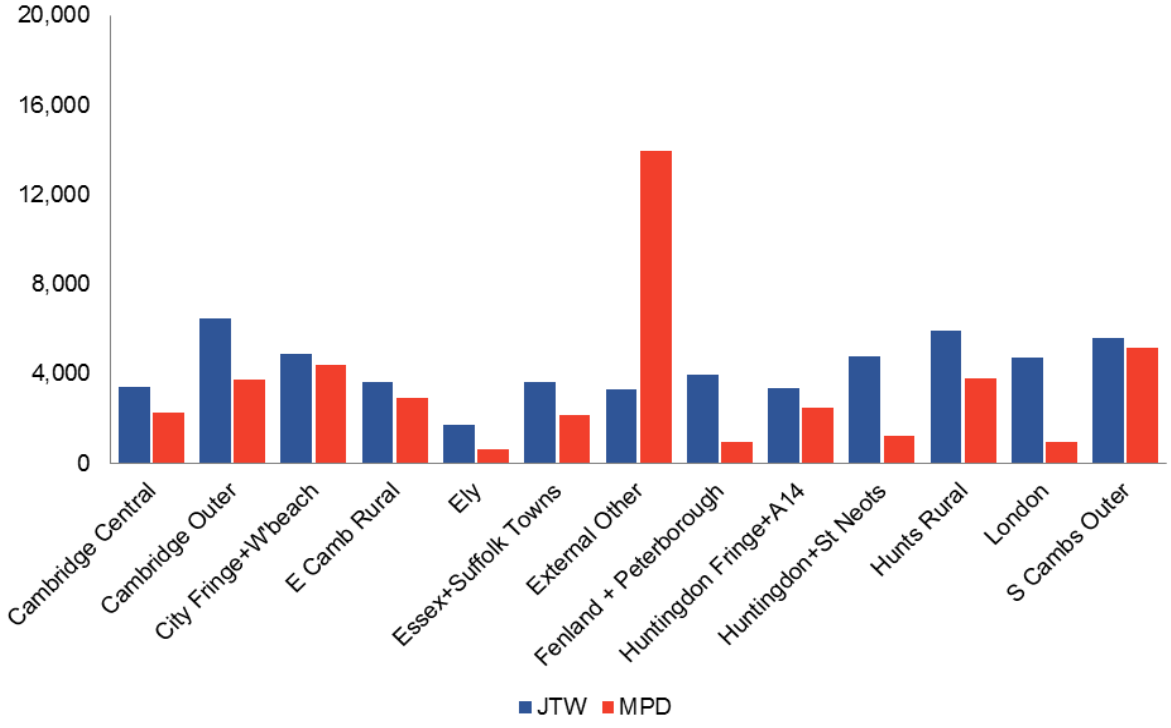


Figure 5-6 MPD vs. JTW Trip Origins - PM

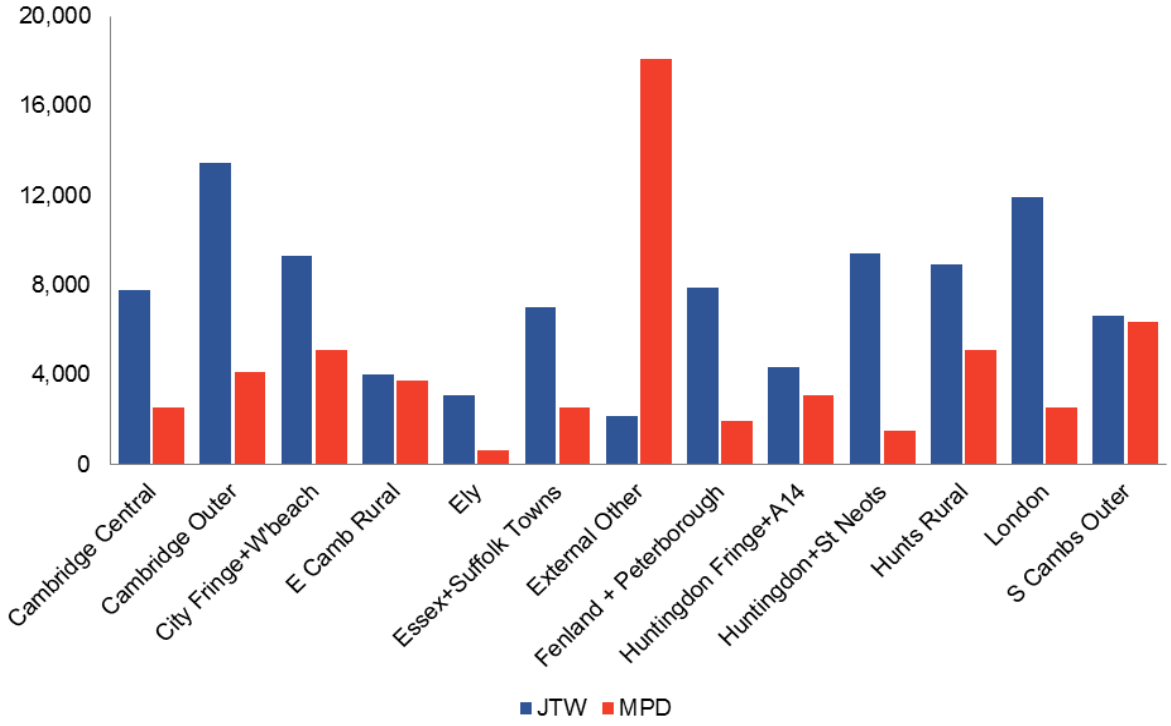


Table 5-9 presents the factors used to scale the MPD. Internal to External, and External to Internal trips were not applied a factor, because in this instance, the MPD is assumed to have the right level of trips. Figure 5-7 to Figure 5-9 highlight the effect of the Census JTW scaling factor on the MPD matrices.

Table 5-9 JTW Factor

Origin Sector (13)	Scale to JTW Factor
Cambridge Central	1.3
Cambridge Outer	1.8
City Fringe & Waterbeach	1.2
East Cambridgeshire Rural	1.9
Ely	3.4
Essex & Suffolk Towns	1.4
External Other	1.0
Fenland & Peterborough	2.5
Huntingdon Fringe & A14	2.1
Huntingdon & St. Neots	3.6
Huntingdonshire Rural	1.8
London	2.4
South Cambridgeshire Outer	1.8

Figure 5-7 MPD Prior & Post JTW Scaling - AM

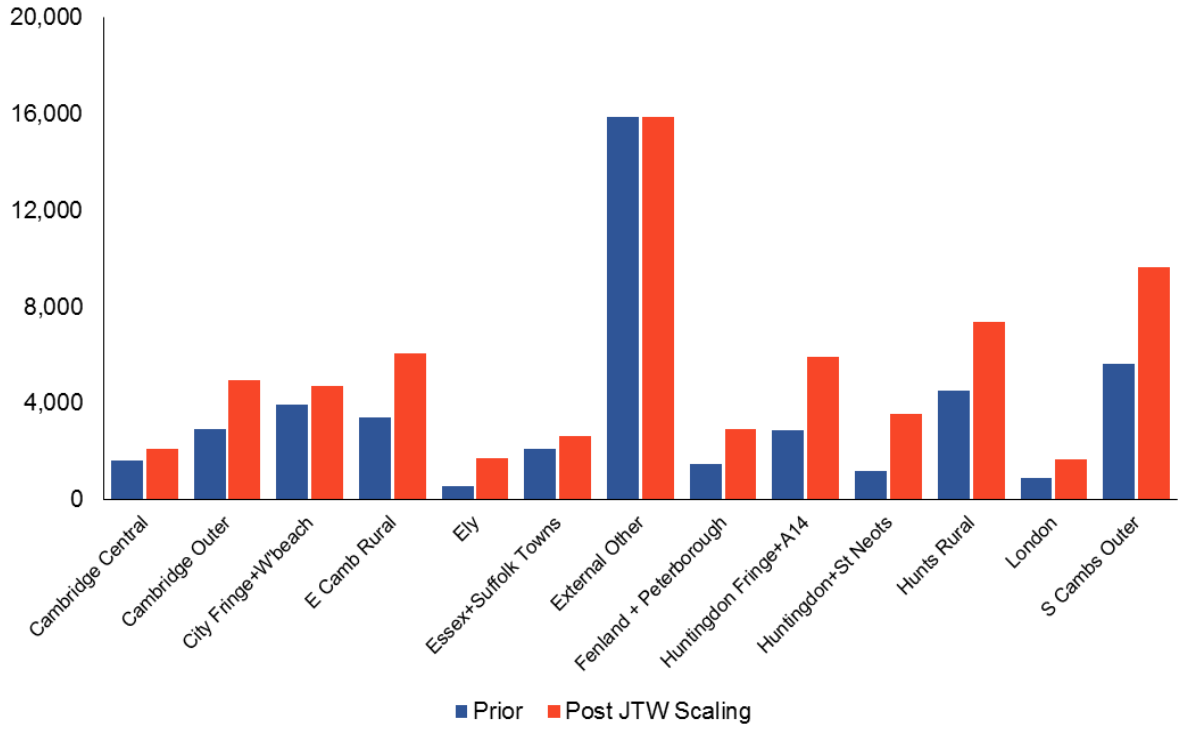


Figure 5-8 MPD Prior & Post JTW Scaling - IP

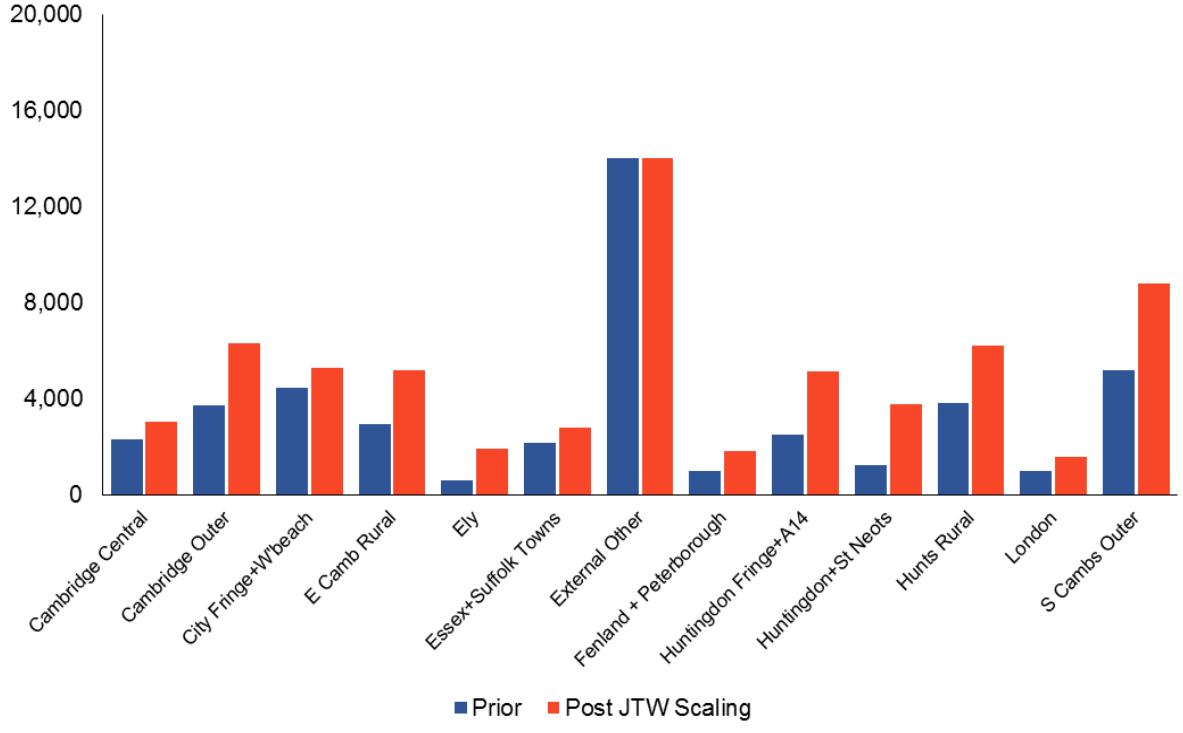
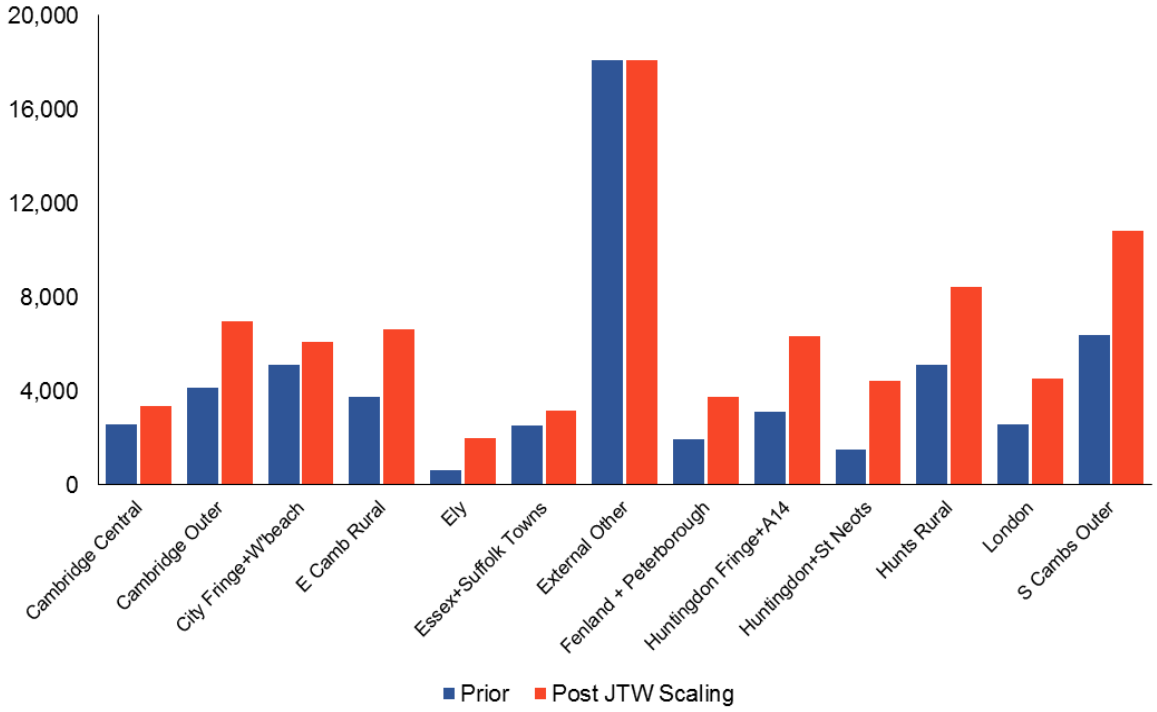


Figure 5-9 MPD Prior & Post JTW Scaling - PM



5.3.4. Vehicle Occupancy

The MPD provided was in "device trips" – every reported trip is a record of a device making that movement rather than an individual vehicle. Vehicles may carry multiple people, each with one or more mobile devices. Whilst it is not possible to identify how many devices are associated with a single person, car occupancy rates are known so a car occupancy rate can be applied to convert the MPD from person trips to vehicular units. An average vehicle occupancy rate taken from the RSI data of 1.2 was applied to all time periods.

5.3.5. Fuse Synthetic Car Matrices

A fusion process was undertaken to supplement the MPD matrices with trips from the synthetic base year highway matrices. Where no trips existed between OD pairs in the MPD, but did exist in the synthetic data, the synthetic trips were added to the matrices. For all other OD pairs, a global factor of 10% MPD and 90% synthetic data was applied.

5.3.6. Substitute P&R Lights

Incoming and outgoing vehicles at P&R sites were fused into the matrices. The P&R matrices used in the matrix build process are described in Section 5.2.4. Trips in the P&R matrices replaced all trips to and from P&R zones in the MPD as the survey data was considered more reliable than the MPD due to the short transfer times from car to P&R.

5.3.7. LGV Split

The MPD included LGV trips which needed to be separated from car trips. LGV trips were separated from car trips in the MPD by applying a time-period dependent factor based on the proportional split from an array of observed 2015 survey data used in the calibration of the assignment model (Table 5-10). The observed data used to derive the proportional split comprised of all Market Town, Radial, River and CSRM2 survey data.

Table 5-10 Car / LGV Split

Time-Period	Car Split	LGV Split
AM	0.91	0.09
IP	0.87	0.13
PM	0.94	0.06

5.3.8. Purpose Split

Car trips were split into eight user classes and LGV trips into two user classes as presented earlier in Section 3.9. The split of purpose was taken from the synthetic data matrices at the individual OD level. Where no data was available for an OD pair, a global average for the study area was applied.

5.3.9. Incorporate HGV

At this stage of the matrix build, HGV trips were added back into the matrices as user classes 9 and 10. HGV matrices were calculated from TrafficMaster data as described in Section 5.2.3.

5.4. Pre-Peak Matrices

For SATURN to adequately represent network performance in congested urban conditions it needs information on the amount of residual traffic queueing in the network at the start of the modelled hour. The PASSQ option in SATURN enables this feature by modelling the pre-peak hour and then carrying over any queueing traffic resulting in the simulation area from overcapacity in the pre-peak through to the peak hour. This process is undertaken in SATURN by creating a pre-peak demand matrix that has been factored from the peak hour matrix. The resulting pre-peak matrix is then assigned to the network to create the pre-peak model assignment. Queued flows are passed from the pre-peak hour across into the main peak hour.

Pre-peak matrices are only required for AM and PM peak models as the inter-peak does not typically suffer from residual queuing from the preceding period.

Analysis of traffic data across the modelled area revealed that the relationship between pre-peak and peak hour traffic varied by geographic location and vehicle type (light/heavy vehicle). For example, there is a greater number of trips originating from outside Cambridge (County) in the AM pre-peak hour, than the peak hour itself. Whereas within Cambridge, there are a greater number of trips in the AM peak hour compared to the pre-peak hour.

To reflect this variation, it was decided to use different factors across the matrix per the observed split between the PASSQ hour and peak hour. 2015 directional totals for County, Radial and River Cam count data was used in the derivation of pre-peak factors. Factors were applied based on the origin and destination of each ij pairing within the matrices. A full matrix of factors was used to generate the PASSQ matrices. Light vehicle factors were applied to user classes 1-8 and 11-12, whilst the heavy vehicle factor was applied to user classes 9-10. The pre-peak factors used are shown in Table 5-11.

Table 5-11 Peak Hour to Pre-Peak Hour Factors

Trip Type	Count Type	Direction	AM		PM	
			Lights	Heavies	Lights	Heavies
County to County	County Screenline	Combined	1.05	1.03	0.91	1.28
County to Cambridge	Radial Cordon	Inbound	1.01	1.05	0.87	1.61
Cambridge to County	Radial Cordon	Outbound	0.82	0.77	0.98	1.61
Cambridge to Cambridge	River Cam Screenline	Combined	0.96	1.08	0.97	1.20

6. Matrix Calibration

6.1. Matrix Calibration

The matrix calibration process involves checking the validity of the trip data used to produce the matrices and focuses principally on ensuring that traffic is assigned to the highway network in the correct volumes and locations. The SATURN modules SATME2 and SATPIJA have been used for the ME of CSRM2 to match assigned modelled link flows with observed traffic counts whilst ensuring that the overall trip distribution of the original trip matrix was maintained.

During the model calibration stage, adjustments were made to the model parameters and trip matrices to improve the correlation between observed and modelled data. A series of techniques were used during the model calibration process, including the following:

- Adjustments to ensure that link speeds on the network were realistic;
- Adjustments to ensure that delay calculations at junctions were realistic;
- Checking of the network to ensure plausible and realistic routeing of traffic; and
- ME to improve the representation of link flows against observations.

It should be noted that although these activities are reported separately, in practice these tasks are interrelated and are undertaken iteratively.

6.2. Application of Matrix Estimation

During ME the SATURN modules SATME2 and SATPIJA are used in combination to attempt to match assigned modelled link flows with observed traffic counts. The ME process forms part of the calibration process and is designed to modify the origin-destination volumes to match the observed traffic counts. Trips are adjusted in the prior matrix to produce the estimated matrix, which is more likely to be consistent with the observed traffic counts.

The equation used may be written as follows:

$$T_{ij} = tij \prod_a X_a^{Pija}$$

where:

- T_{ij} is the output estimated matrix of OD pairs ij;
- tij is the prior matrix of OD pairs ij;
- $\prod_a$ is the product over all counted links a;
- X_a is the balancing factor associated with counted link;
- ^{Pija} is the fraction of trips from I to J using link A.

The application of this process should be strictly controlled to ensure the original patterns do not become distorted. Therefore, the process must be monitored closely to ensure that:

- The trip matrix is converging to a stable solution;
- The changes in travel patterns at a sector level are reasonable; and
- The output trip length distributions are comparable to the prior matrix.

Using the SATPIJA control file, checks are made to ensure that the overall trip distribution of the original prior trip matrix is maintained by limiting the change to cell values for all vehicles.

The ME process was applied to adjust the light vehicle matrix, followed by heavy vehicle matrix. As described previously, the link counts used in the ME process are formed as a series of calibration screenlines for light and heavy vehicles. In addition, diligence was exercised to ensure that the quality and consistency of the input count data was high.

6.3. Matrix Factoring

In traffic assignment modelling, the tolerances between observed and modelled flows are set at a high level, which means the initial matrix scale needs to be an accurate representation of travel patterns. The inherent sampling of mobile phone patterns is always likely to underestimate movements if people switch phones off, forget to carry them or there are discontinuities in signal leading to breaks in the journey pattern trace. This

correction, however can be applied at quite an aggregate level. Hence the matrix calibration included a process to factor the prior matrix using sector based factors derived from observed data with the assistance of ME to improve the initial prior matrix. Factors were based on the difference between the original prior matrices and the initial post-ME matrices. As such, the factoring process involved the derivation of four sequential matrices as described in Table 6-1.

Table 6-1 Matrix Sector Factoring Process

ID	Name	Description
1	Prior	Original prior matrices derived in Section 5
2	Post-ME	Original prior matrices post-ME
3	Scaled Prior	The original prior matrices (1) with scaling factor applied
4	CSRM2 Prior	Removed trips that would not enter the CSRM2 highway network
5	CSRM2 Post-ME	CSRM2 prior matrices (4) post-ME

An initial ME process was undertaken to derive a set of scaling factors from the observed traffic count calibration dataset to apply to the prior matrices at a sector level. The sectoring system used comprised of 58 sectors as shown earlier in this report in Section 3.6.

Scaling factors were calculated between the original prior matrices (1) and the initial post-ME matrices (2) at a 58-sector level. These sector-to-sector scaling factors were applied to the original prior matrices (1) to produce scaled prior matrices (3). Next, trips between certain ij pairs which would not actually enter the CSRM2 highway network were removed from the matrices, to produce CSRM2 prior matrices (4). Finally, ME was run on the CSRM2 prior matrices (4) in a conventional way to give a set of CSRM2 post-ME matrices (5). The CSRM2 post-ME matrices (5) were used as the final CSRM2 base year matrices.

Table 6-2 below compares the matrix totals for the Prior (1) and post scaling Scaled Prior (3) matrices aggregated across all relevant user classes.

Table 6-2 Comparison of Matrix Totals – Prior vs. Post-Factoring

Time-Period	Lights			Heavies		
	Prior (1)	Scaled Prior (3)	% Change	Prior (1)	Scaled Prior (3)	% Change
AM	86,578	96,656	11.6%	9,678	10,261	6.0%
IP	62,178	67,824	9.1%	9,858	10,538	6.9%
PM	95,227	105,203	10.5%	7,703	8,061	4.6%

6.4. Impact of Matrix Estimation

6.4.1. Significance of Matrix Estimation Changes

TAG unit M3.1 states that changes induced by ME should not be significant and specifies a series of criteria that should not be exceeded. The criteria for ME induced changes are presented in Table 2-5 earlier in this report.

6.4.2. Matrix Totals

A comparison of matrix totals before and after ME is shown in Table 6-3. ME increases the volume of trips in most time periods, noting it has limited effect on the PM heavies.

Table 6-3 Comparison of Matrix Totals – Prior vs. Post-ME

Time-Period	Lights			Heavies		
	CSRM2 Prior (4)	CSRM2 Post-ME (5)	% Change	CSRM2 Prior (4)	CSRM2 Post-ME (5)	% Change
AM	91,854	95,706	4.2%	9,889	10,290	4.1%
IP	64,479	66,626	3.3%	9,810	10,207	4.0%
PM	99,966	104,179	4.2%	7,682	7,743	0.8%

6.4.3. Matrix Zonal Values

Matrix zonal changes by time-period are presented in Table 6-4 below. In most cases the criteria are met. Exceedances of the guidance tolerances are most acute in the PM peak. PM trip ends during the matrix estimation process have changed to the extent that the slope of the correlation is 1.05 for origins and 1.05 for destination trip ends rather than the 1.02 recommended, giving the largest aggregate deviation from the prescribed tolerances. The other time periods show minor deviation for the origin and destination row totals with the AM peak trip end slope a little outside the prescribed tolerance at 1.04 for origins and 1.03 for destination trip ends. The interpeak shows similar impacts as the AM time period.

Table 6-4 Matrix Zonal Cell Value Changes – Prior vs. Post-ME

Measure	Significance Criteria	AM	IP	PM
Matrix Zonal Cell Values	Slope within 0.98 and 1.02	1.02	1.02	1.02
	Intercept near zero	0.00	0.00	0.00
	R^2 in excess of 0.95	0.94	0.96	0.95
Matrix Zonal Trip Ends - Origin (Rows)	Slope within 0.99 and 1.01	1.04	1.02	1.05
	Intercept near zero	0.09	0.13	-0.10
	R^2 in excess of 0.98	0.97	0.98	0.98
Matrix Zonal Trip Ends - Destination (Columns)	Slope within 0.99 and 1.01	1.03	1.03	1.05
	Intercept near zero	3.75	0.29	-2.00
	R^2 in excess of 0.98	0.97	0.99	0.99

6.4.4. Matrix Trip Length Distribution

Trip length distributions between the prior and post-ME matrices are compared by user class and time-period in Figure 6-1 to Figure 6-6. The spike shown in long-distance trips on each chart is simply due to it being the widest category on the histogram (including all trips over 95 km) – it is particularly pronounced for heavy vehicles as a larger proportion of their trips are long distance. Table 6-5 to Table 6-7 demonstrate that ME has not significantly affected the length of trips in the matrices for both lights and heavy vehicles. ME has resulted in less than 5% change in mean trip length and standard deviation across all time periods.

Table 6-5 Matrix Trip Length (km) Distribution – Prior vs. Post-ME (AM)

Vehicle Type	Mean				Standard Deviation			
	Prior-ME	Post-ME	Diff.	Diff. (%)	Prior-ME	Post-ME	Diff.	Diff. (%)
Lights	30.4	32.0	1.5	5.0%	50.6	52.4	1.8	3.6%
Heavies	102.5	102.0	-0.5	-0.5%	91.2	92.7	1.6	1.7%
All	37.4	38.8	1.3	3.5%	59.8	61.2	1.4	2.4%

Table 6-6 Matrix Trip Length Distribution – Prior vs. Post-ME (IP)

Vehicle Type	Mean				Standard Deviation			
	Prior-ME	Post-ME	Diff.	Diff. (%)	Prior-ME	Post-ME	Diff.	Diff. (%)
Lights	31.4	32.4	1.0	3.1%	58.0	59.7	1.8	3.0%
Heavies	121.8	120.2	-1.6	-1.3%	95.9	97.2	1.4	1.5%
All	43.3	44.1	0.7	1.6%	71.2	72.4	1.2	1.7%

Table 6-7 Matrix Trip Length Distribution – Prior vs. Post-ME (PM)

Vehicle Type	Mean				Standard Deviation			
	Prior-ME	Post-ME	Diff.	Diff. (%)	Prior-ME	Post-ME	Diff.	Diff. (%)
Lights	33.7	34.9	1.2	3.7%	54.9	56.2	1.4	2.5%
Heavies	119.6	124.9	5.3	4.5%	96.8	100.9	4.1	4.2%
All	39.8	41.2	1.3	3.4%	62.9	64.6	1.7	2.7%

Figure 6-1 Trip Length Distribution - Lights (AM)

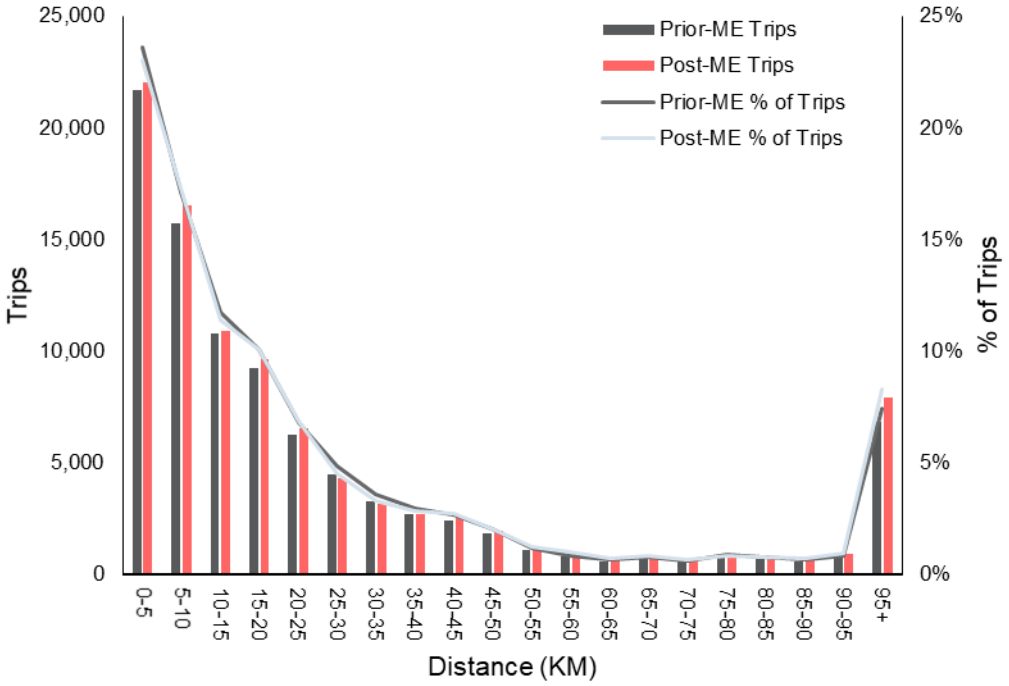


Figure 6-2 Trip Length Distribution - Heavies (AM)

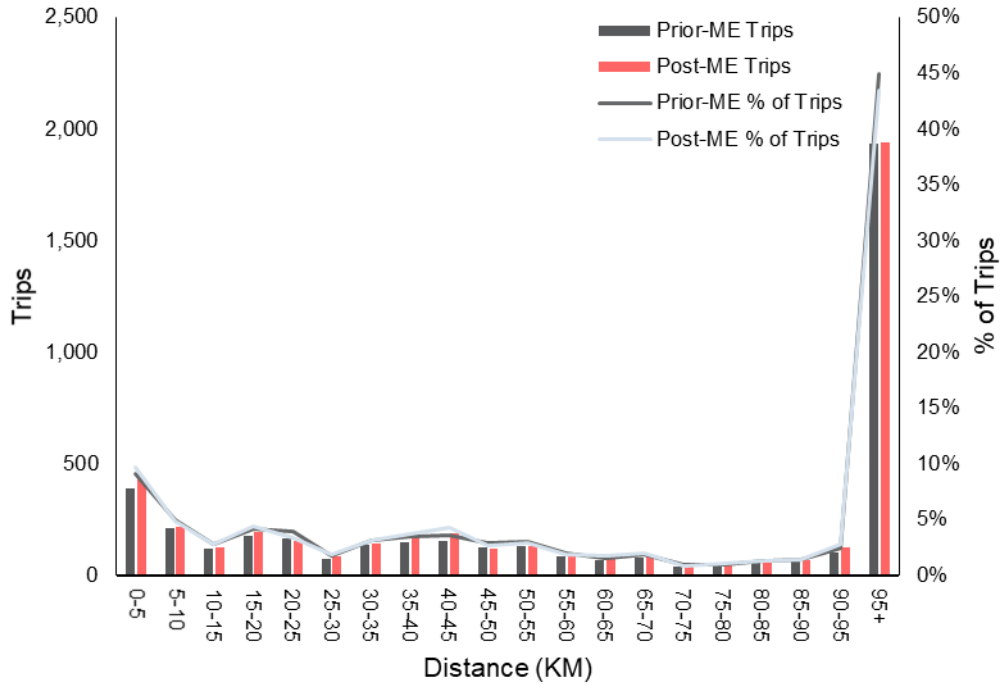


Figure 6-3 Trip Length Distribution - Lights (IP)

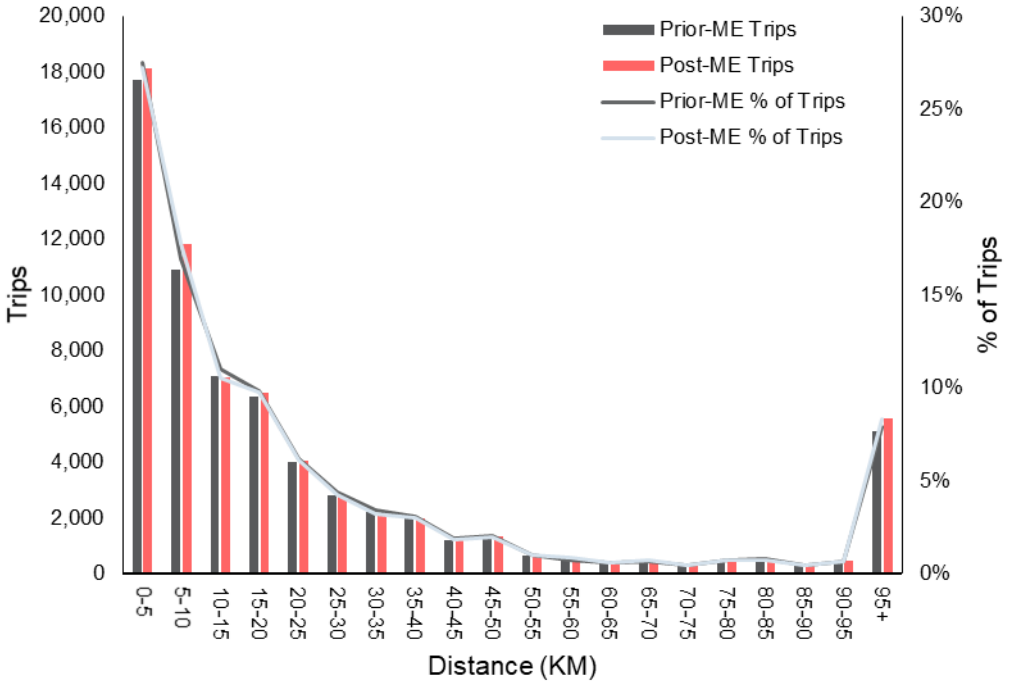


Figure 6-4 Trip Length Distribution - Heavies (IP)

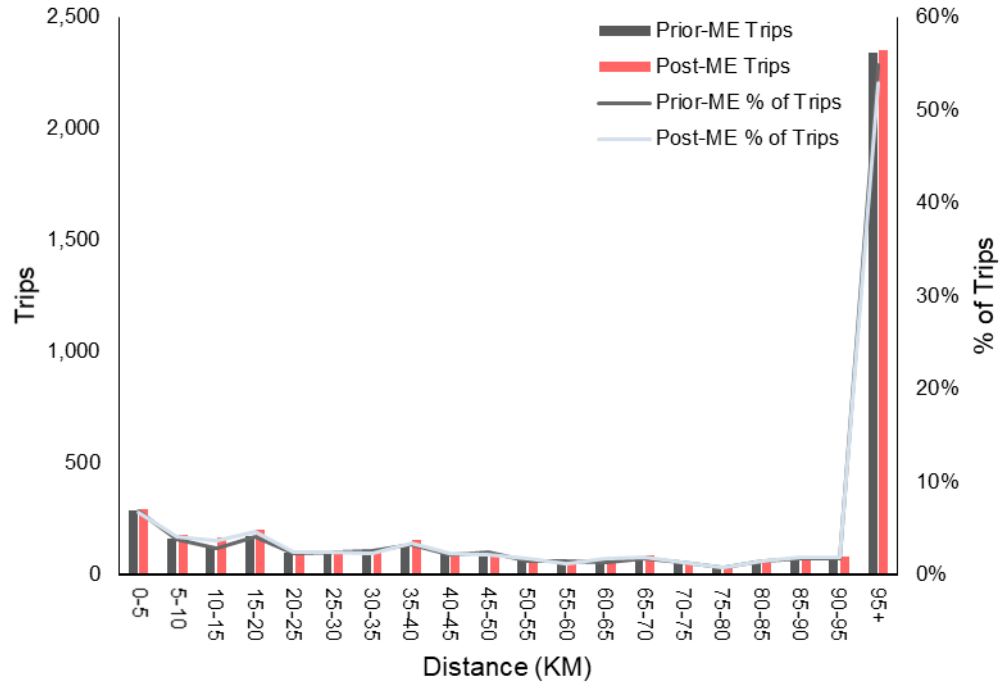


Figure 6-5 Trip Length Distribution - Lights (PM)

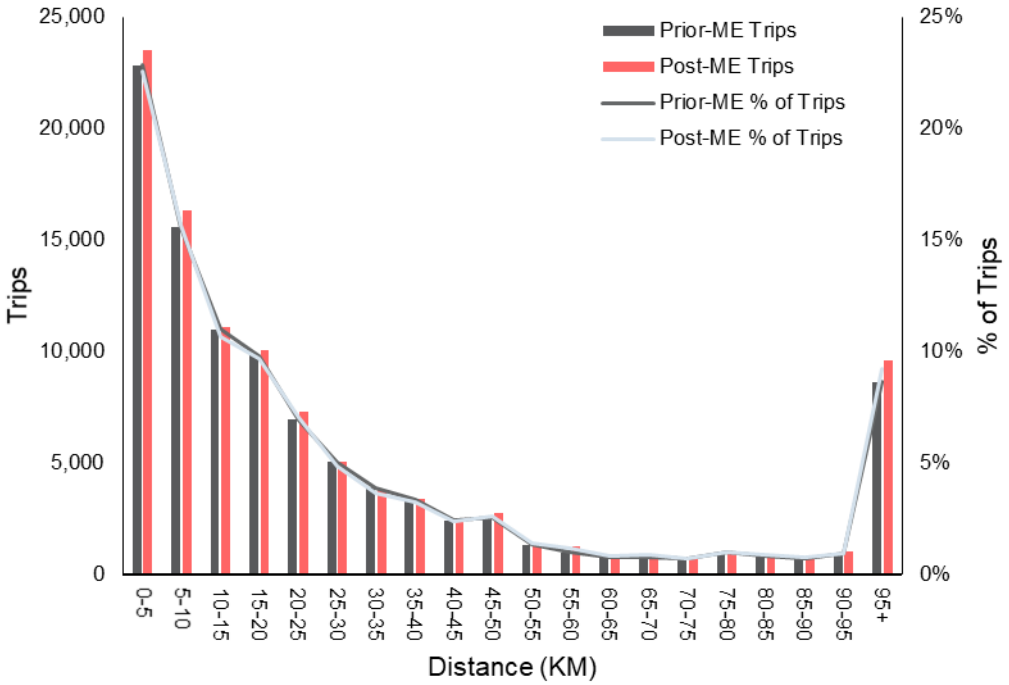
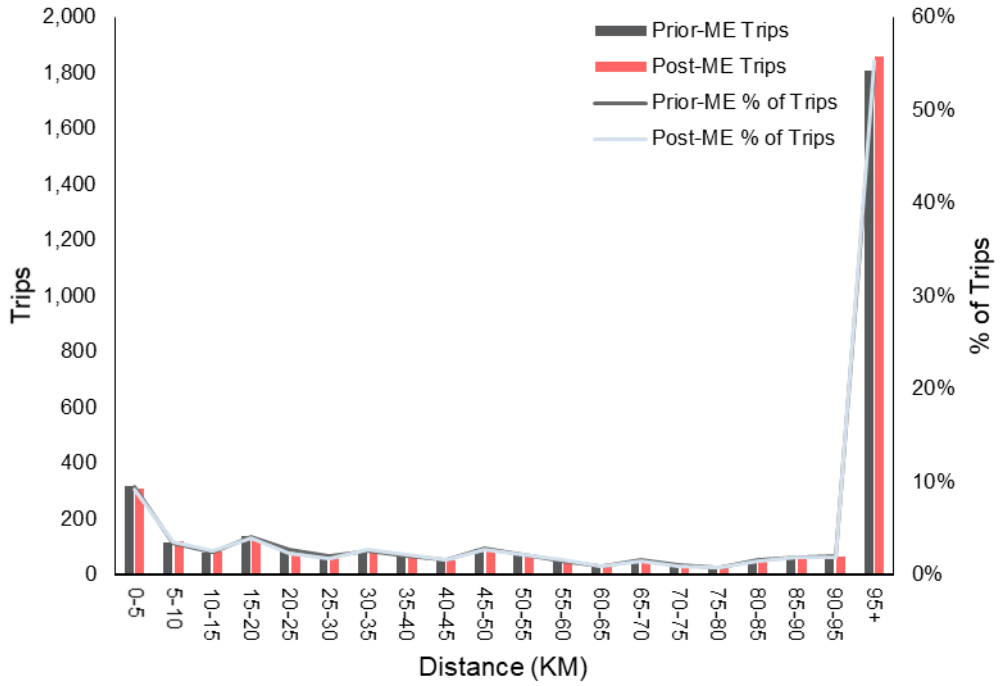


Figure 6-6 Trip Length Distribution - Heavies (PM)



6.4.5. Matrix Sectoring

To determine the impact of ME, trip differences between the prior and post-ME matrices have been investigated at a sector-to-sector level. Comparisons were drawn between the five districts used in CSRM2, plus the external area:

1. Cambridge;
2. South Cambridgeshire;
3. East Cambridgeshire;
4. Huntingdonshire;
5. Fenland; and
6. External.

Although the overall impact of ME is relatively low, some sector-to-sector movements do show significant percentage changes induced by ME. Table 6-8 to Table 6-10 below show the differences between prior and post-ME matrices at a sector-to-sector level.

TAG criteria state that ME should not induce change greater than 5% at a sector-to-sector level. These sector-to-sector movements often only involve a small number of trips. GEH values have been calculated between the prior and post-ME matrices as a useful indicator to identify those sector movements which do not meet the TAG criteria and involve a significant change in the absolute number of trips – these cells have been shaded in both parts of each table. A full commentary is provided below the tables.

Table 6-8 Impact of Matrix Estimation (All Vehicles) - AM

	Sector	Cambridge	S. Cambs	E. Cambs	Hunts	Fenland	External
Percentage Difference (%)	Cambridge	5%	9%	-12%	-9%	10%	30%
	S. Cambs	9%	5%	-13%	-9%	-16%	4%
	E. Cambs	-13%	-11%	4%	-14%	17%	-1%
	Hunts	-5%	-7%	-7%	1%	1%	11%
	Fenland	13%	17%	16%	12%	0%	26%
	External	28%	17%	-4%	2%	9%	5%
GEH	Cambridge	4	6	2	2	0	8
	S. Cambs	6	6	4	4	2	2
	E. Cambs	5	5	3	4	2	1
	Hunts	1	4	2	1	0	7
	Fenland	1	2	3	3	0	3
	External	11	12	2	1	1	6

Table 6-9 Impact of Matrix Estimation (All Vehicles) – IP

	Sector	Cambridge	S. Cambs	E. Cambs	Hunts	Fenland	External
Percentage Difference (%)	Cambridge	10%	7%	2%	-8%	19%	19%
	S. Cambs	10%	1%	-8%	-7%	30%	1%
	E. Cambs	-2%	-10%	6%	-11%	20%	0%
	Hunts	-6%	-7%	-10%	2%	3%	8%
	Fenland	10%	20%	21%	18%	0%	8%
	External	17%	5%	-3%	4%	-11%	3%
GEH	Cambridge	7	4	0	2	1	5
	S. Cambs	6	1	2	3	2	1
	E. Cambs	0	3	4	2	2	0
	Hunts	1	3	2	2	1	4
	Fenland	0	1	3	3	0	1
	External	4	2	1	2	1	4

Table 6-10 Impact of Matrix Estimation (All Vehicles) – PM

	Sector	Cambridge	S. Cambs	E. Cambs	Hunts	Fenland	External
Percentage Difference (%)	Cambridge	7%	2%	7%	-12%	-12%	27%
	S. Cambs	5%	3%	3%	-5%	16%	11%
	E. Cambs	-10%	-7%	1%	0%	25%	-3%
	Hunts	-5%	-10%	-4%	3%	22%	6%
	Fenland	0%	5%	1%	9%	0%	18%
	External	16%	5%	-2%	1%	4%	5%
GEH	Cambridge	6	2	2	4	1	12
	S. Cambs	3	3	1	3	2	8
	E. Cambs	2	2	1	0	5	1
	Hunts	1	5	1	3	5	4
	Fenland	0	0	0	2	0	2
	External	5	3	1	0	1	7

ME by its nature operates in the highway model on individual hours, whilst the synthetic data that forms the bulk of the prior matrix is sourced from the profiling of daily production/attraction demands into time periods and then further profiling into a single hour ready for assignment. Changes at the sector-to-sector level across all three time periods are indicative of a potential underlying shortfall or surplus in the synthetic matrix, TAG suggesting a movement of more than 5% being significant.

The three sector-to-sector movements that have had larger scale changes across two or three time periods are:

- Cambridge City to External (and vice versa);
- Cambridge City to Cambridge City; and
- South Cambridgeshire to Cambridge City;

From the changes for Cambridge to external movements, it is recognised that any synthetic trip ends in the external zones will be quite approximate as it is difficult to capture the proportion of the population/employment to or from the external zones which will be drawn to other competing centres not represented in the model (notably the draw of Greater London). The volume of highway mode from the Cambridge City sector to External destinations in the AM peak has been increased by 30%. The interpeak

and PM increased too, but by only 19% and 27% respectively. In the other direction, trips from External zones to Cambridge has also increased through ME by 28% in the AM, 17% in the IP and 16% in the PM. The congestion effects caused by these trips on the internal network is important to capture in CSRM2, and therefore these larger ME changes have been accepted.

Trips within Cambridge City, and from South Cambridgeshire to Cambridge City, are the most difficult to extract reliably by mode from MPD in the peak hours, as the slow-moving car trips can easily be confused with cycle trips. The changes here are not as extreme as to/from the external areas, with a maximum difference of 10% which occurs in the IP.

The highest one-off value (in one time period only) and of inconsistent sign across other time periods is the sector movements between South Cambridgeshire and Fenland in the interpeak. Trips between East Cambs and Fenland also have large adjustments. Fenland, being the one Cambridgeshire District not directly modelled, is an external sector to the core modelled area. Hence the differences of trip generation between time periods are likely to be purpose or destination specific influences. The numbers involved are very low, in the range 80-120 trips per average hour in either direction, hence it is not considered to be a major concern.

TAG guidance relates to changes to observed data whereas the prior matrices are predominantly derived from a synthetic source. The changes to the matrices made by ME are on the whole correcting unavoidable deficiencies in the synthetic data. As such the scale of changes identified are reasonable and necessary to gain the required calibration of the model.

6.5. 2019 Highway Matrix

The highway matrix for the 2019 PYV has not been created through matrix estimation, but instead reflects the changes in land use and the impacts of the highway congestion and the PT and active alternative mode choices from the 2019 VDM which runs as a forecast year of the CSRM2, pivoting off the 2015 base. Table 6-11 shows the matrix totals for the 2019 HAM and the percentage changes from the 2015 base model.

Table 6-11 Comparison of Matrix Totals – 2019 vs 2015

Time-Period	Lights			Heavies		
	2015	2019	% Change	2015	2019	% Change
AM	95,706	101,130	5.67%	10,290	10,428	1.34%
IP	66,626	72,050	8.14%	10,207	10,365	1.54%
PM	104,179	111,280	6.82%	7,743	7,866	1.60%

7. Calibration and Validation

7.1. Network Calibration and Validation

Highway network calibration was undertaken to improve the model's performance compared to observed traffic characteristics in terms of speed, traffic throughputs and delays by investigating pinch points and problem areas highlighted by the initial model assignments.

The process involved checking and adjusting the highway network principally along the major corridors. Checks were undertaken to ensure that link lengths, turn capacities and saturation flows were correct, using saturation flows which fall within the acceptable range of flows used in the RTMs. This process was carried out for the 2015 base and again for the 2019 PYV where the network had changed in the intervening four years.

Basic checks included:

- Speed Flow Curves (SFCs) – adjustments were made to SFCs to ensure they were appropriate for the link and that journey times more closely matched observations;
- Centroid connectors – the allocation of centroid connectors for internal zones was examined to verify that trips are loading onto the network at locations that are both sensible and realistic;
- Lack of network capacity – where coded network capacity was noticeably lower than the observed count, capacities were amended if necessary;
- Route Choice – routeing was checked to ensure that traffic was being assigned to appropriate routes;
- Excessive junction delay – considerable differences between modelled and observed journey times were investigated, informing alterations to the network coding where necessary;
- Flow disparity – substantial differences between modelled flow and observed counts were investigated. This process revealed instances where traffic was either restricted at an upstream junction, where a competing route was more attractive or where delay was not well represented in the model; and
- Journey time disparity - detailed comparisons of modelled and observed journey time routes helped identify locations where modifications to signal settings were necessary to replicate the observed levels of delay.

7.1.1. Saturation Flow

To better replicate conditions in Cambridge in the 2015 base model, turn saturation flows were reduced by 20%. Due to the prevalence of on-street car parking and a great number of cyclists in Cambridge, a 20% reduction in saturation flow was deemed necessary on turns within Cambridge to improve the representation of the levels of delay in the city and resulting journey times. These alterations have been retained in 2019 (and all other years).

7.1.2. Network Travel Speeds

Free-flow speeds were reduced by 20% from the advertised speed limit throughout the network to represent the impact of on-street parking and high levels of cycling in Cambridge in an effort to improve journey time validation performance. These alterations have been retained in 2019 (and all other years).

7.1.3. HGV Bans

To reflect the extensive access only HGV restrictions that exist in Huntingdon town centre, UC10 as described in Table 3-4, has been created. The HGV bans restrict the wider HGV activity (UC9) using links in Huntingdon as a through route. The matrix is constructed such that the much smaller volumes of HGV that has either trip end within Huntingdon are captured as UC10 which is still permitted to use the routes within Huntingdon town centre.

Other HGV bans within the network such as those within Cambridge are coded as banned turns for UC9 and 10.

7.2. Route Choice Calibration and Validation

The accuracy of the assignment depends on the network structure, the trip matrix and the realism of modelled routes. This section demonstrates that the model provides realistic route choice between origin and destination zones.

The ability of CSRM2 to robustly represent route choice within the network depends on:

- Correct zone sizing and definition, network structure and the realism of the zone connections to the modelled network (centroid connectors);
- The accuracy and consistency of the network coding adopted;
- The accuracy of modelled junction delay and link cruise speeds, which in turn is dependent not only on data and coding accuracy but also junction flow / delay and link speed / flow relationships; and
- How accurately the trip matrices have been built, which, when assigned, will impact on route choice.

Route choice validation considers movements between two sets of zones. The first set focuses on movements to / from outside of Cambridge in addition to one central zone (Figure 7-1), whilst the second set includes movements between zones within Cambridge (Figure 7-2).

Figures have been produced to show route choice between one origin and all other destinations within that set. These can be found in Appendix A. Each zone has been chosen to demonstrate routing into Cambridge and across Cambridge. Different colours have been used to identify routes to different destinations. A single line of one colour represents only one route between these locations whilst multiple lines (of the same colour) show that the model assigns traffic on more than one route.

7.2.1. Route Choice Observations

The 2015 base model demonstrates sensible route choice in the 2015 AM peak, IP and PM peak hours. Traffic tends to route around Cambridge rather than through Cambridge where this is a sensible option for movements between opposite sides of the city. There are slight differences in route choice between time periods as a result of sections of the highway network experiencing heightened congestion at different points in the day (e.g. M11 off-slips are more congested in the AM peak).

In most cases movements between zones within Cambridge route within the city rather than using the A14 and/or M11. However, there are a few exceptions to this rule:

- Trips to / from Cambridge Science Park and Cambridge Airport, in all time periods;
- Trips from Cambridge Science park to Trumpington, in all time periods; and
- Trips from Huntingdon Road to Trumpington, in the PM peak.

Despite being exceptions to the norm, these route choices are deemed to be sensible. Trips to / from Cambridge Science Park are more likely to use the trunk road network due to its close location and excellent accessibility to the A14. Trips between Huntingdon Road and Trumpington in the PM peak are more likely to use the M11 than in other time periods. In the AM peak and IP, trips route through Cambridge between Huntingdon Road and Cambridge. The southbound off-slip at Junction 12 on the M11 is severely congested in the AM peak, whilst trips take the considerably shorter route through Cambridge in the uncongested IP network. However, in the PM peak, the southbound off-slip at Junction 12 is not congested, thus increasing the attractiveness of the M11 for trips between these zones.

In 2019, when the A14 roadworks are in the highway network (including a 40mph speed limit on the Cambridge Northern Bypass), the route choice plots show some diversion away from the A14, such as using Butt Lane and the A10 to avoid the Histon to Milton stretch of A14 when travelling from Histon to Teversham and vice versa in the AM peak. Trips between the Science Park and other parts of the city are also less inclined to use the A14. This is a logical model response to the peak hour congestion caused by the roadworks.

Figure 7-1 Movements Outside of Cambridge

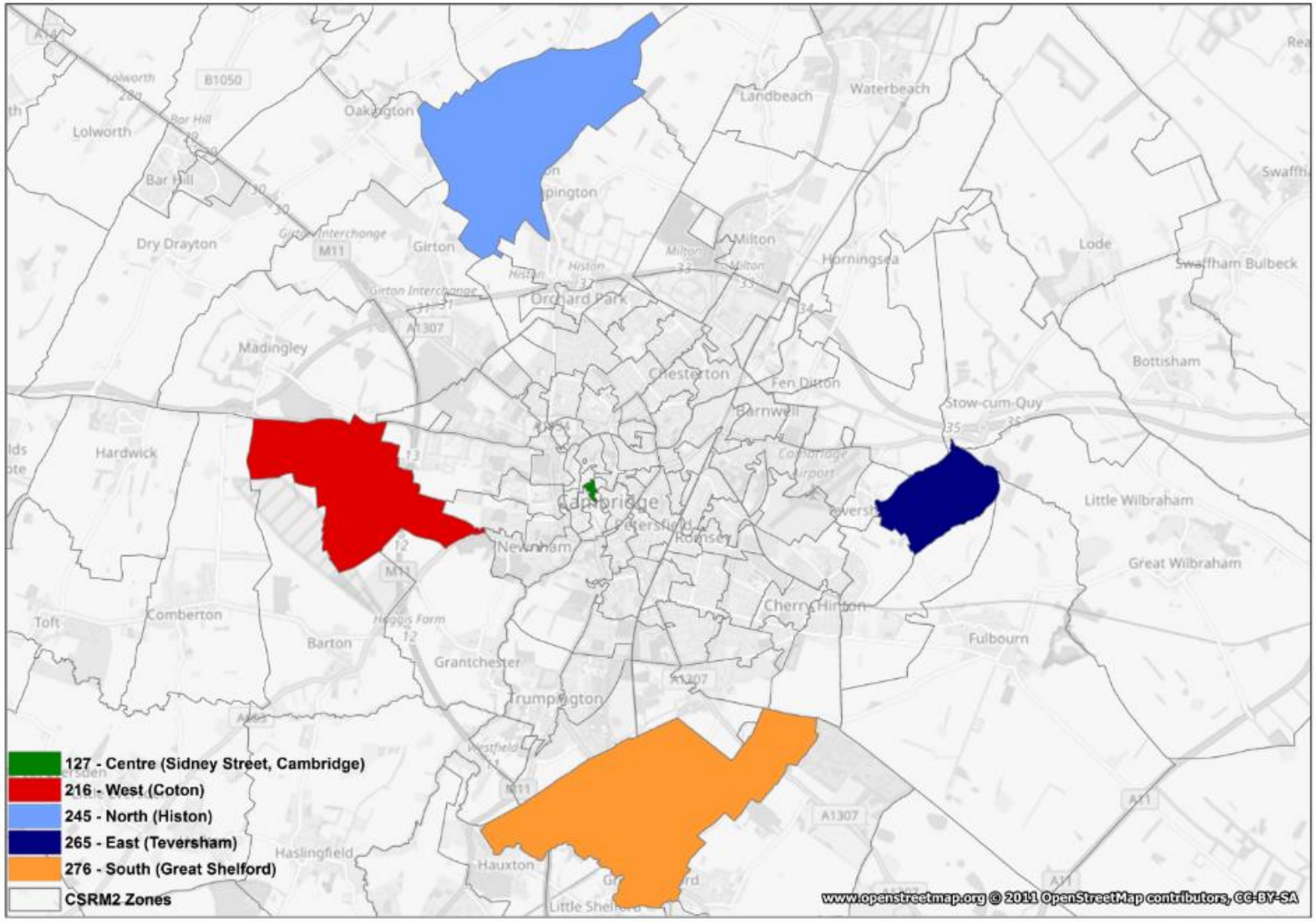
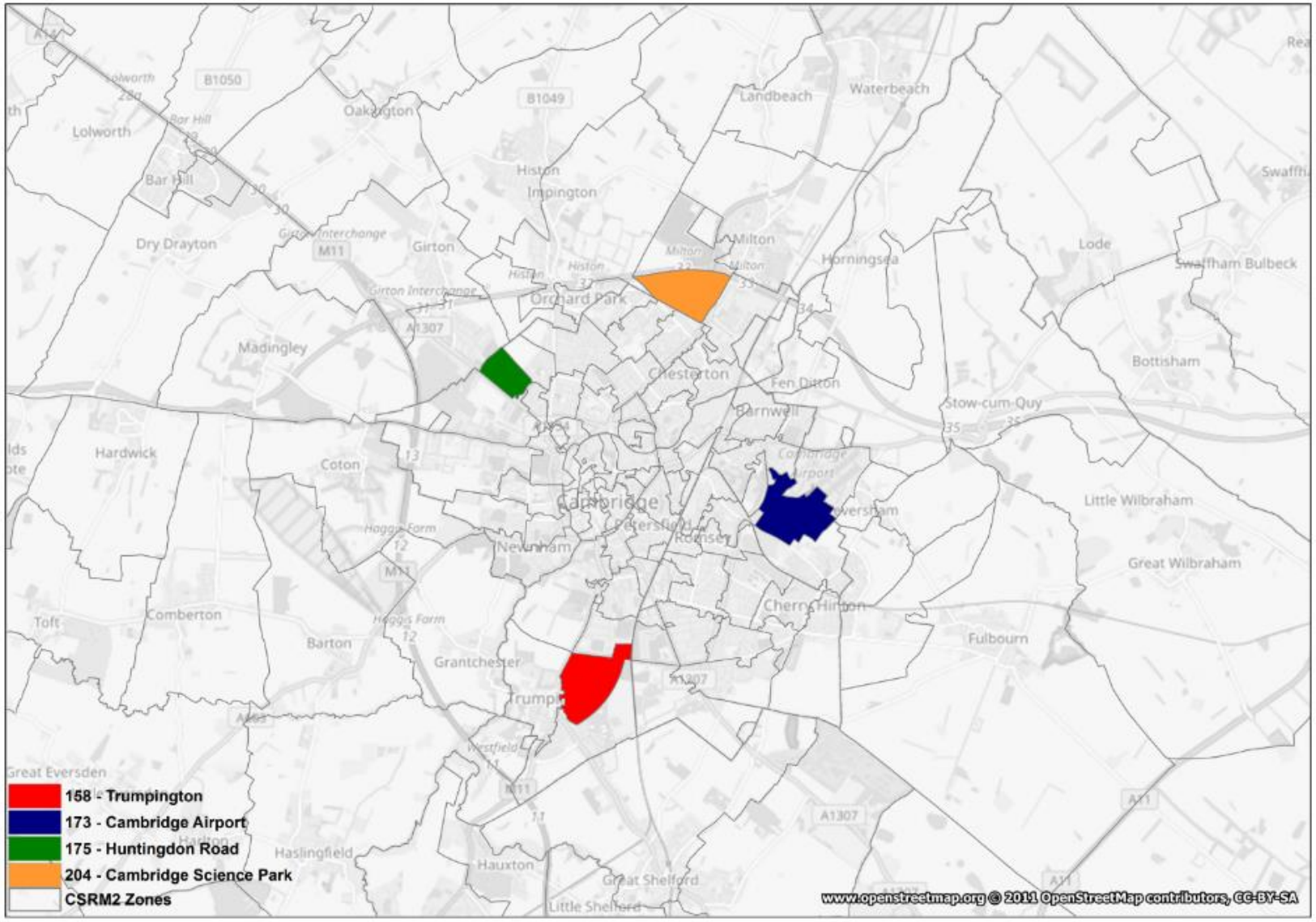


Figure 7-2 Movements Within Cambridge



7.3. 2015 Assignment Calibration and Validation

The base year assignment calibration and validation were undertaken in conjunction with the ME process previously described in Section 6.2. 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.

These adjustments were undertaken as part of the model calibration as described earlier in this report (Section 6) and included:

- Revisions to the network coding including local revisions to the junction coding, typically focussed on the signal timings, speeds and capacity; and
- Revisions to the demand matrices.

The model was validated by means of the following comparisons:

- Modelled and observed traffic flows on links compared by lights and all vehicles by time period; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment.

Each of these validations is presented in separate sections below. The final section presents the levels of model convergence achieved.

7.3.1. Flow Calibration

Assignment calibration was undertaken by comparing modelled flows with observed counts on individual links by vehicle type and time period. Comparisons were made for those links used as constraints in matrix estimation. TAG criteria states that 85% of validation screenlines / links should meet acceptability guidelines for flow and GEH criteria as outlined in TAG Unit M3.1, Table 2. Figure 7-3 and Figure 7-4 show the locations of the screenlines and cordons used in the flow calibration process.

Table 7-1 summarises the percentage of screenlines and individual links which comply with TAG flow and GEH criteria as set out earlier in this report in Table 2-2. A summary of link flow calibration for each time period is shown in Table 7-2 to Table 7-7. Tables containing calibration statistics on a link-by-link basis are shown in Appendix C.

Table 7-1 Screenline / Link TAG Validation – Calibration Counts

Time Period	Vehicle Type	Screenlines		Links
		Flow	GEH	Flow / GEH
AM	Lights	68%	71%	89%
	All Vehicles	68%	75%	89%
IP	Lights	75%	96%	94%
	All Vehicles	79%	93%	93%
PM	Lights	79%	86%	87%
	All Vehicles	79%	86%	87%

Figure 7-3 Flow Calibration Screenline and Cordon Locations (Whole Model)

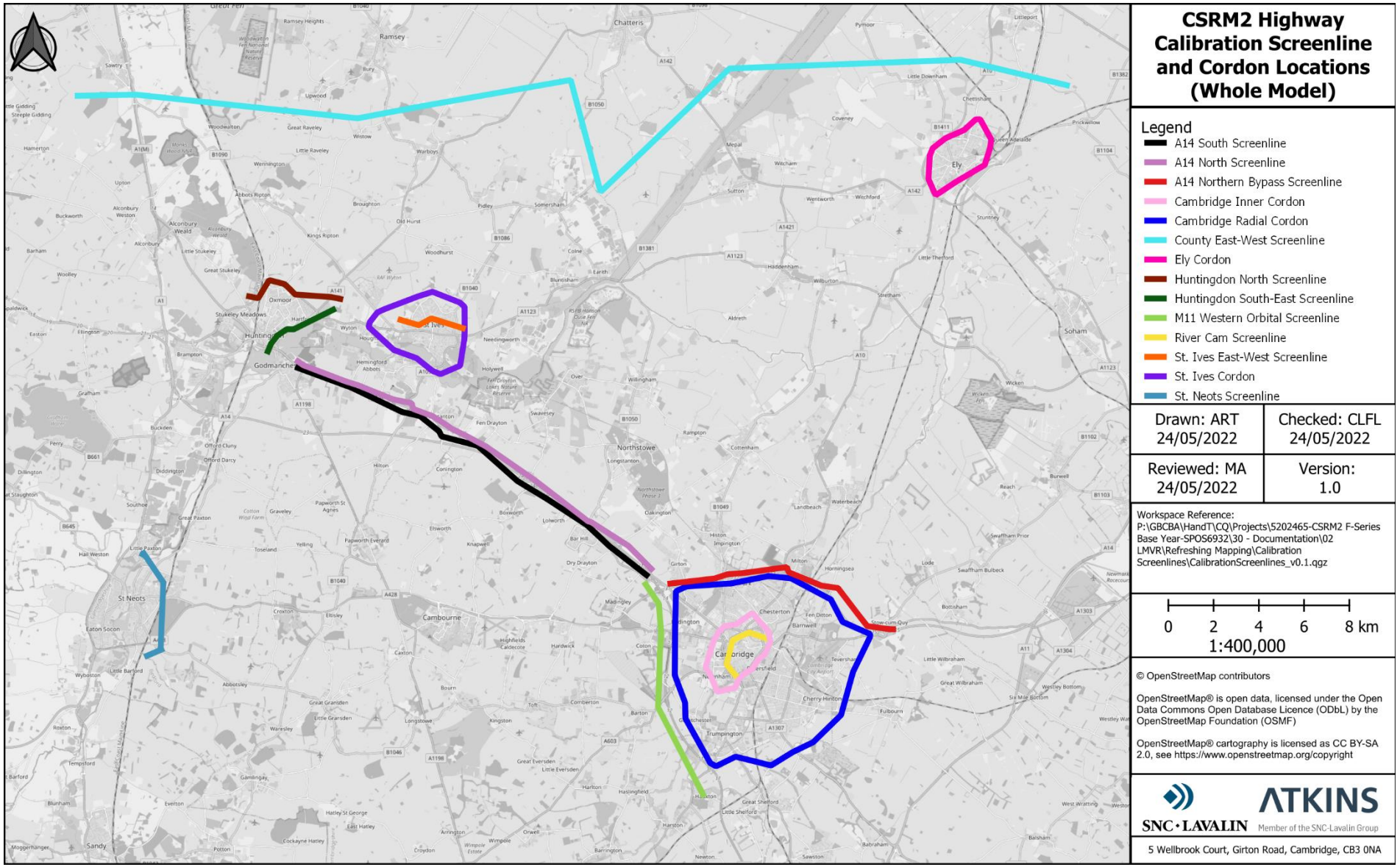


Figure 7-4 Flow Calibration Screenline and Cordon Locations (Cambridge)

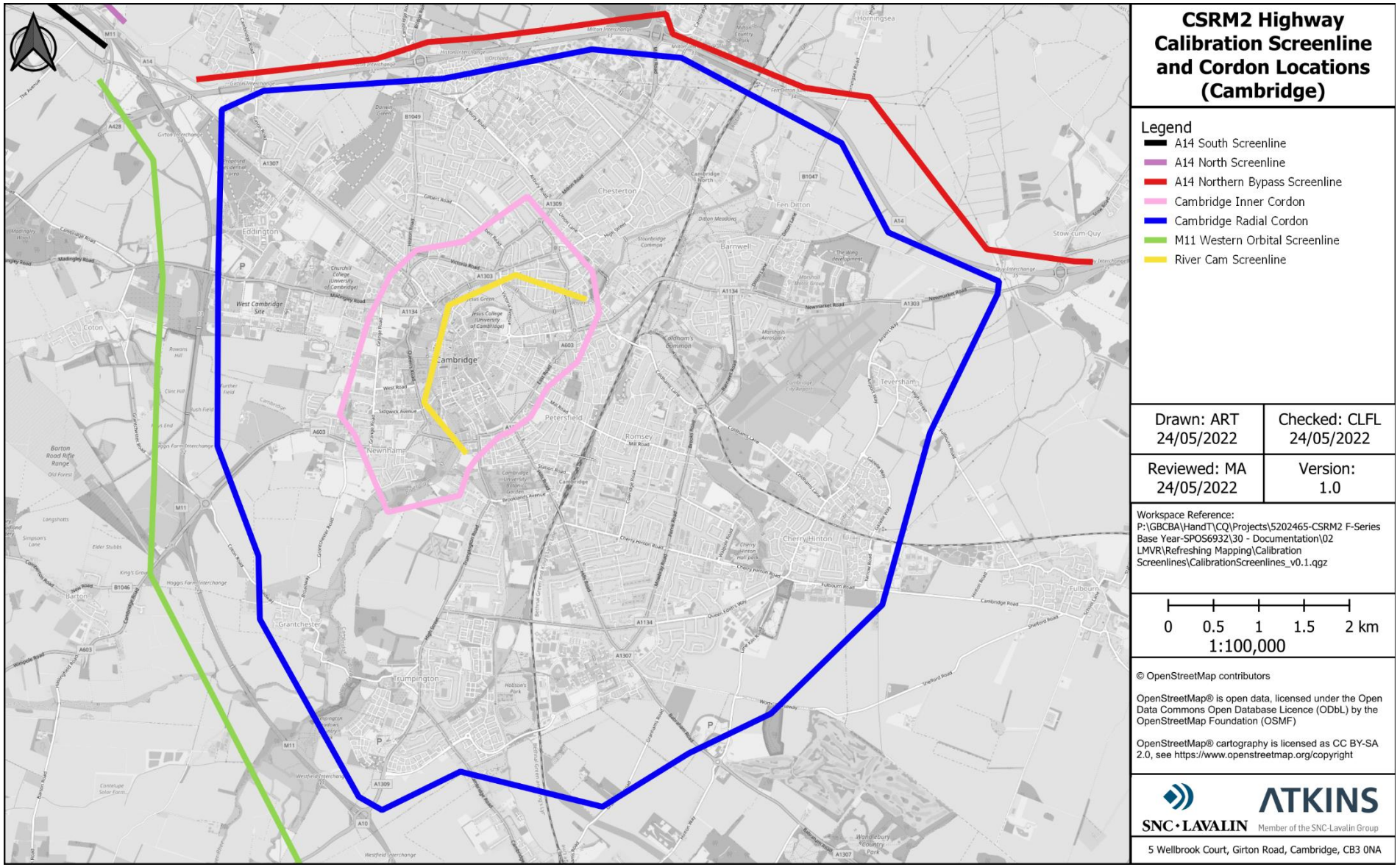


Table 7-2 Summary of Flow Calibration Screenlines (Lights) – AM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	13,921	13,289	-632	-4.5%	5.4	✓	×
	OUT	6,958	6,967	9	0.1%	0.1	✓	✓
5. River Cam Screenline	EB	2,754	3,158	404	14.7%	7.4	×	×
	WB	2,210	2,201	-8	-0.4%	0.2	✓	✓
6. County East-West Screenline	SB	4,800	4,766	-34	-0.7%	0.5	✓	✓
	NB	3,444	3,685	241	7.0%	4.0	×	×
8. Huntingdon North	NB	2,487	2,438	-49	-2.0%	1.0	✓	✓
	SB	3,056	2,511	-546	-17.8%	10.3	×	×
10. St. Ives Cordon	IN	3,145	3,133	-12	-0.4%	0.2	✓	✓
	OUT	2,568	2,321	-247	-9.6%	5.0	×	×
18. St. Neots East Screenline	EB	1,538	1,679	141	9.2%	3.5	×	✓
	WB	1,380	1,376	-4	-0.3%	0.1	✓	✓
14. Ely Cordon	IN	2,666	2,489	-177	-6.6%	3.5	×	✓
	OUT	2,245	1,898	-347	-15.4%	7.6	×	×
15. A14 South	NB	1,891	1,889	-1	-0.1%	0.0	✓	✓
	SB	2,451	2,464	14	0.6%	0.3	✓	✓
16. A14 North	NB	3,025	3,126	101	3.3%	1.8	✓	✓
	SB	4,120	4,179	58	1.4%	0.9	✓	✓
1. A14 Northern Bypass	NB	2,713	2,675	-38	-1.4%	0.7	✓	✓
	SB	4,269	3,838	-431	-10.1%	6.8	×	×
2. M11 Western Orbital	EB	4,335	4,510	175	4.0%	2.6	✓	✓
	WB	2,757	2,761	5	0.2%	0.1	✓	✓

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
4. Cambridge Inner Cordon	IN	7,653	7,667	15	0.2%	0.2	✓	✓
	OUT	5,351	5,301	-49	-0.9%	0.7	✓	✓
9. Huntingdon South-East	EB	3,587	3,570	-18	-0.5%	0.3	✓	✓
	WB	4,983	4,698	-285	-5.7%	4.1	×	×
11. St. Ives East-West Screenline	EB	1,299	1,284	-15	-1.1%	0.4	✓	✓
	WB	837	840	4	0.4%	0.1	✓	✓

Table 7-3 Summary of Flow Calibration Screenlines (All Vehicles) - AM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	14,295	13,600	-695	-4.9%	5.9	✓	×
	OUT	7,256	7,133	-122	-1.7%	1.4	✓	✓
5. River Cam Screenline	EB	2,820	3,215	396	14.0%	7.2	×	×
	WB	2,267	2,225	-42	-1.8%	0.9	✓	✓
6. County East-West Screenline	SB	5,296	5,308	12	0.2%	0.2	✓	✓
	NB	3,952	4,179	227	5.7%	3.6	×	✓
8. Huntingdon North	NB	2,770	2,735	-35	-1.3%	0.7	✓	✓
	SB	3,350	2,802	-548	-16.3%	9.9	×	×
10. St. Ives Cordon	IN	3,311	3,270	-41	-1.2%	0.7	✓	✓
	OUT	2,712	2,446	-265	-9.8%	5.2	×	×
18. St. Neots East Screenline	EB	1,647	1,791	143	8.7%	3.5	×	✓
	WB	1,495	1,484	-11	-0.7%	0.3	✓	✓
14. Ely Cordon	IN	2,710	2,531	-178	-6.6%	3.5	×	✓
	OUT	2,293	1,940	-353	-15.4%	7.7	×	×

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
15. A14 South	NB	2,026	1,999	-27	-1.3%	0.6	✓	✓
	SB	2,571	2,585	14	0.5%	0.3	✓	✓
16. A14 North	NB	3,196	3,277	81	2.5%	1.4	✓	✓
	SB	4,330	4,395	65	1.5%	1.0	✓	✓
1. A14 Northern Bypass	NB	2,801	2,823	22	0.8%	0.4	✓	✓
	SB	4,420	3,950	-471	-10.6%	7.3	×	×
2. M11 Western Orbital	EB	4,487	4,701	215	4.8%	3.2	✓	✓
	WB	2,895	2,905	11	0.4%	0.2	✓	✓
4. Cambridge Inner Cordon	IN	7,789	7,761	-28	-0.4%	0.3	✓	✓
	OUT	5,459	5,380	-78	-1.4%	1.1	✓	✓
9. Huntingdon South-East	EB	4,233	4,182	-50	-1.2%	0.8	✓	✓
	WB	5,666	5,349	-317	-5.6%	4.3	×	×
11. St. Ives East-West Screenline	EB	1,347	1,319	-28	-2.1%	0.8	✓	✓
	WB	882	874	-8	-0.9%	0.3	✓	✓

Table 7-4 Summary of Flow Calibration Screenlines (Lights) - IP

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	6,403	6,518	115	1.8%	1.4	✓	✓
	OUT	6,079	6,378	299	4.9%	3.8	✓	✓
5. River Cam Screenline	EB	2,208	2,330	123	5.6%	2.6	×	✓
	WB	2,042	2,066	25	1.2%	0.6	✓	✓
6. County East-West Screenline	SB	2,683	2,759	76	2.8%	1.5	✓	✓
	NB	2,570	2,664	93	3.6%	1.8	✓	✓

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
8. Huntingdon North	NB	2,103	2,107	4	0.2%	0.1	✓	✓
	SB	2,098	2,058	-40	-1.9%	0.9	✓	✓
10. St. Ives Cordon	IN	1,884	1,898	13	0.7%	0.3	✓	✓
	OUT	1,882	1,893	11	0.6%	0.2	✓	✓
18. St. Neots East Screenline	EB	972	879	-94	-9.6%	3.1	×	✓
	WB	989	984	-4	-0.4%	0.1	✓	✓
14. Ely Cordon	IN	1,719	1,820	102	5.9%	2.4	×	✓
	OUT	1,749	1,644	-105	-6.0%	2.6	×	✓
15. A14 South	NB	1,541	1,543	2	0.1%	0.1	✓	✓
	SB	1,455	1,460	5	0.3%	0.1	✓	✓
16. A14 North	NB	2,161	2,224	63	2.9%	1.3	✓	✓
	SB	2,334	2,354	20	0.8%	0.4	✓	✓
1. A14 Northern Bypass	NB	2,933	2,699	-234	-8.0%	4.4	×	×
	SB	2,677	2,605	-72	-2.7%	1.4	✓	✓
2. M11 Western Orbital	EB	1,580	1,559	-21	-1.3%	0.5	✓	✓
	WB	1,549	1,553	4	0.3%	0.1	✓	✓
4. Cambridge Inner Cordon	IN	4,606	4,630	23	0.5%	0.3	✓	✓
	OUT	4,316	4,229	-86	-2.0%	1.3	✓	✓
9. Huntingdon South-East	EB	3,620	3,477	-144	-4.0%	2.4	✓	✓
	WB	3,986	3,894	-93	-2.3%	1.5	✓	✓
11. St. Ives East-West Screenline	EB	740	638	-102	-13.8%	3.9	×	✓
	WB	731	661	-70	-9.6%	2.7	×	✓

Table 7-5 Summary of Flow Calibration Screenlines (All Vehicles) - IP

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	6,759	6,711	-48	-0.7%	0.6	✓	✓
	OUT	6,460	6,598	138	2.1%	1.7	✓	✓
5. River Cam Screenline	EB	2,271	2,378	107	4.7%	2.2	✓	✓
	WB	2,100	2,108	8	0.4%	0.2	✓	✓
6. County East-West Screenline	SB	3,309	3,327	18	0.6%	0.3	✓	✓
	NB	3,202	3,242	40	1.3%	0.7	✓	✓
8. Huntingdon North	NB	2,400	2,393	-7	-0.3%	0.1	✓	✓
	SB	2,398	2,332	-65	-2.7%	1.3	✓	✓
10. St. Ives Cordon	IN	2,062	2,054	-8	-0.4%	0.2	✓	✓
	OUT	2,058	2,057	-1	-0.1%	0.0	✓	✓
18. St. Neots East Screenline	EB	1,096	992	-104	-9.5%	3.2	×	✓
	WB	1,097	1,084	-13	-1.2%	0.4	✓	✓
14. Ely Cordon	IN	1,762	1,859	97	5.5%	2.3	×	✓
	OUT	1,797	1,689	-108	-6.0%	2.6	×	✓
15. A14 South	NB	1,674	1,675	1	0.1%	0.0	✓	✓
	SB	1,568	1,564	-4	-0.2%	0.1	✓	✓
16. A14 North	NB	2,343	2,388	45	1.9%	0.9	✓	✓
	SB	2,533	2,566	33	1.3%	0.7	✓	✓
1. A14 Northern Bypass	NB	3,034	2,794	-239	-7.9%	4.4	×	×
	SB	2,783	2,728	-55	-2.0%	1.0	✓	✓
2. M11 Western Orbital	EB	1,686	1,691	5	0.3%	0.1	✓	✓
	WB	1,657	1,662	5	0.3%	0.1	✓	✓

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
4. Cambridge Inner Cordon	IN	4,792	4,703	-89	-1.9%	1.3	✓	✓
	OUT	4,491	4,306	-185	-4.1%	2.8	✓	✓
9. Huntingdon South-East	EB	4,426	4,202	-225	-5.1%	3.4	✓	✓
	WB	4,855	4,676	-179	-3.7%	2.6	✓	✓
11. St. Ives East-West Screenline	EB	787	667	-120	-15.2%	4.4	×	×
	WB	783	678	-105	-13.4%	3.9	×	✓

Table 7-6 Summary of Flow Calibration Screenlines (Lights) - PM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	8,360	7,582	-778	-9.3%	8.7	×	×
	OUT	13,626	13,595	-31	-0.2%	0.3	✓	✓
5. River Cam Screenline	EB	2,364	2,369	5	0.2%	0.1	✓	✓
	WB	2,819	2,783	-36	-1.3%	0.7	✓	✓
6. County East-West Screenline	SB	3,756	3,823	67	1.8%	1.1	✓	✓
	NB	5,897	6,010	113	1.9%	1.5	✓	✓
8. Huntingdon North	NB	3,323	2,973	-350	-10.5%	6.2	×	×
	SB	2,872	2,842	-31	-1.1%	0.6	✓	✓
10. St. Ives Cordon	IN	3,107	3,037	-70	-2.3%	1.3	✓	✓
	OUT	3,335	3,382	47	1.4%	0.8	✓	✓
18. St. Neots East Screenline	EB	1,568	1,432	-136	-8.6%	3.5	×	✓
	WB	1,917	1,915	-2	-0.1%	0.0	✓	✓
14. Ely Cordon	IN	2,657	2,115	-542	-20.4%	11.1	×	×
	OUT	2,434	2,385	-49	-2.0%	1.0	✓	✓

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
15. A14 South	NB	3,277	3,270	-7	-0.2%	0.1	✓	✓
	SB	2,624	2,618	-6	-0.2%	0.1	✓	✓
16. A14 North	NB	4,178	4,390	213	5.1%	3.2	✓	✓
	SB	3,594	3,742	148	4.1%	2.4	✓	✓
1. A14 Northern Bypass	NB	5,130	4,866	-264	-5.1%	3.7	✓	✓
	SB	3,032	3,039	8	0.3%	0.1	✓	✓
2. M11 Western Orbital	EB	2,658	2,753	95	3.6%	1.8	✓	✓
	WB	4,762	4,518	-244	-5.1%	3.6	✓	✓
4. Cambridge Inner Cordon	IN	6,291	6,111	-180	-2.9%	2.3	✓	✓
	OUT	7,373	7,110	-263	-3.6%	3.1	✓	✓
9. Huntingdon South-East	EB	5,618	5,428	-190	-3.4%	2.6	✓	✓
	WB	5,589	5,567	-22	-0.4%	0.3	✓	✓
11. St. Ives East-West Screenline	EB	1,256	1,095	-161	-12.8%	4.7	×	×
	WB	1,440	1,314	-126	-8.7%	3.4	×	✓

Table 7-7 Summary of Flow Calibration Screenlines (All Vehicles) - PM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
3. Cambridge Radial Cordon	IN	8,463	7,661	-802	-9.5%	8.9	×	×
	OUT	13,771	13,680	-91	-0.7%	0.8	✓	✓
5. River Cam Screenline	EB	2,378	2,374	-4	-0.2%	0.1	✓	✓
	WB	2,837	2,785	-52	-1.8%	1.0	✓	✓

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
6. County East-West Screenline	SB	4,168	4,240	72	1.7%	1.1	✓	✓
	NB	6,335	6,437	102	1.6%	1.3	✓	✓
8. Huntingdon North	NB	3,483	3,116	-367	-10.5%	6.4	×	×
	SB	3,007	2,956	-51	-1.7%	0.9	✓	✓
10. St. Ives Cordon	IN	3,221	3,122	-98	-3.1%	1.7	✓	✓
	OUT	3,423	3,484	61	1.8%	1.0	✓	✓
18. St. Neots East Screenline	EB	1,621	1,487	-134	-8.2%	3.4	×	✓
	WB	1,991	1,989	-2	-0.1%	0.0	✓	✓
14. Ely Cordon	IN	2,668	2,148	-520	-19.5%	10.6	×	×
	OUT	2,448	2,410	-38	-1.6%	0.8	✓	✓
15. A14 South	NB	3,387	3,403	15	0.5%	0.3	✓	✓
	SB	2,721	2,722	1	0.1%	0.0	✓	✓
16. A14 North	NB	4,314	4,535	221	5.1%	3.3	✓	✓
	SB	3,698	3,900	202	5.5%	3.3	✓	✓
1. A14 Northern Bypass	NB	5,207	4,937	-270	-5.2%	3.8	✓	✓
	SB	3,105	3,132	28	0.9%	0.5	✓	✓
2. M11 Western Orbital	EB	2,726	2,848	122	4.5%	2.3	✓	✓
	WB	4,872	4,633	-239	-4.9%	3.5	✓	✓
4. Cambridge Inner Cordon	IN	6,313	6,123	-190	-3.0%	2.4	✓	✓
	OUT	7,412	7,126	-286	-3.9%	3.4	✓	✓
9. Huntingdon South-East	EB	6,186	5,971	-215	-3.5%	2.8	✓	✓
	WB	6,216	6,198	-18	-0.3%	0.2	✓	✓
11. St. Ives East-West Screenline	EB	1,278	1,107	-171	-13.4%	5.0	×	×
	WB	1,470	1,340	-131	-8.9%	3.5	×	✓

7.3.2. Interpretation of calibration screenlines results

Table 7-1 presents the percentage of screenlines and percentage of individual calibration link counts meeting the TAG criteria. In each time period, for all vehicles and for lights only, the number of individual links passing meets the criterion (>85% passing).

The screenlines in Cambridge City and South Cambridgeshire are the critical measures when the proposed GCP applications of the model are considered. These are typically better at meeting the TAG criteria than the screenlines in Huntingdonshire and East Cambridgeshire are. The worst performing time period in this regard being the AM peak, where the Cambridge Radial Cordon fails to meet the GEH criterion inbound (GEH 5.4), the River Cam Screenline fails to meet both the flow and GEH criteria eastbound (GEH 7.4) and the A14 Northern Bypass fails to meet both criterion southbound (GEH 6.8).

Where the criteria have not been fully met in Huntingdonshire and Ely, this is less of a concern with regards to the intended applications of the model. Further local validation would be required in these areas before using CSRM2 to take Huntingdonshire or East Cambridgeshire schemes beyond Outline Business Case level.

The following analysis will examine each failing screenline and cordon in turn at the individual link level (as can be found in Appendix C).

AM

The AM peak has the lowest number of screenlines meeting the calibration goodness of fit criteria. Table 7-3 for the AM peak showed that six screenlines were failing on both the flow and GEH criteria.

The A14 Northern Bypass Screenline features too little southbound flow in the AM peak due to significantly low flows southbound on Cambridge Road, Girton, relative to observed figures. However, analysis showed that the other links across this screenline, as well as Huntingdon Road inbound, feature acceptable levels of flows, and as such the accuracy of these more strategically important routes has been prioritised over Cambridge Road. The reality of the junction of Huntingdon Road and Cambridge Road is that it does not operate as a priority junction in the AM peak hour, as traffic from Huntingdon Road allows traffic from Cambridge Road to merge at a high rate: this behaviour cannot be represented in SATURN.

The main discrepancy on the River Cam Screenline is Bridge Street which consistently carries too much traffic and can be traced to local connection issues within the inner ring road, due to the size of the model zones (which are appropriate for a strategic model but cannot capture every detail in the city centre). This also disrupts Victoria Avenue and Fen Causeway slightly.

The Huntingdon North Screenline consists of four links across the Huntingdon Northern Bypass. Two of these links on the bypass itself fail, with too low a flow at the western and eastern ends of the built-up area of Huntingdon. This may in part be related to zone detail for the more northern fringes of Huntingdon.

The St Ives Cordon has too little flow outbound at Houghton Hill Road (A1123), which causes the whole cordon to fail outbound. As with the Huntingdon North Screenline, this may be related to zone detail.

Finally in the AM, the model traffic flows through the Ely Cordon are too low in both directions. The main area of weakness is around Prickwillow Road to the East of Ely both inbound and outbound, which may be a result of the positioning of zone loading points and the position of the screenline itself.

IP

Table 7-5 shows the interpeak has only two screenlines failing the calibration goodness of fit criteria.

The A14 Northern Bypass screenline fails again, this time northbound due to there being too little flow in this direction between Milton Interchange and Milton Tesco in the model.

The St Ives East-West Screenline just passes westbound and just fails eastbound due to very low flows modelled on Ramsey Road (South) in both directions relative to the flows observed. This is due to the positioning of the centroid connectors for the zones and relatively low level of detail generally in St Ives, which was not an area of focus for the F-series updates.

PM

Table 7-7 shows that the PM peak has four screenlines failing the calibration goodness of fit criteria.

Whilst the Cambridge Radial Cordon passes easily in the critical outbound direction, the inbound screenline has insufficient traffic returning into Cambridge. Whilst several links have too little traffic, the main issues are on Horningsea Road and Hauxton Road.

The Huntingdon North Screenline fails northbound at the western edge of the Huntingdon Northern Bypass at Spittals Way, as it did in the AM peak. This screenline having model flows that are too low relative to the observed flows pulls the overall screenline below the goodness of fit criteria.

The Ely Cordon also fails in the PM peak due to the same weakness in the cordon on the Eastern side of Ely.

Finally in the PM peak, the St Ives East-West Screenline fails as it did in the interpeak because of there being too little modelled traffic on Ramsey Road due to the positioning of the zones in St Ives.

7.3.3. Journey Time Validation

Journey time validation has been undertaken comparing modelled journey times against the 2015 TrafficMaster data collected for each time period for the routes shown in Figure 4-6 and Figure 4-7.

TAG states that modelled journey times should be within ± 15% of observed times (or ± 1 minute if higher) on 85% of routes. Figure **7-5** to Figure 7-7 compare modelled journey times and observed journey times (±15%) for each journey time route by time period. Descriptions of each journey time route can be found in Table 4-2. Graphs showing the performance of each route can be found in Appendix B.

The number of journey time routes that satisfy the TAG validation criteria are summarised as follows:

- AM: 17 out of 30 routes (57%);
- IP: 21 out of 30 routes (70%); and
- PM: 14 out of 30 routes (47%).

The precise impact of cycles on the network in Cambridge is very difficult to incorporate in a strategic highway model of this nature. Even with a comprehensive dataset for cycle flows, the model could not be expected to reflect the irregular delays caused by vehicles attempting to pass moving cyclists. This is particularly an issue for HGVs at some locations where there is insufficient road width to safely overtake. This is one explanation for the under-representation of delays on certain routes in the peak periods.

The TrafficMaster data used as the source for the observed journey times includes incidents and accidents within its dataset. The delay captured is heavily influenced by the Q-nodes which are immediately downstream of merge sections (which are used to reflect the pinch-points caused just after the two streams merge), which can be particularly critical on the D2AP sections of the A14. Endeavours have been made to balance the three time periods however the model still tends to run too fast EB on the A14 in the AM peak.

Figure 7-5 Modelled vs. Observed Journey times - AM Peak

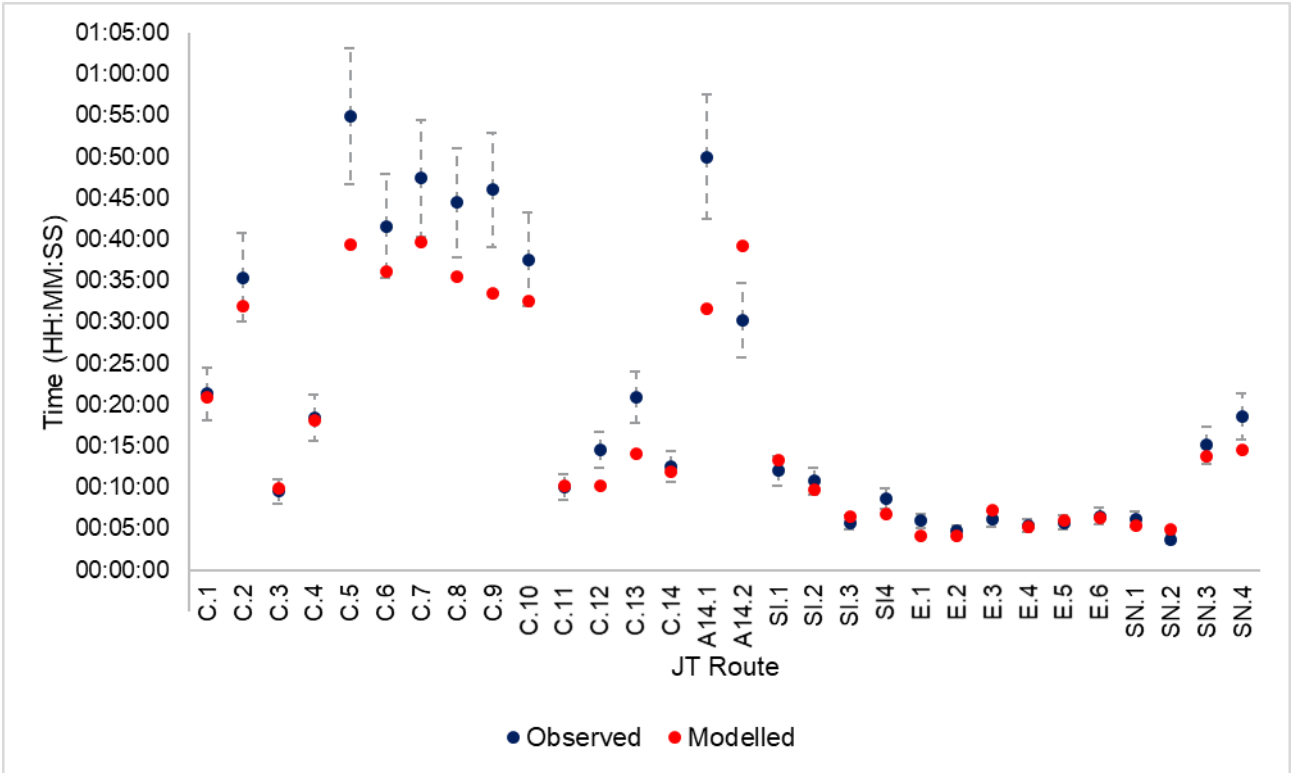


Figure 7-6 Modelled vs. Observed Journey times - IP

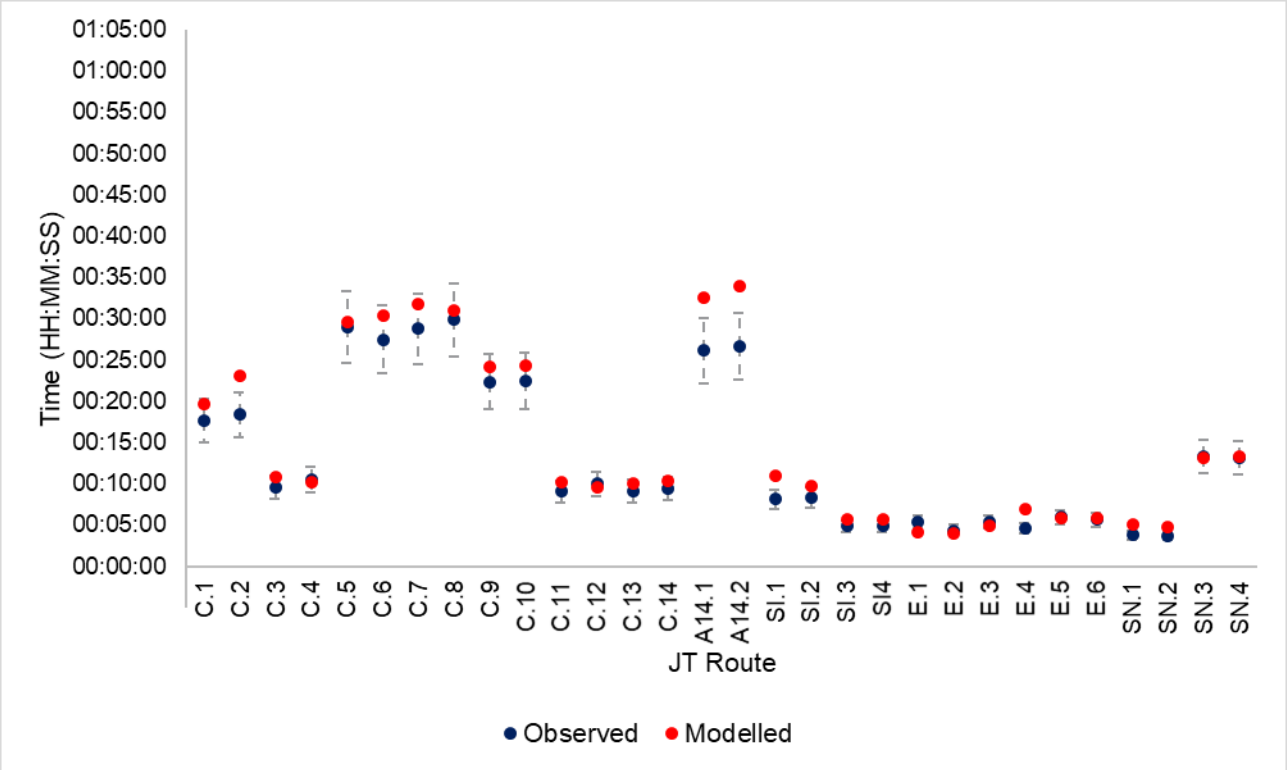
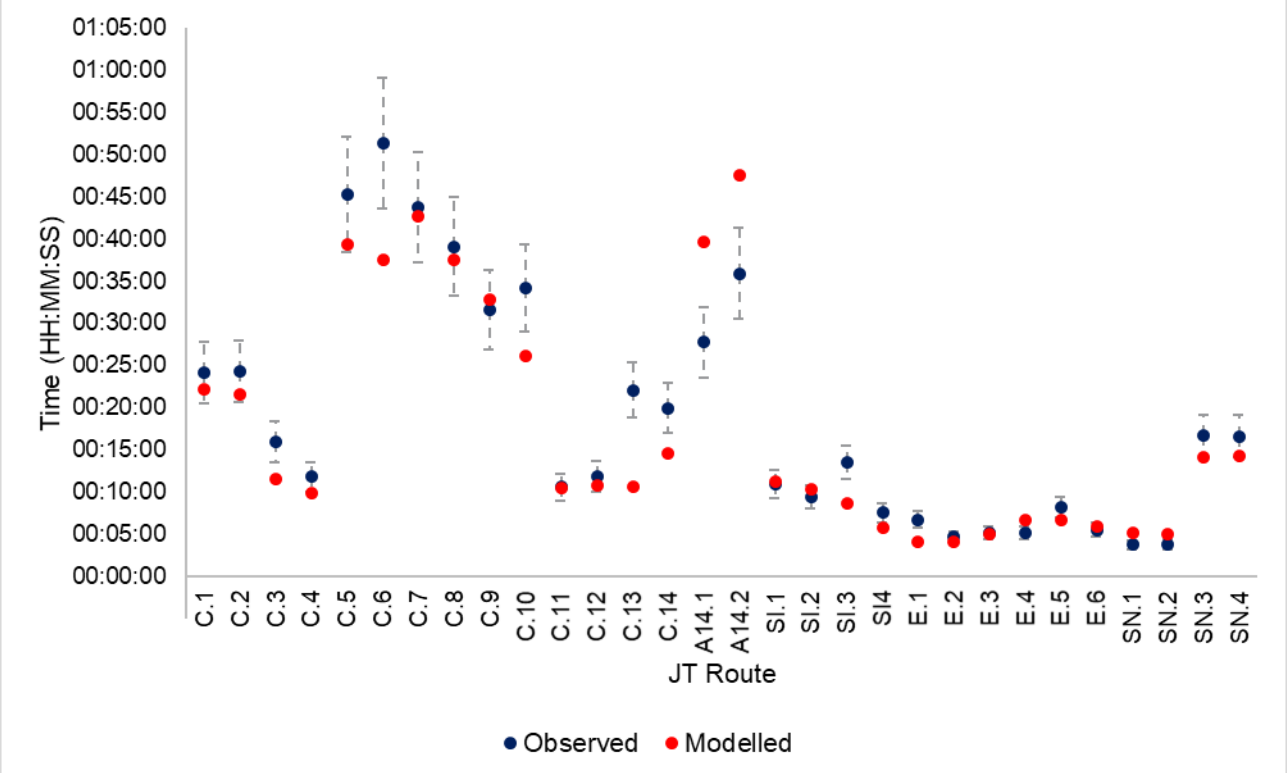


Figure 7-7 Modelled vs. Observed Journey times - PM Peak



7.3.4. Flow Validation

Assignment flow validation was undertaken by comparing modelled flows with observed counts by vehicle type and time period on a screenline running north / south across the study area. TAG states that 85% of

screenlines / links should meet acceptability guidelines for flow and GEH criteria as outlined in TAG Unit M3.1, Table 2.

Figure 7-8 shows the location of the validation screenline used in the flow validation process. Since there is only a single screenline, the pass rate for validation at a screenline level is a very coarse measure. Table 7-8 summarises the percentage of validation screenlines and individual links which comply with TAG flow and GEH criteria as set out in Table 2-2.

A summary of each screenline flow validation for each time period is shown in Table 7-9 to Table 7-11. Tables containing validation statistics on a link-by-link basis are shown in Appendix C.4.

Table 7-8 Screenline / Link TAG Validation – Validation Counts

Time Period	Vehicle Type	Screenlines		Links
		Flow	GEH	Flow / GEH
AM	Lights	50%	0%	79%
	All Vehicles	100%	50%	86%
IP	Lights	100%	100%	82%
	All Vehicles	100%	100%	86%
PM	Lights	50%	50%	79%
	All Vehicles	50%	50%	75%

Figure 7-8 Flow Validation Screenline Location

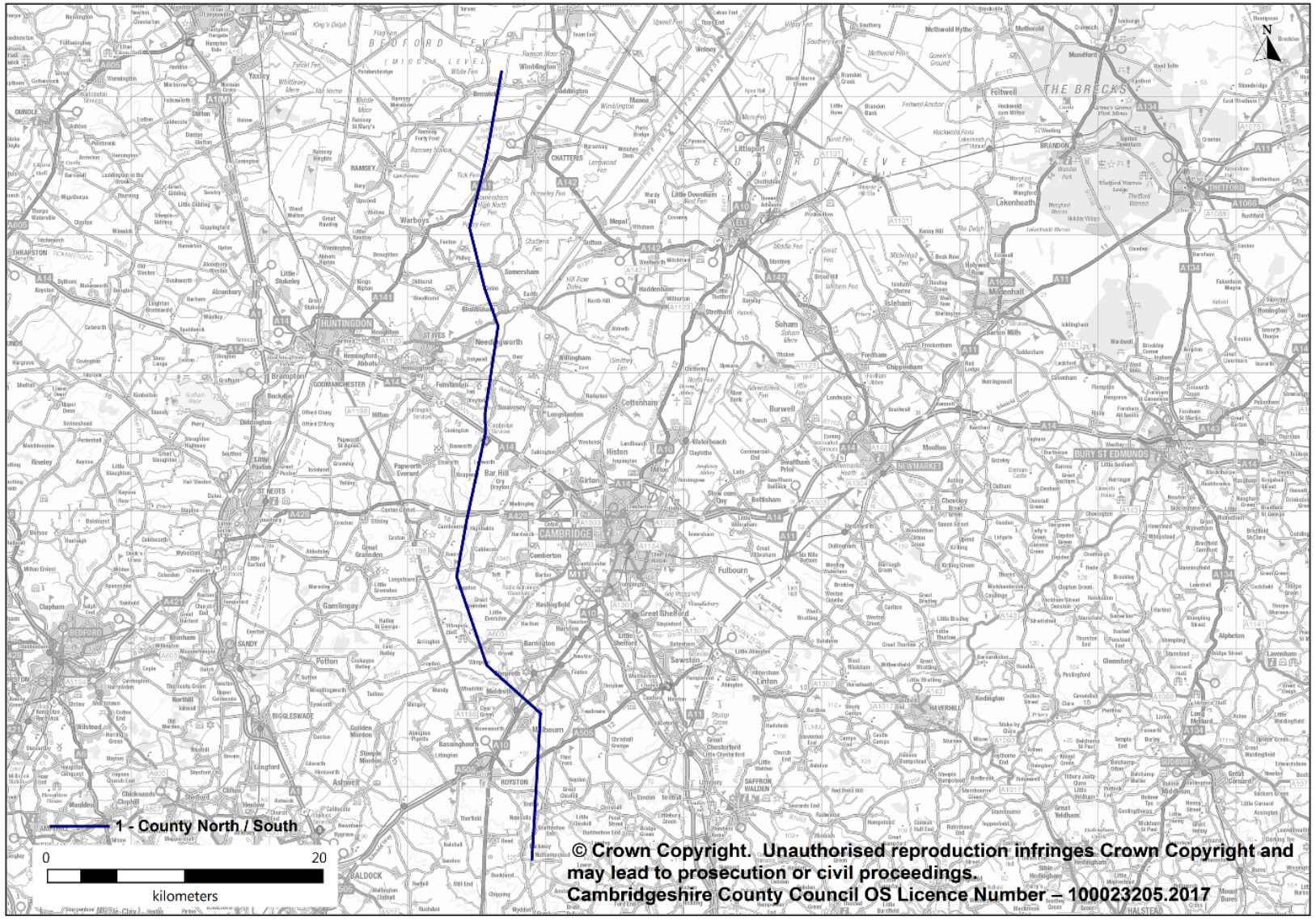


Table 7-9 Summary of Flow Validation by Vehicle Type - AM

Vehicle Type	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
Lights	EB	7,729	7,361	-368	-5%	4.2	✓	×
	WB	6,629	7,124	495	7%	6.0	×	×
All Vehicles	EB	8,520	8,220	-300	-4%	3.3	✓	✓
	WB	7,606	8,020	414	5%	4.7	✓	×

Table 7-10 Summary of Flow Validation by Vehicle Type - IP

Vehicle Type	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
Lights	EB	4,562	4,532	-30	-0.7%	0.4	✓	✓
	WB	4,763	4,660	-103	-2.2%	1.5	✓	✓
All Vehicles	EB	5,450	5,474	24	0.4%	0	✓	✓
	WB	5,702	5,559	-144	-2.5%	2	✓	✓

Table 7-11 Summary of Flow Validation by Vehicle Type - PM

Vehicle Type	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
Lights	EB	7,143	7,749	606	8%	7.0	×	×
	WB	8,379	8,550	170	2%	1.9	✓	✓
All Vehicles	EB	7,666	8,514	848	11%	9	×	×
	WB	8,880	9,215	335	4%	4	✓	✓

7.3.5. Convergence

The convergence for each model period is summarised in Table 7-12. This shows that the assignment model converges for all three time periods, it is stable for at least four consecutive assignment-simulation loops and the delta values (as measured by the SATURN %GAP statistic) achieve the targets specified in TAG.

Table 7-12 Summary of Model Convergence

Time Period	Assignment - Simulation Loop	% Flow Change (P)	Delta (%) (δ)	%Gap
AM	23	98.9	99.1	0.007
	24	98.2	99.2	0.008
	25	99.0	99.3	0.006
	26	99.3	99.0	0.015
IP	13	98.2	99.7	0.002
	14	98.5	99.7	0.003
	15	98.9	99.8	0.001
	16	99.2	99.8	0.001
PM	19	99.2	99.0	0.012
	20	99.4	99.3	0.012
	21	99.5	99.2	0.008
	22	99.1	99.2	0.011

7.4. 2019 Present Year Validation

As described previously, 2019 is run as a forecast year of CSRM2 and its outputs are compared against observed data. The PYV exercise was commissioned during 2020 and would ideally have been a 2020 PYV, but the COVID-19 pandemic meant this was impractical. Hence the decision was made to carry out a 2019 PYV and make use of existing available data (since it was too late to collect new 2019 data.

Calibration of the 2019 highway model was carried out to the extent of examining the results of journey time and link flow validation statistics, and considering whether any adjustments could be made to the transport supply or land use inputs (in a way that would not affect the 2015 base, or would be similarly beneficial to it). No matrix estimation was undertaken for the 2019 PYV, since its highway matrices are a direct output of the CSRM2 forecasting process.

The 2019 model was validated by means of the following comparisons:

- Modelled and observed traffic flows on links compared by lights and all vehicles by time period; and
- Modelled and observed journey times along routes, as a check on the quality of the network and the assignment.

Each of these validations is presented in separate sections below. The final section presents the levels of model convergence achieved in 2019.

7.4.1. Journey Time Validation

Journey time validation has been undertaken comparing modelled journey times against the 2019 TrafficMaster data collected for each time period for the same routes used for the 2015 journey time validation (see Figure 4-6 and Figure 4-7).

TAG states that modelled journey times should be within ± 15% of observed times (or ± 1 minute if higher) on 85% of routes. Figure 7-9 to Figure 7-11 compare modelled journey times and observed journey times (±15%) for each journey time route by time period. Descriptions of each journey time route can be found in Table 4-2. Graphs showing the performance of each route can be found in Appendix B.

The number of journey time routes that satisfy the TAG validation criteria are summarised as follows:

- AM: 17 out of 30 routes (57%);

- IP: 20 out of 30 routes (67%); and
- PM: 10 out of 30 routes (33%).

The journey time analysis shows that the 2019 has similar results to the 2015 base model whose results are shown in section 7.3.3 above. The AM peak has the same number of routes meeting the criteria, with some variations in which routes pass.

Two areas where the 2019 validation might have been further improved were the A14 roadworks and the Hills Road / Fendon Road area (where further roadworks were ongoing in October 2019, due to a gas leak on Hills Road as well as the upgrade to the Fendon Road roundabout). However, given the time constraints of carrying out the PYV, it was agreed that extra effort to code temporary roadworks was not warranted.

In addition, the signal timings for 2019 are taken from the 2015 inputs (with the exception of signalised junctions that were created or altered by specific scheme coding in 2019). Again, the client direction was that the effort to update all the signal timings to 2019 settings was not warranted for the PYV exercise, since all signal timings are optimised automatically by SATURN in the later CSRM2 forecast years.

Figure 7-9 Modelled vs. Observed Journey Times - AM Peak

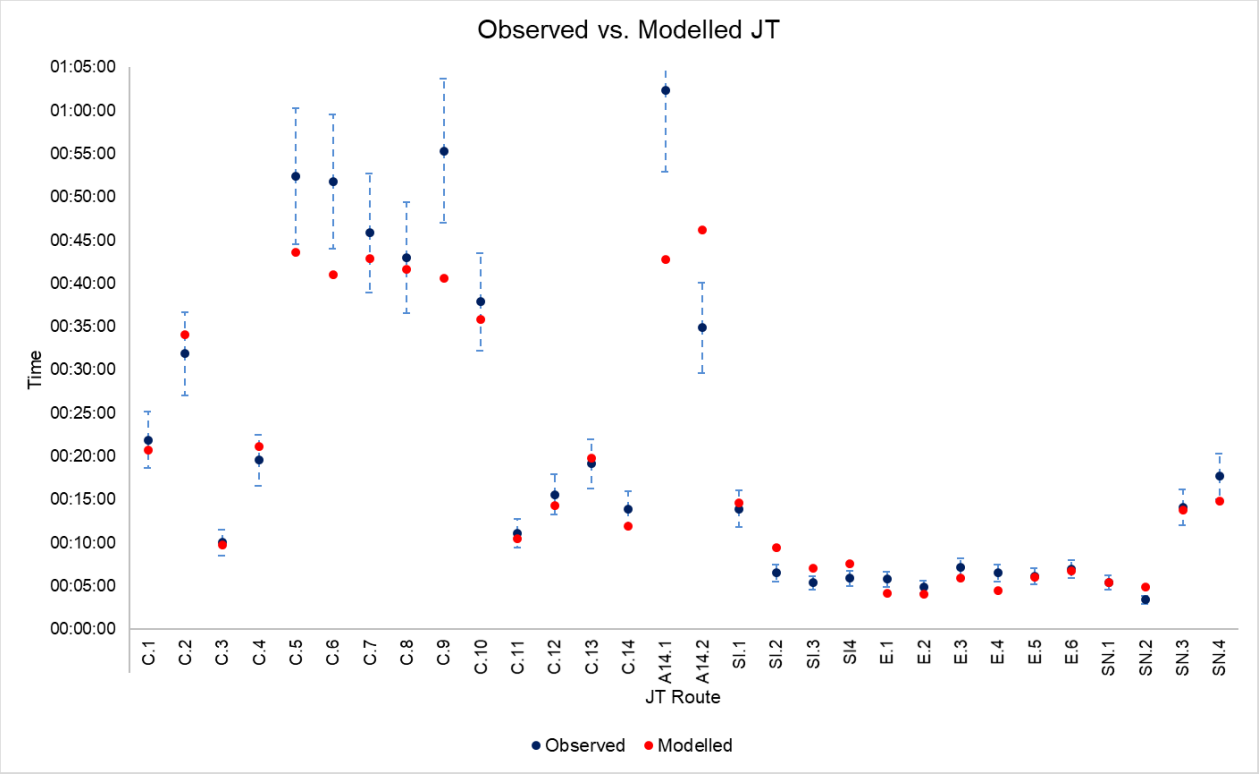


Figure 7-10 Modelled vs. Observed Journey Times - IP

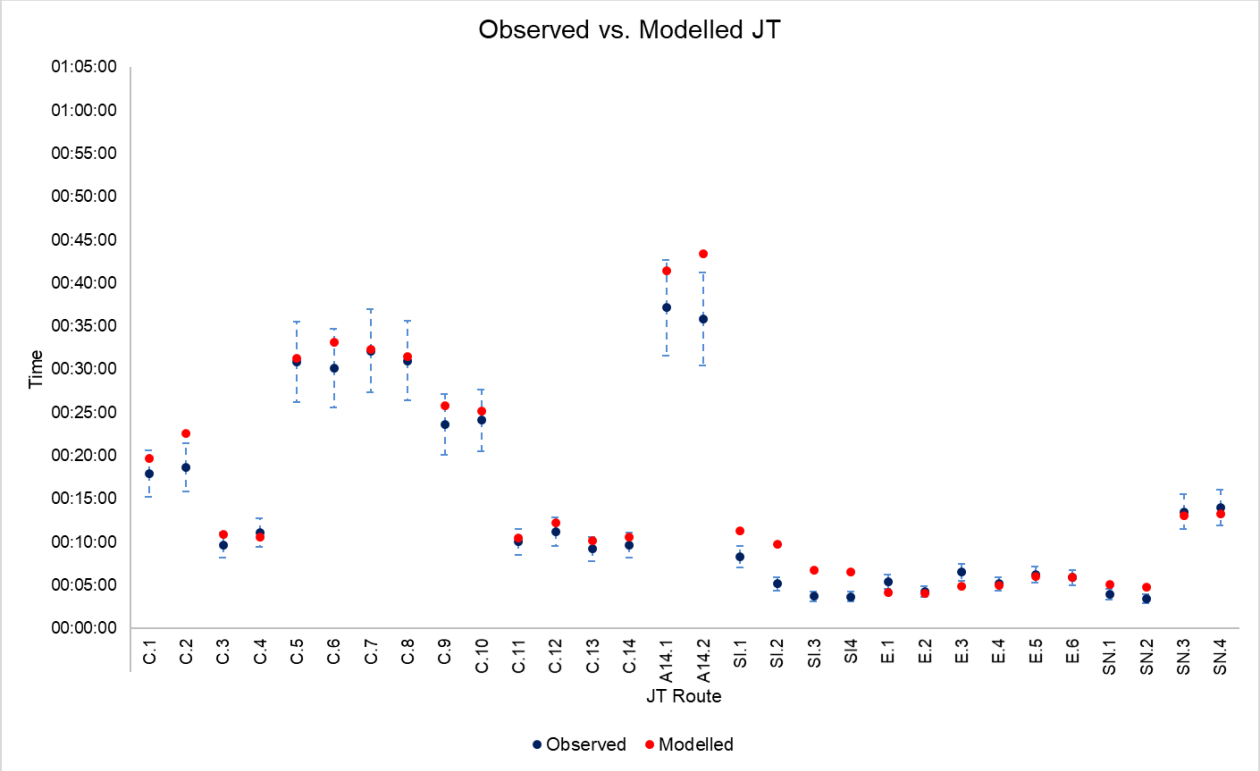
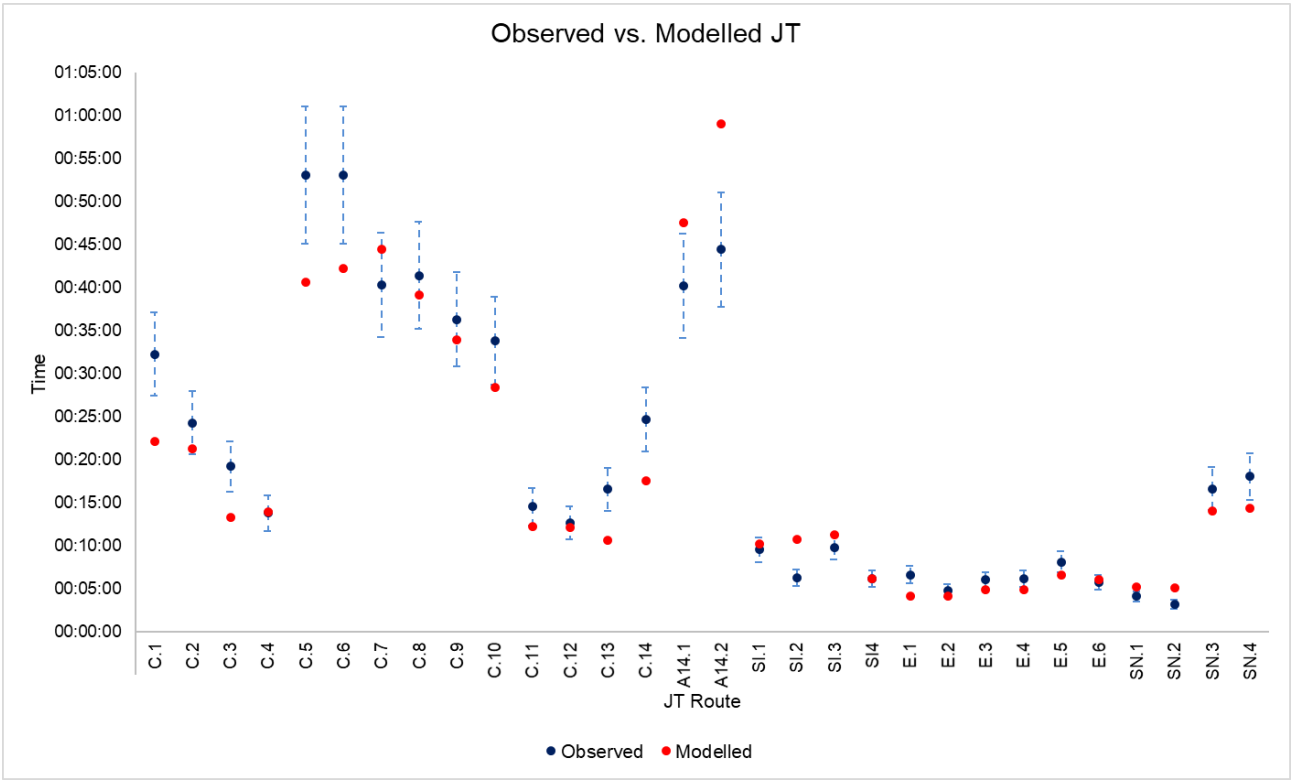


Figure 7-11 Modelled vs. Observed Journey Times - PM Peak



7.4.2. Flow Validation

The available 2019 flow validation data (as described in Section 4.2) has been assembled into two screenlines and a collection of 27 other bi-directional count sites across the CSRM2 area. The two screenlines are equivalent to the base year calibration screenlines 5 (River Cam Screenline) and 18 (St Neots East Screenline) (see Figure 7-3).

Assignment flow validation was undertaken by comparing modelled flows with observed counts by vehicle type and time period on these two screenlines in each direction. Table 7-13 summarises the percentage of validation screenlines and individual links which comply with TAG flow and GEH criteria as set out in Table 2-2. (Note that the set of individual links in this table includes those that do not form part of either screenline as well as those that do).

A summary of each screenline flow validation for each time period is shown in Table 7-14 to Table 7-19. Tables containing validation statistics on a link-by-link basis are shown in Appendix Sections C.5 to C.7.

The commentary on potential improvements that could have been made to the 2019 PYV model that was given in Section 7.4.1 above applies equally here: the roadworks and signal timings would influence traffic flows/routing as well as the journey times.

Table 7-13 Screenline / Link TAG Validation – PYV Counts

Time Period	Vehicle Type	Screenlines		Links
		Flow	GEH	Flow / GEH
AM	Lights	25%	50%	63%
	All Vehicles	50%	75%	63%
IP	Lights	0%	75%	82%
	All Vehicles	25%	75%	79%
PM	Lights	50%	100%	64%
	All Vehicles	50%	100%	64%

Table 7-14 Summary of PYV Screenlines (Lights) – AM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,694	3,411	717	26.6%	13.0	×	×
	WB	2,029	2,065	36	1.8%	0.8	✓	✓
18. St. Neots East Screenline	EB	1,690	1,906	216	12.8%	5.1	×	×
	WB	1,394	1,509	115	8.3%	3.0	×	✓

Table 7-15 Summary of PYV Screenlines (All Vehicles) - AM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,755	3,469	714	25.9%	12.8	×	×
	WB	2,076	2,089	13	0.6%	0.3	✓	✓
18. St. Neots East Screenline	EB	1,850	2,021	172	9.3%	3.9	×	✓
	WB	1,539	1,622	83	5.4%	2.1	✓	✓

Table 7-16 Summary of PYV Screenlines (Lights) - IP

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,298	2,436	138	6.0%	2.8	×	✓
	WB	2,403	2,200	-203	-8.4%	4.2	×	×
18. St. Neots East Screenline	EB	1,110	1,005	-106	-9.5%	3.2	×	✓
	WB	1,173	1,096	-77	-6.6%	2.3	×	✓

Table 7-17 Summary of PYV Screenlines (All Vehicles) - IP

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,358	2,484	126	5.3%	2.6	✓	✓
	WB	2,466	2,244	-222	-9.0%	4.6	×	×
18. St. Neots East Screenline	EB	1,252	1,120	-131	-10.5%	3.8	×	✓
	WB	1,310	1,198	-112	-8.5%	3.1	×	✓

Table 7-18 Summary of PYV Screenlines (Lights) - PM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,373	2,409	36	1.5%	0.7	✓	✓
	WB	2,868	2,967	99	3.4%	1.8	✓	✓
18. St. Neots East Screenline	EB	1,523	1,622	99	6.5%	2.5	×	✓
	WB	2,034	2,163	128	6.3%	2.8	×	✓

Table 7-19 Summary of PYV Screenlines (All Vehicles) - PM

Screenline	Direction	Observed	Modelled	Difference	Difference (%)	GEH	TAG Criteria	
							Flow	GEH
5. River Cam Screenline	EB	2,378	2,413	35	1.5%	0.7	✓	✓
	WB	2,881	2,969	88	3.1%	1.6	✓	✓
18. St. Neots East Screenline	EB	1,575	1,685	110	7.0%	2.7	×	✓
	WB	2,106	2,236	130	6.2%	2.8	×	✓

7.4.3. Convergence

The convergence for each model period is summarised in Table 7-20. This shows that the assignment model converges for all three time periods and has a gap value well below the required 0.1%.

Table 7-20 Summary of Model Convergence

Time Period	Assignment - Simulation Loop	% Flow Change (P)	Delta (%) (δ)	%Gap
AM	28	95.9	98.5	0.013
	29	98.6	99.0	0.018
	30	98.9	98.9	0.011
	31	98.4	99.0	0.009
IP	14	98.0	99.6	0.009
	15	97.8	99.7	0.006
	16	97.7	99.7	0.002
	17	98.9	99.8	0.003
PM	22	98.6	98.8	0.006
	23	98.2	98.8	0.006
	24	98.0	98.9	0.005
	25	98.4	98.9	0.009

8. Summary of Model Development

8.1. Summary of Model Development

The CSRM has been refreshed to a base year of 2015 to simulate the movement of traffic on the strategic road network within the Cambridge sub-region for the primary purpose of assessing and appraising schemes related to the GCP. The model can be used to test and assess the traffic impacts of future land-use scenarios, proposed highway schemes and mitigation measures. The model covers the Cambridgeshire districts of Cambridge City, South Cambridgeshire, East Cambridgeshire and Huntingdonshire. The area of detailed simulation modelling covers Cambridge and Huntingdon, including the A14 and M11. The external area covers the rest of Great Britain in a skeletal form. The current version of the model is the CSRM2 F-series, and includes numerous refinements and improvements that have been implemented since the original CSRM2 refresh.

The base model represents a typical weekday (Tuesday – Thursday) in November 2015, and has a Present Year Validation representing October 2019. It covers the AM peak hour (08:00 – 09:00), an average inter-peak hour (10:00 – 16:00) and the PM peak hour (17:00 - 18:00). The model has utilised data from a number of local and national sources, supplemented by bespoke data collected for the study.

This LMVR has described the development of the modelled networks and trip matrices, and their calibration and validation. ME procedures have been used to fit the highway prior trip matrices to a set of 2015 observed traffic count data.

8.2. Summary of Standards Achieved

CSRM2 has been tested against the TAG calibration and validation criteria for:

- Model convergence;
- Link flows across selected screenlines, individual flows; and
- Journey time comparison.

The assignment model is stable for the three modelled peak hours and meets the convergence criteria.

The IP hour model gives a good fit against observed traffic flows, with more than 90% of screenlines and individual links within the specified tolerances. In the congested AM and PM peak hours, 75% and 86% of screenlines meet the criteria respectively, with more than 85% of individual links passing in both time periods. On the whole, the flow validation in Cambridge meets the TAG criteria. Where the criteria are not achieved it tends to be in the outlying towns of Huntingdon, St Neots and Ely.

The County Screenline north-south validation line, which cuts through the centre of the model, meets the screenline criteria in the IP. In the AM peak, the validation screenline only passes in the eastbound direction, with westbound having 414 more vehicles than observed, while the PM peak passes westbound but has 848 more vehicles eastbound than observed.

Modelled journey times within Cambridge are generally faster than observed with under-representation of delay on some routes. One explanation for this is the impact of cycles on the network in Cambridge which is very difficult to incorporate even with a comprehensive dataset for cycle flows, as the model could not be expected to reflect the irregular delays caused by vehicles attempting to pass moving cyclists.

The model also tends to run too fast EB on the A14 in the AM, but too slow WB and in both directions in the other time periods, which reflects the difficulties in representing the erratic behaviour of this congested road in the base model. The A14 Cambridge to Huntingdon improvement scheme opened in 2020 and has completely changed the nature of this stretch of road.

This model has been prepared with reference to TAG guidance and reasonable steps have been taken to meet the calibration and validation criteria contained in the guidance. The strengths and weaknesses of the model have been considered carefully and discussed with CCC, and it has been agreed that the model is capable of providing outputs of sufficient quality to support planning of the strategic highway network in the core modelled area. As set out in Section 2.8, the requirements for good flow and journey time validation must be balanced against minimising the impacts of matrix estimation, with the latter being prioritised. Although the matrix estimation process has been allowed to make larger than recommended changes in some sector-to-sector movements for justifiable reasons, a still more aggressive matrix estimation could have increased the flow and journey time validation pass rates – but this would have been against TAG recommendations.

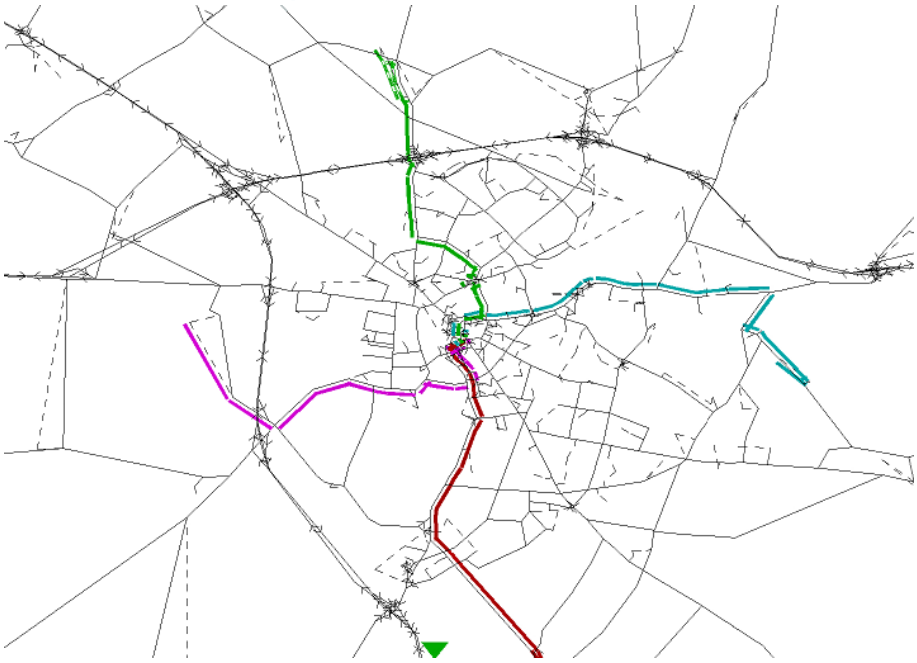
The 2019 PYV has been carried out following the TAG guidance as per the base year (subject to data availability) in absence of further guidelines. Despite the validation not being as precise as the 2015 base year due to the model running as a forecast year capturing the impact on traffic of other mode shares, the exercise confirmed that CSRM2 would still meet an adequate level of precision and accuracy despite its base year being older than five years.

Appendices

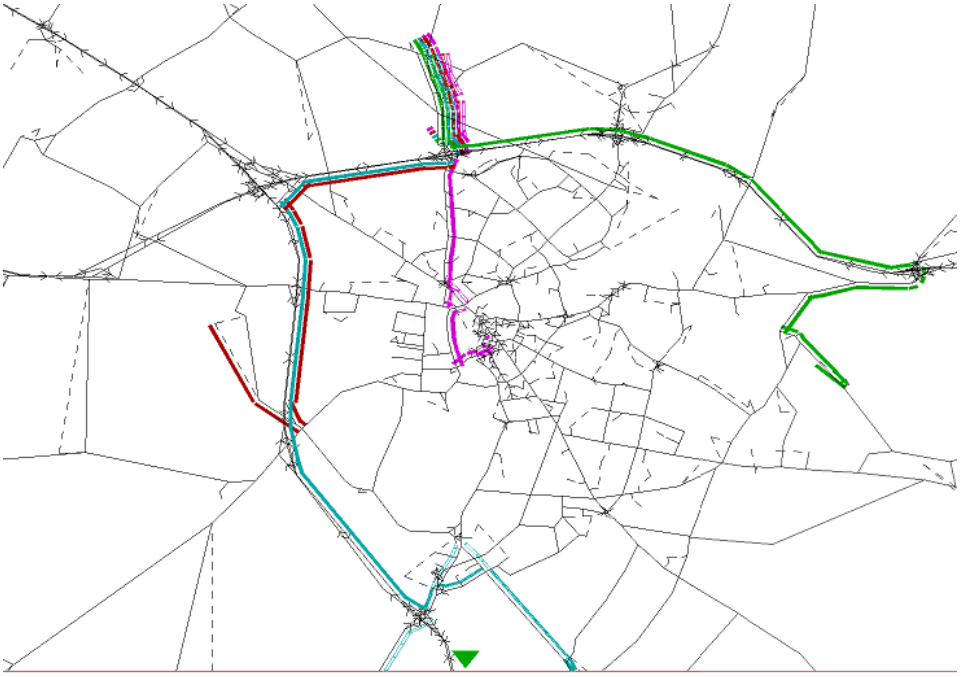
Appendix A. Assignment Route Choice Validation

A.1. Route Choice 2015 - AM

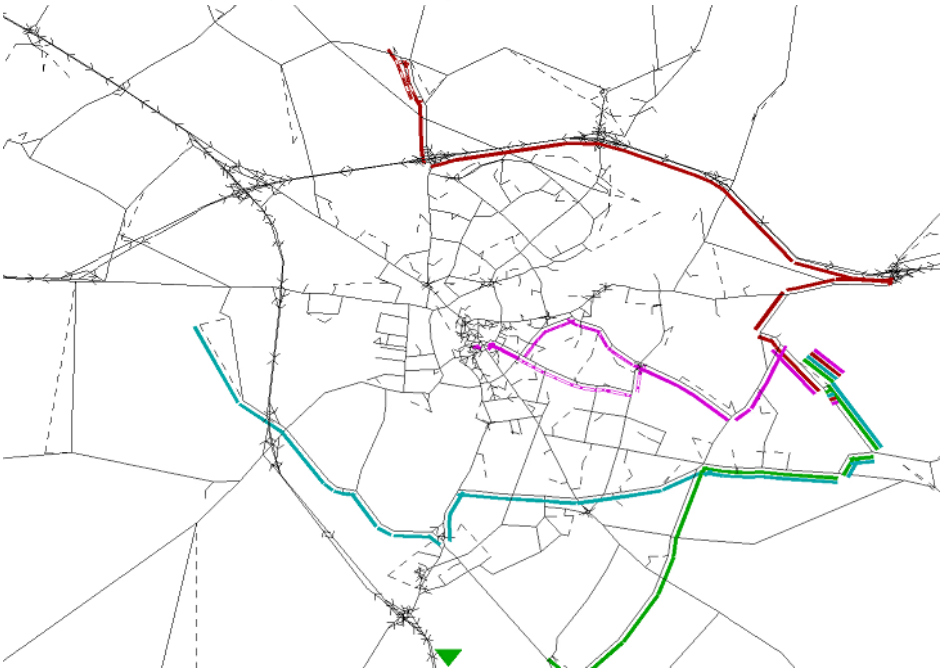
A.1.1. Centre of Cambridge (Sidney Street, Cambridge) – AM



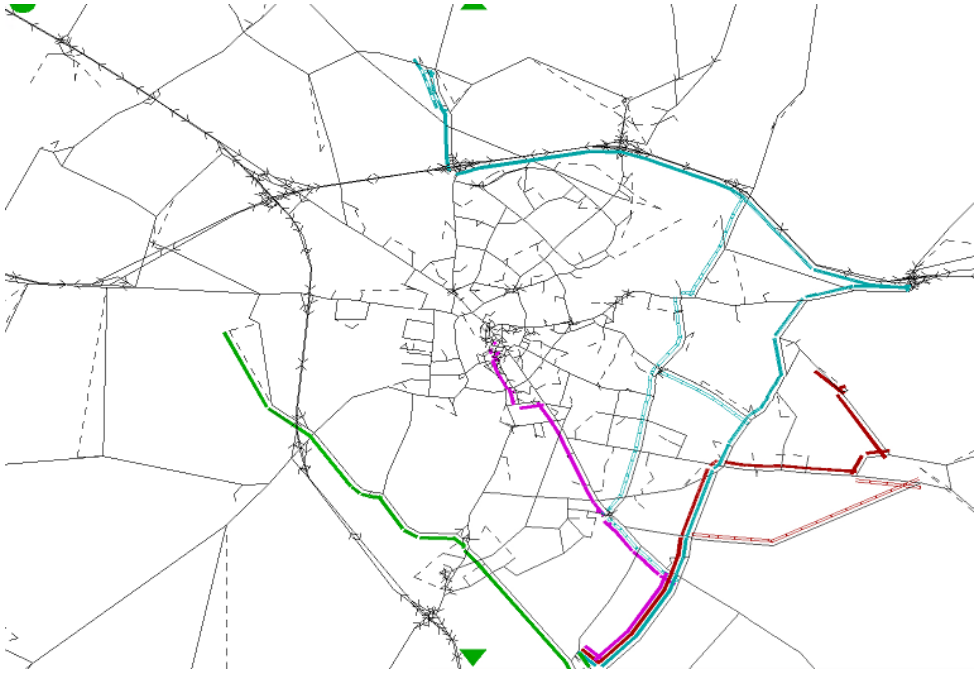
A.1.2. North of Cambridge (Histon) – AM



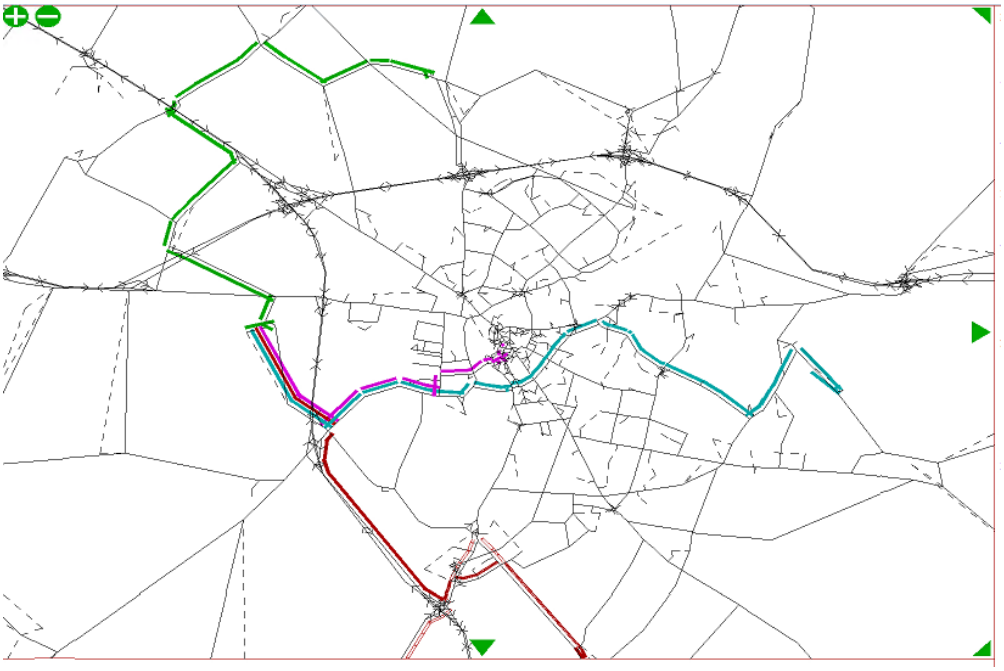
A.1.3. East of Cambridge (Teversham) – AM



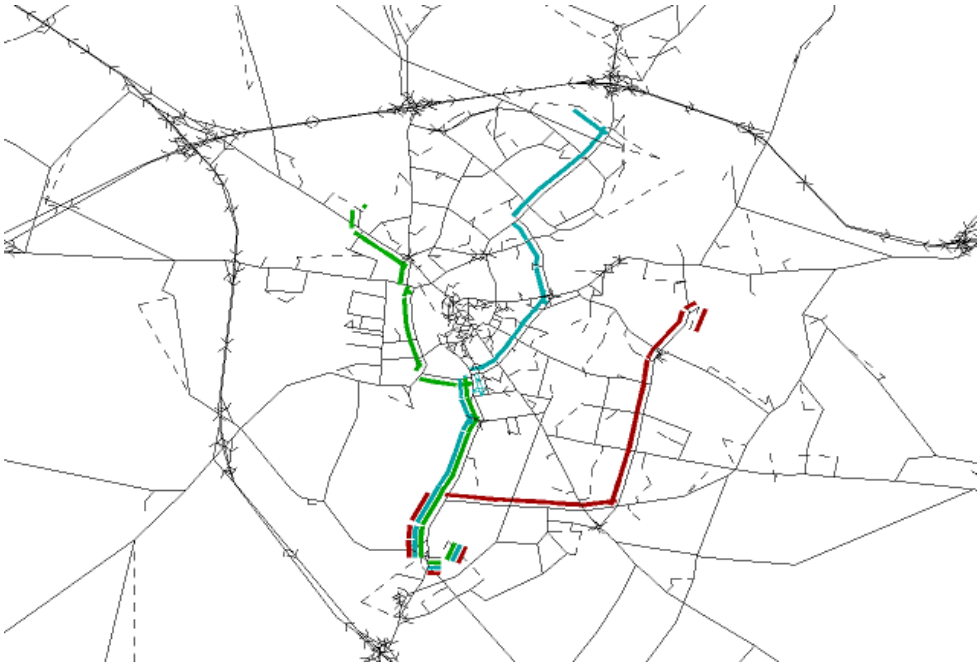
A.1.4. South of Cambridge (Great Shelford) – AM



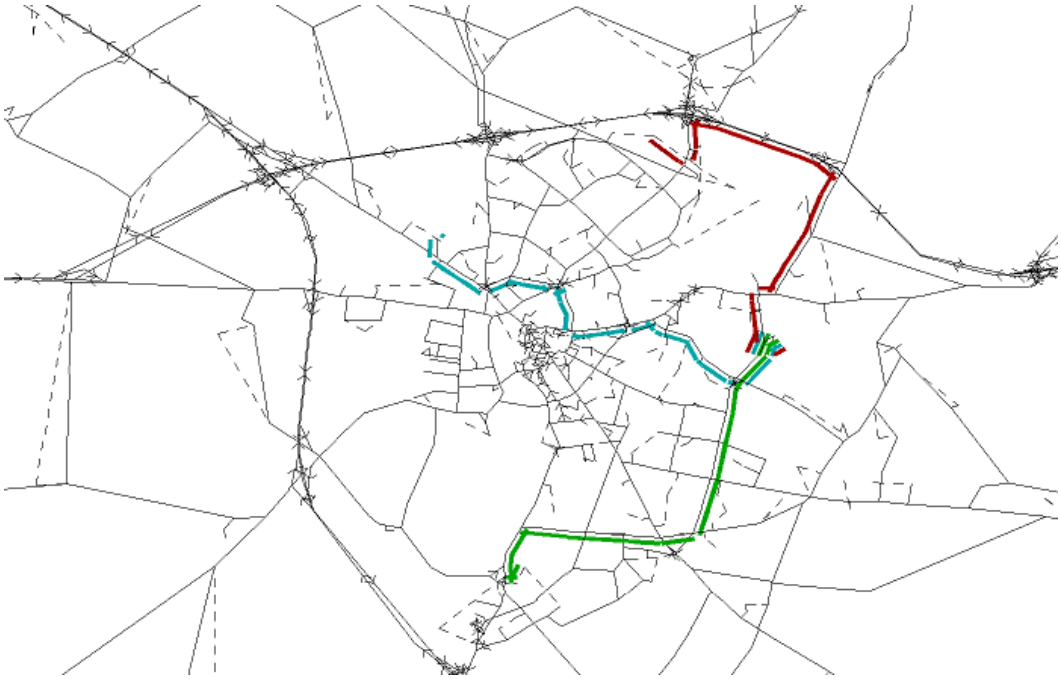
A.1.5. West of Cambridge (Coton) – AM



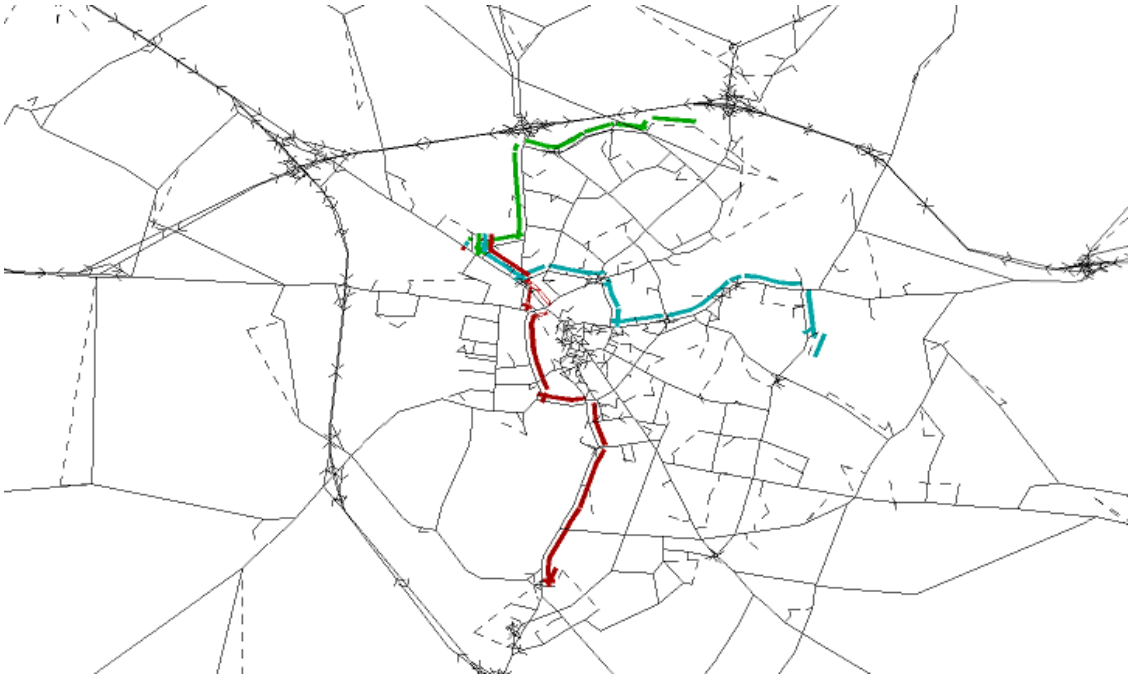
A.1.6. Trumpington, Cambridge – AM



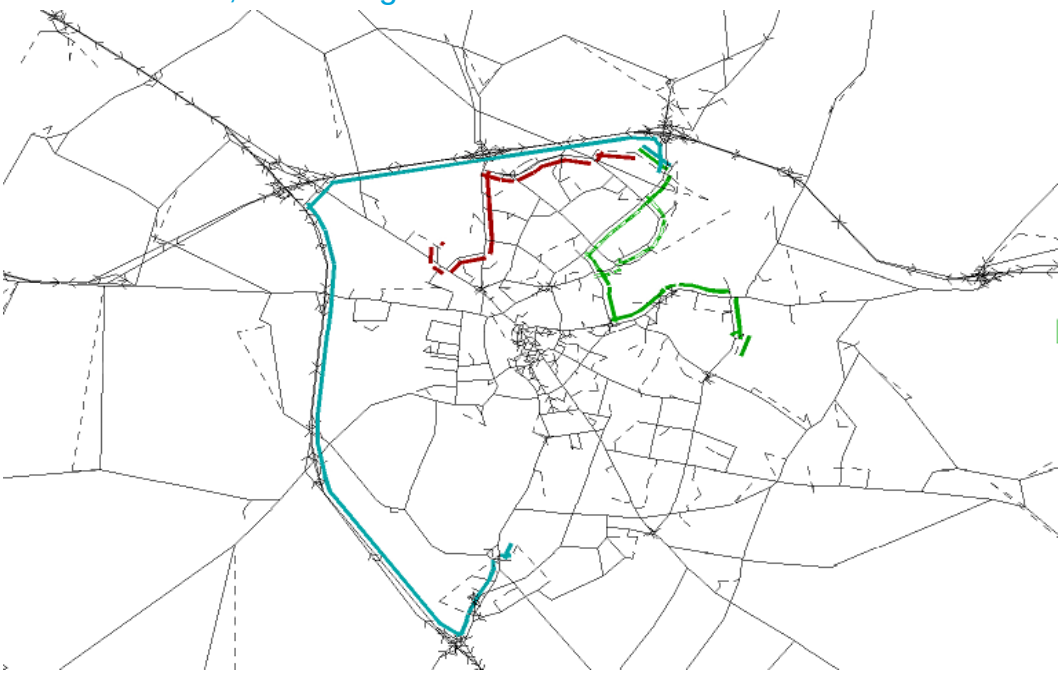
A.1.7. Airport, Cambridge – AM



A.1.8. Huntingdon Road, Cambridge – AM

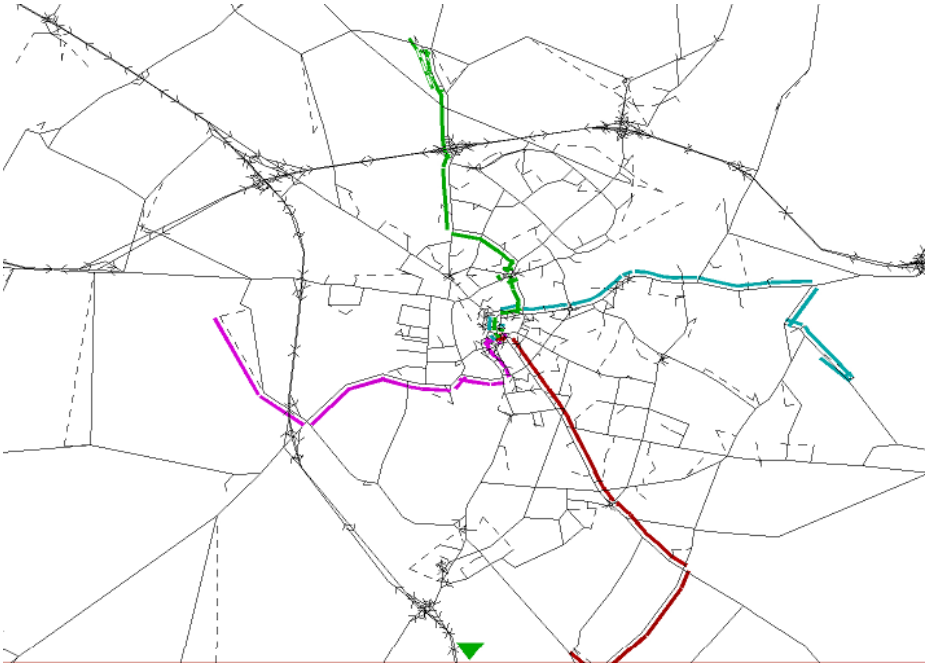


A.1.9. Science Park, Cambridge – AM

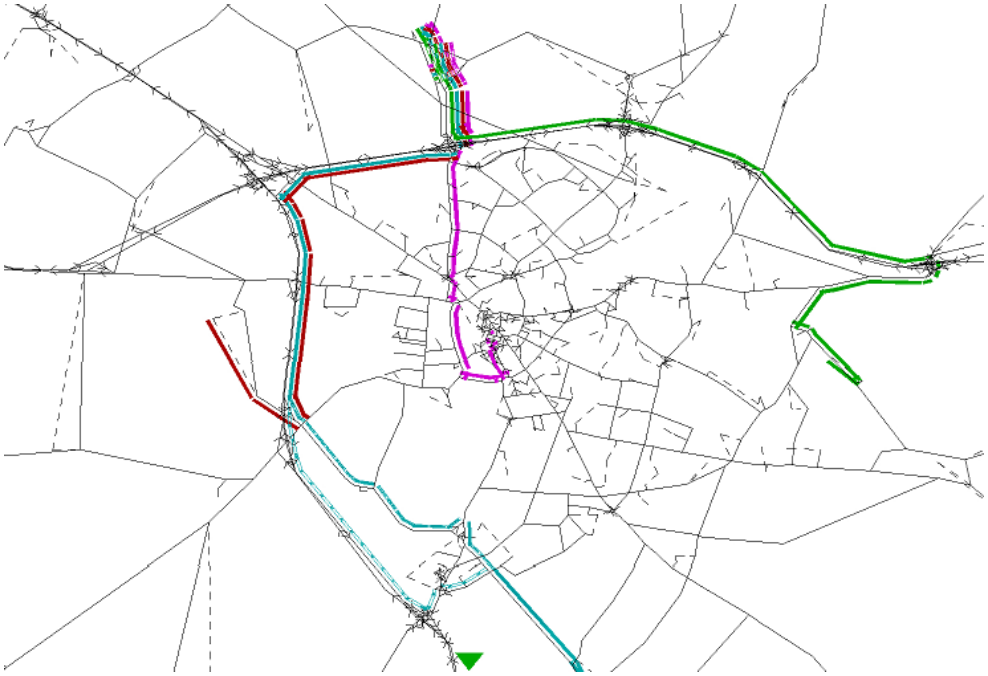


A.2. Route Choice 2015 - IP

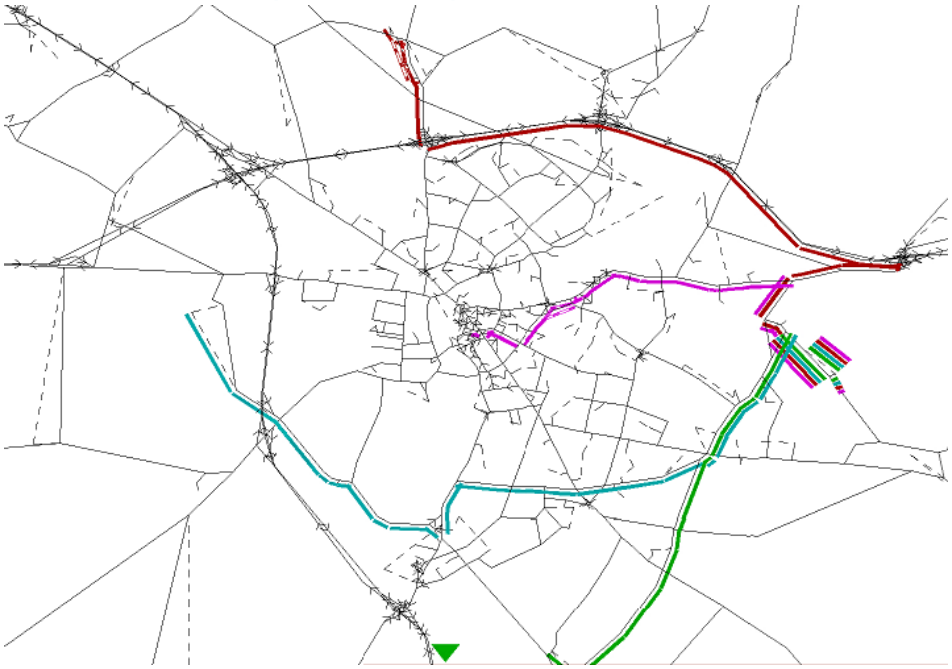
A.2.1. Centre of Cambridge (Sidney Street, Cambridge) – IP



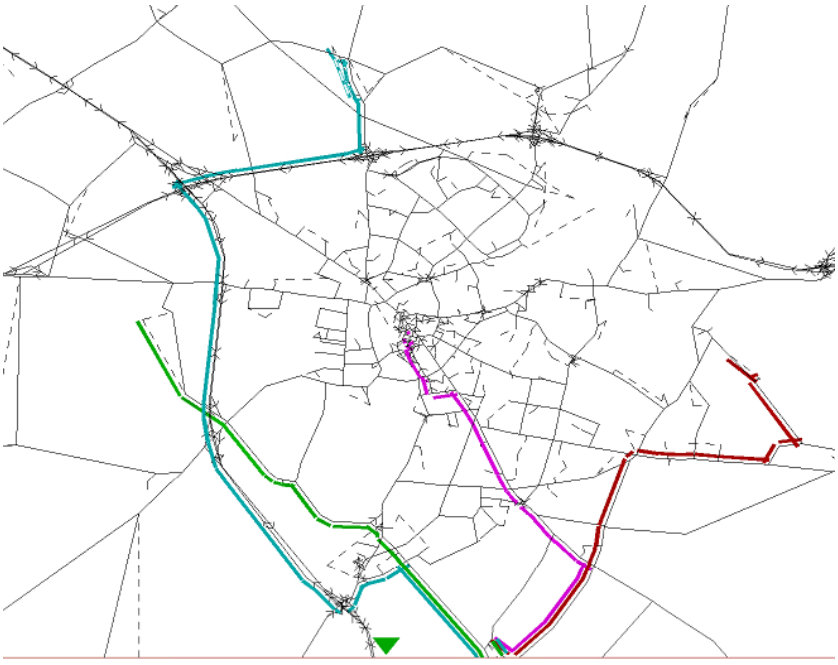
A.2.2. North of Cambridge (Histon) – IP



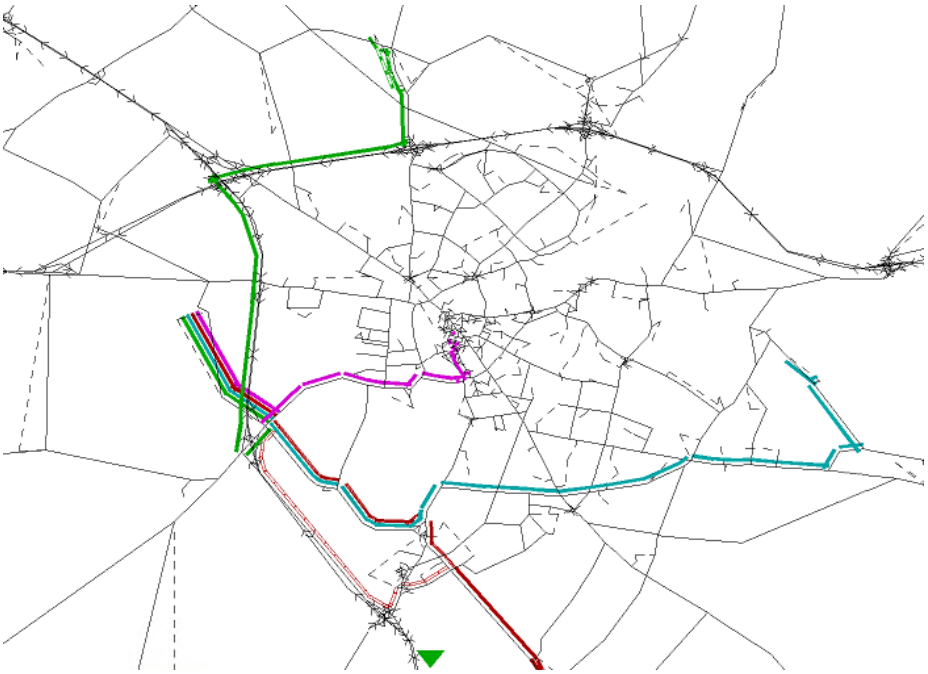
A.2.3. East of Cambridge (Teversham) – IP



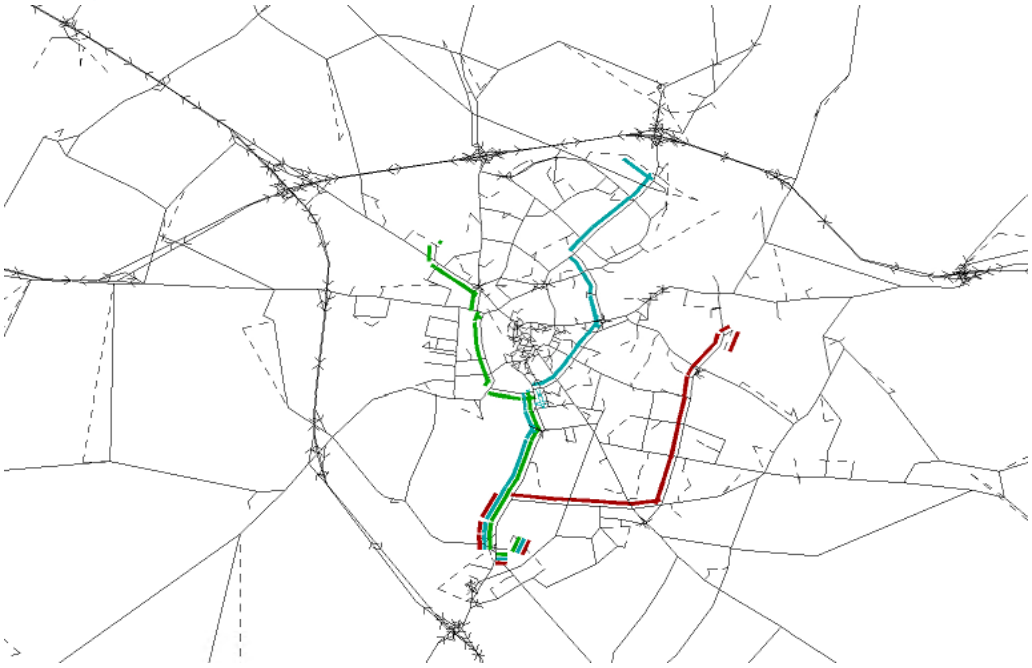
A.2.4. South of Cambridge (Great Shelford) – IP



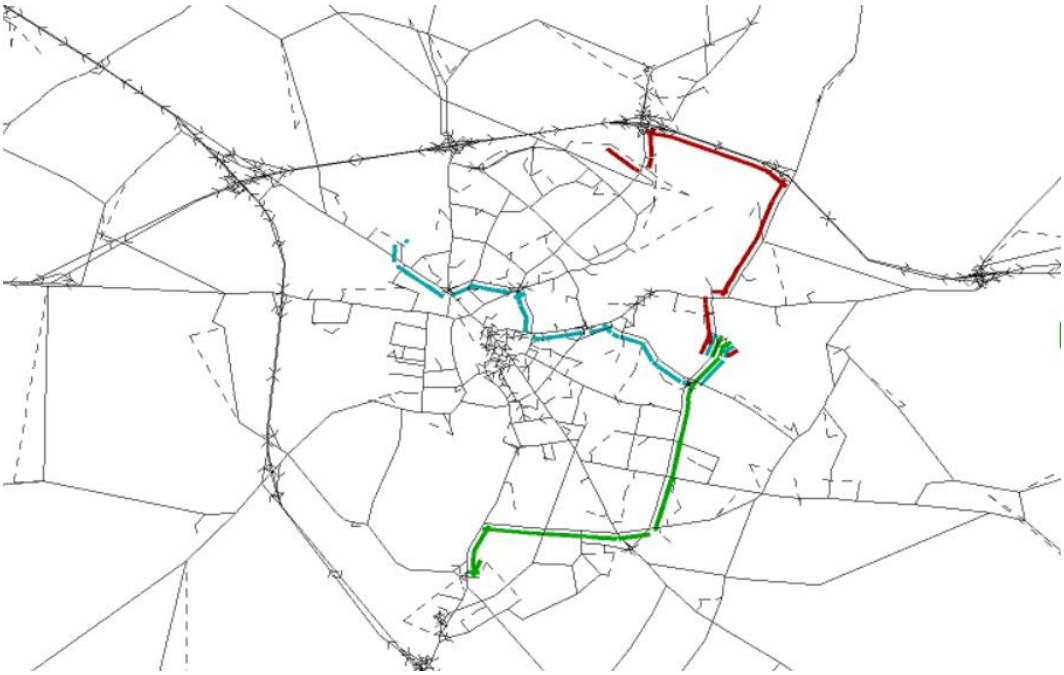
A.2.5. West of Cambridge (Coton) – IP



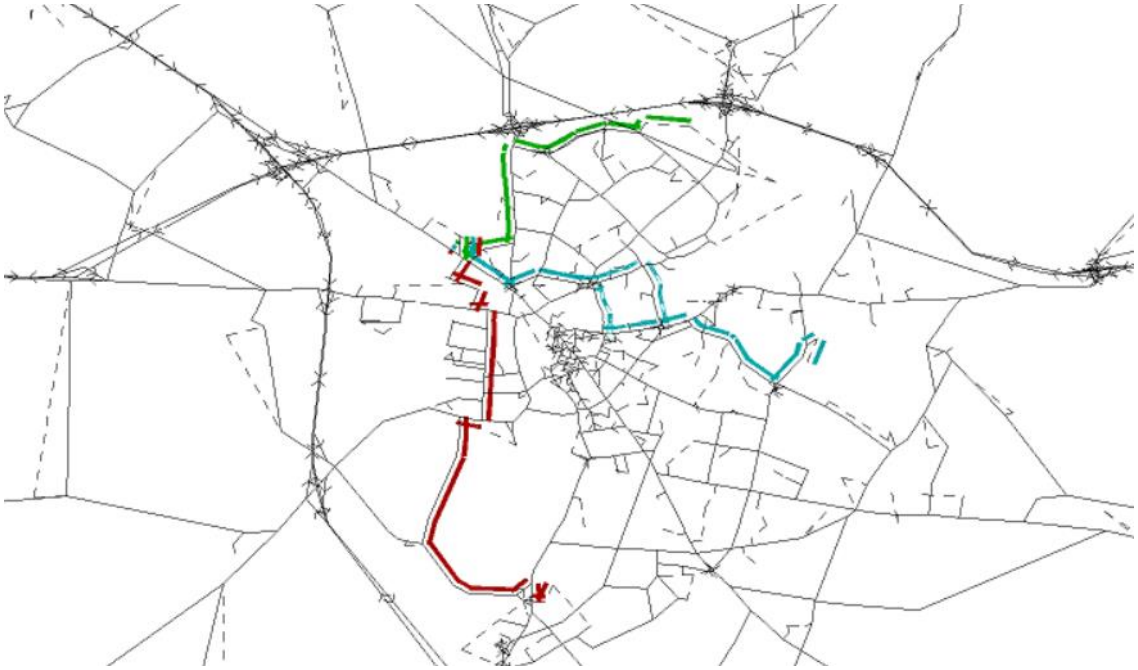
A.2.6. Trumpington, Cambridge – IP



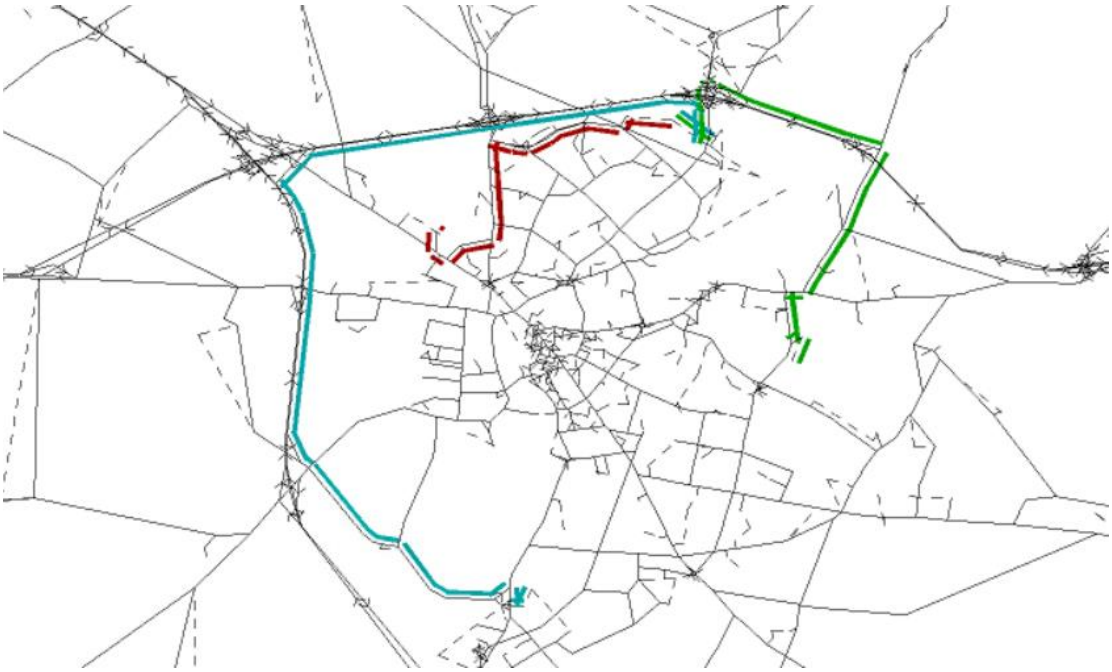
A.2.7. Airport, Cambridge – IP



A.2.8. Huntingdon Road, Cambridge – IP

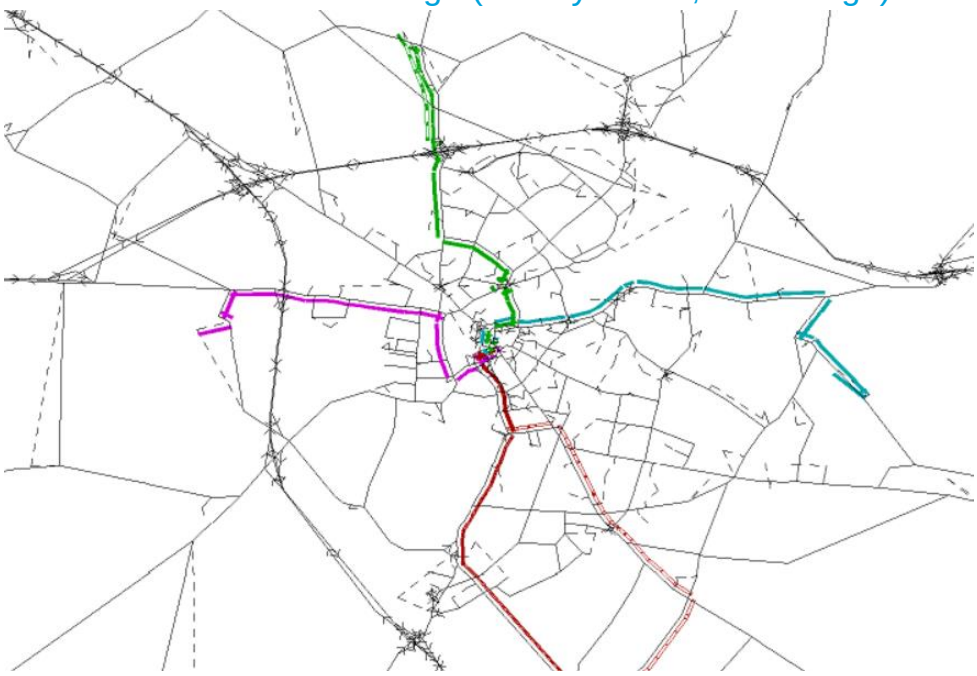


A.2.9. Science Park, Cambridge – IP

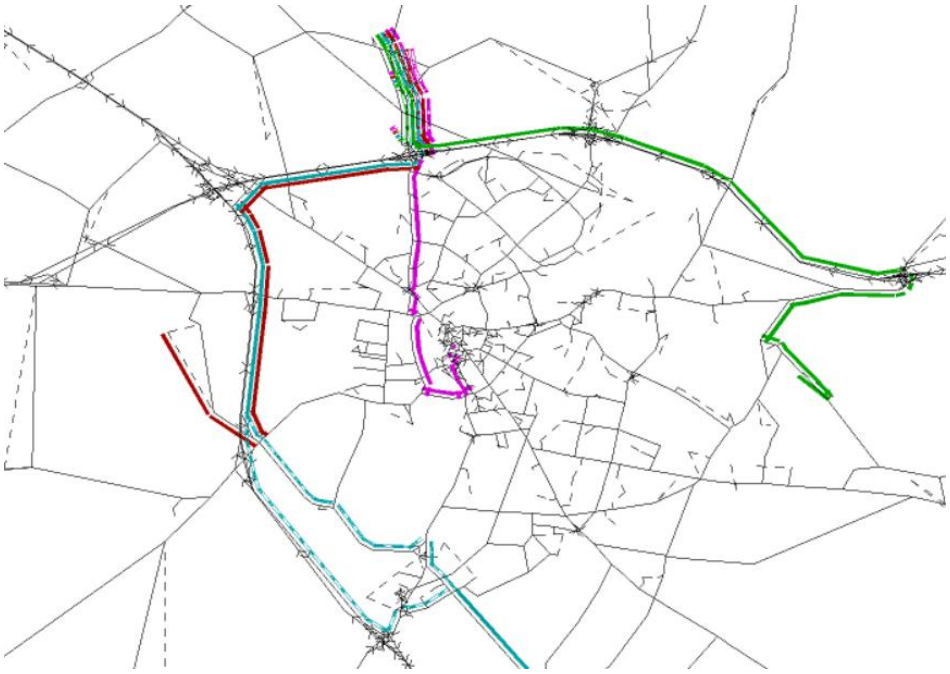


A.3. Route Choice 2015 - PM

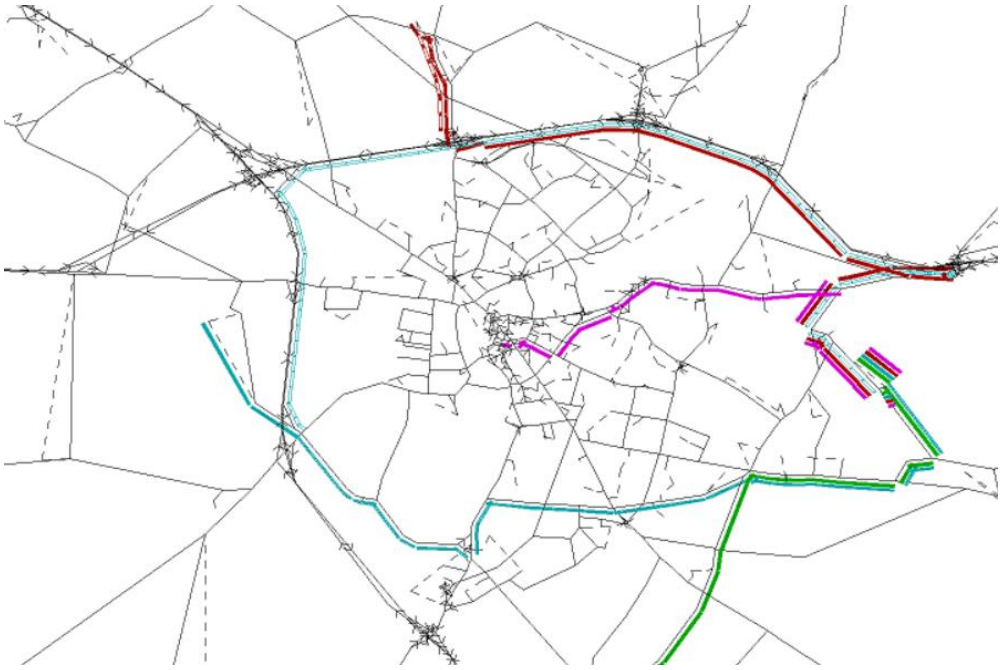
A.3.1. Centre of Cambridge (Sidney Street, Cambridge) – PM



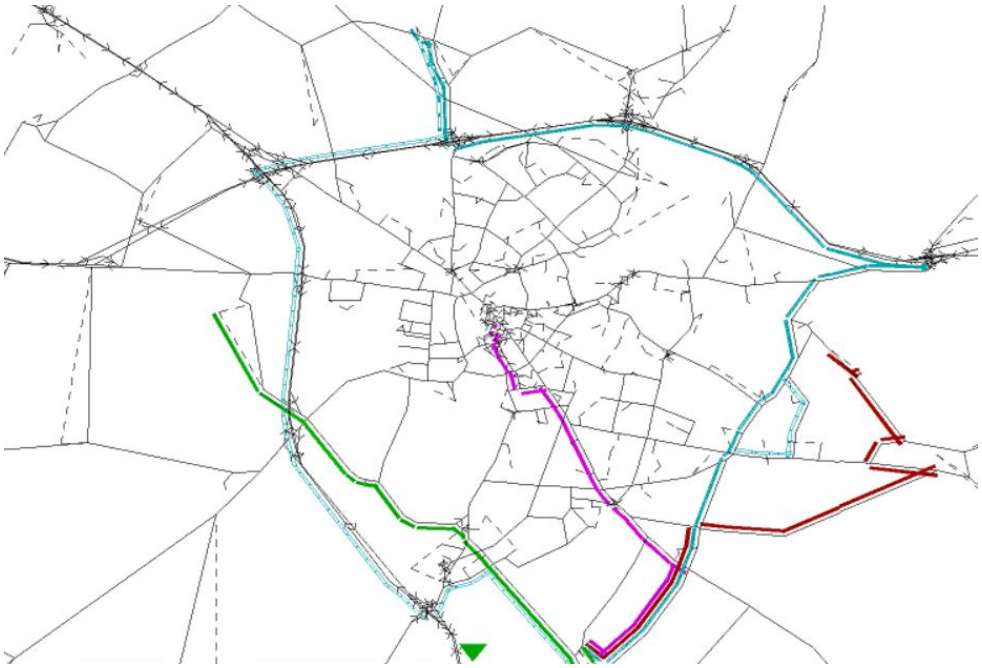
A.3.2. North of Cambridge (Histon) – PM



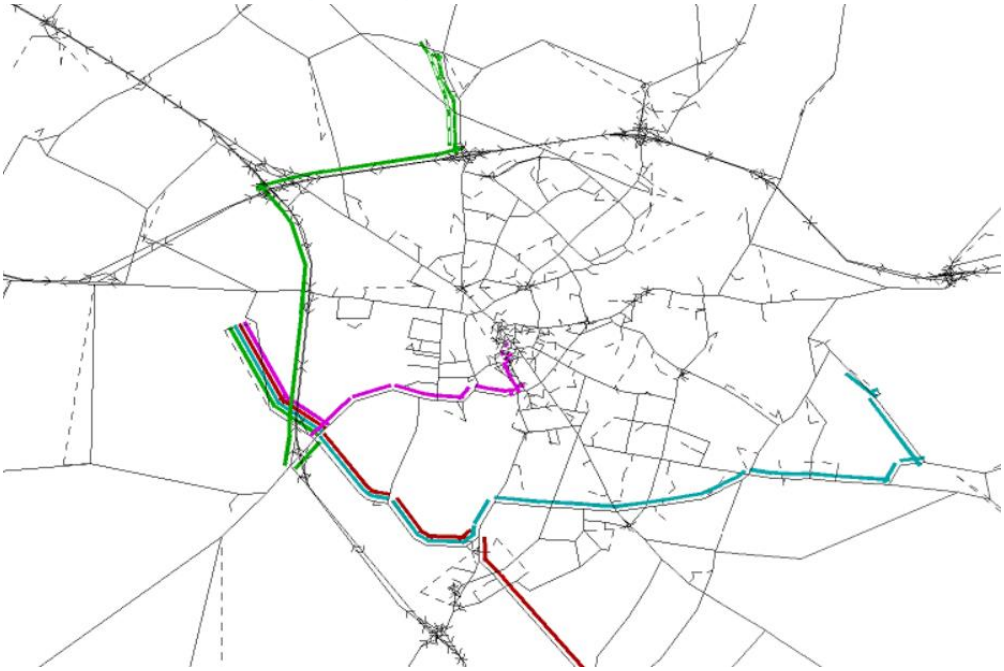
A.3.3. East of Cambridge (Teversham) – PM



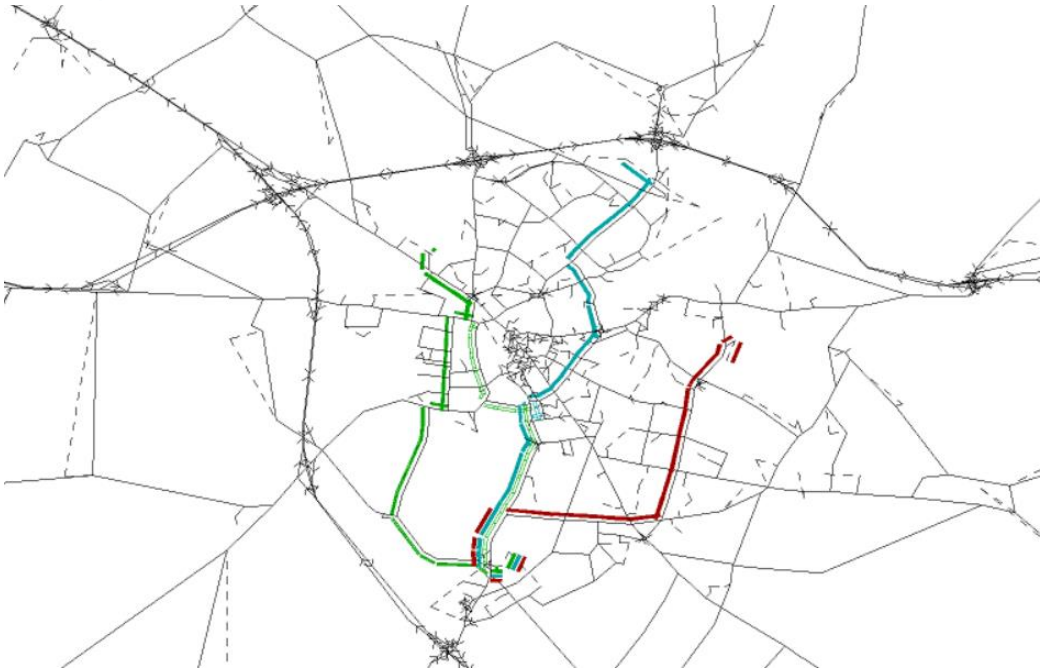
A.3.4. South of Cambridge (Great Shelford) – PM



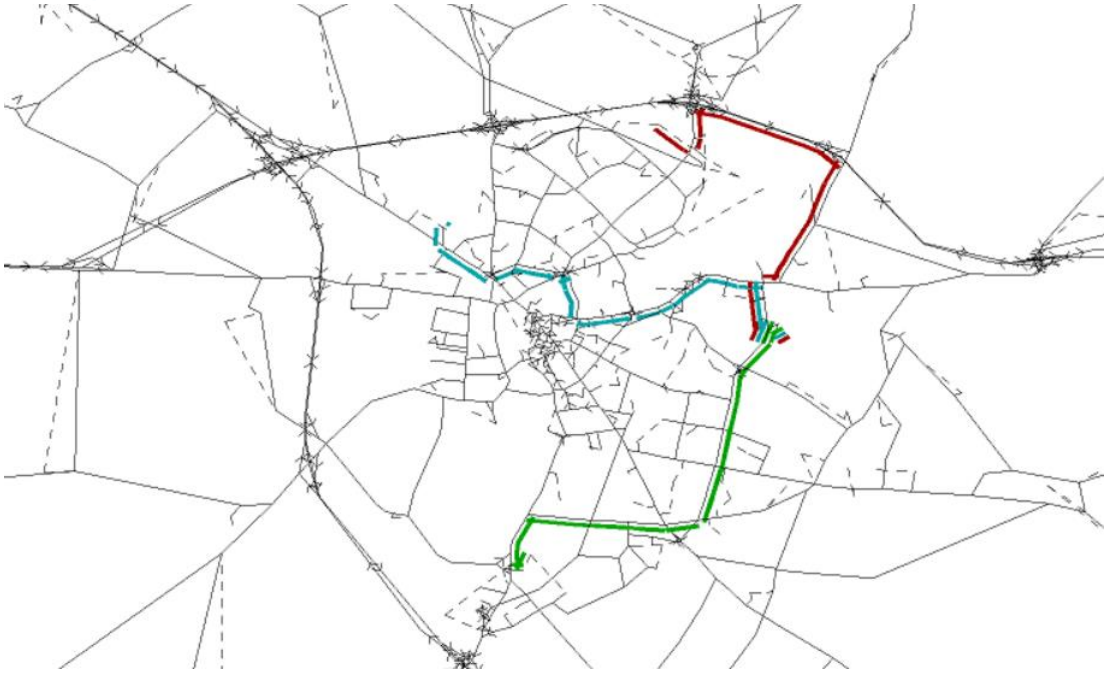
A.3.5. West of Cambridge (Coton) – PM



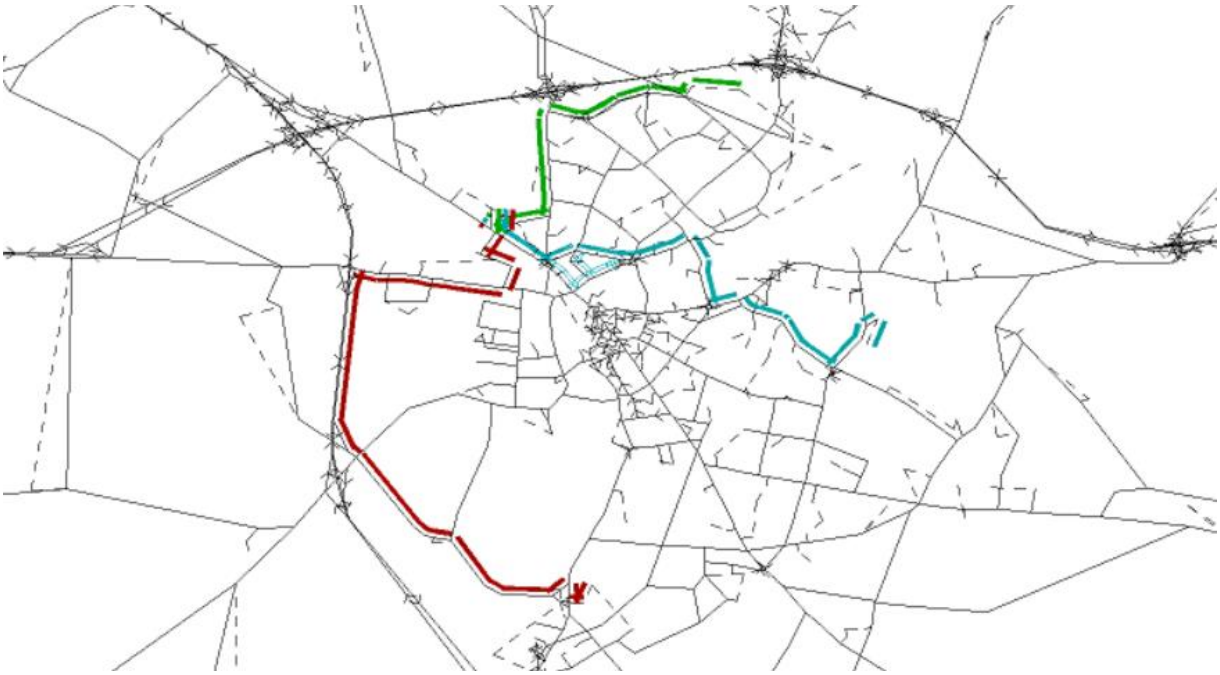
A.3.6. Trumpington, Cambridge – PM



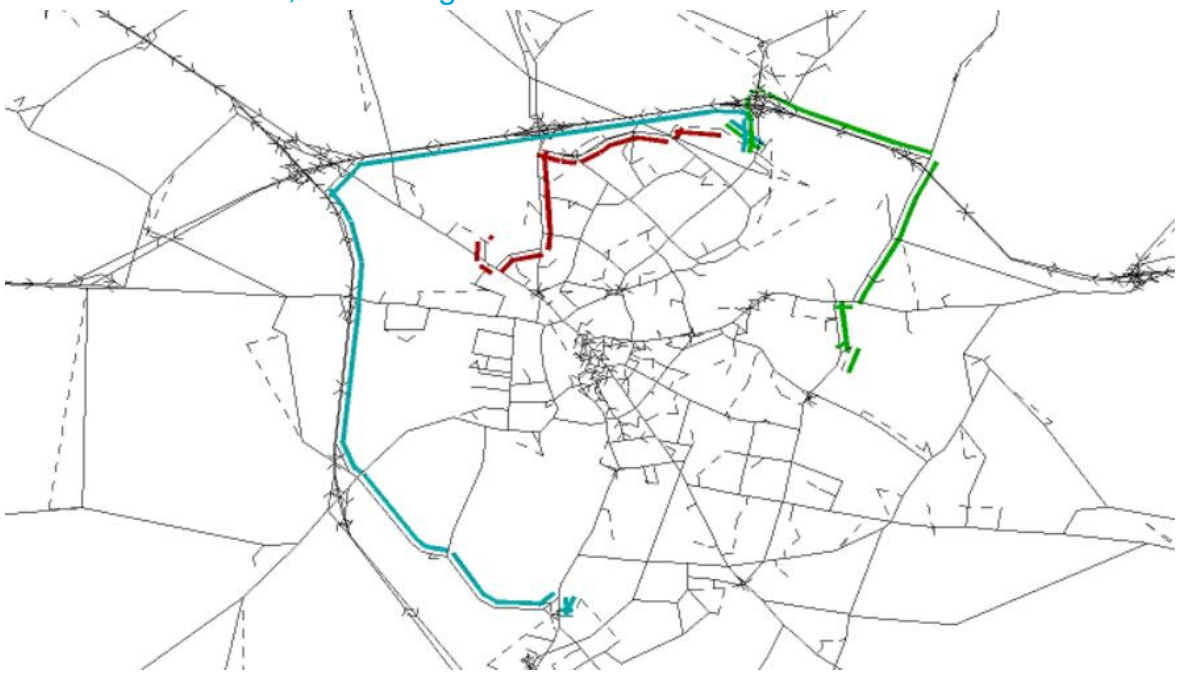
A.3.7. Airport, Cambridge – PM



A.3.8. Huntingdon Road, Cambridge – PM

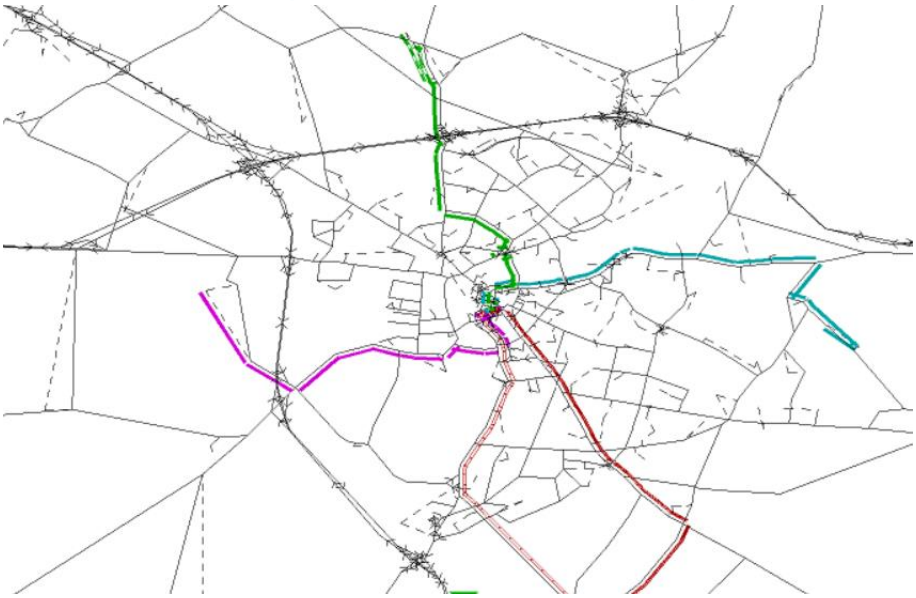


A.3.9. Science Park, Cambridge – PM

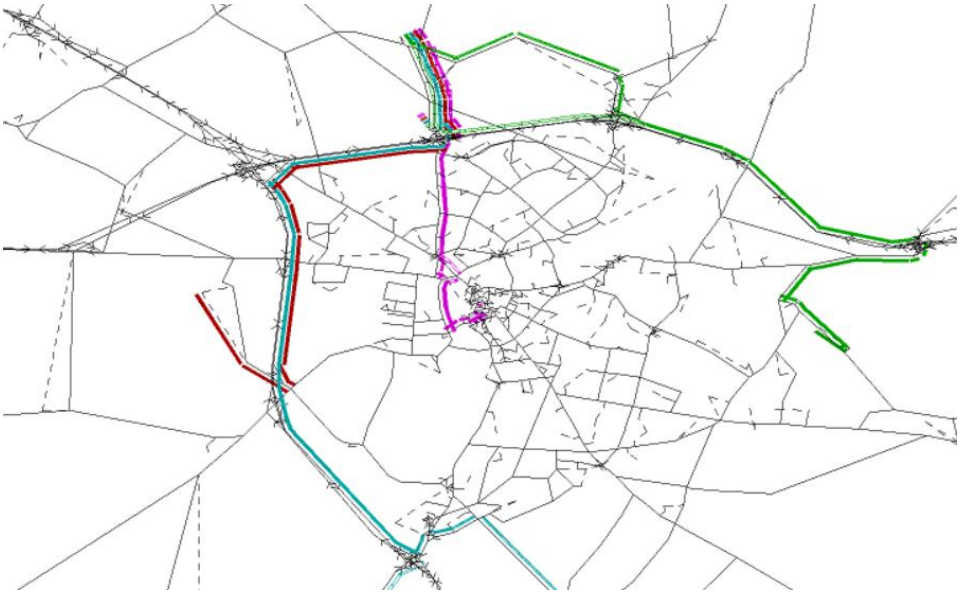


A.4. Route Choice 2019 - AM

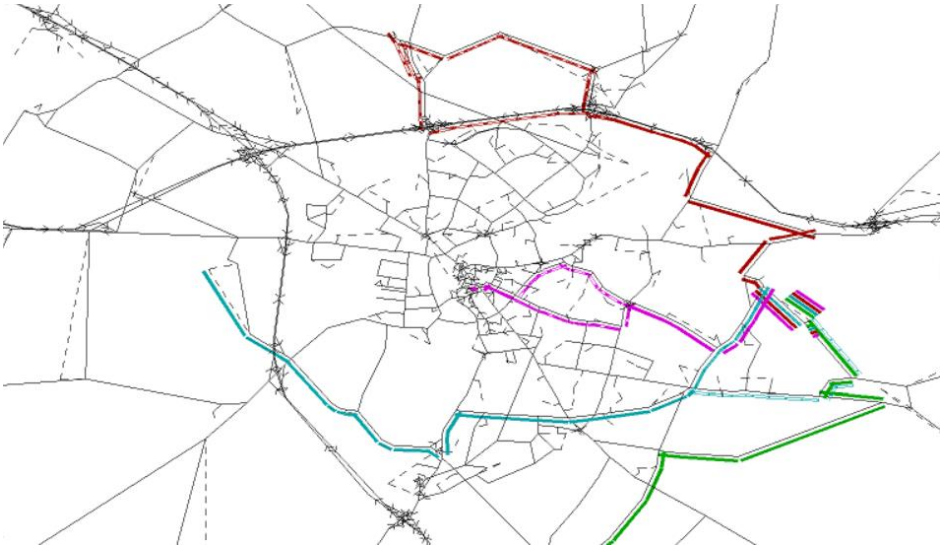
A.4.1. Centre of Cambridge (Sidney Street, Cambridge) – AM



A.4.2. North of Cambridge (Histon) – AM

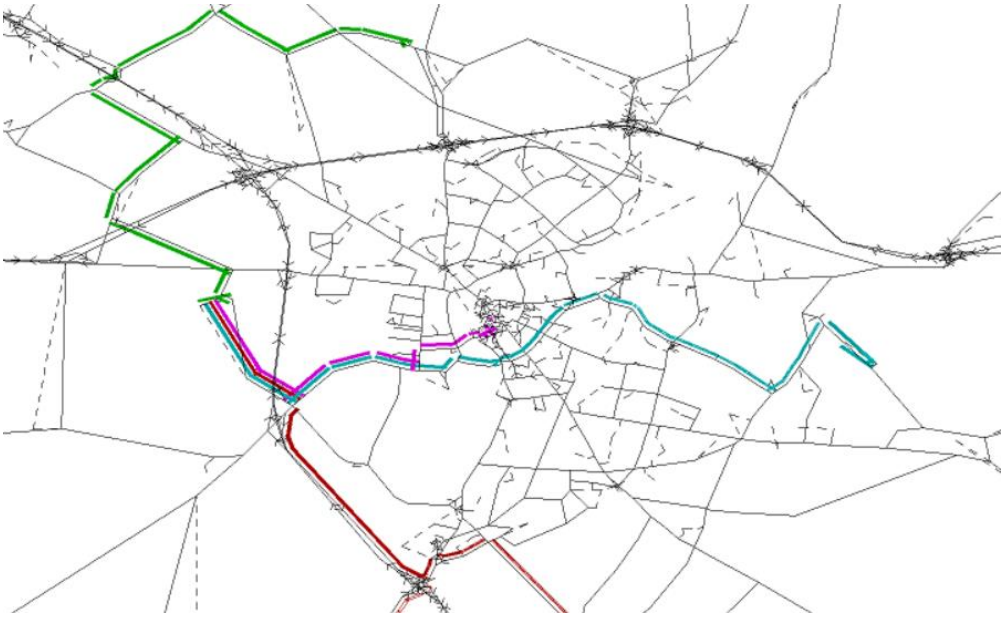


A.4.3. East of Cambridge (Teversham) – AM

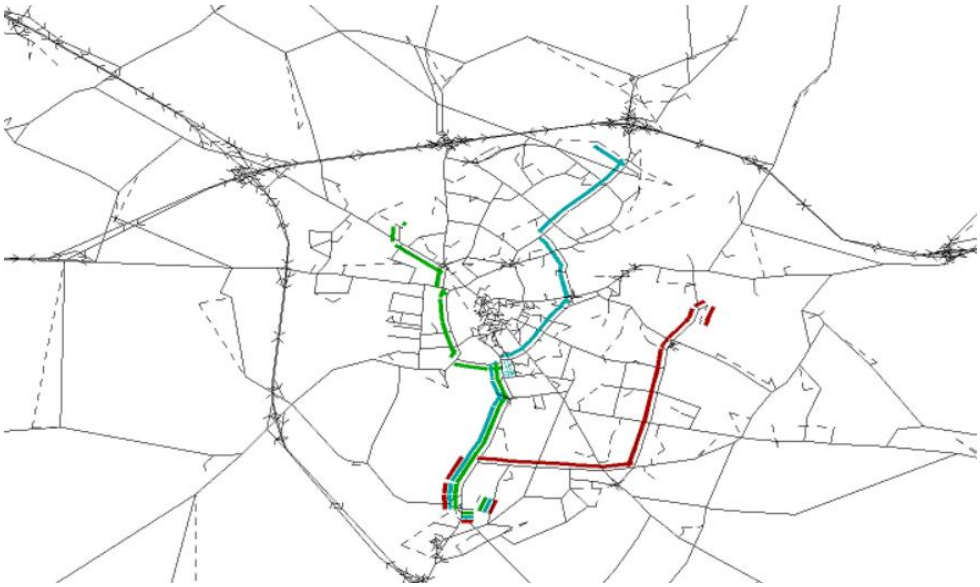


A.4.4. South of Cambridge (Great Shelford) – AM

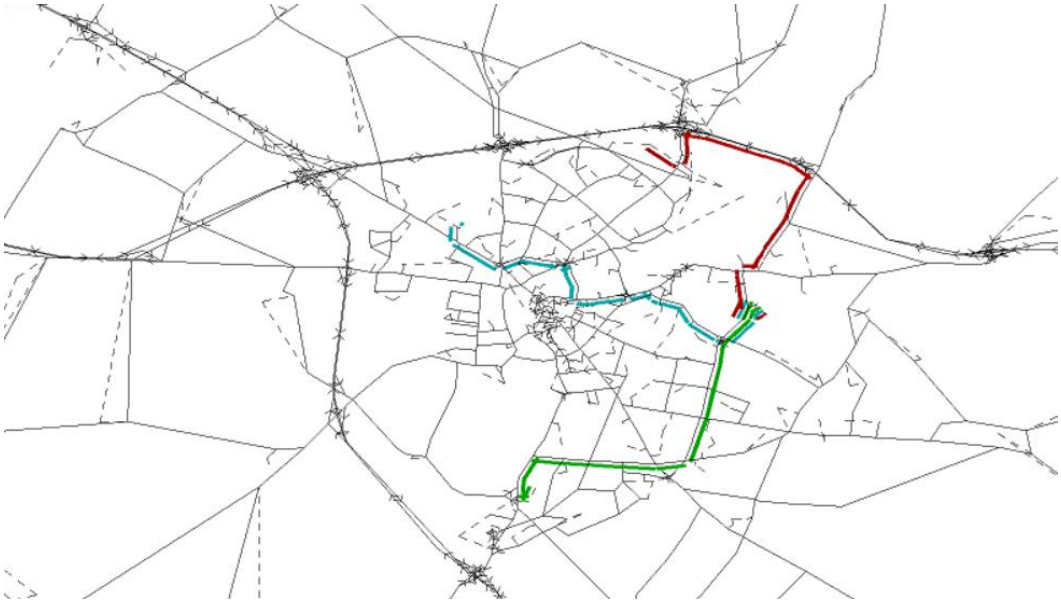
A.4.5. West of Cambridge (Coton) – AM



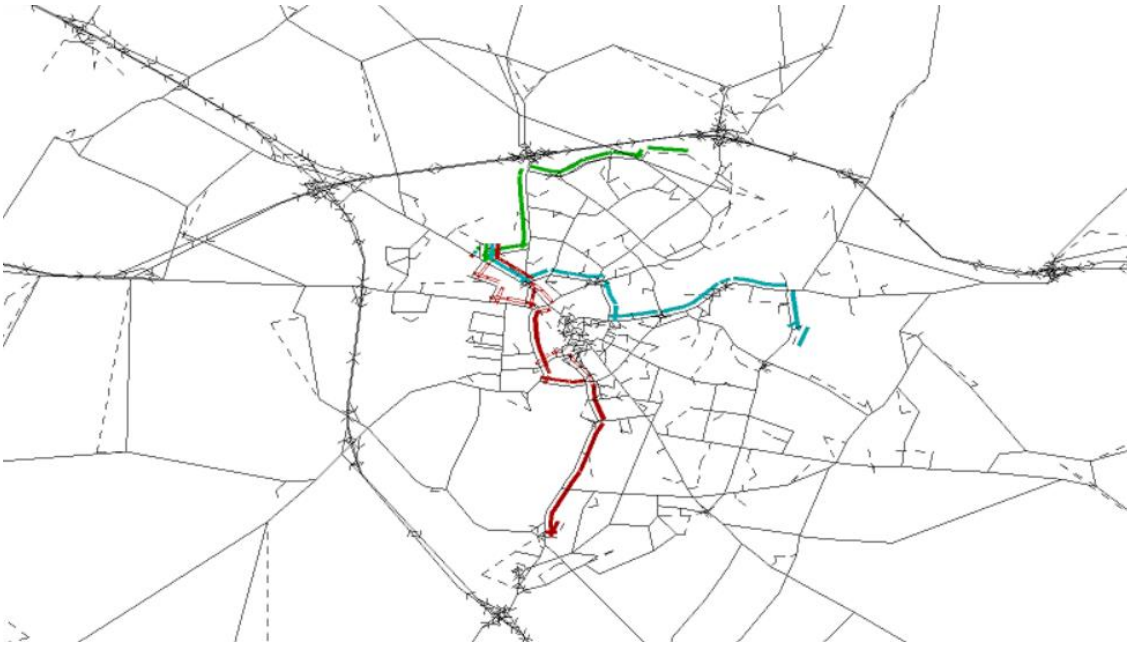
A.4.6. Trumpington, Cambridge – AM



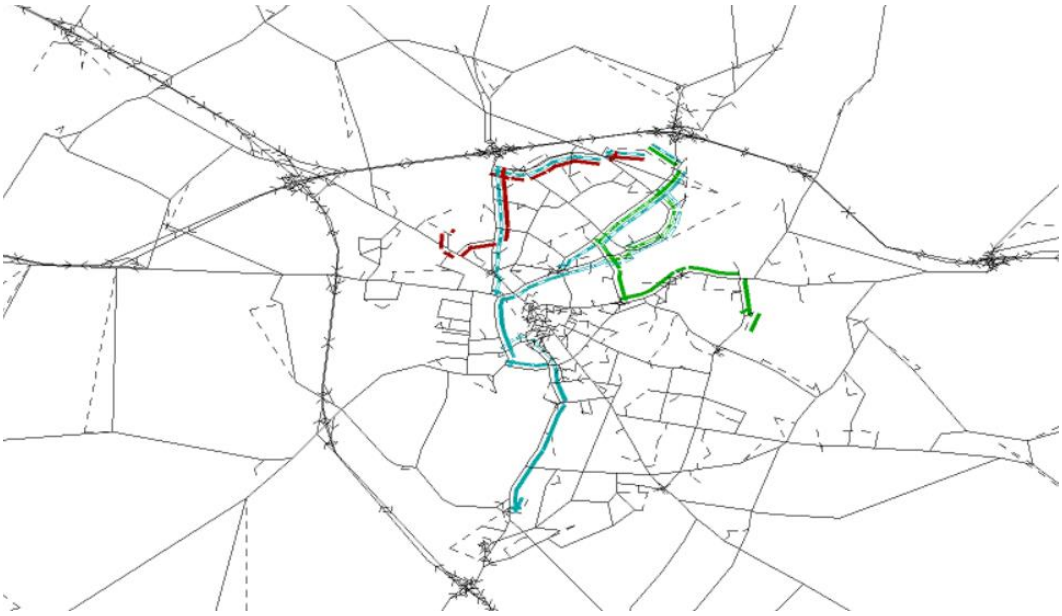
A.4.7. Airport, Cambridge – AM



A.4.8. Huntingdon Road, Cambridge – AM

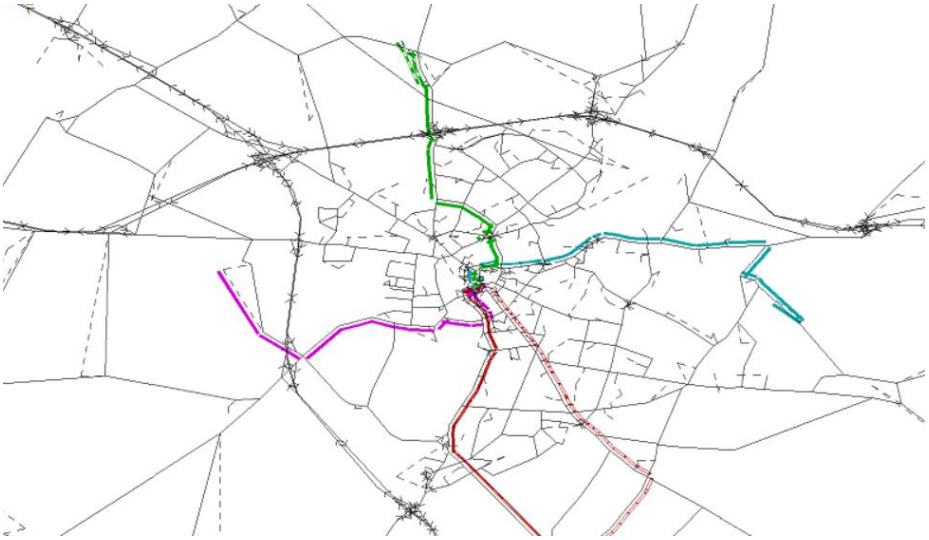


A.4.9. Science Park, Cambridge – AM

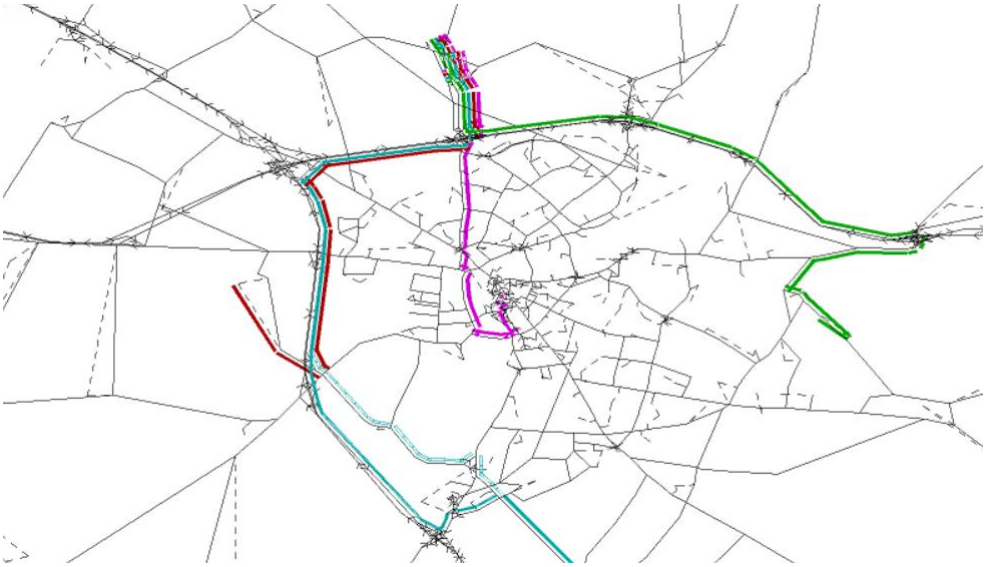


A.5. Route Choice 2019 - IP

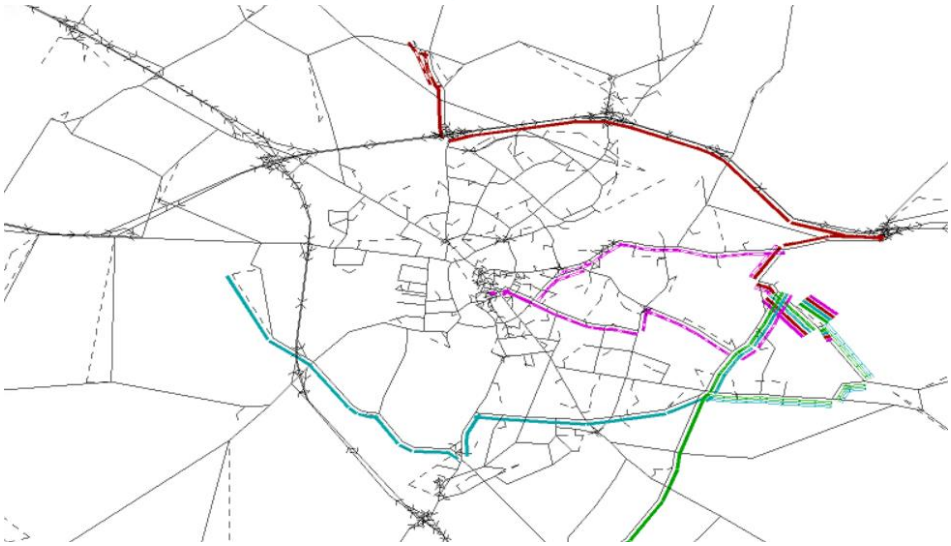
A.5.1. Centre of Cambridge (Sidney Street, Cambridge) – IP



A.5.2. North of Cambridge (Histon) – IP

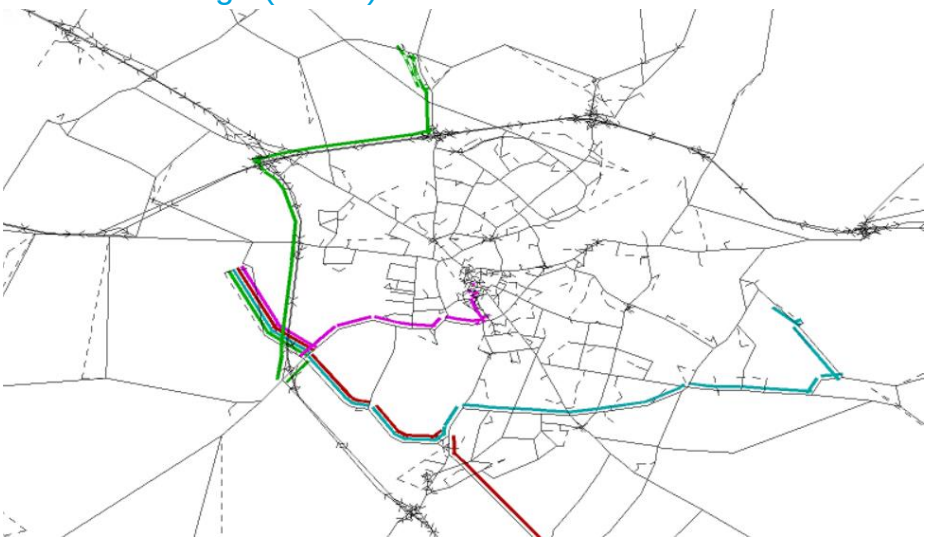


A.5.3. East of Cambridge (Teversham) – IP

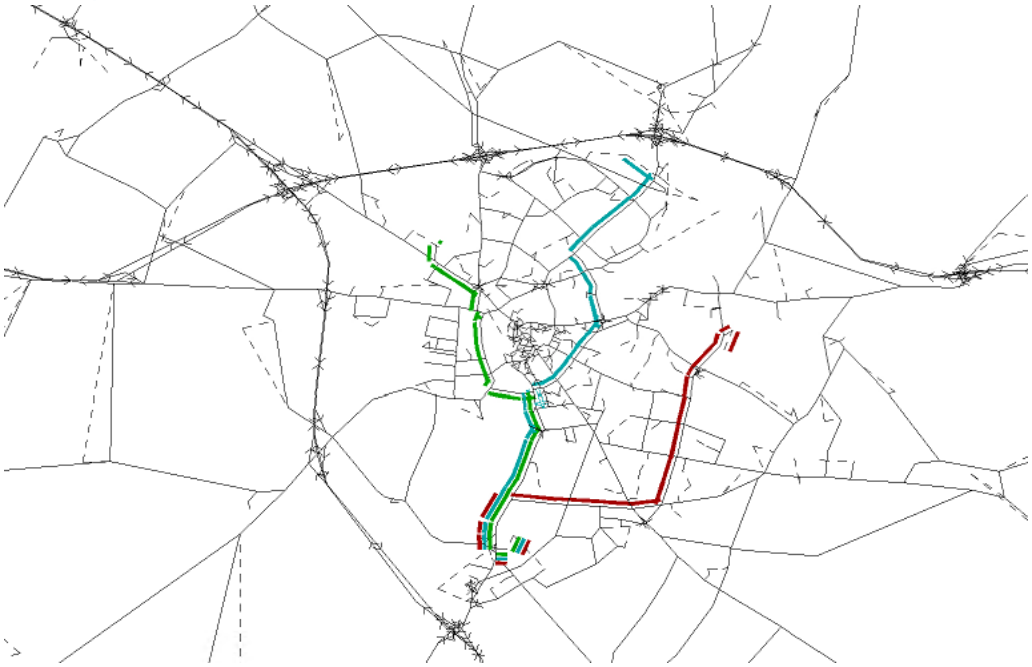


A.5.4. South of Cambridge (Great Shelford) – IP

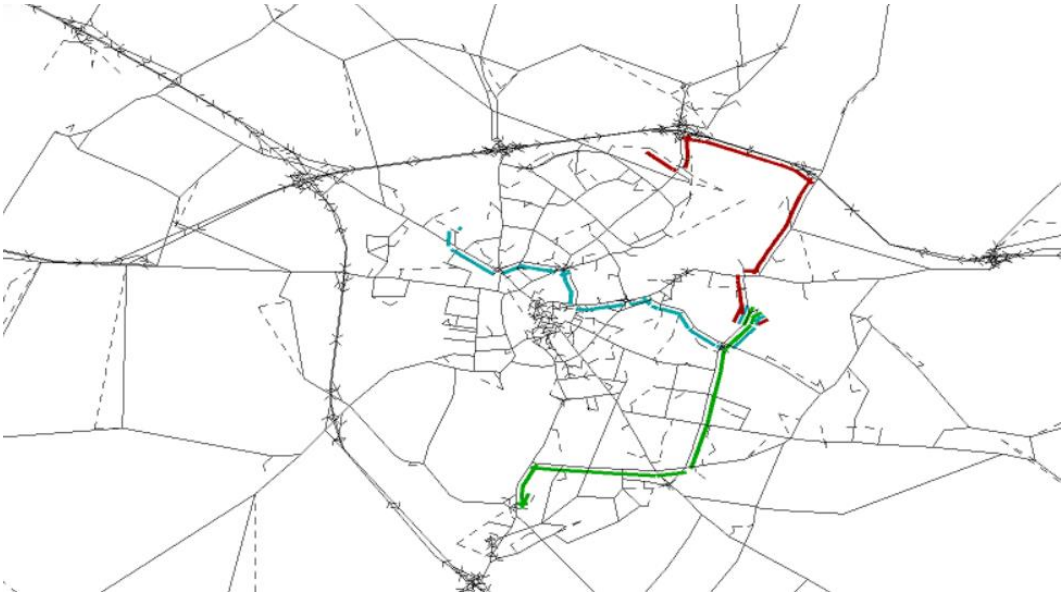
A.5.5. West of Cambridge (Coton) – IP



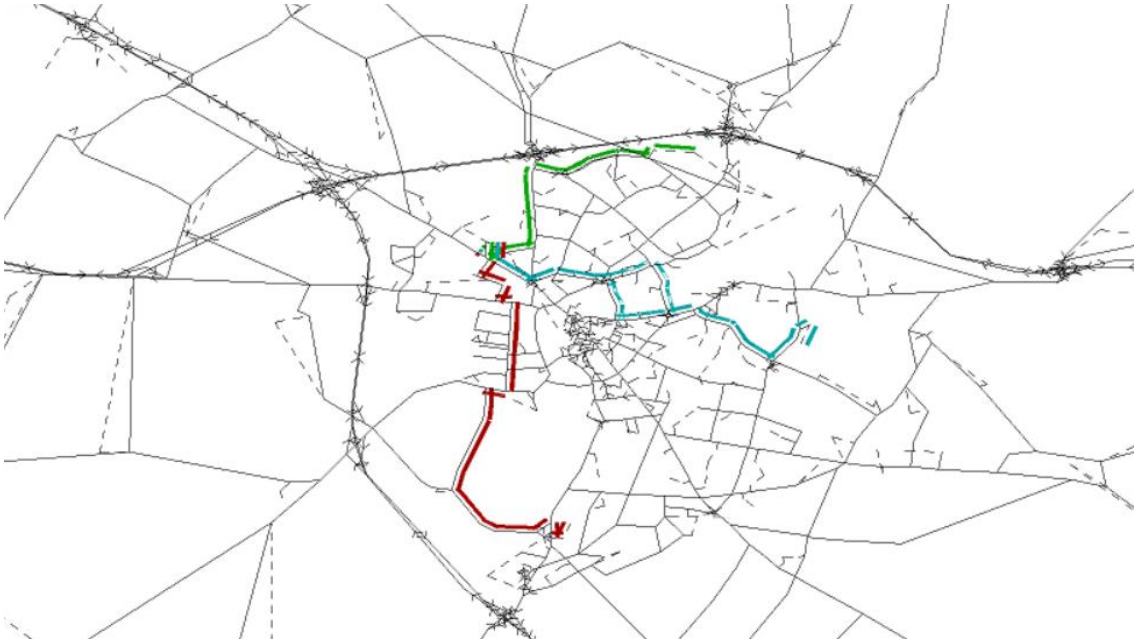
A.5.6. Trumpington, Cambridge – IP



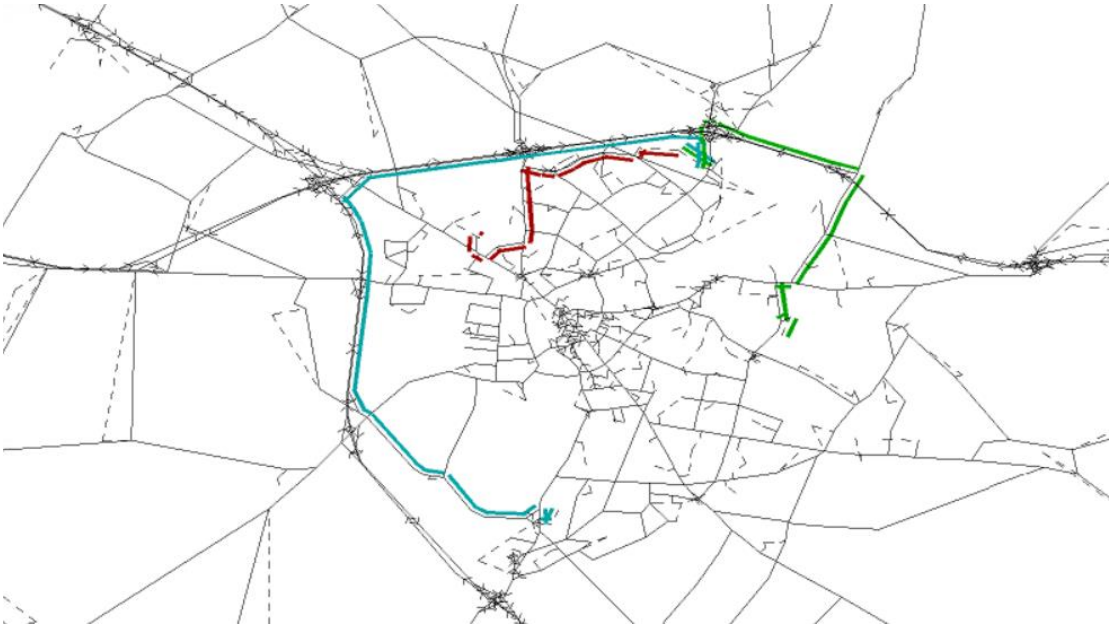
A.5.7. Airport, Cambridge – IP



A.5.8. Huntingdon Road, Cambridge – IP

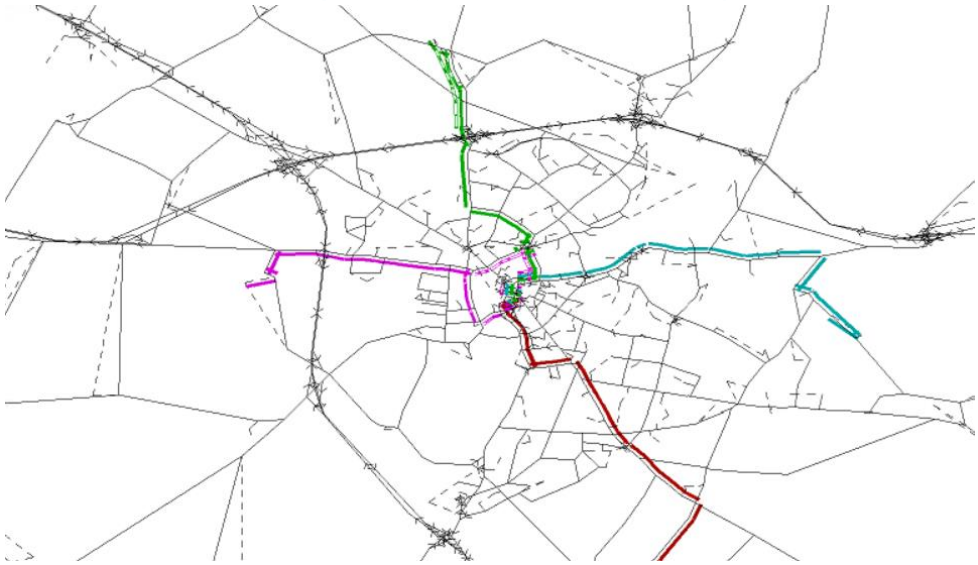


A.5.9. Science Park, Cambridge – IP

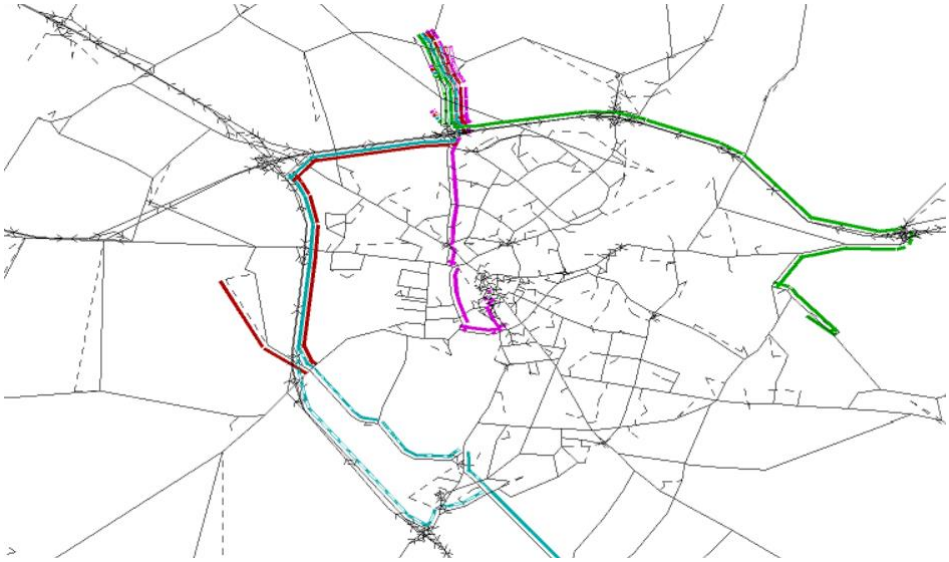


A.6. Route Choice 2019 - PM

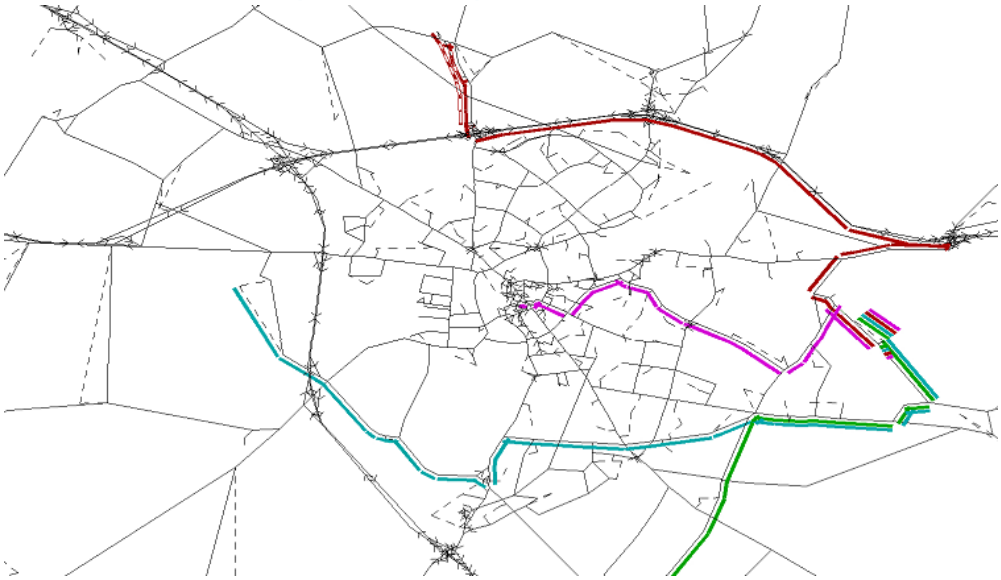
A.6.1. Centre of Cambridge (Sidney Street, Cambridge) – PM



A.6.2. North of Cambridge (Histon) – PM

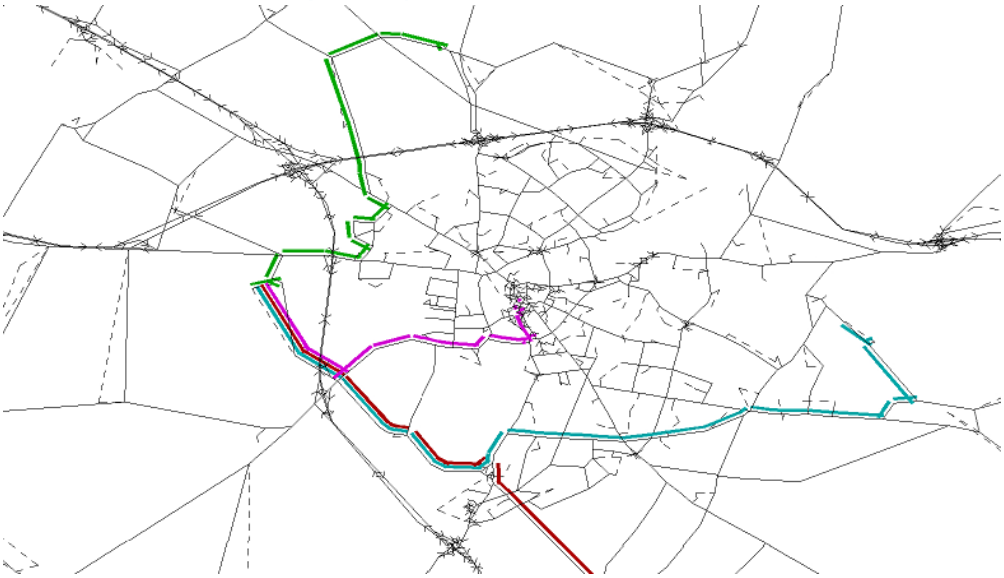


A.6.3. East of Cambridge (Teversham) – PM

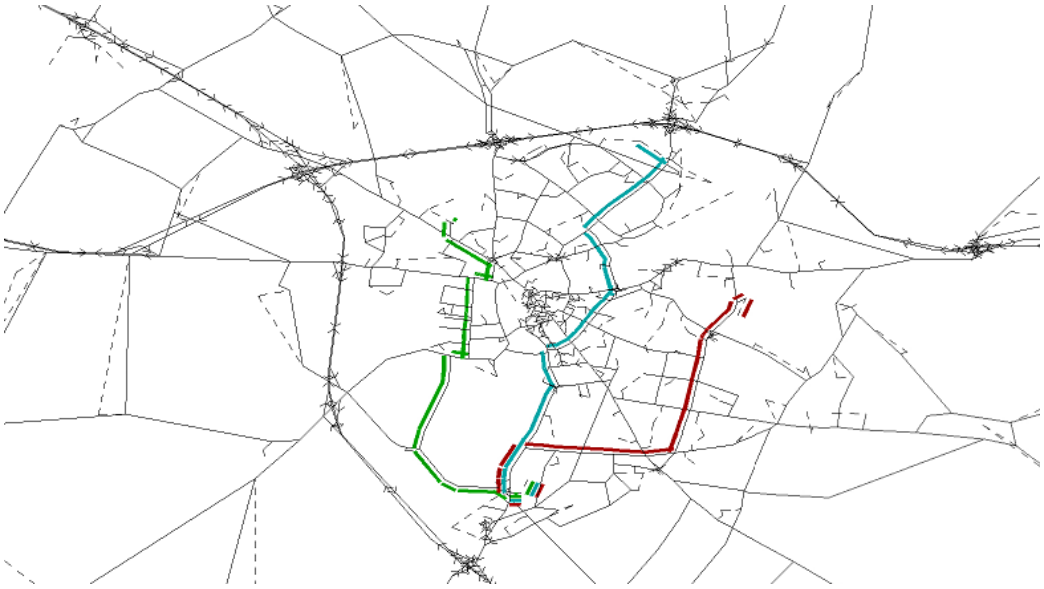


A.6.4. South of Cambridge (Great Shelford) – PM

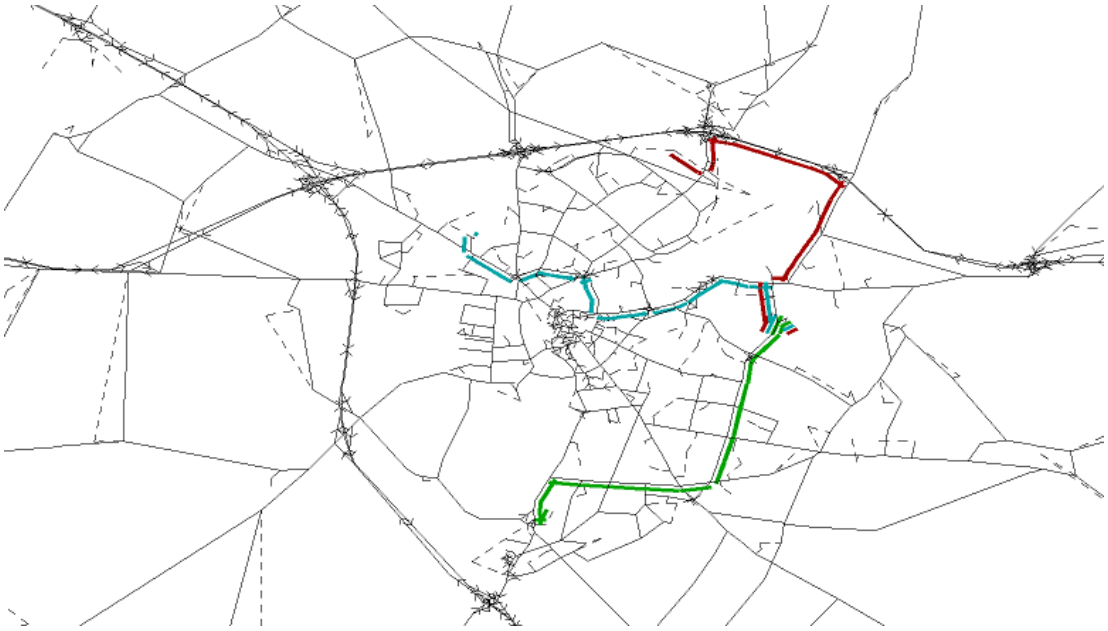
A.6.5. West of Cambridge (Coton) – PM



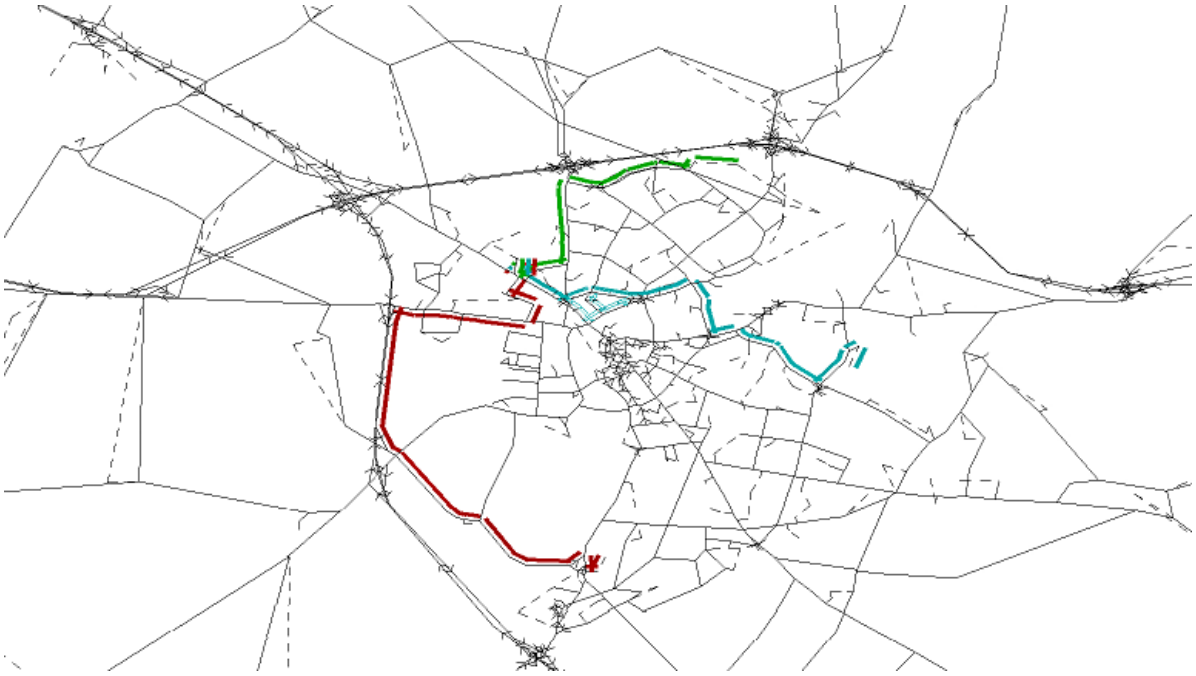
A.6.6. Trumpington, Cambridge – PM



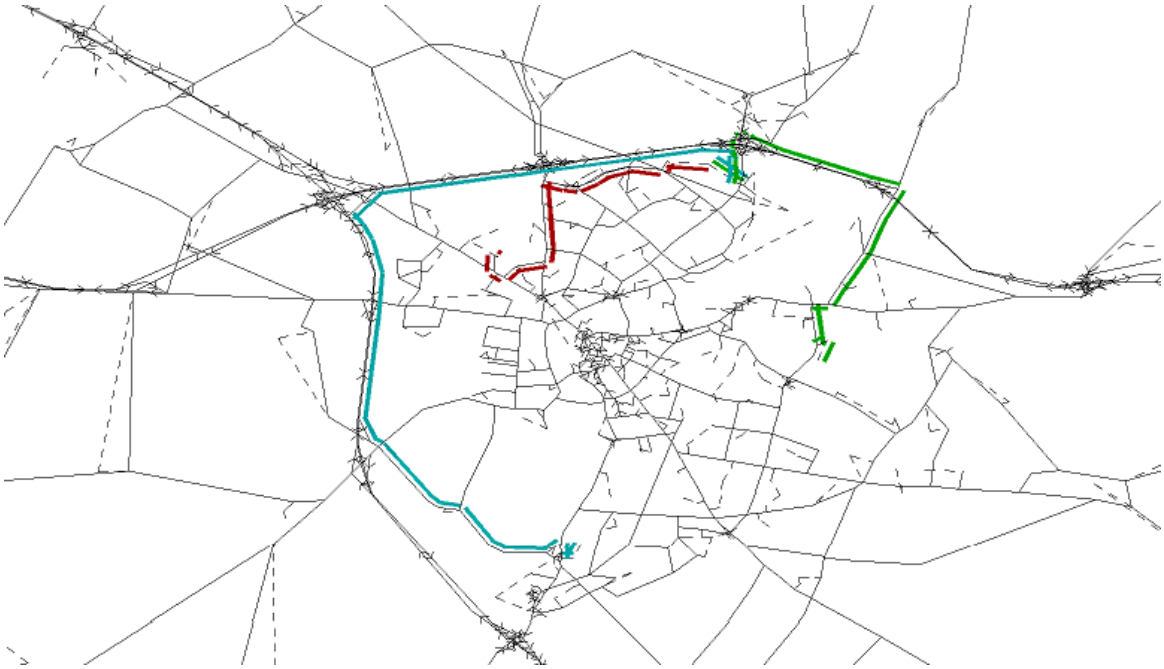
A.6.7. Airport, Cambridge – PM



A.6.8. Huntingdon Road, Cambridge – PM



A.6.9. Science Park, Cambridge – PM



Appendix B. Journey Time Validation

B.1. 2015 Journey Time Route Summaries

Table B-1 2015 AM Peak Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:21:18	00:24:30	00:18:06	00:20:50	✓
		SB	00:35:23	00:40:42	00:30:05	00:31:58	✓
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:09:30	00:10:55	00:08:04	00:09:55	✓
		WB	00:18:28	00:19:51	00:14:40	00:18:03	✓
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:54:57	01:03:12	00:46:43	00:39:21	×
		NB	00:41:37	00:47:52	00:35:23	00:36:09	✓
Cambridge 4	Impington Lane - M11	WB	00:47:23	00:54:30	00:40:17	00:39:45	×
		EB	00:44:25	00:51:05	00:37:45	00:35:31	×
Cambridge 5	A428 Rbt. - Milton Village	EB	00:46:02	00:52:57	00:39:08	00:33:25	×
		WB	00:37:33	00:43:11	00:31:55	00:32:30	✓
Cambridge 6	Elizabeth Way - Teversham Drift	EB	00:10:01	00:11:31	00:08:31	00:10:08	✓
		WB	00:14:33	00:16:44	00:12:22	00:10:09	×
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:20:54	00:24:03	00:17:46	00:14:08	×
		WB	00:12:29	00:14:21	00:10:36	00:11:50	✓
A14	Ellington - Horningsea Rd.	EB	00:49:59	00:57:28	00:42:29	00:31:41	×
		WB	00:30:10	00:34:42	00:25:39	00:39:09	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:11:59	00:13:46	00:10:11	00:13:14	✓
		WB	00:10:45	00:12:21	00:09:08	00:09:40	✓
St. Ives 2	A14 / A1096 - A1123	NB	00:05:42	00:06:34	00:04:51	00:06:30	✓
		SB	00:08:38	00:09:56	00:07:21	00:06:47	×
Ely 1	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	EB	00:05:57	00:06:50	00:05:03	00:04:08	×
		WB	00:04:42	00:05:24	00:03:59	00:04:04	✓

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:06:06	00:07:01	00:05:11	00:07:10	×
		NB	00:05:21	00:06:10	00:04:33	00:05:16	✓
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:05:45	00:06:36	00:04:53	00:05:56	✓
		SB	00:06:32	00:07:31	00:05:33	00:06:22	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:06:08	00:07:03	00:05:13	00:05:21	✓
		NB	00:03:41	00:04:14	00:03:08	00:04:50	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:15:07	00:17:23	00:12:51	00:13:46	✓
		SB	00:18:32	00:21:18	00:15:45	00:14:28	×

Table B-2 2015 IP Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:17:35	00:20:14	00:14:57	00:19:44	✓
		SB	00:18:20	00:21:06	00:15:35	00:23:02	×
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:09:32	00:10:58	00:08:06	00:10:44	✓
		WB	00:10:26	00:12:00	00:08:52	00:10:15	✓
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:29:00	00:33:21	00:24:39	00:29:36	✓
		NB	00:27:27	00:31:34	00:23:20	00:30:18	✓
Cambridge 4	Impington Lane - M11	WB	00:28:46	00:33:05	00:24:27	00:31:48	✓
		EB	00:29:50	00:34:19	00:25:22	00:30:55	✓
Cambridge 5	A428 Rbt. - Milton Village	EB	00:22:21	00:25:42	00:19:00	00:24:08	✓
		WB	00:22:27	00:25:49	00:19:05	00:24:23	✓
Cambridge 6		EB	00:09:04	00:10:25	00:07:42	00:10:10	✓

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
	Elizabeth Way - Teversham Drift	WB	00:09:58	00:11:28	00:08:28	00:09:33	✓
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:09:06	00:10:28	00:07:44	00:10:04	✓
		WB	00:09:26	00:10:51	00:08:01	00:10:18	✓
A14	Ellington - Horningsea Rd.	EB	00:26:07	00:30:02	00:22:12	00:32:32	×
		WB	00:26:38	00:30:37	00:22:38	00:34:00	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:08:06	00:09:19	00:06:53	00:11:01	×
		WB	00:08:22	00:09:38	00:07:07	00:09:39	×
St. Ives 2	A14 / A1096 - A1123	NB	00:04:51	00:05:35	00:04:07	00:05:45	✓
		SB	00:04:52	00:05:36	00:04:08	00:05:40	✓
Ely 1	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	EB	00:05:20	00:06:07	00:04:32	00:04:06	×
		WB	00:04:22	00:05:01	00:03:42	00:04:00	✓
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:05:19	00:06:07	00:04:31	00:04:54	✓
		NB	00:04:36	00:05:17	00:03:54	00:06:51	×
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:05:57	00:06:51	00:05:04	00:05:55	✓
		SB	00:05:38	00:06:28	00:04:47	00:05:48	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:03:46	00:04:20	00:03:12	00:05:02	×
		NB	00:03:42	00:04:15	00:03:08	00:04:49	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:13:16	00:15:15	00:11:16	00:13:07	✓
		SB	00:13:09	00:15:08	00:11:11	00:13:13	✓

Table B-3 2015 PM Peak Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:24:12	00:27:49	00:20:34	00:22:11	✓
		SB	00:24:22	00:28:01	00:20:42	00:21:38	✓
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:15:59	00:18:23	00:13:35	00:11:32	×
		WB	00:11:46	00:13:32	00:10:00	00:09:55	×
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:45:17	00:52:04	00:38:29	00:39:21	✓
		NB	00:51:20	00:59:02	00:43:38	00:37:34	×
Cambridge 4	Impington Lane - M11	WB	00:43:44	00:50:18	00:37:11	00:42:43	✓
		EB	00:39:04	00:44:56	00:33:12	00:37:29	✓
Cambridge 5	A428 Rbt. - Milton Village	EB	00:31:35	00:36:19	00:26:51	00:32:51	✓
		WB	00:34:08	00:39:15	00:29:01	00:26:03	×
Cambridge 6	Elizabeth Way - Teversham Drift	EB	00:10:34	00:12:09	00:08:59	00:10:33	✓
		WB	00:11:51	00:13:38	00:10:04	00:10:46	✓
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:22:05	00:25:24	00:18:46	00:10:38	×
		WB	00:19:56	00:22:56	00:16:57	00:14:33	×
A14	Ellington - Horningsea Rd.	EB	00:27:47	00:31:57	00:23:37	00:39:36	×
		WB	00:35:52	00:41:15	00:30:29	00:47:35	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:10:56	00:12:34	00:09:17	00:11:11	✓
		WB	00:09:25	00:10:49	00:08:00	00:10:15	✓
St. Ives 2	A14 / A1096 - A1123	NB	00:13:30	00:15:31	00:11:28	00:08:38	×
		SB	00:07:35	00:08:44	00:06:27	00:05:47	×
Ely 1		EB	00:06:42	00:07:43	00:05:42	00:04:10	×

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	WB	00:04:39	00:05:21	00:03:57	00:04:05	✓
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:05:11	00:05:58	00:04:25	00:04:59	✓
		NB	00:05:06	00:05:51	00:04:20	00:06:45	×
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:08:13	00:09:27	00:06:59	00:06:37	×
		SB	00:05:32	00:06:22	00:04:43	00:05:57	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:03:43	00:04:17	00:03:10	00:05:09	×
		NB	00:03:47	00:04:21	00:03:13	00:05:04	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:16:39	00:19:09	00:14:09	00:14:05	×
		SB	00:16:37	00:19:07	00:14:08	00:14:16	✓

B.2. 2019 Journey Time Route Summaries

Table B-4 2019 AM Peak Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:21:54	00:25:12	00:18:37	00:20:42	✓
		SB	00:31:52	00:36:39	00:27:05	00:34:05	✓
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:10:03	00:11:34	00:08:33	00:09:44	✓
		WB	00:19:32	00:22:28	00:16:37	00:21:10	✓
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:52:23	01:00:15	00:44:32	00:43:36	×
		NB	00:51:48	00:59:34	00:44:02	00:41:04	×
Cambridge 4	Impington Lane - M11	WB	00:45:53	00:52:46	00:39:00	00:42:54	✓
		EB	00:43:00	00:49:27	00:36:33	00:41:37	✓
Cambridge 5	A428 Rbt. - Milton Village	EB	00:55:21	01:03:39	00:47:02	00:40:36	×
		WB	00:37:52	00:43:33	00:32:11	00:35:50	✓
Cambridge 6	Elizabeth Way - Teversham Drift	EB	00:11:04	00:12:44	00:09:24	00:10:29	✓
		WB	00:15:35	00:17:55	00:13:15	00:14:18	✓
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:19:08	00:22:00	00:16:16	00:19:49	✓
		WB	00:13:51	00:15:56	00:11:46	00:11:58	✓
A14	Ellington - Horningsea Rd.	EB	01:02:19	01:11:40	00:52:58	00:42:47	×
		WB	00:34:53	00:40:06	00:29:39	00:46:13	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:13:57	00:16:02	00:11:51	00:14:36	✓
		WB	00:06:30	00:07:29	00:05:32	00:09:27	×
St. Ives 2	A14 / A1096 - A1123	NB	00:05:21	00:06:10	00:04:33	00:07:04	×
		SB	00:05:54	00:06:48	00:05:01	00:07:34	×
Ely 1		EB	00:05:47	00:06:39	00:04:55	00:04:08	×

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	WB	00:04:53	00:05:37	00:04:09	00:04:04	✓
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:07:07	00:08:11	00:06:03	00:05:56	×
		NB	00:06:31	00:07:29	00:05:32	00:04:27	×
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:06:09	00:07:05	00:05:14	00:06:01	✓
		SB	00:06:58	00:08:01	00:05:55	00:06:44	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:05:26	00:06:15	00:04:37	00:05:23	✓
		NB	00:03:24	00:03:54	00:02:53	00:04:52	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:14:06	00:16:13	00:11:59	00:13:46	✓
		SB	00:17:43	00:20:22	00:15:03	00:14:51	×

Table B-5 2019 IP Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:17:57	00:20:39	00:15:15	00:19:41	✓
		SB	00:18:41	00:21:29	00:15:53	00:22:35	×
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:09:40	00:11:07	00:08:13	00:10:56	✓
		WB	00:11:06	00:12:46	00:09:26	00:10:32	✓
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:30:51	00:35:29	00:26:14	00:31:16	✓
		NB	00:30:10	00:34:41	00:25:38	00:33:11	✓
Cambridge 4	Impington Lane - M11	WB	00:32:09	00:36:58	00:27:19	00:32:22	✓
		EB	00:31:02	00:35:41	00:26:22	00:31:28	✓
Cambridge 5		EB	00:23:39	00:27:11	00:20:06	00:25:47	✓

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
	A428 Rbt. - Milton Village	WB	00:24:06	00:27:43	00:20:29	00:25:11	✓
Cambridge 6	Elizabeth Way - Teversham Drift	EB	00:10:03	00:11:33	00:08:32	00:10:30	✓
		WB	00:11:11	00:12:51	00:09:30	00:12:16	✓
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:09:12	00:10:35	00:07:49	00:10:08	✓
		WB	00:09:38	00:11:04	00:08:11	00:10:35	✓
A14	Ellington - Horningsea Rd.	EB	00:37:08	00:42:43	00:31:34	00:41:28	✓
		WB	00:35:52	00:41:15	00:30:29	00:43:26	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:08:18	00:09:33	00:07:04	00:11:16	×
		WB	00:05:10	00:05:56	00:04:23	00:09:44	×
St. Ives 2	A14 / A1096 - A1123	NB	00:03:42	00:04:16	00:03:09	00:06:43	×
		SB	00:03:41	00:04:14	00:03:08	00:06:31	×
Ely 1	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	EB	00:05:23	00:06:11	00:04:34	00:04:07	×
		WB	00:04:17	00:04:56	00:03:39	00:04:02	✓
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:06:31	00:07:29	00:05:32	00:04:55	×
		NB	00:05:10	00:05:56	00:04:23	00:05:01	✓
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:06:11	00:07:07	00:05:16	00:06:01	✓
		SB	00:05:53	00:06:46	00:05:00	00:05:57	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:03:57	00:04:33	00:03:22	00:05:04	×
		NB	00:03:27	00:03:59	00:02:56	00:04:50	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:13:31	00:15:32	00:11:29	00:13:06	✓
		SB	00:14:00	00:16:06	00:11:54	00:13:17	✓

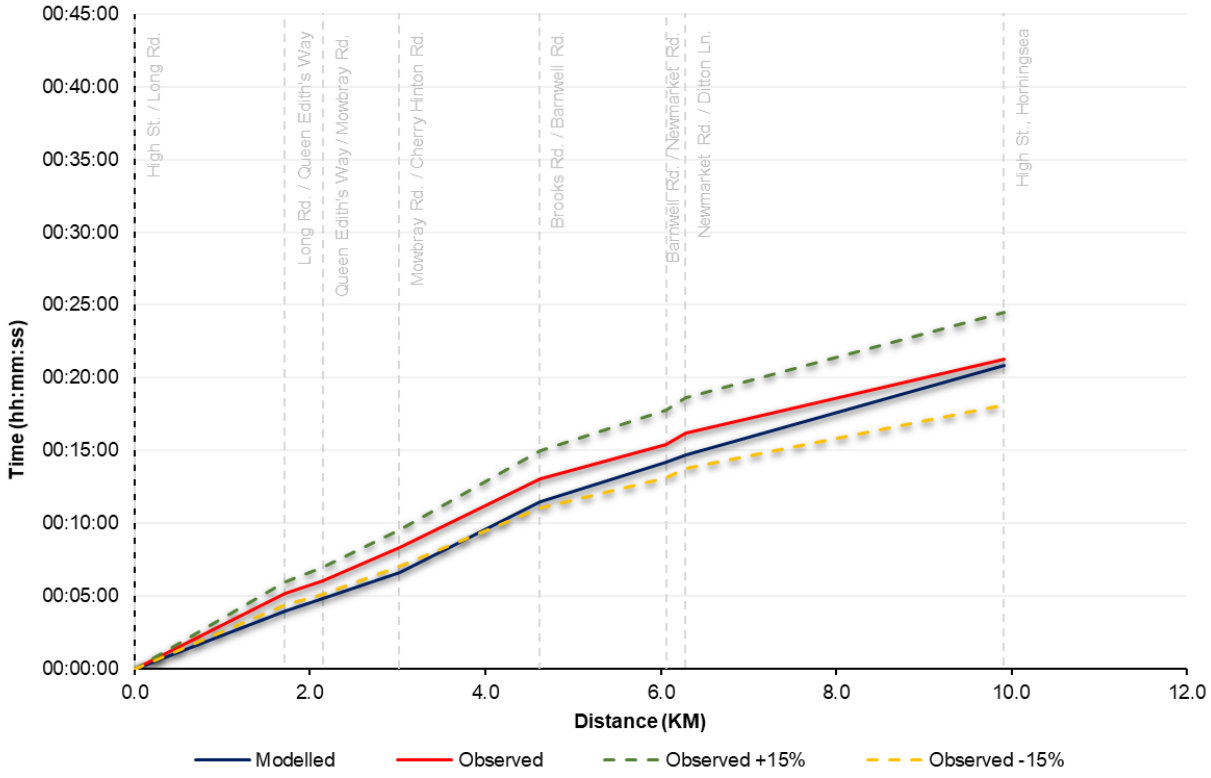
Table B-6 2019 PM Peak Journey Time Validation

Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Cambridge 1	Trumpington Rd. - Priory Rd., Horningsea	NB	00:32:18	00:37:08	00:27:27	00:22:12	×
		SB	00:24:19	00:27:58	00:20:40	00:21:19	✓
Cambridge 2	Barnwell Rd. / Wadloes Rbt. - High Ditch Rd.	EB	00:19:14	00:22:07	00:16:21	00:13:18	×
		WB	00:13:49	00:15:53	00:11:45	00:13:57	✓
Cambridge 3	Oakington Rd. - Fendon Rd.	SB	00:53:04	01:01:01	00:45:06	00:40:38	×
		NB	00:53:05	01:01:03	00:45:08	00:42:13	×
Cambridge 4	Impington Lane - M11	WB	00:40:23	00:46:26	00:34:19	00:44:30	✓
		EB	00:41:26	00:47:39	00:35:13	00:39:10	✓
Cambridge 5	A428 Rbt. - Milton Village	EB	00:36:20	00:41:47	00:30:53	00:33:59	✓
		WB	00:33:52	00:38:57	00:28:48	00:28:28	×
Cambridge 6	Elizabeth Way - Teversham Drift	EB	00:14:35	00:16:47	00:12:24	00:12:13	×
		WB	00:12:44	00:14:38	00:10:49	00:12:09	✓
Cambridge 7	Hauxton Rd. (M11) - Lensfield Rd.	EB	00:16:35	00:19:04	00:14:06	00:10:42	×
		WB	00:24:44	00:28:26	00:21:01	00:17:35	×
A14	Ellington - Horningsea Rd.	EB	00:40:14	00:46:16	00:34:12	00:47:32	×
		WB	00:44:27	00:51:07	00:37:47	00:59:03	×
St. Ives 1	A141 / B1514 Rbt. - A1123 / B1040 Rbt.	EB	00:09:35	00:11:02	00:08:09	00:10:16	✓
		WB	00:06:18	00:07:15	00:05:22	00:10:45	×
St. Ives 2	A14 / A1096 - A1123	NB	00:09:52	00:11:21	00:08:23	00:11:21	×
		SB	00:06:11	00:07:07	00:05:15	00:06:13	✓
Ely 1	St Mary's St. / Lynn Rd. - A142 / Witchford Rd.	EB	00:06:41	00:07:41	00:05:41	00:04:10	×
		WB	00:04:48	00:05:31	00:04:05	00:04:08	✓

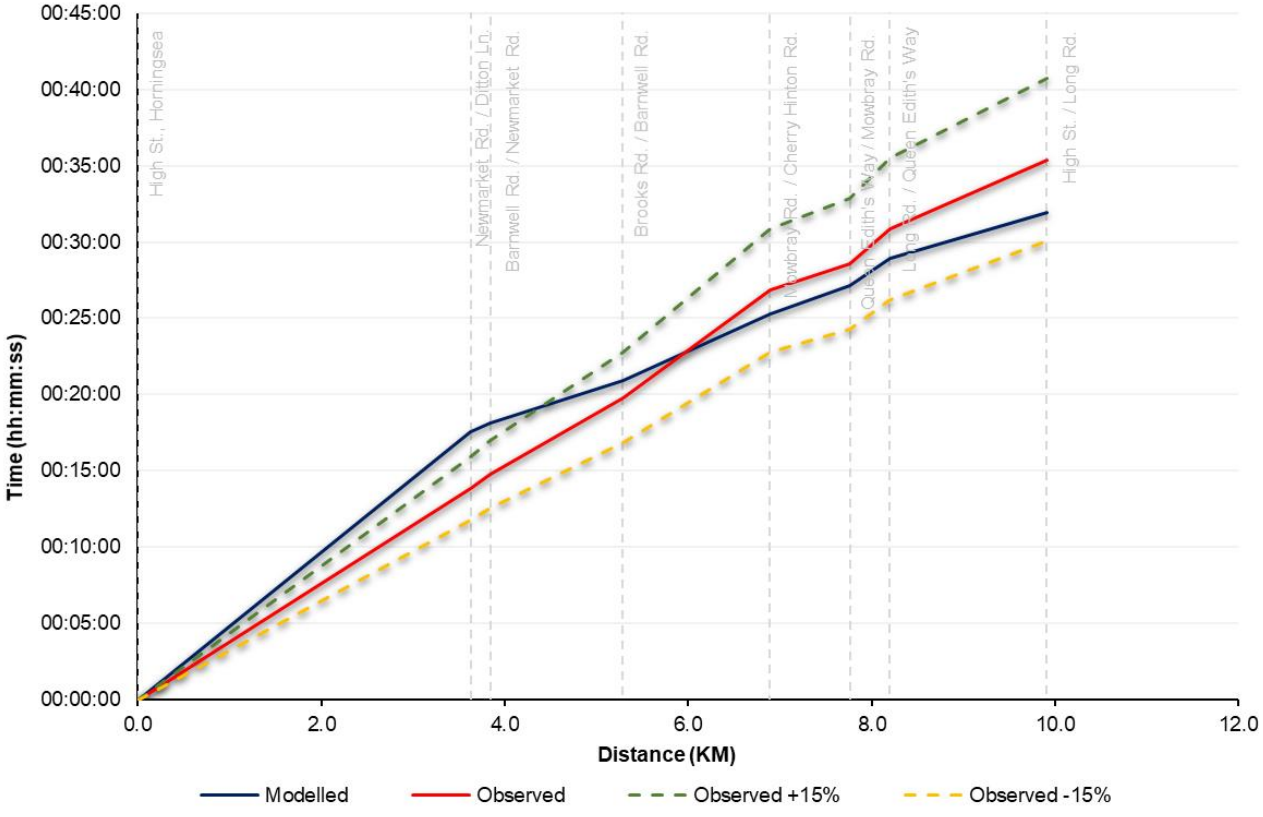
Journey Time Route	Description	Direction	Observed	Obs. +15%	Obs. -15%	Modelled	Compliance with WebTAG
Ely 2	A10 / B1411 Rbt. - A142 / Station Rd. Rbt.	SB	00:06:05	00:06:59	00:05:10	00:04:54	×
		NB	00:06:13	00:07:09	00:05:17	00:04:56	×
Ely 3	Wilburton Rd. Rbt. - Cambridge Rd.	NB	00:08:08	00:09:21	00:06:55	00:06:39	×
		SB	00:05:46	00:06:38	00:04:54	00:06:03	✓
St. Neots 1	A1 Little Paxton - A421	SB	00:04:08	00:04:46	00:03:31	00:05:13	×
		NB	00:03:13	00:03:42	00:02:44	00:05:11	×
St. Neots 2	A1 B465 - A1 Wyboston via Cambridge Rd.	NB	00:16:39	00:19:09	00:14:09	00:14:06	×
		SB	00:18:04	00:20:47	00:15:22	00:14:22	×

B.3. 2015 Journey Time Route Graphs

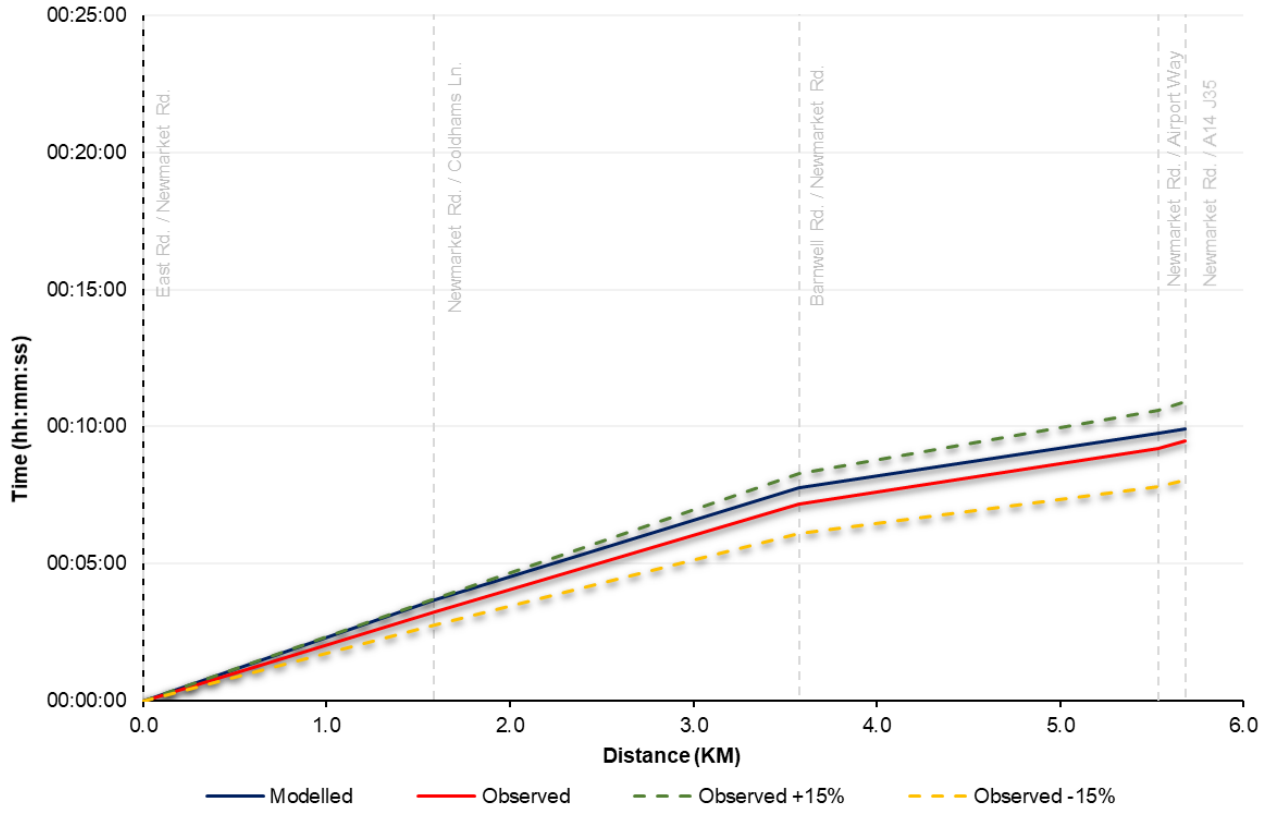
B.3.1. 2015 C-01: Trumpington Rd. to Priory Rd., Horningsea – AM



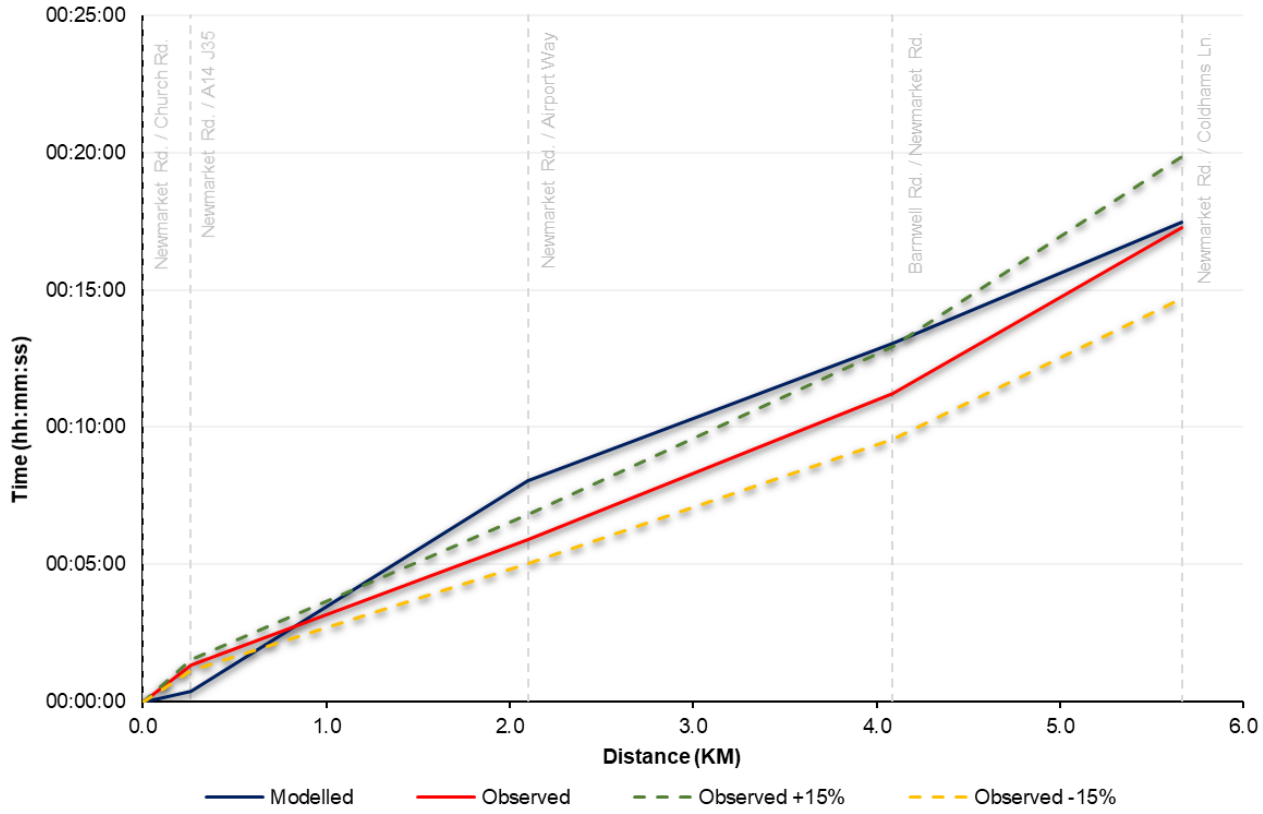
B.3.2. 2015 C-02: Priory Rd., Horningsea to Trumpington Rd. – AM



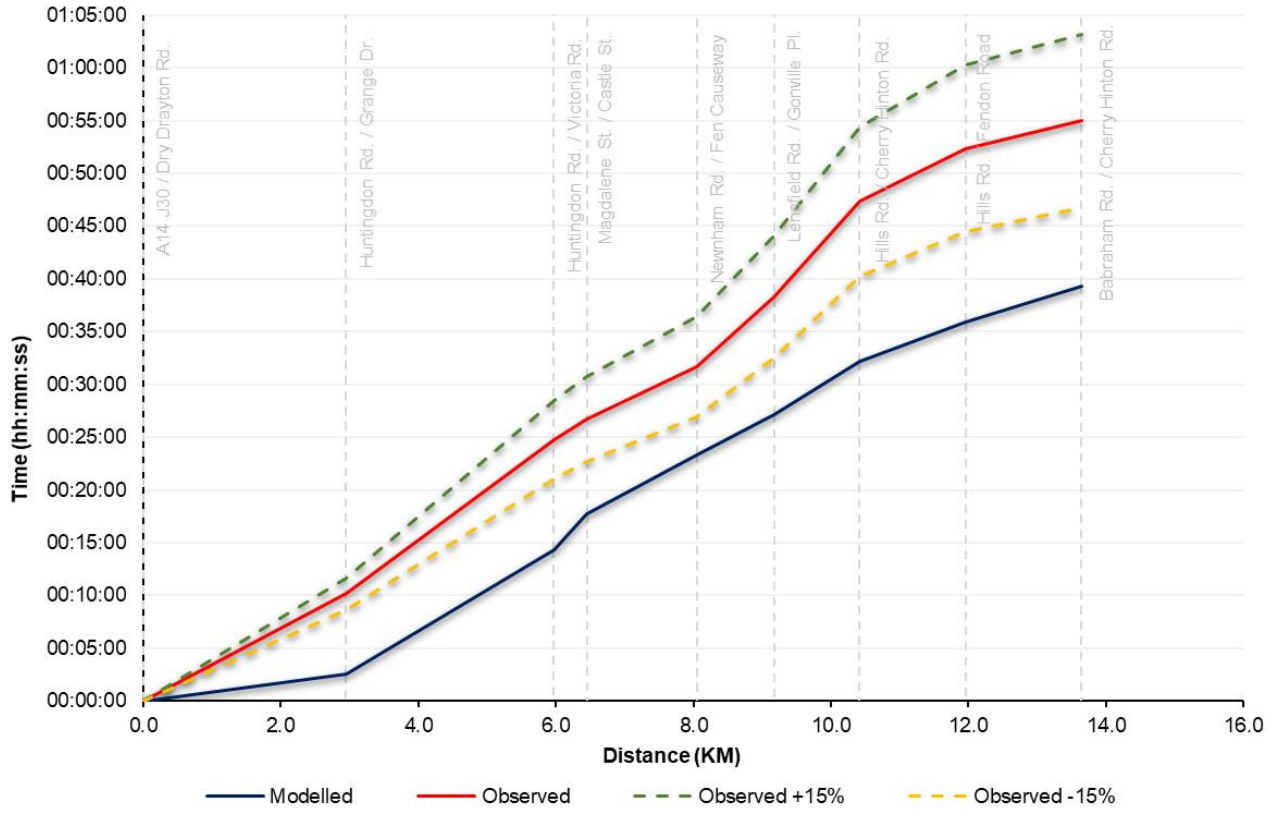
B.3.3. 2015 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – AM



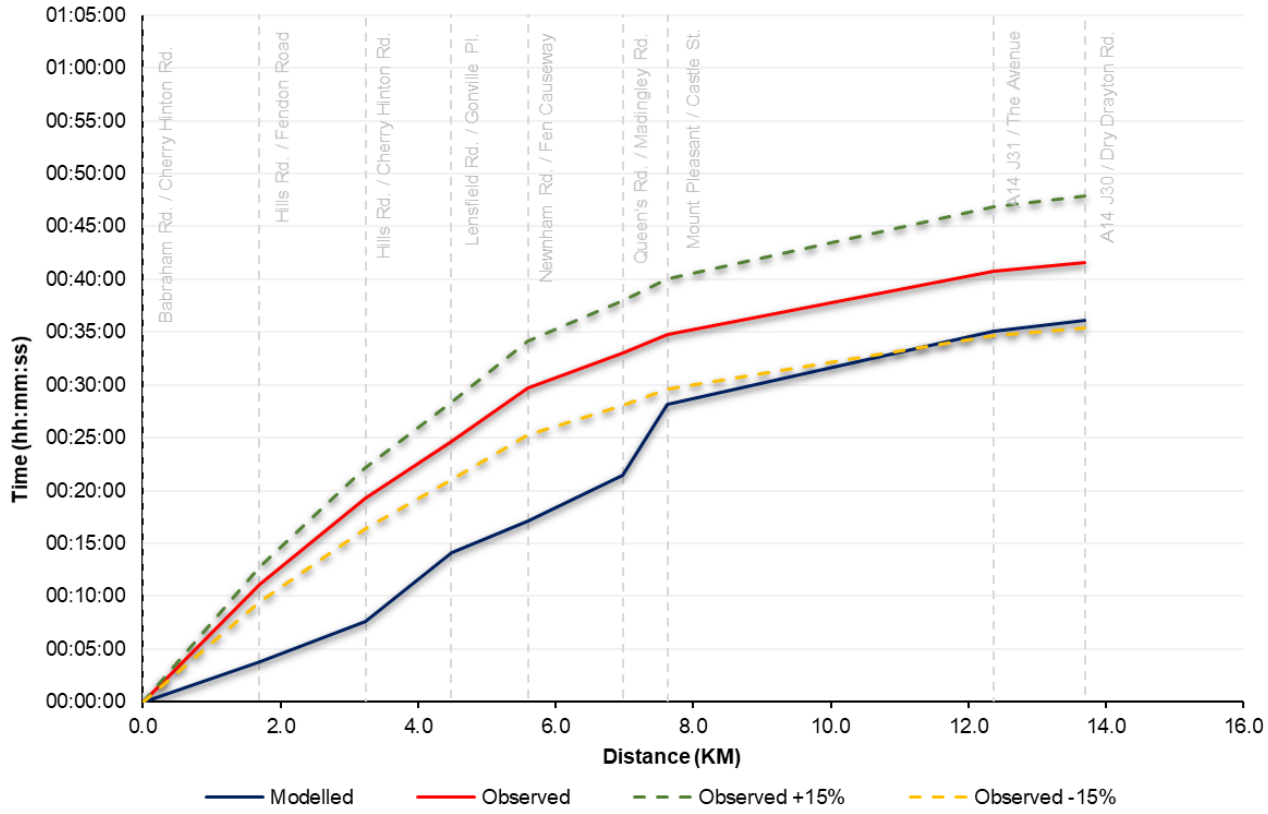
B.3.4. 2015 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – AM



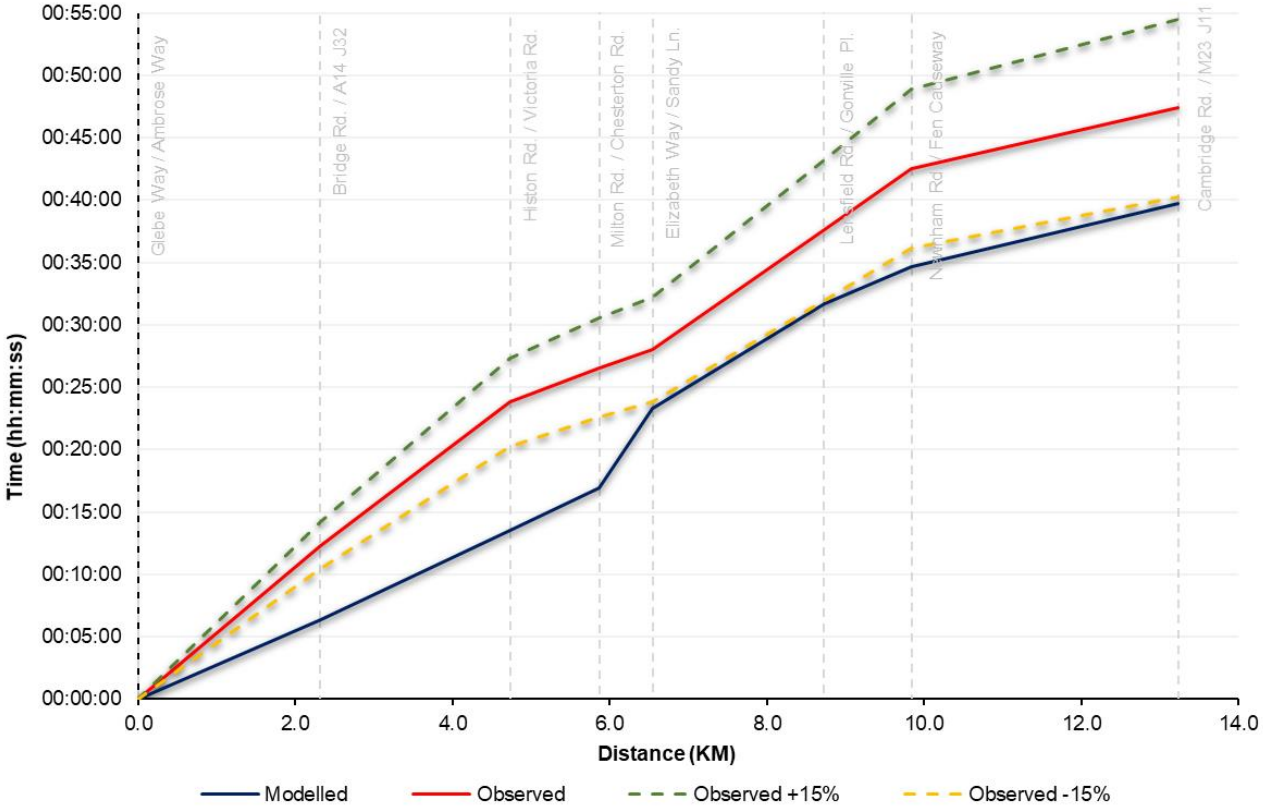
B.3.5. 2015 C-05: Oakington Rd. to Fendon Rd. – AM



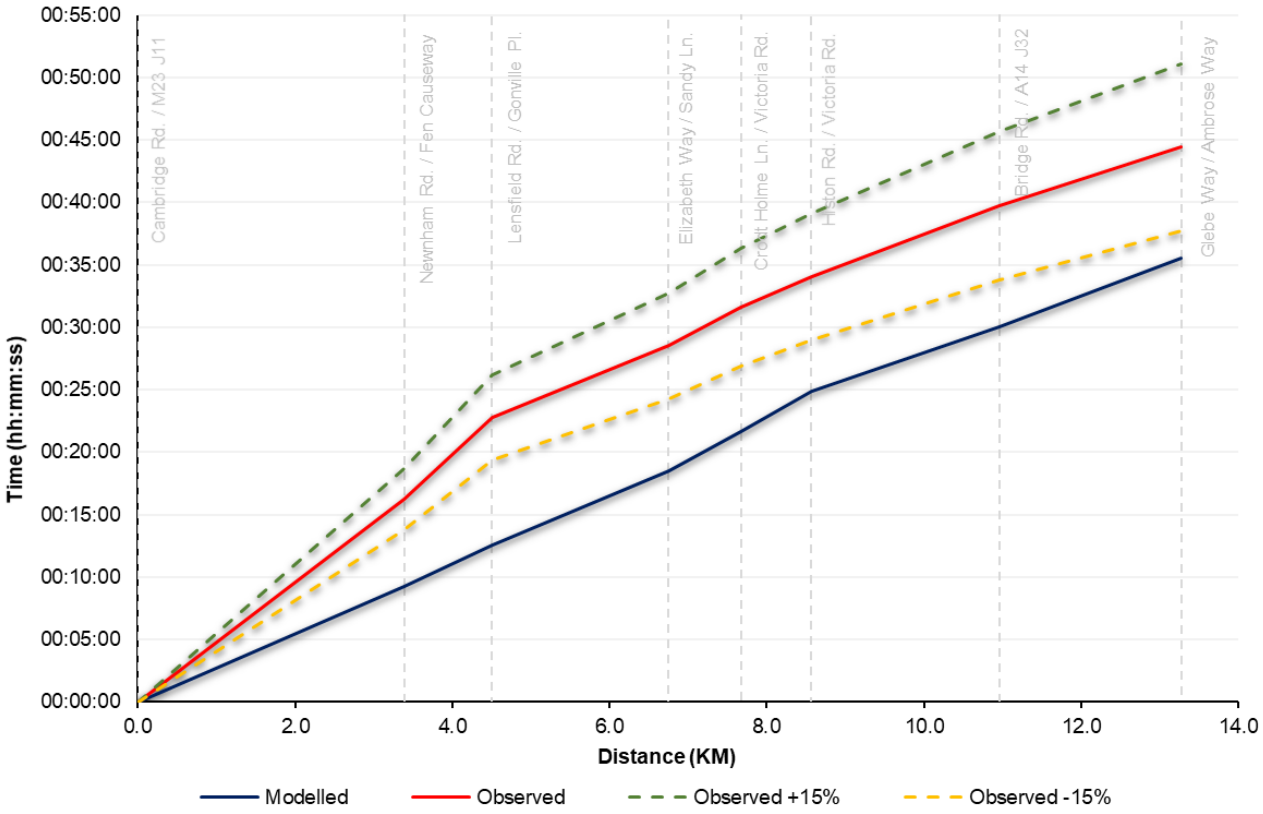
B.3.6. 2015 C-06: Fendon Rd. to Oakington Rd. – AM



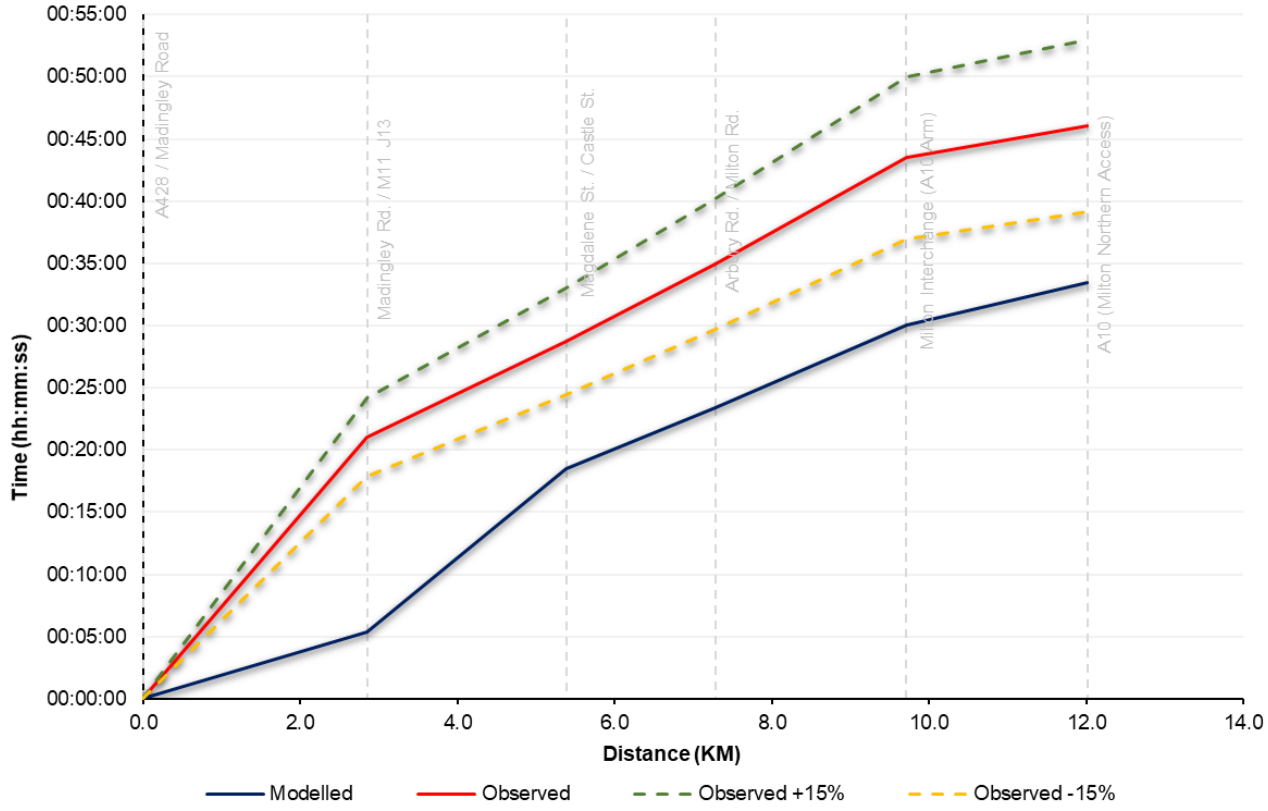
B.3.7. 2015 C-07: Impington Ln. to M11 – AM



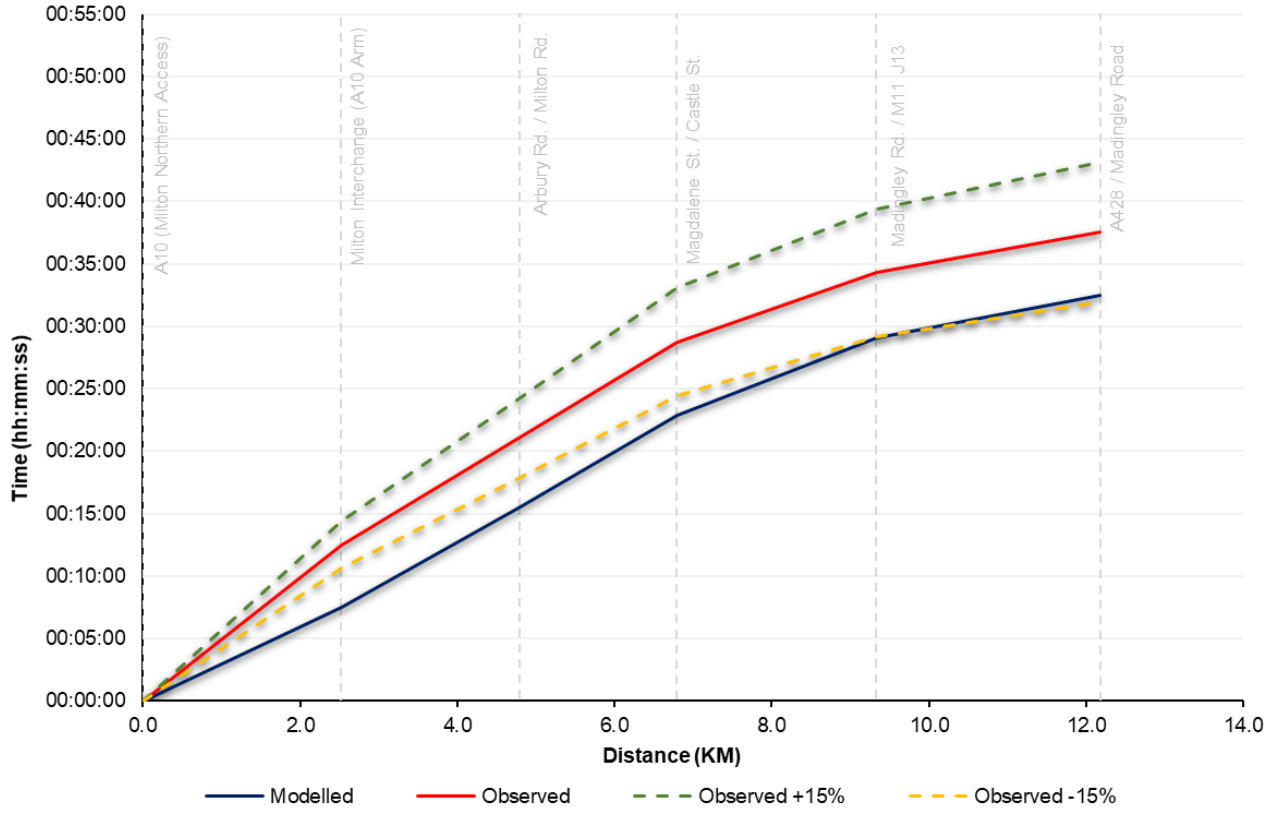
B.3.8. 2015 C-08: M11 to Impington Ln. – AM



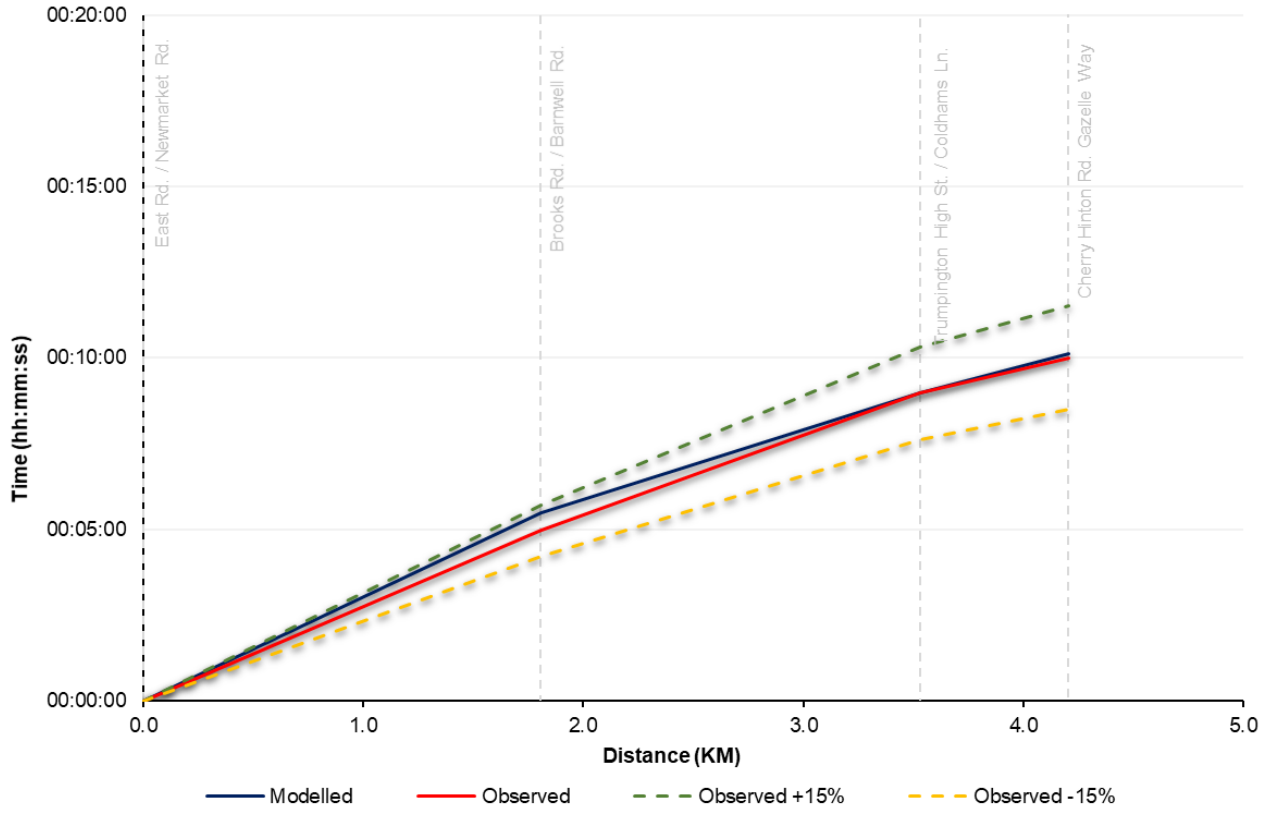
B.3.9. 2015 C-09: A428 Rbt. to Milton – AM



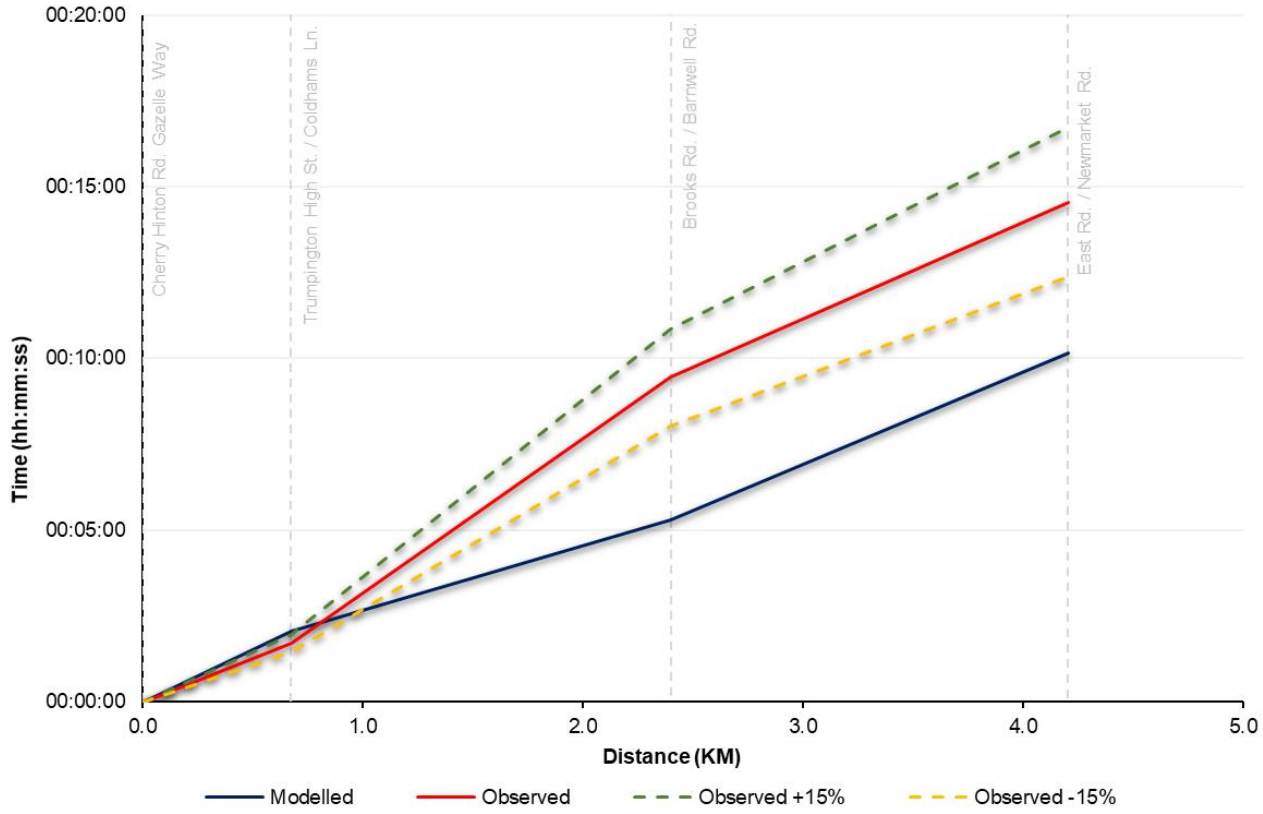
B.3.10. 2015 C-10: Milton to A428 Rbt. – AM



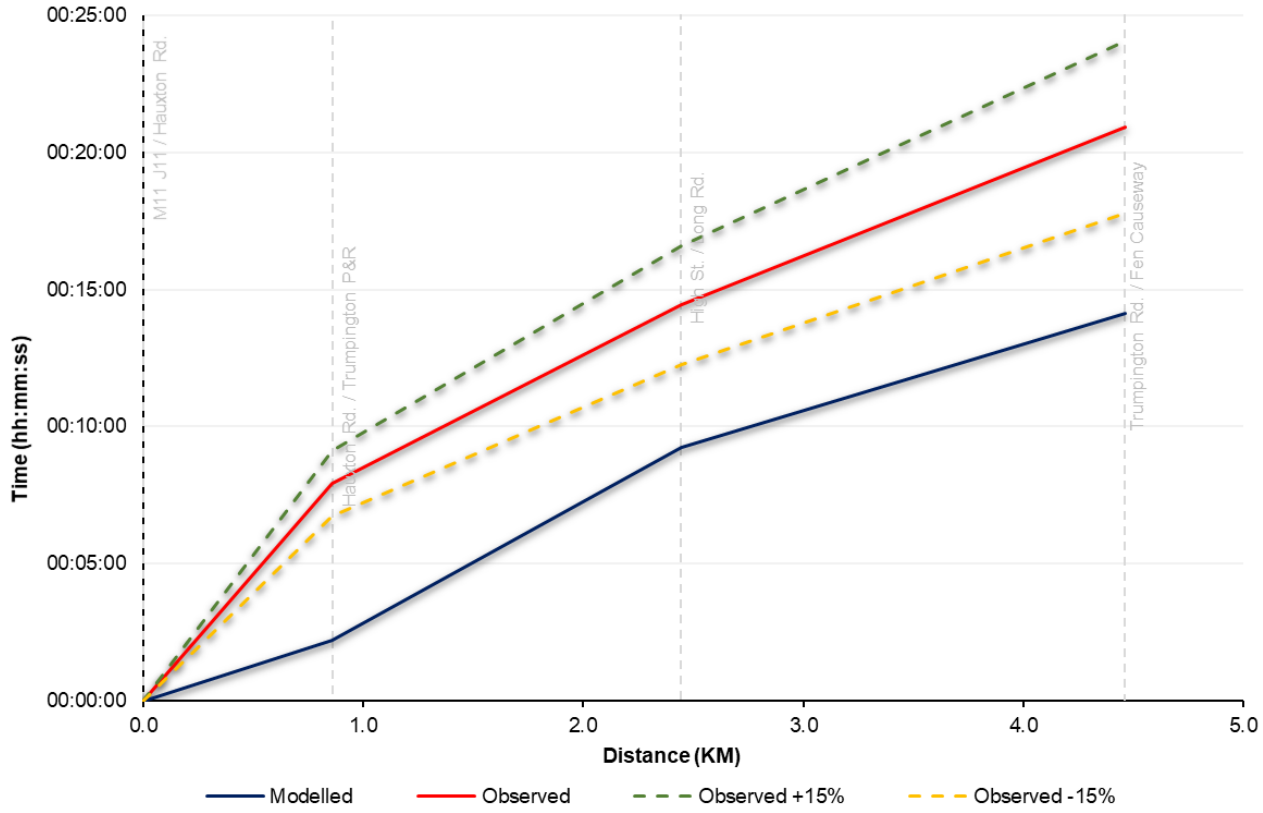
B.3.11. 2015 C-11: Elizabeth Way to Teversham Drift – AM



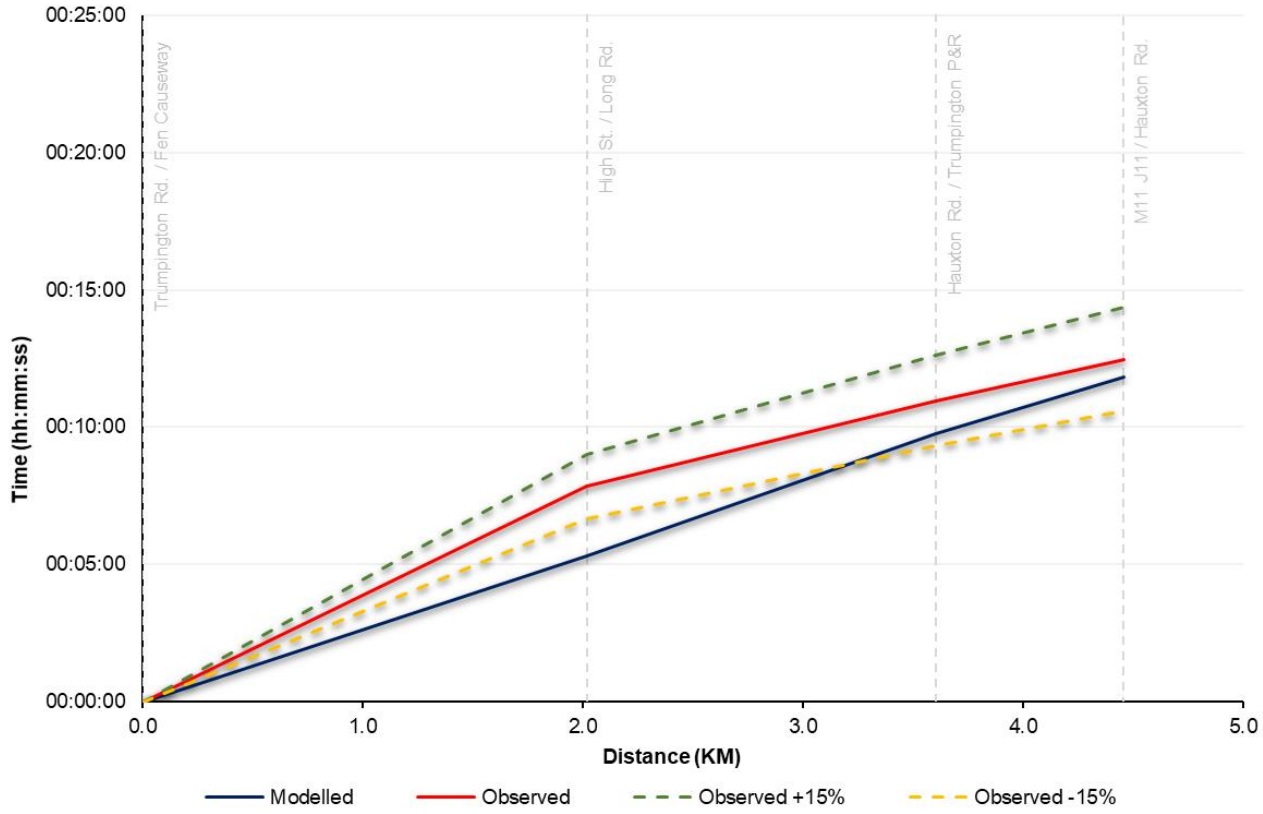
B.3.12. 2015 C-12: Teversham Drift to Elizabeth Way – AM



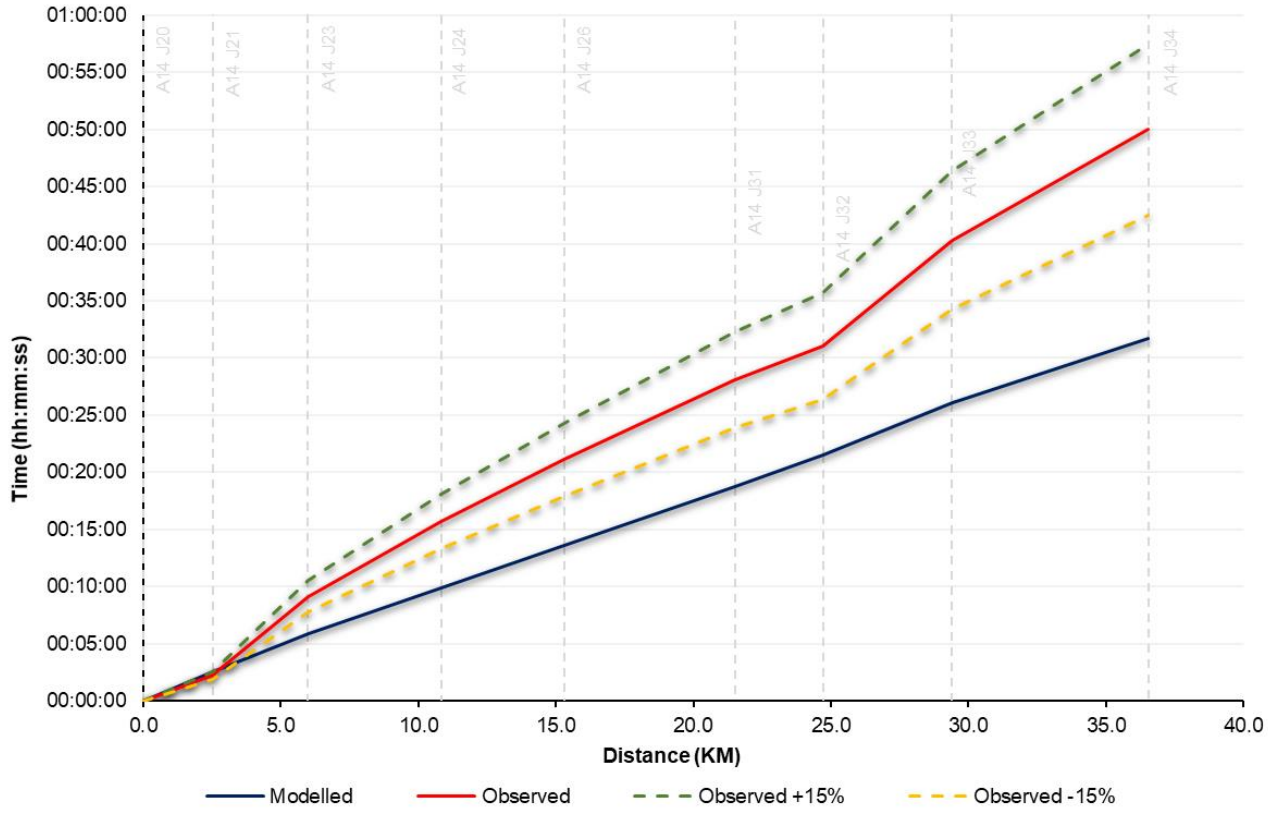
B.3.13. 2015 C-13: Hauxton Rd. (M11) to Lensfield Rd. – AM



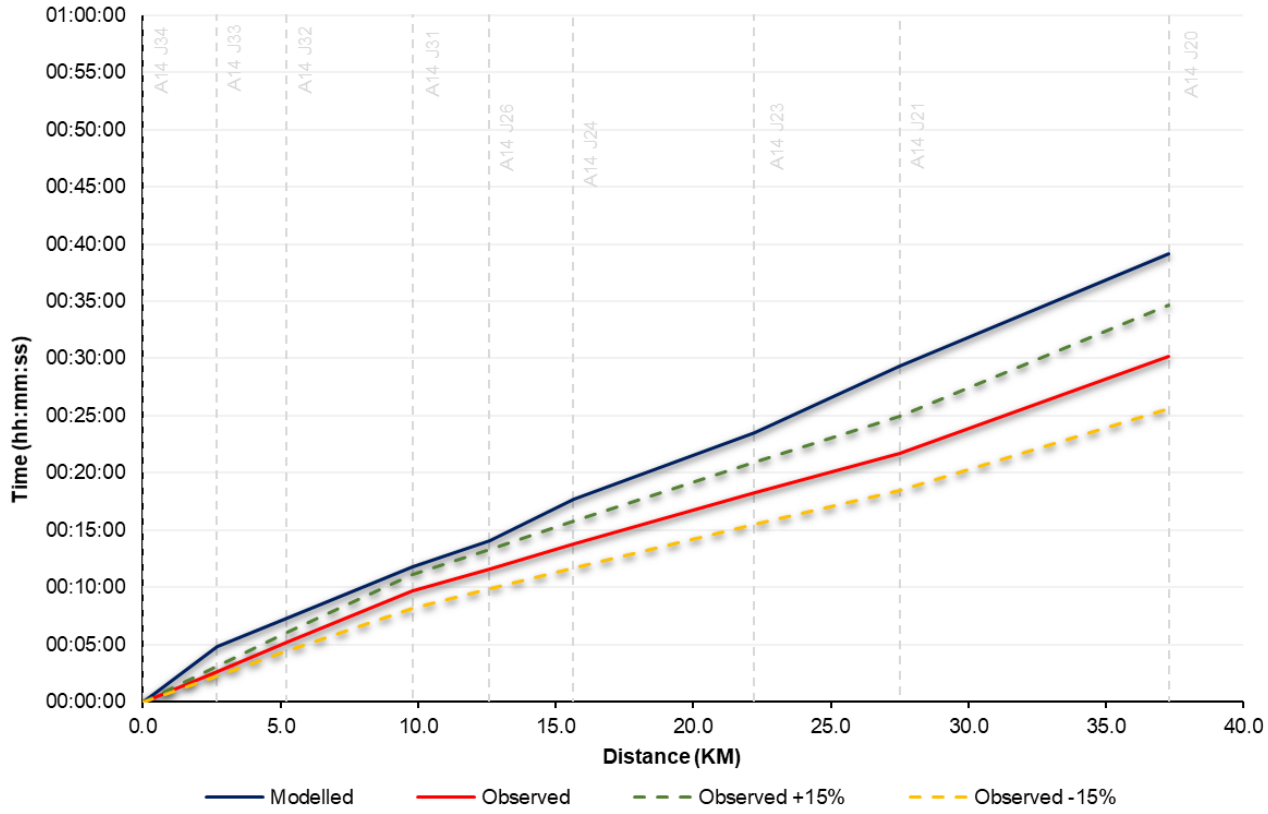
B.3.14. 2015 C-14: Lensfield Rd. to Hauxton Rd. (M11) – AM



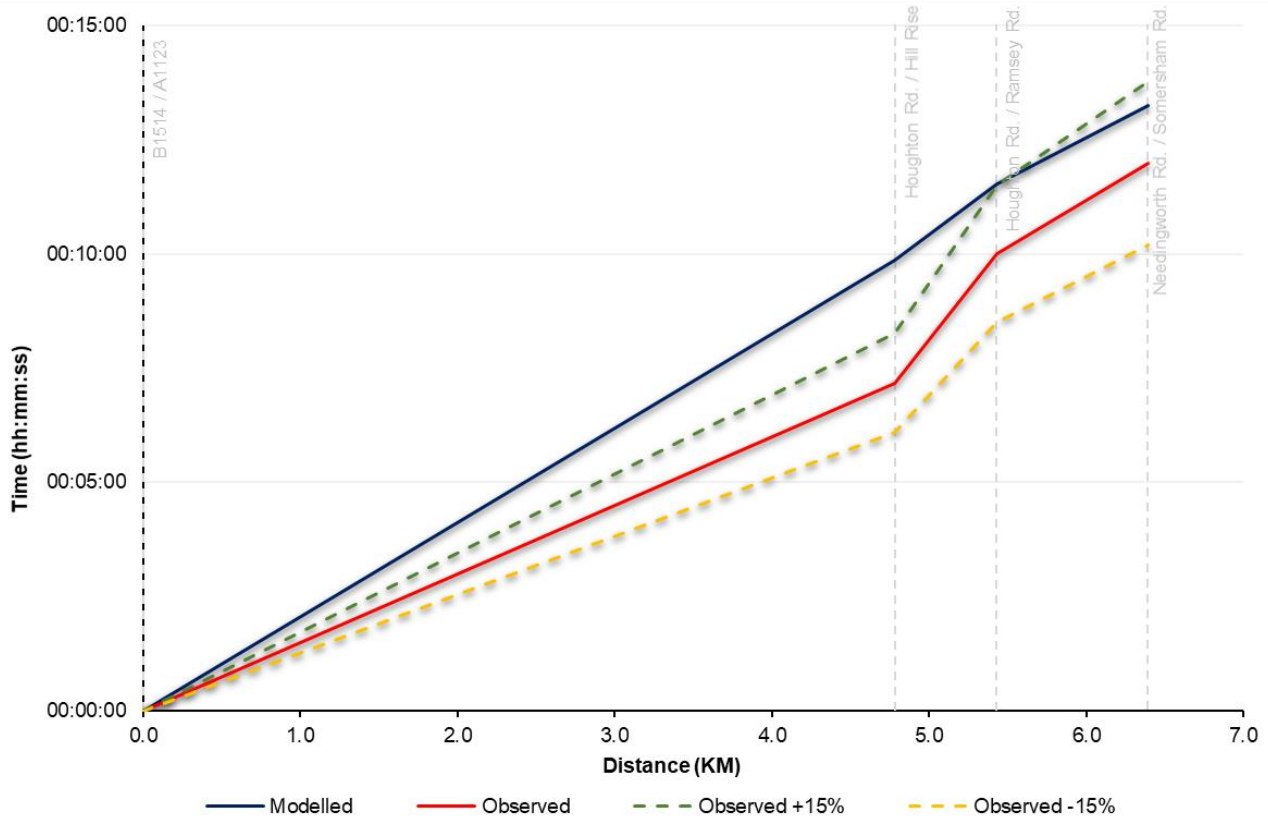
B.3.15. 2015 A14-01: Ellington to Horningsea Rd. – AM



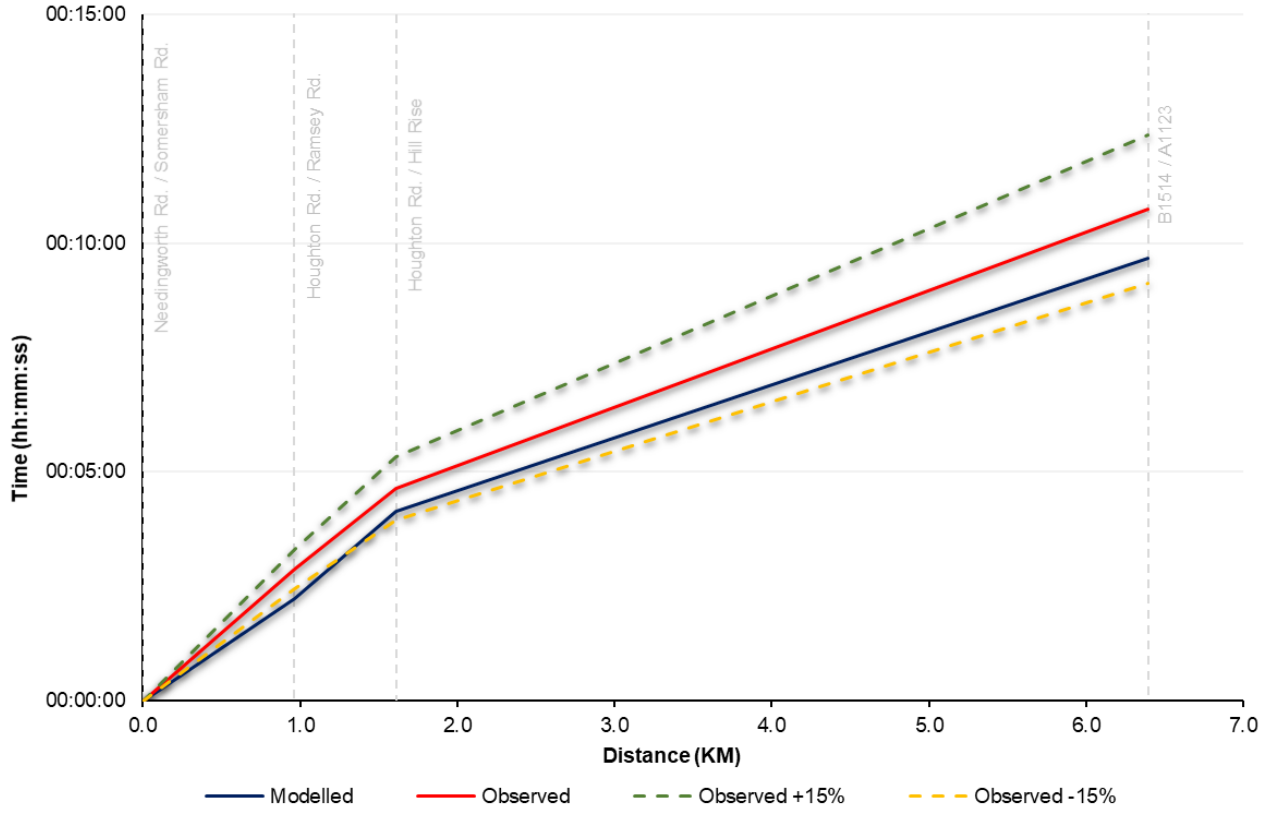
B.3.16. 2015 A14-02: Horningsea Rd. to Ellington – AM



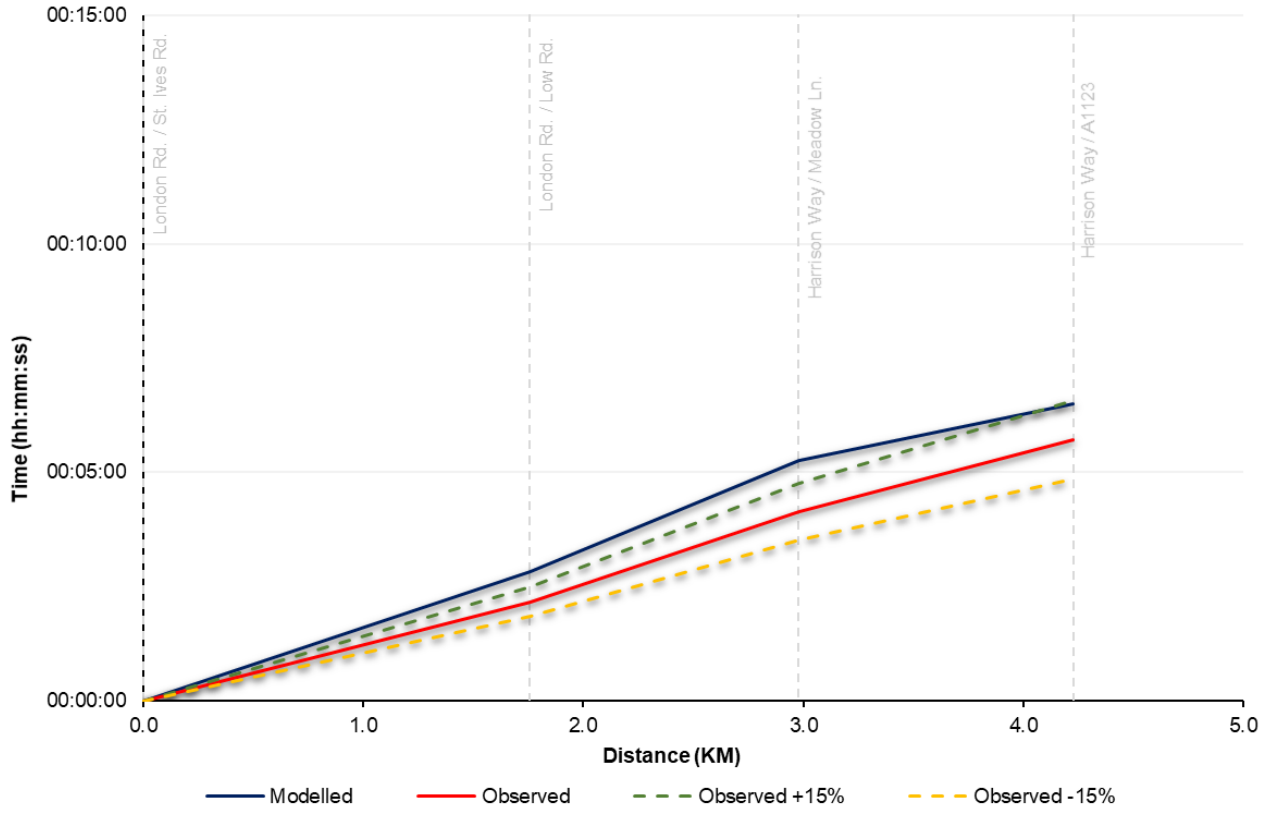
B.3.17. 2015 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – AM



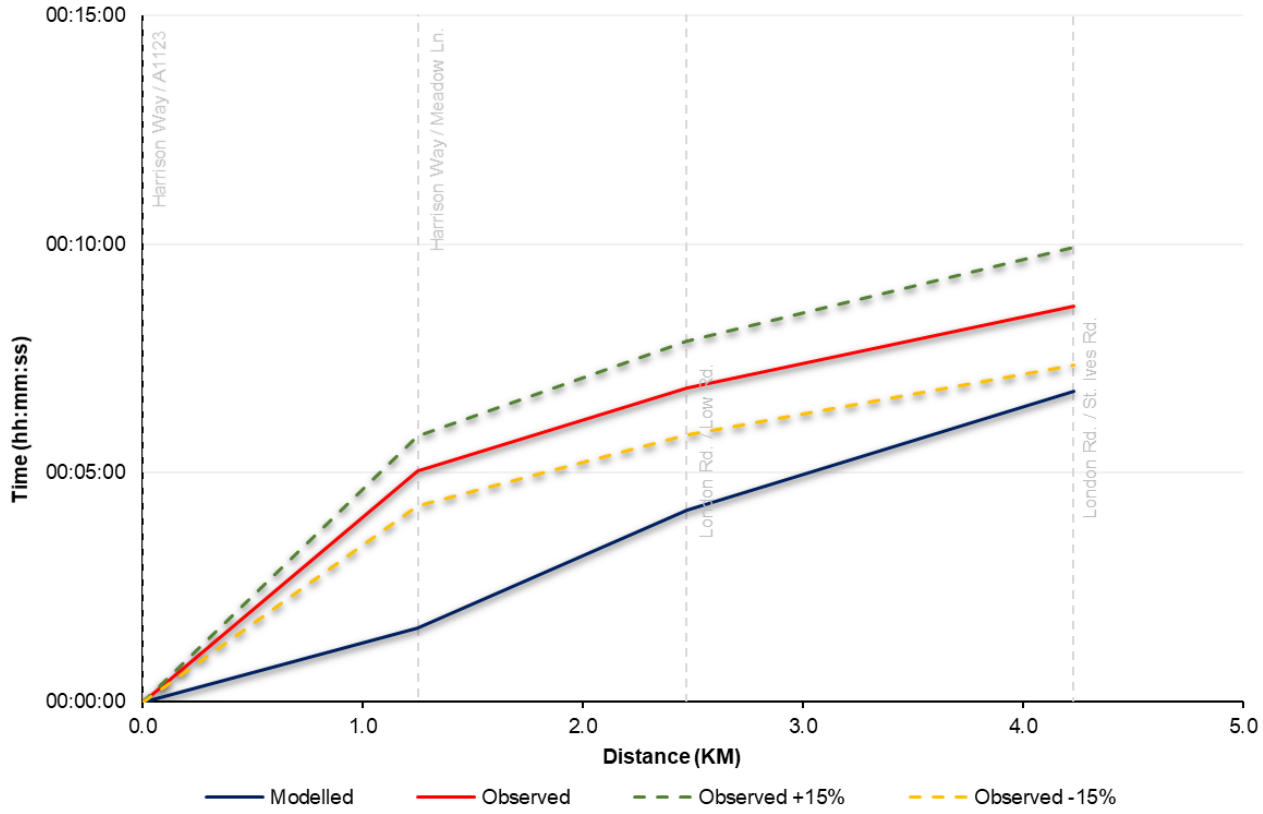
B.3.18. 2015 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – AM



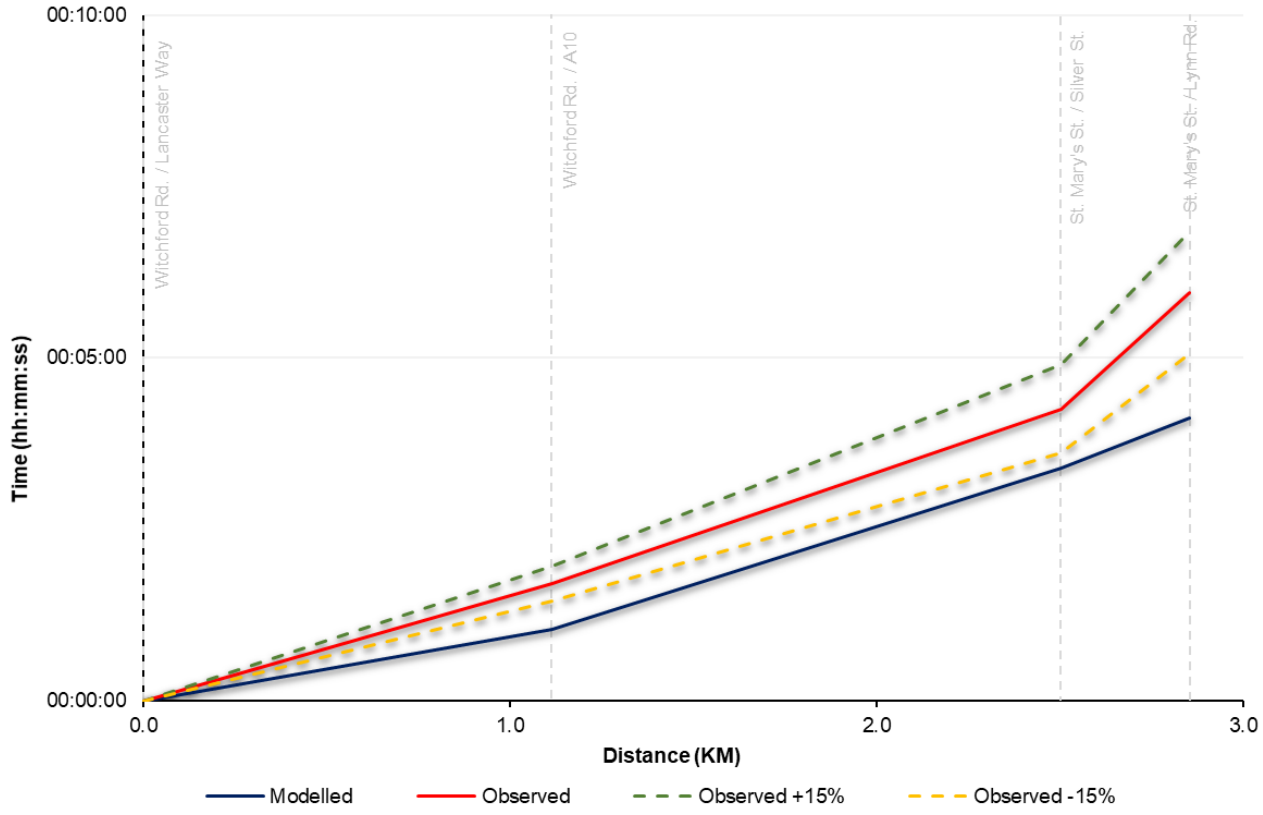
B.3.19. 2015 SI-03: A14 / A1096 to A1123 – AM



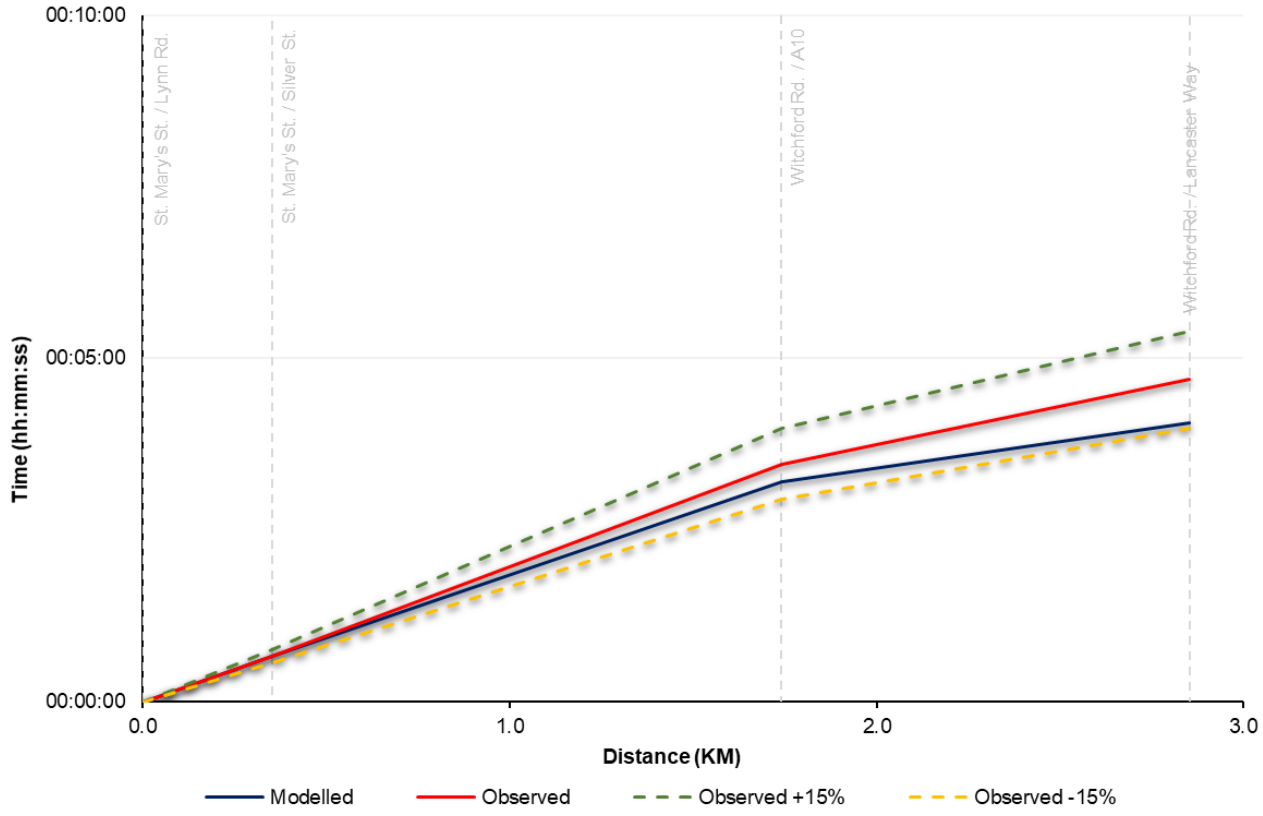
B.3.20. 2015 SI-04: A1123 to A14 / A1096 – AM



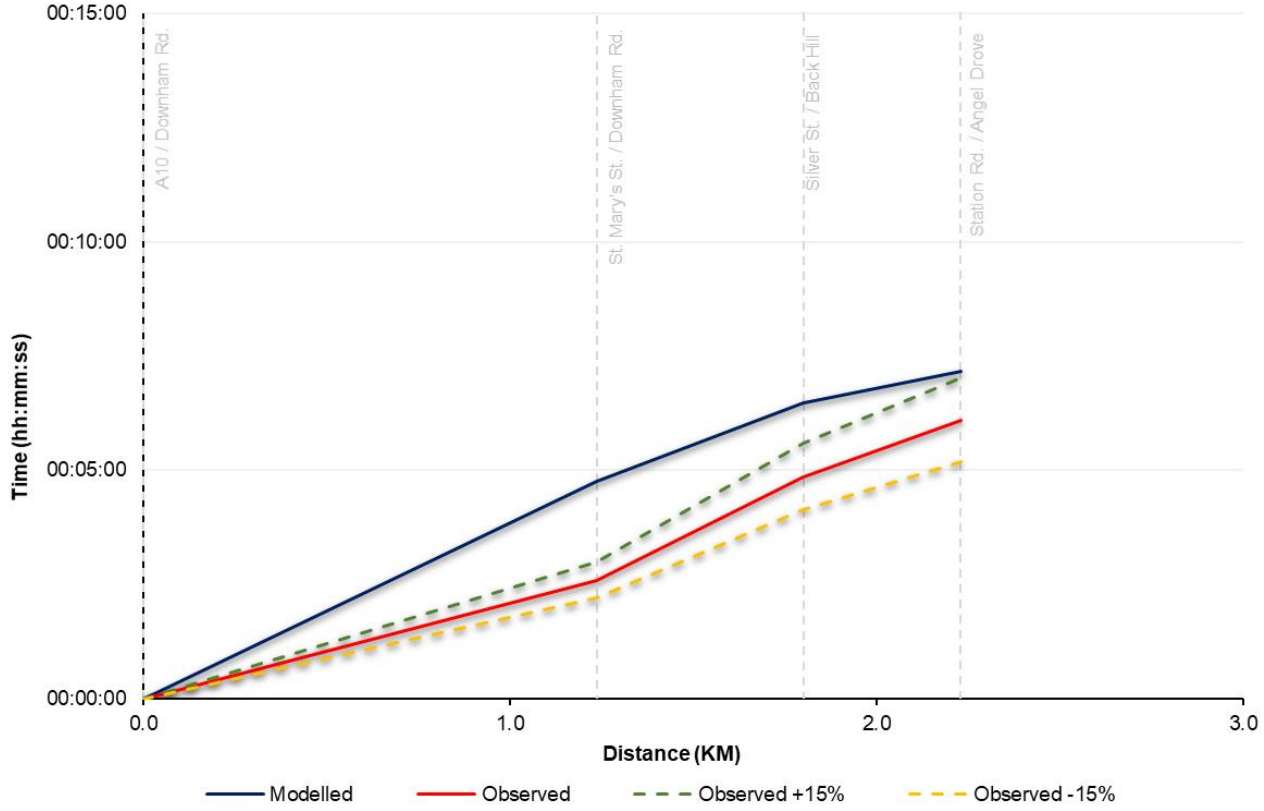
B.3.21. 2015 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – AM



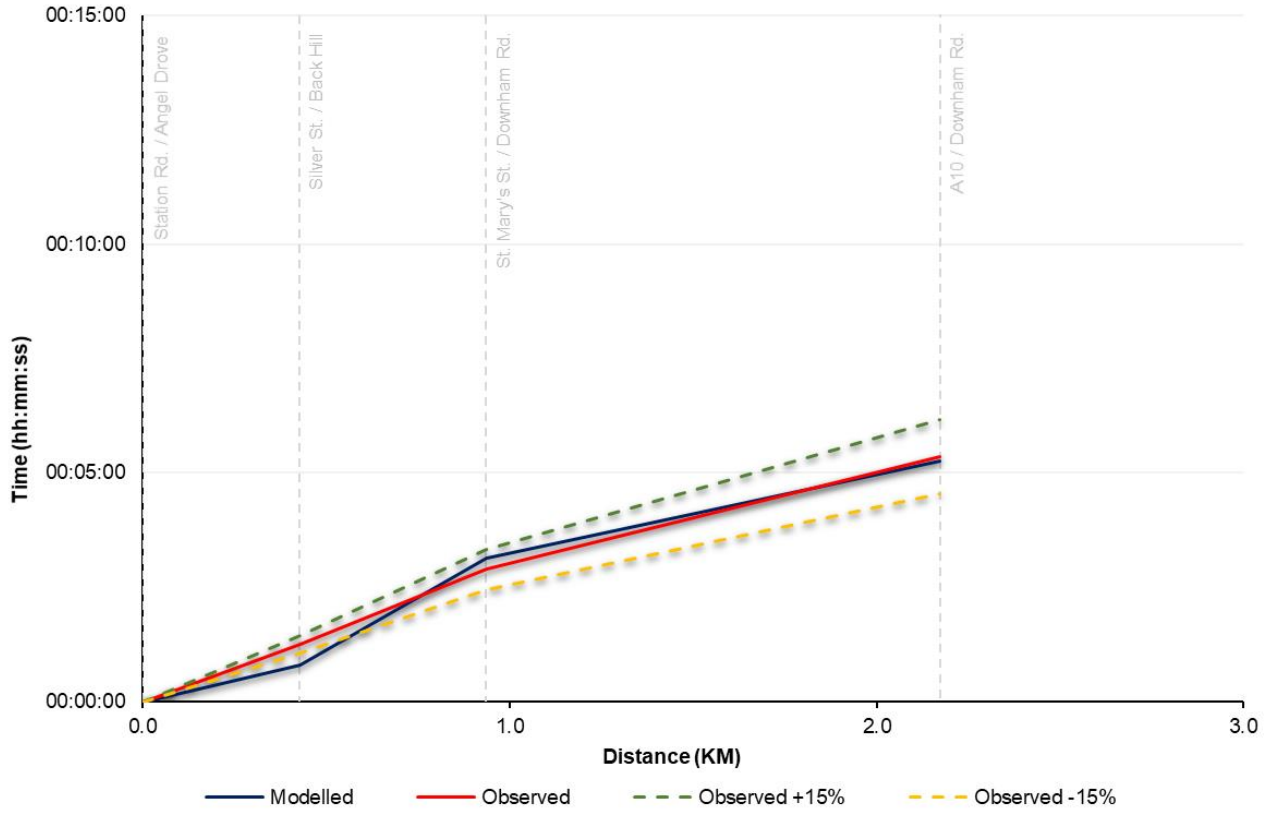
B.3.22. 2015 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – AM



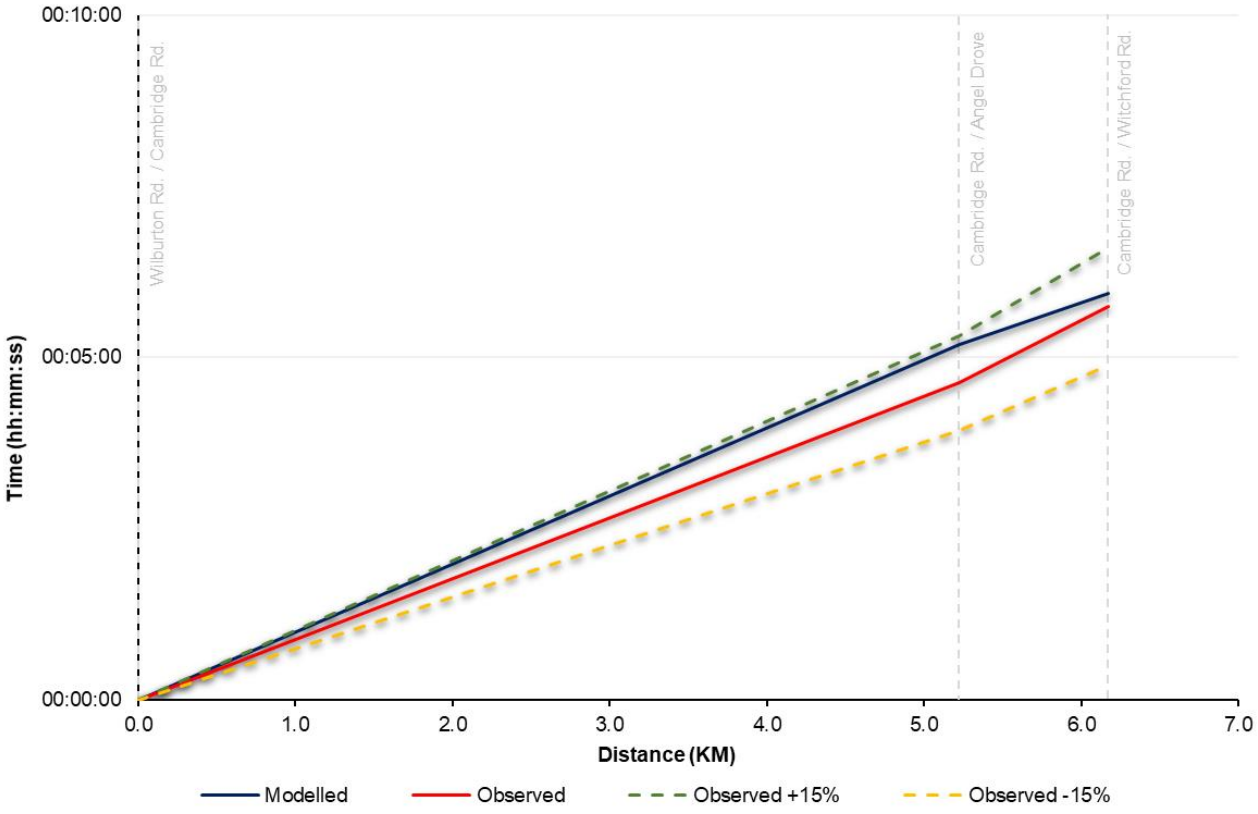
B.3.23. 2015 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – AM



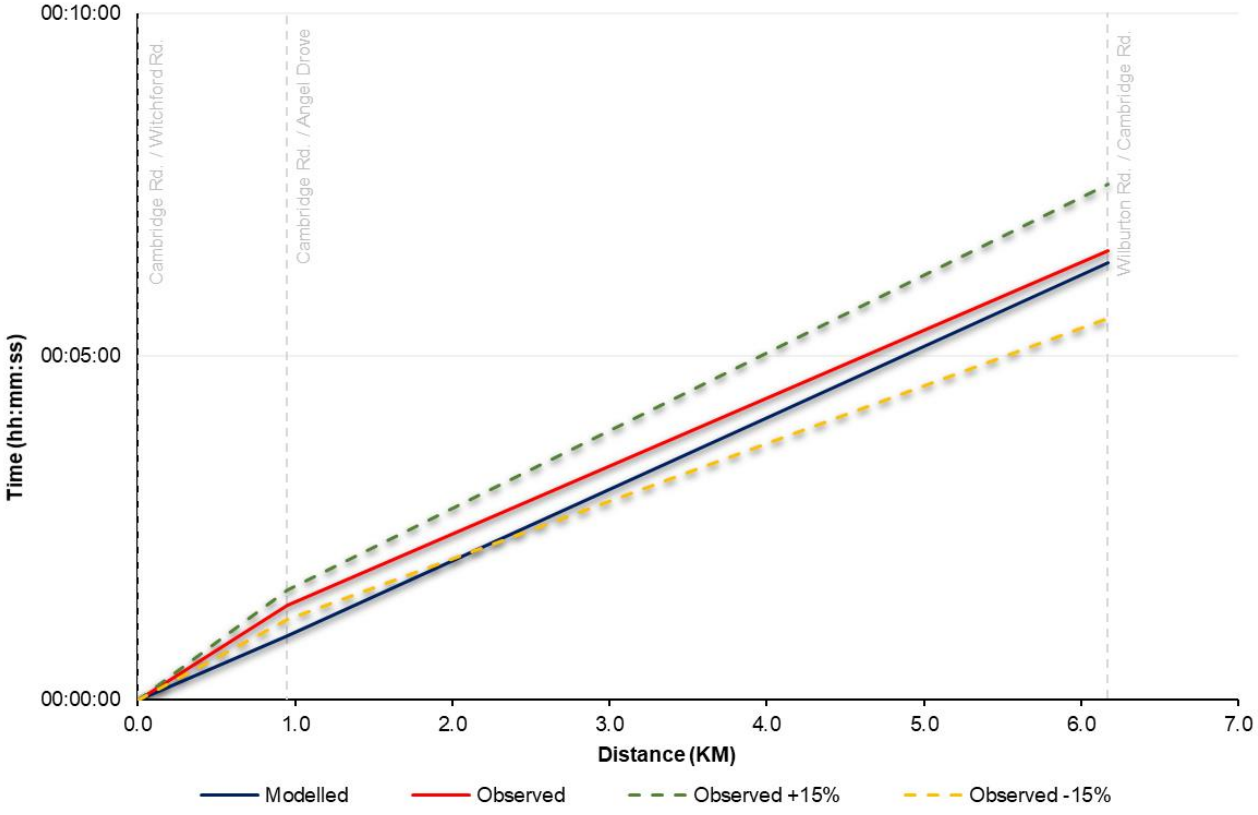
B.3.24. 2015 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – AM



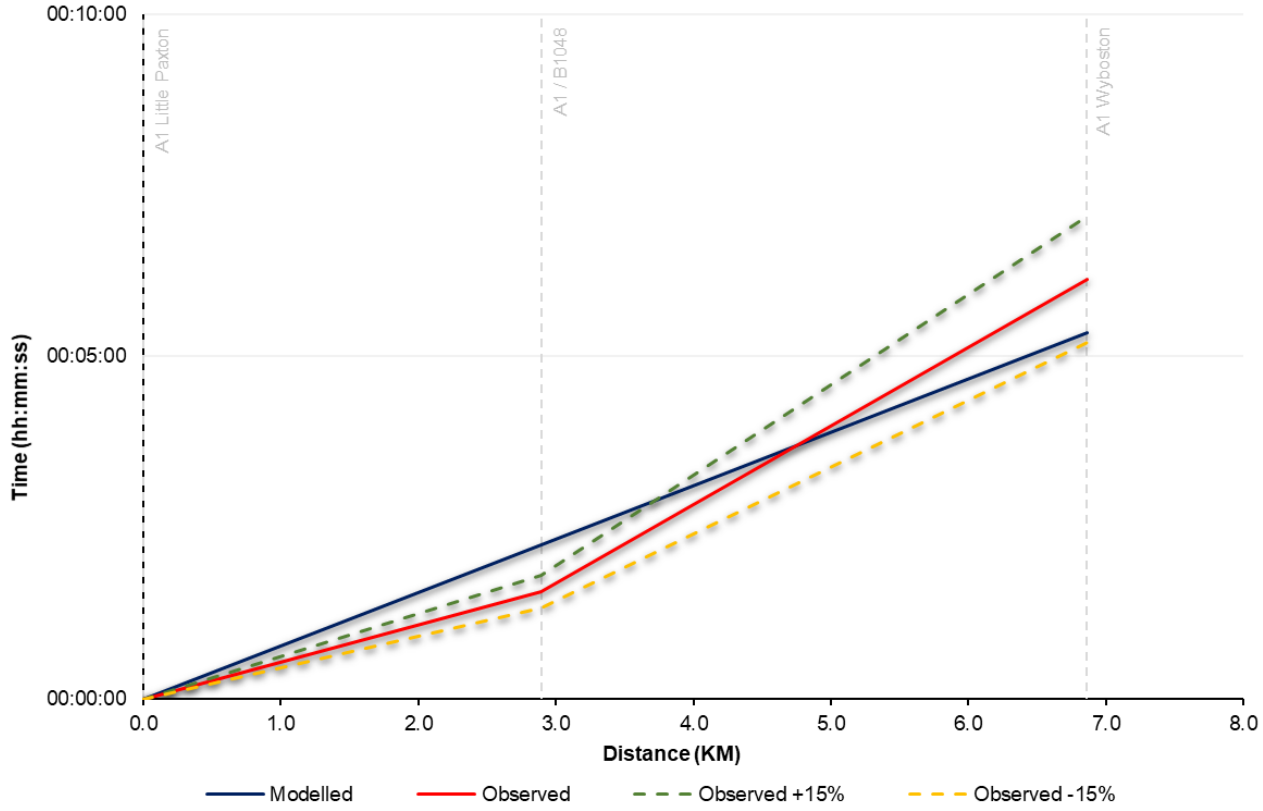
B.3.25. 2015 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – AM



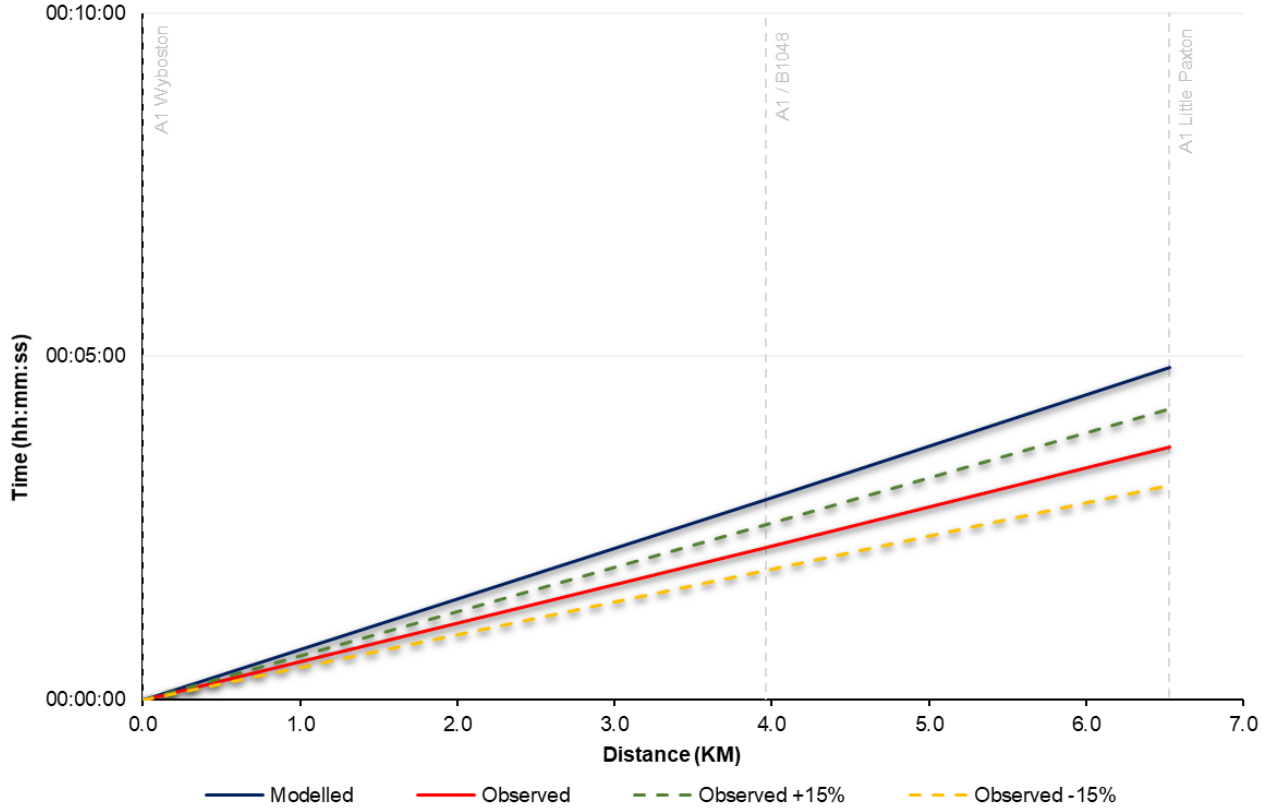
B.3.26. 2015 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – AM



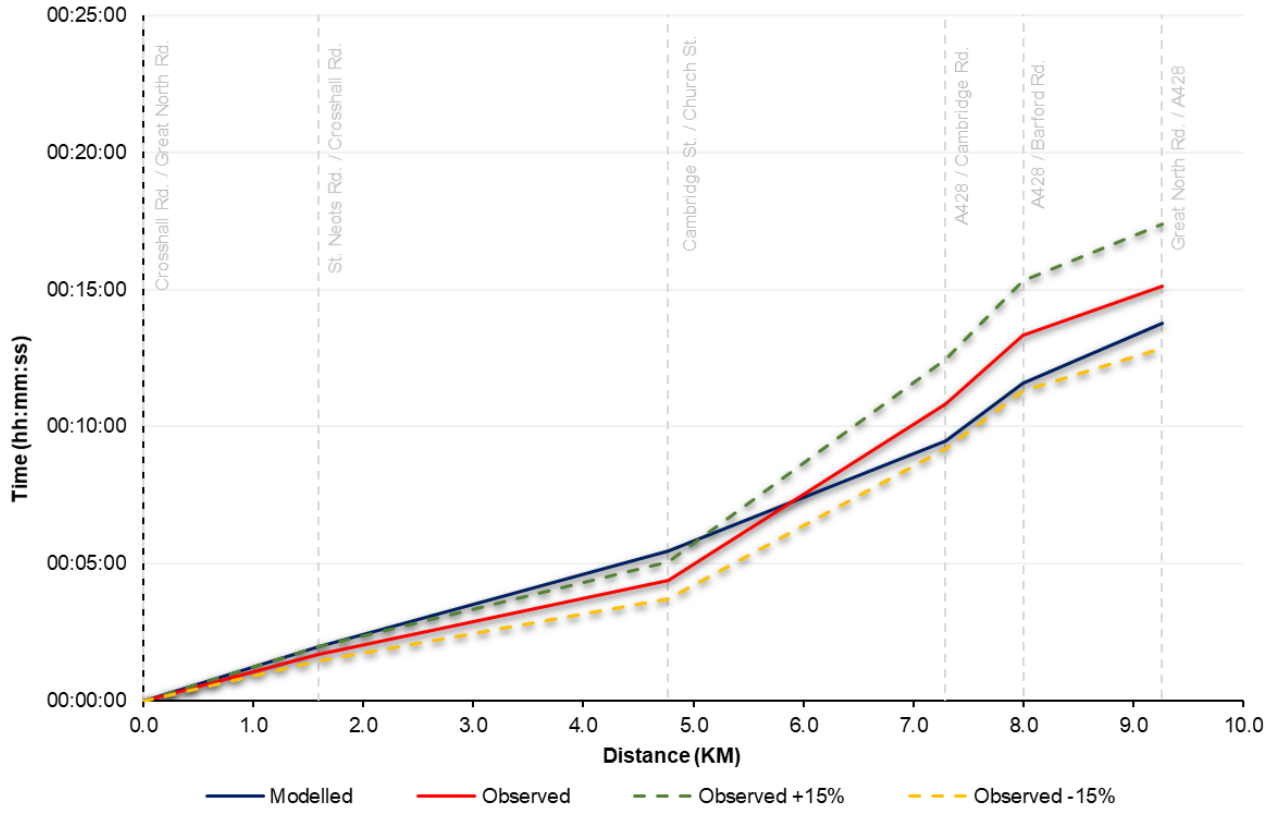
B.3.27. 2015 SN-01: A1 Little Paxton to A421 – AM



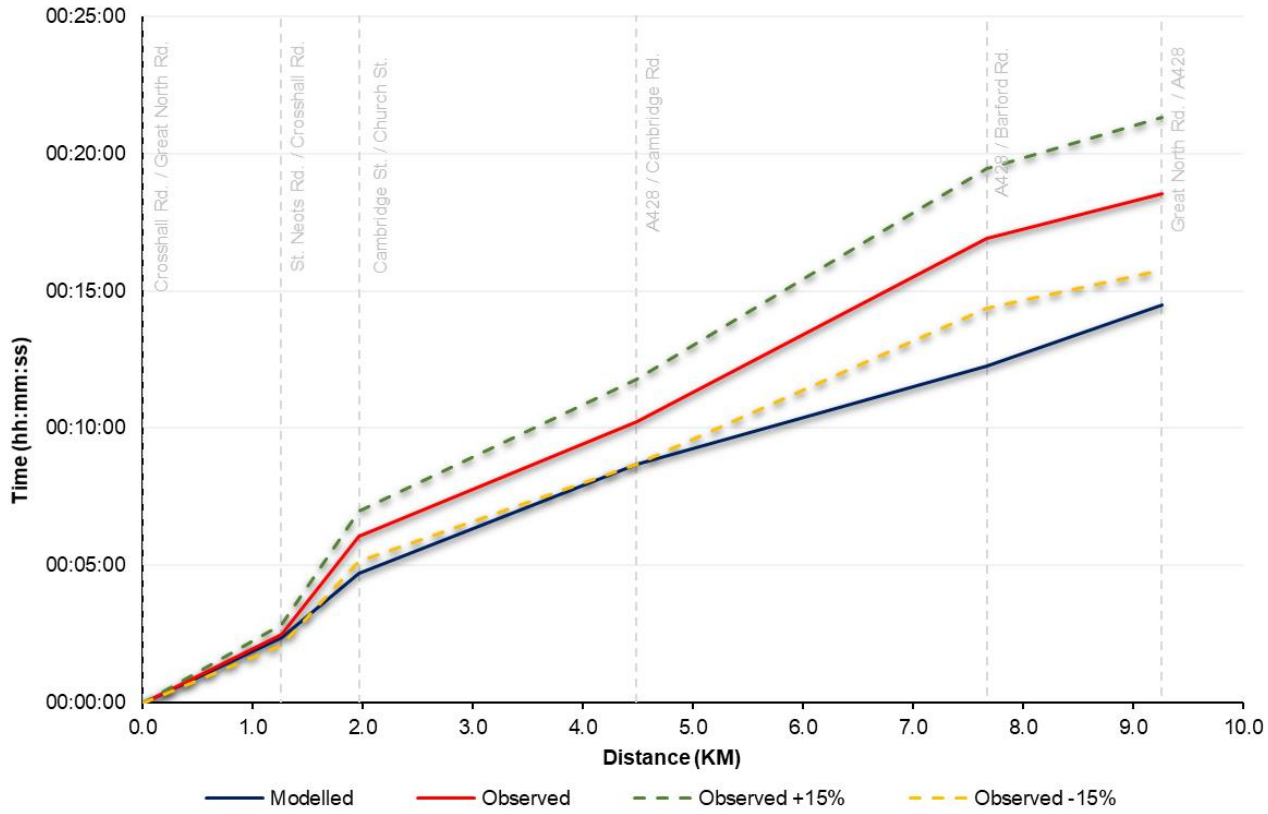
B.3.28. 2015 SN-02: A421 to A1 Little Paxton – AM



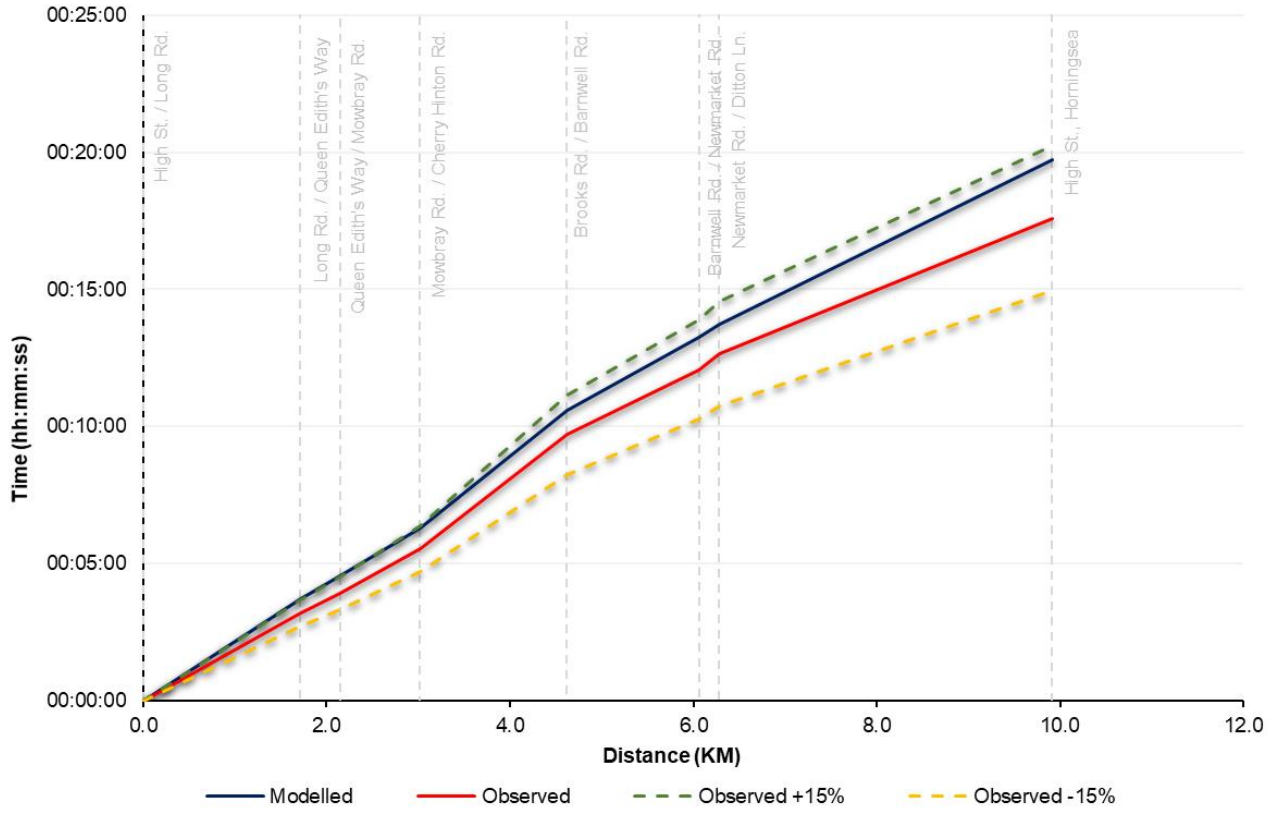
B.3.29. 2015 SN-03: A1 / B465 via Cambridge Rd. – AM



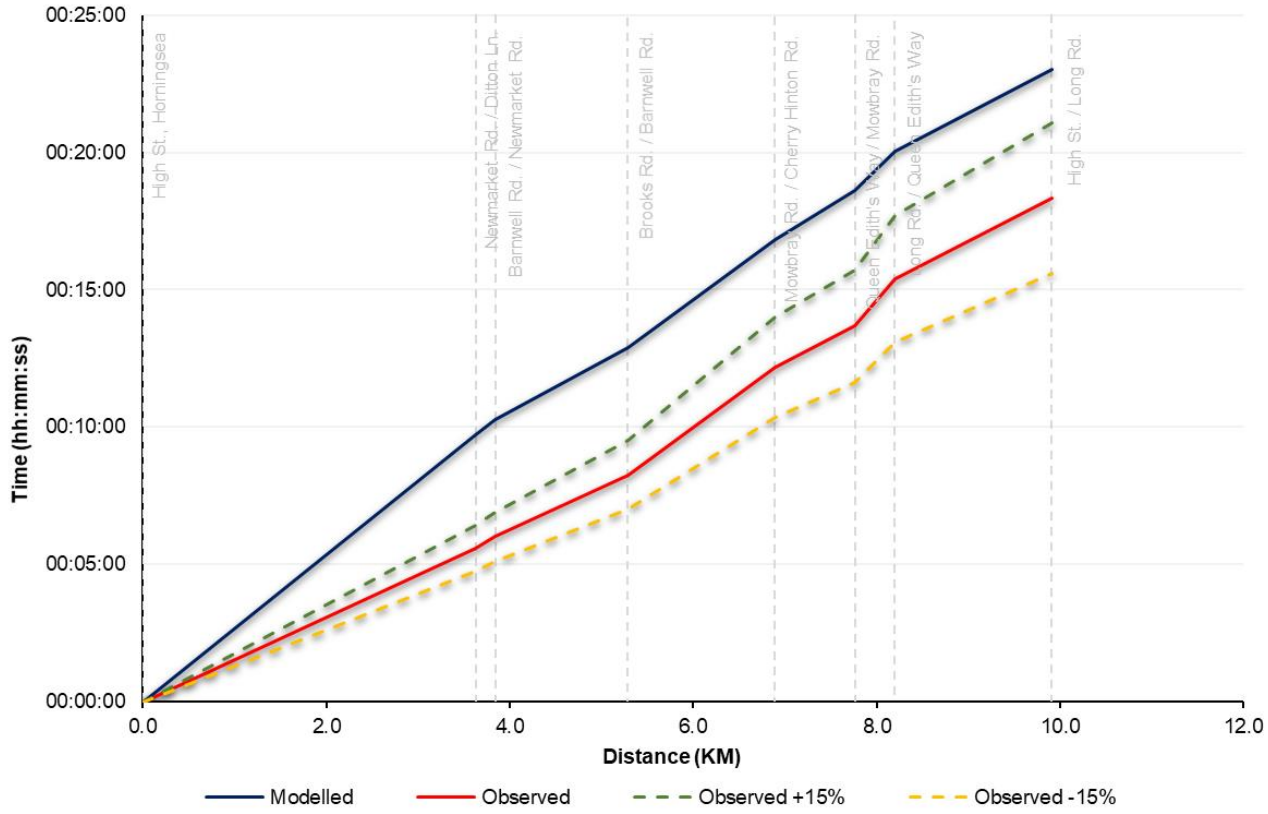
B.3.30. 2015 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – AM



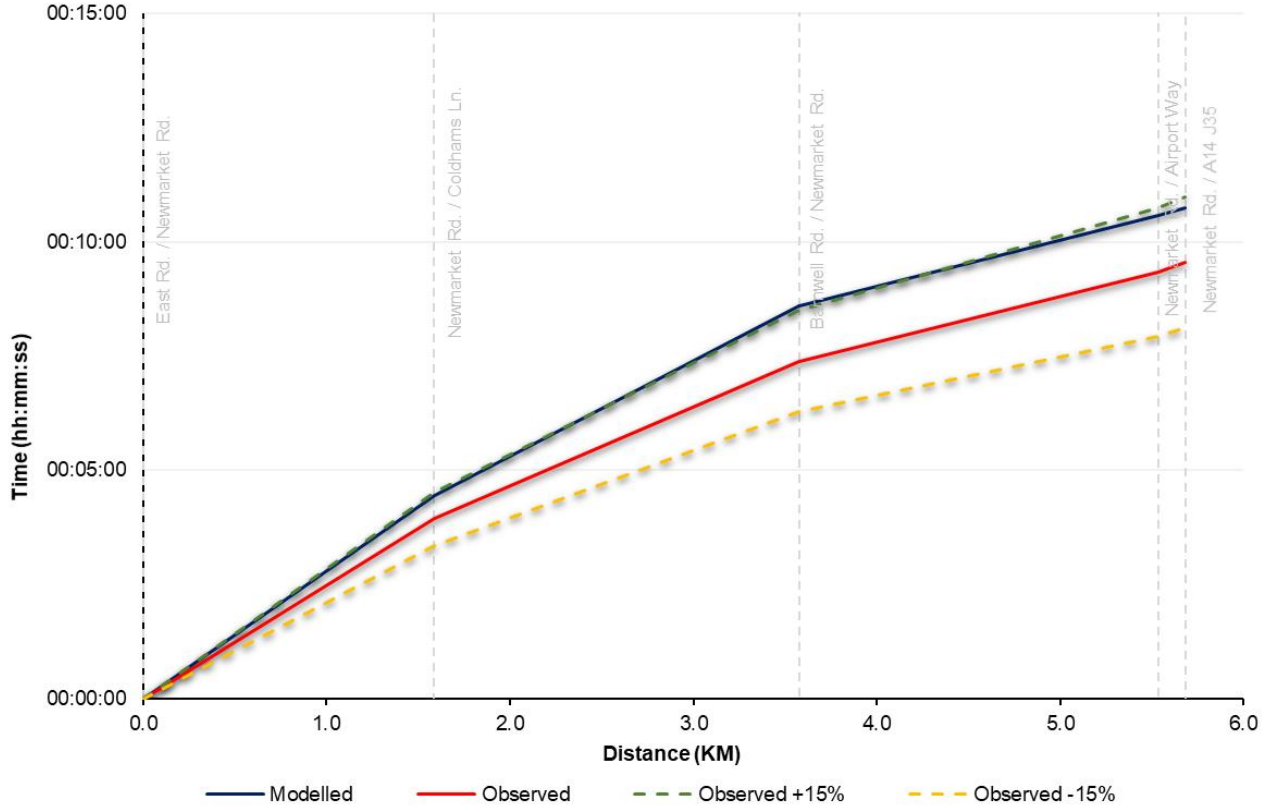
B.3.31. 2015 C-01: Trumpington Rd. to Priory Rd., Horningsea – IP



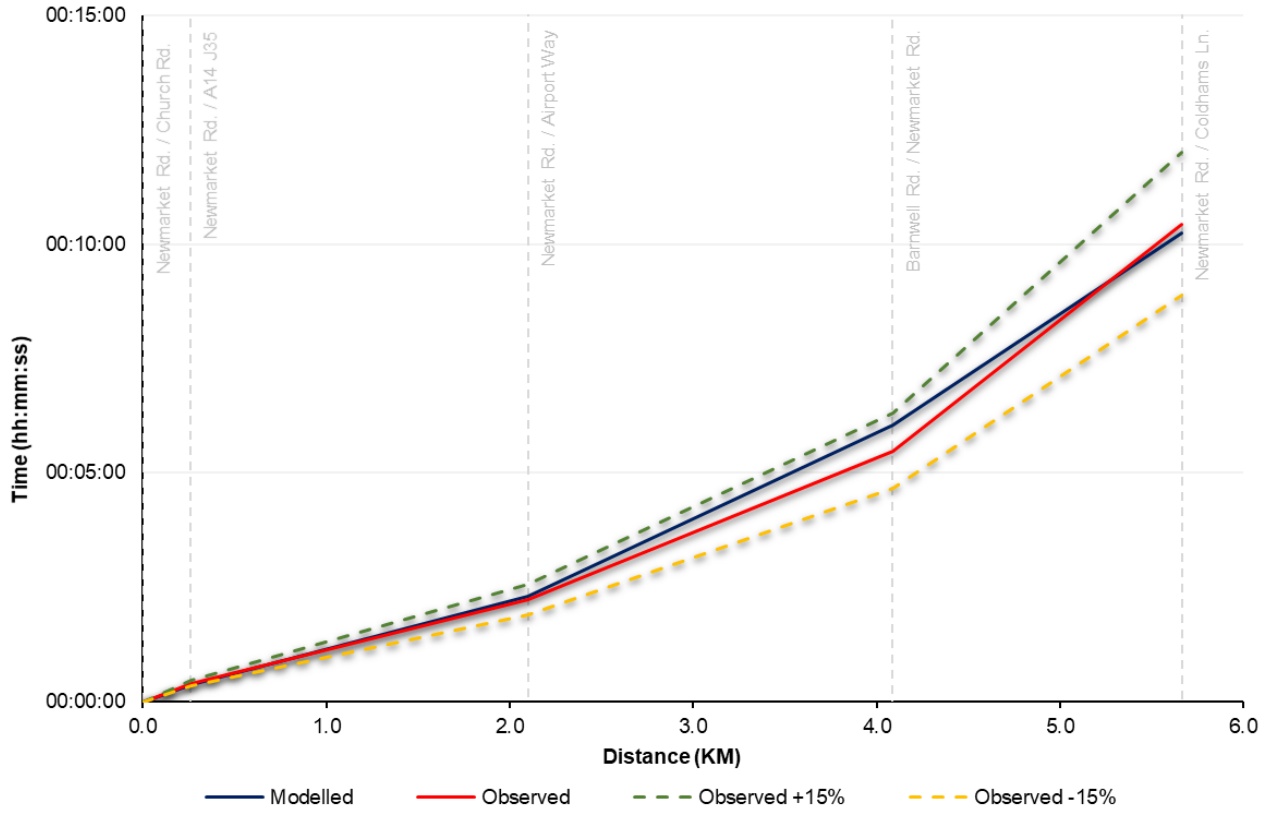
B.3.32. 2015 C-02: Priory Rd., Horningsea to Trumpington Rd. – IP



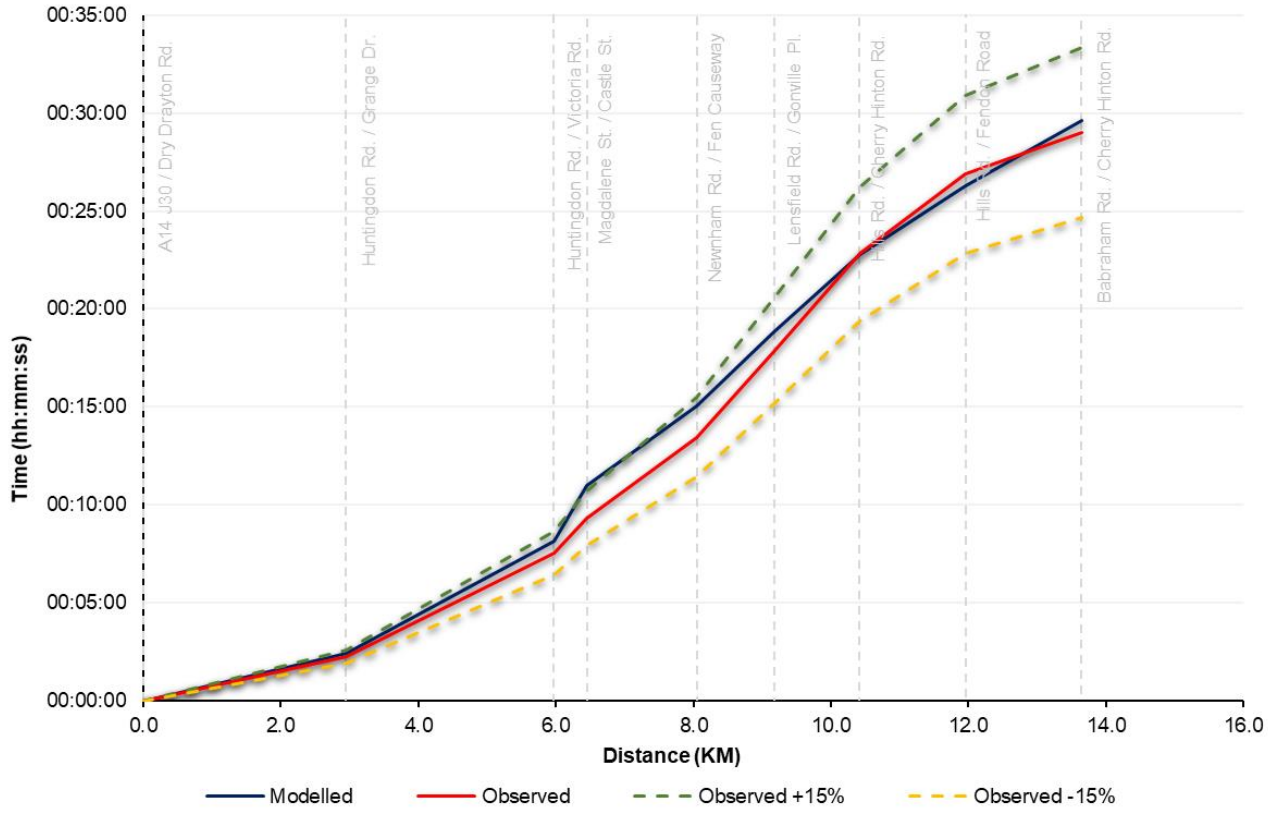
B.3.33. 2015 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – IP



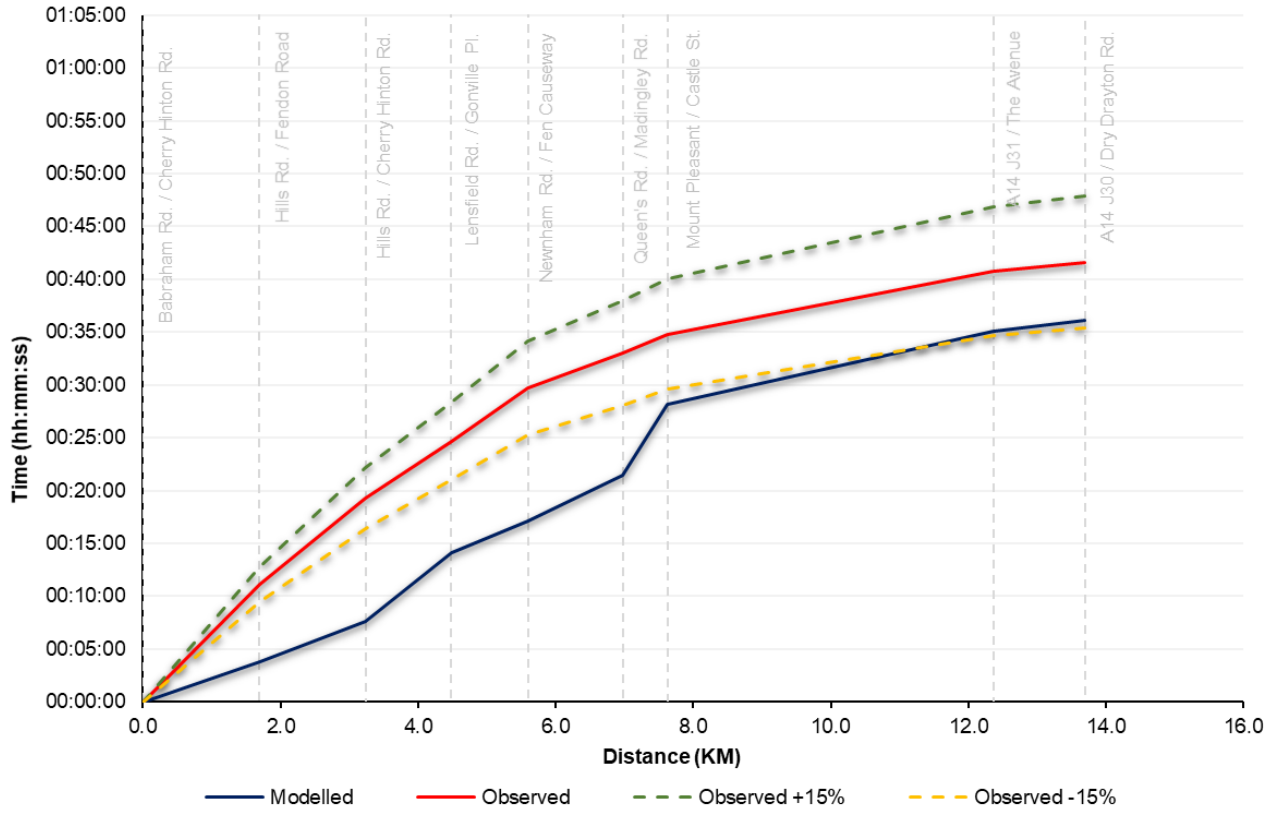
B.3.34. 2015 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – IP



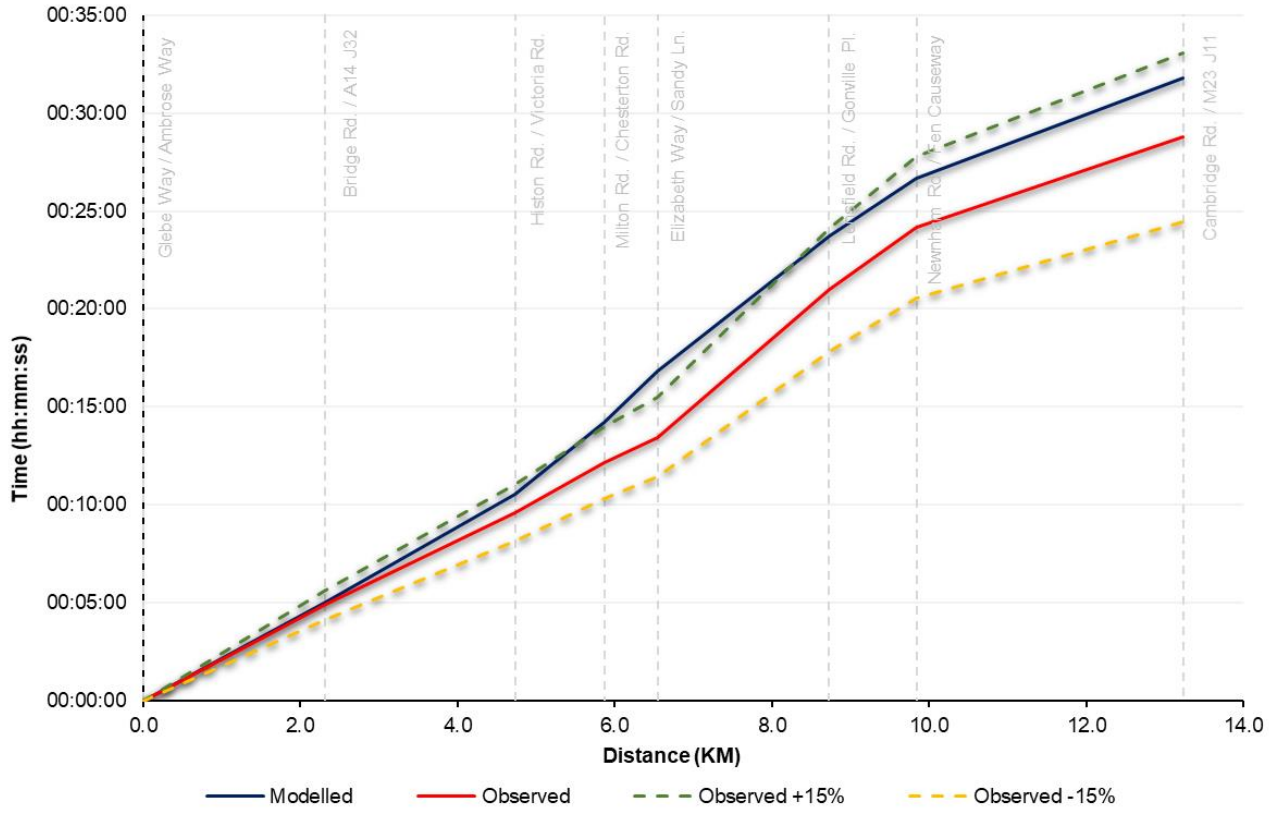
B.3.35. 2015 C-05: Oakington Rd. to Fendon Rd. – IP



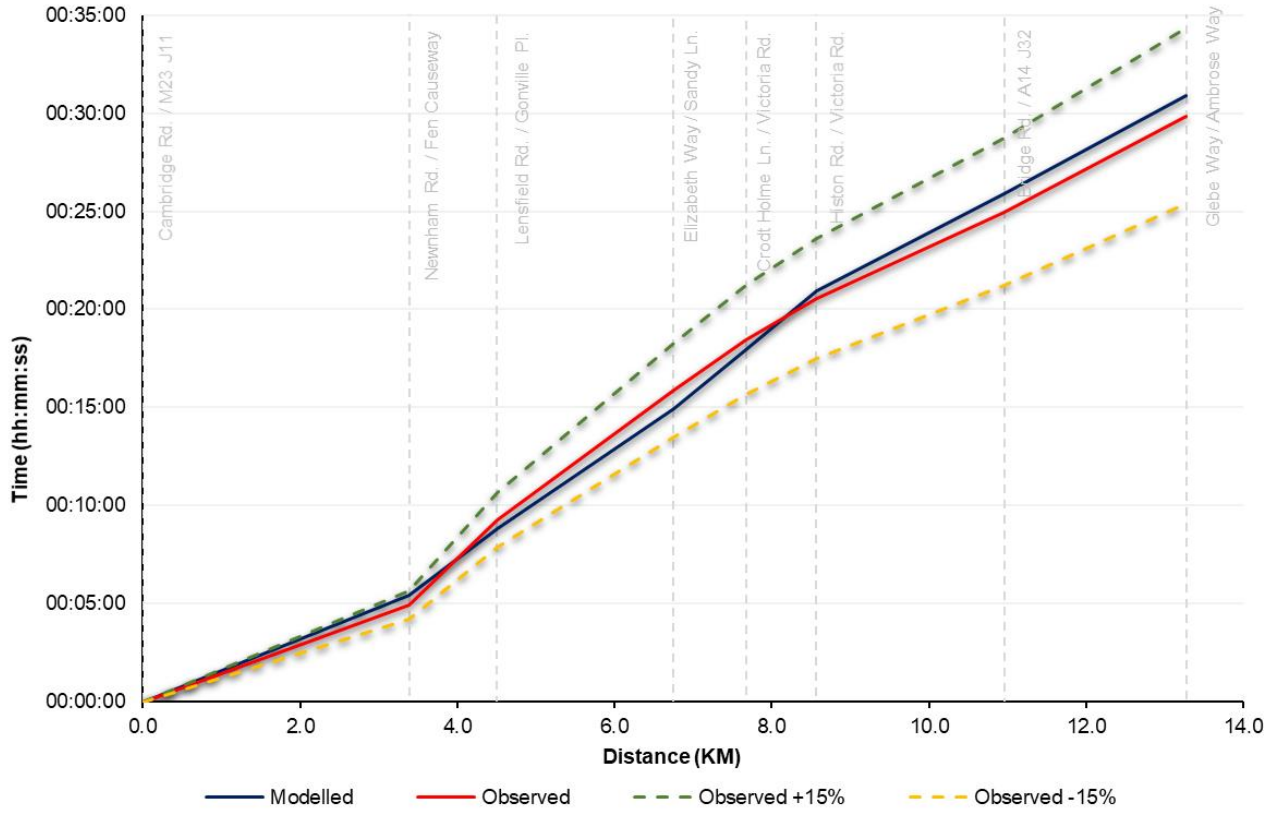
B.3.36. 2015 C-06: Fendon Rd. to Oakington Rd. – IP



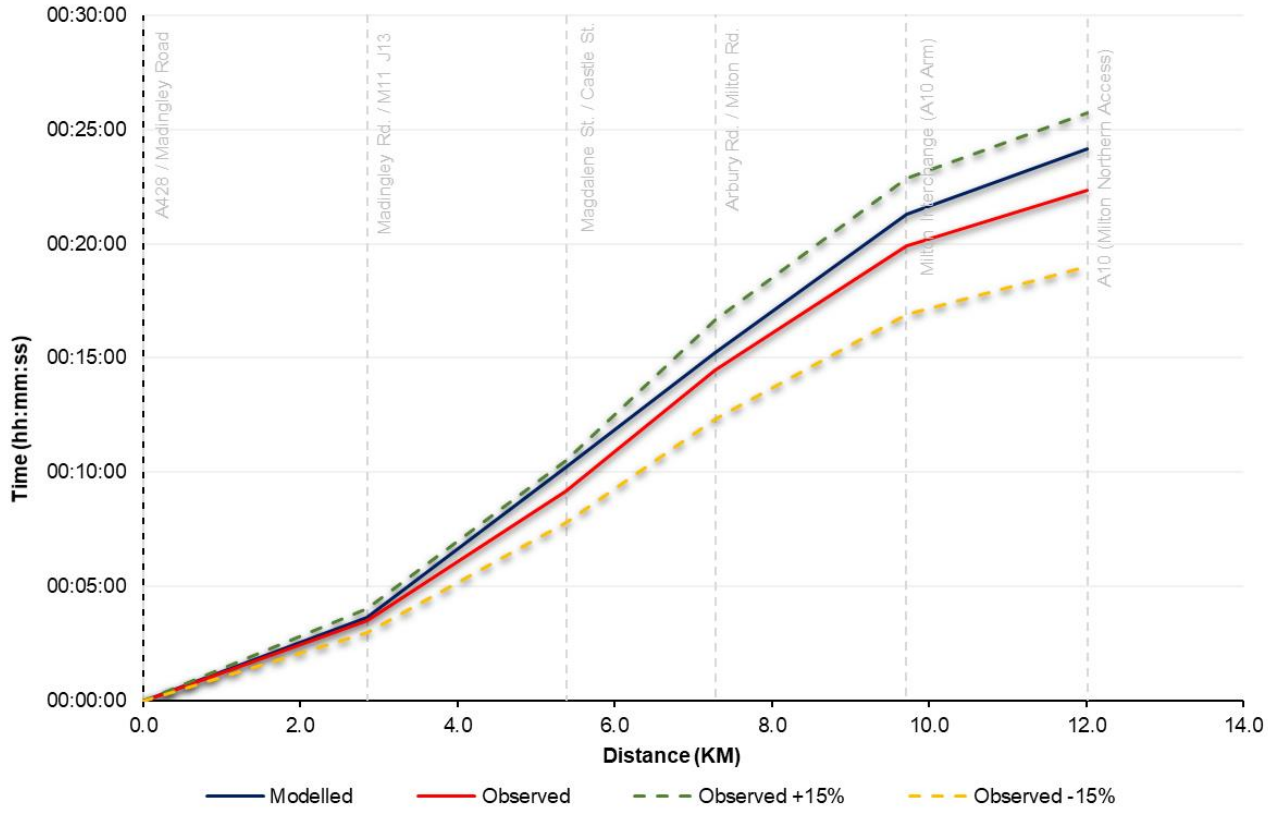
B.3.37. 2015 C-07: Impington Ln. to M11 – IP



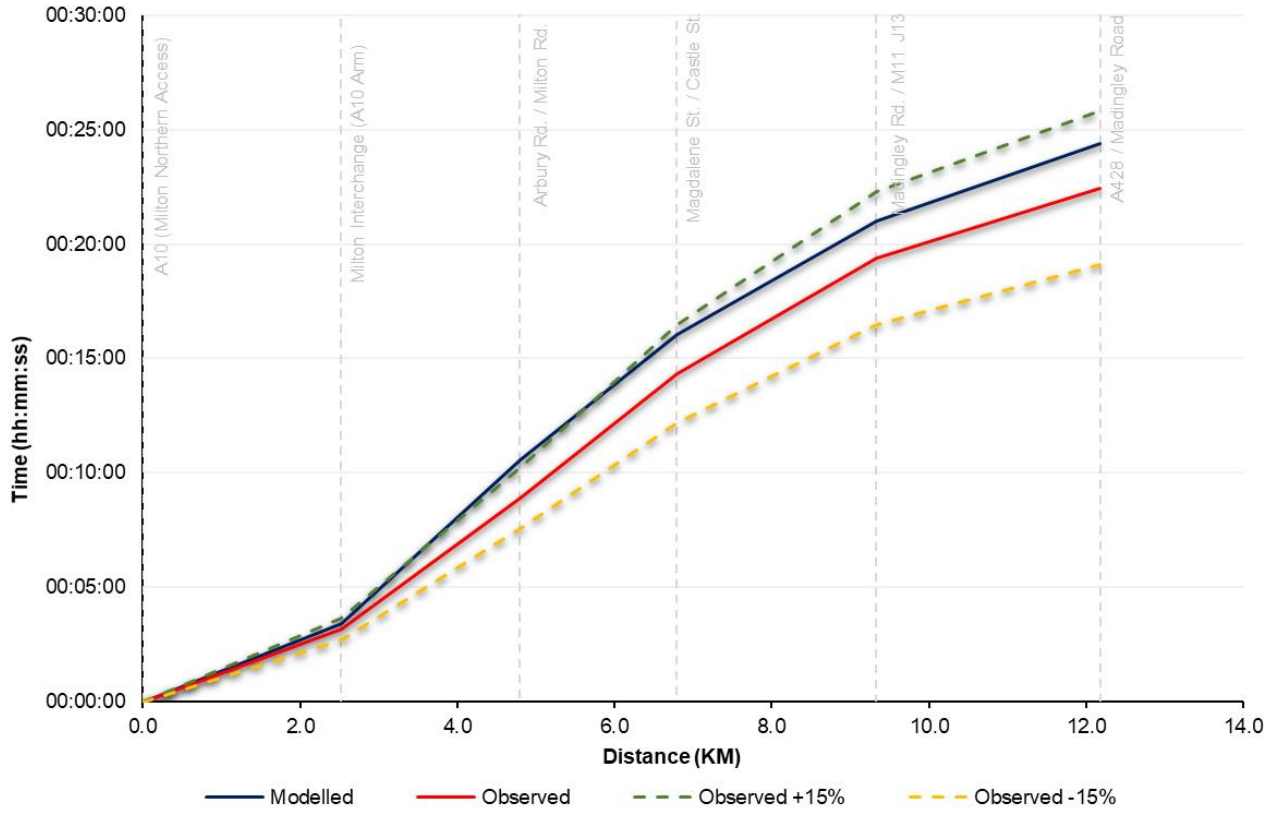
B.3.38. 2015 C-08: M11 to Impington Ln. – IP



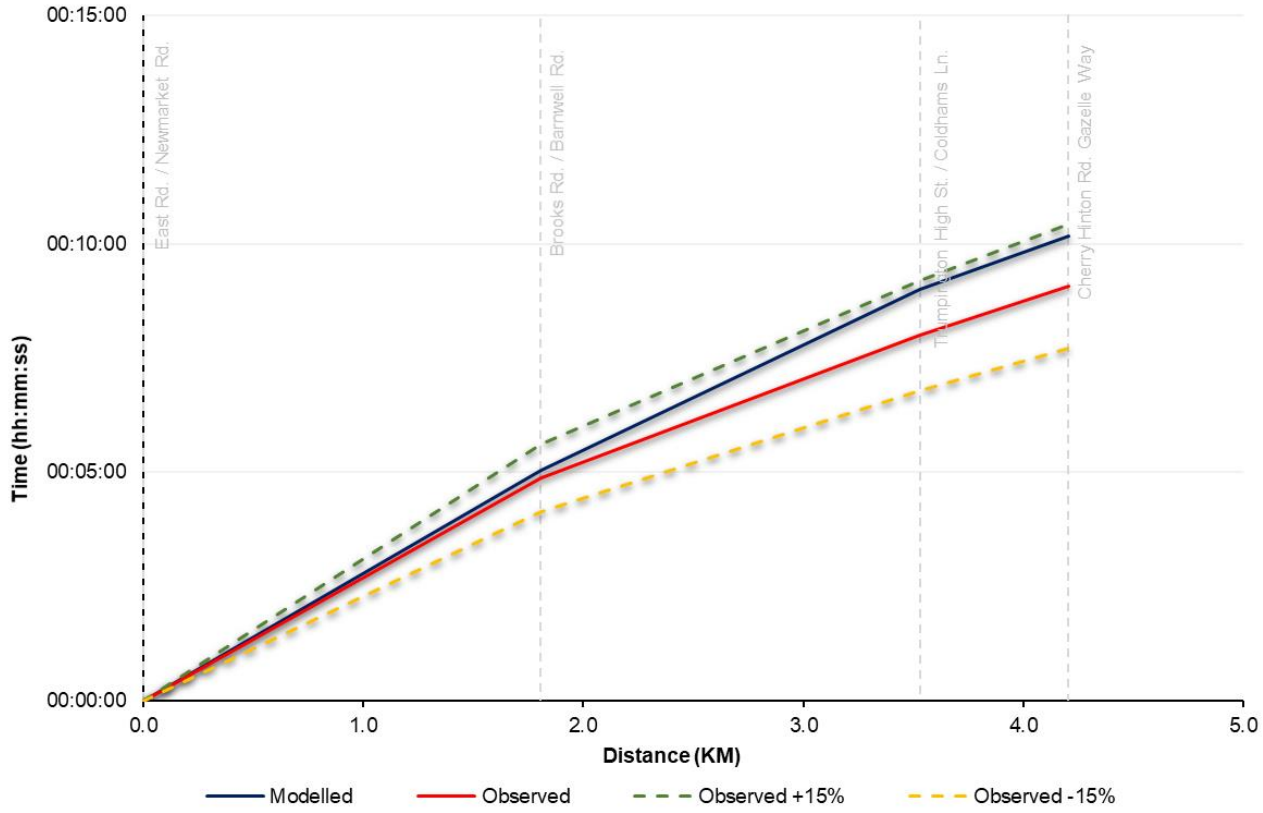
B.3.39. 2015 C-09: A428 Rbt. to Milton – IP



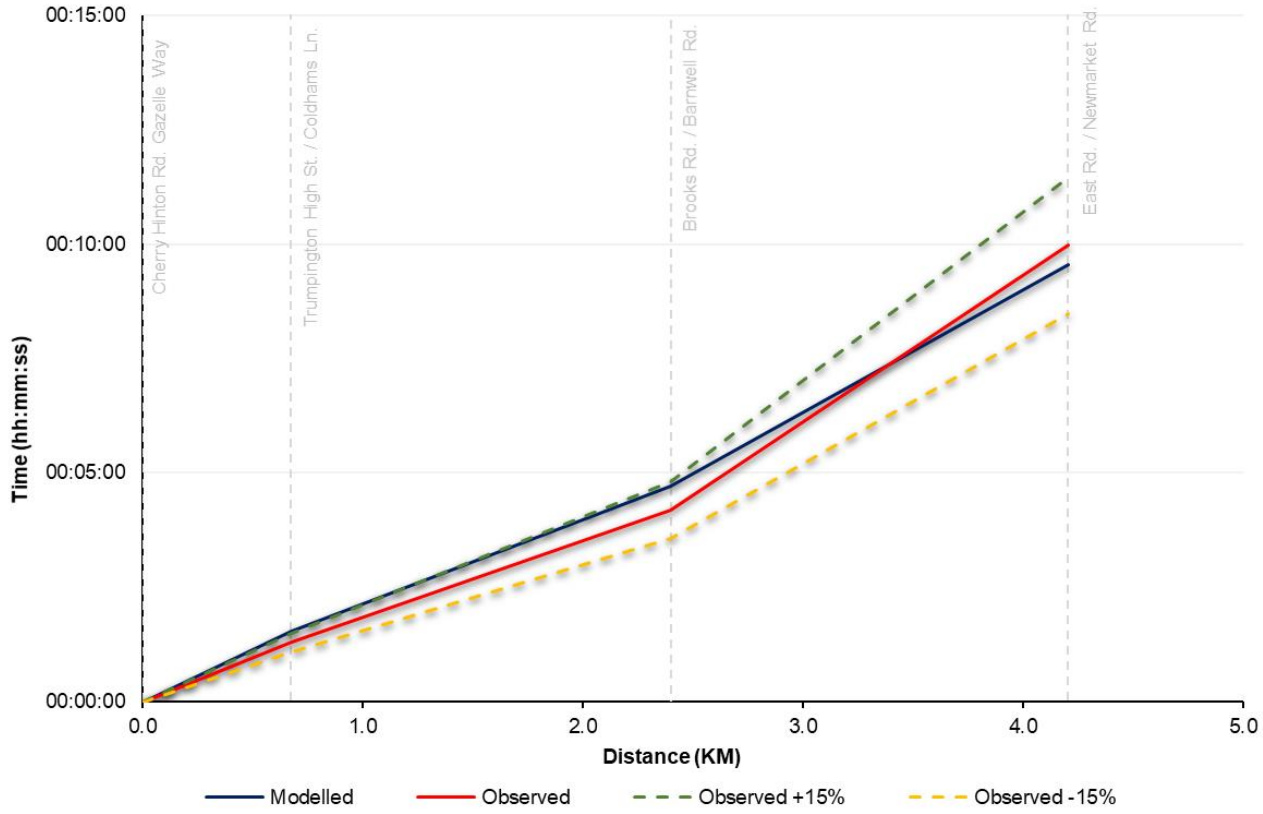
B.3.40. 2015 C-10: Milton to A428 Rbt. – IP



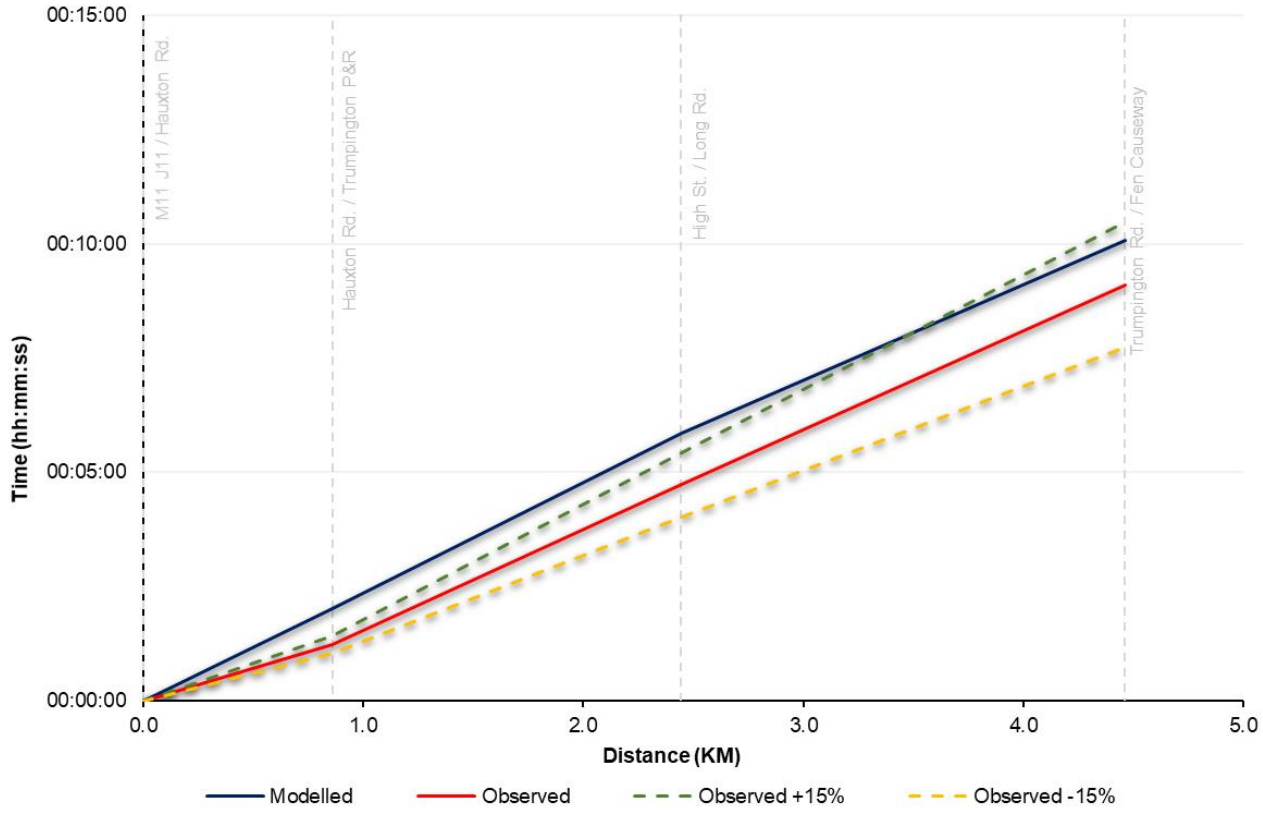
B.3.41. 2015 C-11: Elizabeth Way to Teversham Drift – IP



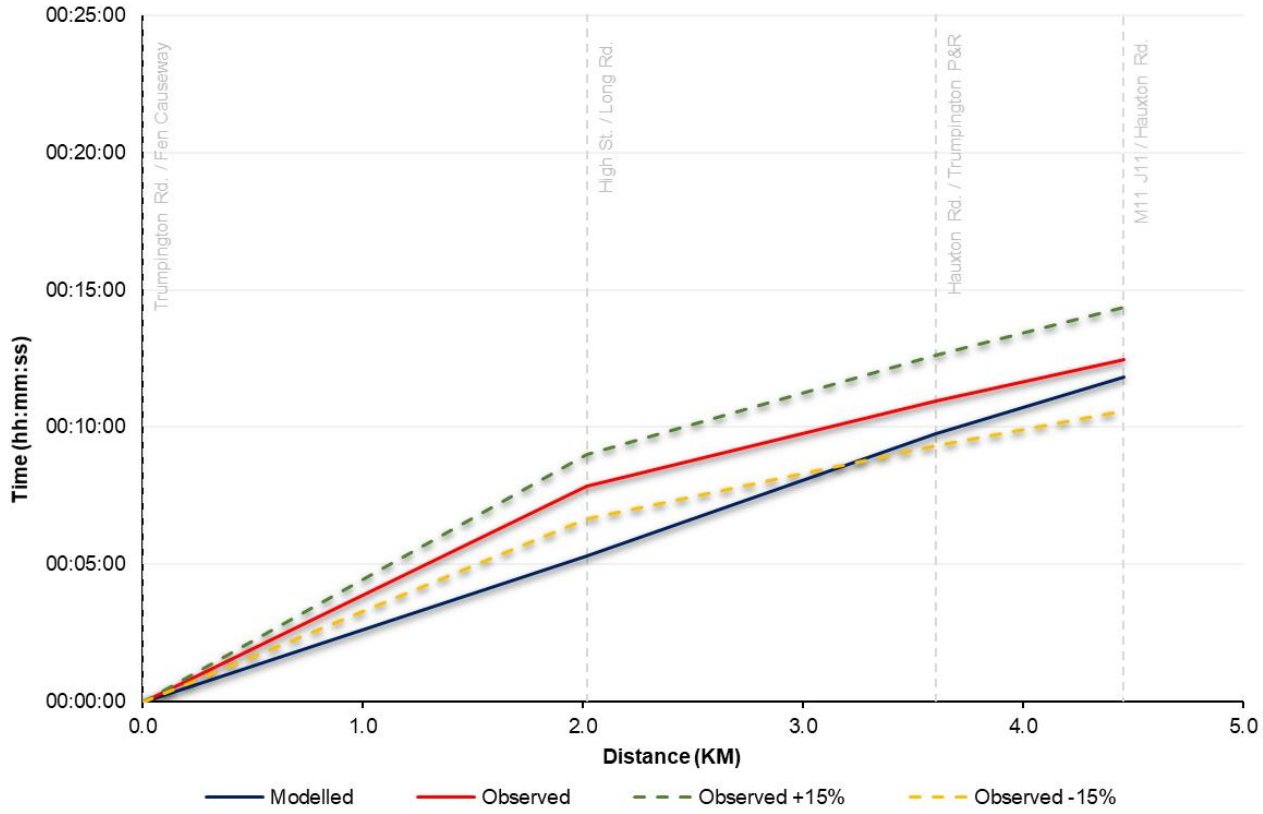
B.3.42. 2015 C-12: Teversham Drift to Elizabeth Way – IP



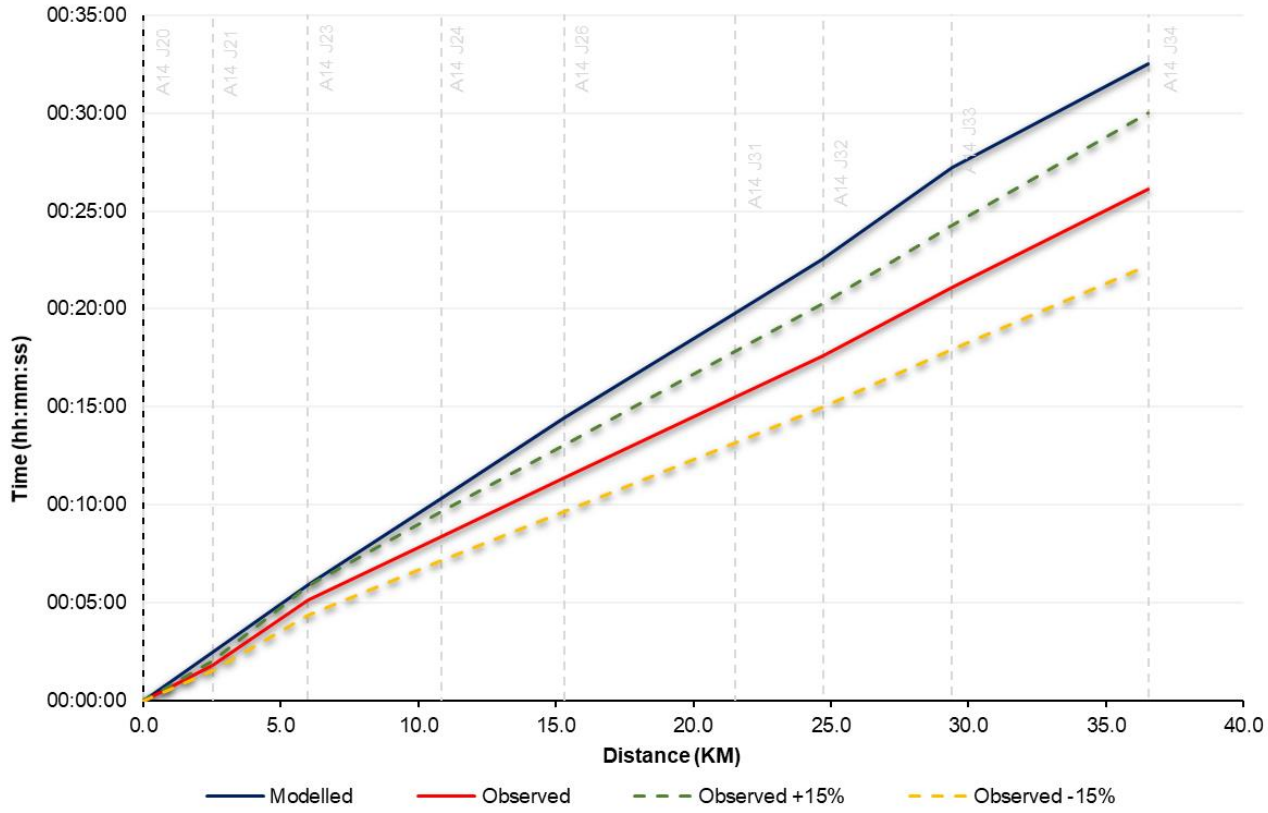
B.3.43. 2015 C-13: Hauxton Rd. (M11) to Lensfield Rd. – IP



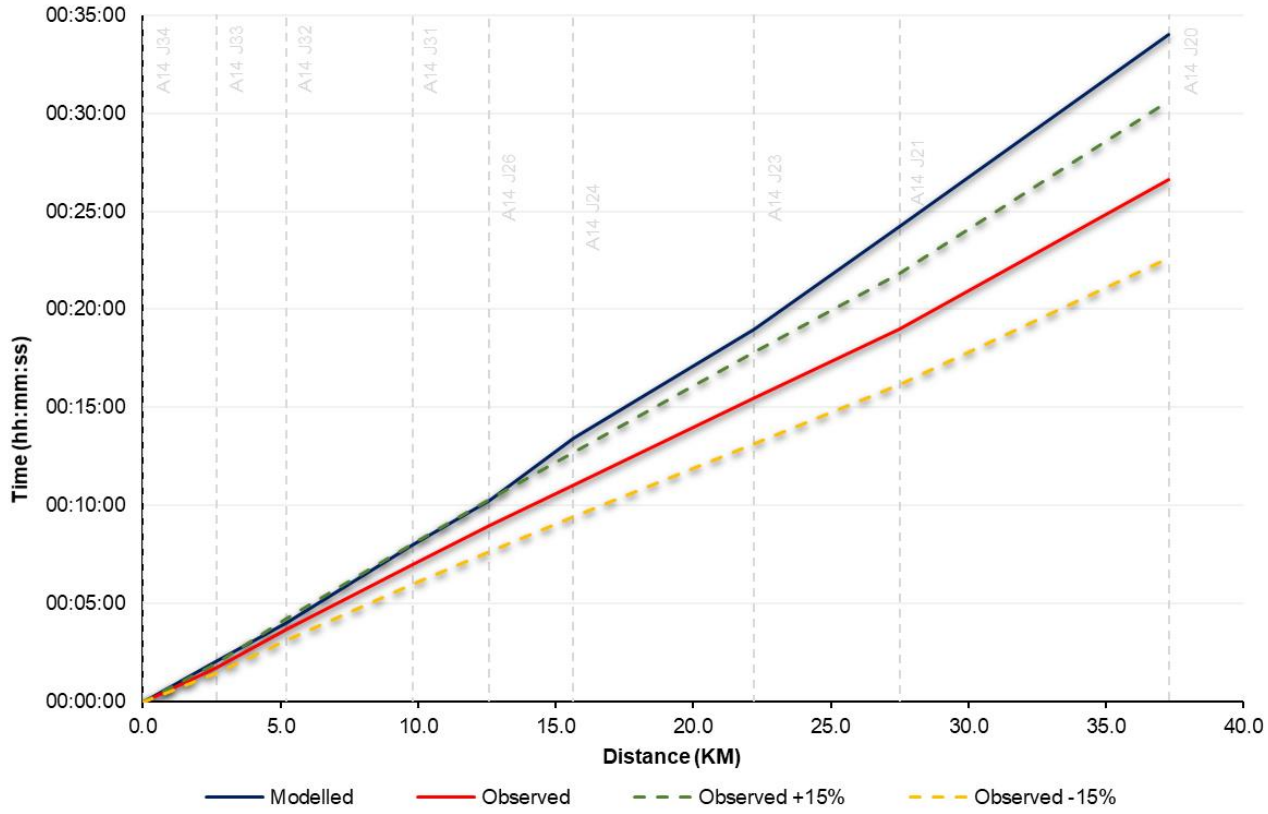
B.3.44. 2015 C-14: Lensfield Rd. to Hauxton Rd. (M11) – IP



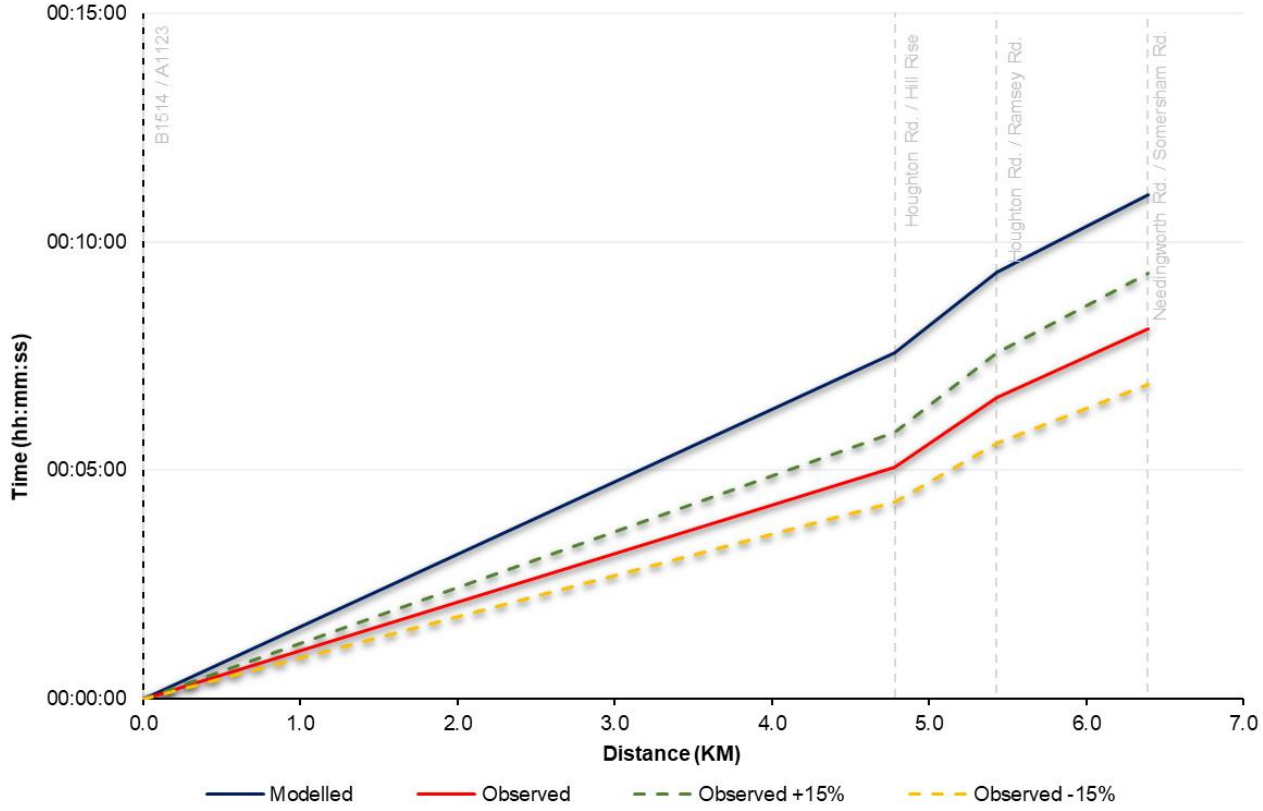
B.3.45. 2015 A14-01: Ellington to Horningsea Rd. – IP



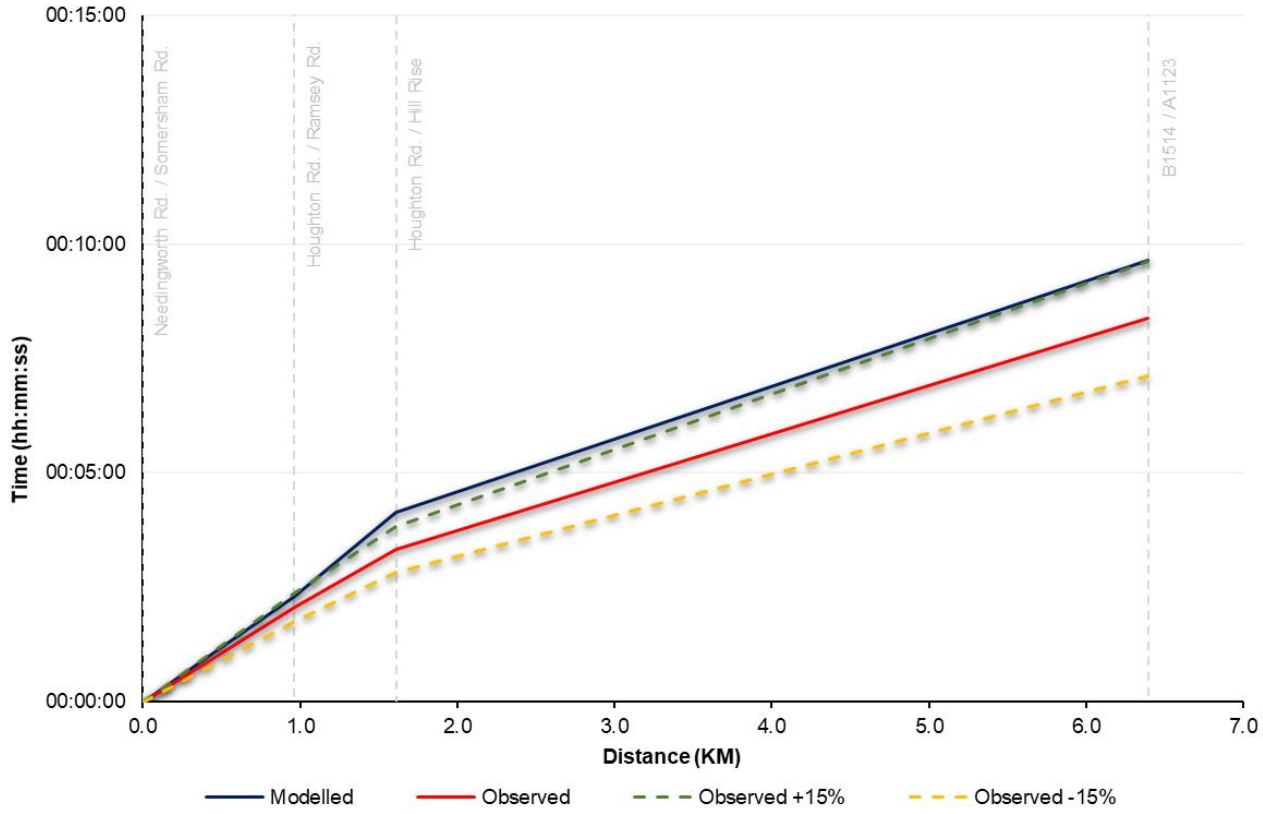
B.3.46. 2015 A14-02: Horningsea Rd. to Ellington – IP



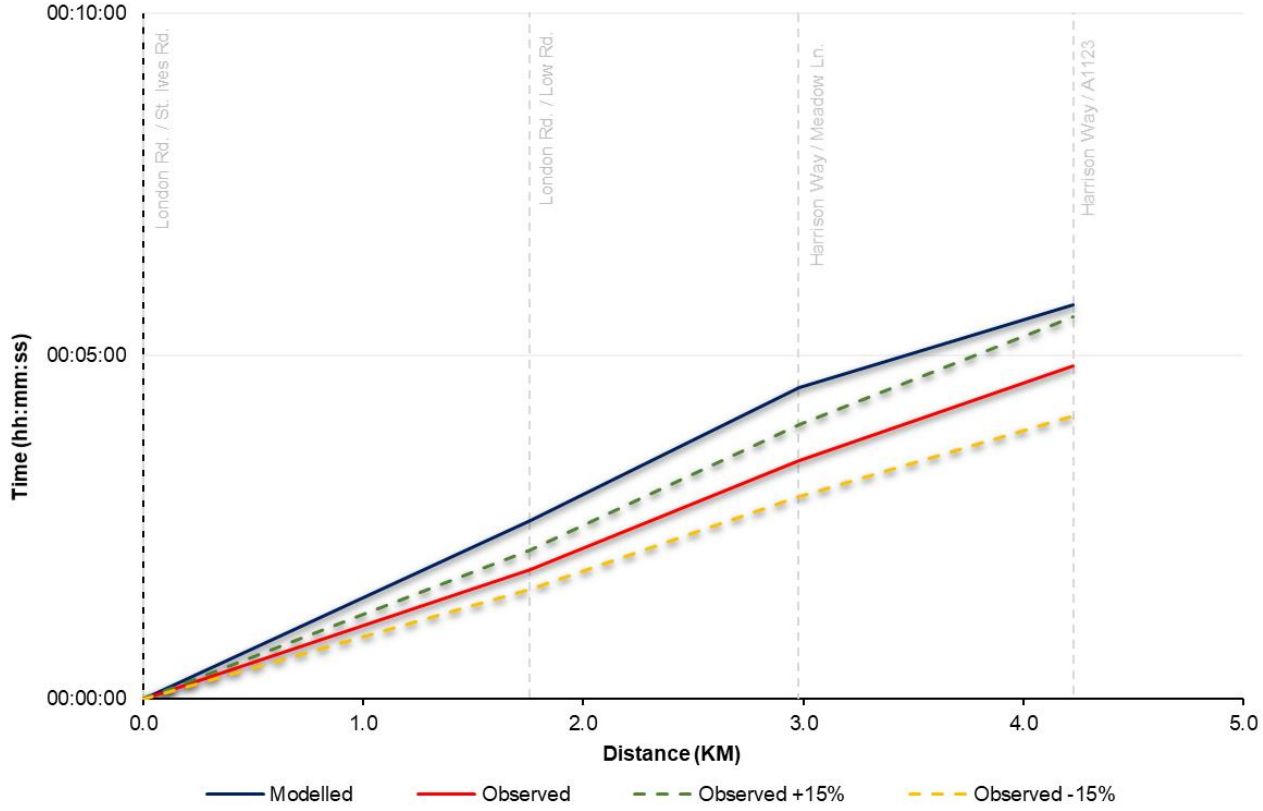
B.3.47. 2015 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – IP



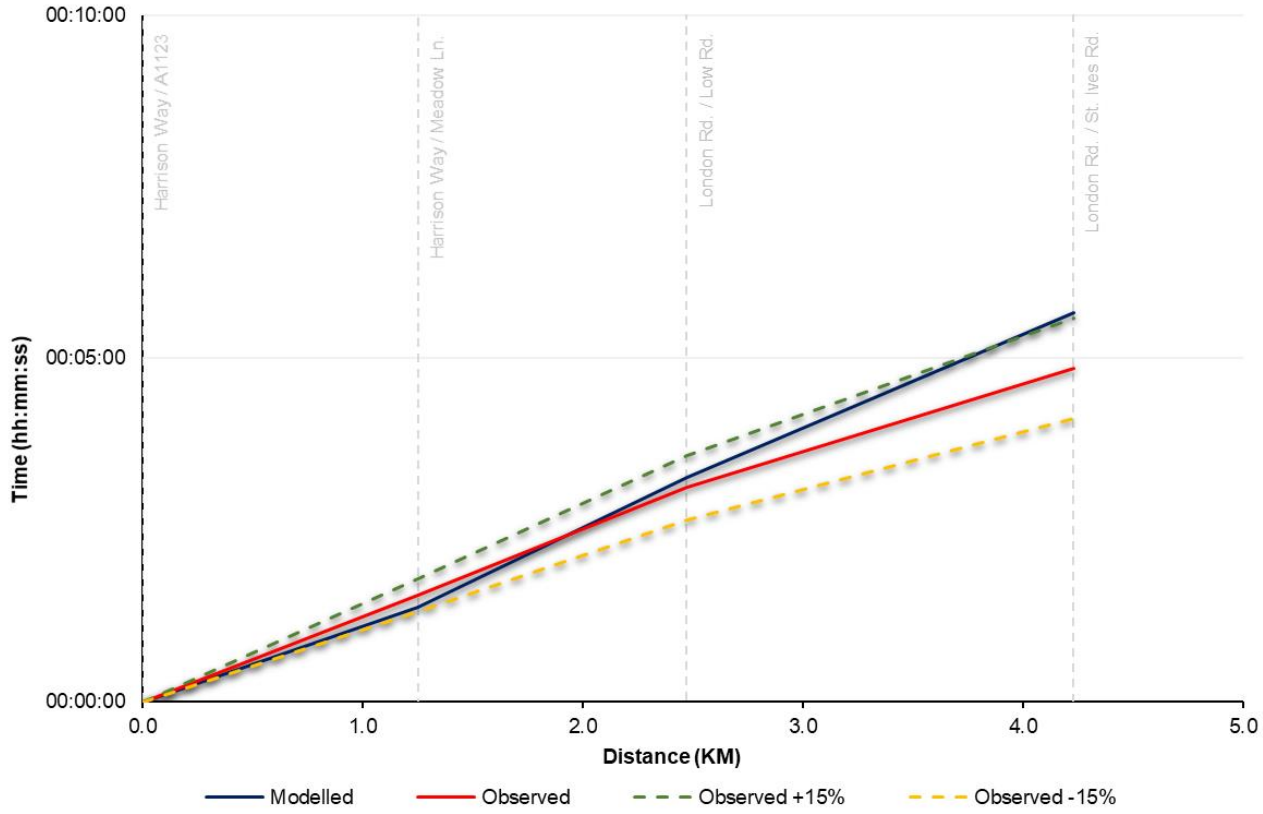
B.3.48. 2015 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – IP



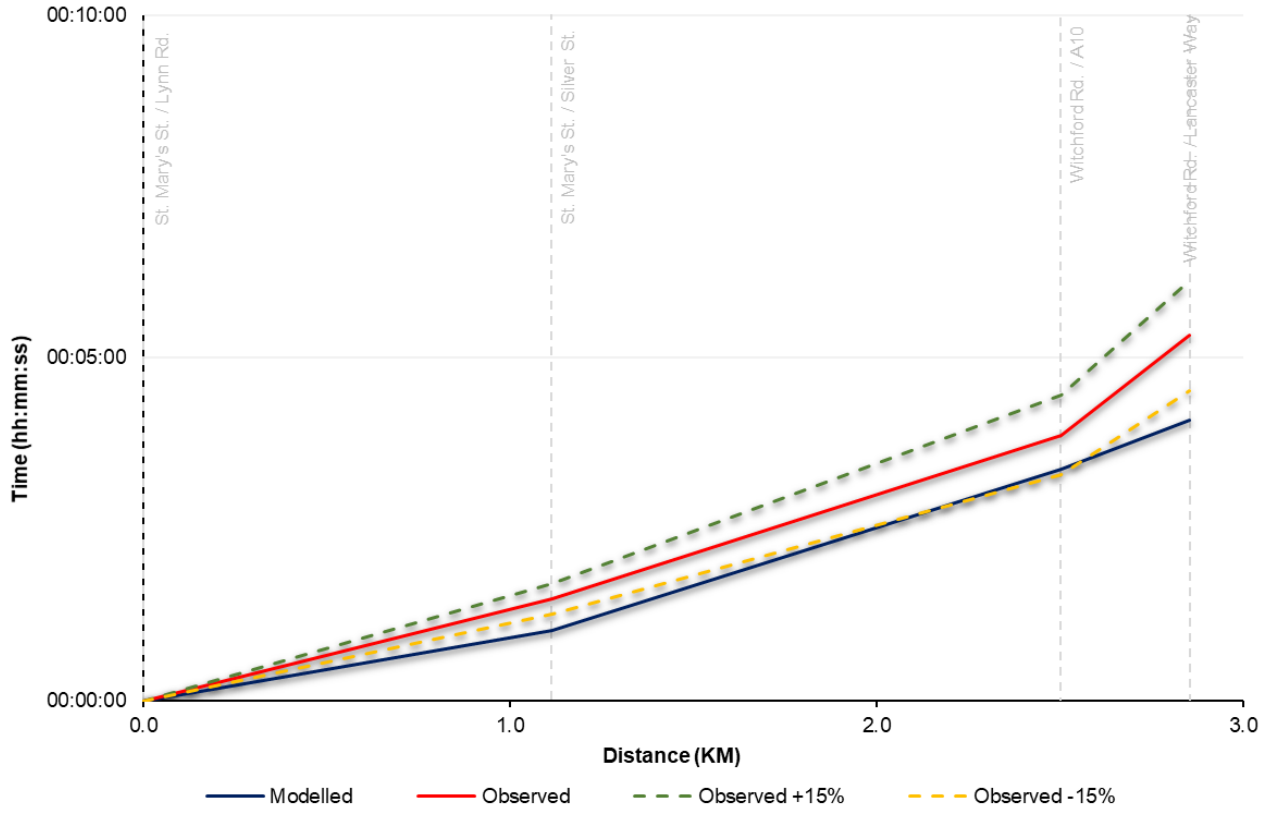
B.3.49. 2015 SI-03: A14 / A1096 to A1123 – IP



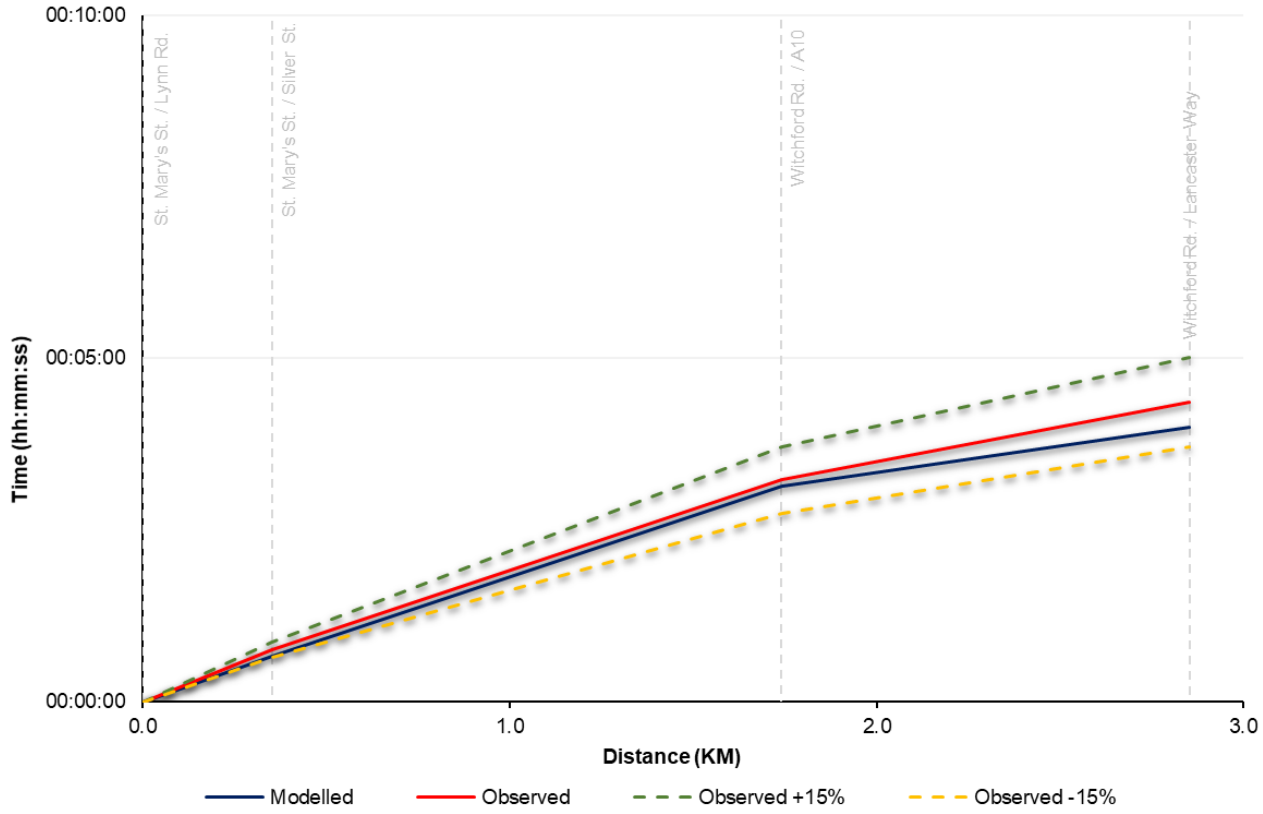
B.3.50. 2015 SI-04: A1123 to A14 / A1096 – IP



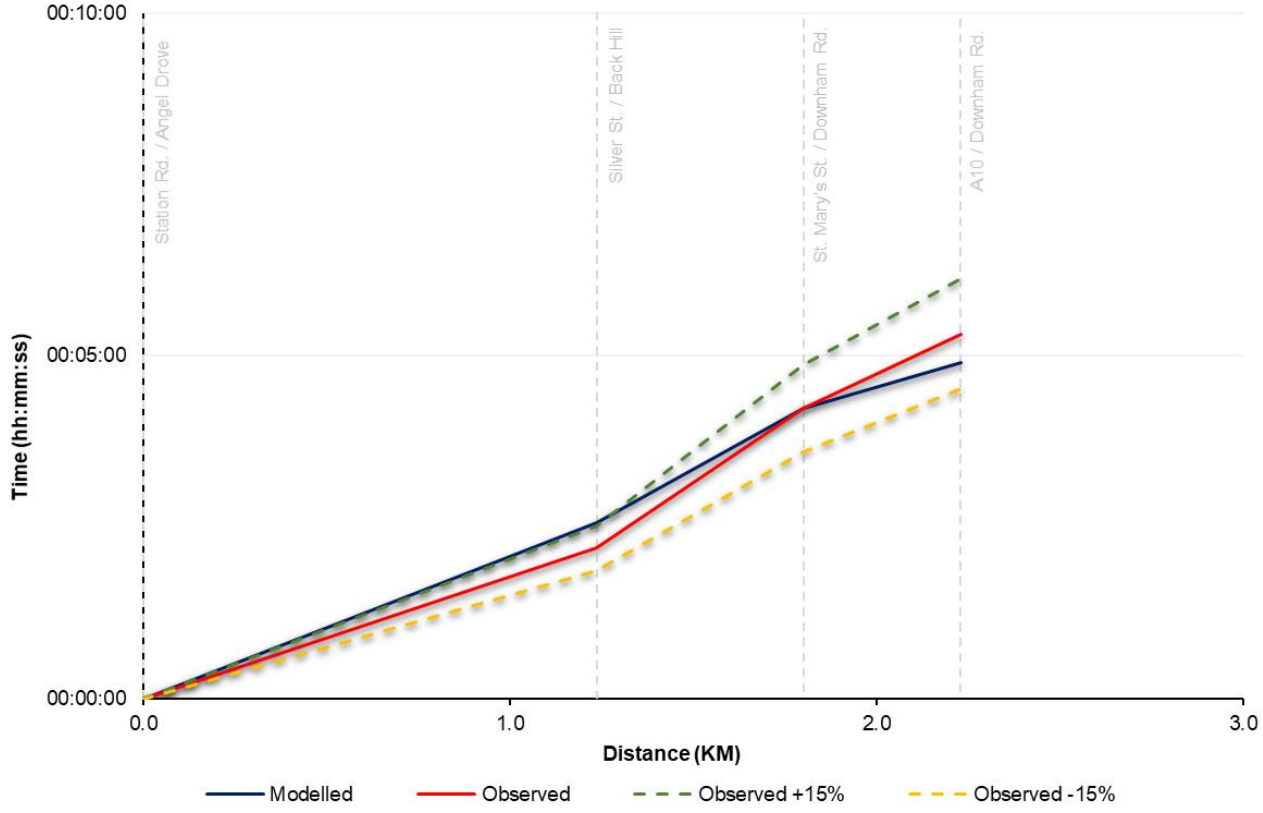
B.3.51. 2015 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – IP



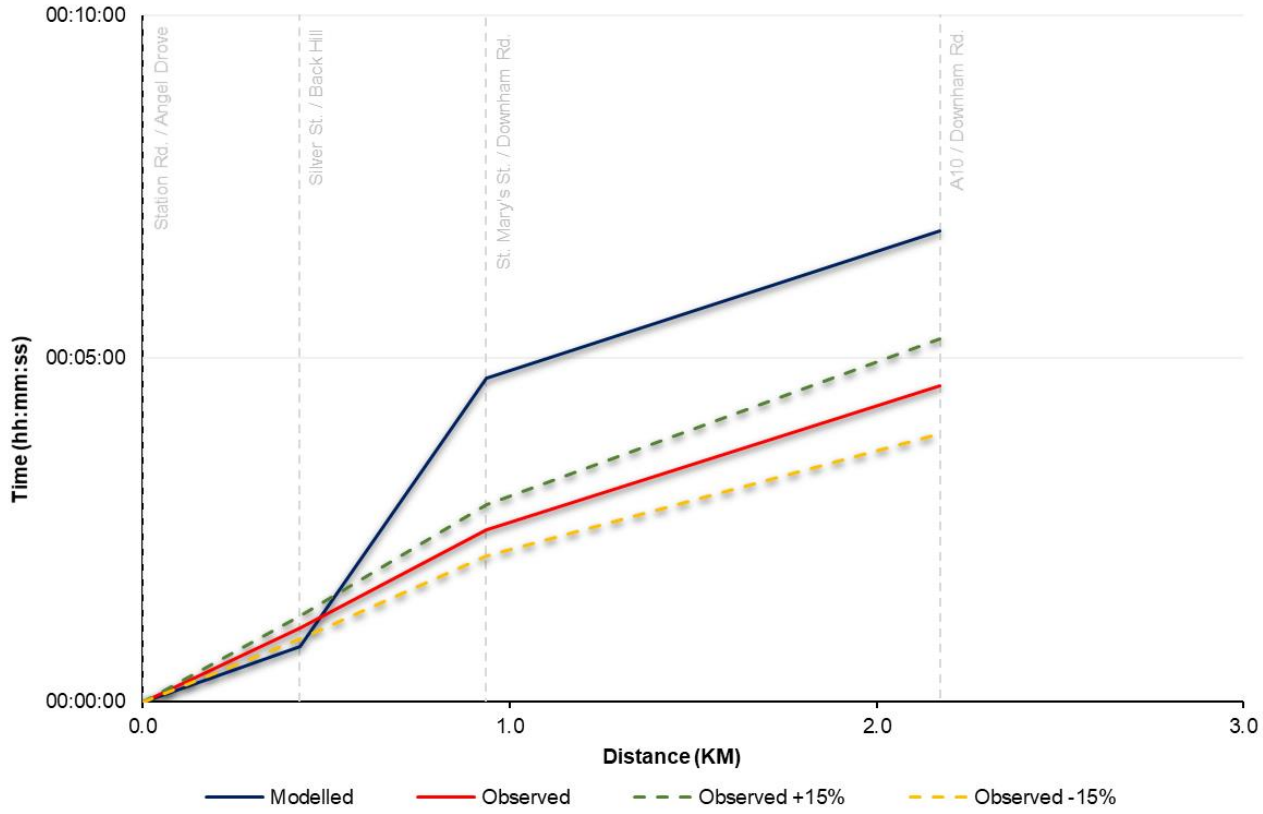
B.3.52. 2015 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – IP



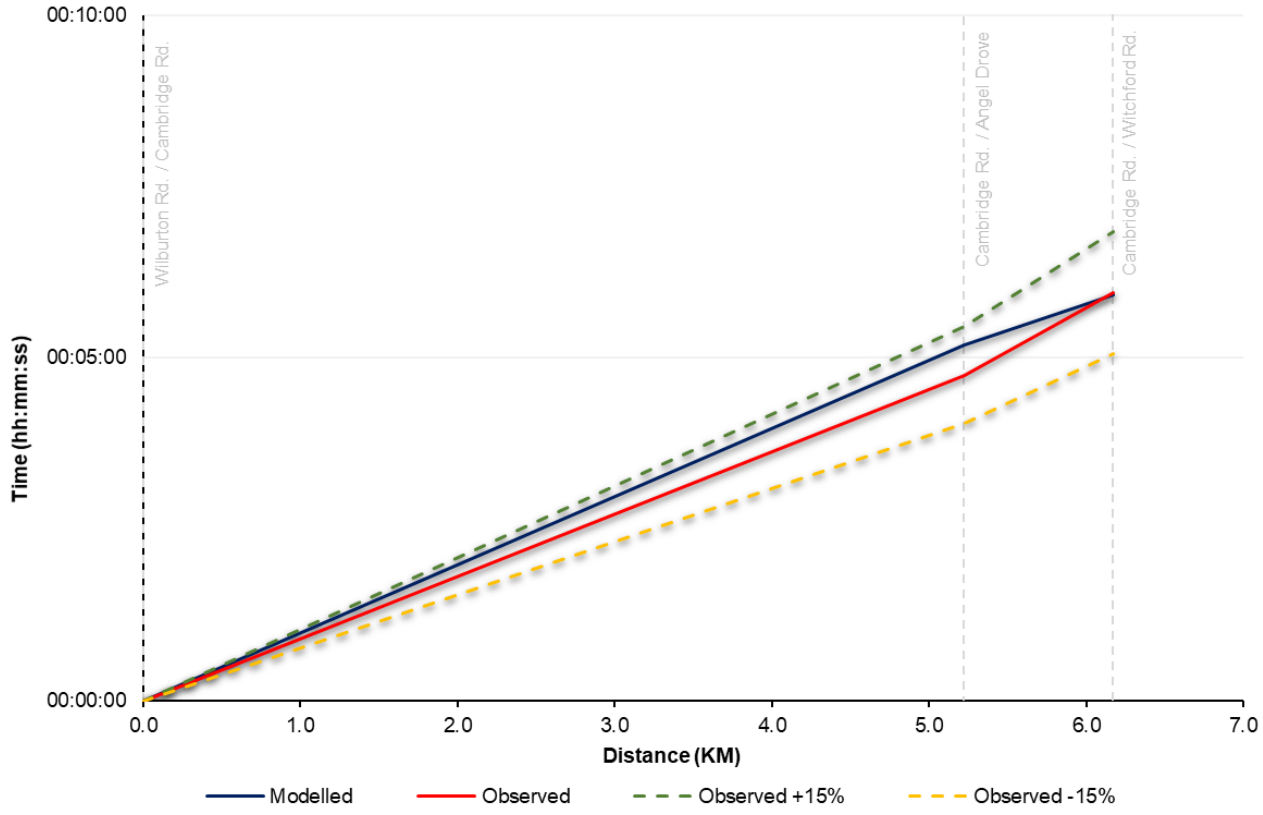
B.3.53. 2015 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – IP



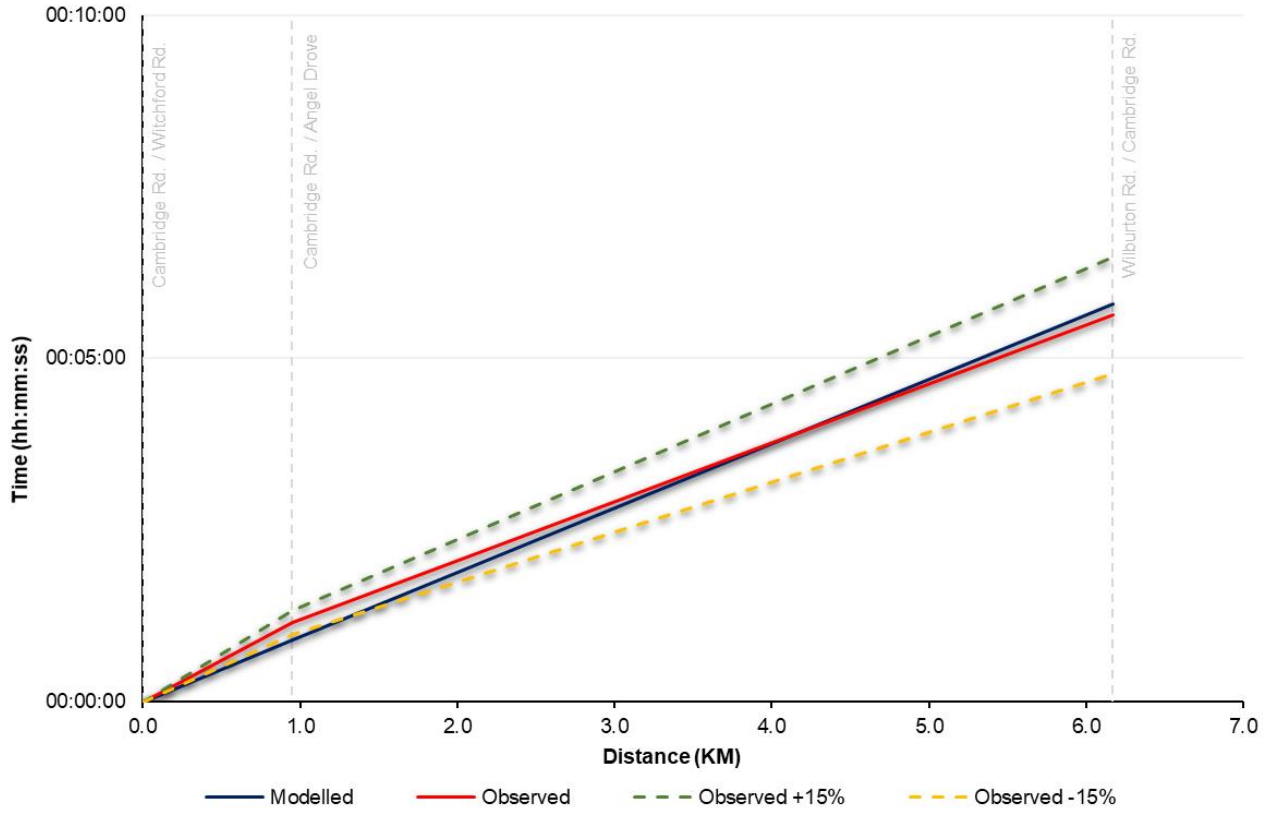
B.3.54. 2015 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – IP



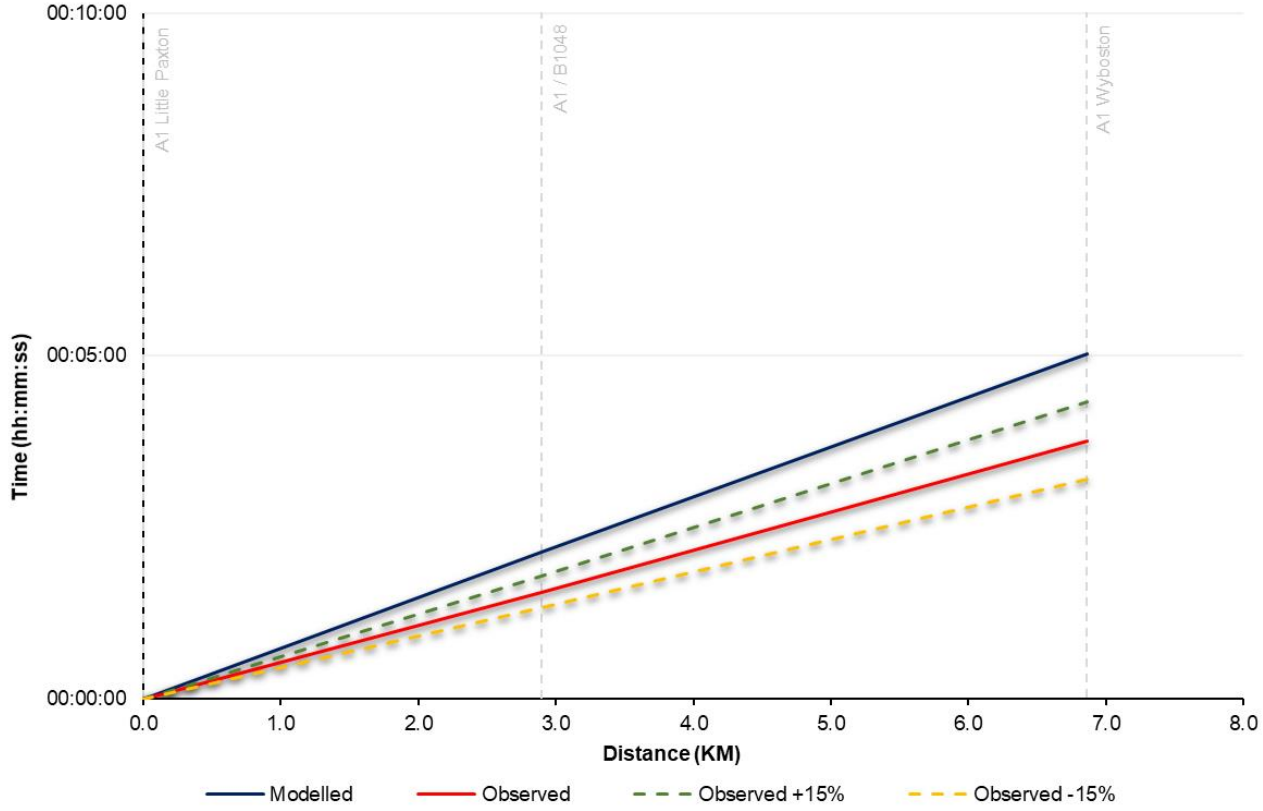
B.3.55. 2015 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – IP



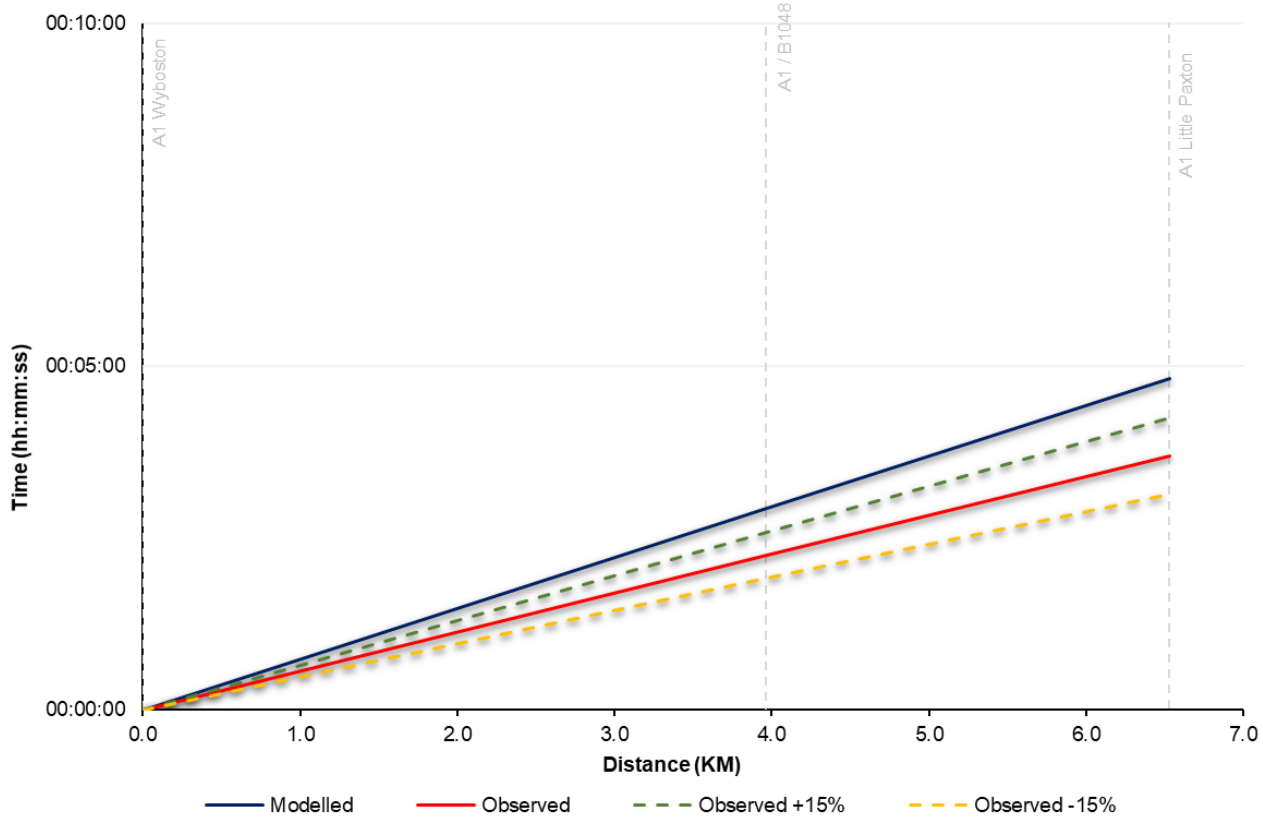
B.3.56. 2015 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – IP



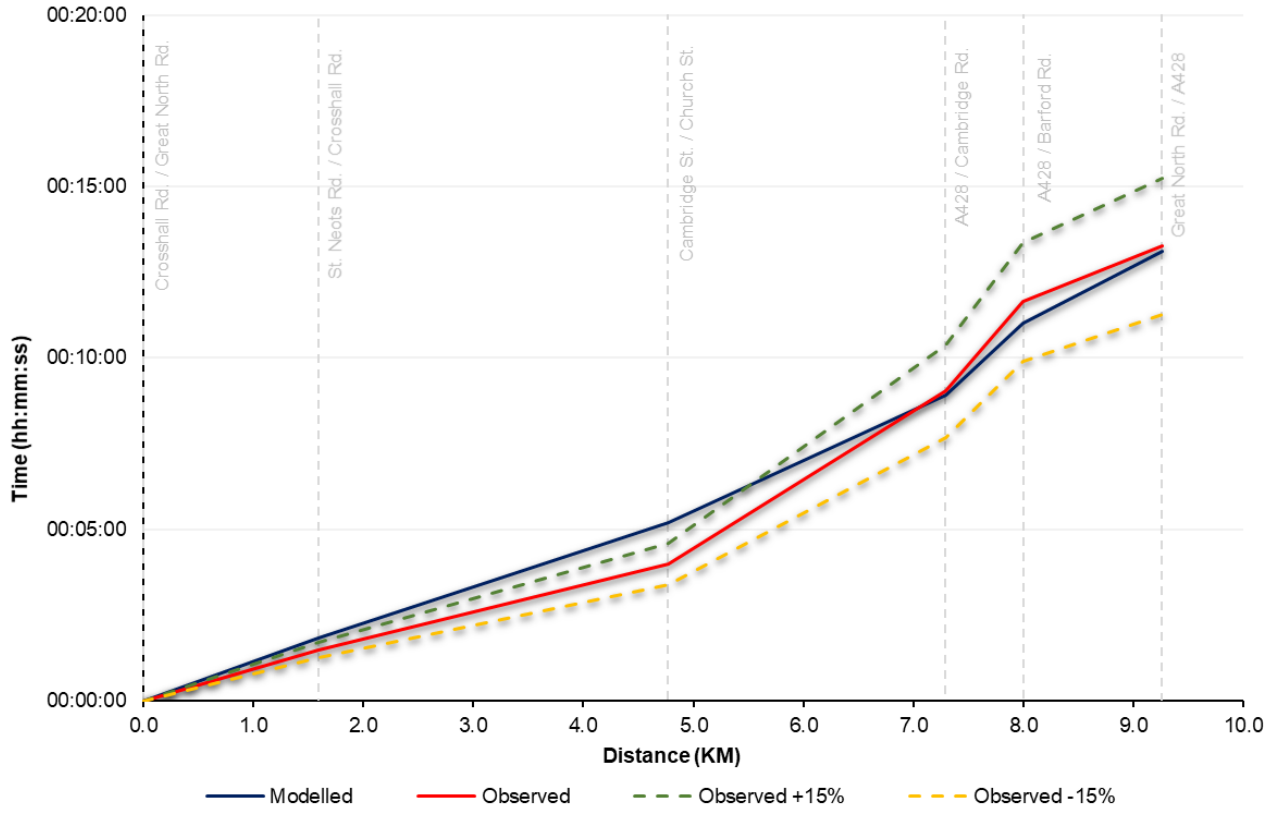
B.3.57. 2015 SN-01: A1 Little Paxton to A421 – IP



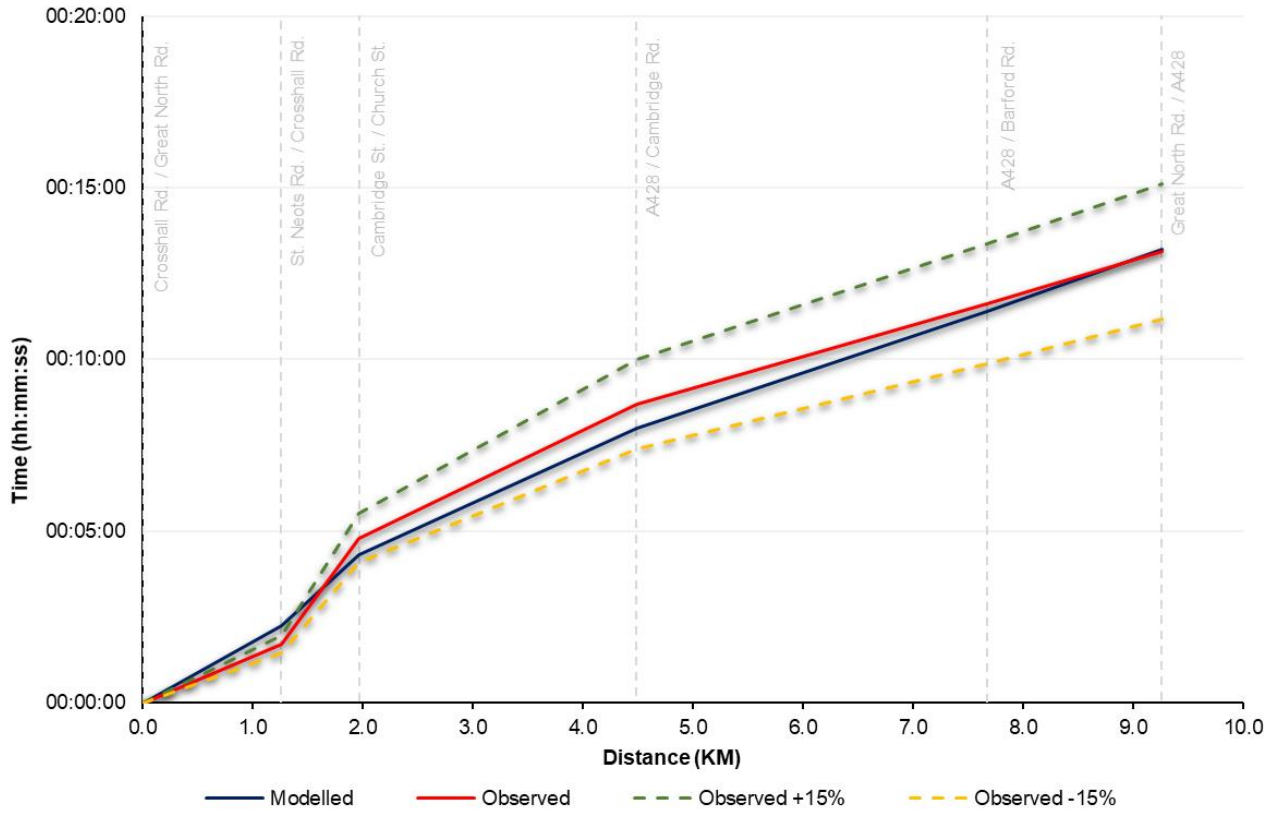
B.3.58. 2015 SN-02: A421 to A1 Little Paxton – IP



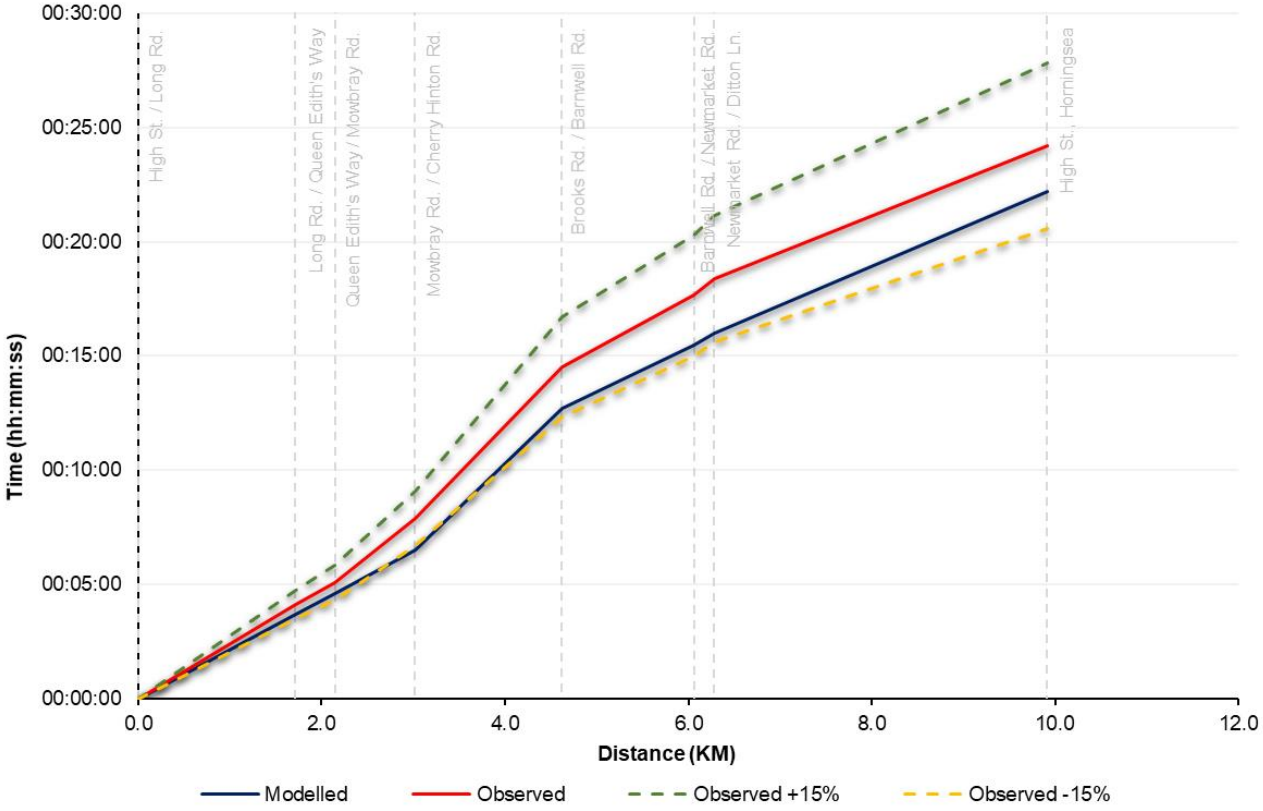
B.3.59. 2015 SN-03: A1 / B465 via Cambridge Rd. – IP



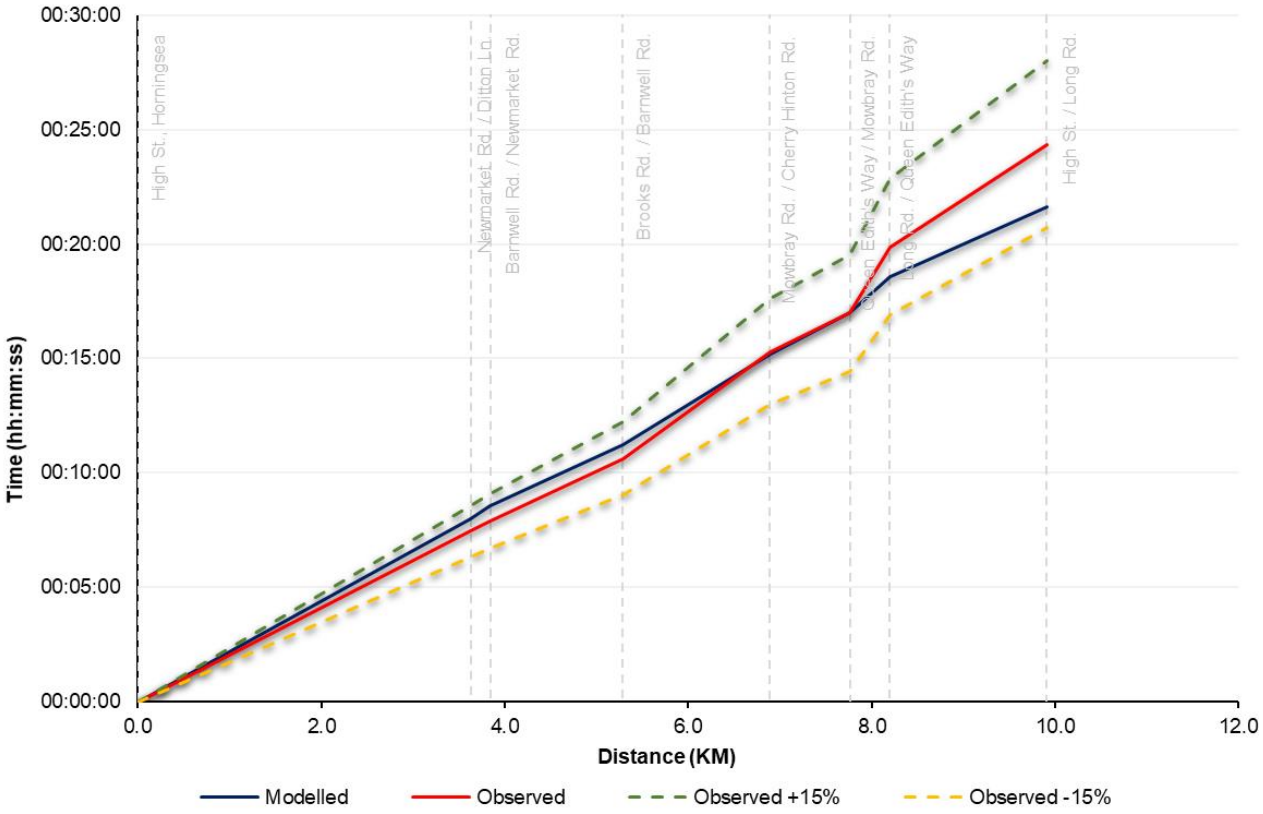
B.3.60. 2015 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – IP



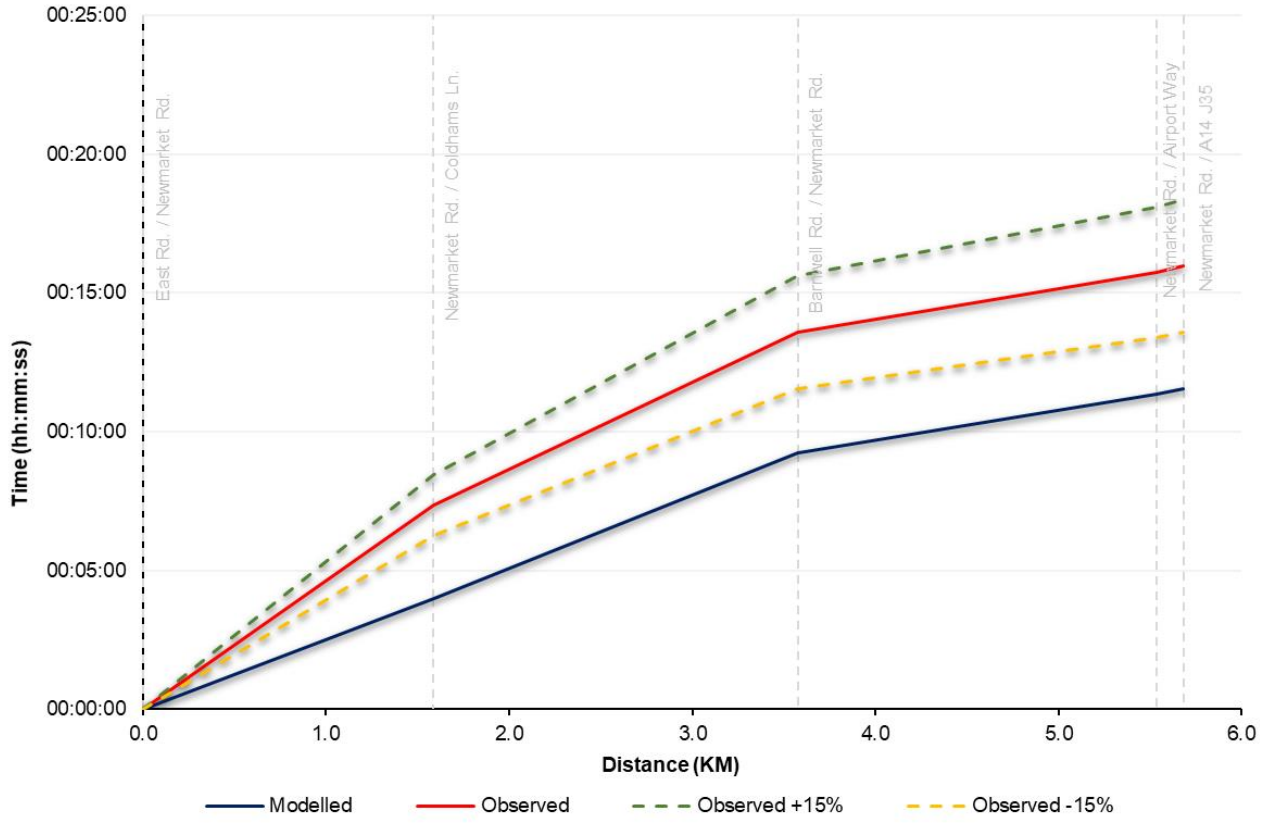
B.3.61. 2015 C-01: Trumpington Rd. to Priory Rd., Horningsea – PM



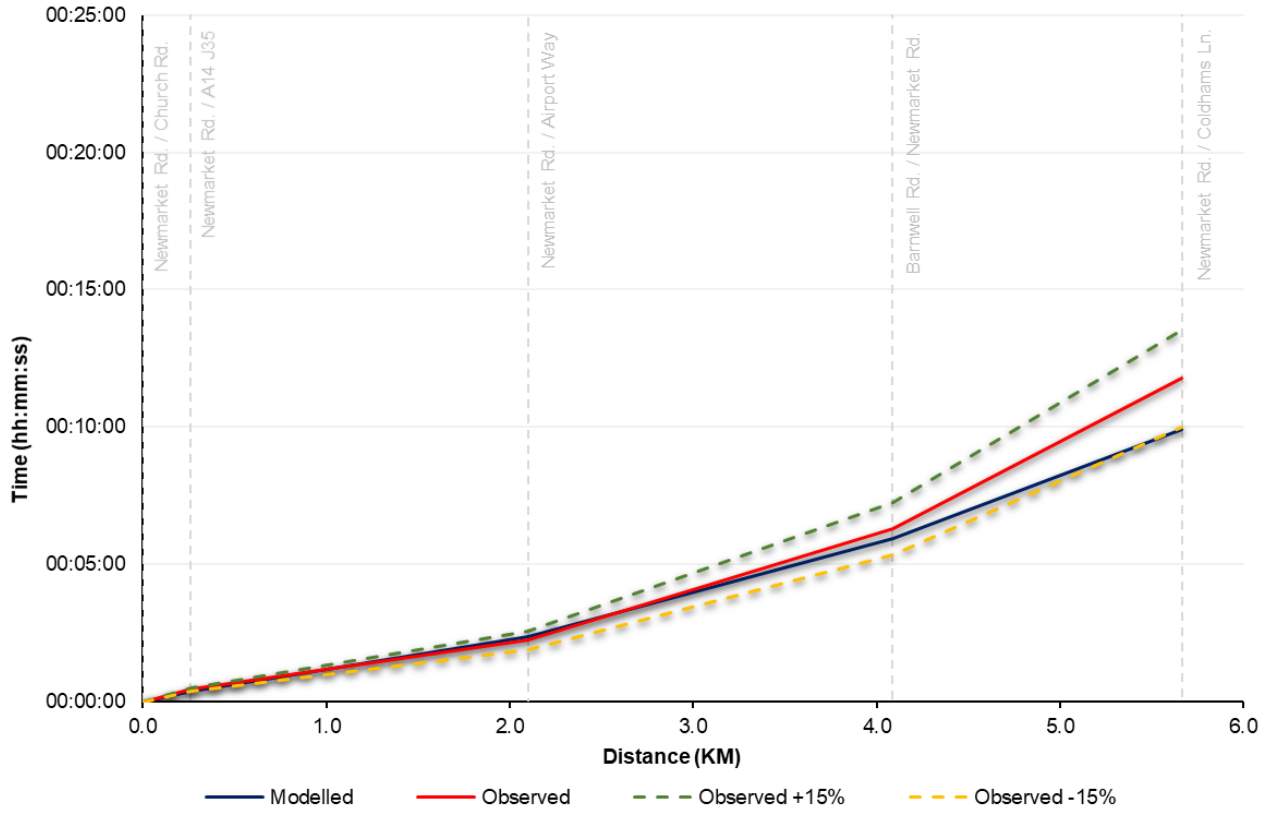
B.3.62. 2015 C-02: Priory Rd., Horningsea to Trumpington Rd. – PM



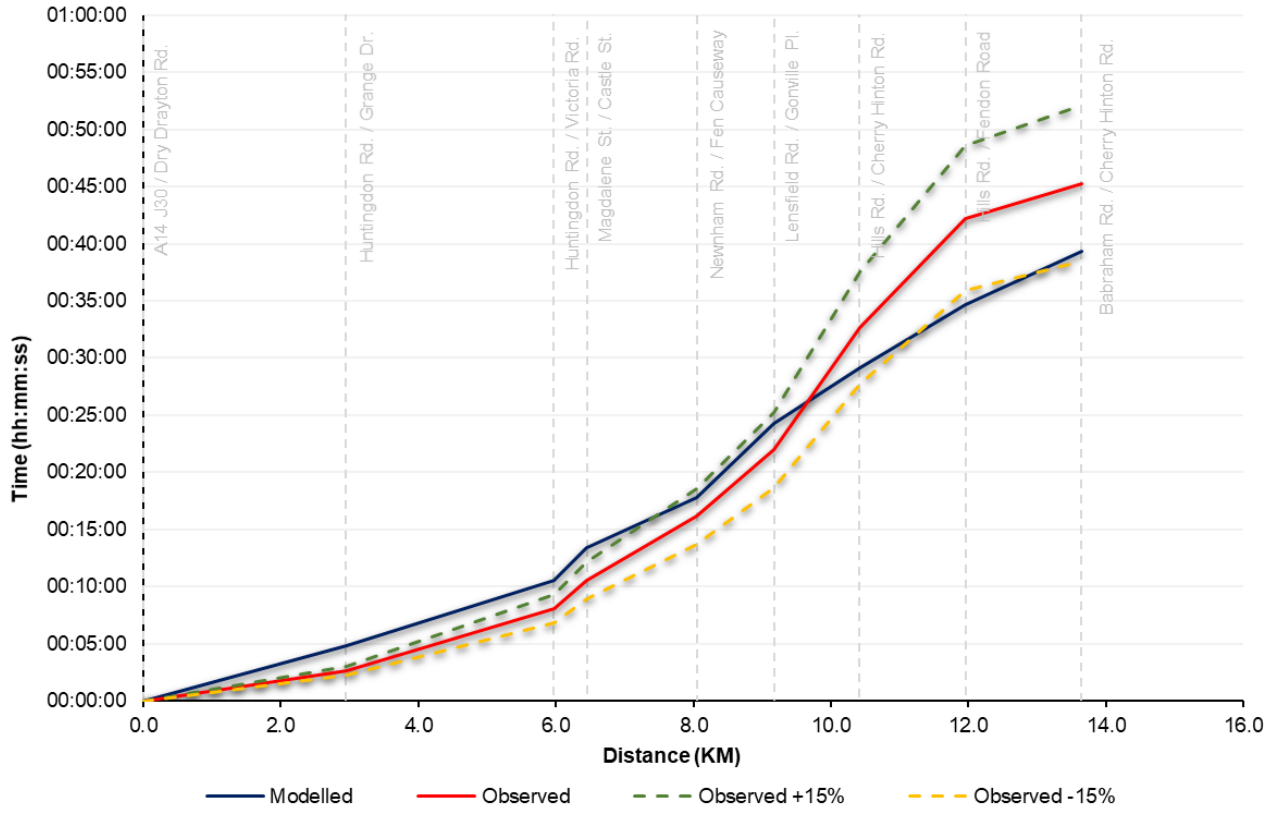
B.3.63. 2015 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – PM



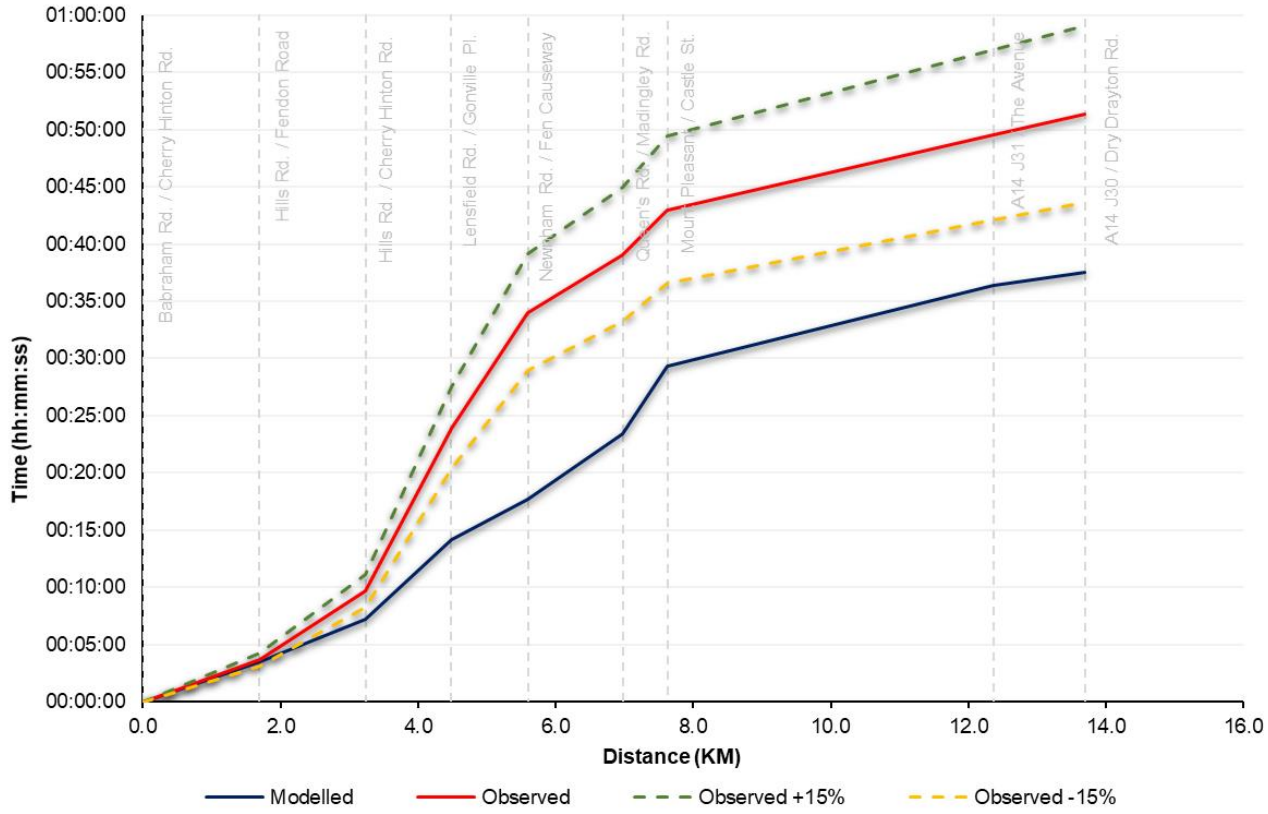
B.3.64. 2015 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – PM



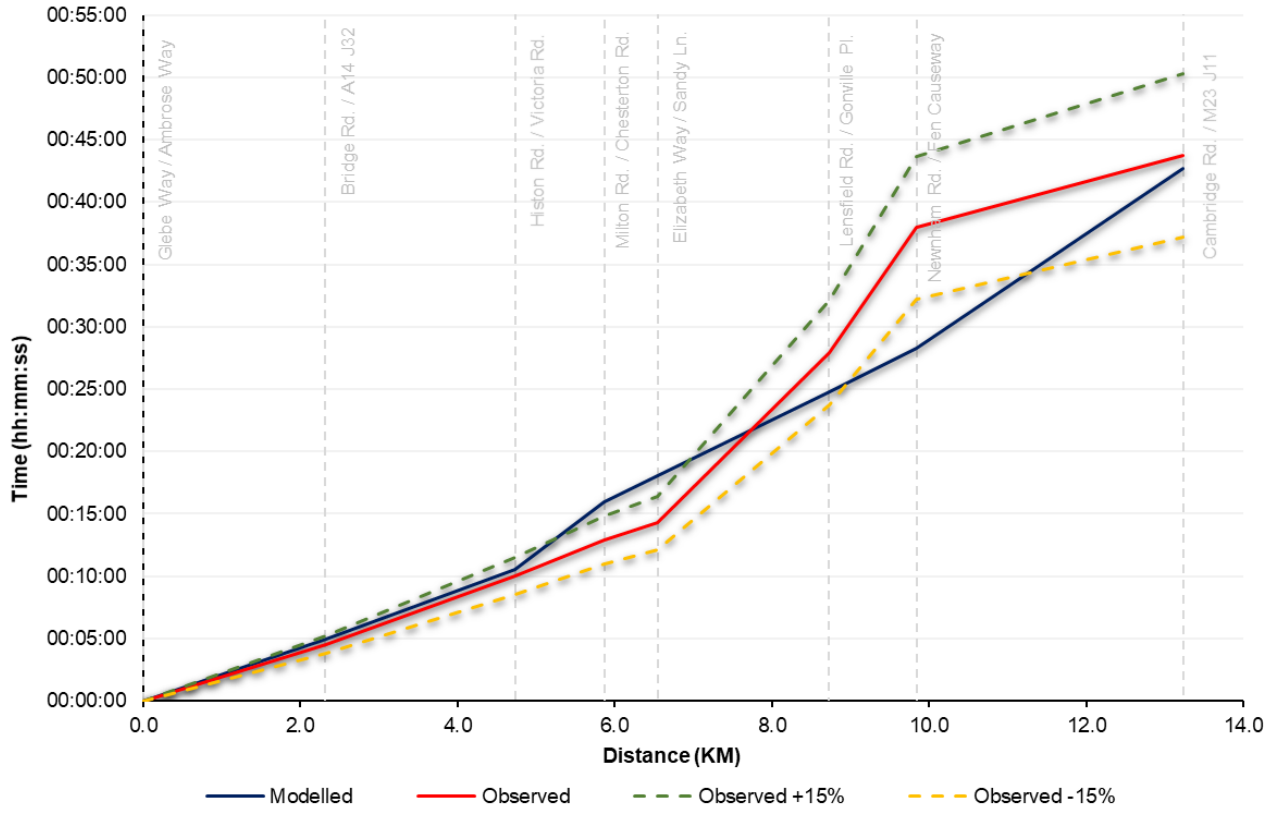
B.3.65. 2015 C-05: Oakington Rd. to Fendon Rd. – PM



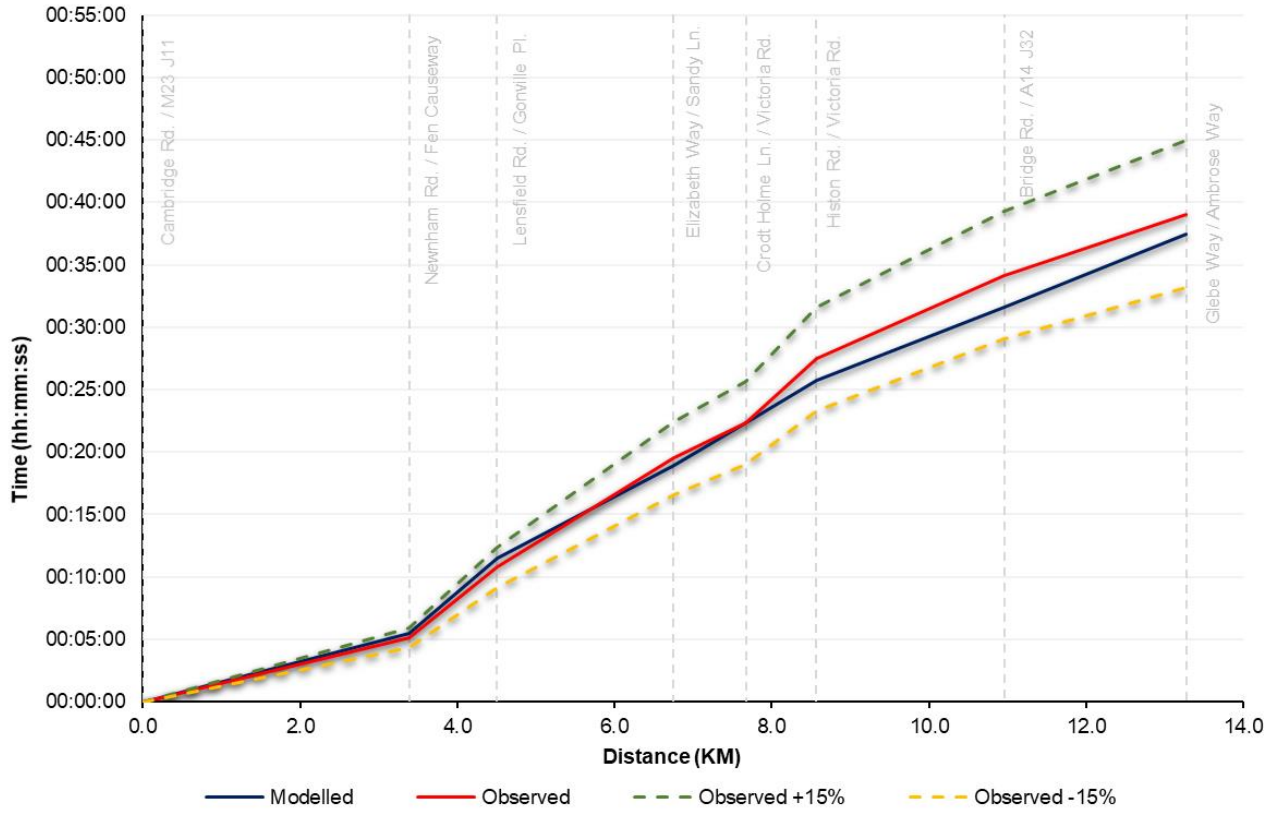
B.3.66. 2015 C-06: Fendon Rd. to Oakington Rd. – PM



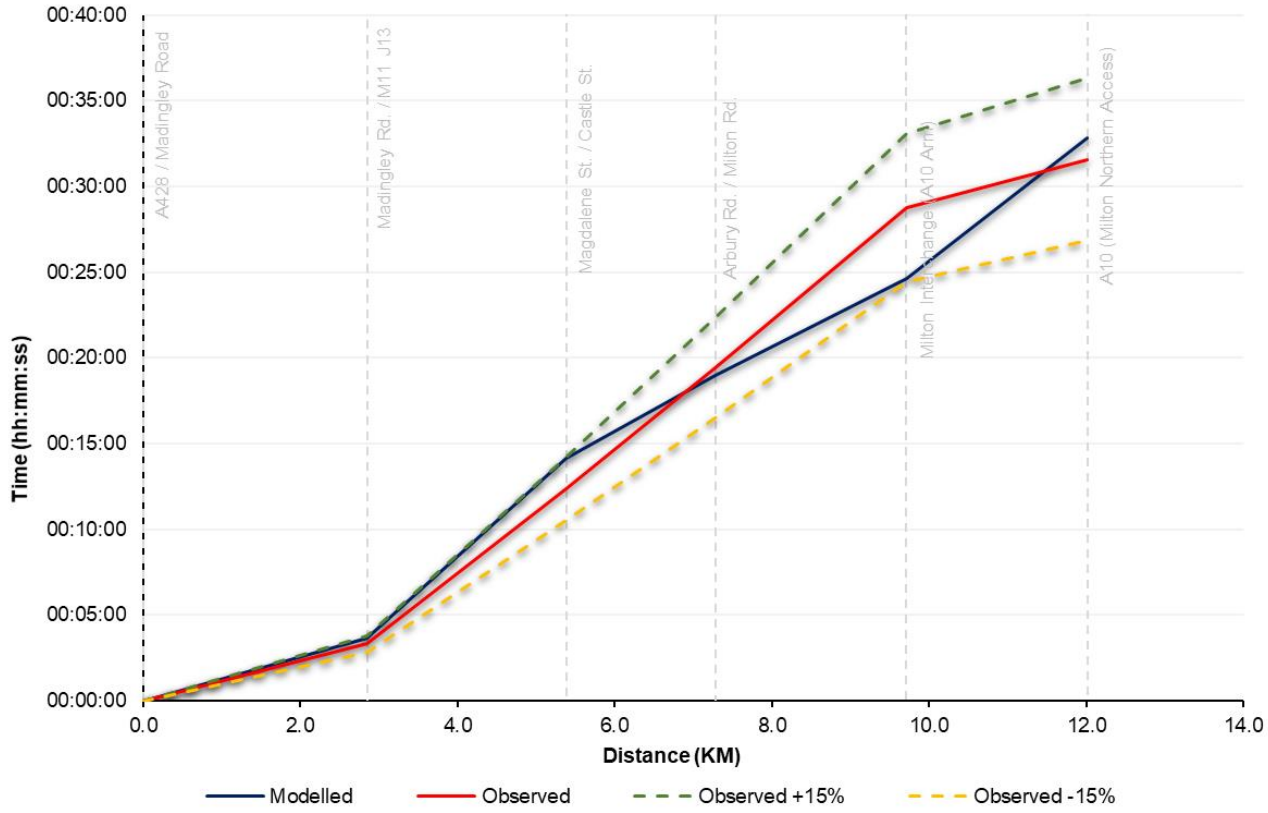
B.3.67. 2015 C-07: Impington Ln. to M11 – PM



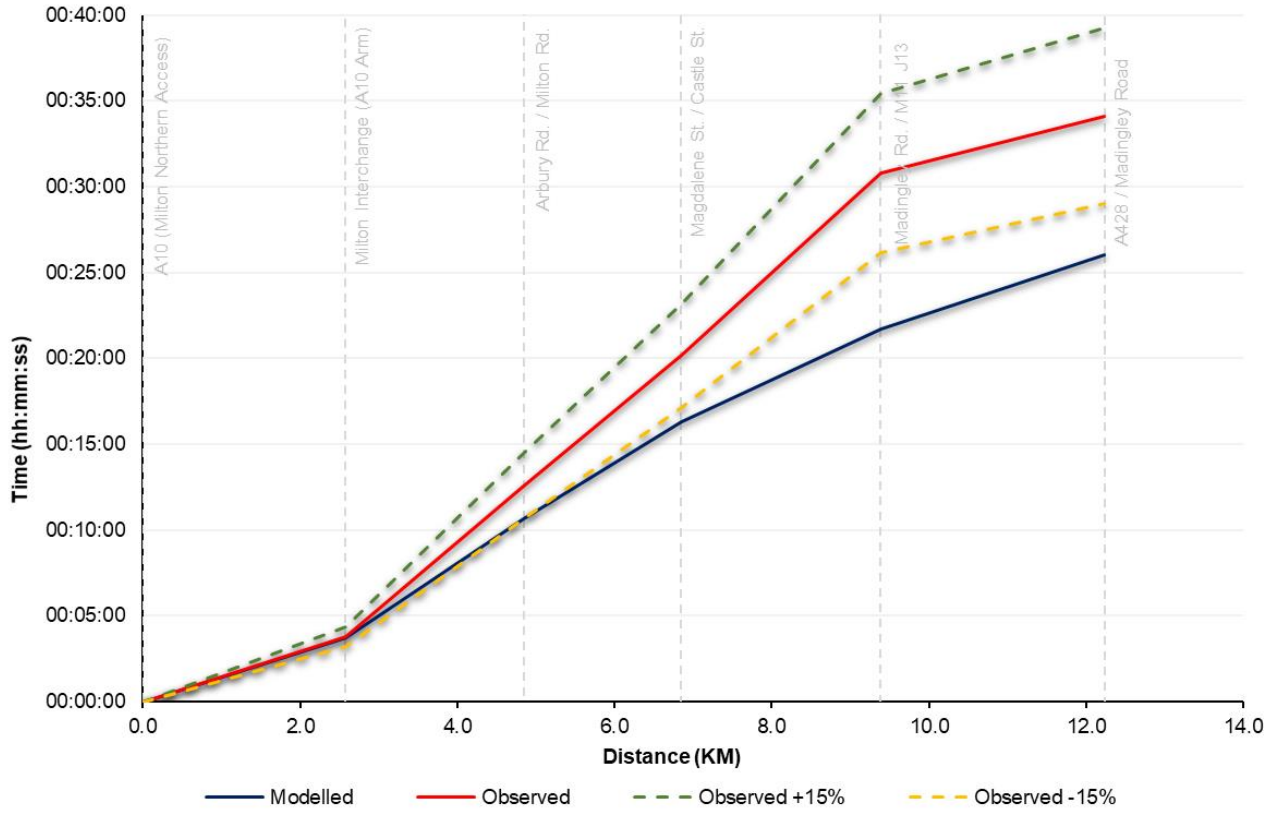
B.3.68. 2015 C-08: M11 to Impington Ln. – PM



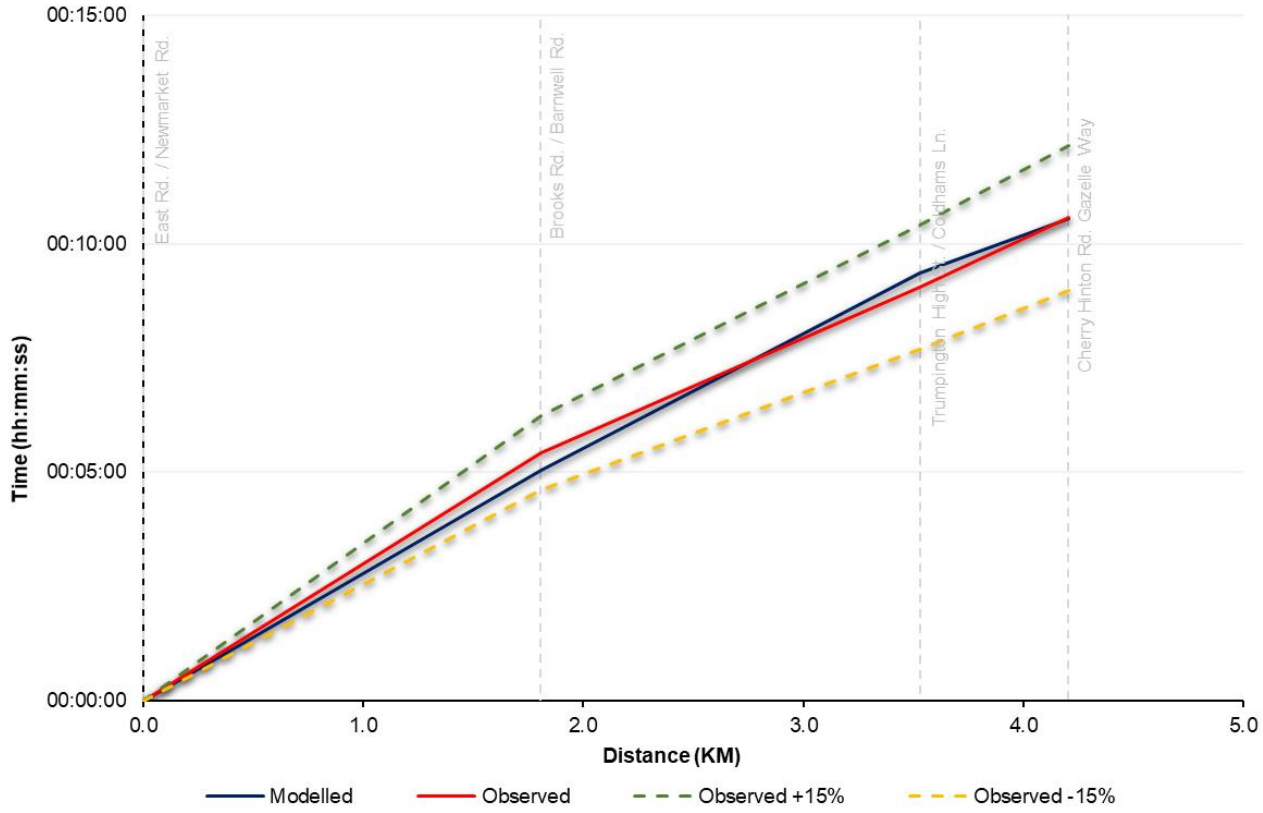
B.3.69. 2015 C-09: A428 Rbt. to Milton – PM



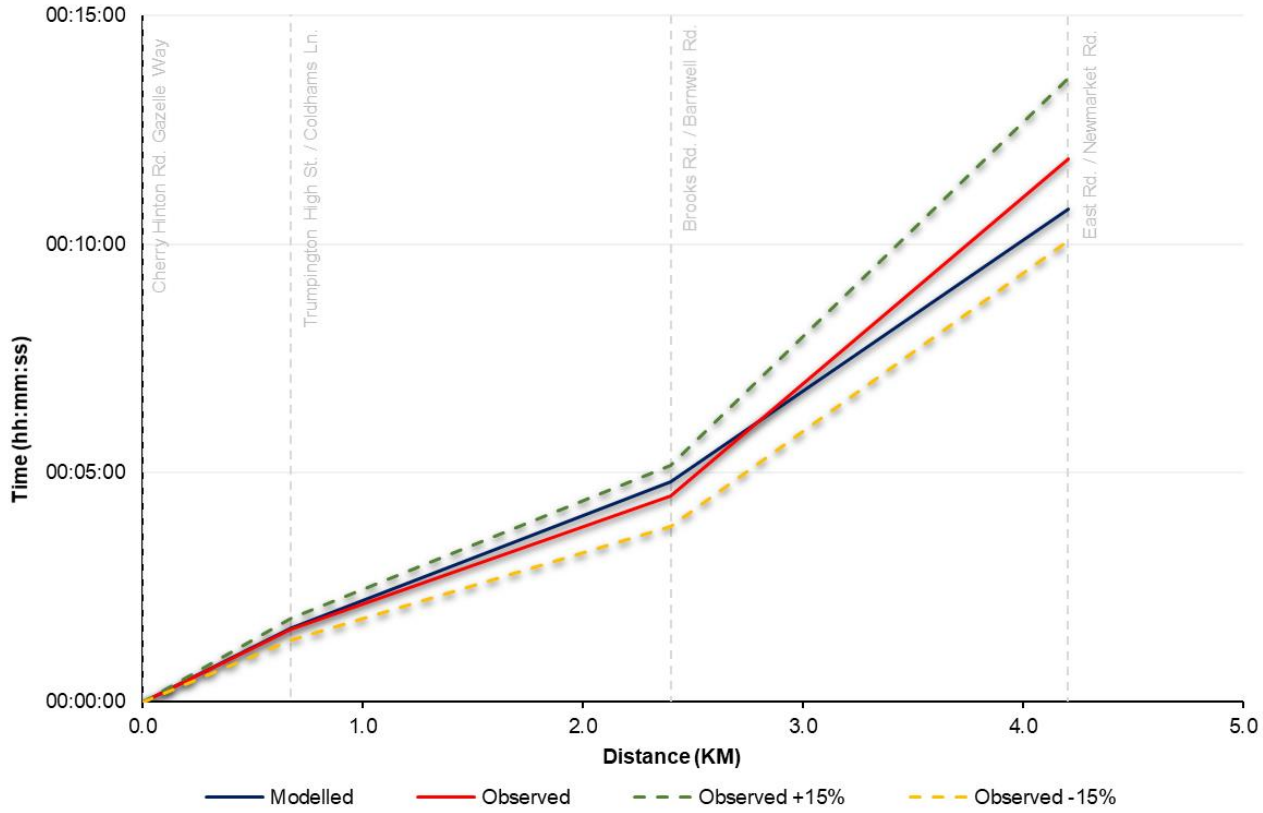
B.3.70. 2015 C-10: Milton to A428 Rbt. – PM



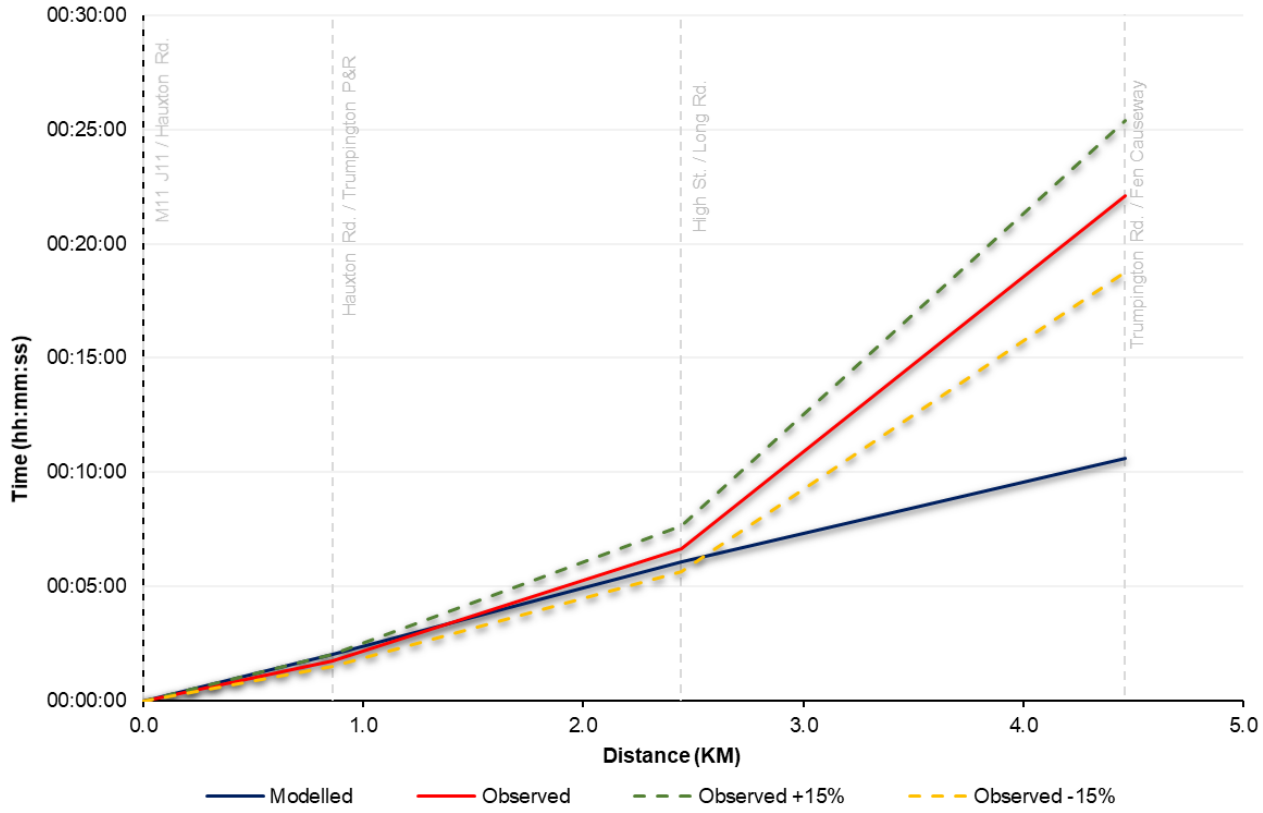
B.3.71. 2015 C-11: Elizabeth Way to Teversham Drift – PM



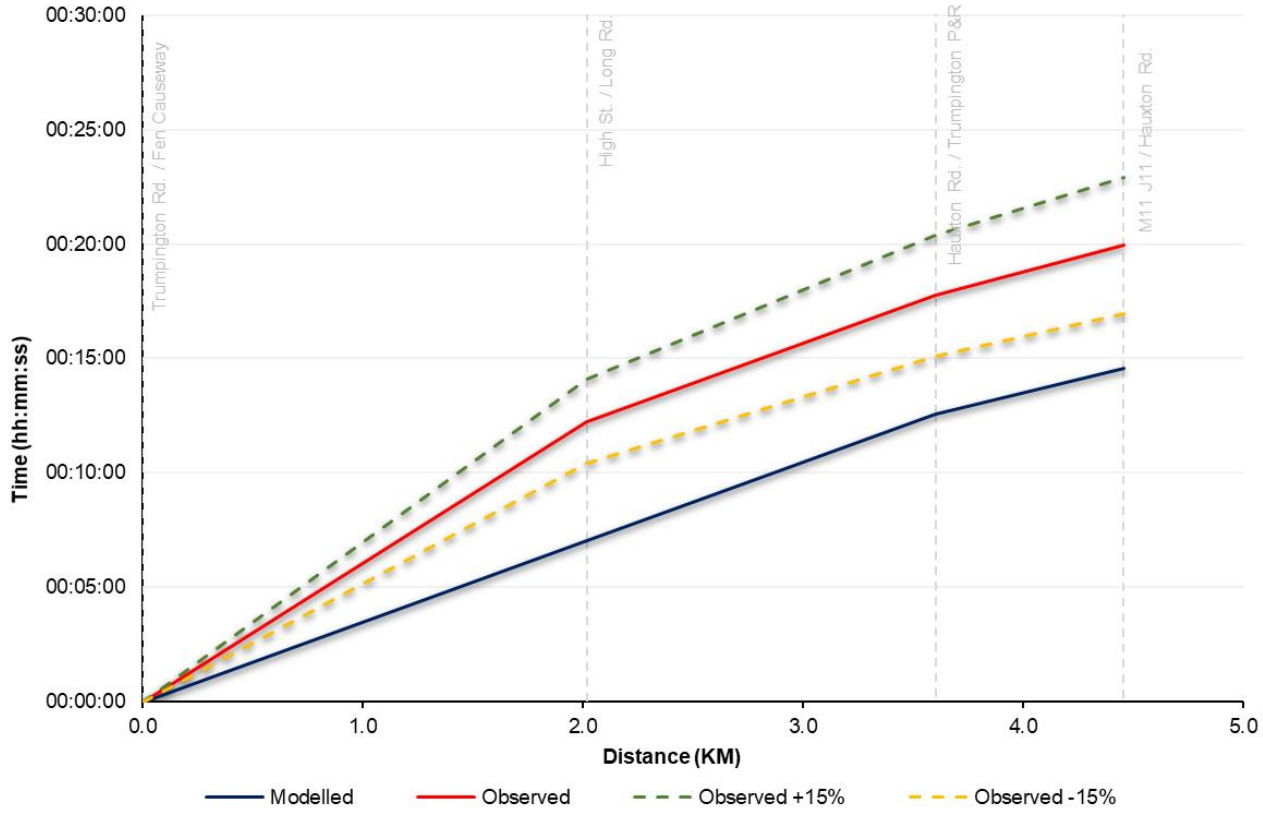
B.3.72. 2015 C-12: Teversham Drift to Elizabeth Way – PM



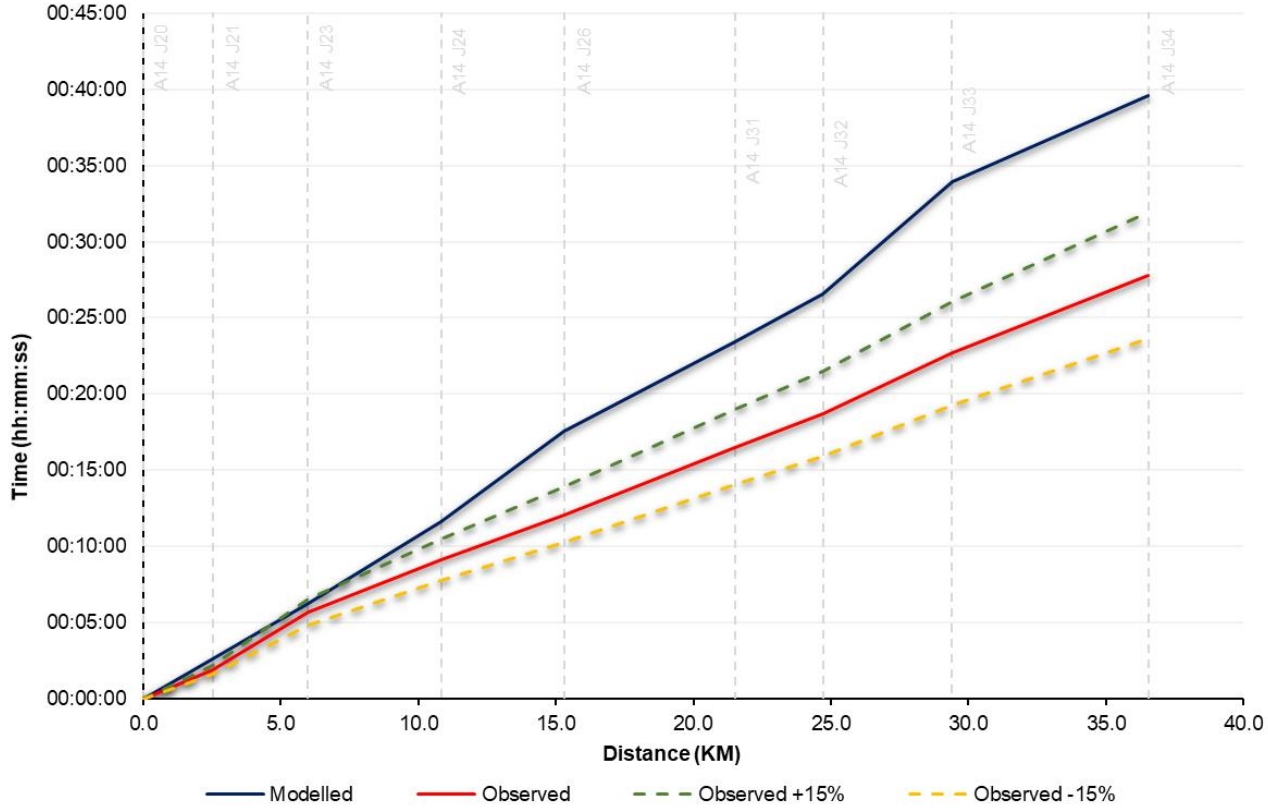
B.3.73. 2015 C-13: Hauxton Rd. (M11) to Lensfield Rd. – PM



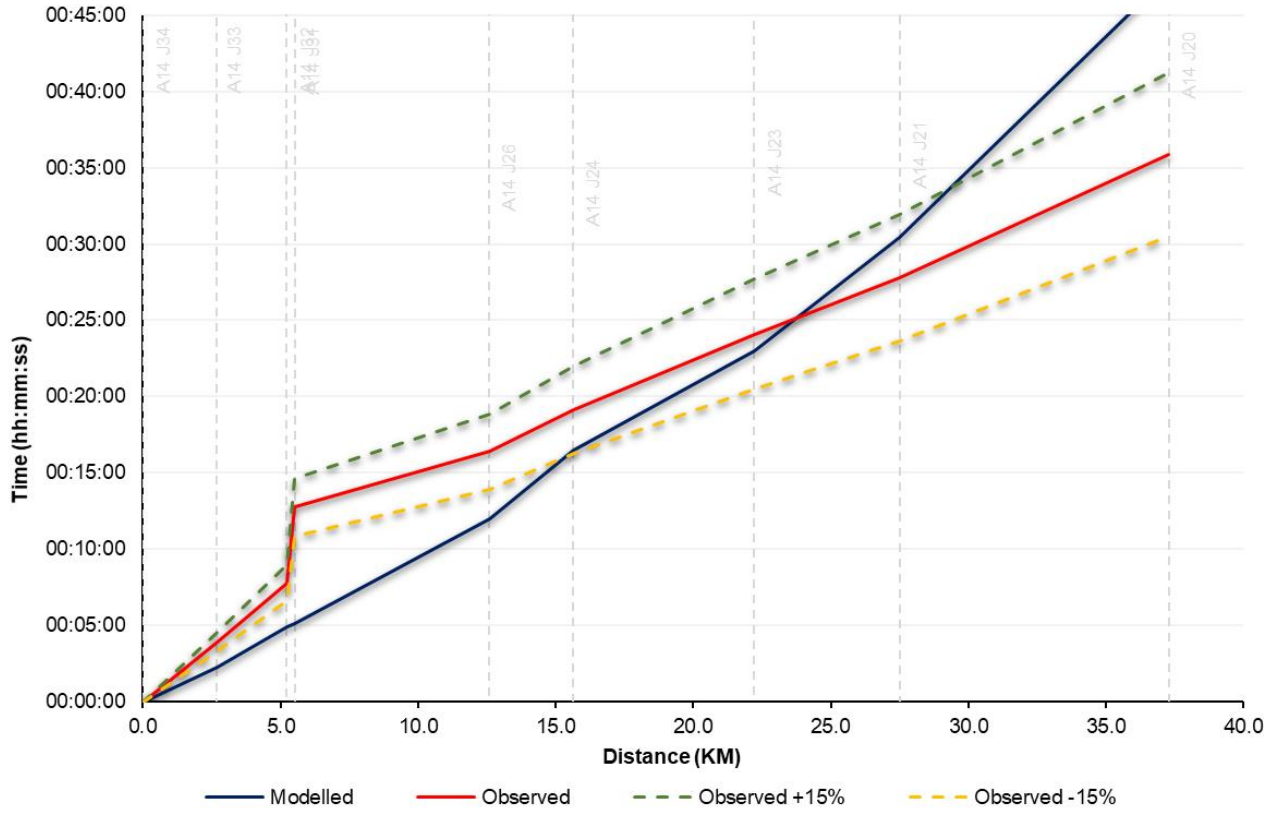
B.3.74. 2015 C-14: Lensfield Rd. to Hauxton Rd. (M11) – PM



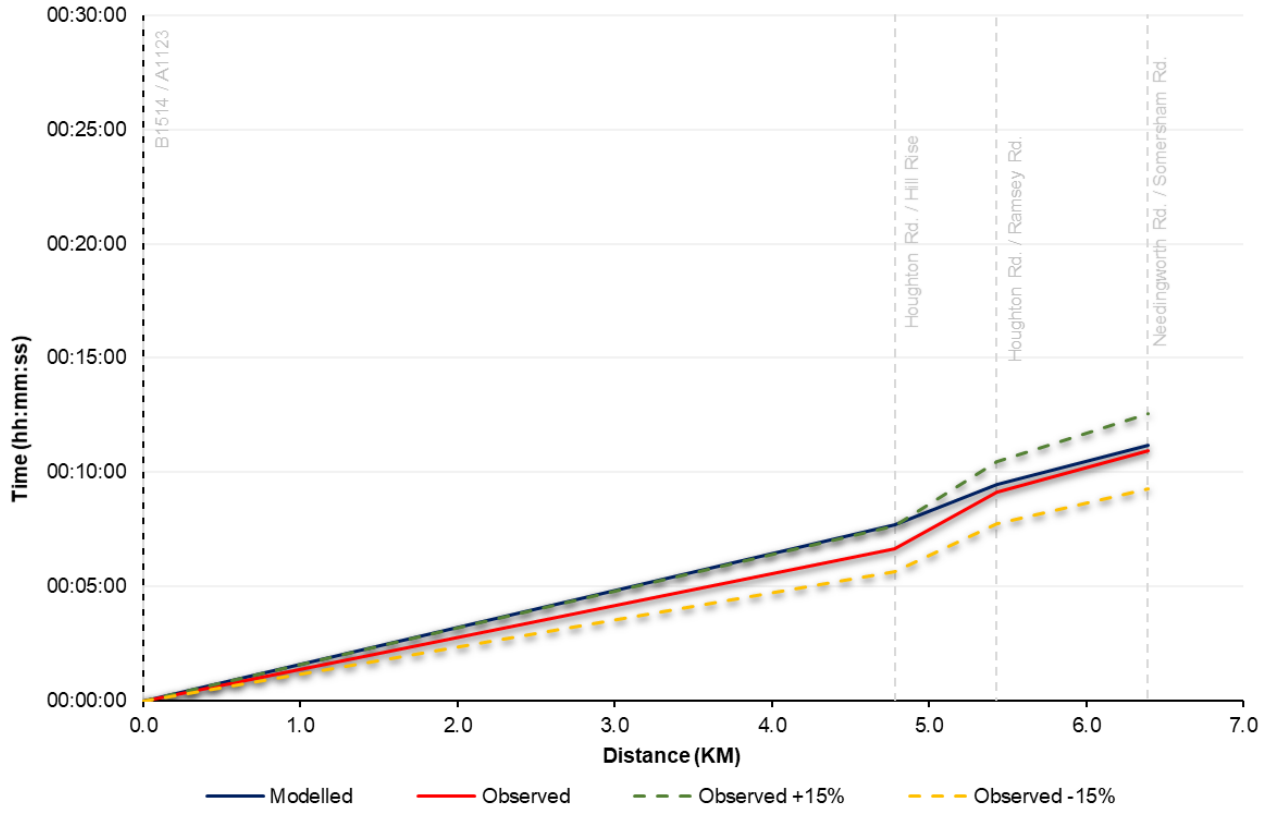
B.3.75. 2015 A14-01: Ellington to Horningsea Rd. – PM



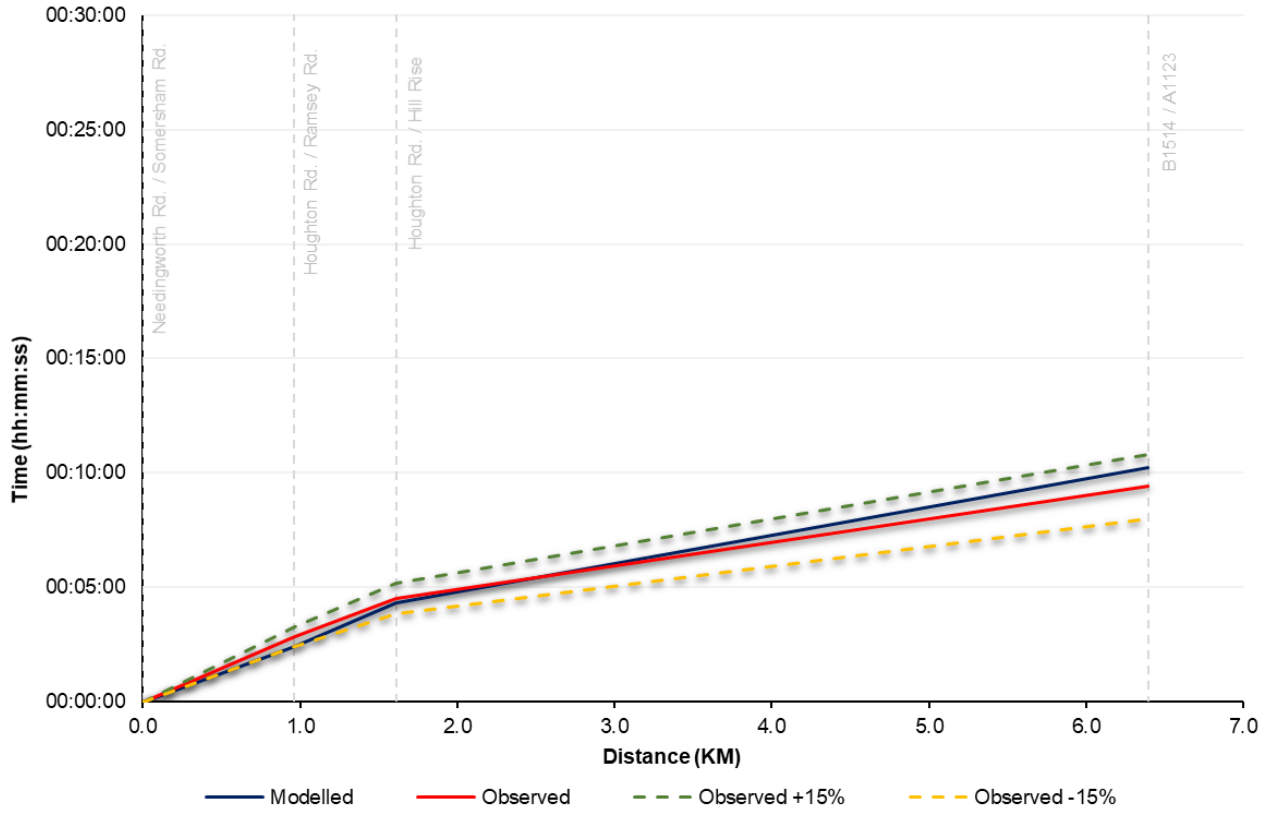
B.3.76. 2015 A14-02: Horningsea Rd. to Ellington – PM



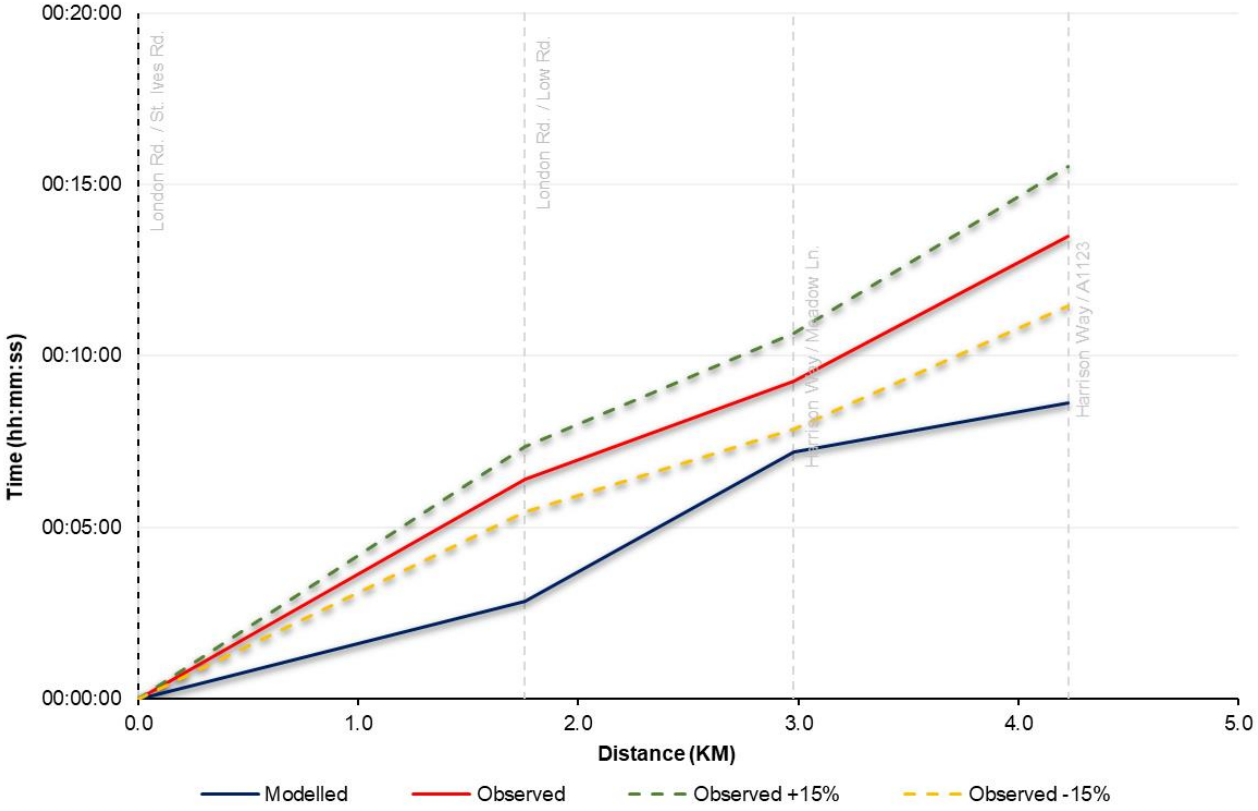
B.3.77. 2015 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – PM



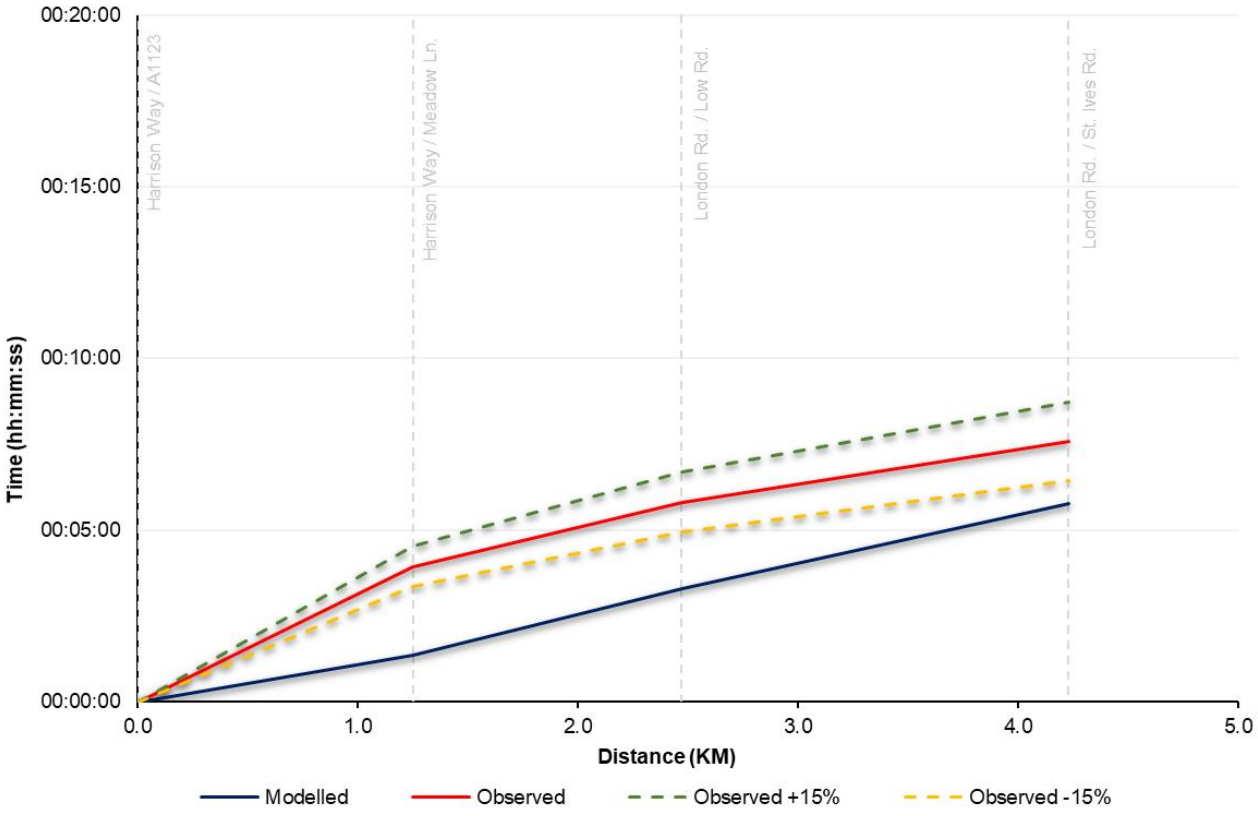
B.3.78. 2015 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – PM



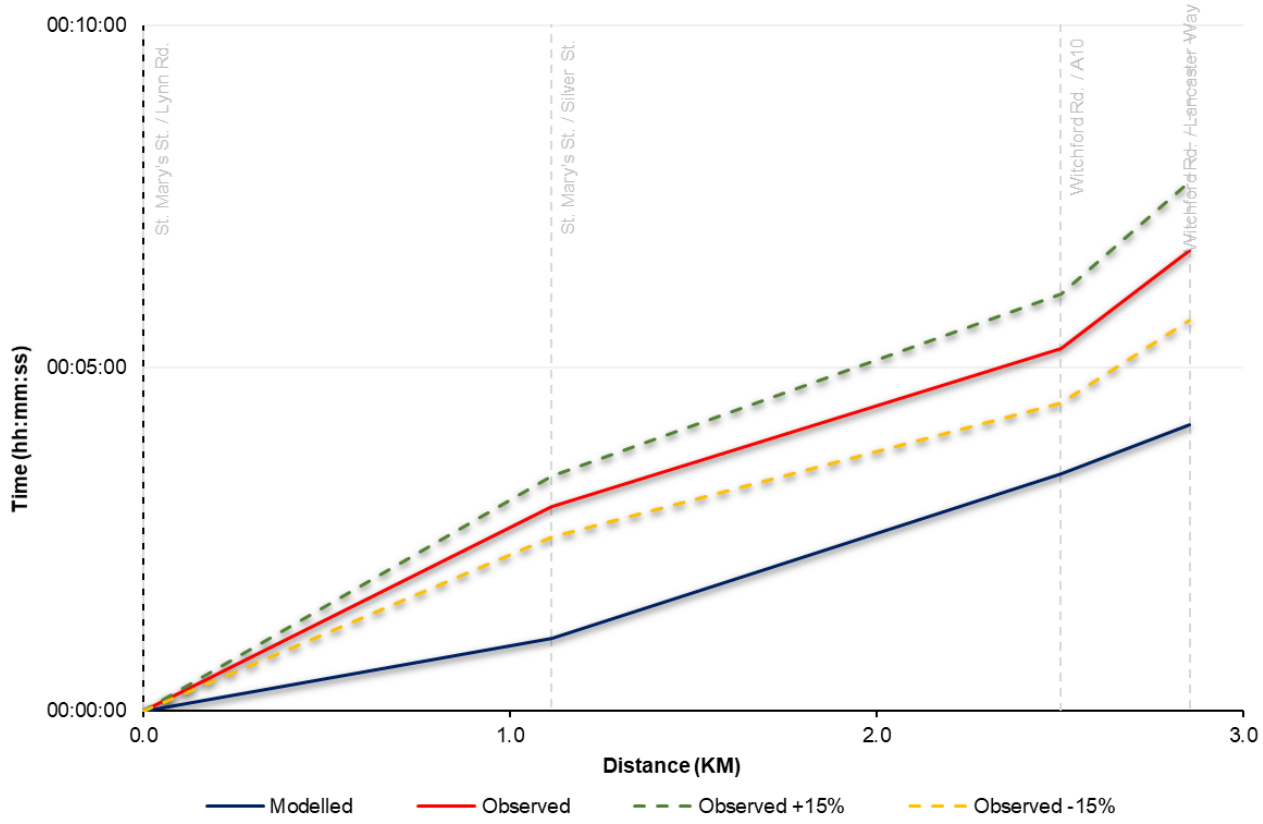
B.3.79. 2015 SI-03: A14 / A1096 to A1123 – PM



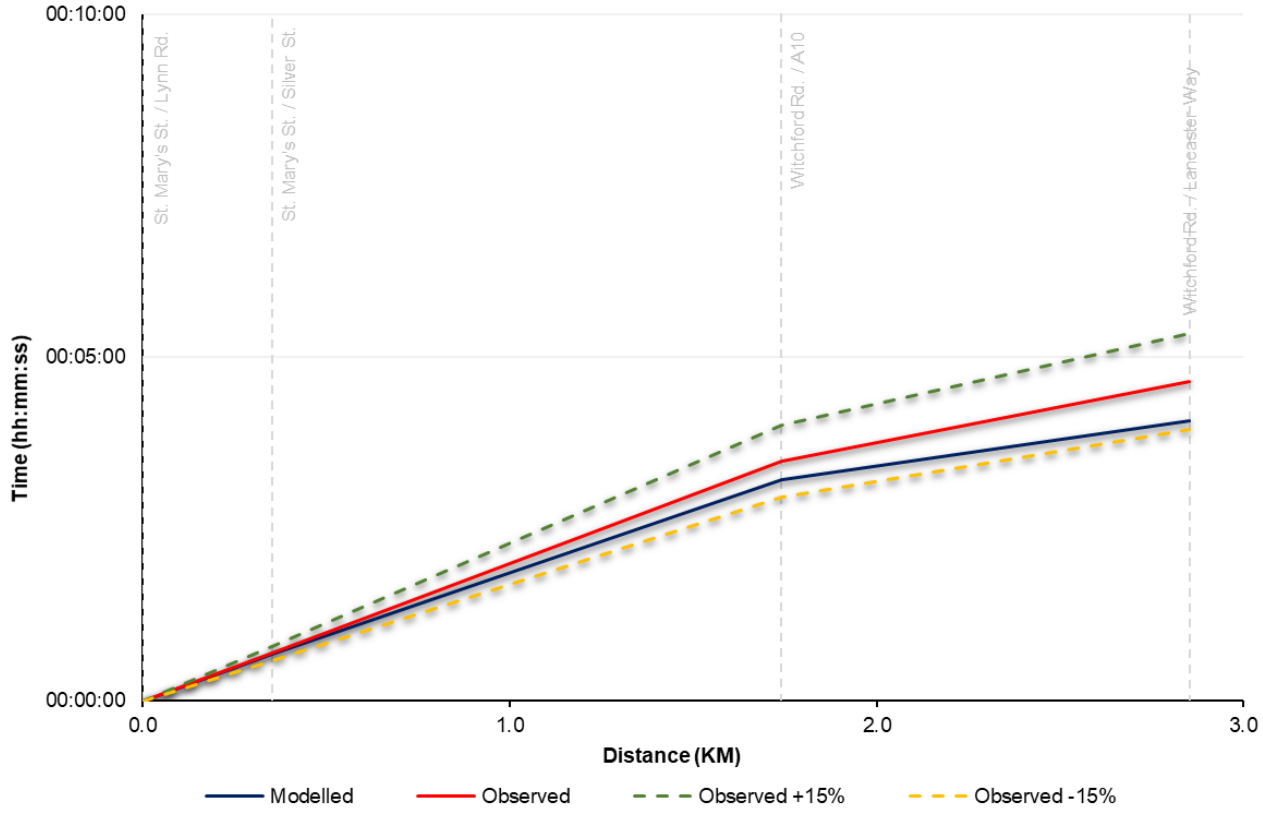
B.3.80. 2015 SI-04: A1123 to A14 / A1096 – PM



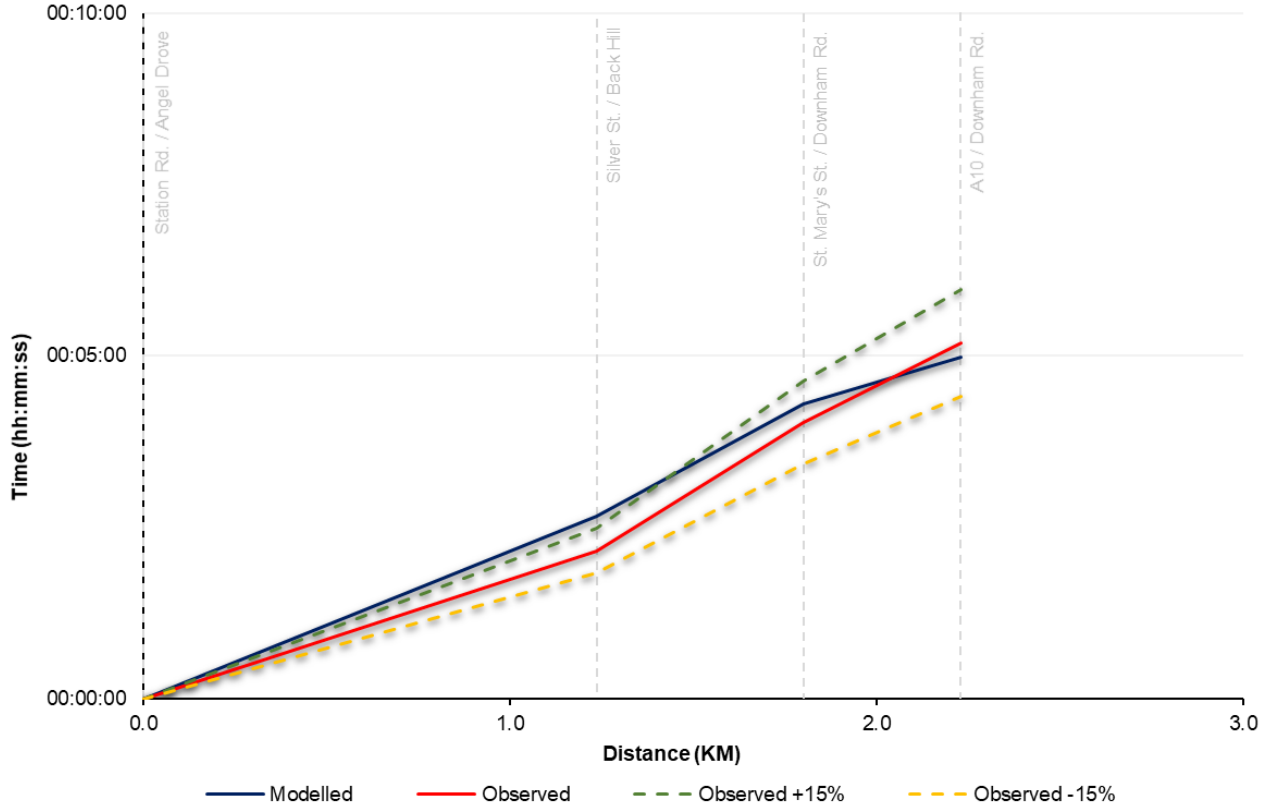
B.3.81. 2015 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – PM



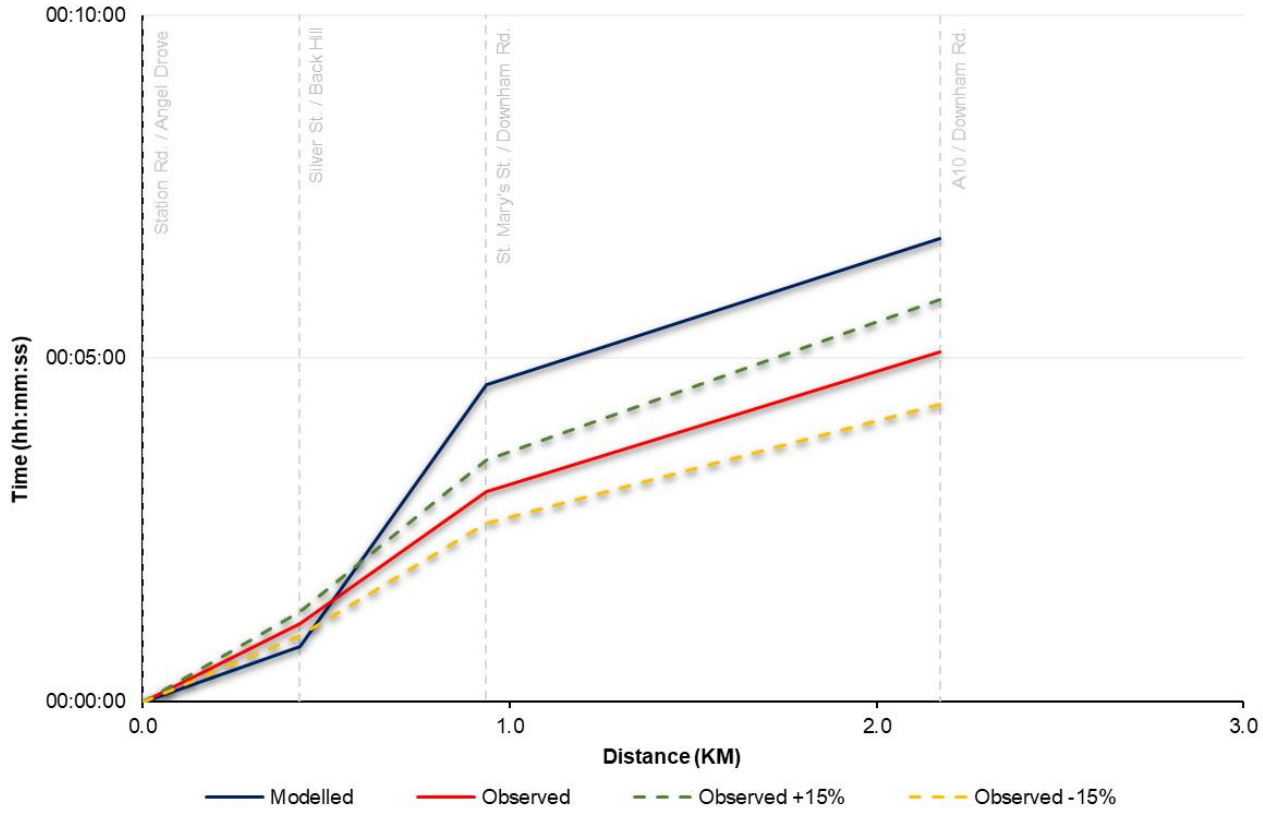
B.3.82. 2015 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – PM



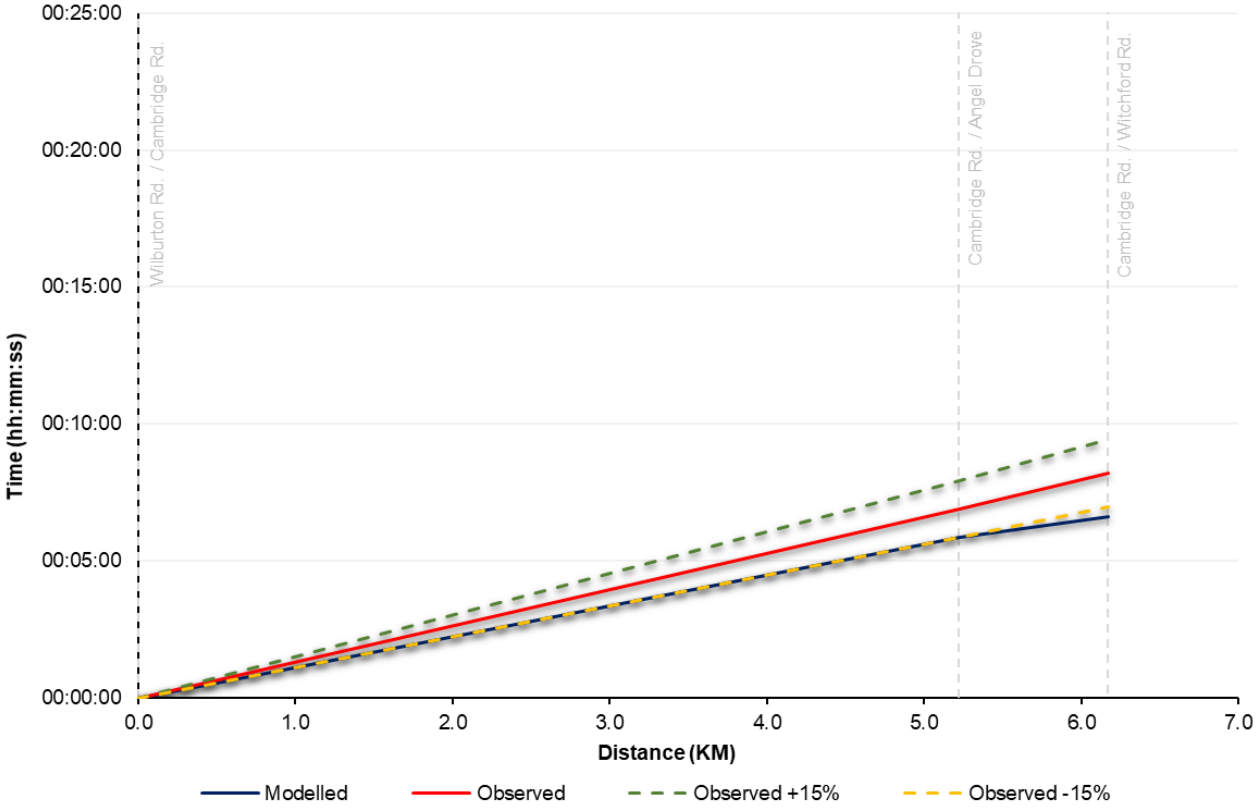
B.3.83. 2015 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – PM



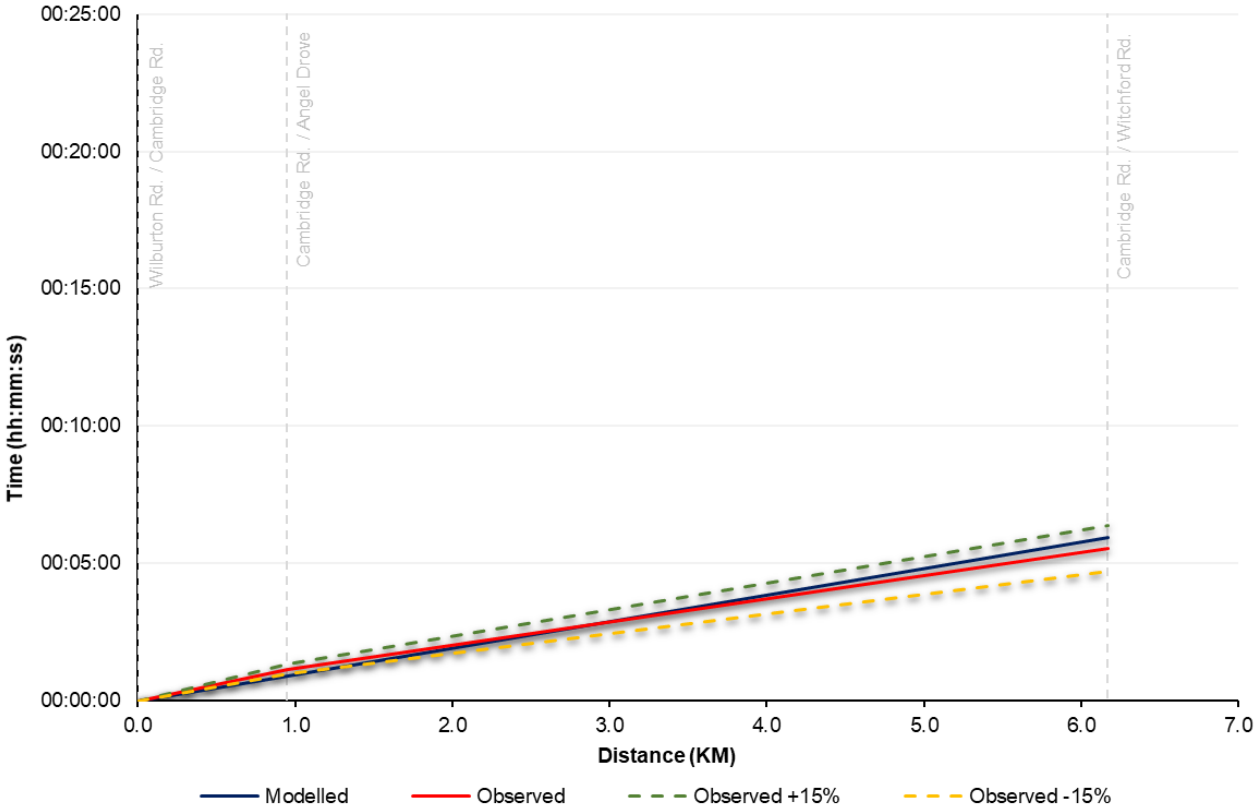
B.3.84. 2015 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – PM



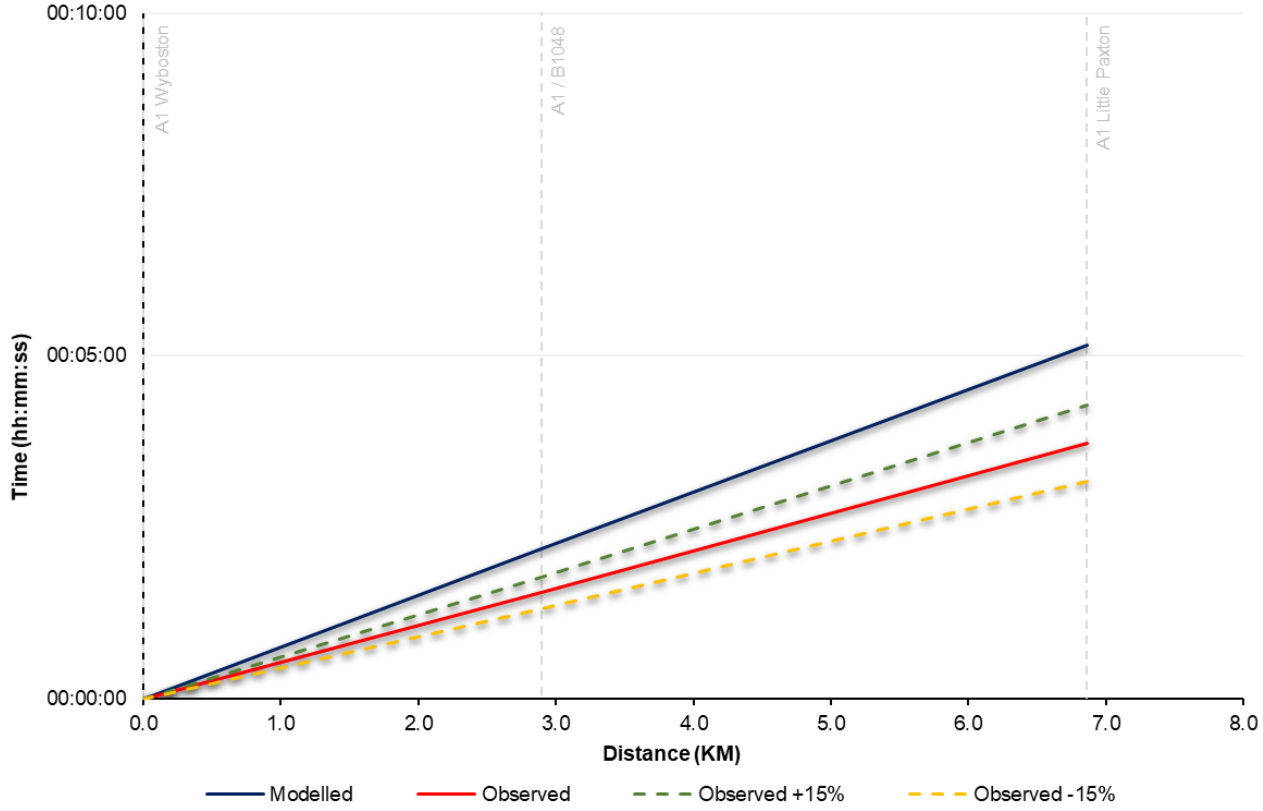
B.3.85. 2015 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – PM



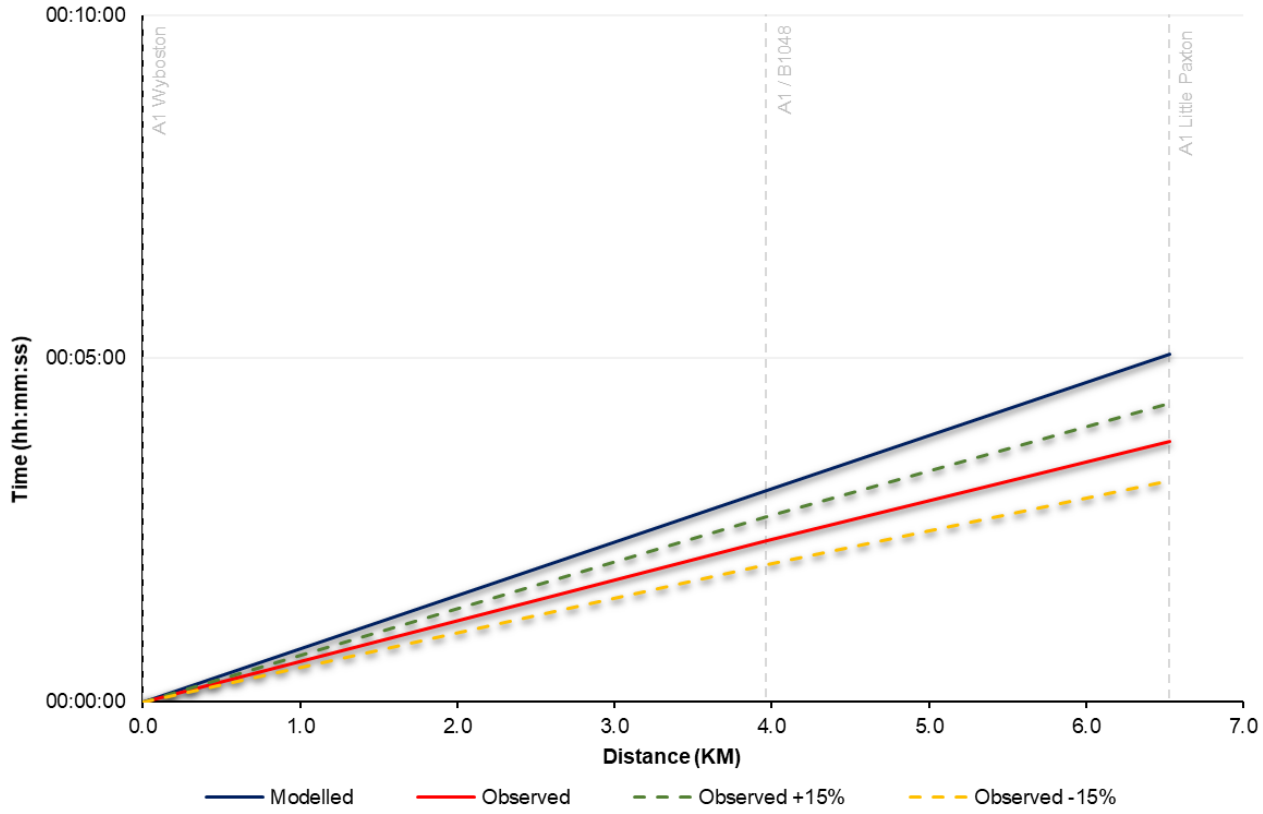
B.3.86. 2015 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – PM



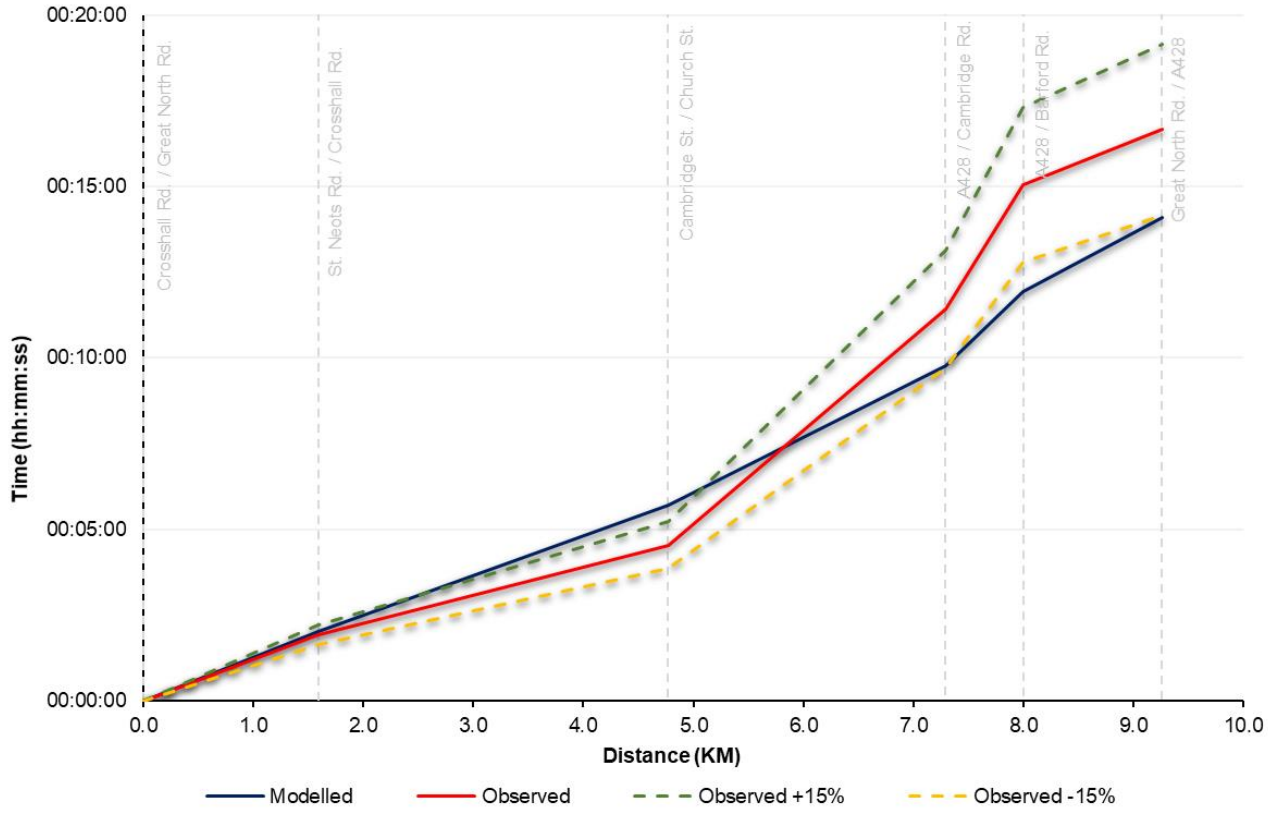
B.3.87. 2015 SN-01: A1 Little Paxton to A421 – PM



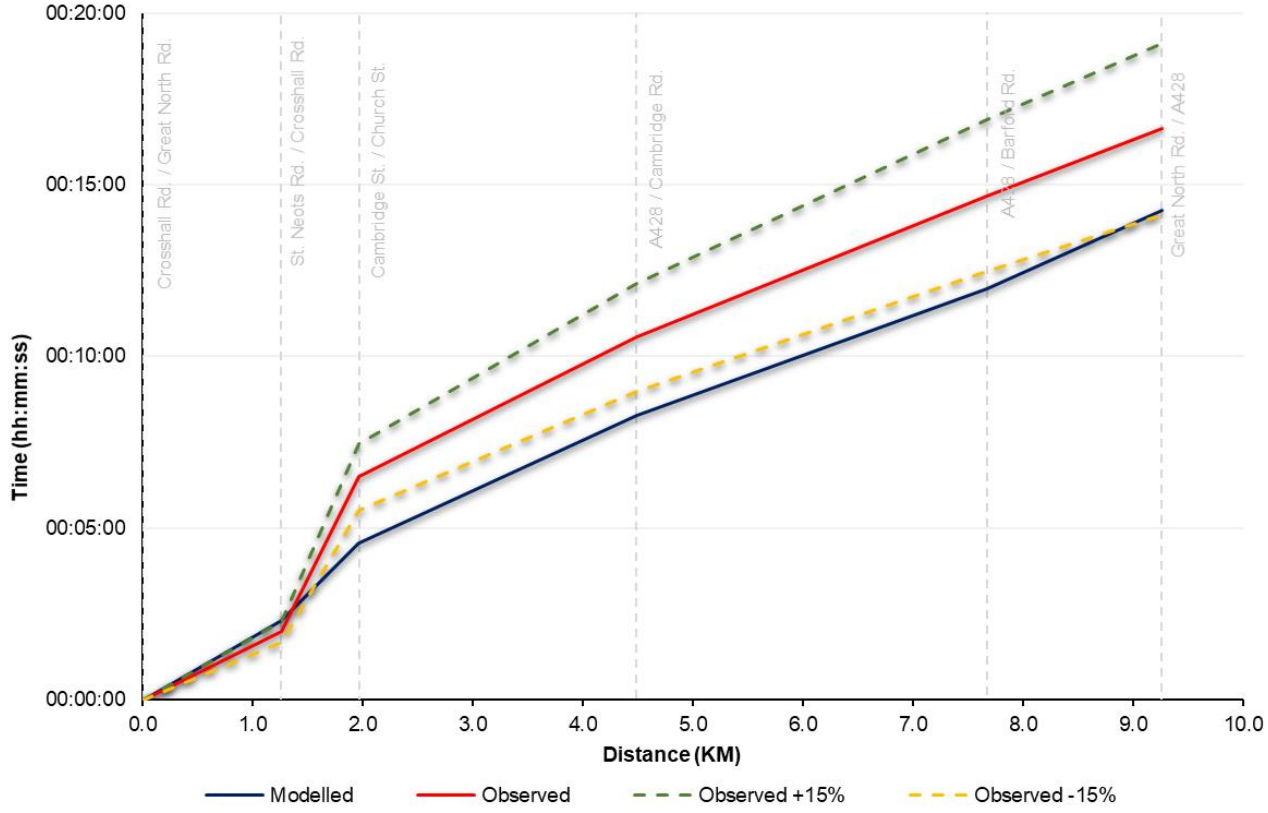
B.3.88. 2015 SN-02: A421 to A1 Little Paxton – PM



B.3.89. 2015 SN-03: A1 / B465 via Cambridge Rd. – PM

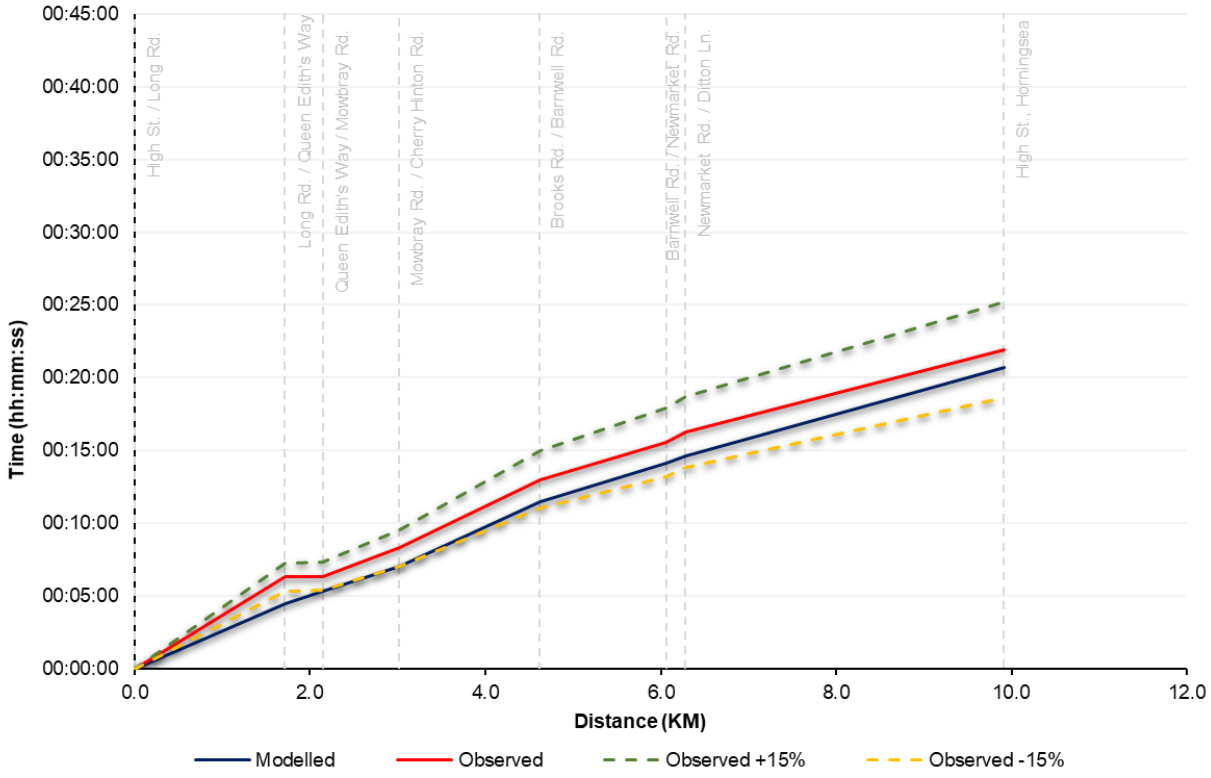


B.3.90. 2015 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – PM

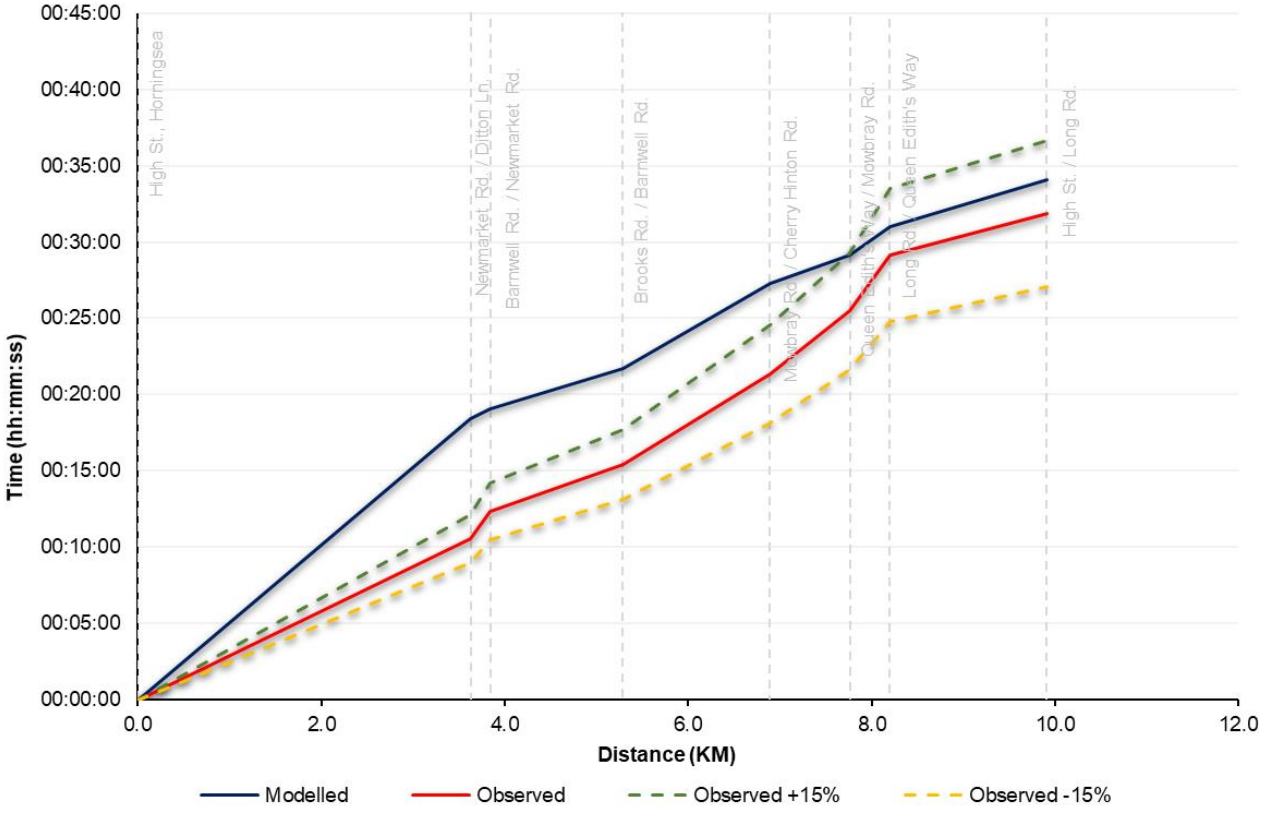


B.4. 2019 Journey Time Route Graphs

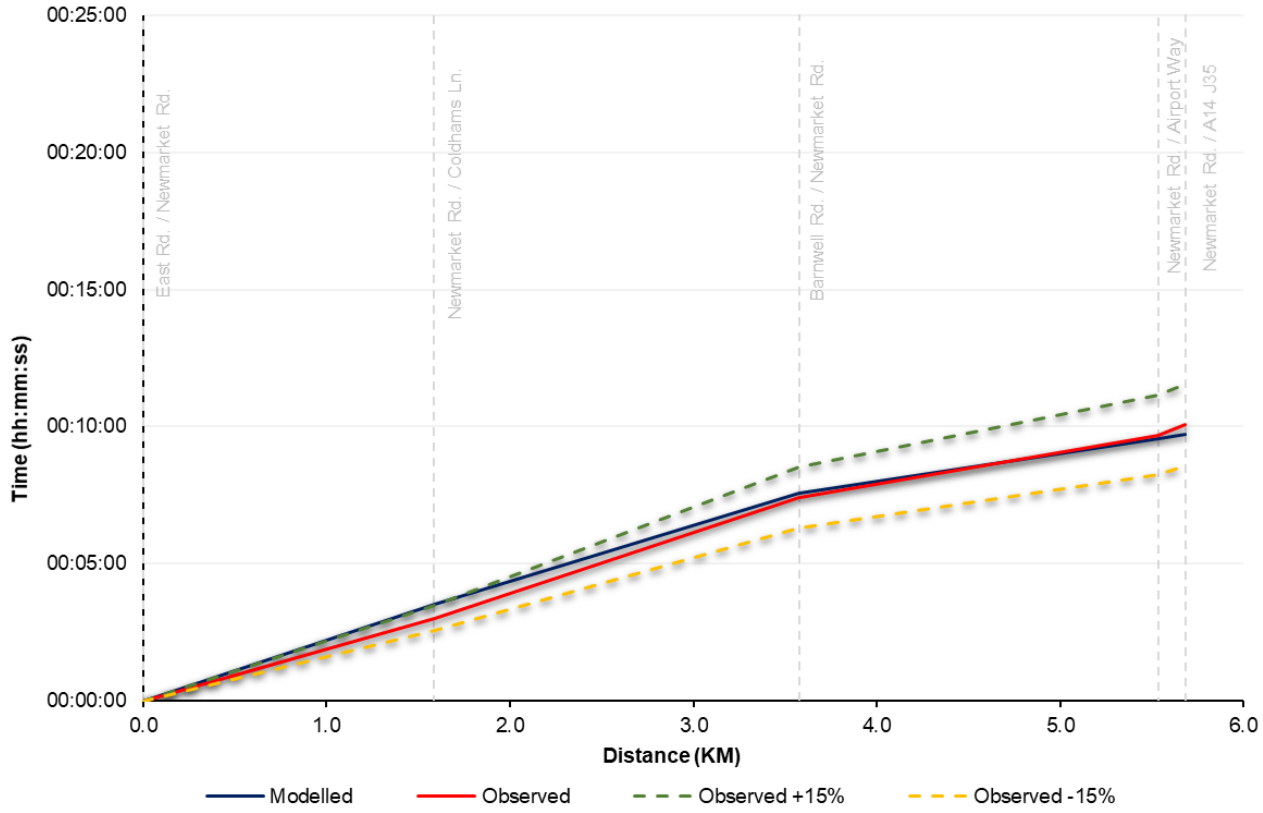
B.4.1. 2019 C-01: Trumpington Rd. to Priory Rd., Horningsea – AM



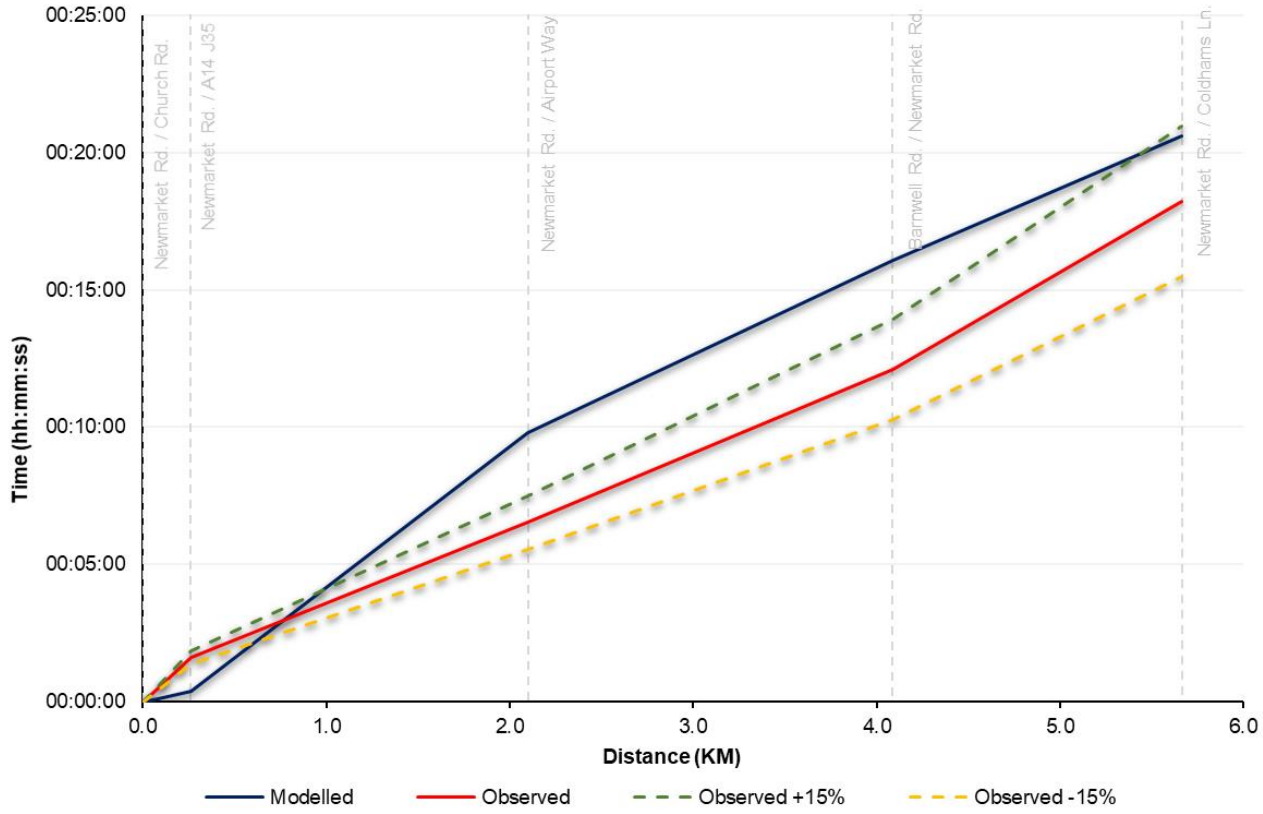
B.4.2. 2019 C-02: Priory Rd., Horningsea to Trumpington Rd. – AM



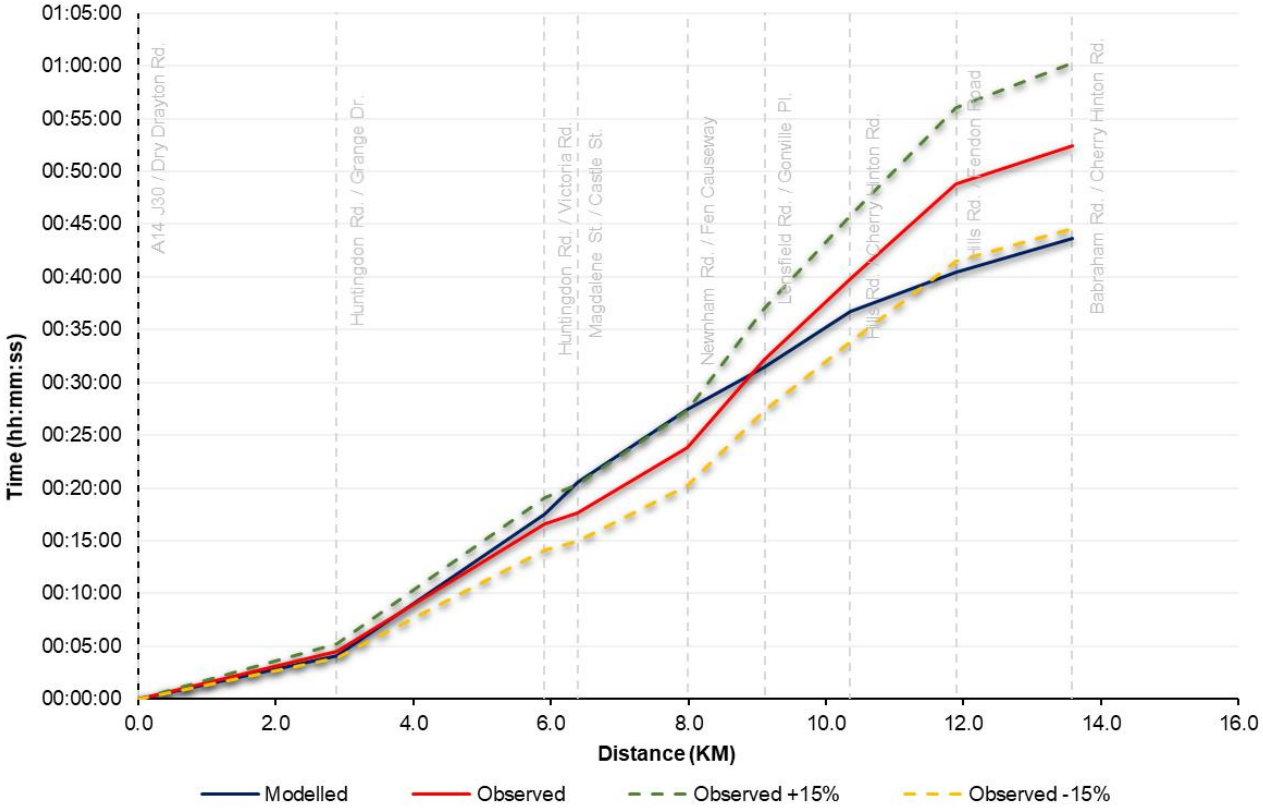
B.4.3. 2019 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – AM



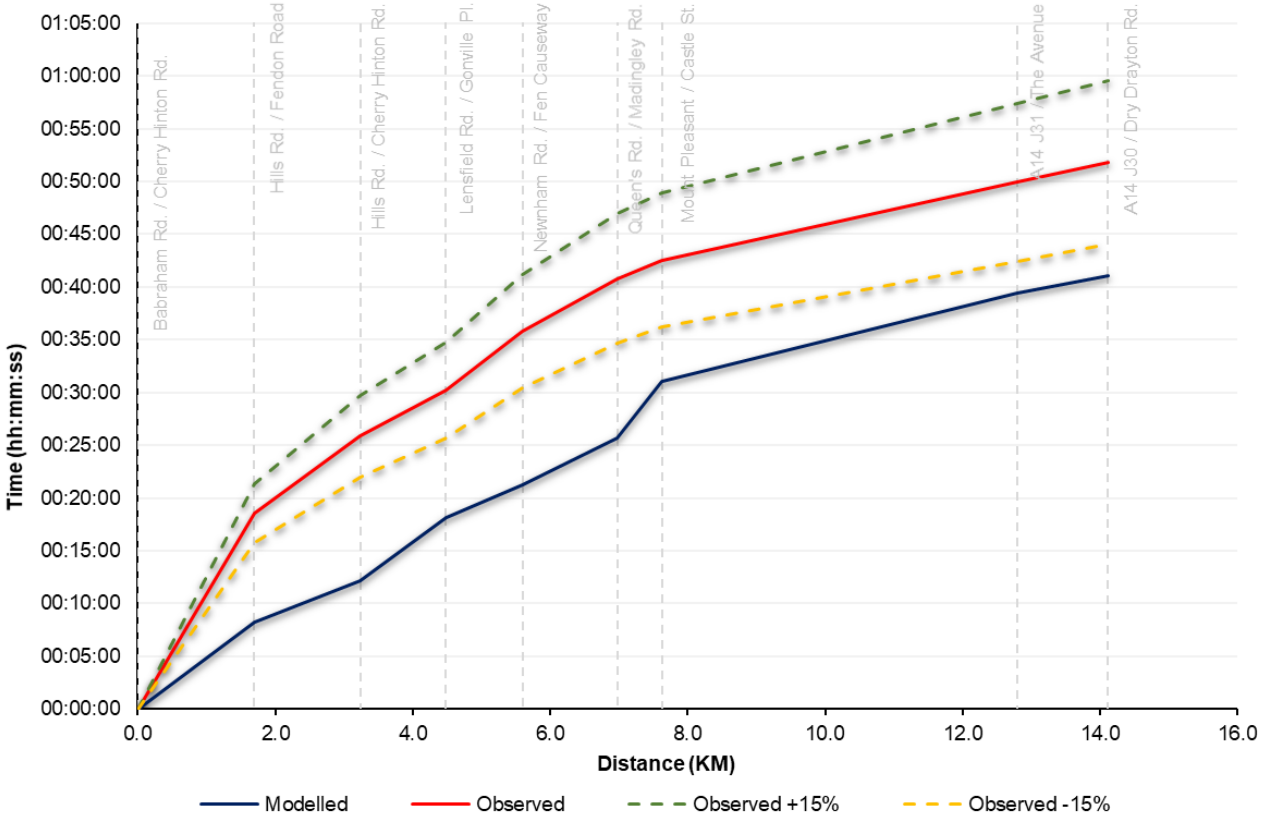
B.4.4. 2019 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – AM



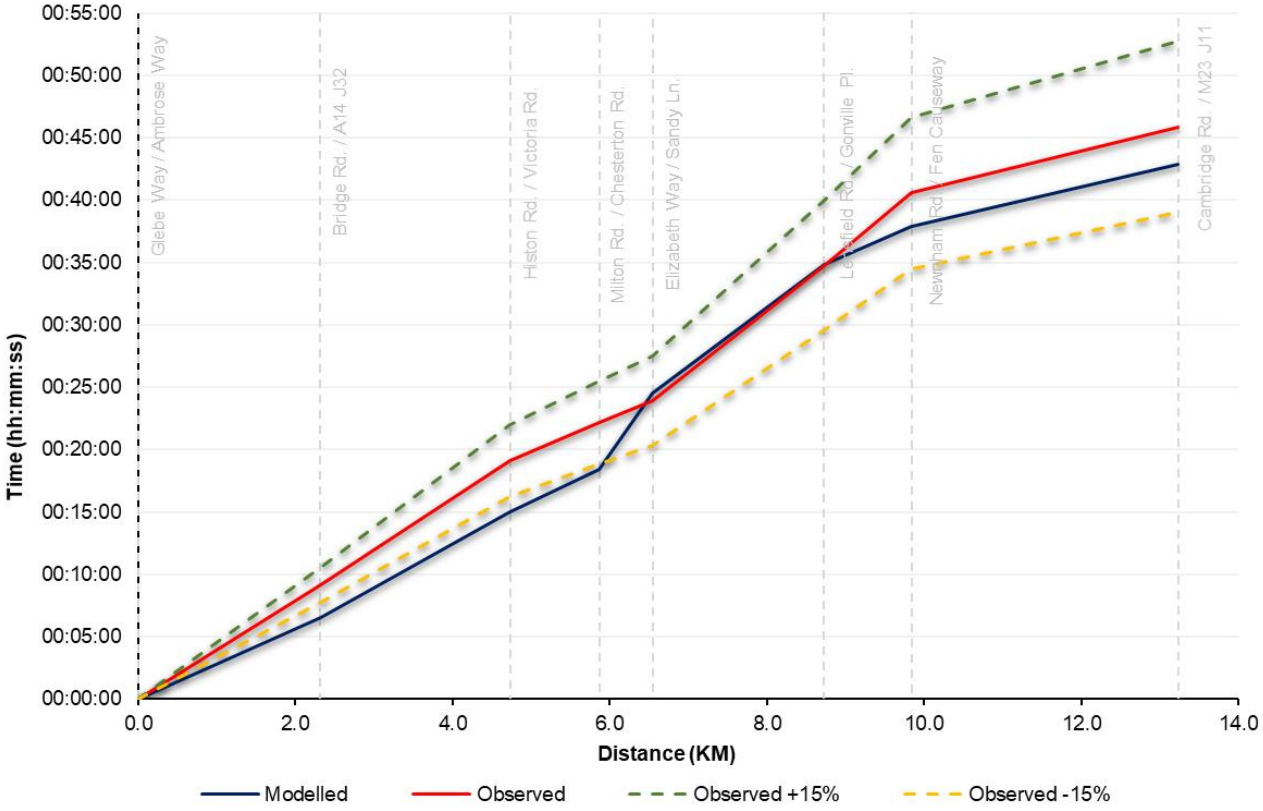
B.4.5. 2019 C-05: Oakington Rd. to Fendon Rd. – AM



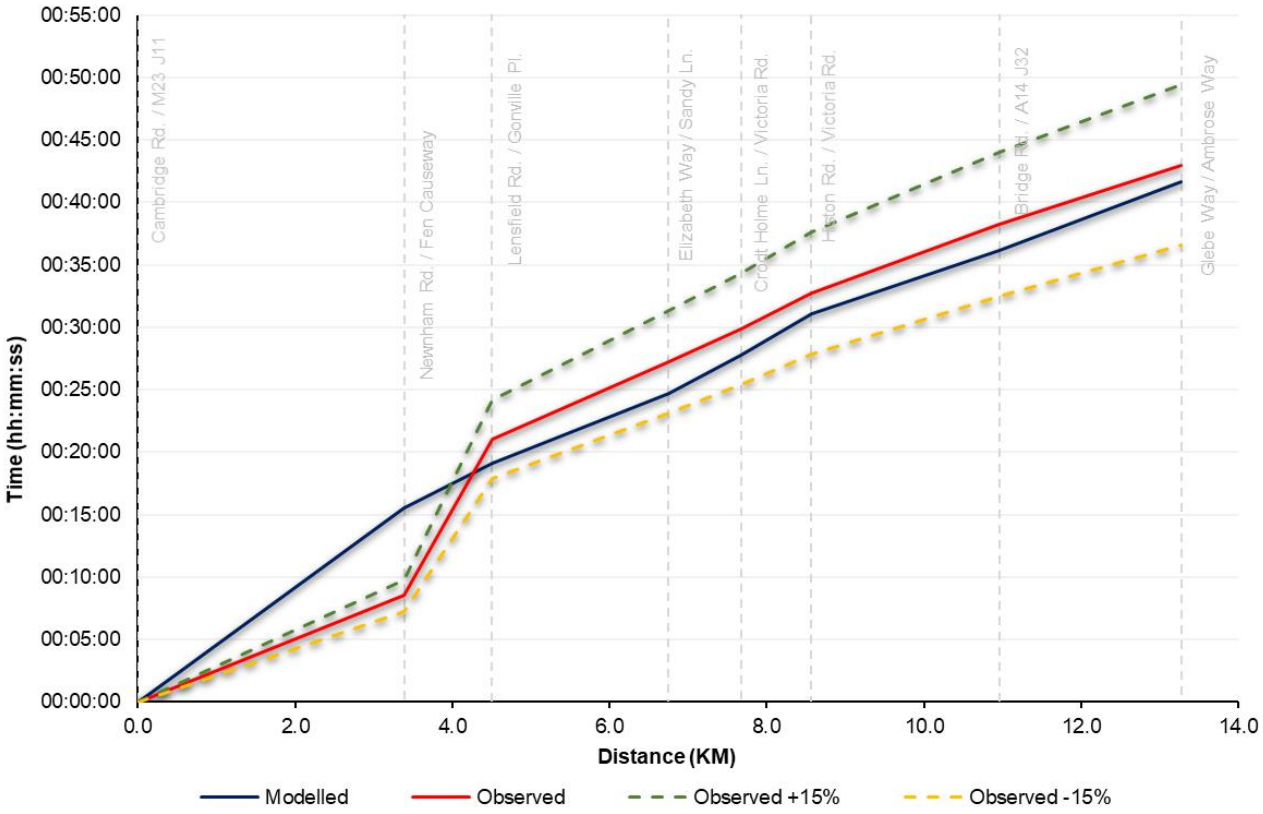
B.4.6. 2019 C-06: Fendon Rd. to Oakington Rd. – AM



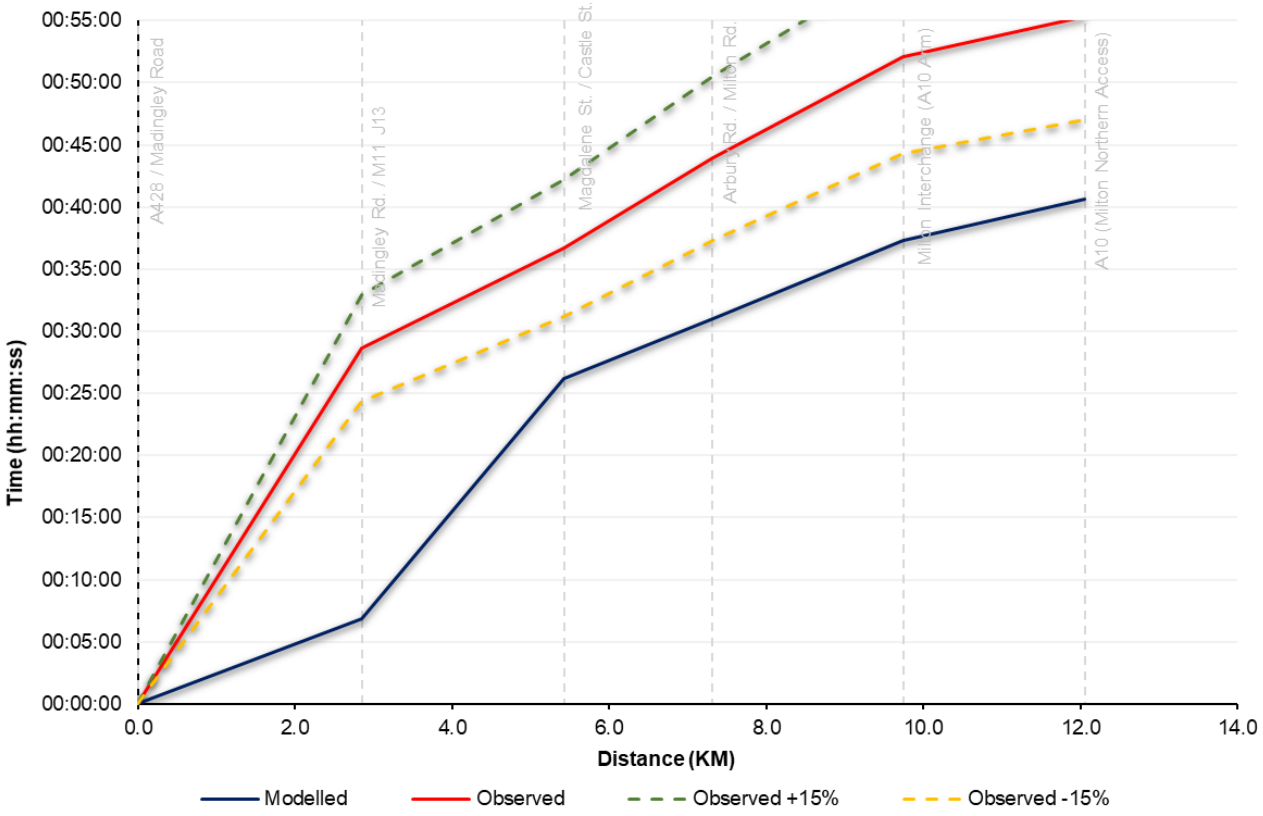
B.4.7. 2019 C-07: Impington Ln. to M11 – AM



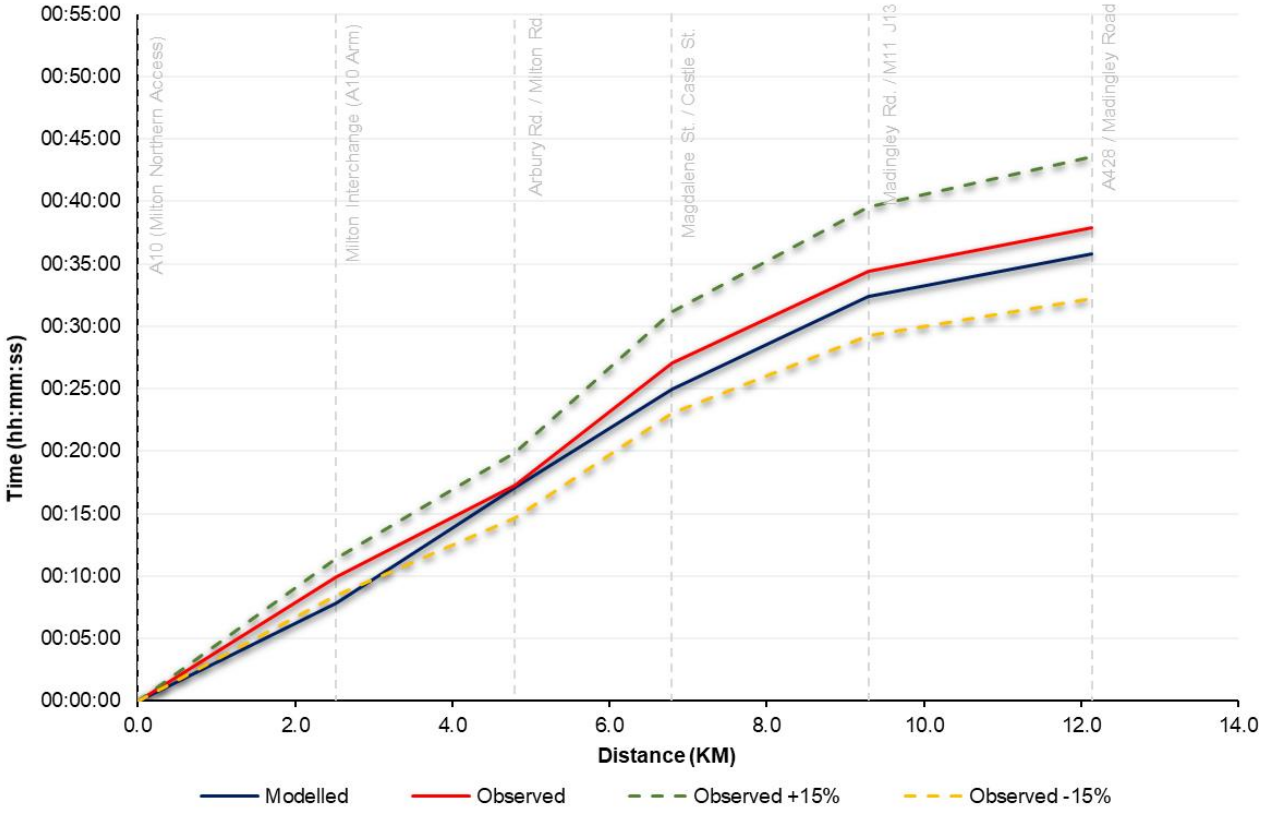
B.4.8. 2019 C-08: M11 to Impington Ln. – AM



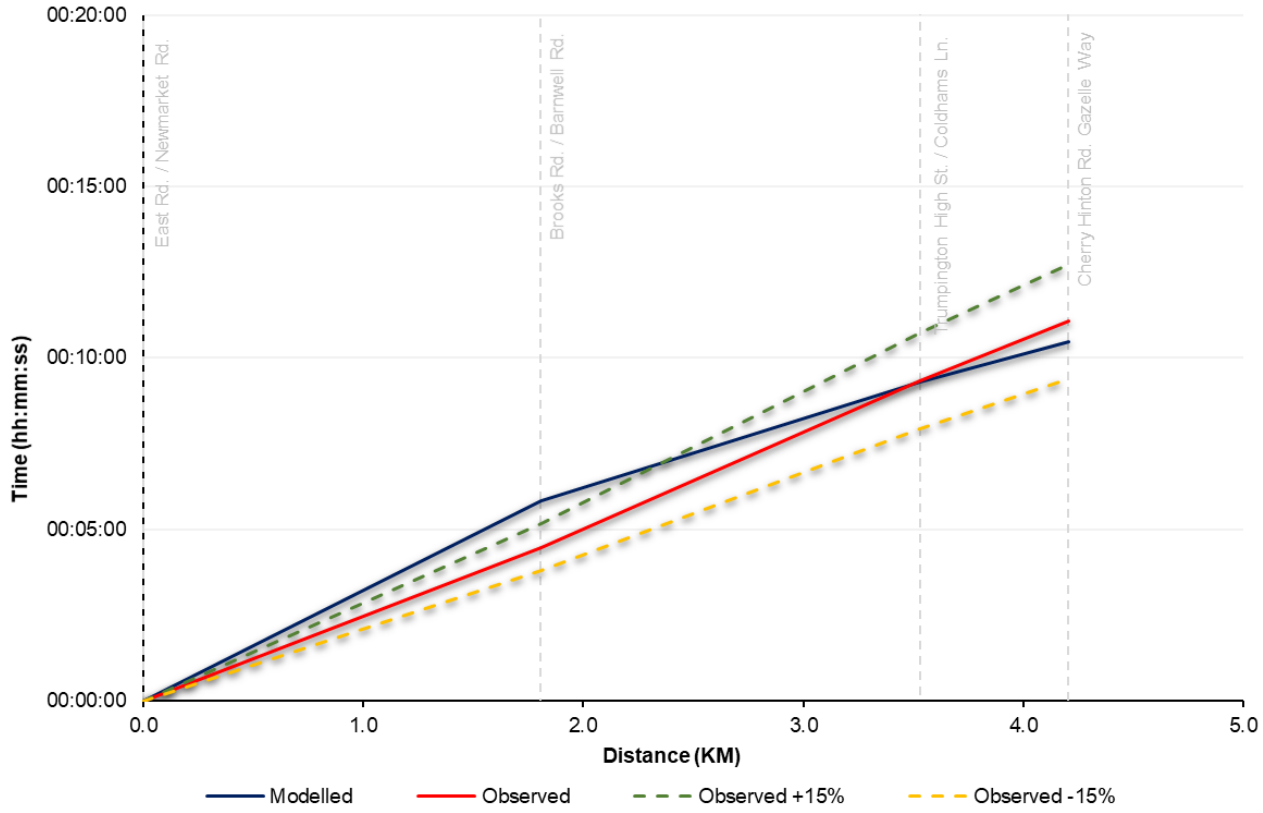
B.4.9. 2019 C-09: A428 Rbt. to Milton – AM



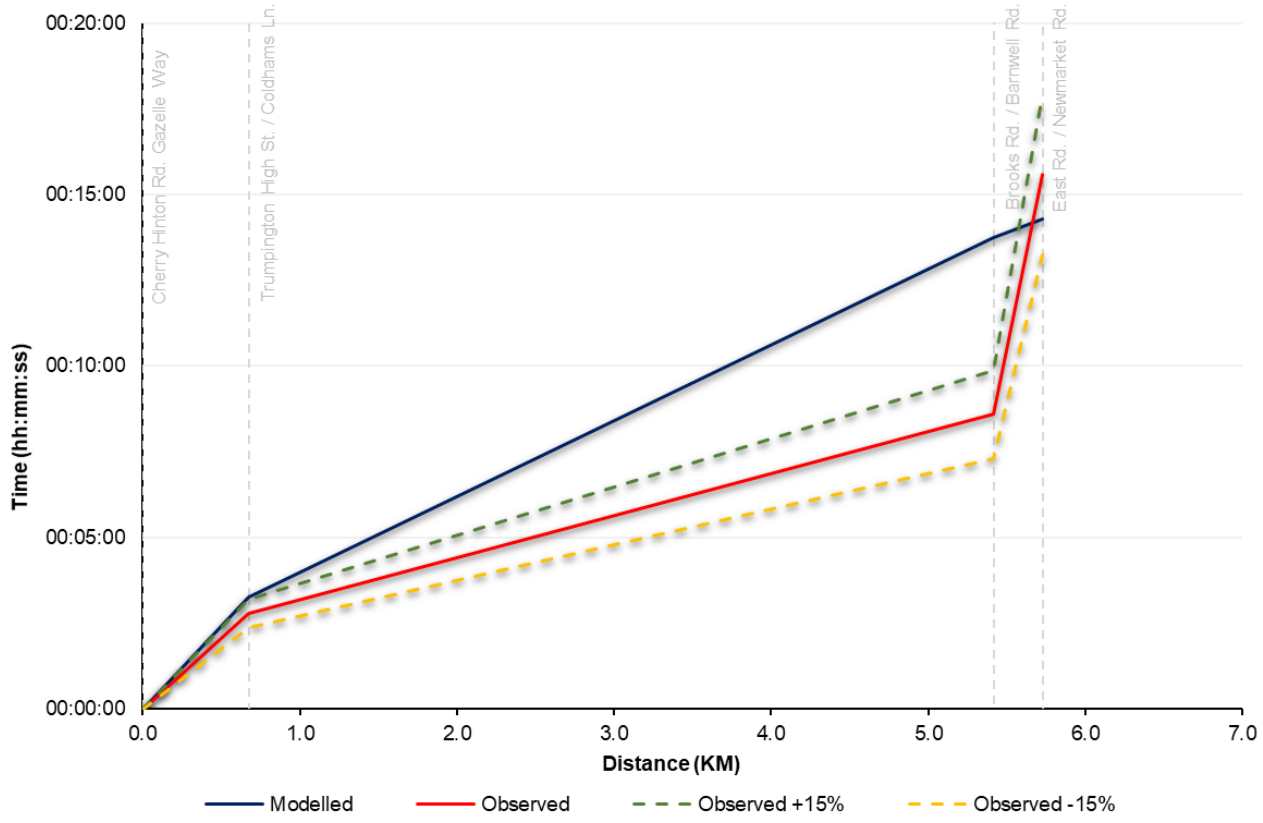
B.4.10. 2019 C-10: Milton to A428 Rbt. – AM



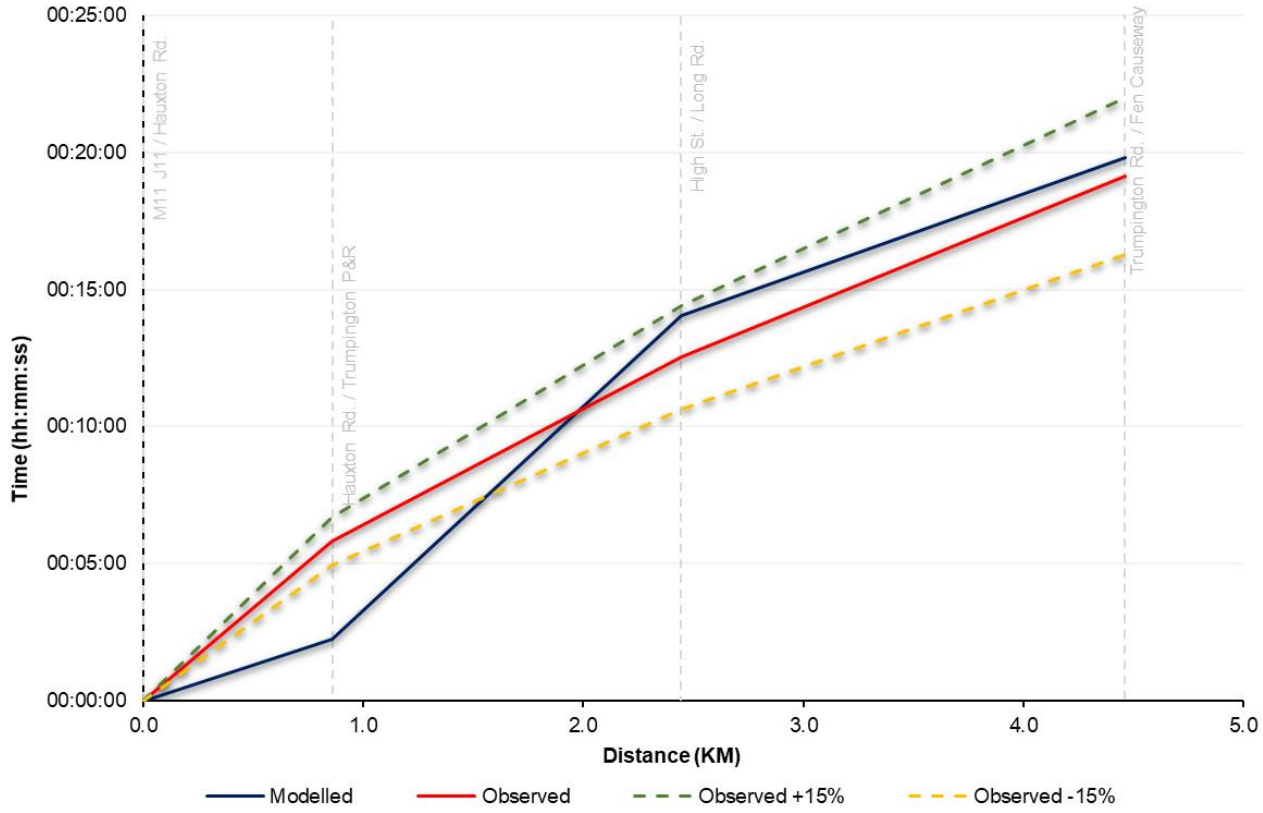
B.4.11. 2019 C-11: Elizabeth Way to Teversham Drift – AM



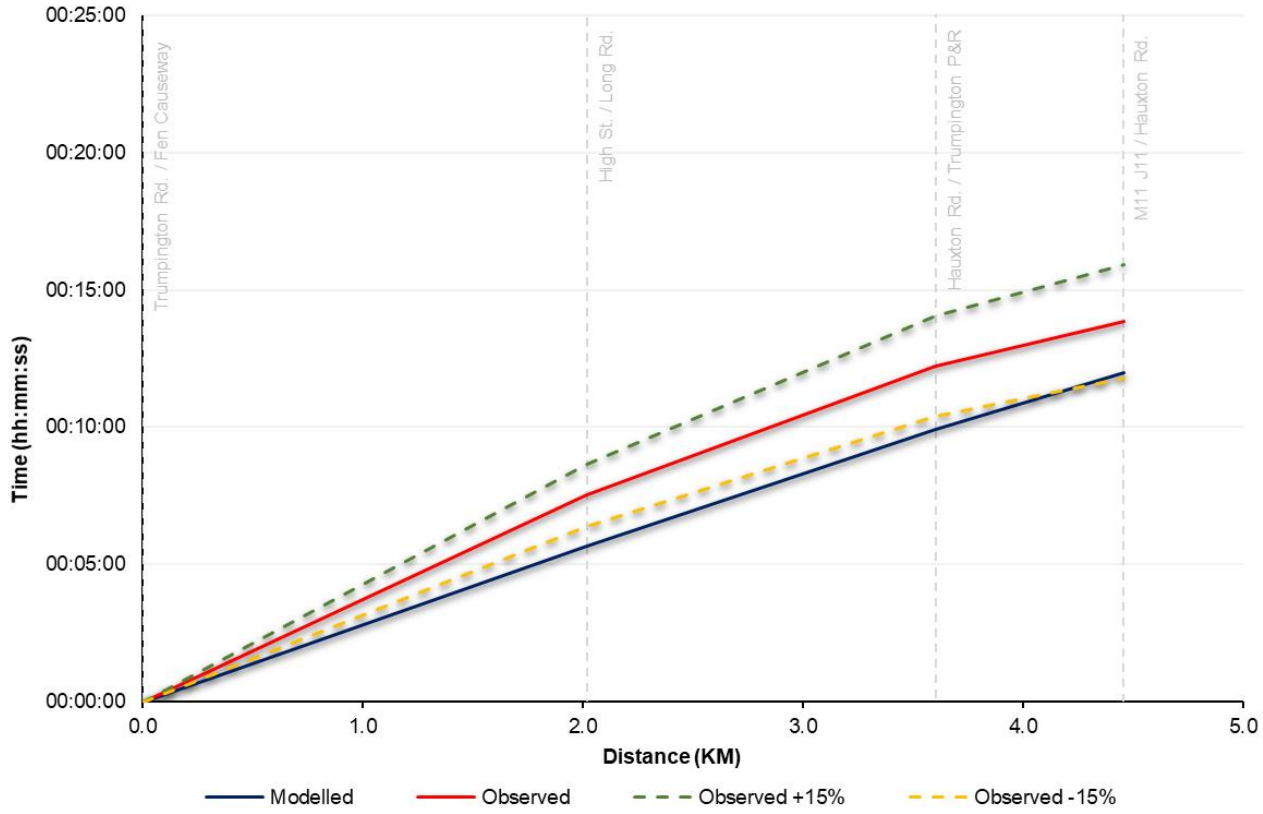
B.4.12. 2019 C-12: Teversham Drift to Elizabeth Way – AM



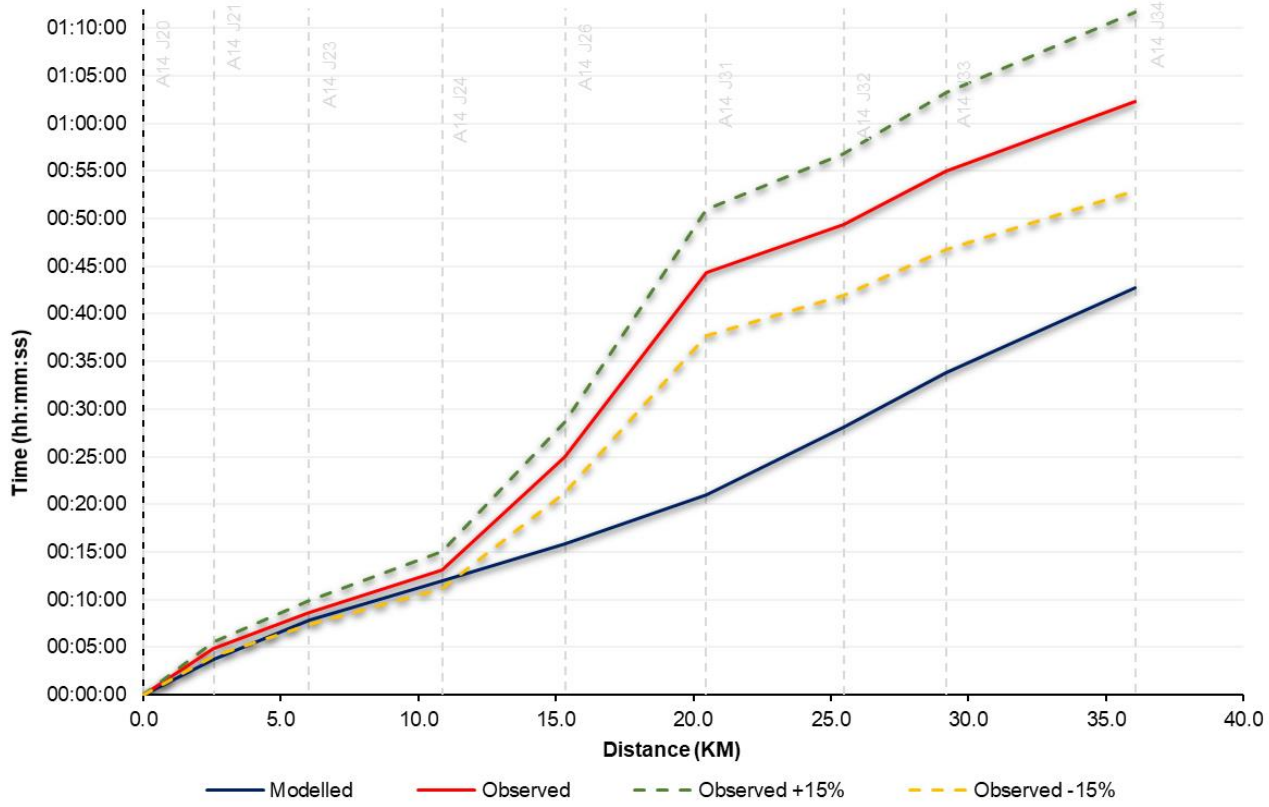
B.4.13. 2019 C-13: Hauxton Rd. (M11) to Lensfield Rd. – AM



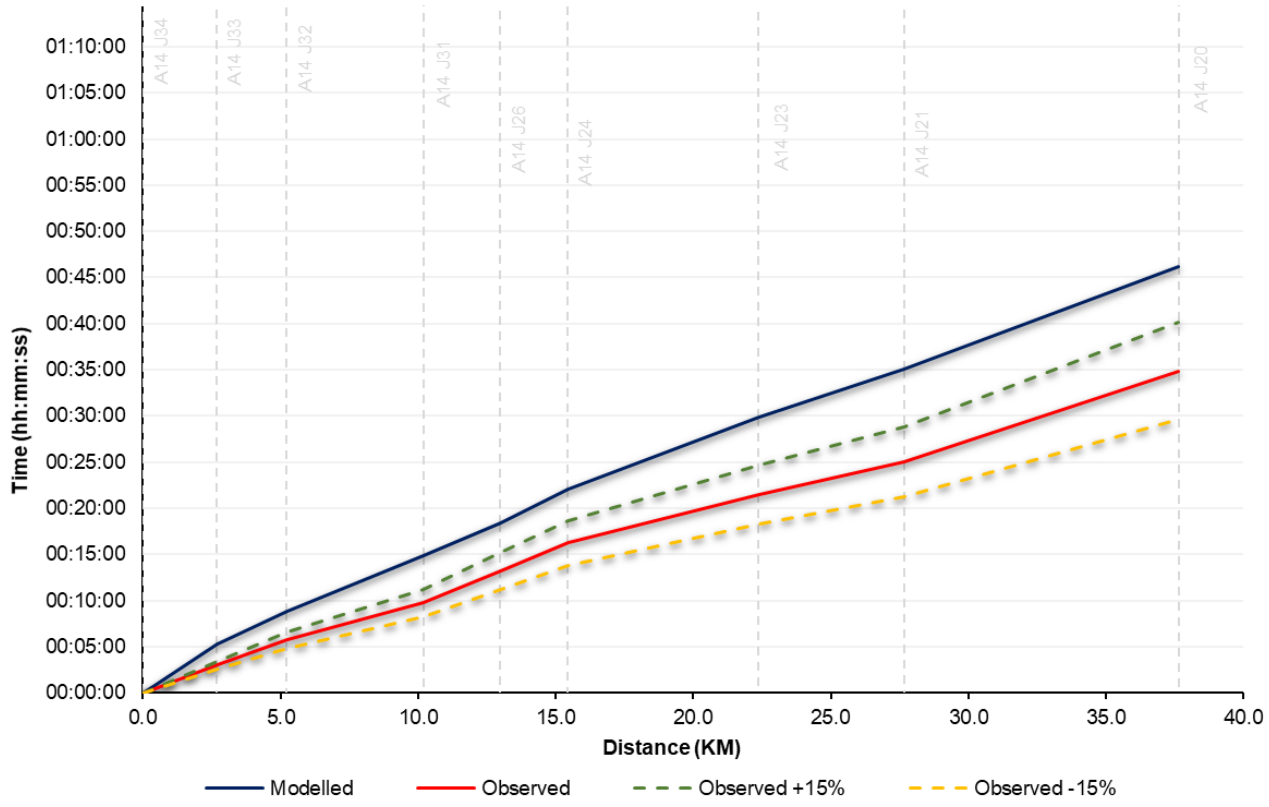
B.4.14. 2019 C-14: Lensfield Rd. to Hauxton Rd. (M11) – AM



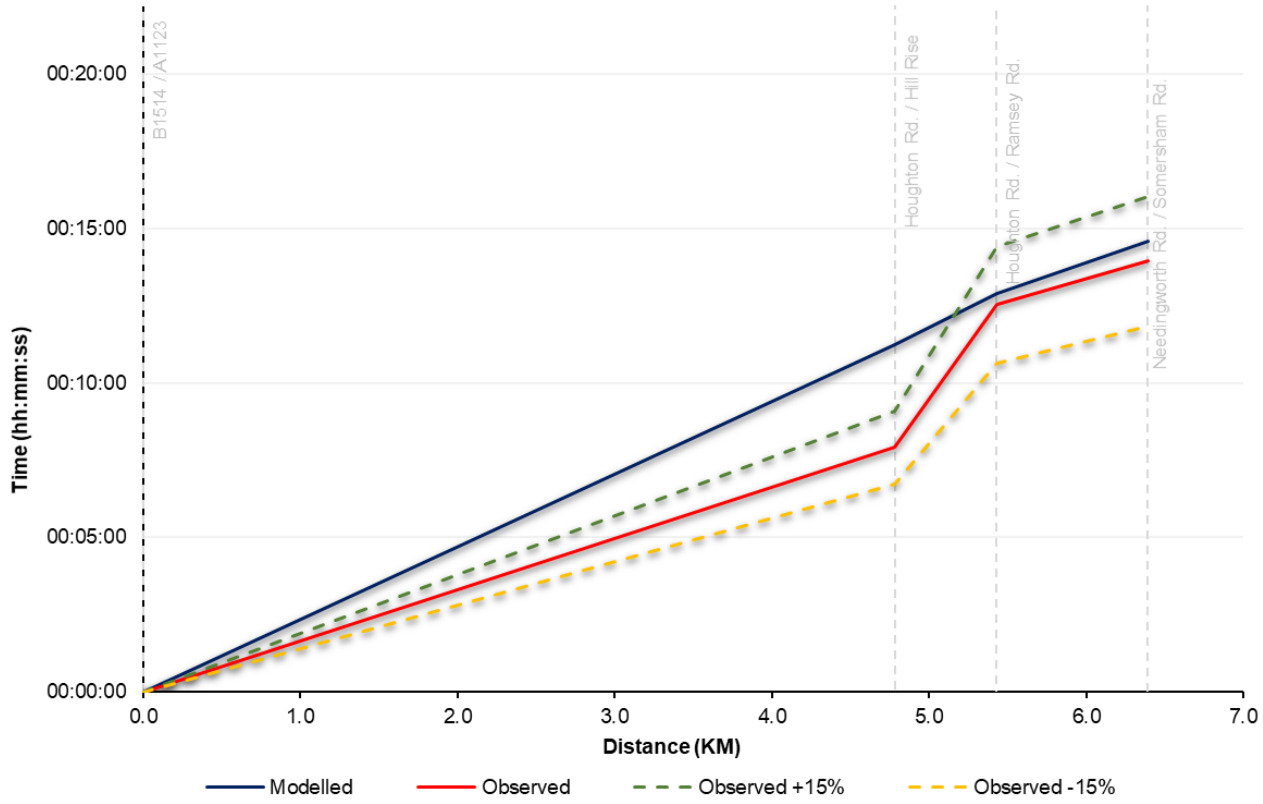
B.4.15. 2019 A14-01: Ellington to Horningsea Rd. – AM



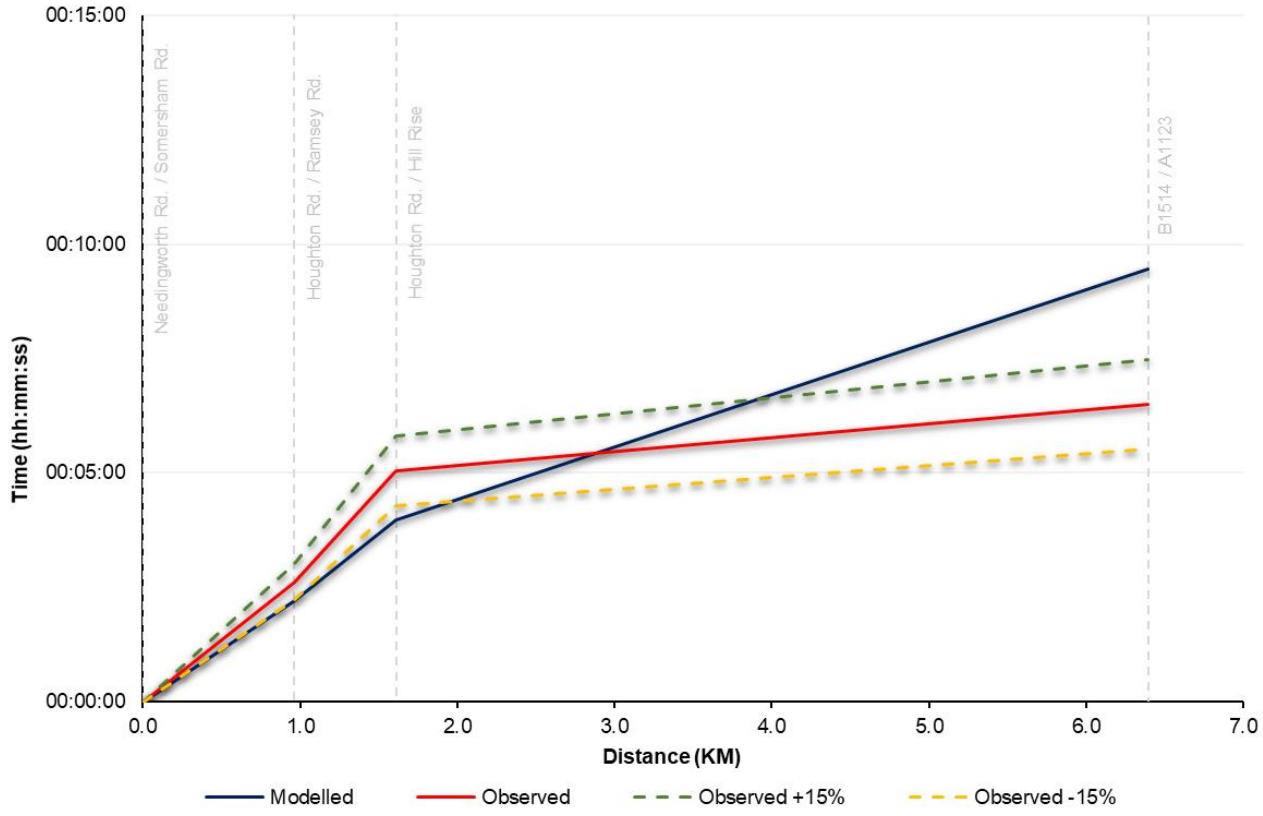
B.4.16. 2019 A14-02: Horningsea Rd. to Ellington – AM



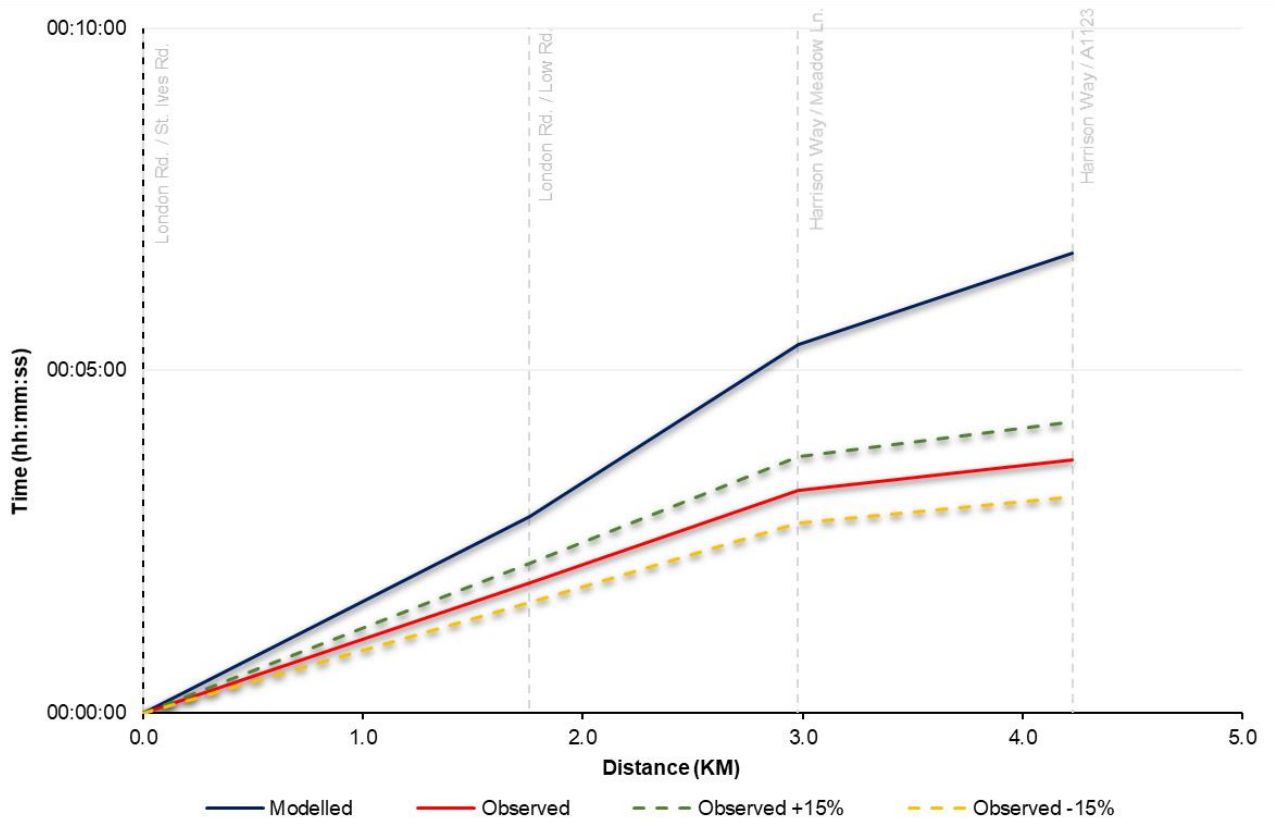
B.4.17. 2019 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – AM



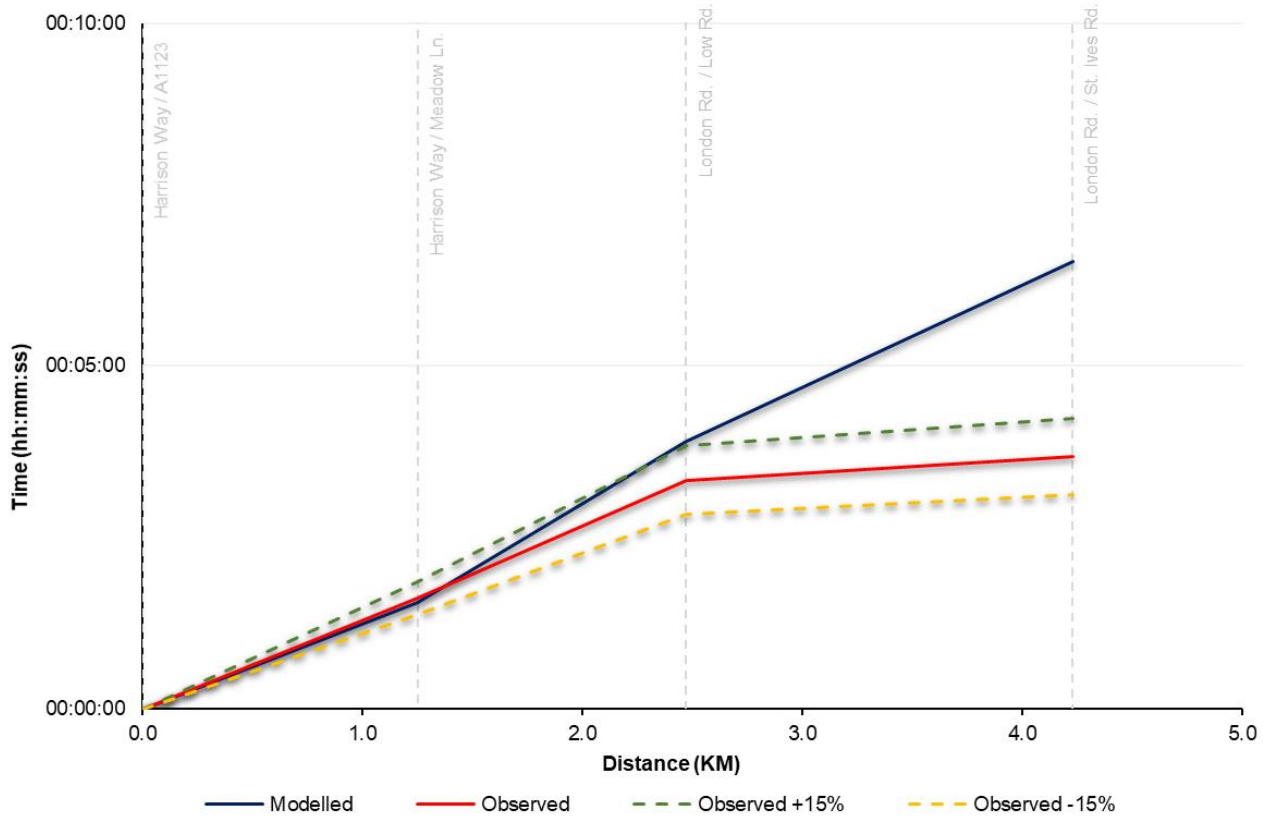
B.4.18. 2019 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – AM



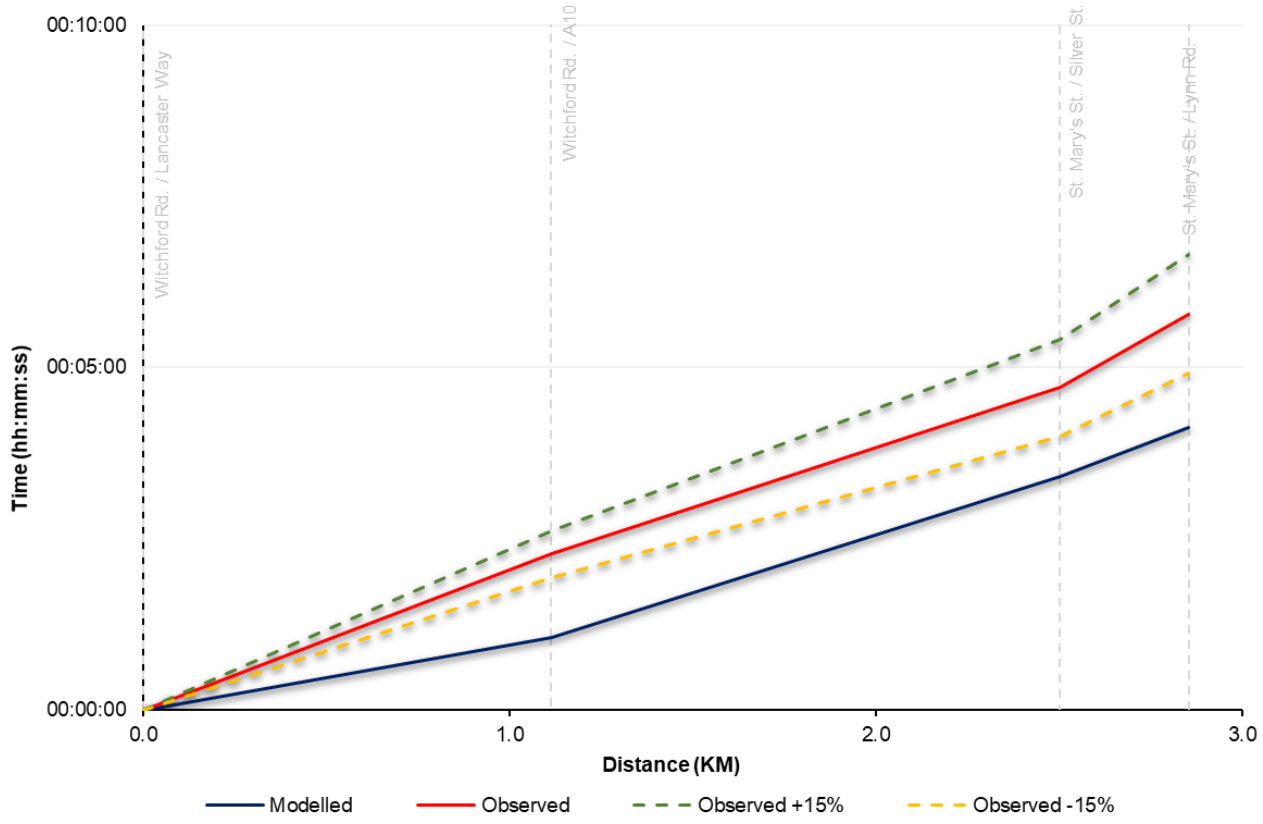
B.4.19. 2019 SI-03: A14 / A1096 to A1123 – AM



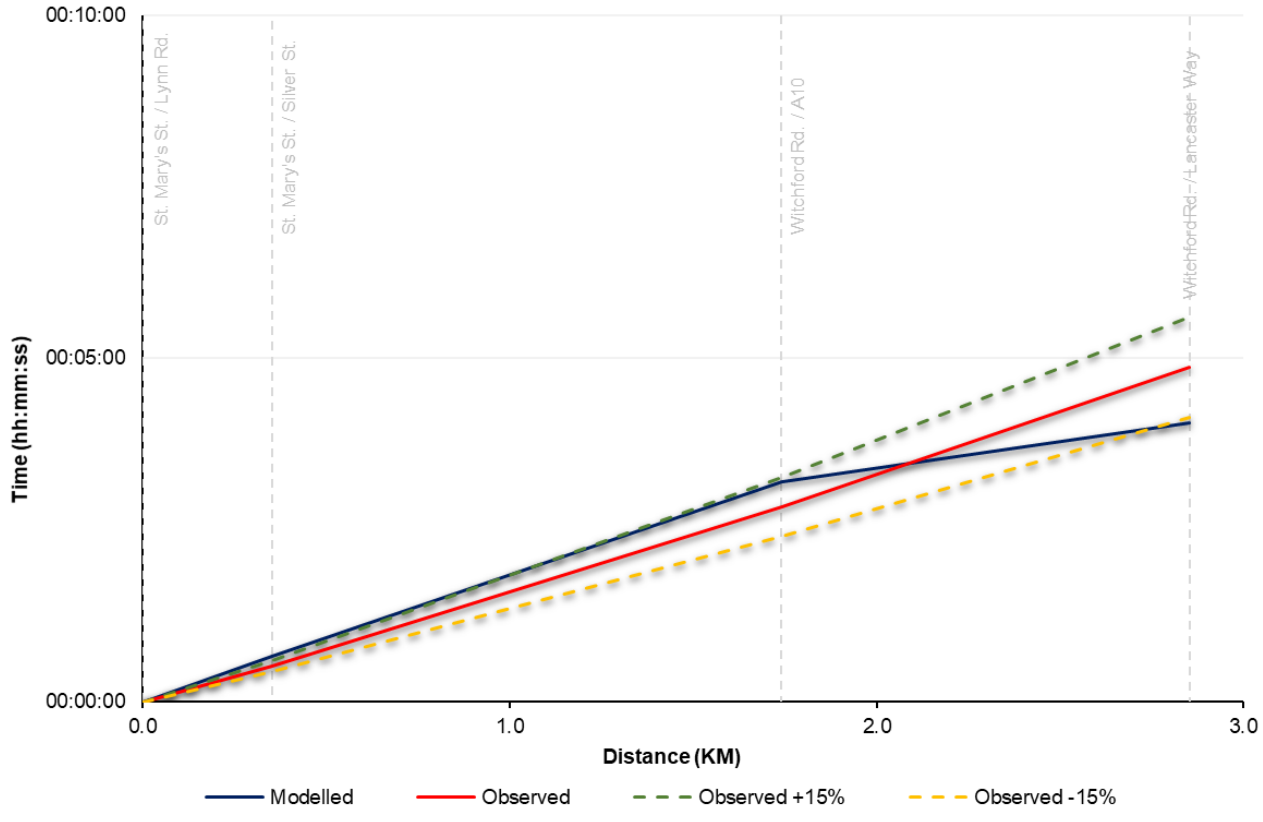
B.4.20. 2019 SI-04: A1123 to A14 / A1096 – AM



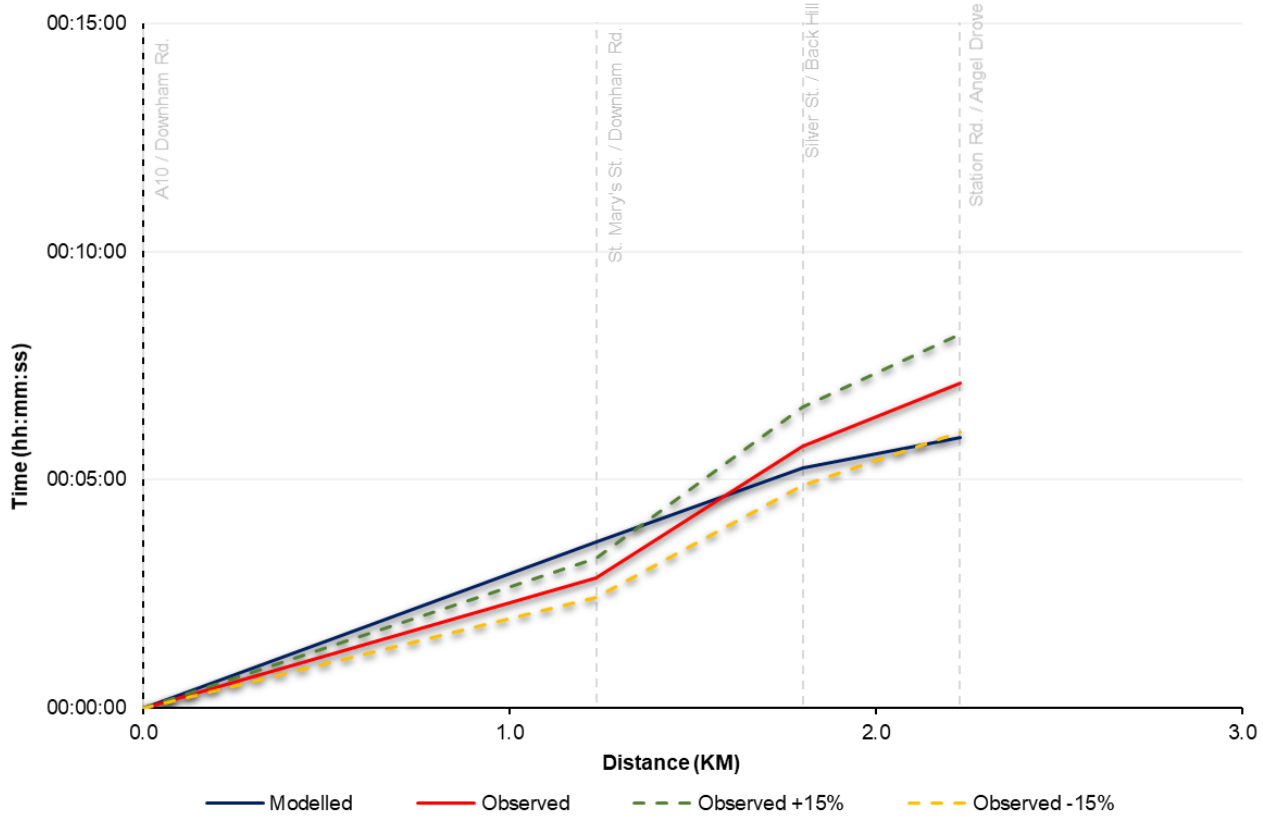
B.4.21. 2019 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – AM



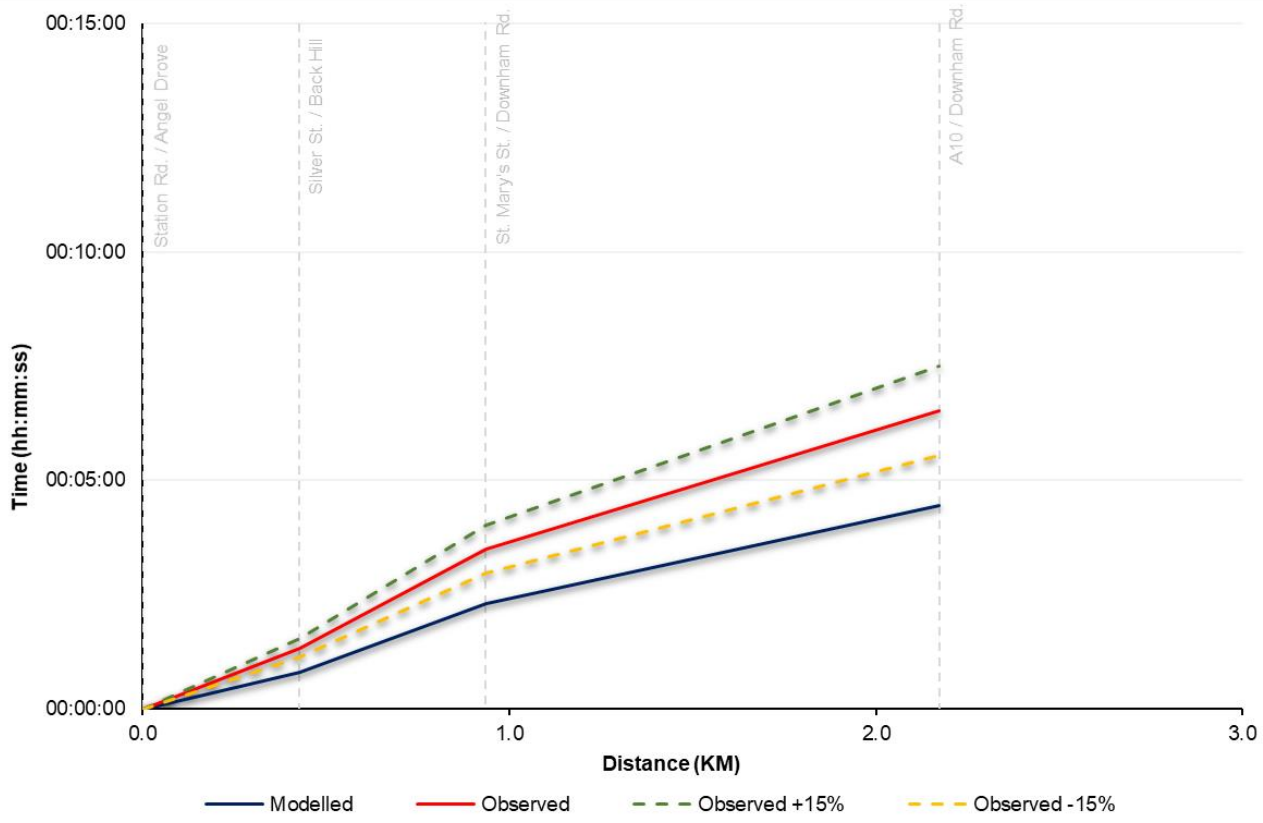
B.4.22. 2019 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – AM



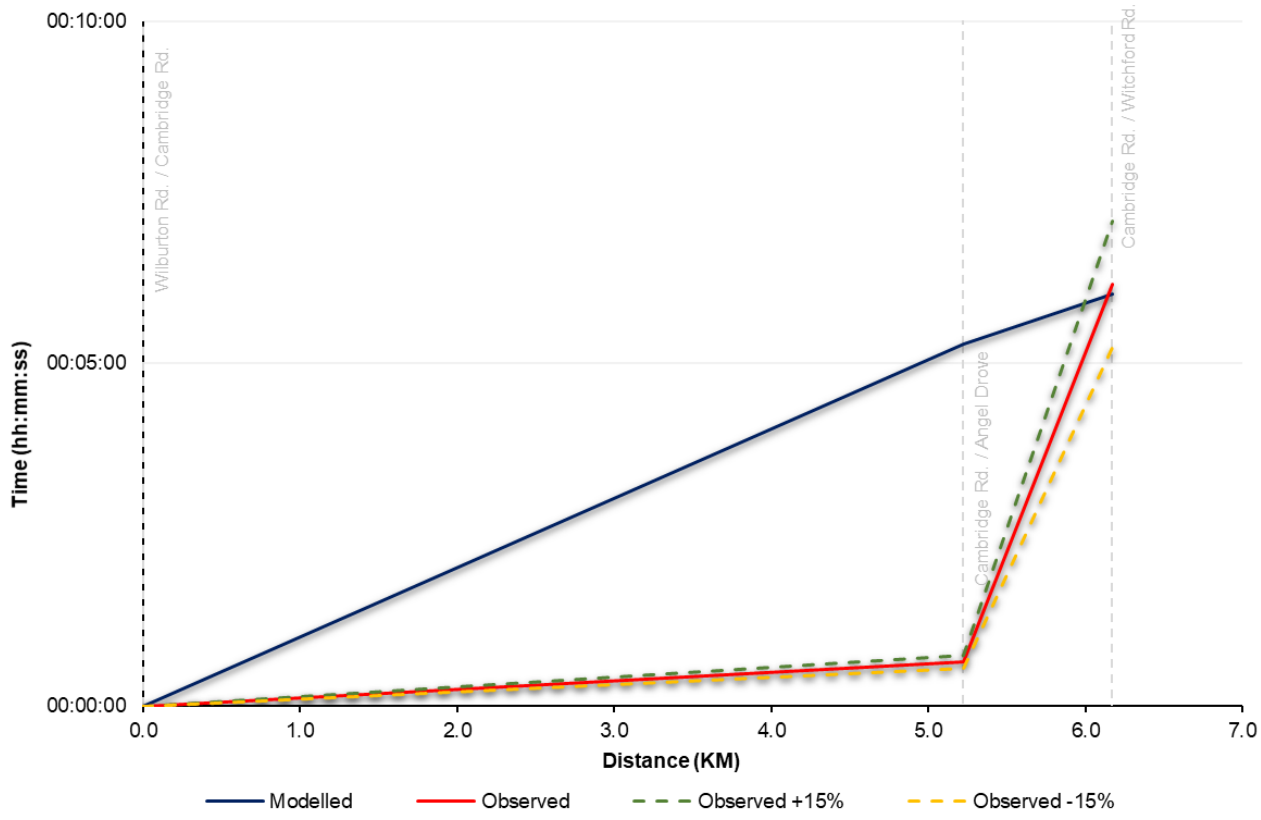
B.4.23. 2019 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – AM



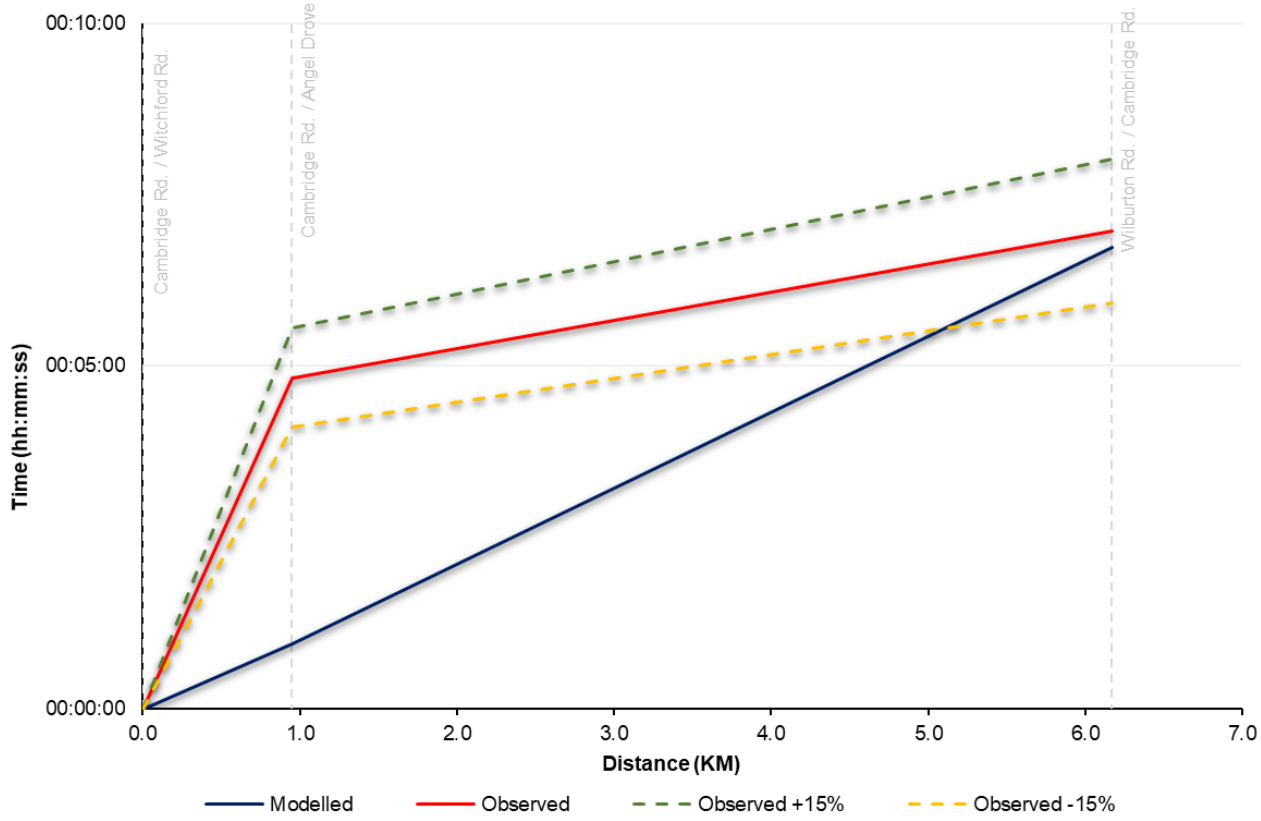
B.4.24. 2019 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – AM



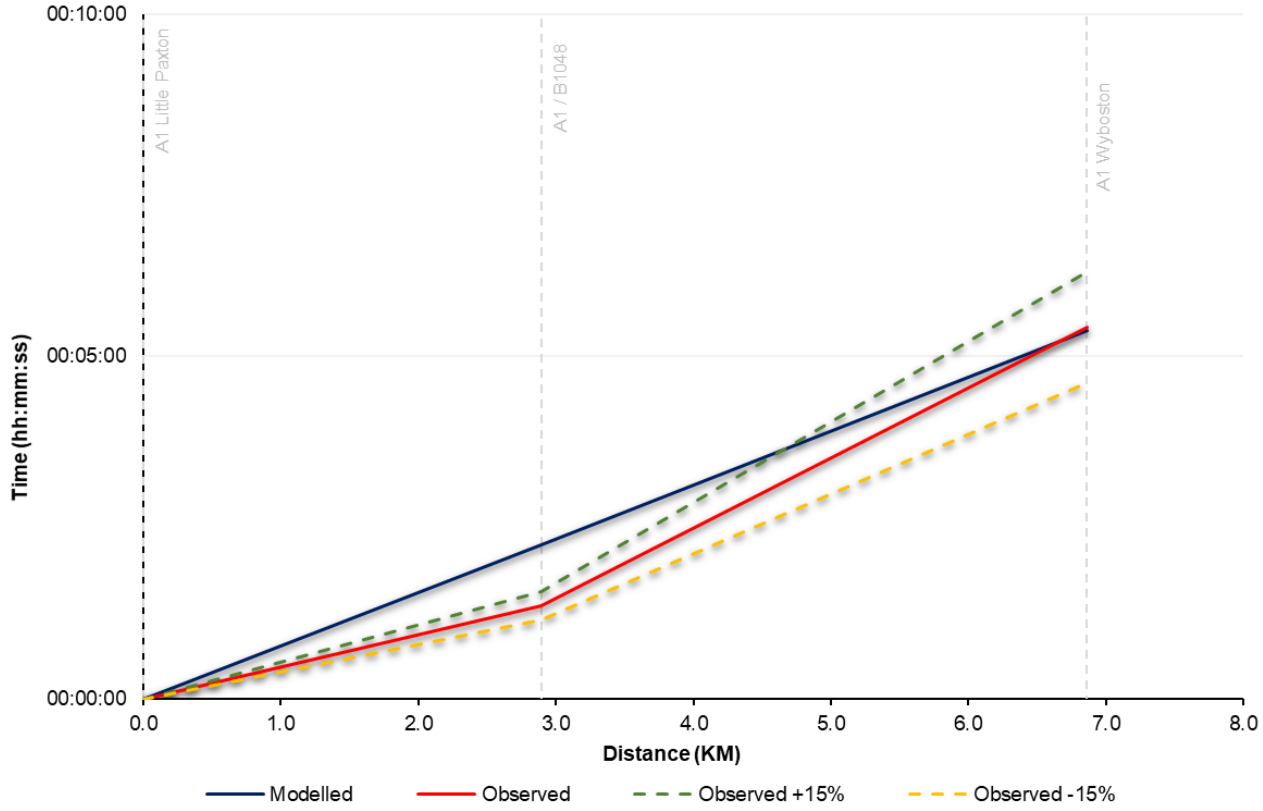
B.4.25. 2019 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – AM



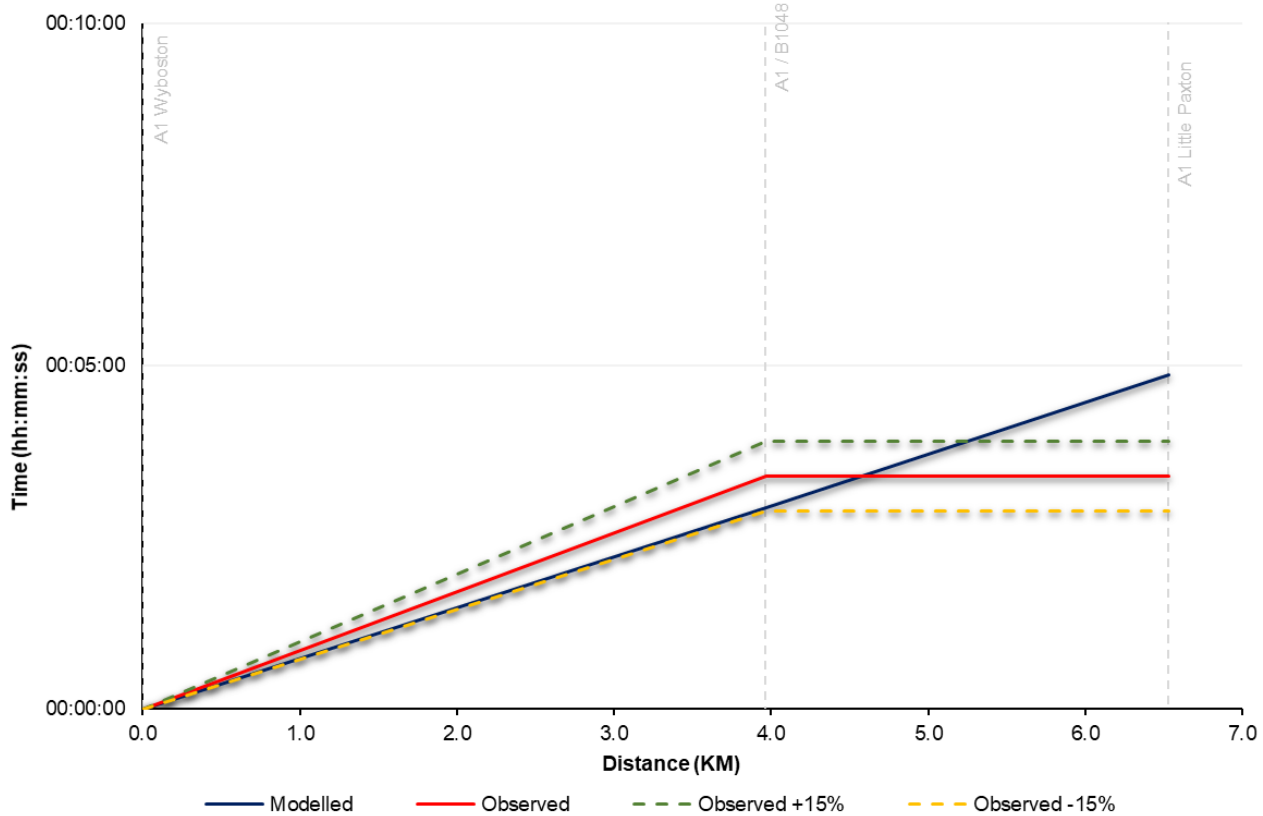
B.4.26. 2019 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – AM



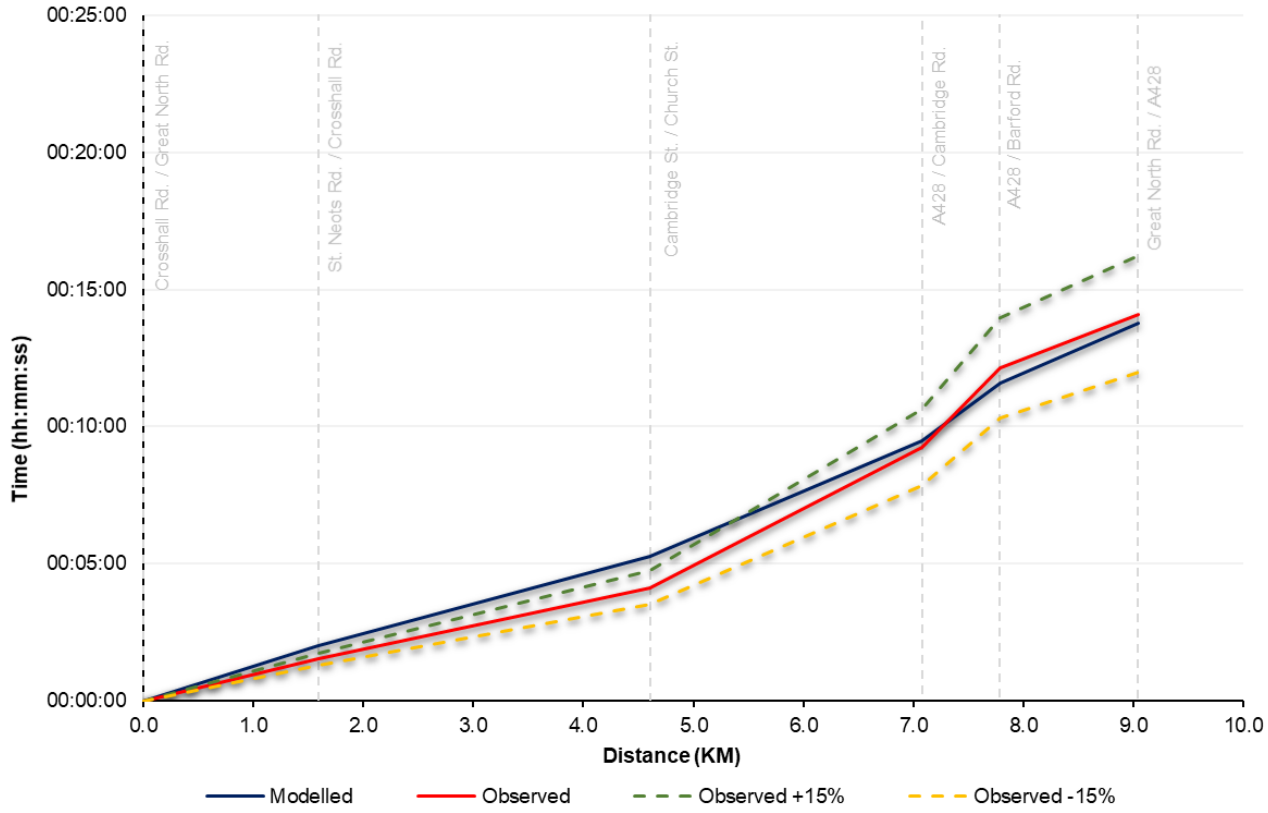
B.4.27. 2019 SN-01: A1 Little Paxton to A421 – AM



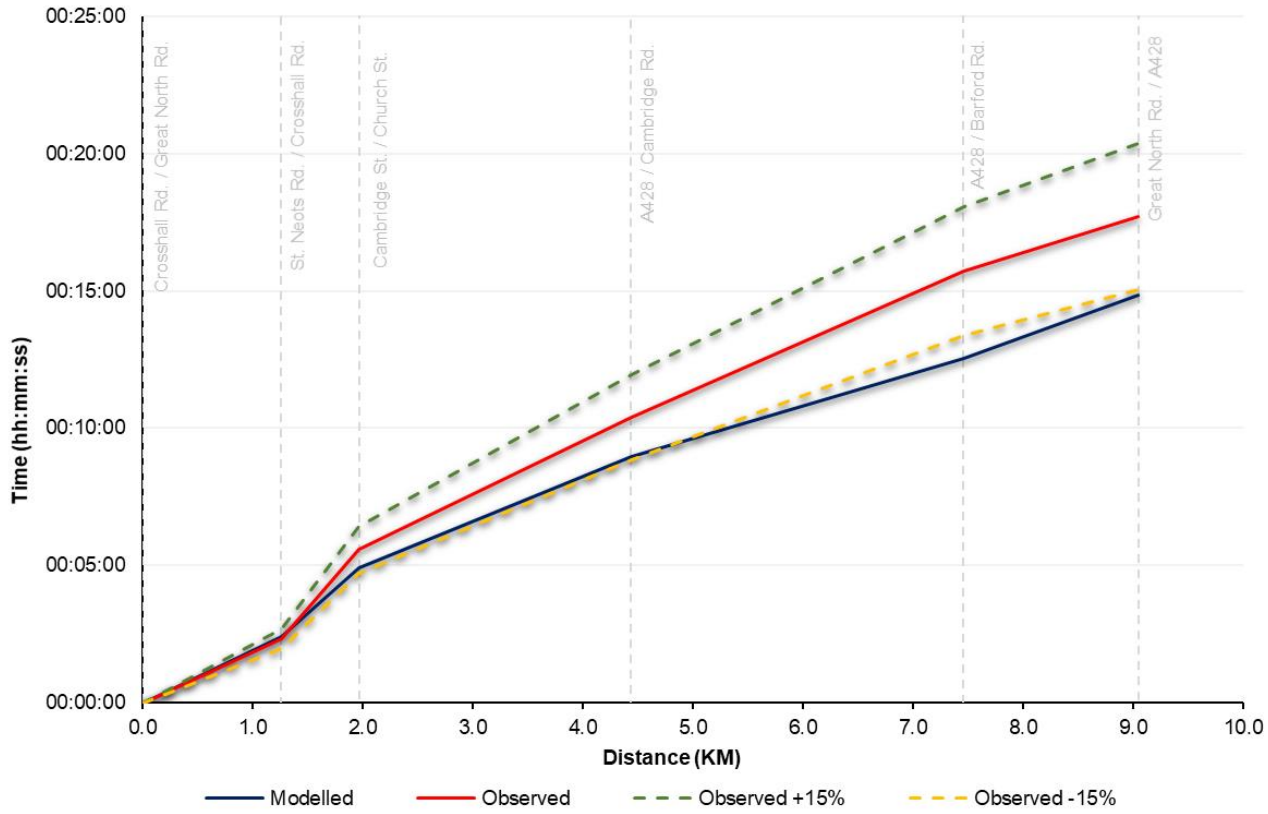
B.4.28. 2019 SN-02: A421 to A1 Little Paxton – AM



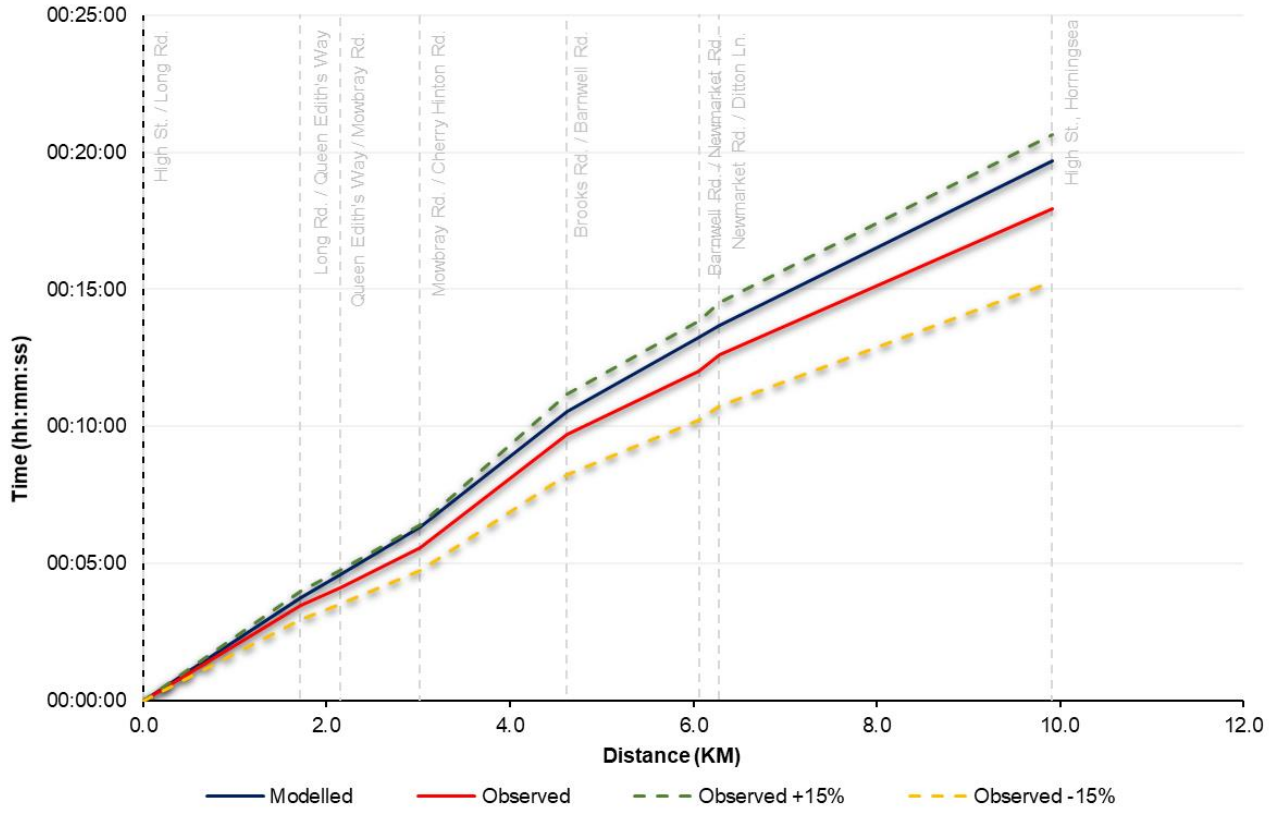
B.4.29. 2019 SN-03: A1 / B465 via Cambridge Rd. – AM



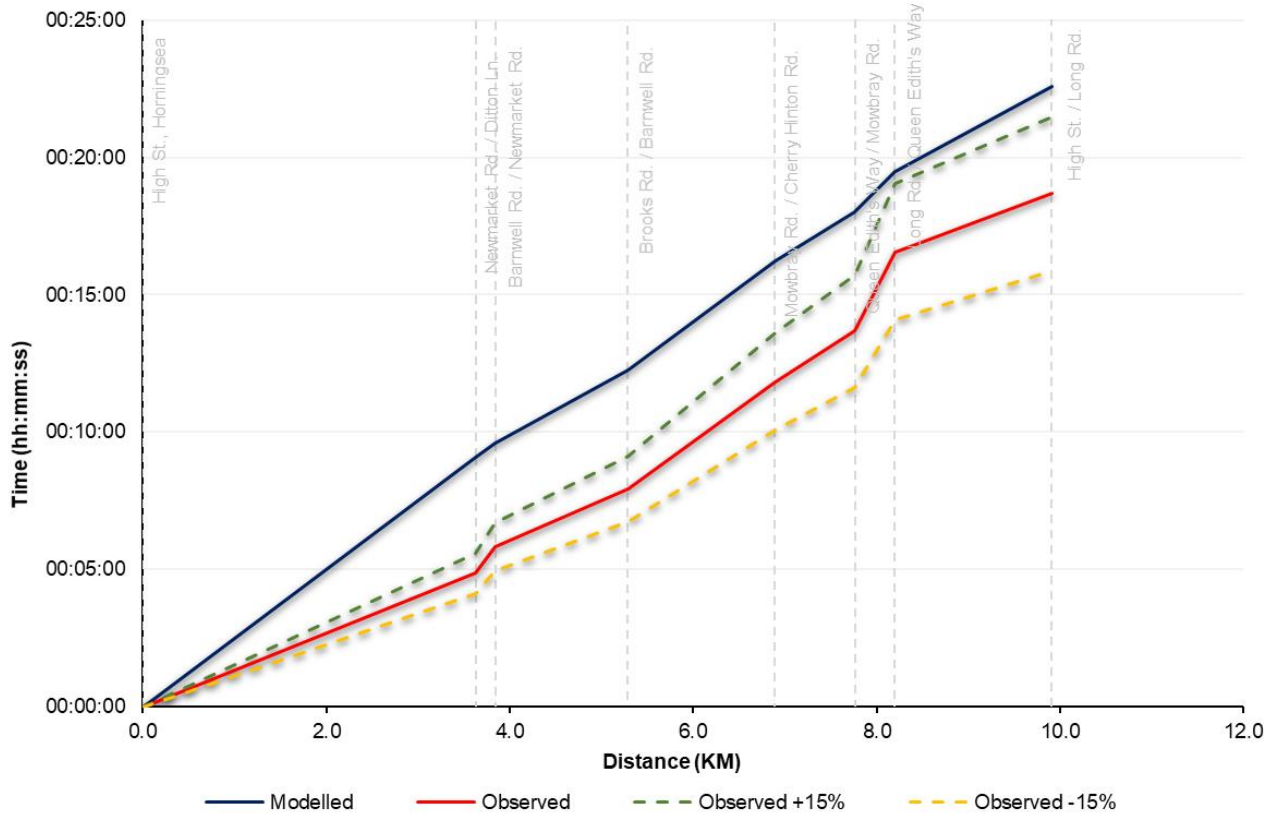
B.4.30. 2019 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – AM



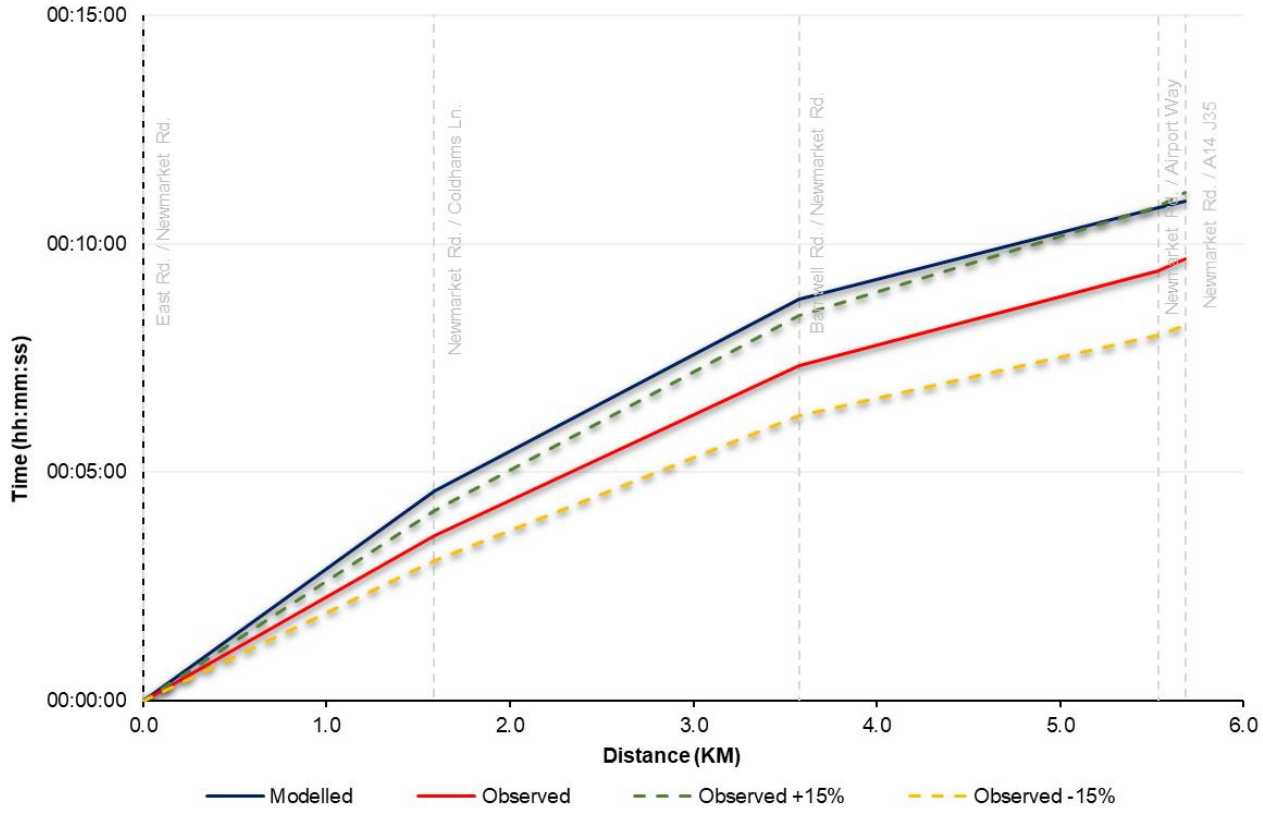
B.4.31. 2019 C-01: Trumpington Rd. to Priory Rd., Horningsea – IP



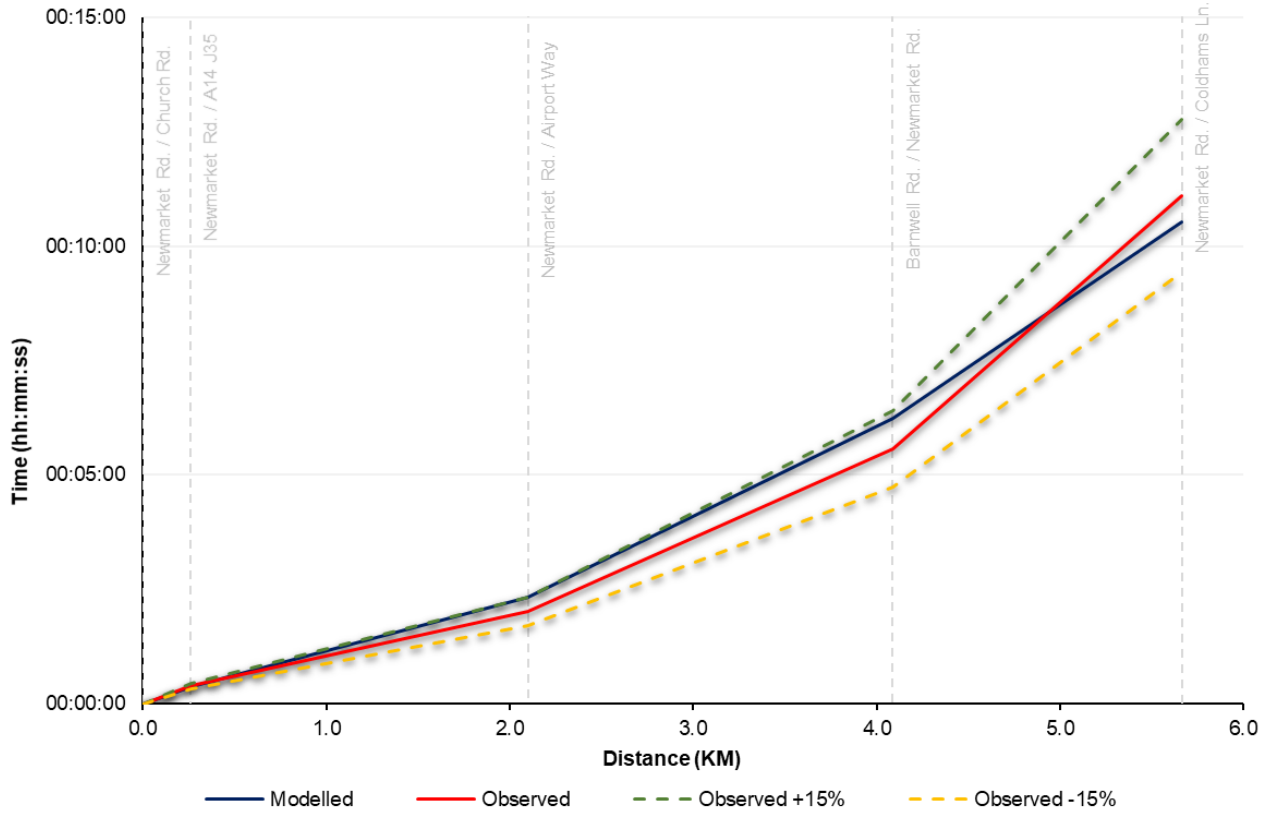
B.4.32. 2019 C-02: Priory Rd., Horningsea to Trumpington Rd. – IP



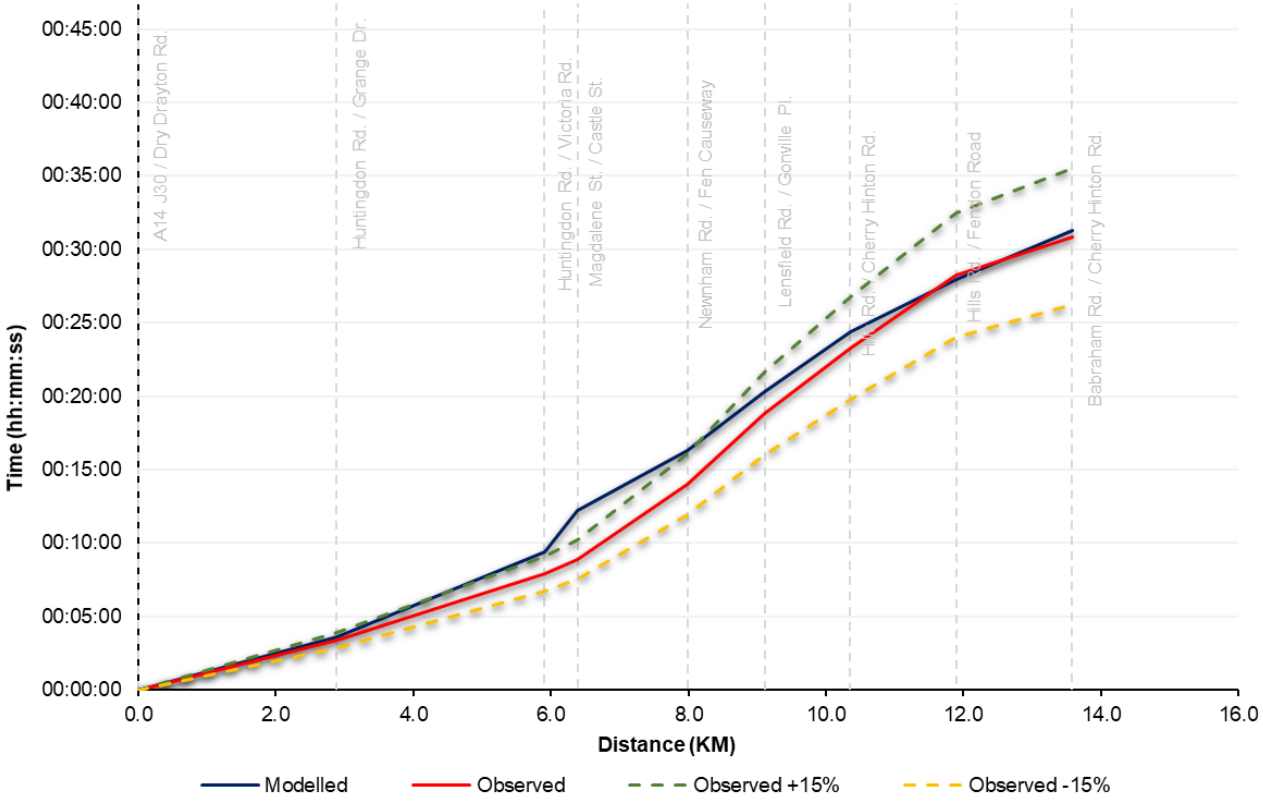
B.4.33. 2019 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – IP



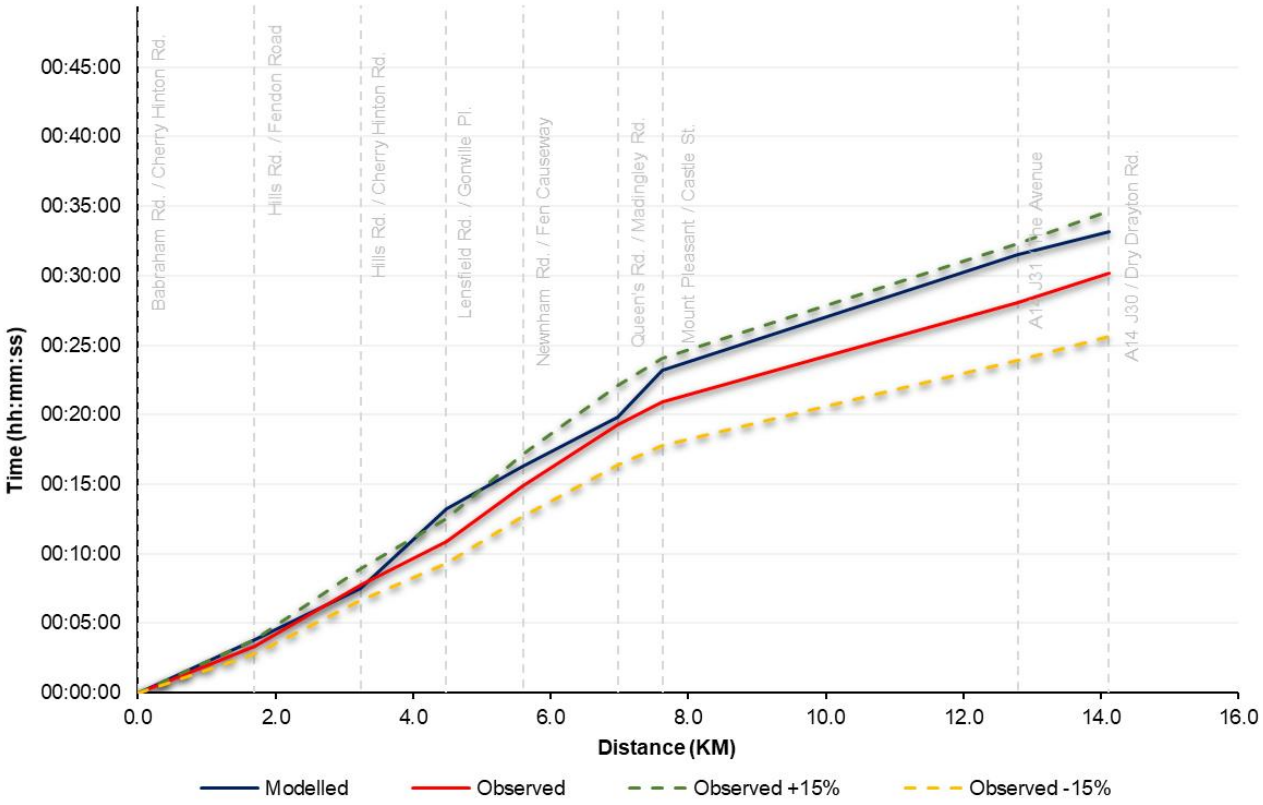
B.4.34. 2019 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – IP



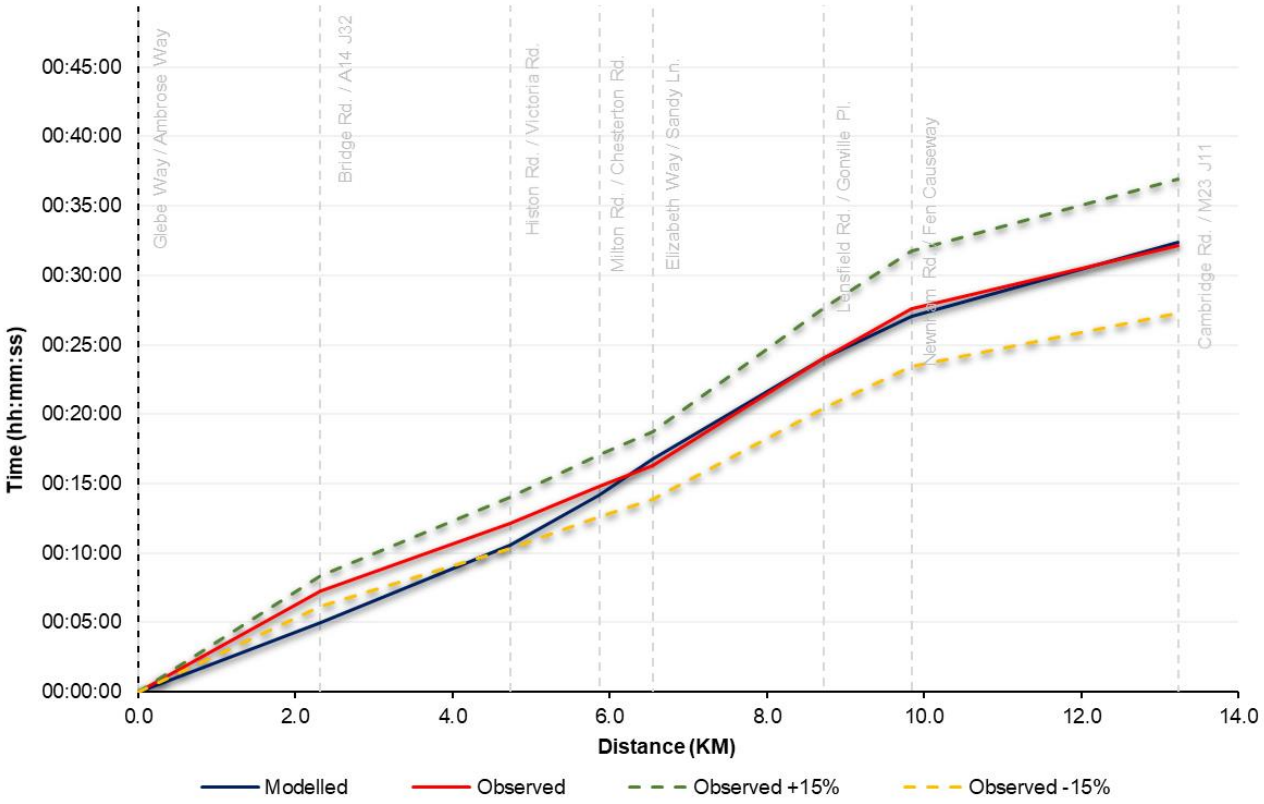
B.4.35. 2019 C-05: Oakington Rd. to Fendon Rd. – IP



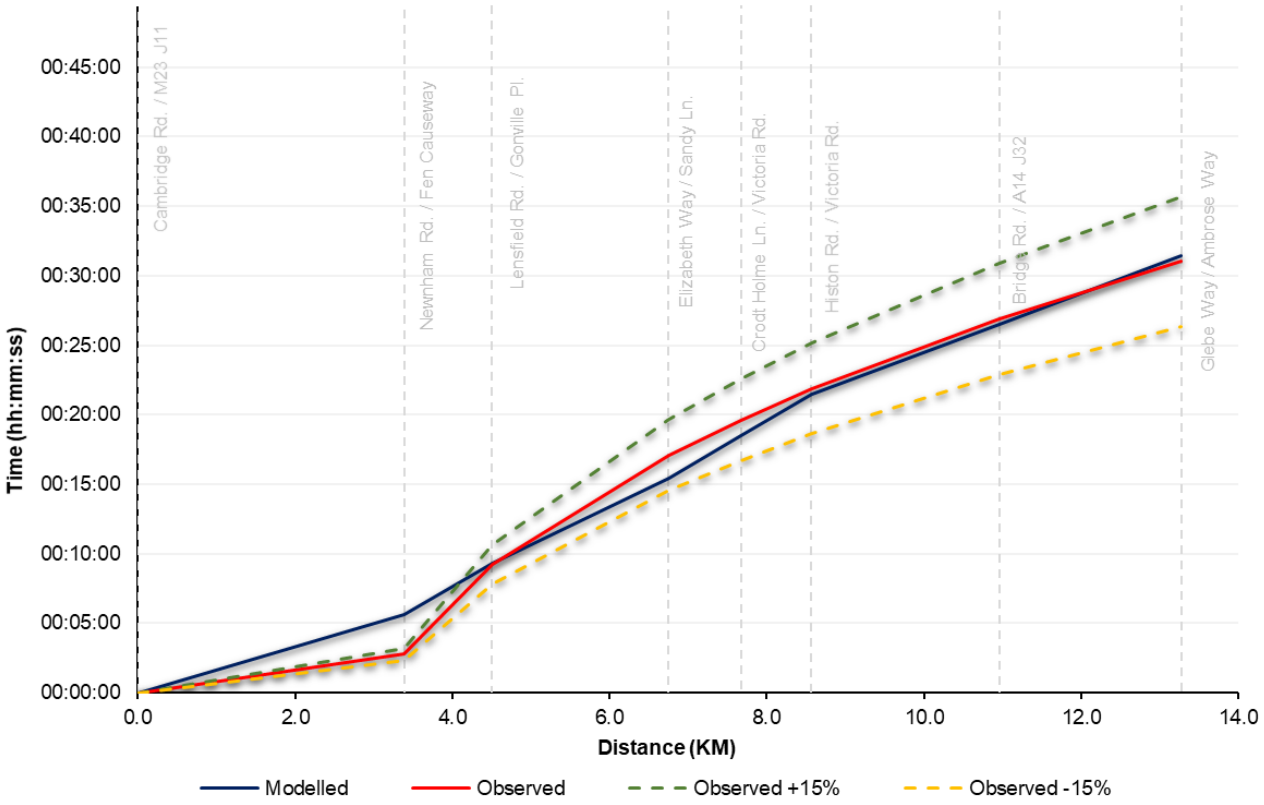
B.4.36. 2019 C-06: Fendon Rd. to Oakington Rd. – IP



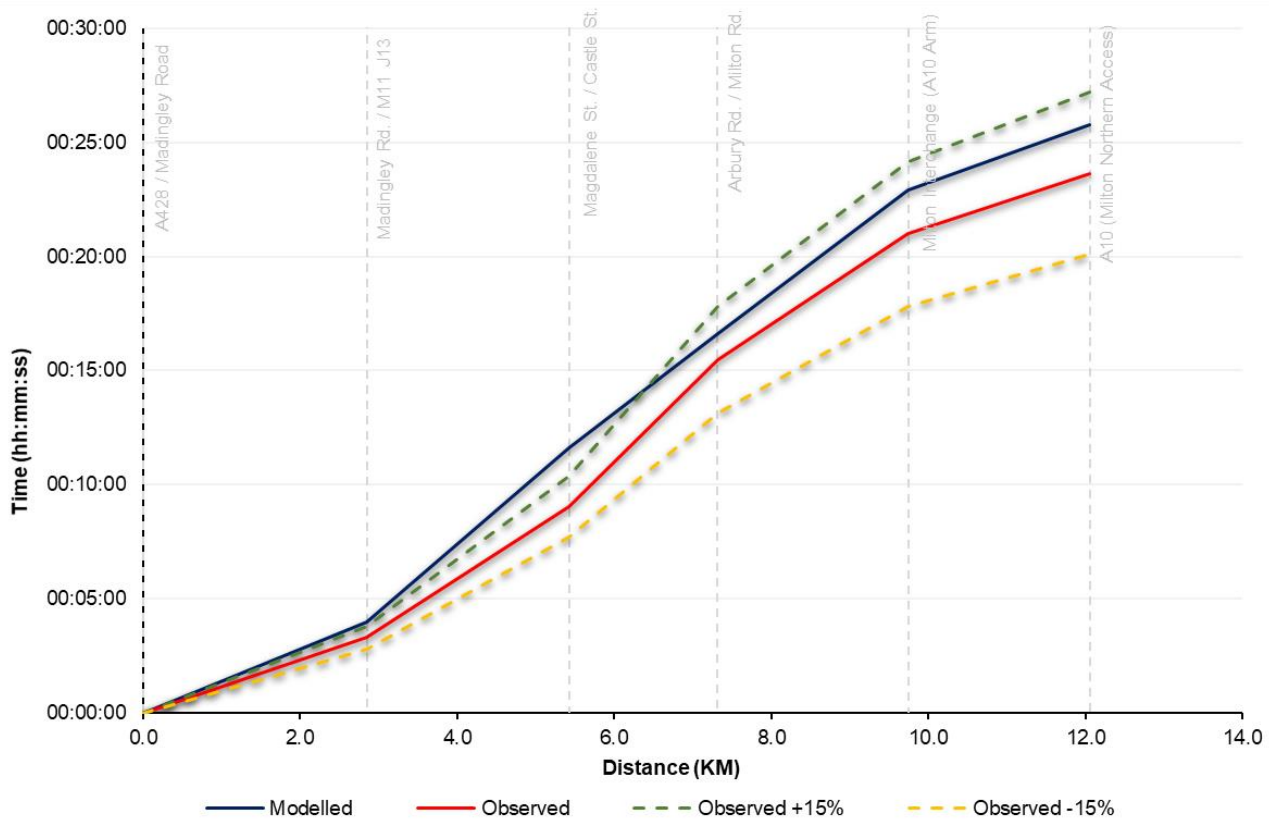
B.4.37. 2019 C-07: Impington Ln. to M11 – IP



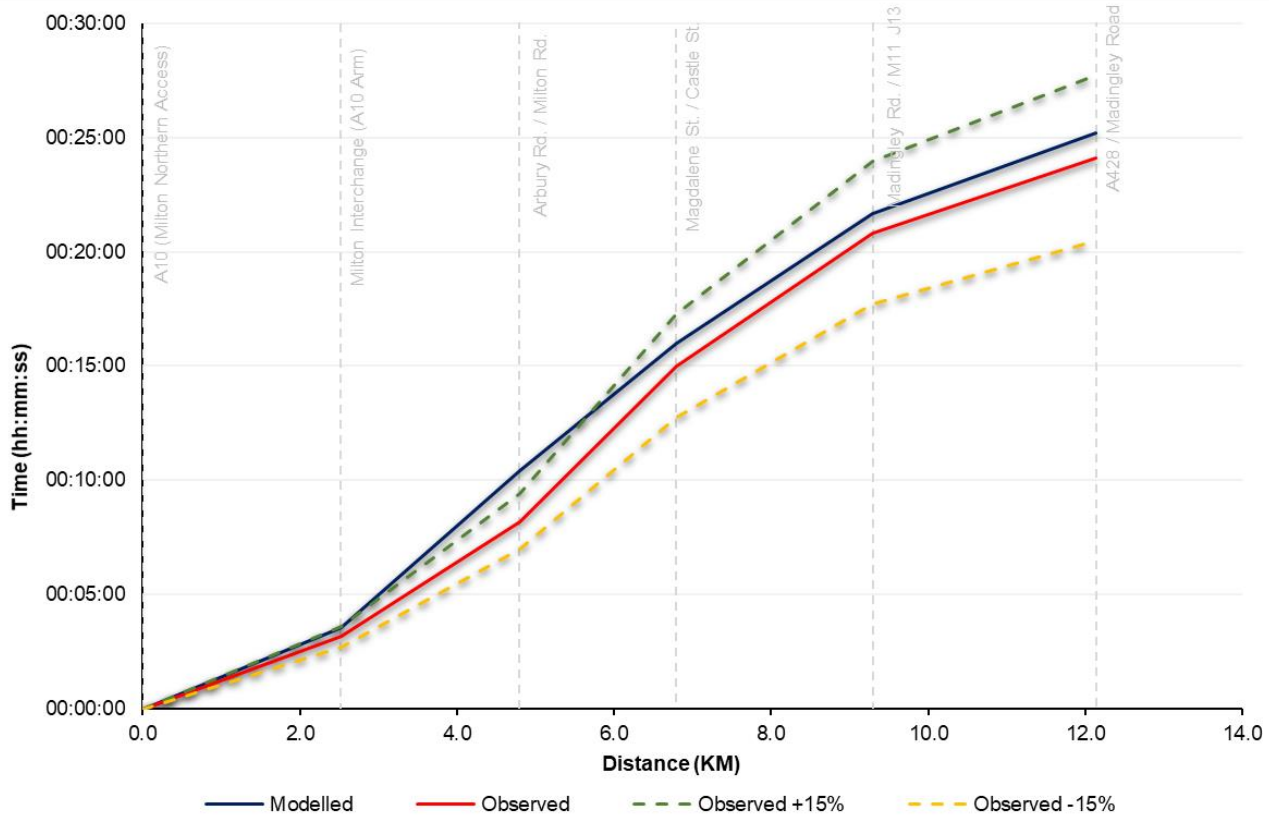
B.4.38. 2019 C-08: M11 to Impington Ln. – IP



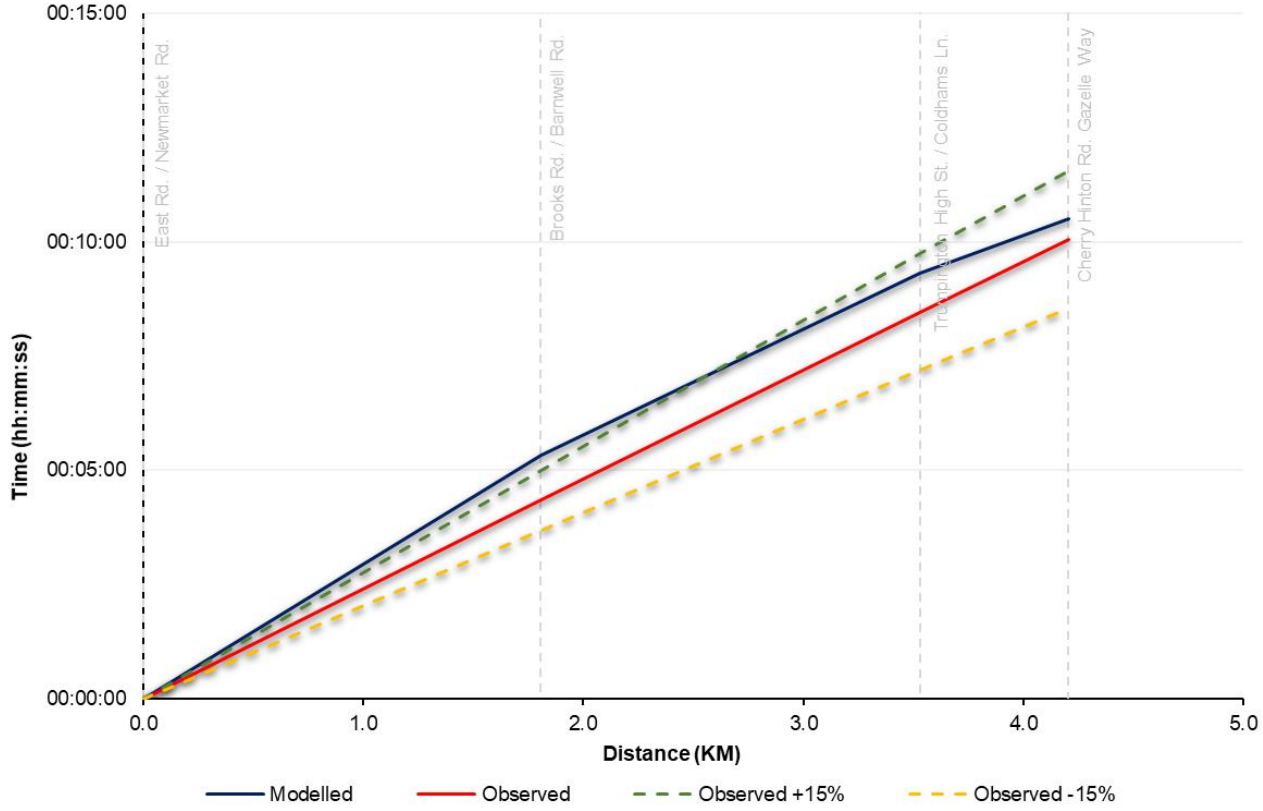
B.4.39. 2019 C-09: A428 Rbt. to Milton – IP



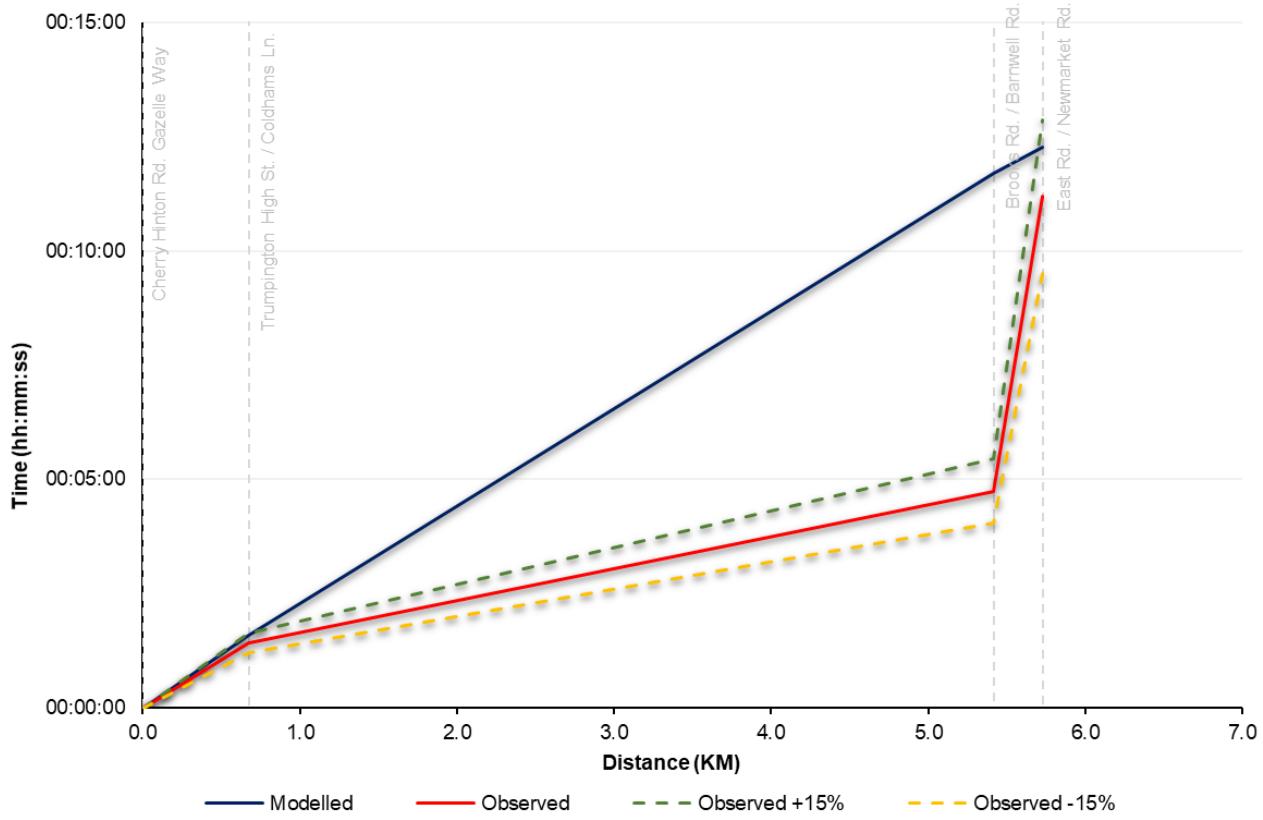
B.4.40. 2019 C-10: Milton to A428 Rbt. – IP



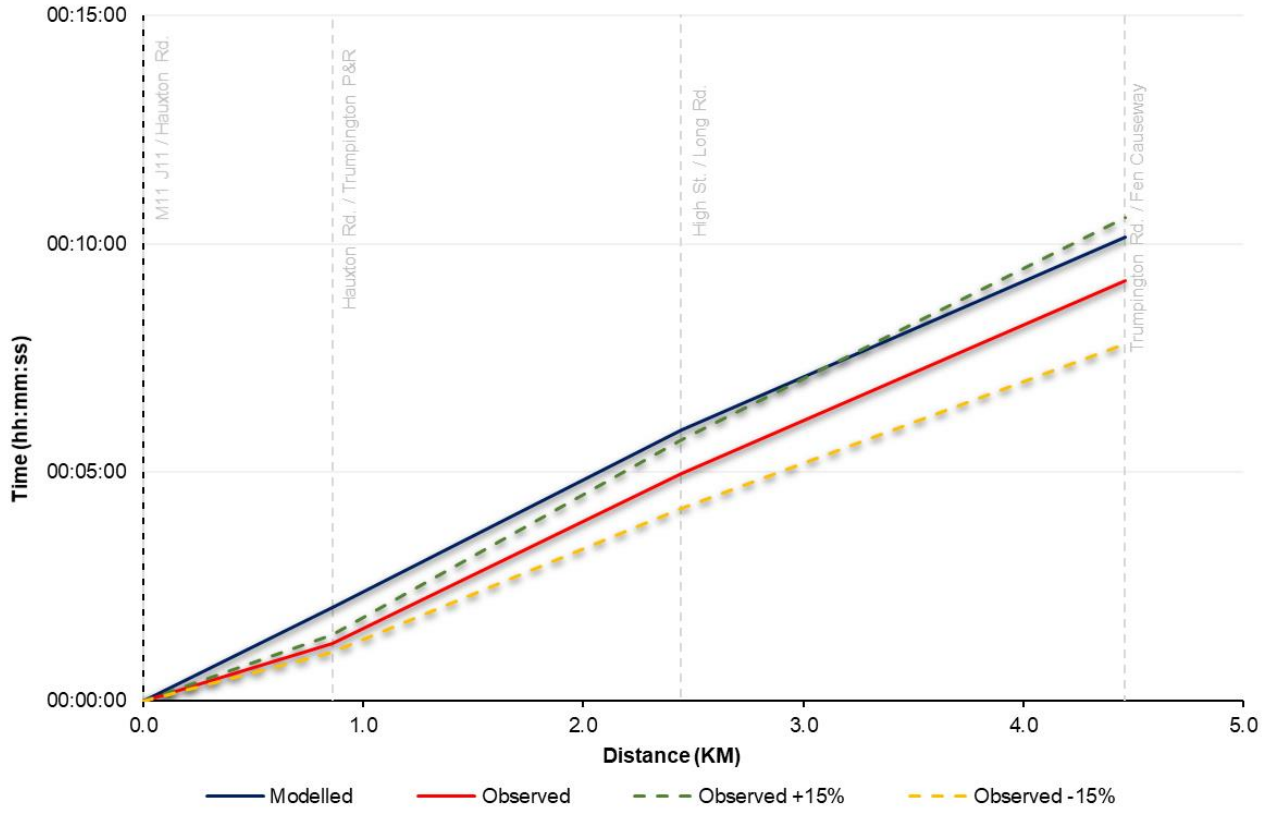
B.4.41. 2019 C-11: Elizabeth Way to Teversham Drift – IP



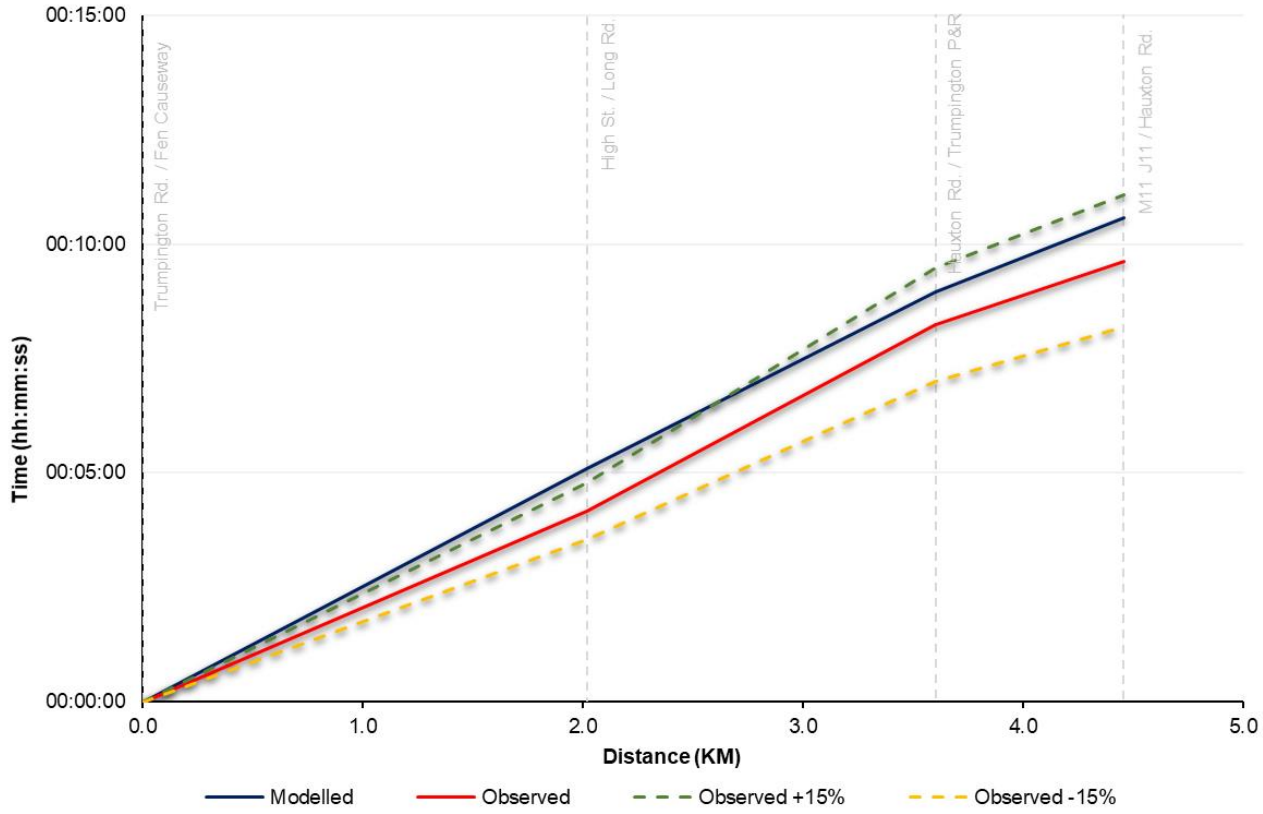
B.4.42. 2019 C-12: Teversham Drift to Elizabeth Way – IP



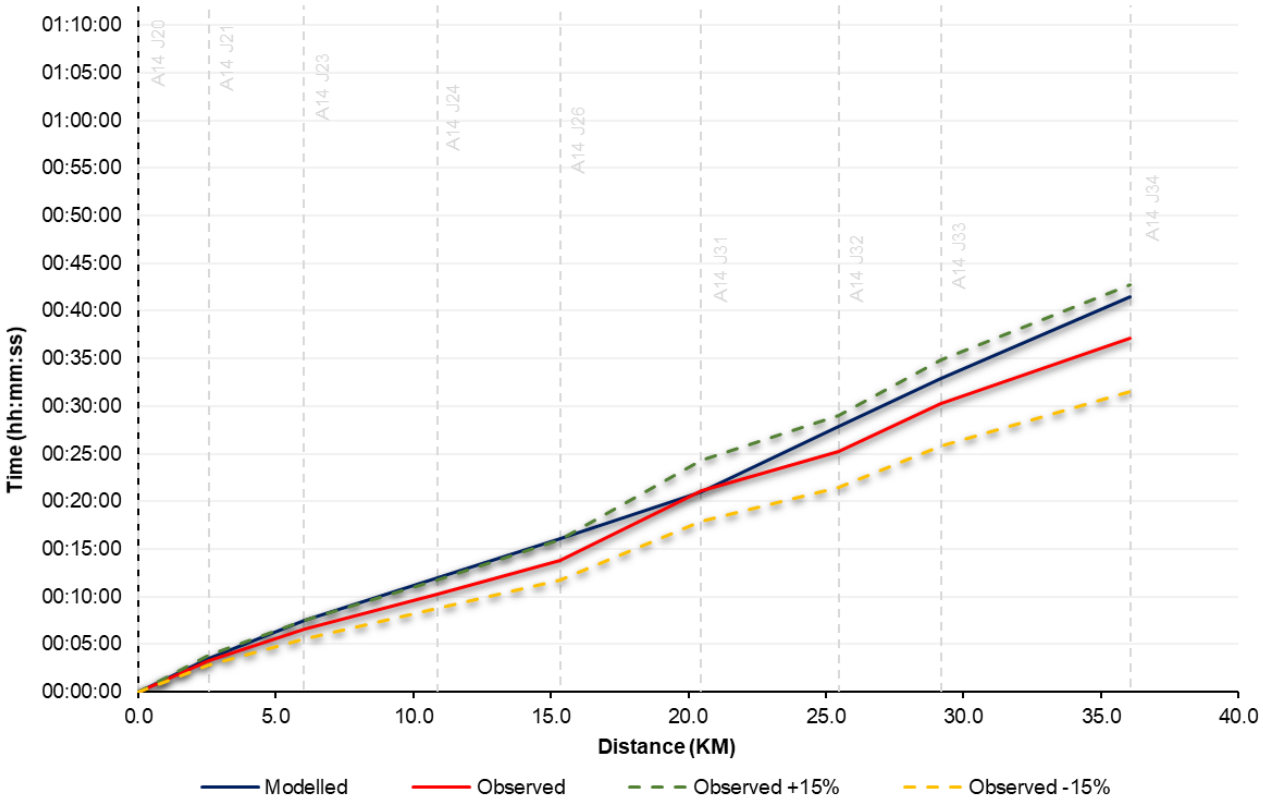
B.4.43. 2019 C-13: Hauxton Rd. (M11) to Lensfield Rd. – IP



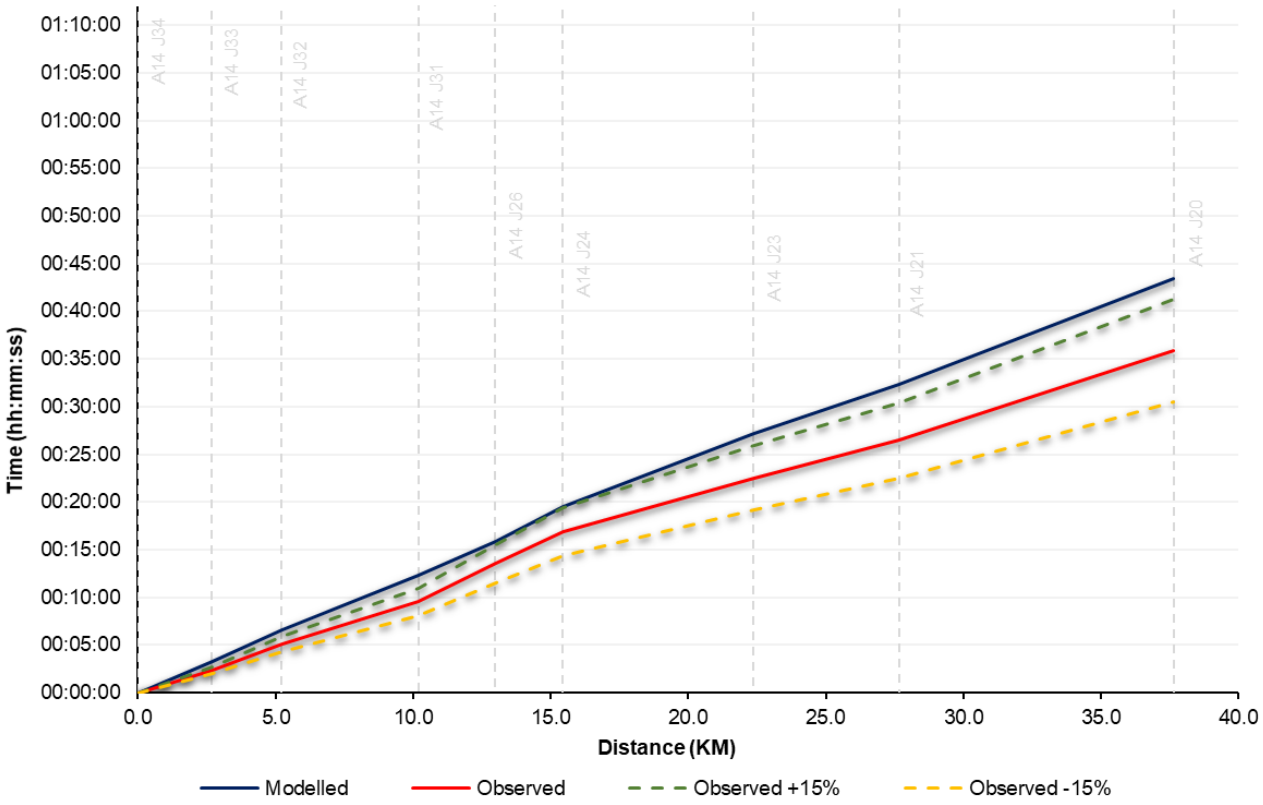
B.4.44. 2019 C-14: Lensfield Rd. to Hauxton Rd. (M11) – IP



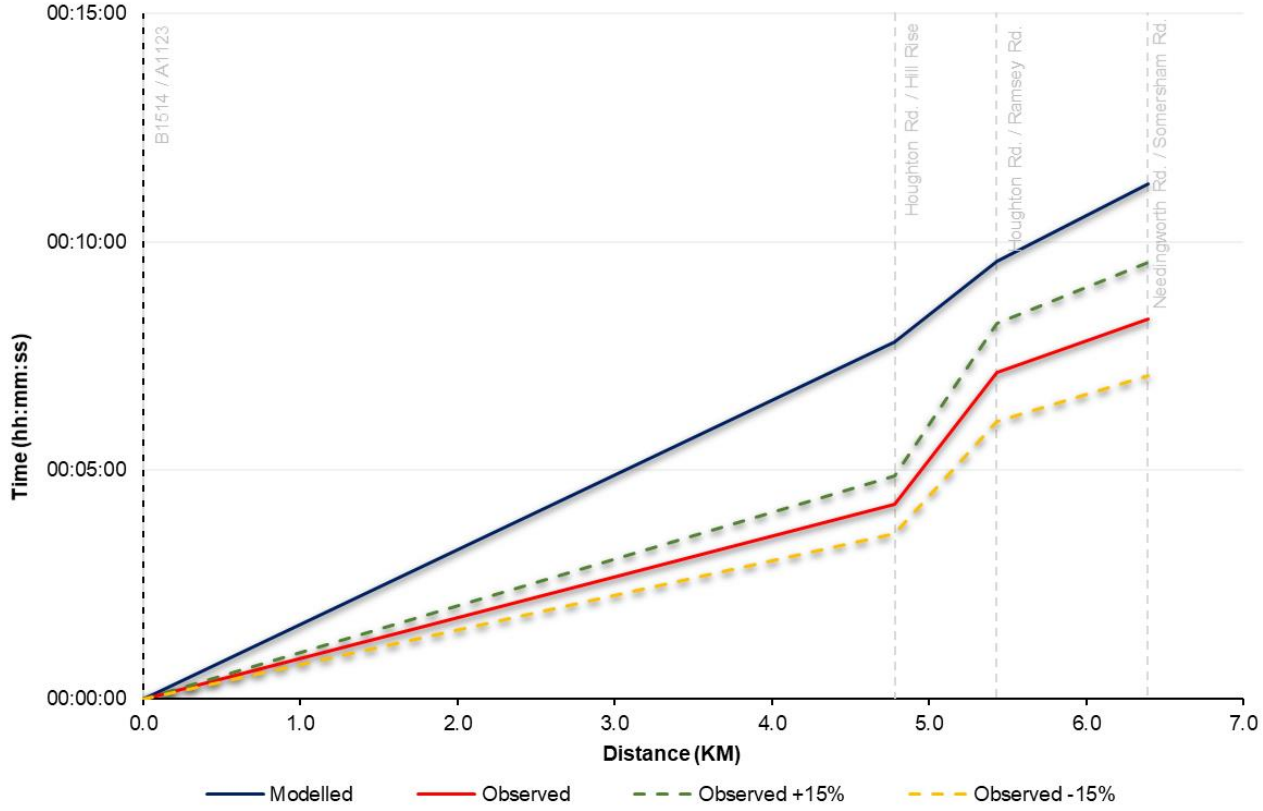
B.4.45. 2019 A14-01: Ellington to Horningsea Rd. – IP



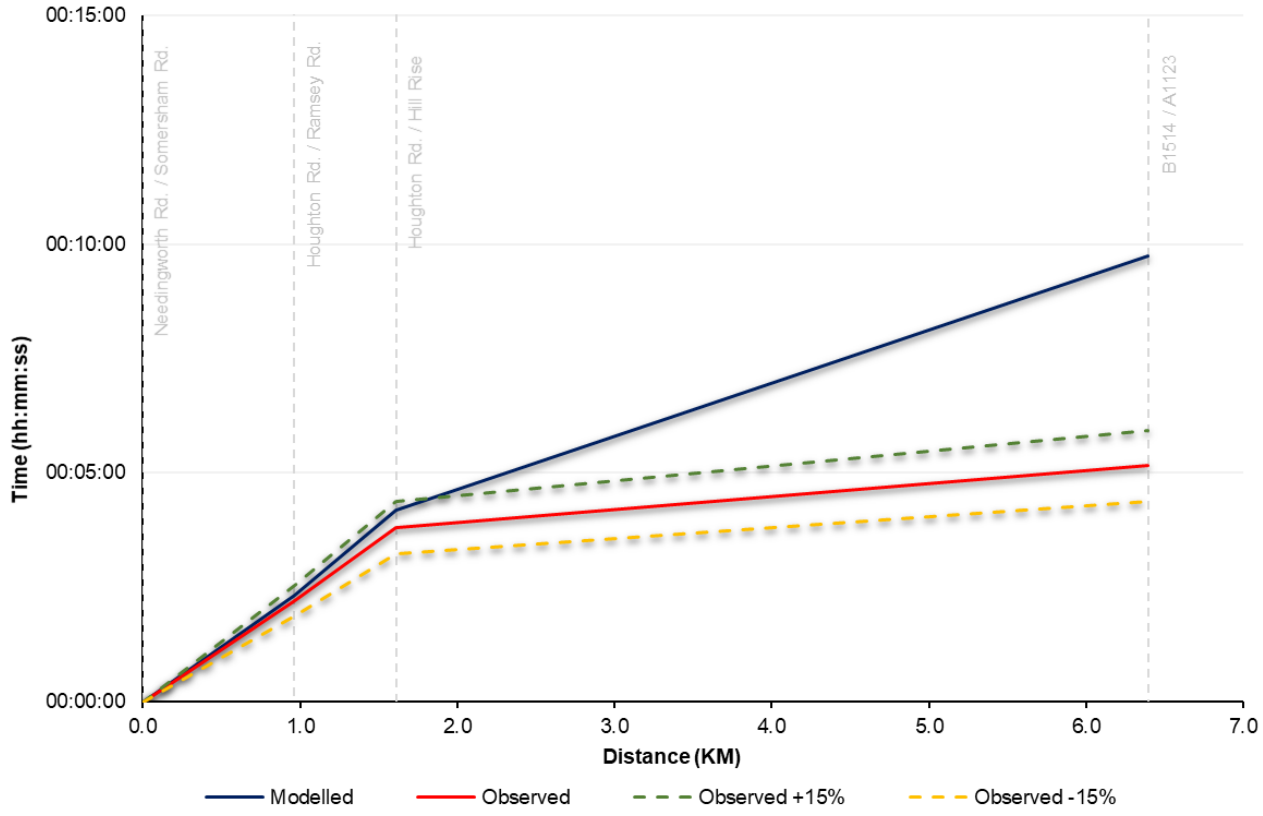
B.4.46. 2019 A14-02: Horningsea Rd. to Ellington – IP



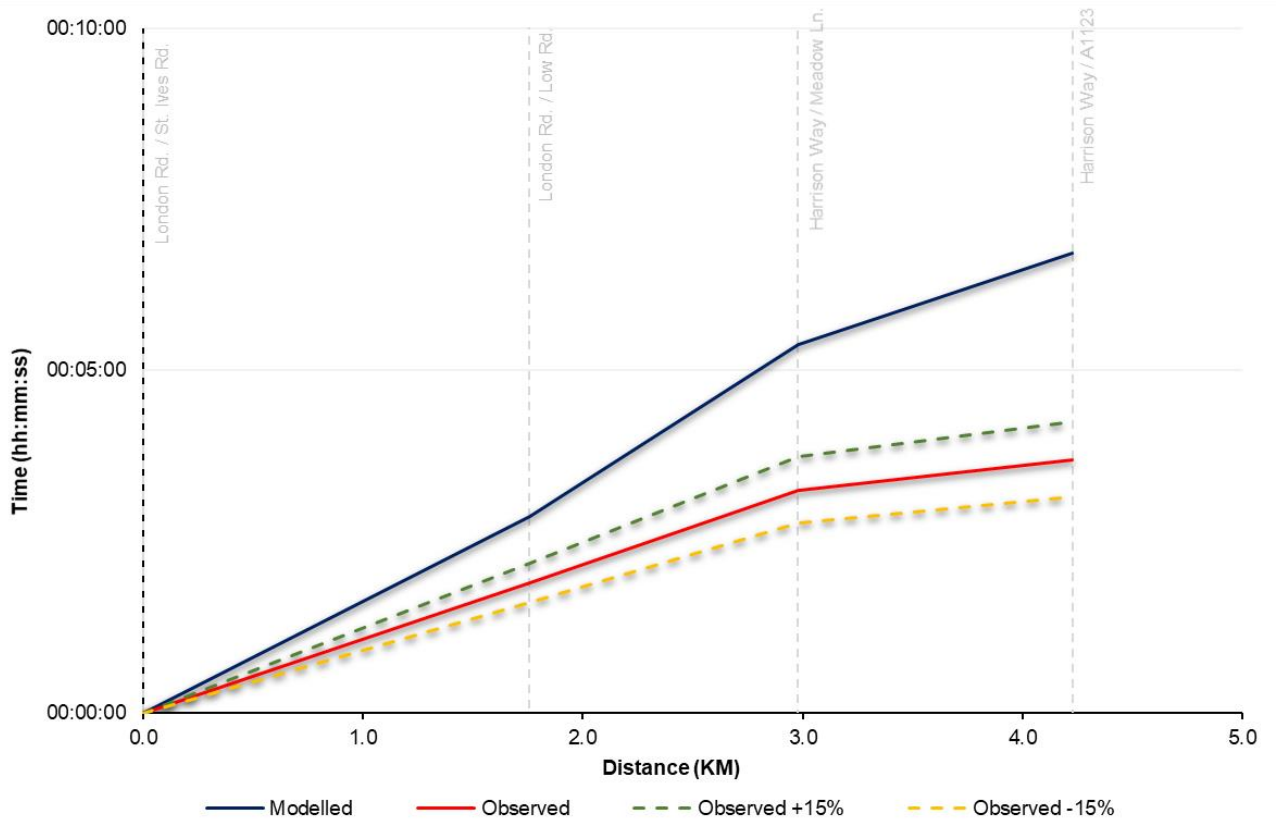
B.4.47. 2019 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – IP



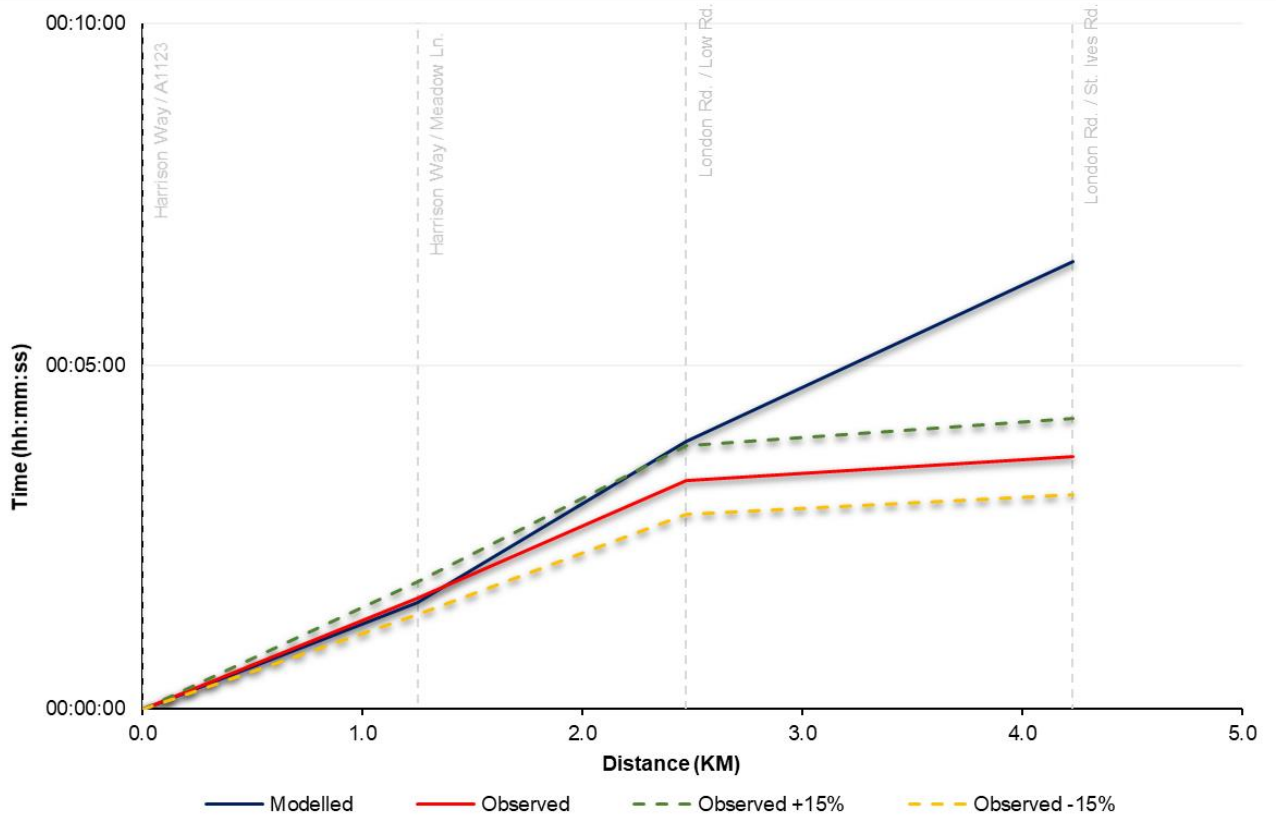
B.4.48. 2019 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – IP



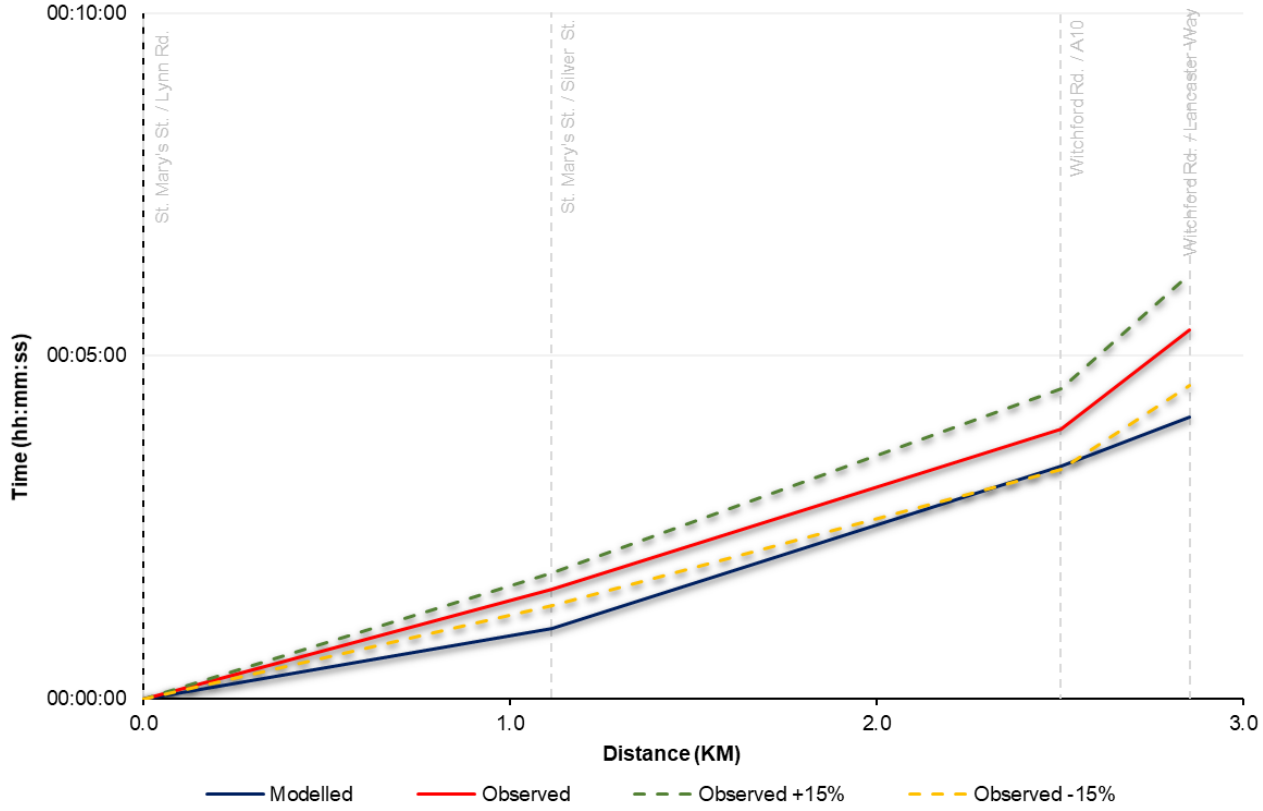
B.4.49. 2019 SI-03: A14 / A1096 to A1123 – IP



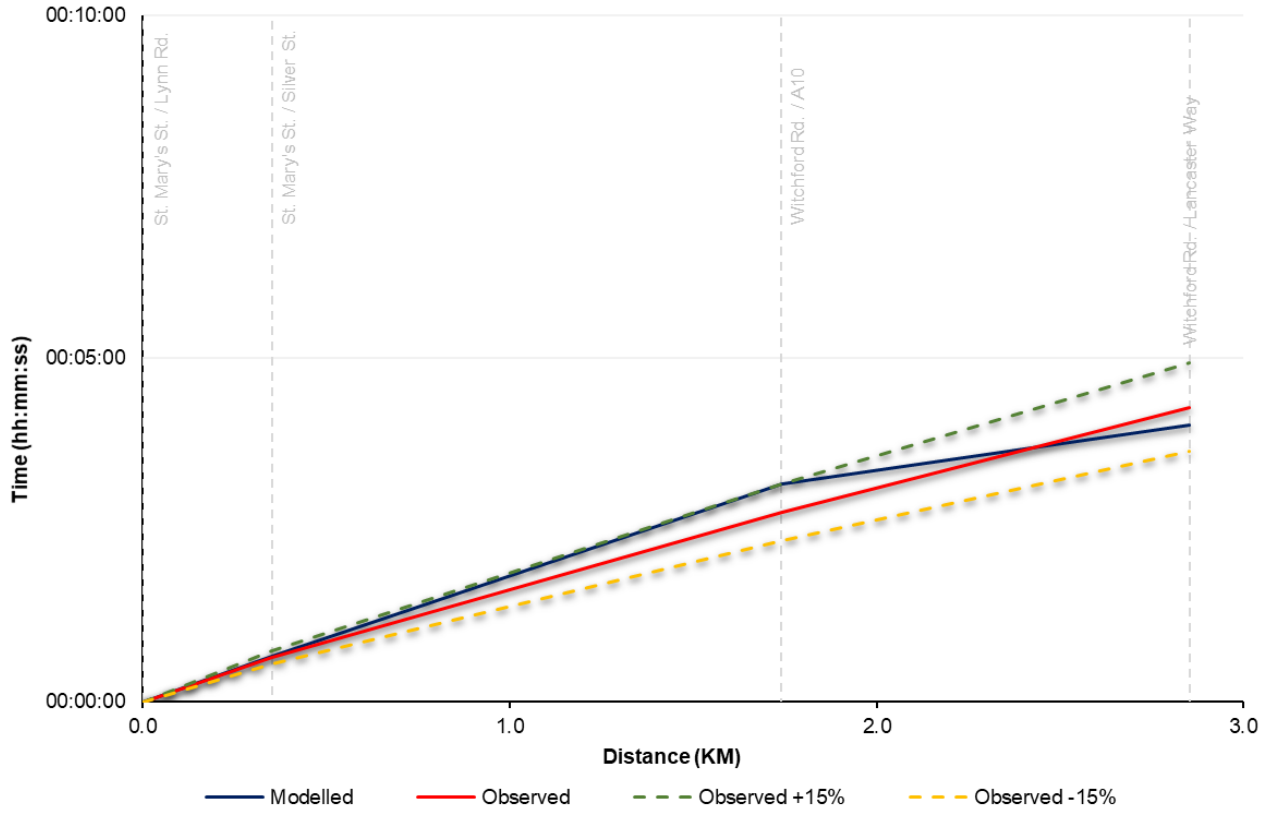
B.4.50. 2019 SI-04: A1123 to A14 / A1096 – IP



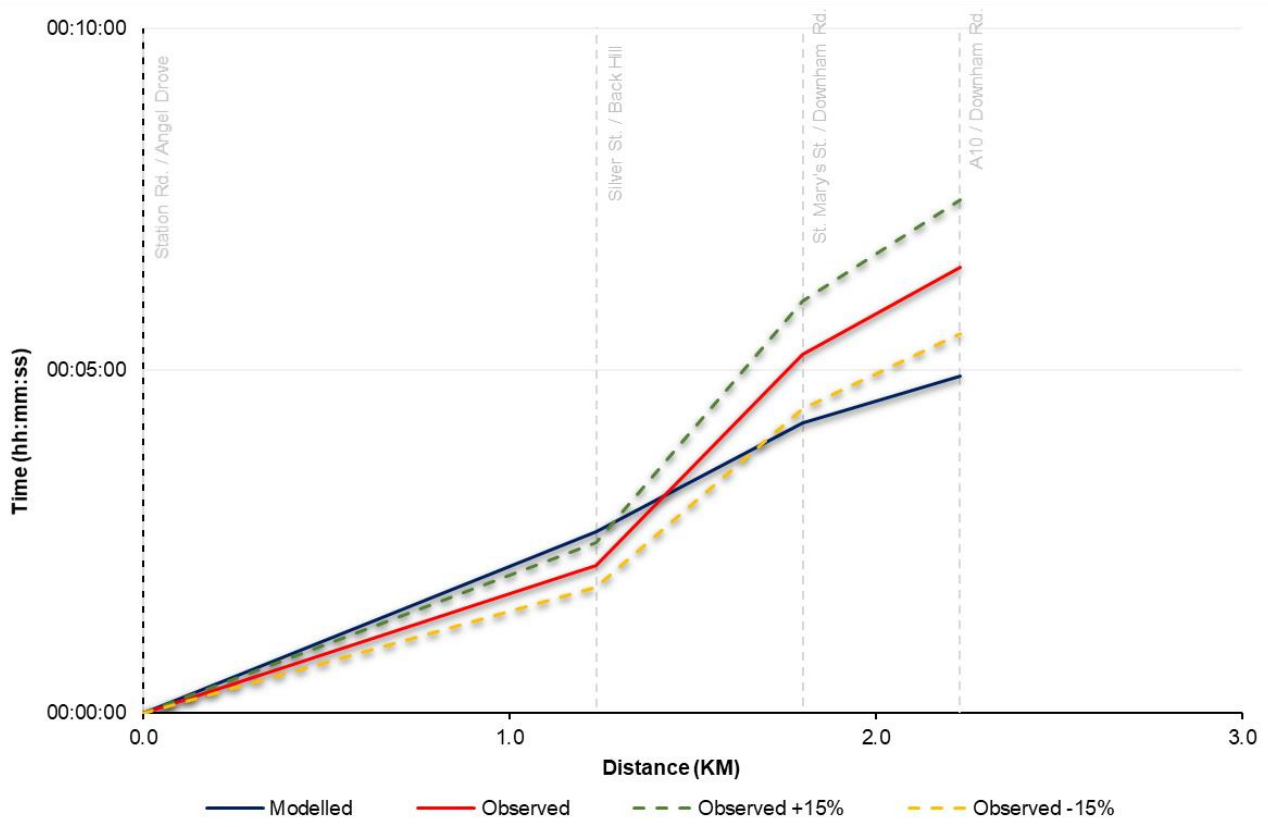
B.4.51. 2019 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – IP



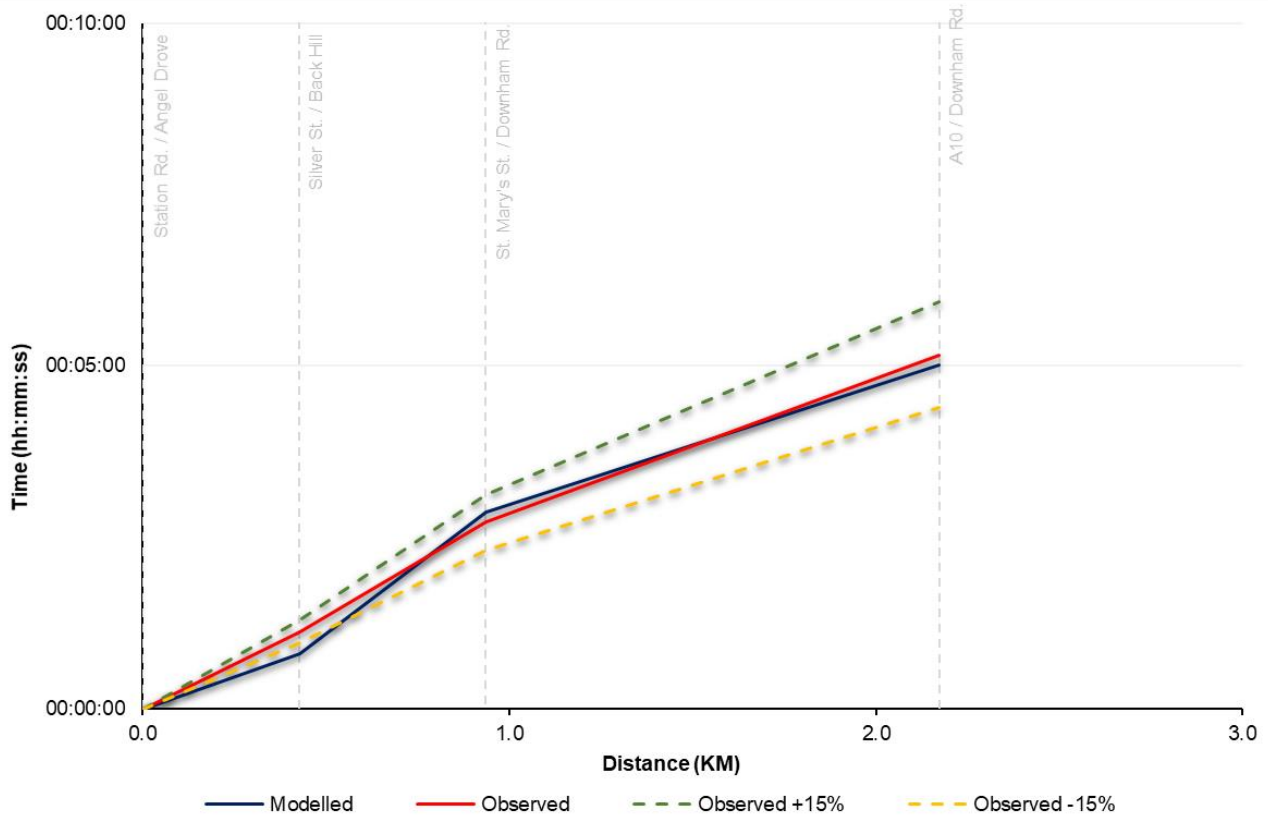
B.4.52. 2019 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – IP



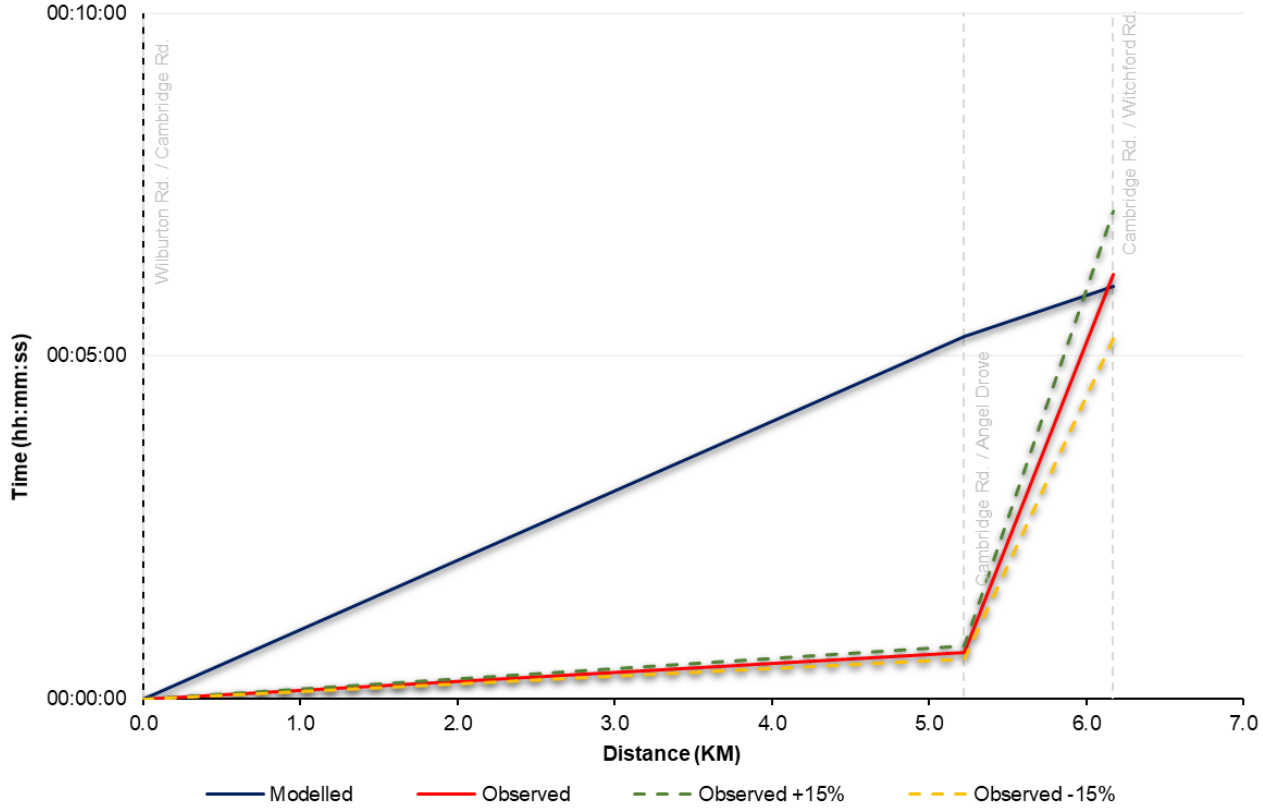
B.4.53. 2019 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – IP



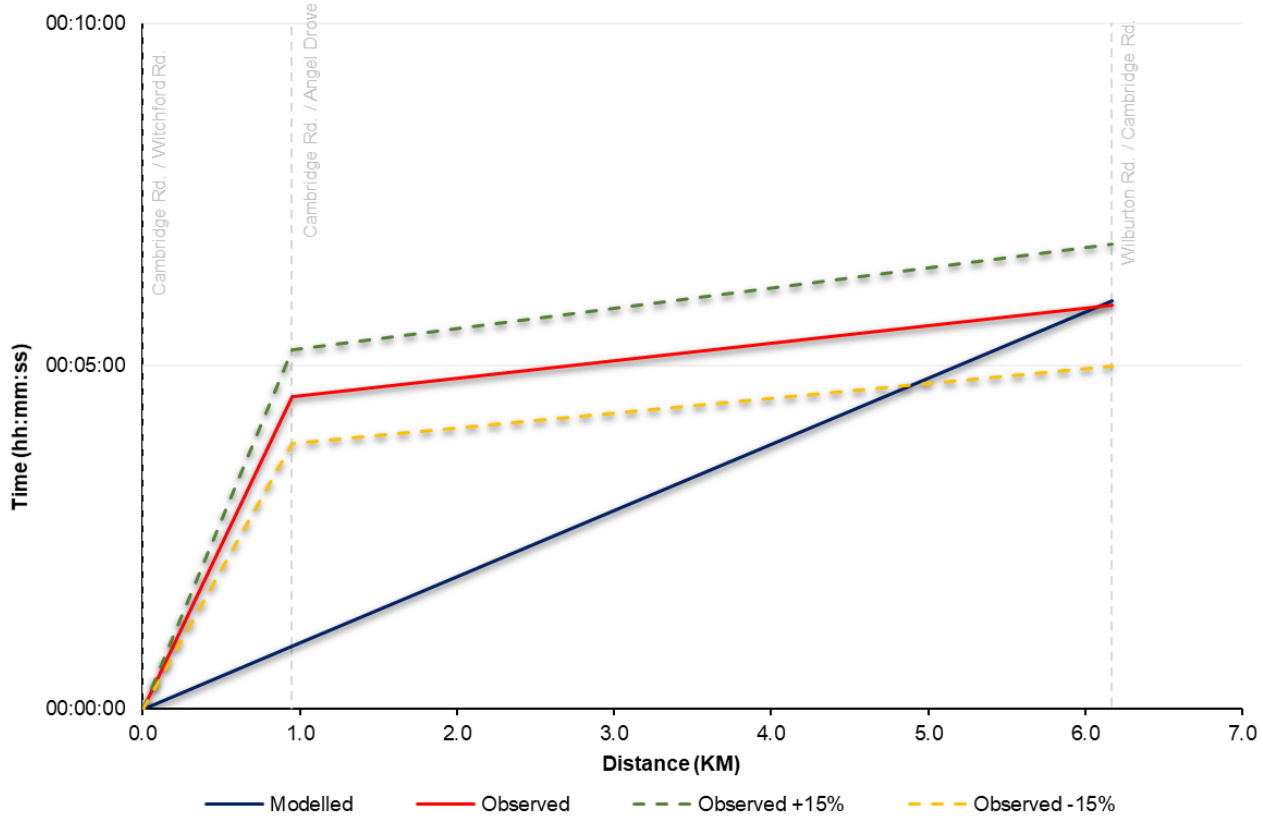
B.4.54. 2019 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – IP



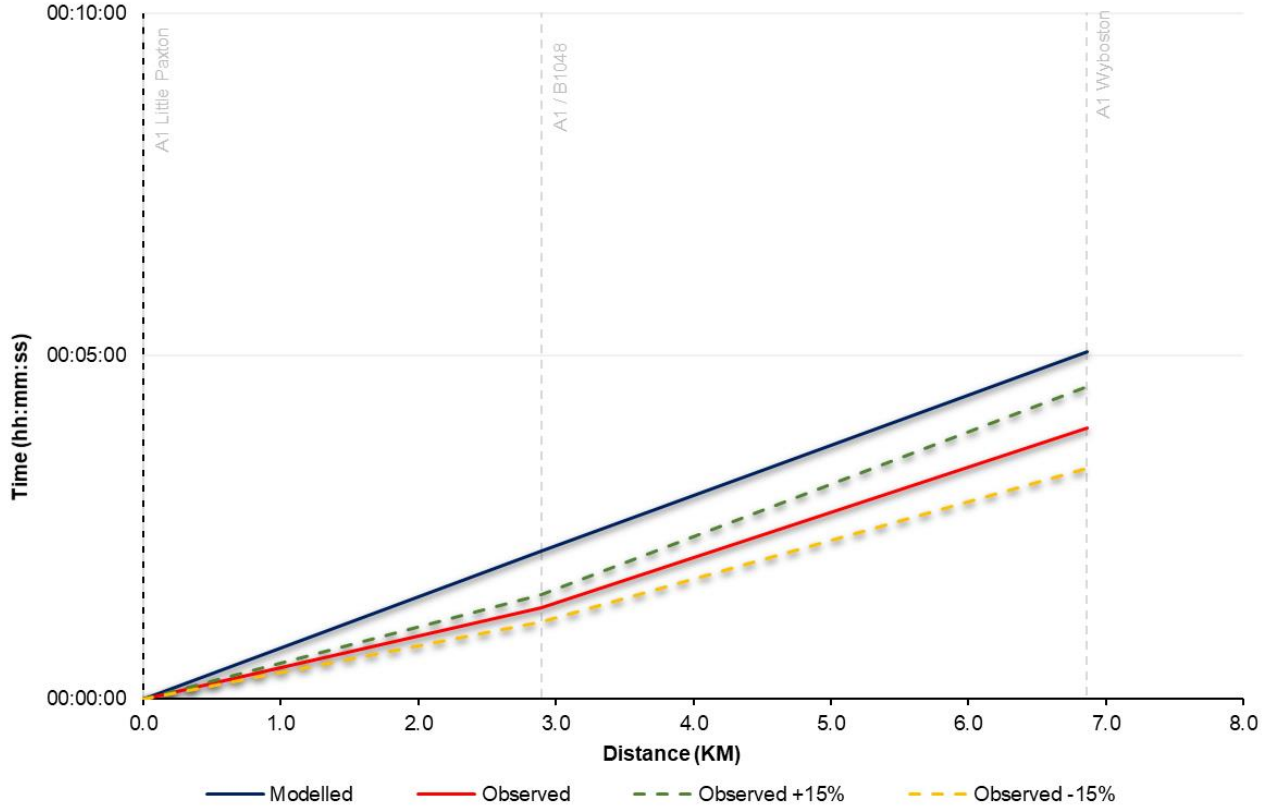
B.4.55. 2019 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – IP



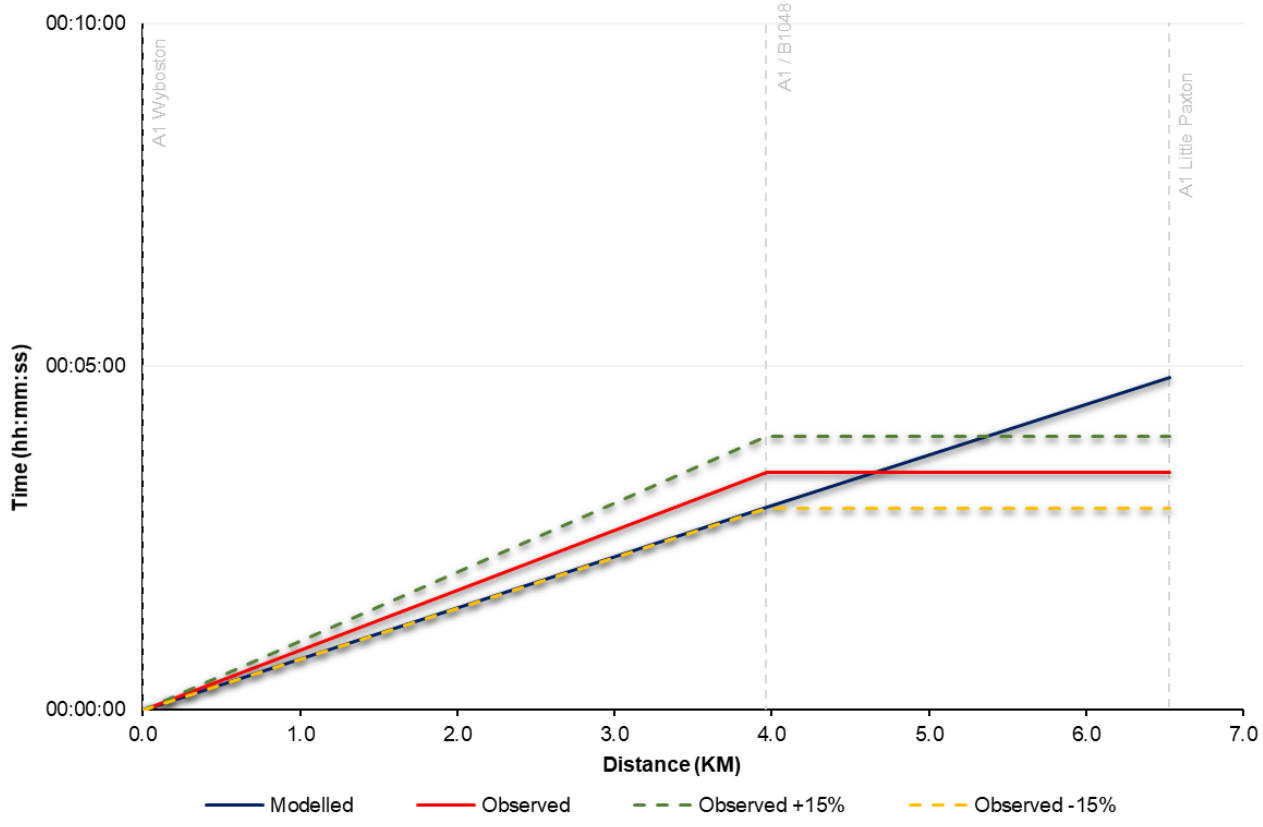
B.4.56. 2019 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – IP



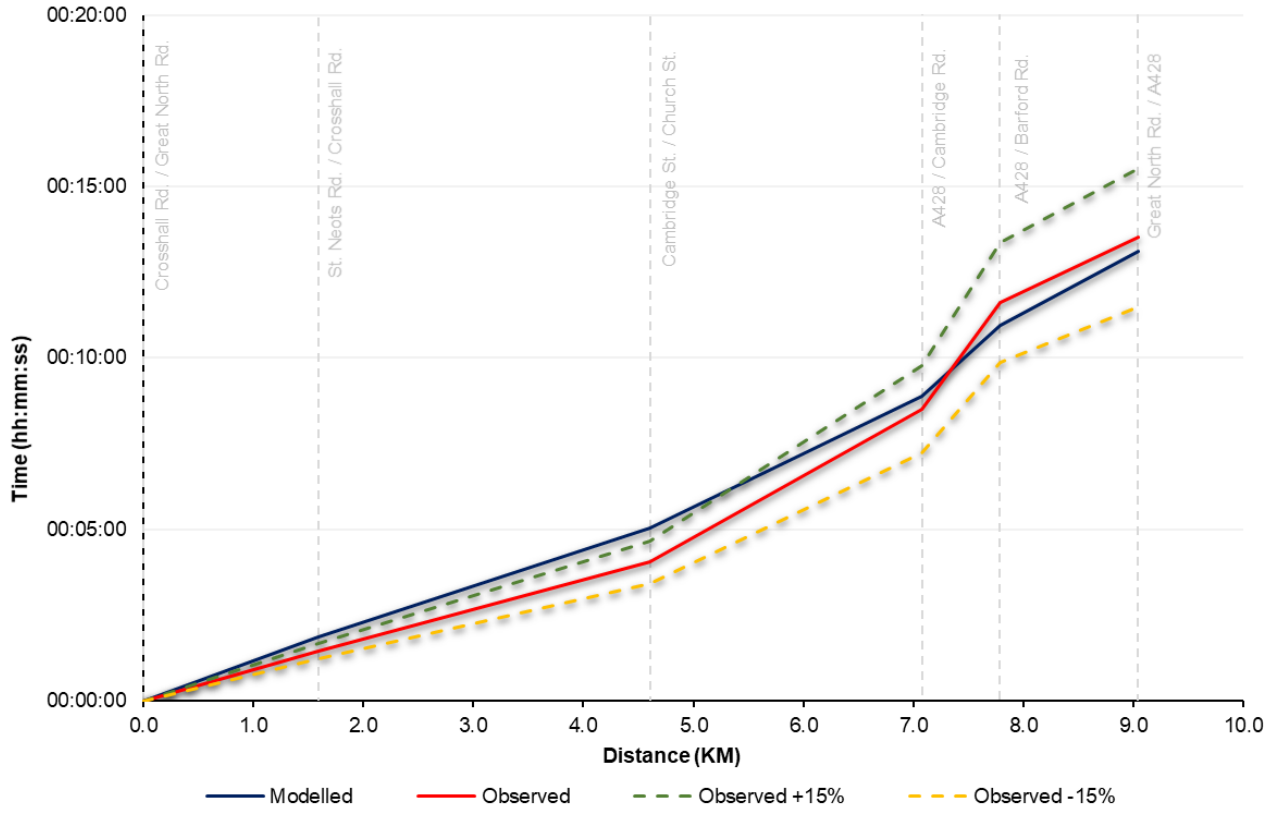
B.4.57. 2019 SN-01: A1 Little Paxton to A421 – IP



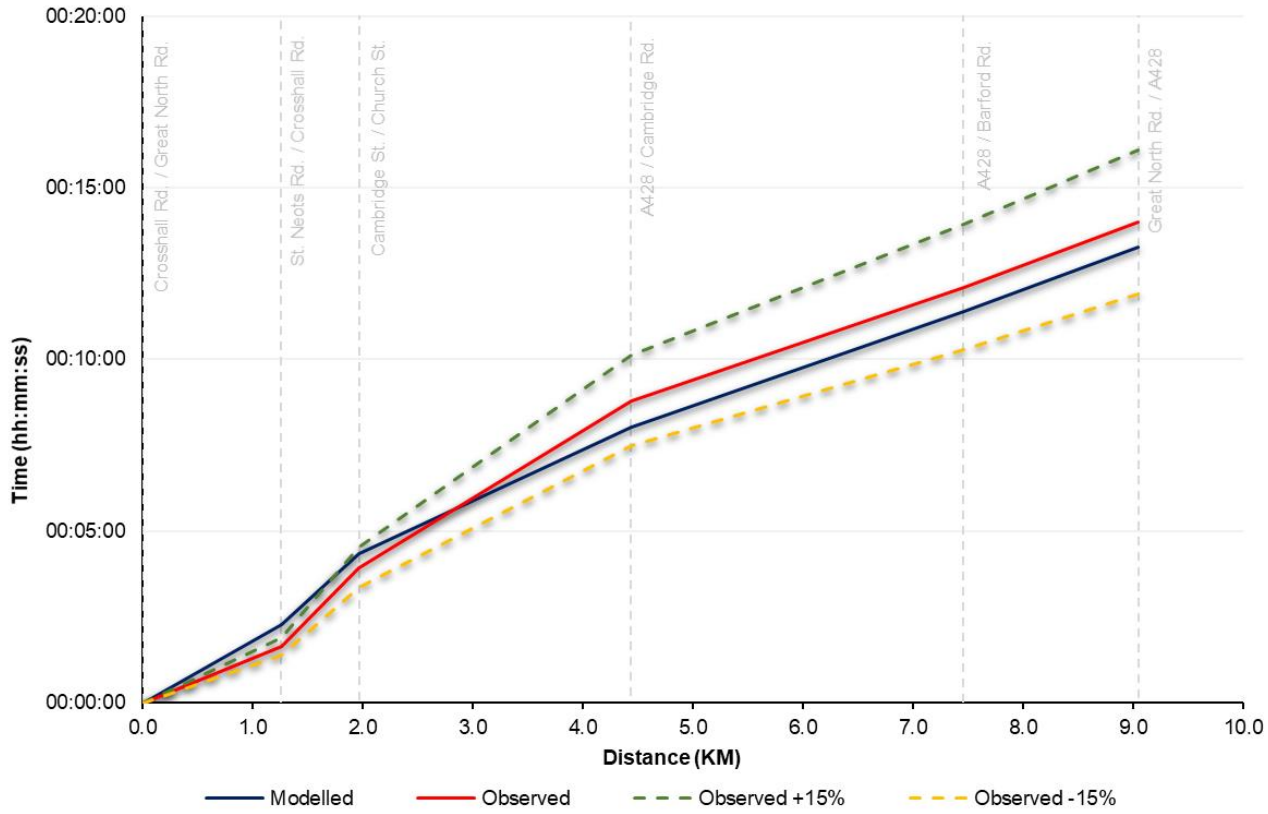
B.4.58. 2019 SN-02: A421 to A1 Little Paxton – IP



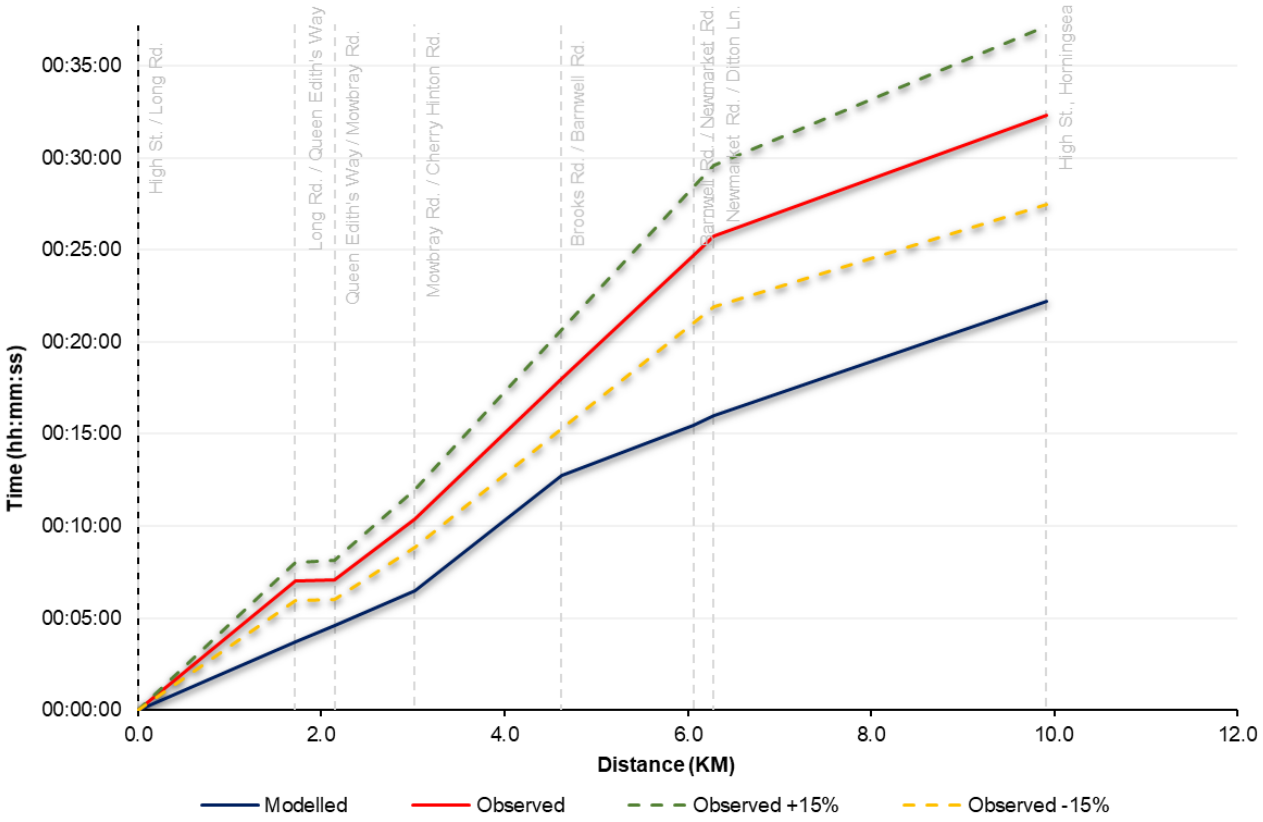
B.4.59. 2019 SN-03: A1 / B465 via Cambridge Rd. – IP



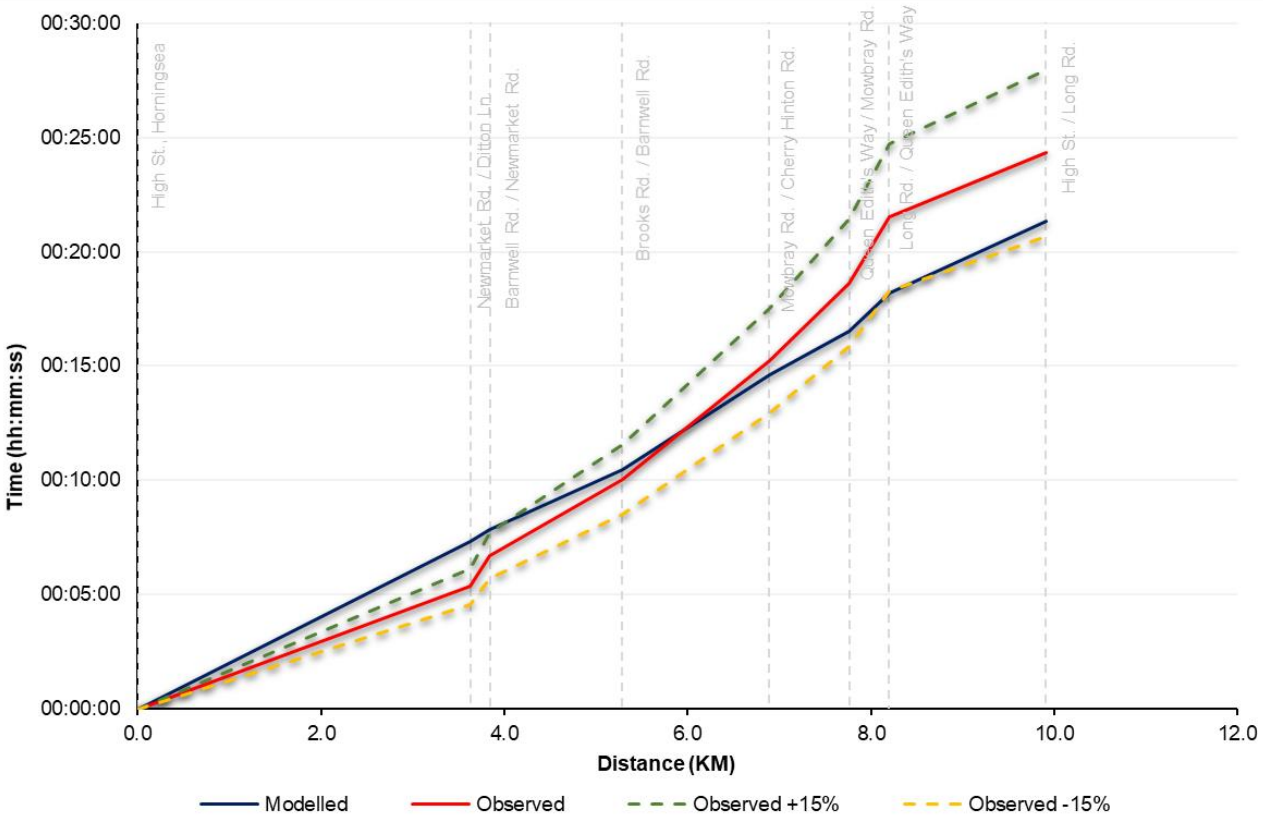
B.4.60. 2019 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – IP



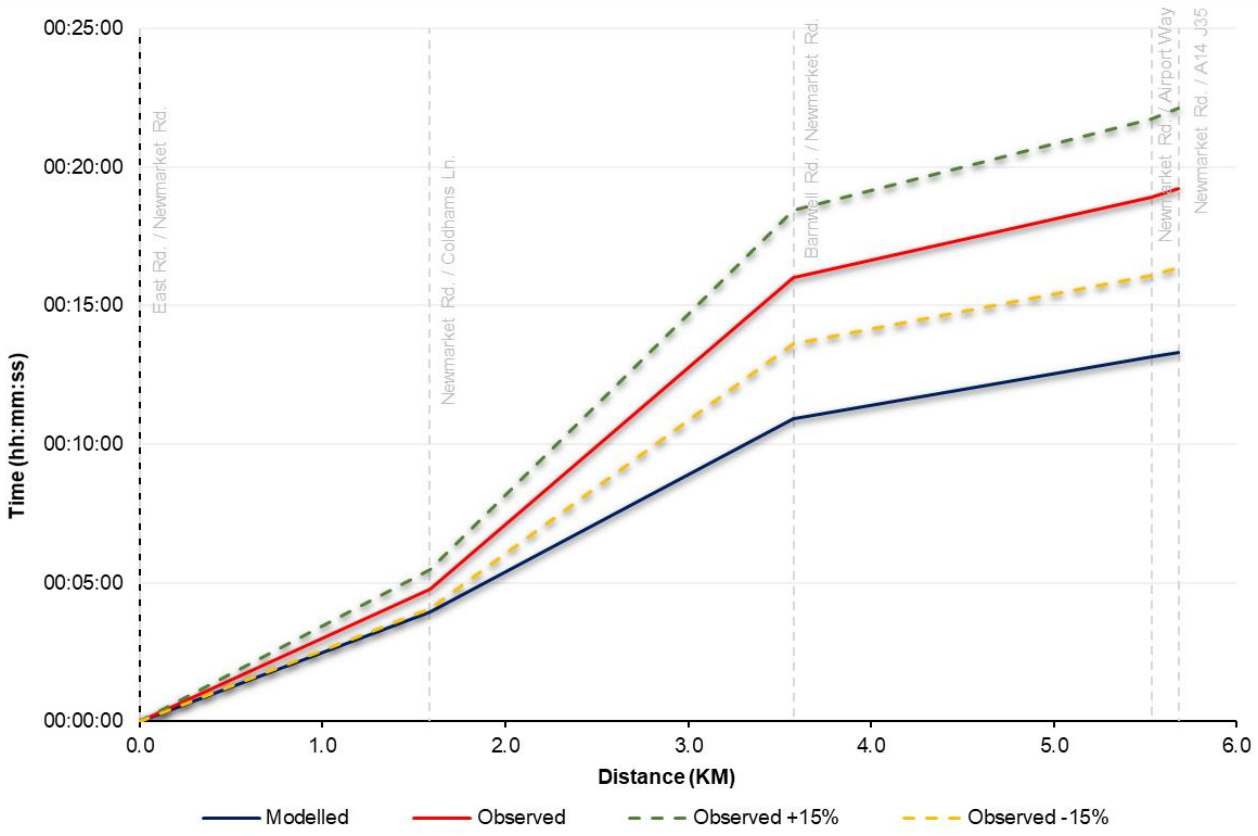
B.4.61. 2019 C-01: Trumpington Rd. to Priory Rd., Horningsea – PM



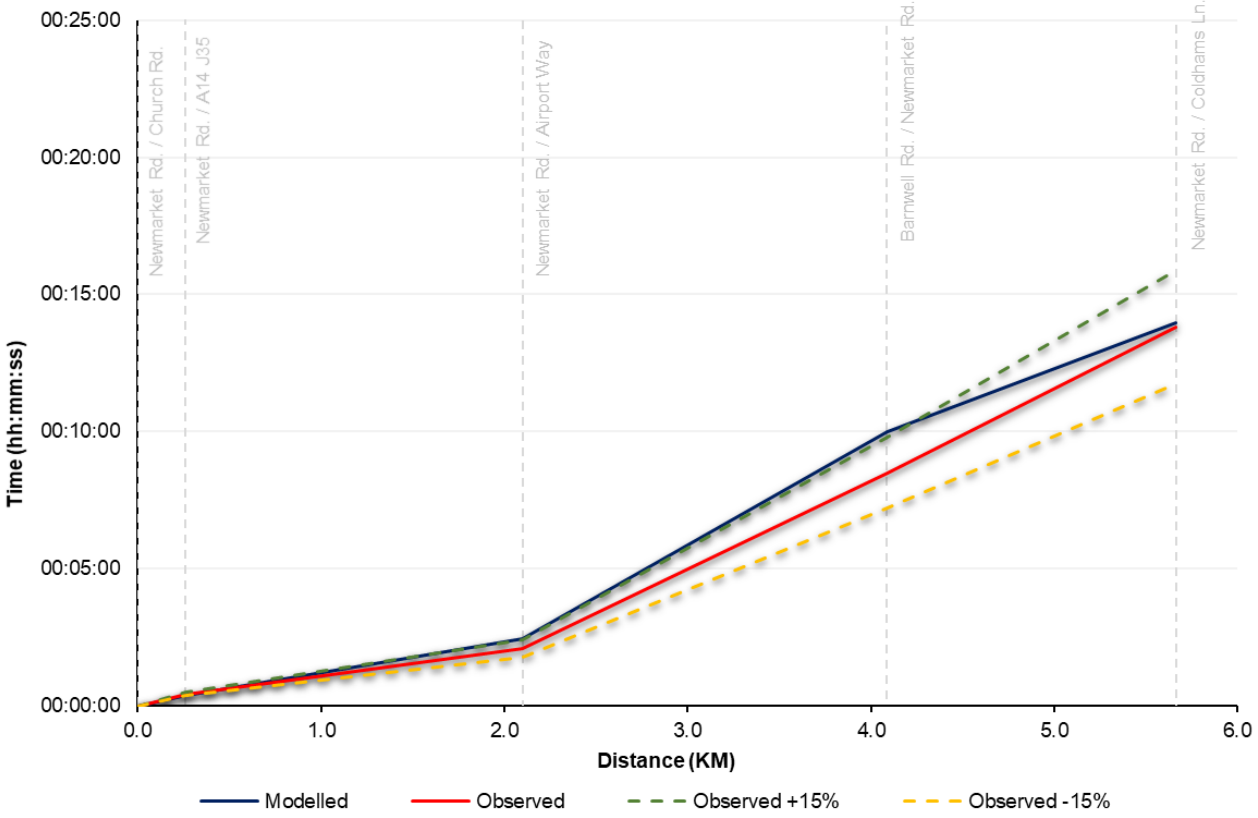
B.4.62. 2019 C-02: Priory Rd., Horningsea to Trumpington Rd. – PM



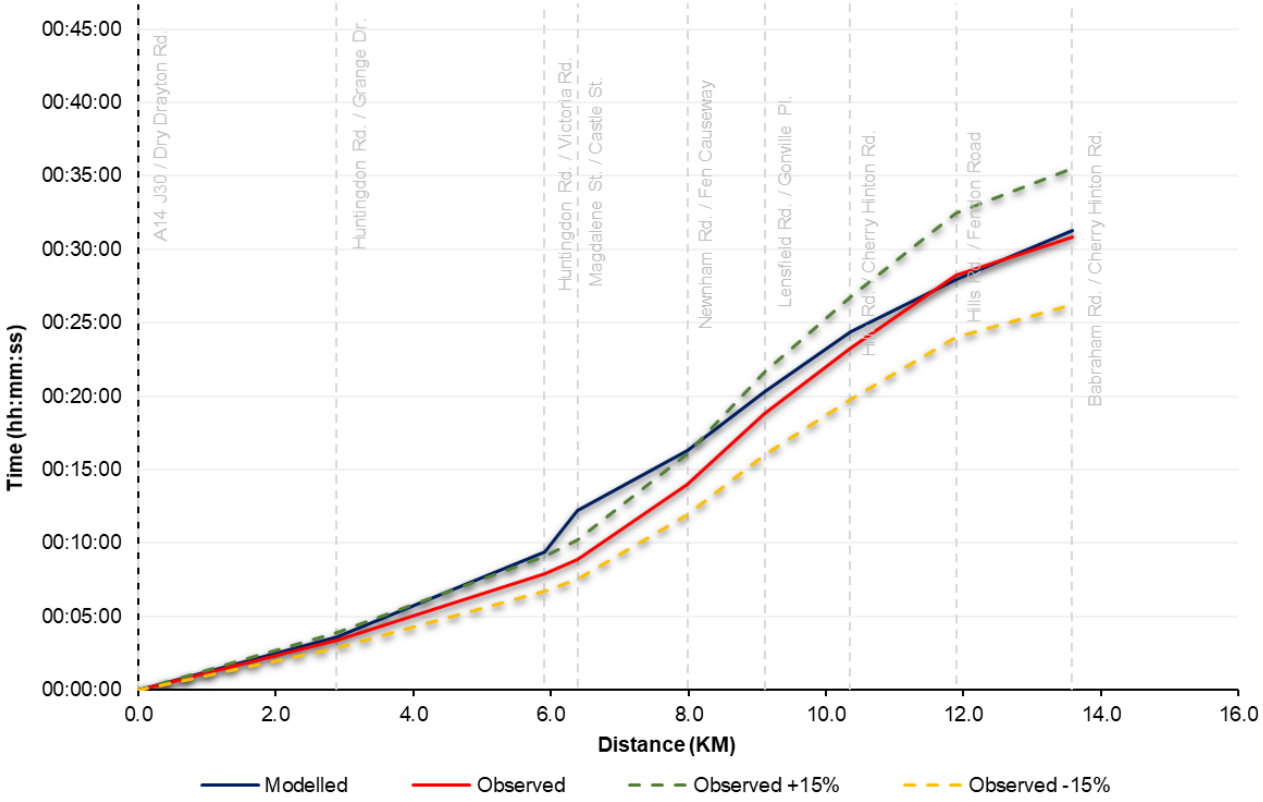
B.4.63. 2019 C-03: Barnwell Rd. / Wadloes Rbt. to High Ditch Rd. – PM



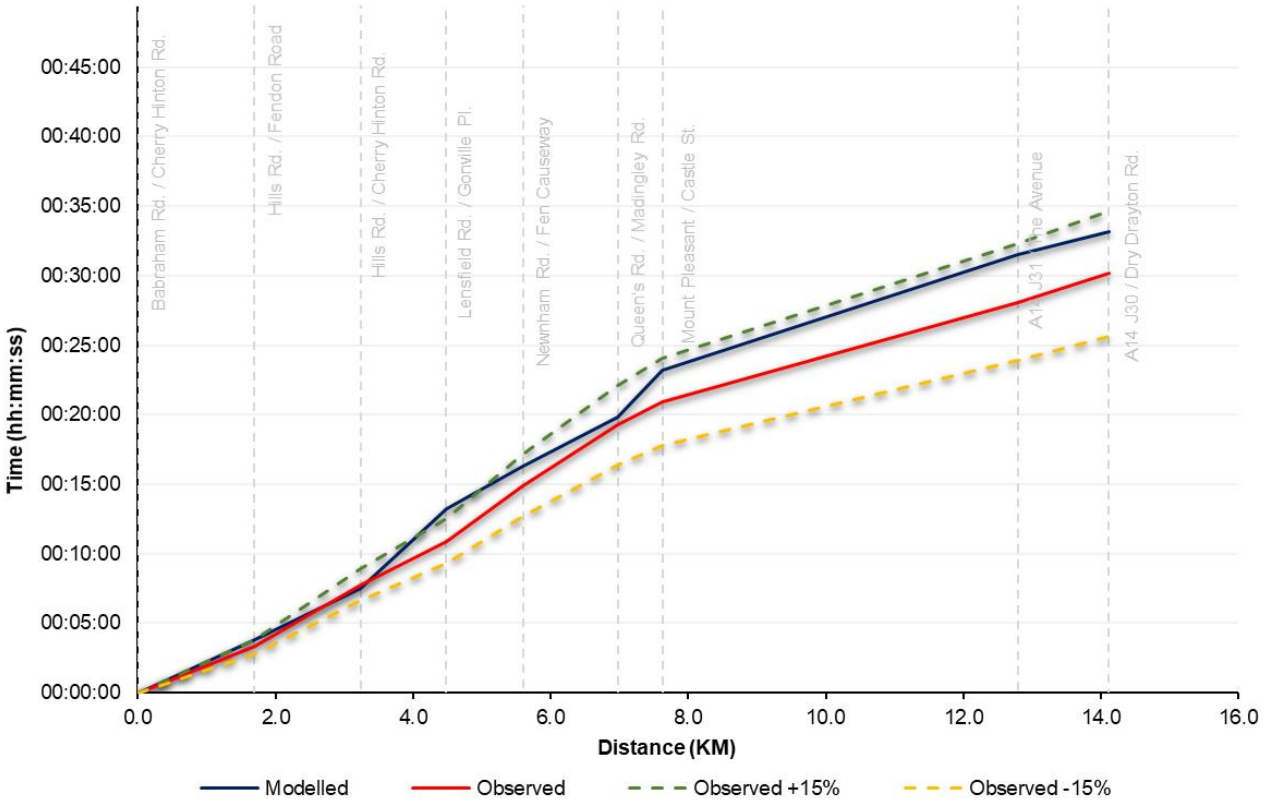
B.4.64. 2019 C-04: High Ditch Rd. to Barnwell Rd. / Wadloes Rbt. – PM



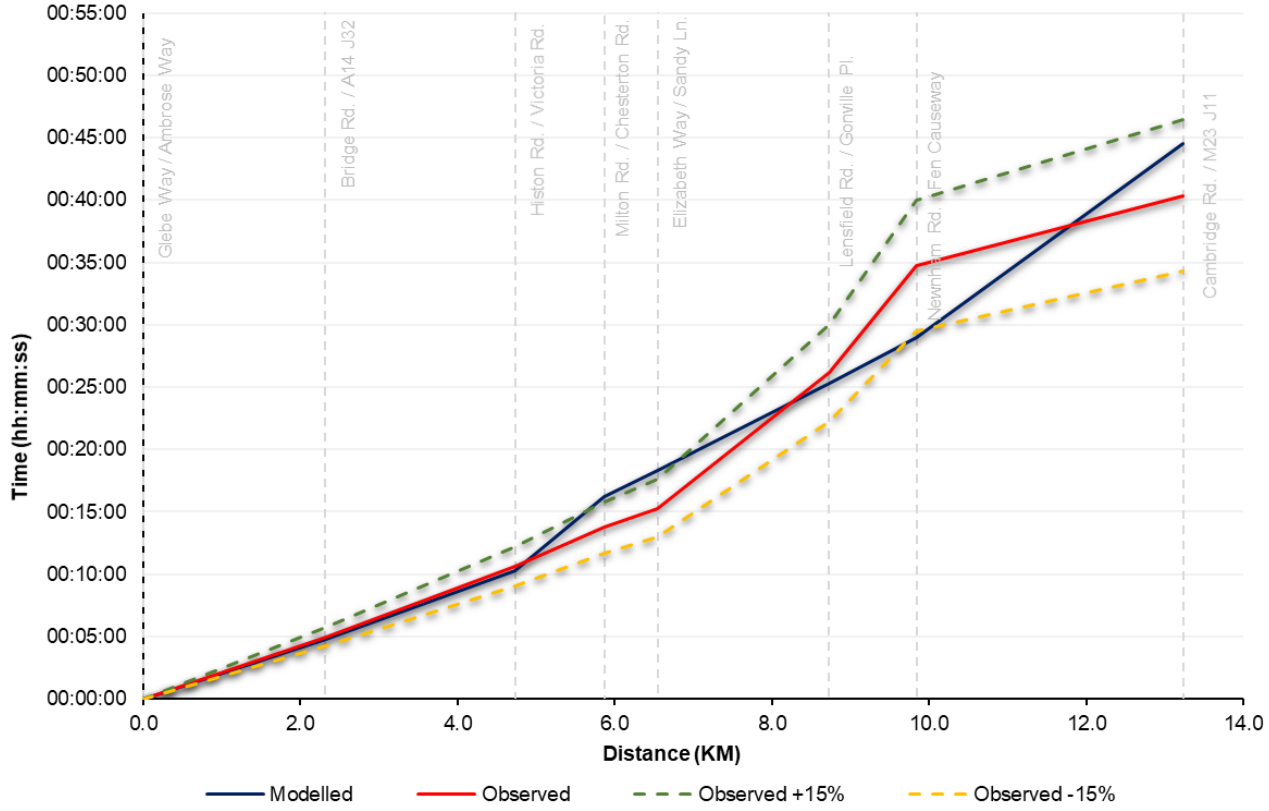
B.4.65. 2019 C-05: Oakington Rd. to Fendon Rd. – PM



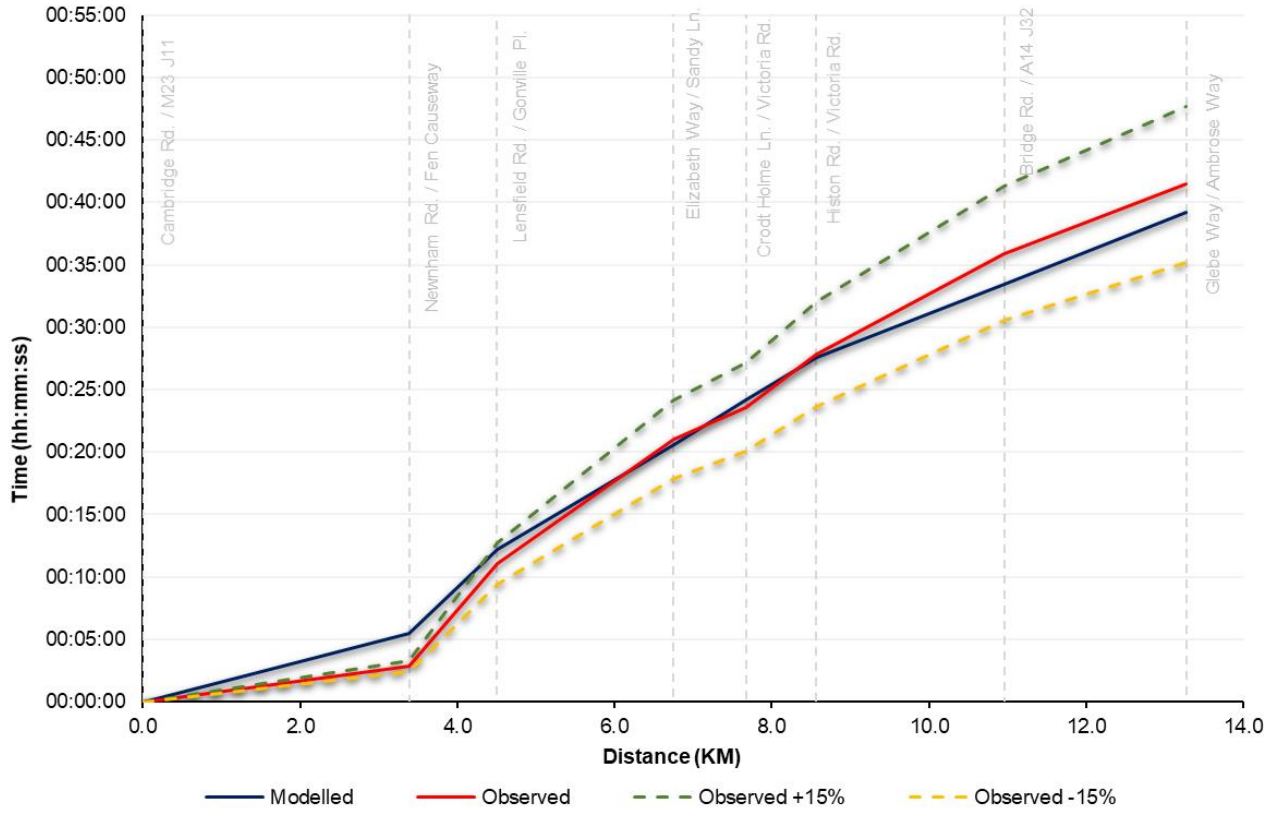
B.4.66. 2019 C-06: Fendon Rd. to Oakington Rd. – PM



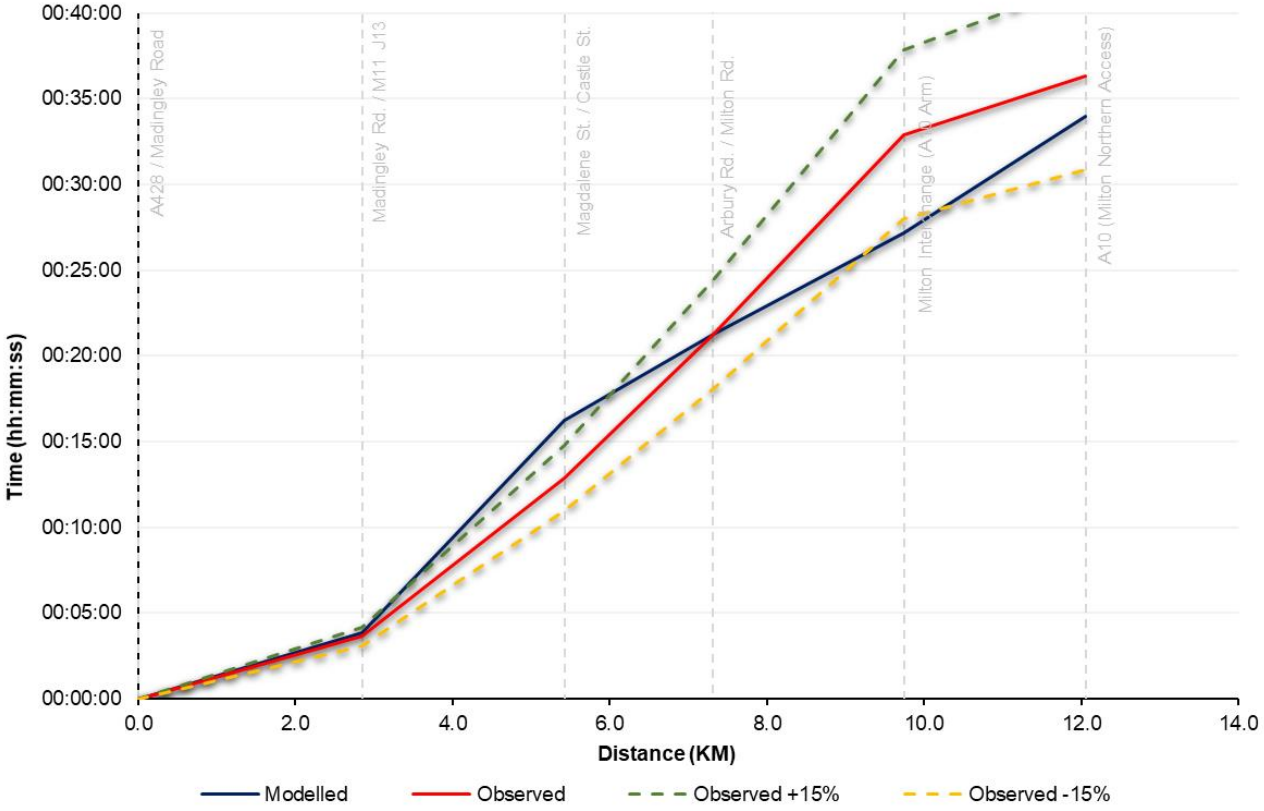
B.4.67. 2019 C-07: Impington Ln. to M11 – PM



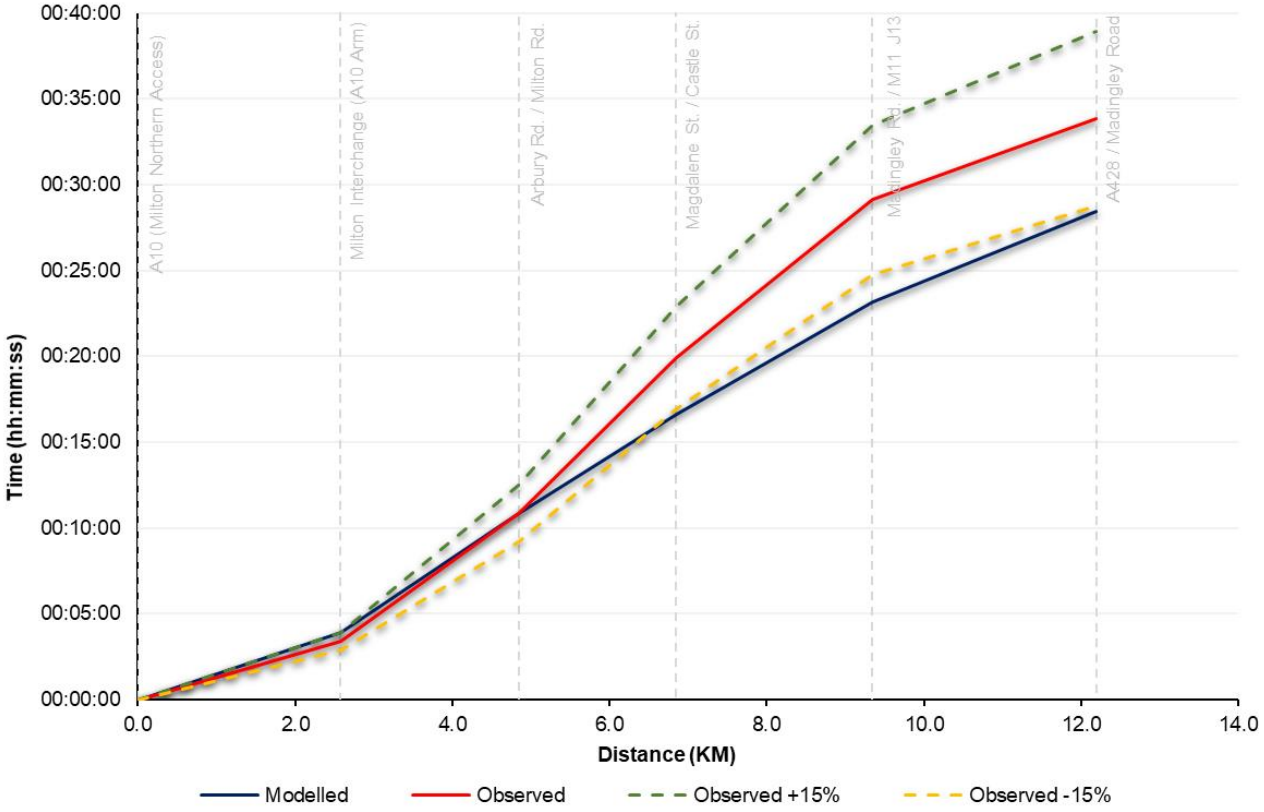
B.4.68. 2019 C-08: M11 to Impington Ln. – PM



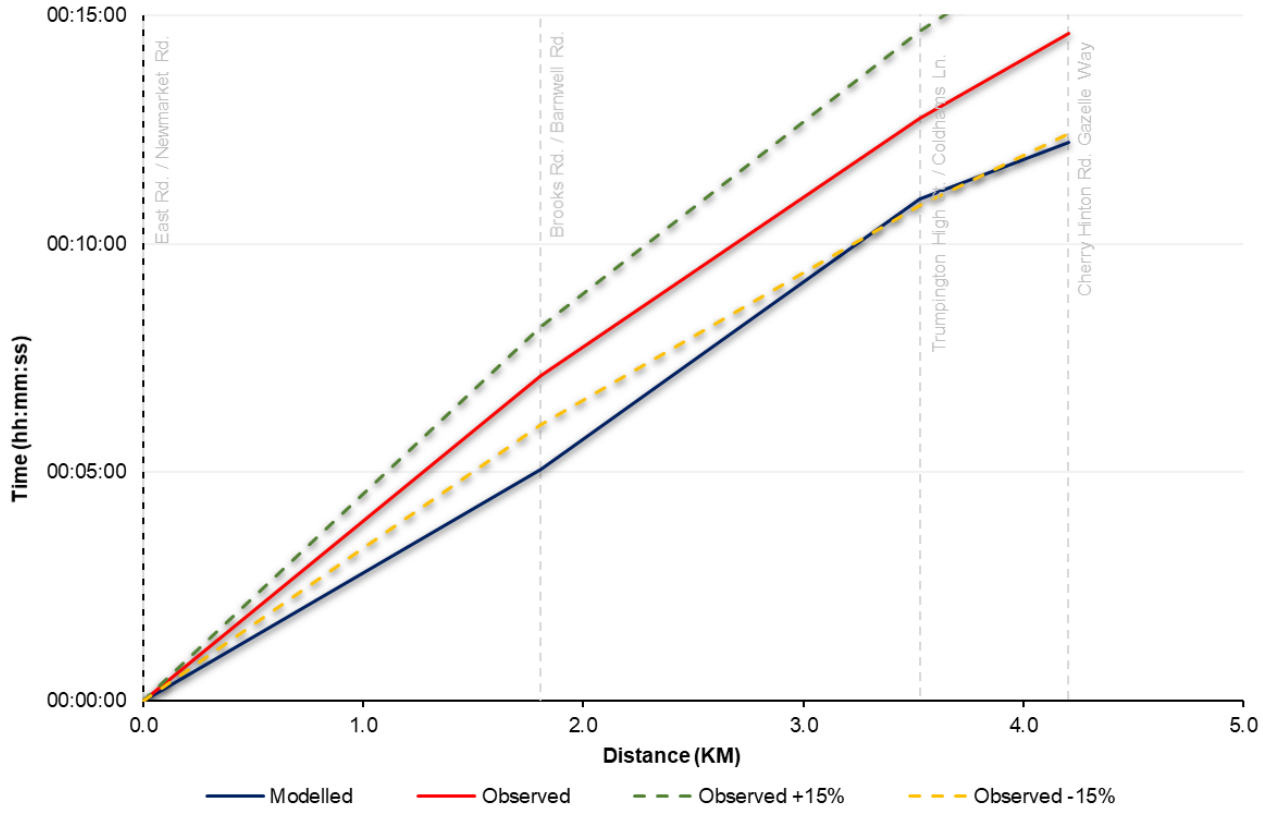
B.4.69. 2019 C-09: A428 Rbt. to Milton – PM



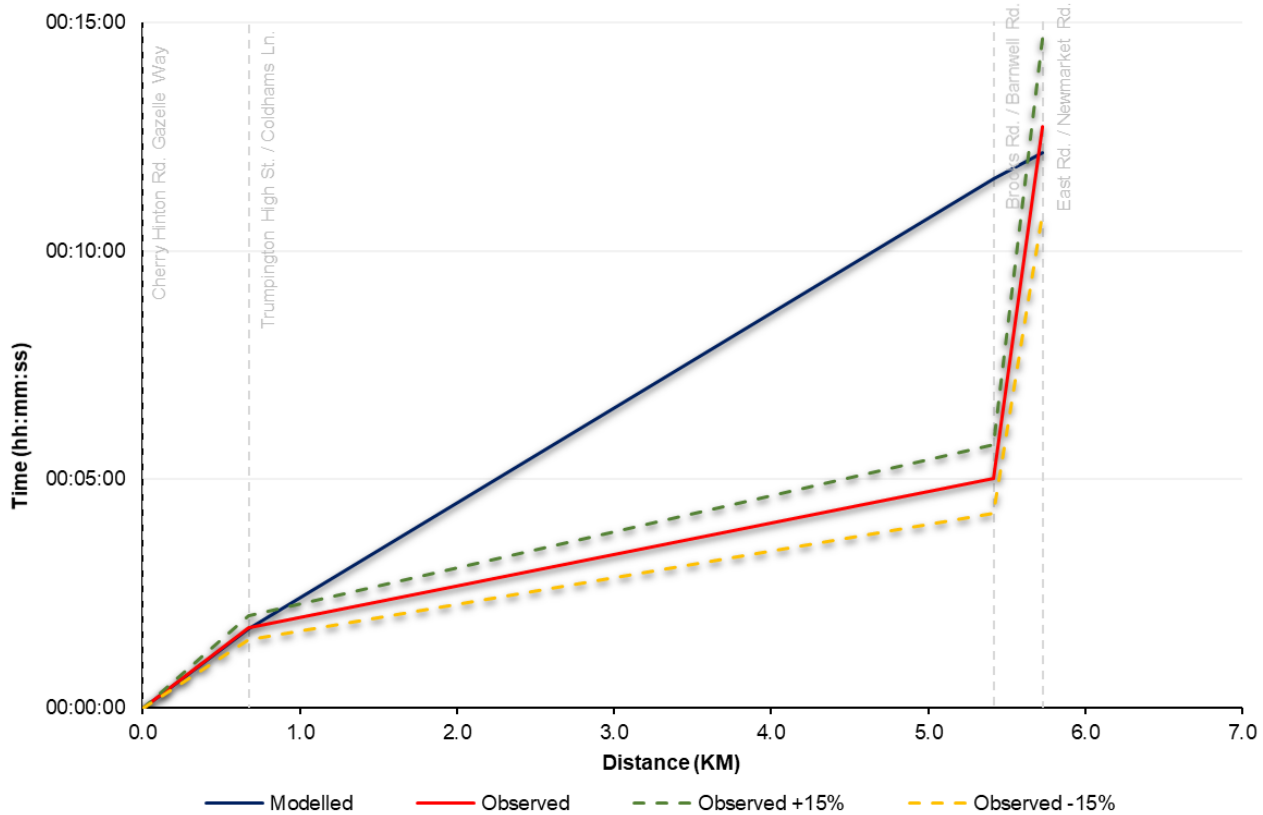
B.4.70. 2019 C-10: Milton to A428 Rbt. – PM



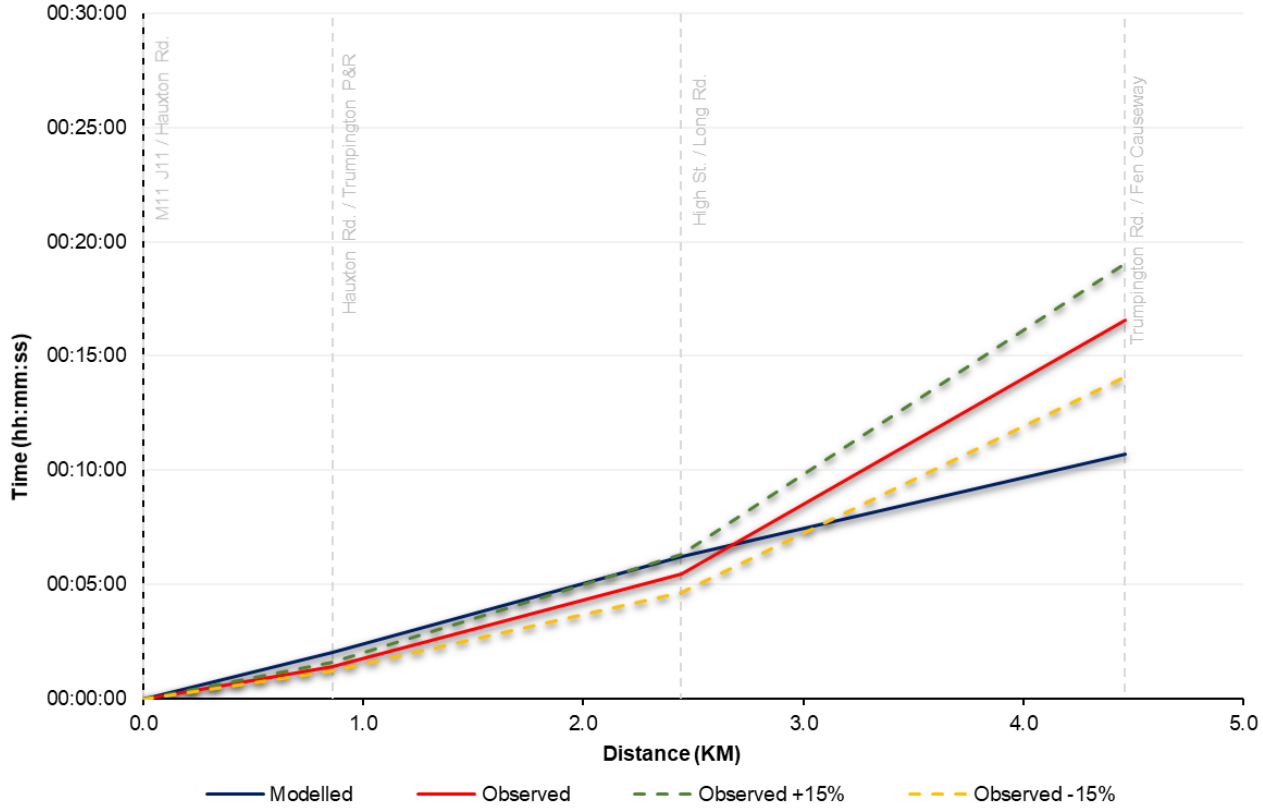
B.4.71. 2019 C-11: Elizabeth Way to Teversham Drift – PM



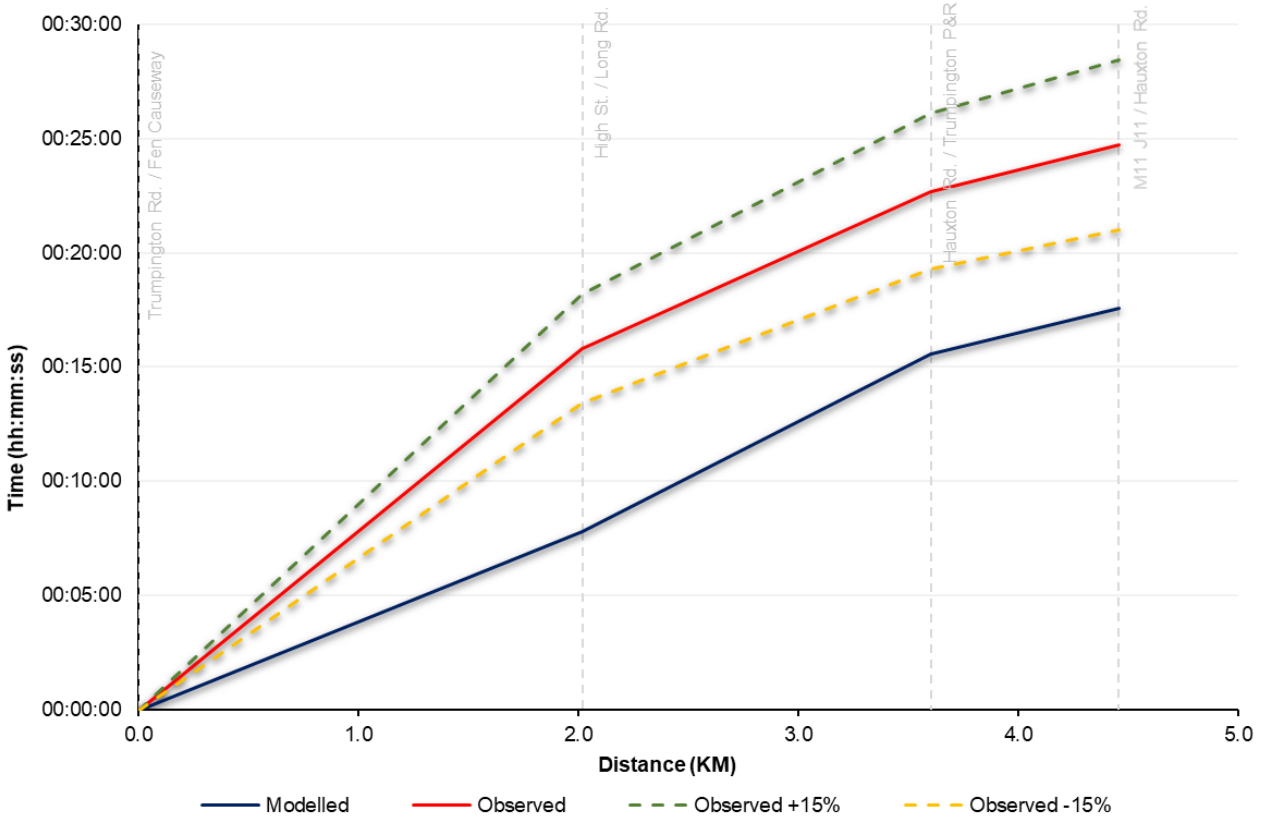
B.4.72. 2019 C-12: Teversham Drift to Elizabeth Way – PM



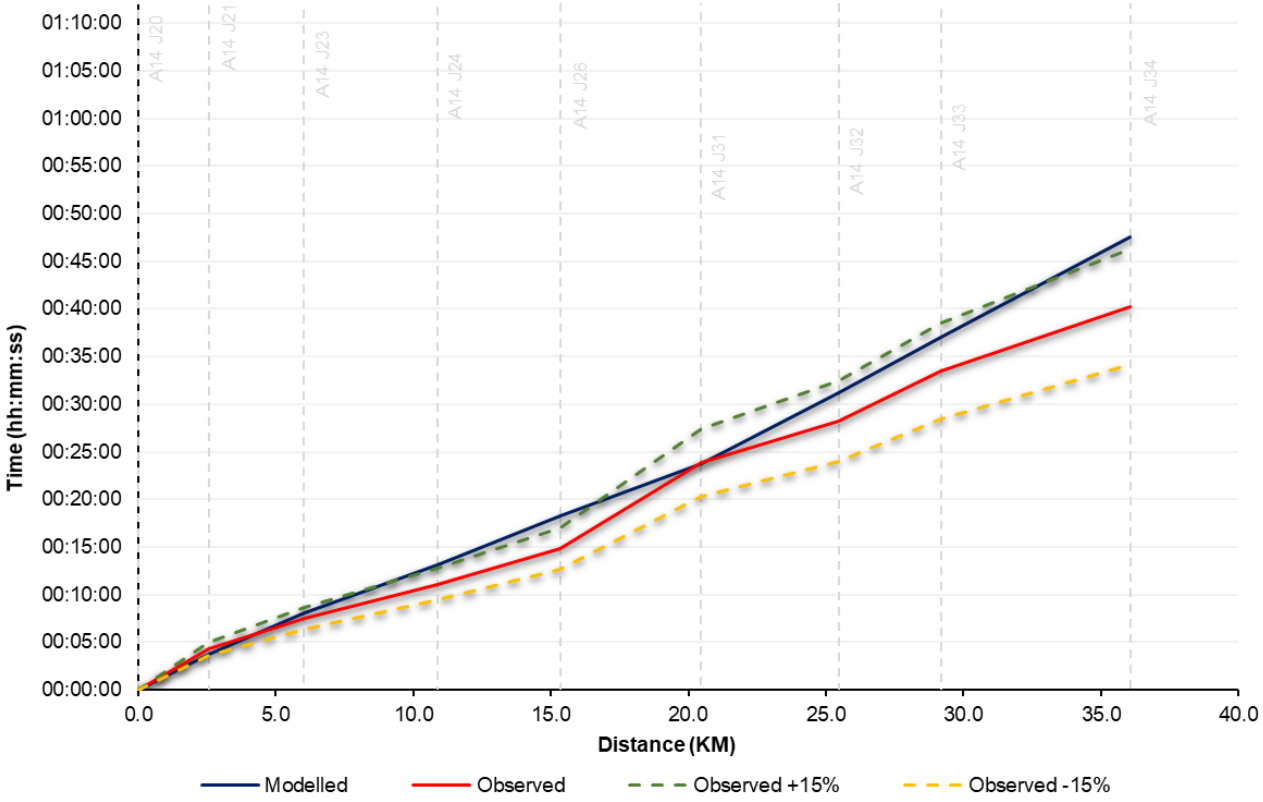
B.4.73. 2019 C-13: Hauxton Rd. (M11) to Lensfield Rd. – PM



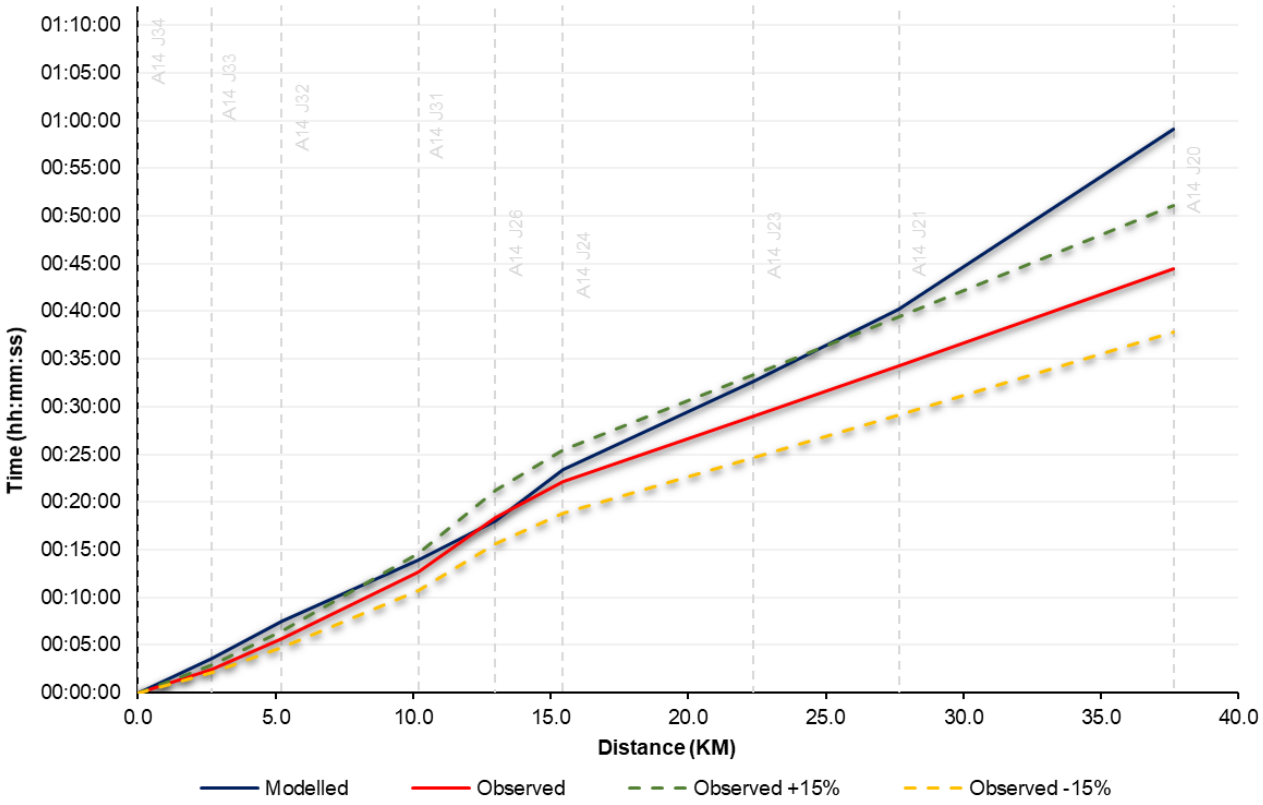
B.4.74. 2019 C-14: Lensfield Rd. to Hauxton Rd. (M11) – PM



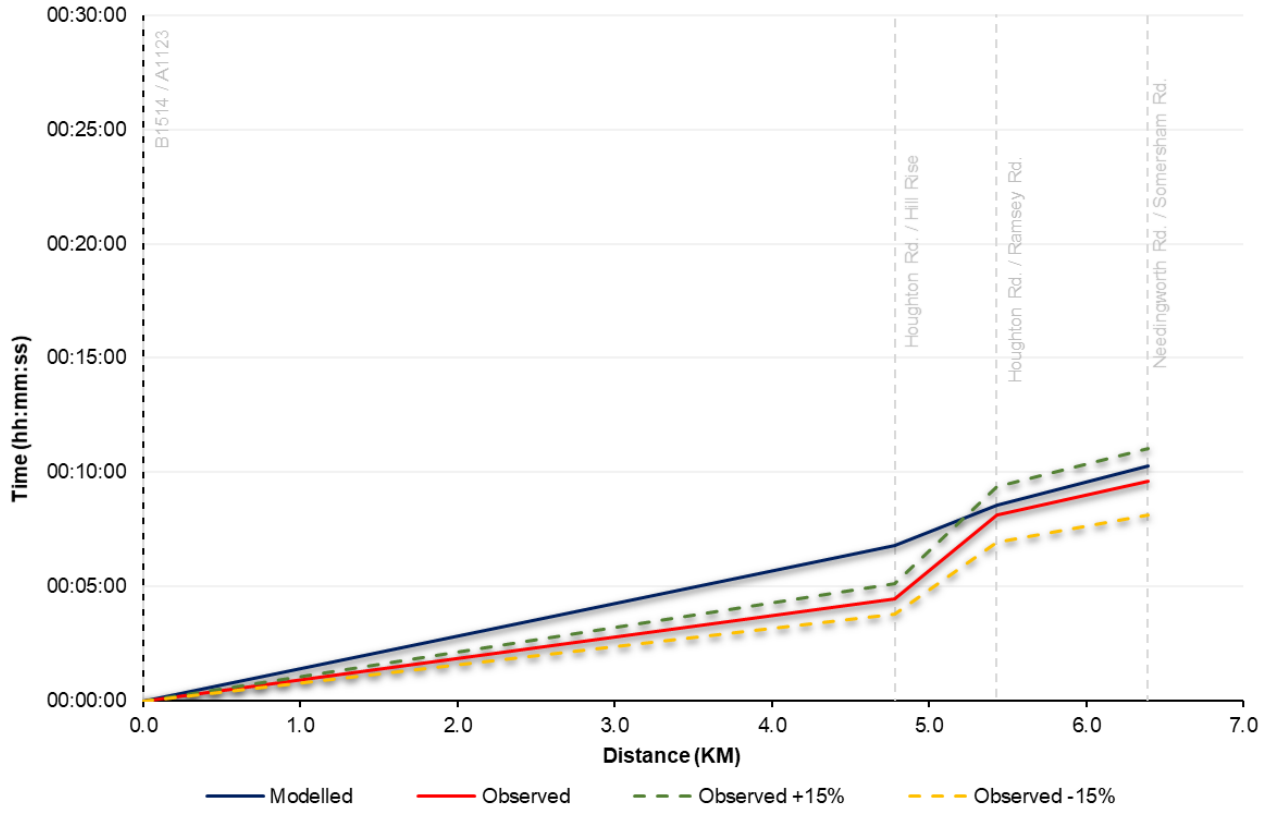
B.4.75. 2019 A14-01: Ellington to Horningsea Rd. – PM



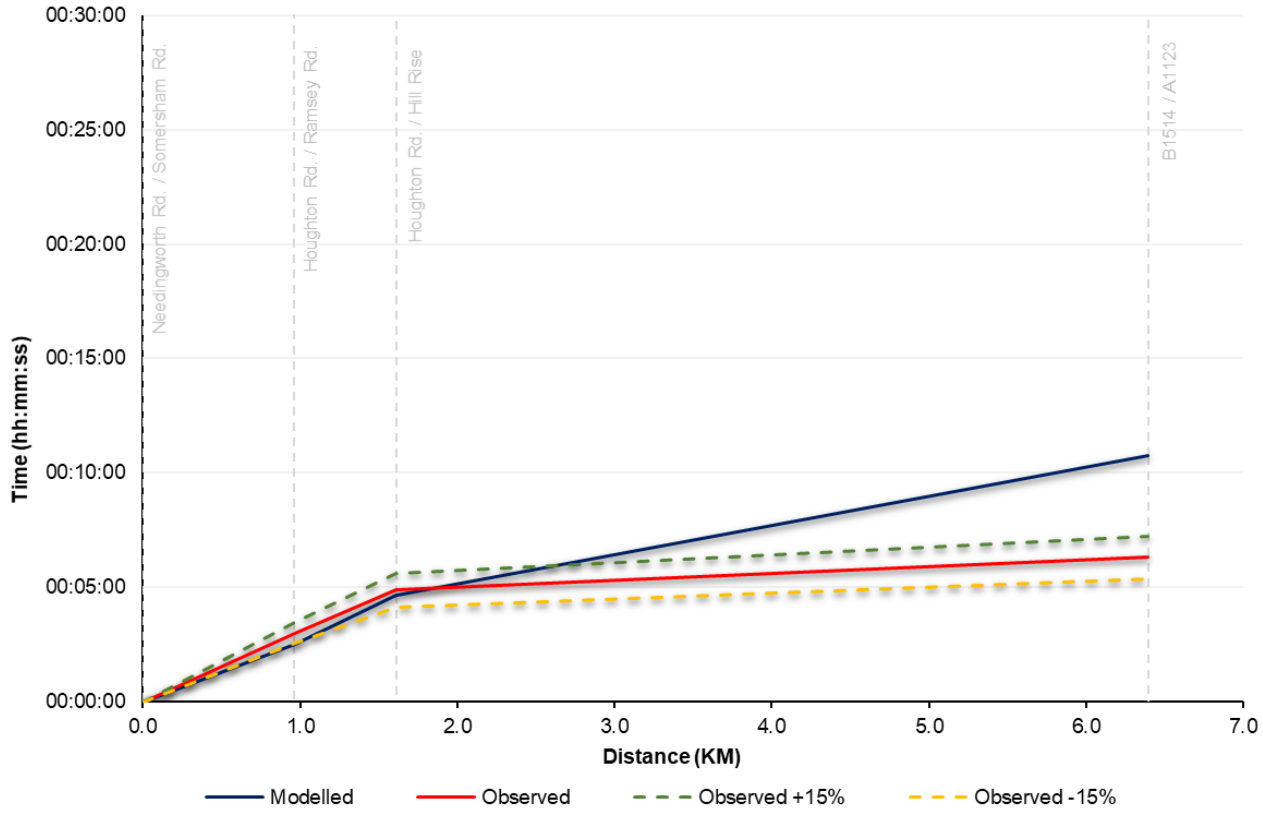
B.4.76. 2019 A14-02: Horningsea Rd. to Ellington – PM



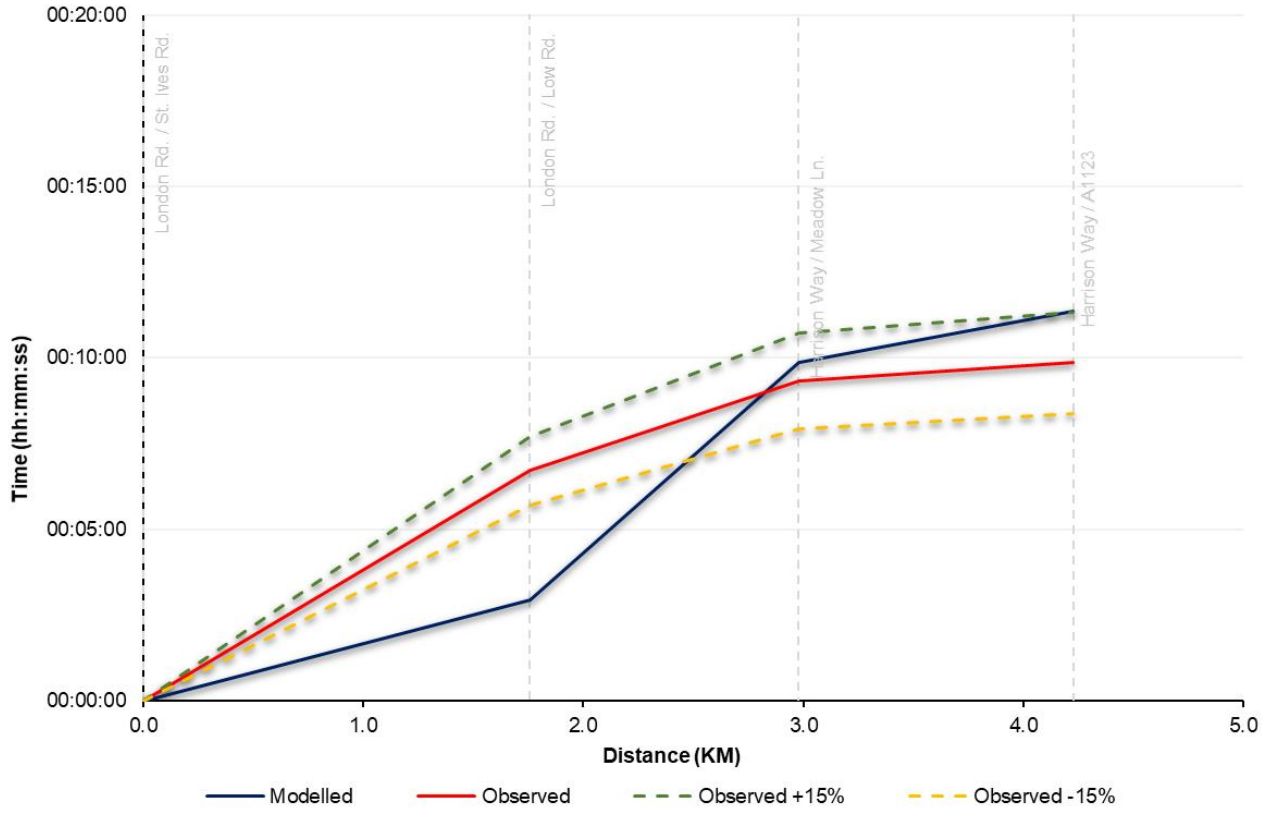
B.4.77. 2019 SI-01: A141 / B1514 Rbt. to A1123 / B1040 Rbt. – PM



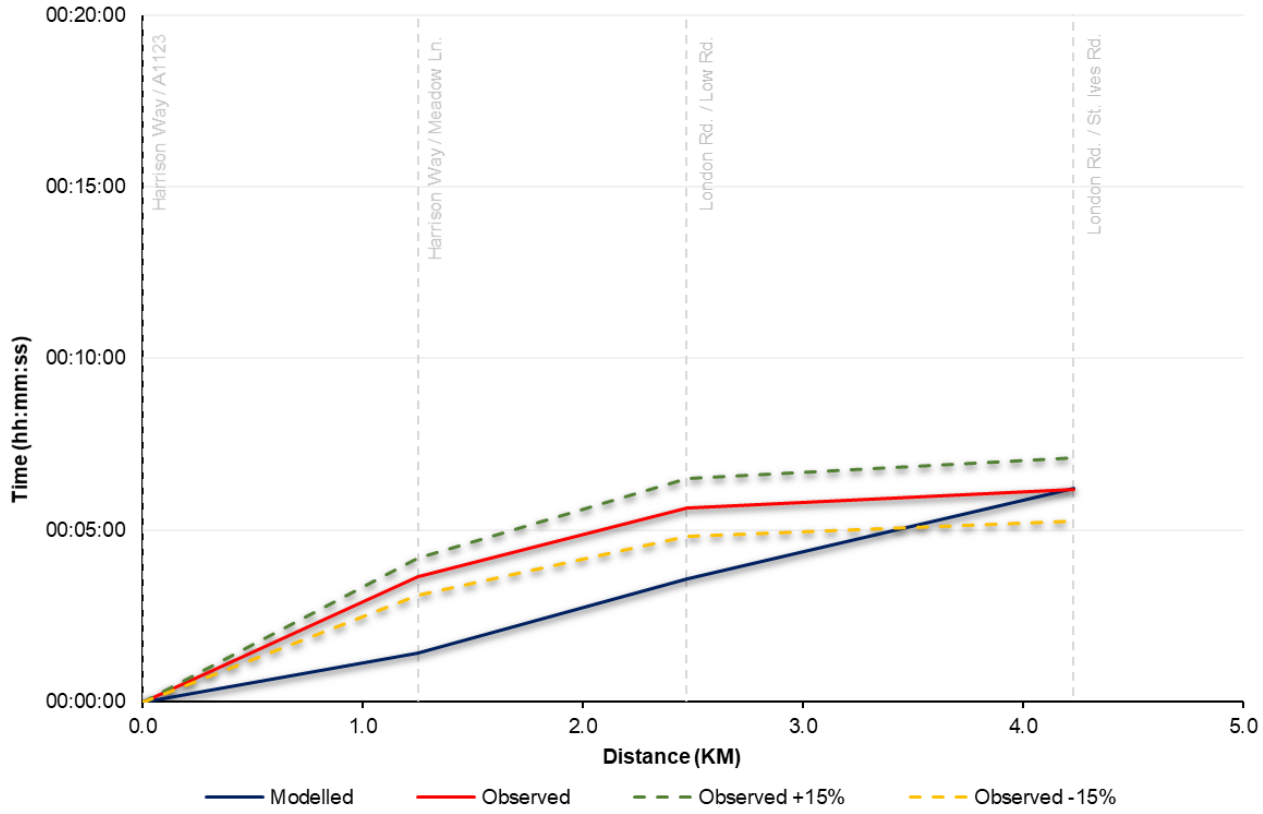
B.4.78. 2019 SI-02: A1123 / B1040 Rbt. to A141 / B1514 Rbt. – PM



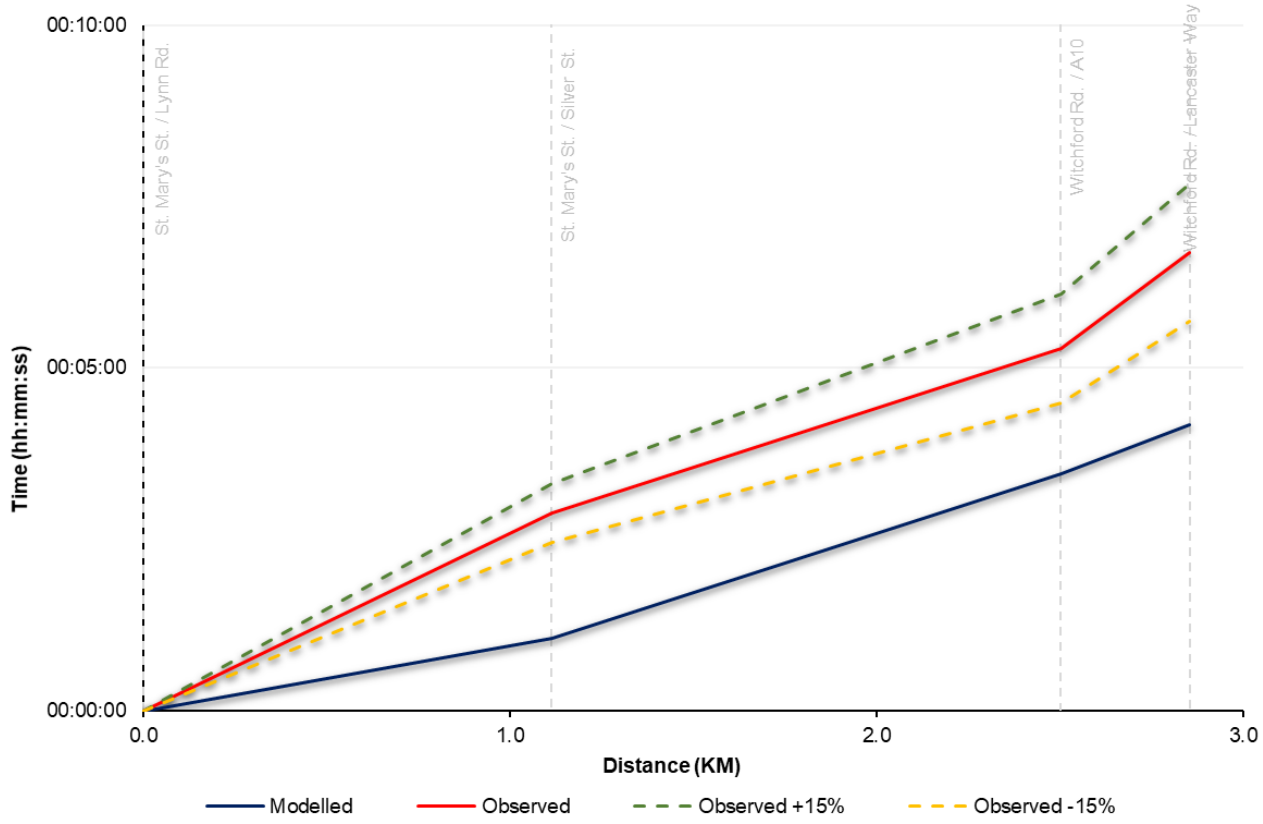
B.4.79. 2019 SI-03: A14 / A1096 to A1123 – PM



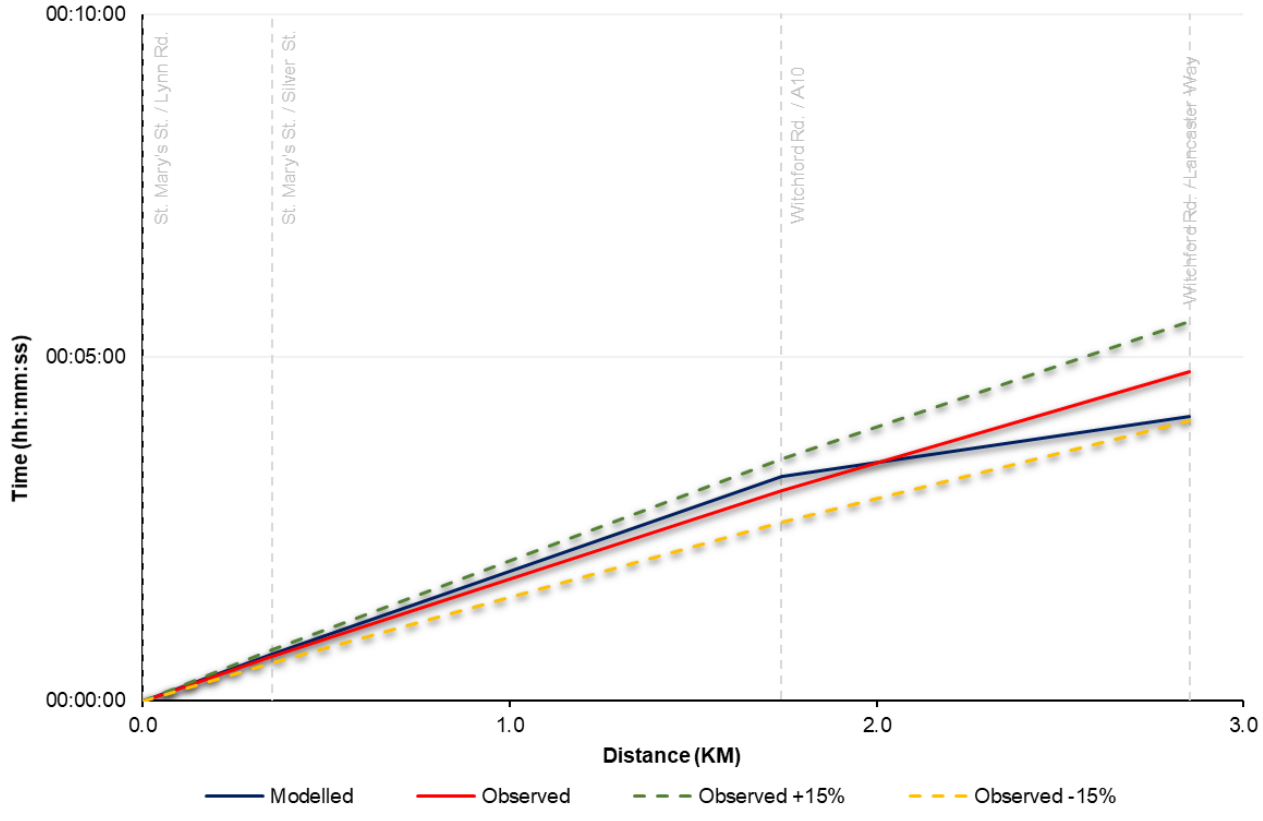
B.4.80. 2019 SI-04: A1123 to A14 / A1096 – PM



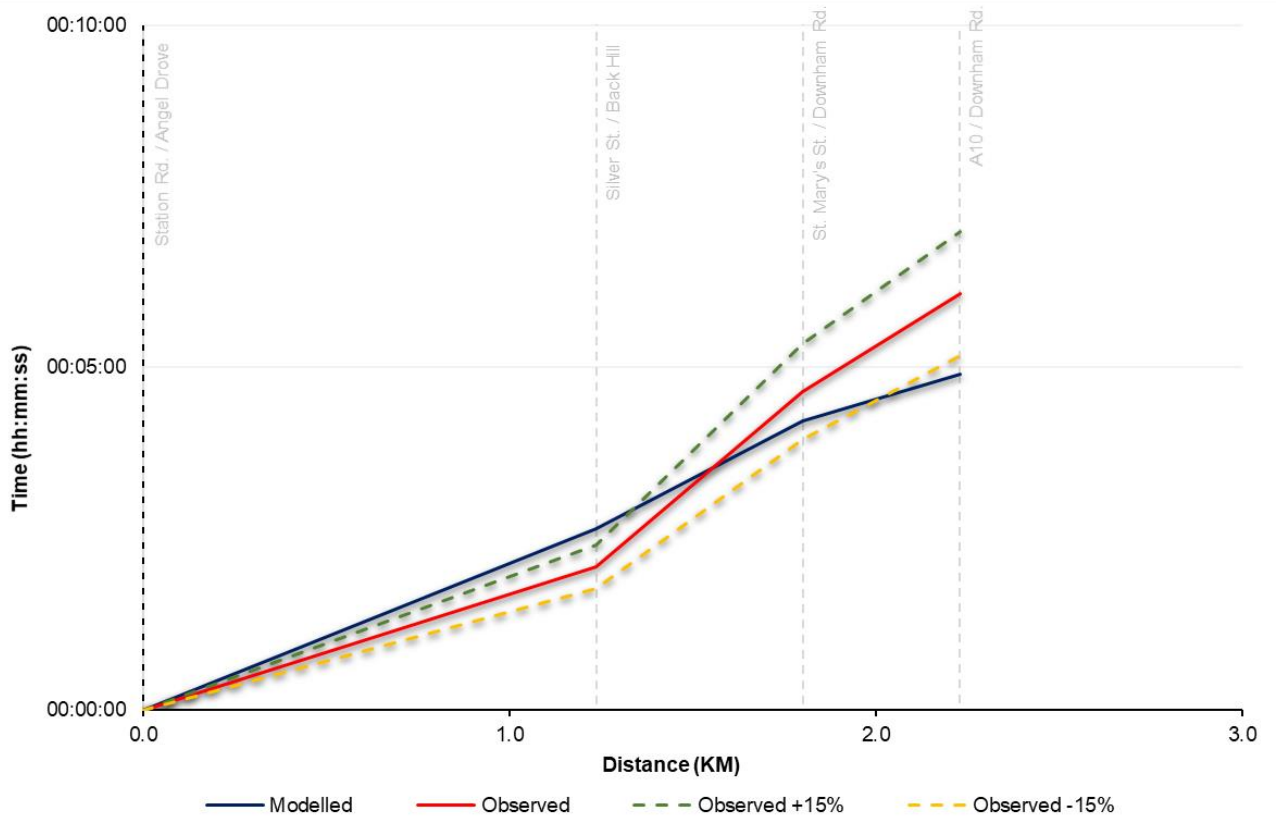
B.4.81. 2019 E-01: A142 / Witchford Rd. Rbt. to St Mary's St. / Lynn Rd. – PM



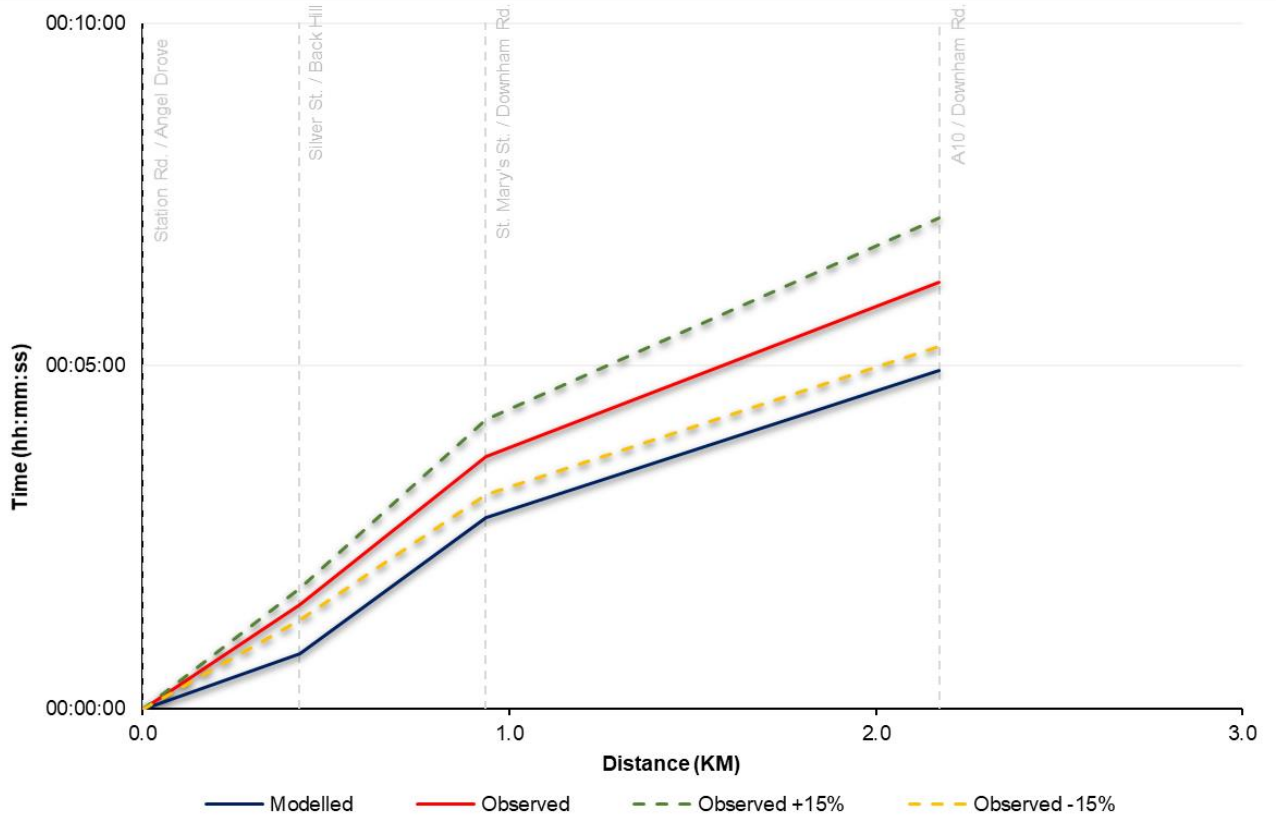
B.4.82. 2019 E-02: St Mary's St. / Lynn Rd. to A142 / Witchford Rd. – PM



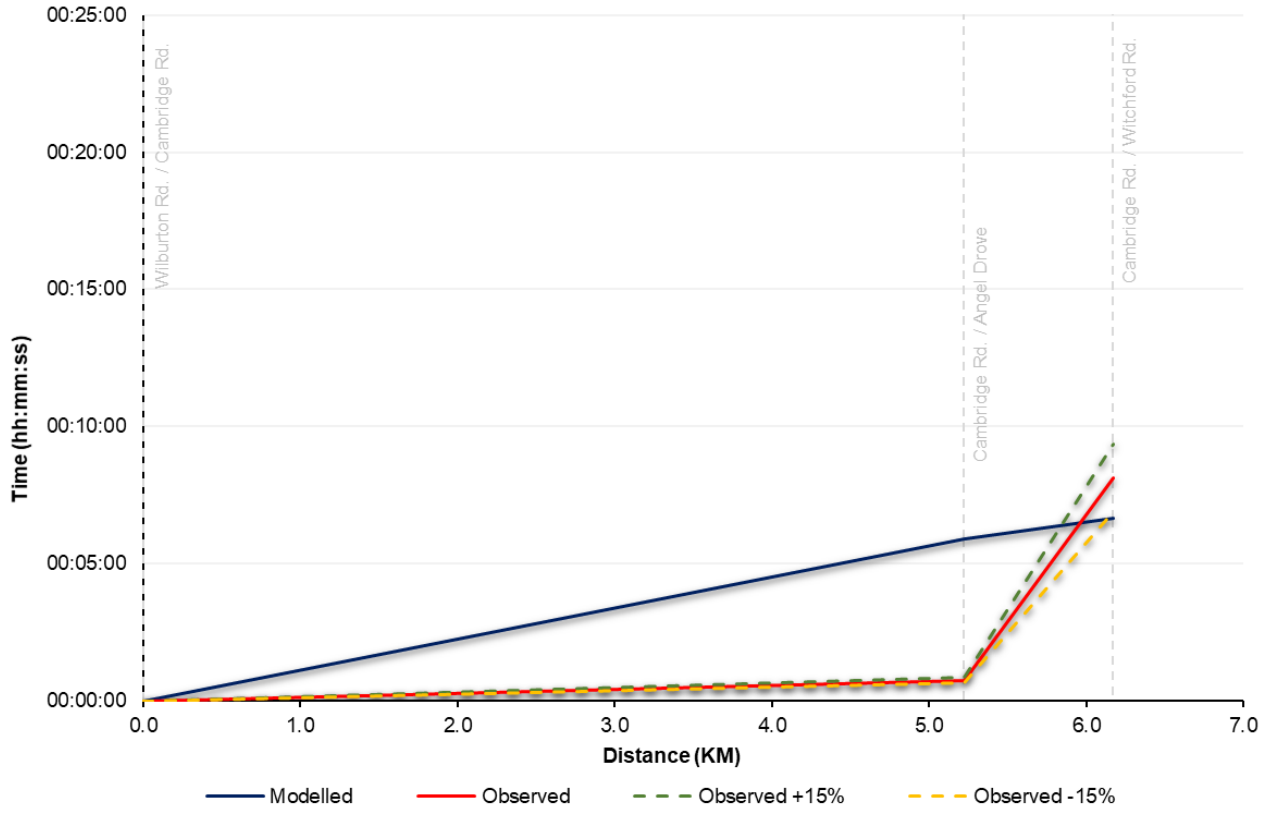
B.4.83. 2019 E-03: A10 / B1411 Rbt. to A142 / Station Rd. Rbt. – PM



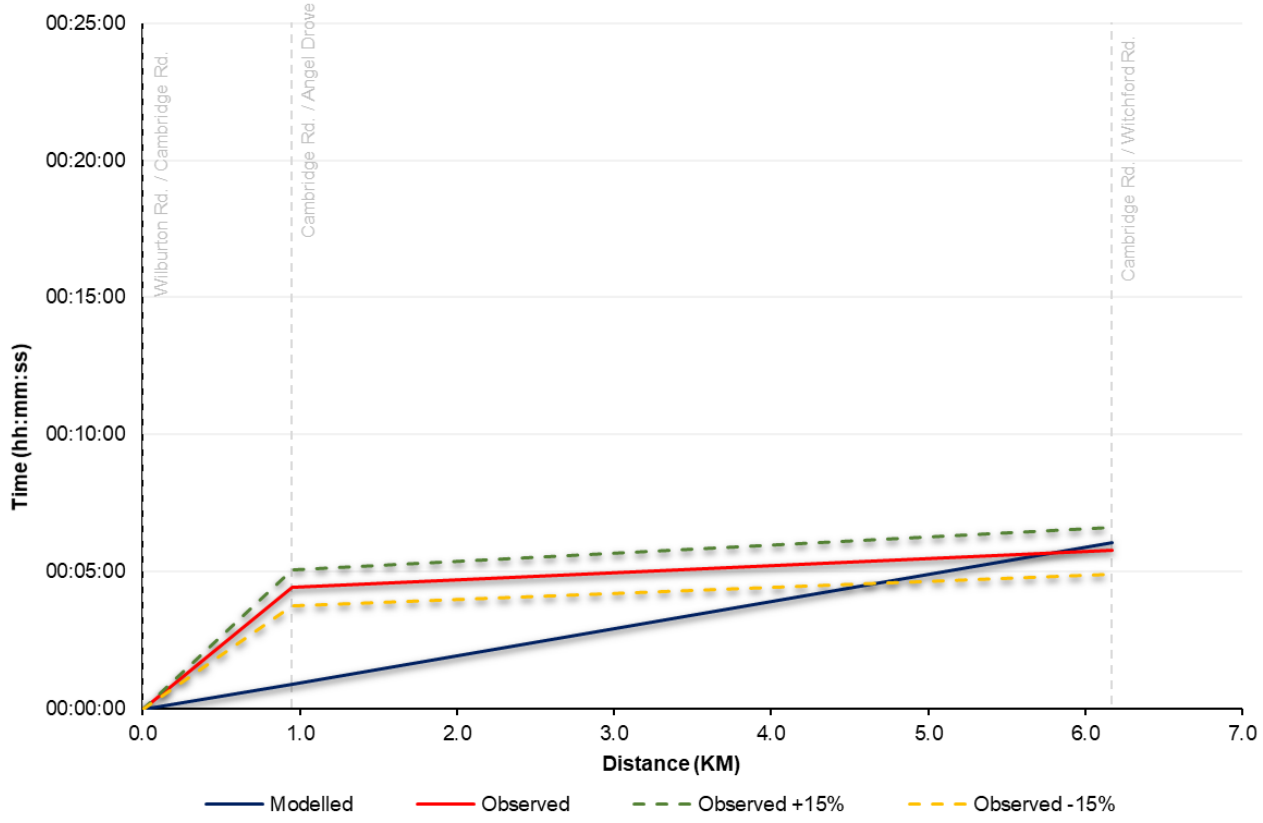
B.4.84. 2019 E-04: A142 / Station Rd. Rbt. to A10 / B1411 Rbt. – PM



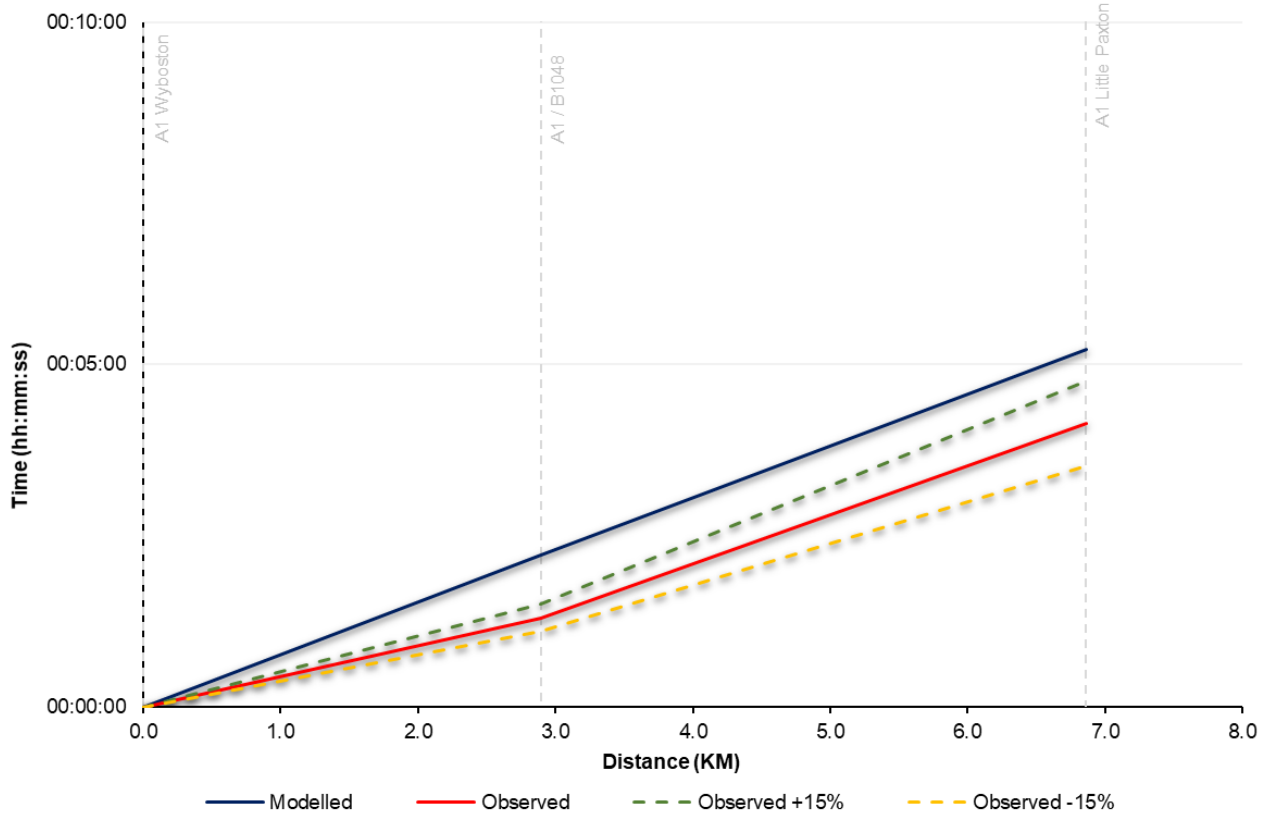
B.4.85. 2019 E-05: A10 / Wilburton Rd. Rbt. to Cambridge Rd. / Witchford Rd. – PM



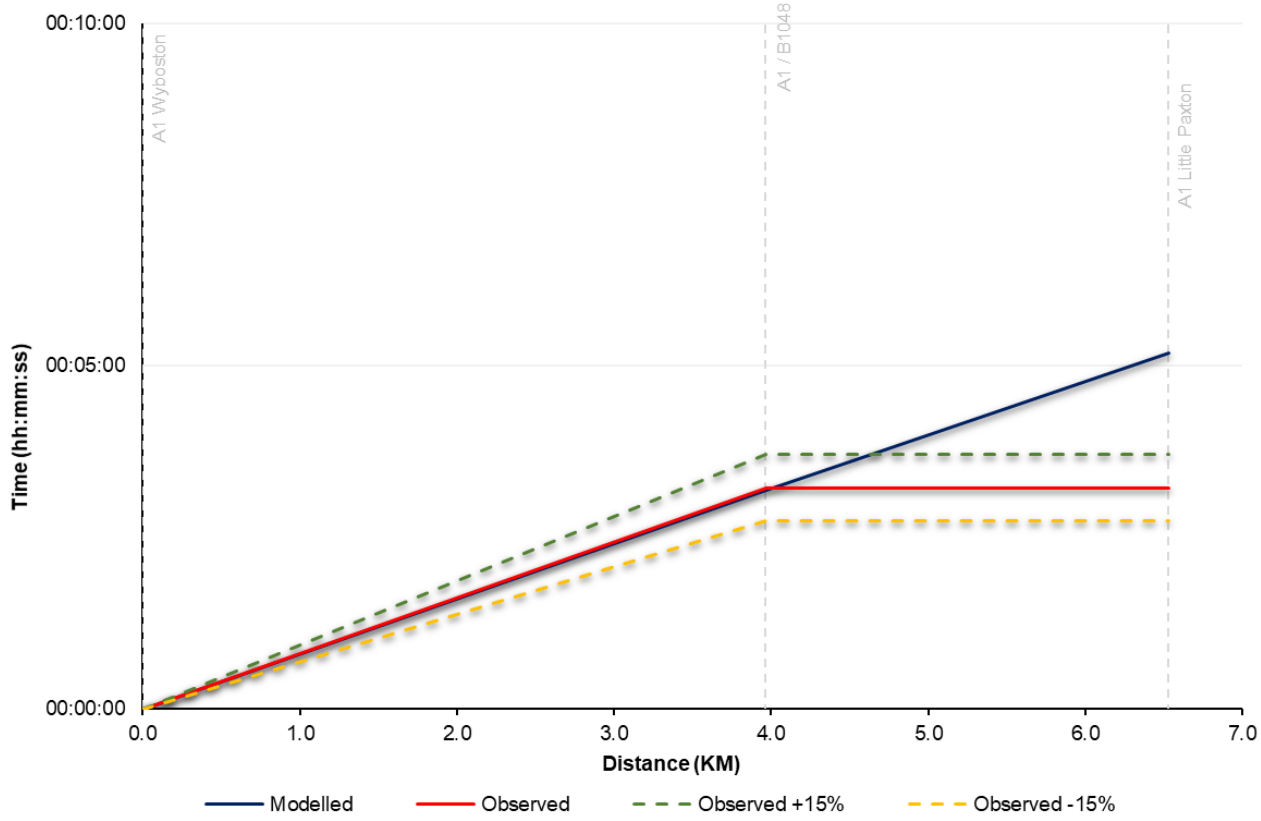
B.4.86. 2019 E-06: Cambridge Rd. / Witchford Rd. to A10 / Wilburton Rd. Rbt. – PM



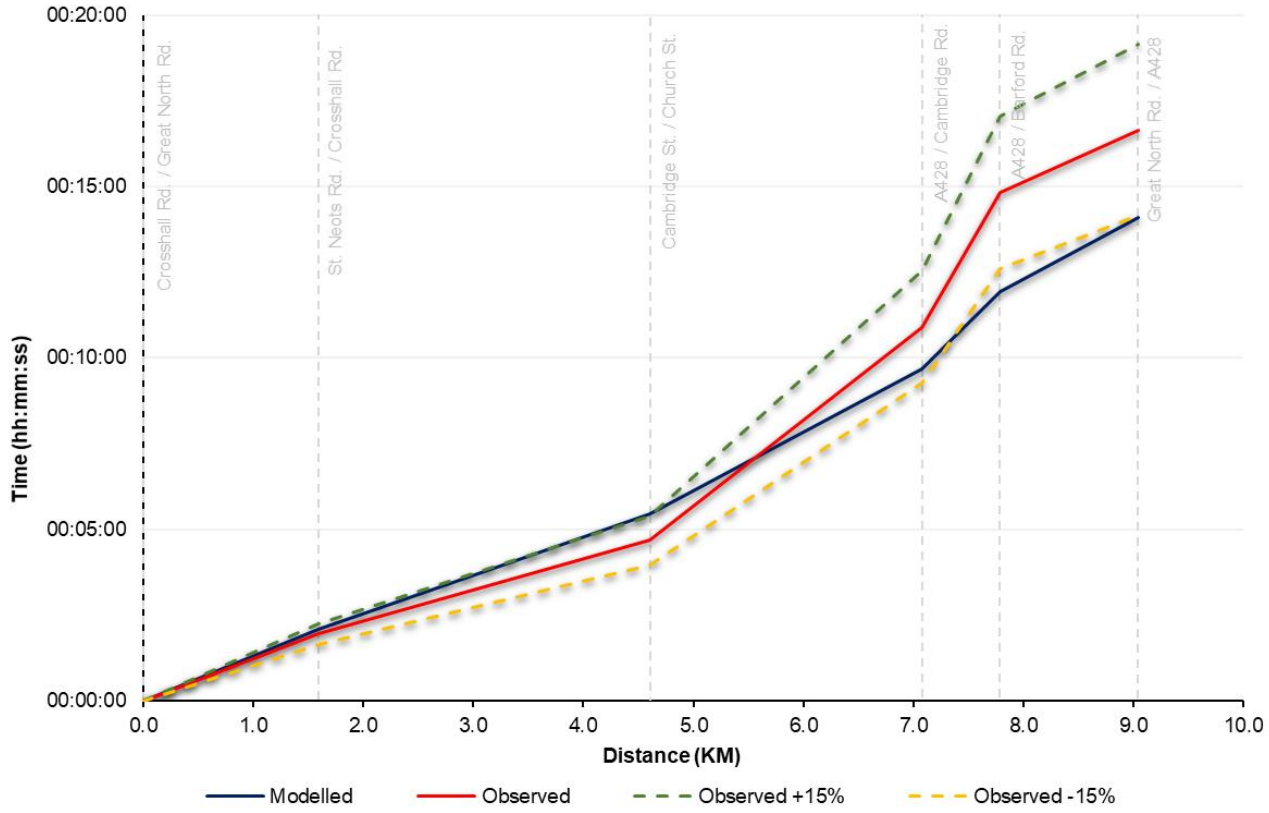
B.4.87. 2019 SN-01: A1 Little Paxton to A421 – PM



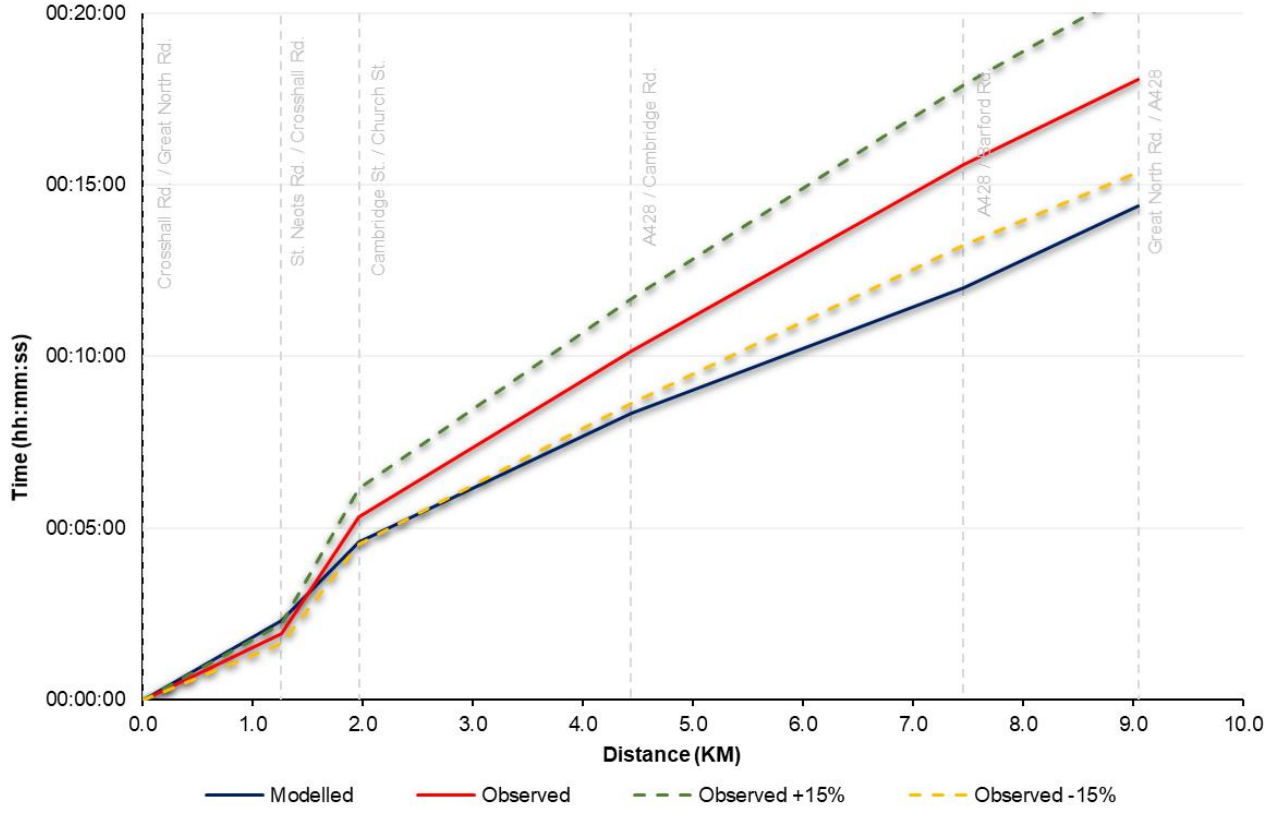
B.4.88. 2019 SN-02: A421 to A1 Little Paxton – PM



B.4.89. 2019 SN-03: A1 / B465 via Cambridge Rd. – PM



B.4.90. 2019 SN-04: A1 / B465 to A1 Wyboston via Cambridge Rd. – PM



Appendix C. Traffic Flow Calibration and Validation

C.1. 2015 Flow Calibration - AM

C.1.1. A14 Northern Bypass - AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road, Girton	NB	20205-23905	167	158	-8	-5%	0.7	✓	✓	✓
2	Cambridge Road, Girton	SB	23905-20205	541	311	-230	-43%	11.2	×	×	×
3	B1049 Bridge Road	NB	24611-24609	820	782	-38	-5%	1.4	✓	✓	✓
4	B1049 Bridge Road	SB	24609-24614	1055	1052	-3	0%	0.1	✓	✓	✓
5	A10, just north of A14	NB	25602-97403	746	766	20	3%	0.7	✓	✓	✓
6	A10, just north of A14	SB	25603-25602	1244	1058	-186	-15%	5.5	✓	×	✓
7	Cambridge Road (between Tesco and A14), Milton	NB	25703-25705	291	289	-2	-1%	0.1	✓	✓	✓
8	Cambridge Road (between Tesco and A14), Milton	SB	25705-25703	360	303	-58	-16%	3.2	✓	✓	✓
9	Horningsea Road (just north of A14), Horningsea	NB	27702-27703	125	134	9	8%	0.8	✓	✓	✓
10	Horningsea Road (just north of A14), Horningsea	SB	27703-27702	465	479	14	3%	0.7	✓	✓	✓
11	Newmarket Road (just north of A14)	NB	27803-27811	653	694	40	6%	1.6	✓	✓	✓
12	Newmarket Road (just north of A14)	SB	27807-27806	755	747	-9	-1%	0.3	✓	✓	✓

C.1.2. M11 Western Orbital – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A10 (just south of M11), Hauxton	EB	24101-24303	894	952	58	7%	1.9	✓	✓	✓
2	A10 (just south of M11), Hauxton	WB	24303-24101	985	960	-25	-3%	0.8	✓	✓	✓
3	Cambridge Road (just west of M11), Barton	EB	21404-21501	1273	1242	-31	-2%	0.9	✓	✓	✓
4	Cambridge Road (just west of M11), Barton	WB	21501-21404	536	562	25	5%	1.1	✓	✓	✓
5	Grantchester Road	EB	21604-21502	108	316	208	193%	14.3	×	×	×
6	Grantchester Road	WB	21502-21604	106	115	9	8%	0.8	✓	✓	✓
7	A1303 Madingley Road	EB	21603-14001	596	579	-17	-3%	0.7	✓	✓	✓
8	A1303 Madingley Road	WB	14001-21603	481	480	-1	0%	0.1	✓	✓	✓
9	A428, between A1303 and M11-A14	EB	91029-91031	1616	1612	-4	0%	0.1	✓	✓	✓
10	A428, between M11-A14 and A1303	WB	91032-91030	787	790	3	0%	0.1	✓	✓	✓

C.1.3. Cambridge Radial Cordon – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Babraham Rd	OUT	14714-27611	588	572	-16	-3%	0.6	✓	✓	✓
2	Babraham Rd	IN	27611-14714	518	531	13	2%	0.6	✓	✓	✓
3	Granhams Rd	IN	27606-27618	278	203	-75	-27%	4.8	✓	✓	✓
4	Granhams Rd	OUT	27618-27606	94	89	-5	-5%	0.5	✓	✓	✓
5	Shelford Rd	OUT	15518-27601	385	392	7	2%	0.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
6	Shelford Rd	IN	27601-15518	527	524	-3	-1%	0.1	✓	✓	✓
7	Hauxton Rd	OUT	15506-15505	960	895	-65	-7%	2.1	✓	✓	✓
8	Hauxton Rd	IN	15504-15506	1704	1671	-33	-2%	0.8	✓	✓	✓
9	Coton Rd	IN	21406-21503	436	257	-179	-41%	9.6	×	×	×
10	Coton Rd	OUT	21503-21406	71	131	60	85%	6.0	✓	×	✓
11	Barton Rd	IN	21406-21605	607	748	141	23%	5.4	×	×	×
12	Barton Rd	OUT	21605-21406	316	330	14	4%	0.8	✓	✓	✓
13	Madingley Rd	OUT	14003-14002	385	381	-4	-1%	0.2	✓	✓	✓
14	Madingley Rd	IN	14002-14003	1105	1099	-6	-1%	0.2	✓	✓	✓
15	Huntingdon Rd	OUT	20202-23906	289	287	-2	-1%	0.1	✓	✓	✓
16	Huntingdon Rd	IN	23906-20202	484	479	-5	-1%	0.2	✓	✓	✓
17	Girton Rd	OUT	20205-23905	162	158	-4	-2%	0.3	✓	✓	✓
18	Girton Rd	IN	23905-20205	534	311	-223	-42%	10.9	×	×	×
19	Histon Rd	OUT	24612-20301	927	891	-36	-4%	1.2	✓	✓	✓
20	Histon Rd	IN	20301-24612	1788	1761	-27	-1%	0.6	✓	✓	✓
21	Milton Rd	IN	20405-20406	2425	2400	-25	-1%	0.5	✓	✓	✓
22	Milton Rd	OUT	20406-20405	651	611	-40	-6%	1.6	✓	✓	✓
23	Horningsea Rd	OUT	27904-27701	701	696	-5	-1%	0.2	✓	✓	✓
24	Horningsea Rd	IN	27701-27904	650	637	-13	-2%	0.5	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
25	Newmarket Rd	OUT	29010-27801	674	643	-31	-5%	1.2	✓	✓	✓
26	Newmarket Rd	IN	27801-29010	1593	1461	-132	-8%	3.4	✓	✓	✓
27	High St Teversham	OUT	26604-26501	152	58	-94	-62%	9.2	✓	×	✓
28	High St Teversham	IN	26501-26604	305	174	-131	-43%	8.5	×	×	×
29	Fulbourn	IN	20104-20102	588	598	10	2%	0.4	✓	✓	✓
30	Fulbourn	OUT	20102-20104	485	483	-2	0%	0.1	✓	✓	✓
31	Worts' Causeway	OUT	27614-11601	78	87	9	12%	1.0	✓	✓	✓
32	Worts' Causeway	IN	11601-27614	142	145	4	2%	0.3	✓	✓	✓
33	Cherry Hinton Road (N)	IN	27611-27613	611	601	-10	-2%	0.4	✓	✓	✓
34	Cherry Hinton Road (N)	OUT	27613-27611	337	428	91	27%	4.7	✓	✓	✓

C.1.4. Cambridge Inner Cordon – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A1307 Huntingdon Rd	IN	11404-11104	736	742	6	1%	0.2	✓	✓	✓
2	A1307 Huntingdon Rd	OUT	11104-11404	425	397	-27	-6%	1.3	✓	✓	✓
3	Histon Road	IN	10802-10801	497	506	9	2%	0.4	✓	✓	✓
4	Histon Road	OUT	10801-10802	292	282	-9	-3%	0.6	✓	✓	✓
5	Harvey Goodwin Avenue	IN	10808-10807	153	144	-9	-6%	0.7	✓	✓	✓
6	Harvey Goodwin Avenue	OUT	10807-10808	68	16	-52	-76%	8.0	✓	×	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
7	Gilbert Road(N)	IN	16207-16210	449	396	-52	-12%	2.5	✓	✓	✓
8	Gilbert Road(N)	OUT	16210-16207	252	216	-36	-14%	2.3	✓	✓	✓
9	Highworth Avenue	IN	16303-16405	10	99	89	923%	12.1	✓	×	✓
10	Highworth Avenue	OUT	16405-16303	8	55	48	617%	8.5	✓	×	✓
11	Milton road(N)	IN	16306-16405	788	635	-153	-19%	5.7	×	×	×
12	Milton road(N)	OUT	16405-16306	599	586	-13	-2%	0.5	✓	✓	✓
13	High St	IN	12303-16407	450	603	153	34%	6.7	×	×	×
14	High St	OUT	16407-12303	388	402	14	4%	0.7	✓	✓	✓
15	Newmarket Road	IN	10203-10202	1087	1062	-25	-2%	0.8	✓	✓	✓
16	Newmarket Road	OUT	10202-10203	1011	1069	58	6%	1.8	✓	✓	✓
17	Coldhams Lane / New St.	OUT	12804-10204	128	93	-34	-27%	3.3	✓	✓	✓
18	Coldhams Lane / New St.	IN	10204-12804	192	196	4	2%	0.3	✓	✓	✓
19	Mill Road	IN	14206-14205	399	393	-6	-2%	0.3	✓	✓	✓
20	Mill Road	OUT	14205-14206	473	431	-41	-9%	1.9	✓	✓	✓
21	Hills Road	IN	16104-16011	419	382	-37	-9%	1.8	✓	✓	✓
22	Hills Road	OUT	16011-16104	296	316	21	7%	1.2	✓	✓	✓
23	Panton Street (one-way)	IN	16009-16008	172	362	190	111%	11.6	×	×	×
24	Trumpington Rd / Lensfield Rd / Fen Causeway	IN	16003-16002	790	763	-27	-3%	1.0	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
25	Trumpington Rd / Lensfield Rd / Fen Causeway	OUT	16002-16003	546	541	-5	-1%	0.2	✓	✓	✓
26	Barton Rd	IN	13605-13606	876	769	-107	-12%	3.7	✓	✓	✓
27	Barton Rd	OUT	13606-13605	369	359	-10	-3%	0.5	✓	✓	✓
28	Madingley Road	OUT	11102-14006	607	615	8	1%	0.3	✓	✓	✓
29	Madingley Road	IN	14006-11102	773	710	-63	-8%	2.3	✓	✓	✓

C.1.5. River Cam Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	532	662	130	24%	5.3	×	×	×
2	Fen Causeway	WB	13201-13610	810	786	-25	-3%	0.9	✓	✓	✓
3	Silver St	EB	13907-13101	625	615	-9	-1%	0.4	✓	✓	✓
4	Silver St	WB	13101-13907	27	6	-21	-78%	5.2	✓	×	✓
5	Bridge St	WB	13001-11002	62	102	41	67%	4.5	✓	✓	✓
6	Bridge St	EB	11002-13001	63	240	177	282%	14.4	×	×	×
7	Victoria Ave	WB	12901-16209	523	508	-15	-3%	0.7	✓	✓	✓
8	Victoria Ave	EB	16209-12901	452	678	226	50%	9.5	×	×	×
9	Elizabeth Way	WB	12909-16502	845	823	-22	-3%	0.7	✓	✓	✓
10	Elizabeth Way	EB	16502-12909	1148	1020	-128	-11%	3.9	✓	✓	✓

C.1.6. County East-West Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	South of Sawtry	NB	94004-94014	2446	2566	120	5%	2.4	✓	✓	✓
2	South of Sawtry	SB	94014-94004	2576	2644	68	3%	1.3	✓	✓	✓
3	Warboys - Ramsey	NB	57603-57702	285	289	4	2%	0.3	✓	✓	✓
4	Warboys - Ramsey	SB	57702-57603	395	390	-5	-1%	0.3	✓	✓	✓
5	South of Sawtry Relief Road	NB	56801-94003	71	124	53	74%	5.3	✓	×	✓
6	South of Sawtry Relief Road	SB	94003-56801	293	83	-210	-72%	15.3	×	×	×
7	Chatteris - Somersham	NB	57002-70103	66	69	3	5%	0.4	✓	✓	✓
8	Chatteris - Somersham	SB	70103-57002	158	171	13	8%	1.0	✓	✓	✓
9	Chatteris - Mepal	NB	41601-70103	455	467	12	3%	0.5	✓	✓	✓
10	Chatteris - Mepal	SB	70103-41601	766	753	-13	-2%	0.5	✓	✓	✓
11	Ely Littleport Bypass	NB	40402-40411	432	417	-15	-3%	0.7	✓	✓	✓
12	Ely Littleport Bypass	SB	40411-40402	620	621	1	0%	0.0	✓	✓	✓
13	Chettisham	NB	40302-41305	88	138	50	57%	4.7	✓	✓	✓
14	Chettisham	SB	41305-40302	258	407	149	58%	8.2	×	×	×
15	Queen Adelaide	NB	40601-41306	109	109	0	0%	0.0	✓	✓	✓
16	Queen Adelaide	SB	41306-40601	230	240	10	4%	0.7	✓	✓	✓

C.1.7. Huntingdon North – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Spittals Way	NB	55203-50301	1009	976	-34	-3%	1.1	✓	✓	✓
2	Spittals Way	SB	50301-55203	968	585	-383	-40%	13.7	×	×	×
3	St. Peters Rd., Huntingdon	NB	53503-53502	631	620	-11	-2%	0.4	✓	✓	✓
4	St. Peters Rd., Huntingdon	SB	53502-53503	837	800	-37	-4%	1.3	✓	✓	✓
5	A141 between Kings Ripton Rd. and A1123	SB	53403-52910	616	490	-126	-20%	5.4	×	×	×
6	A141 between Kings Ripton Rd. and A1123	NB	52910-53403	589	595	7	1%	0.3	✓	✓	✓
7	A141 South of B1090	NB	52910-57502	541	544	2	0%	0.1	✓	✓	✓
8	A141 South of B1090	SB	57502-52910	929	927	-1	0%	0.0	✓	✓	✓

C.1.8. Huntingdon South-East – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A14, between J24 and J23	WB	92011-92106	2897	2940	43	1%	0.8	✓	✓	✓
2	A14, between J23 and J24	EB	92108-92012	1946	1946	-1	0%	0.0	✓	✓	✓
3	Castle Moat Rd.	WB	52705-52703	1520	1514	-6	0%	0.2	✓	✓	✓
4	Nursery Rd.	EB	53103-53104	820	773	-47	-6%	1.7	✓	✓	✓
5	Hartford Rd.	WB	53106-52911	449	387	-62	-14%	3.0	✓	✓	✓
6	Hartford Rd.	EB	52911-53106	958	967	8	1%	0.3	✓	✓	✓
7	Huntingdon Rd. A1123	EB	52910-59601	508	497	-11	-2%	0.5	✓	✓	✓
8	Huntingdon Rd. A1123	WB	59601-52910	800	508	-292	-37%	11.4	×	×	×

C.1.9. St. Ives Cordon – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Houghton Hill Road A1123	IN	52910-59601	516	497	-19	-4%	0.9	✓	✓	✓
2	Houghton Hill Road A1123	OUT	59601-52910	784	508	-276	-35%	10.9	×	×	×
3	Sawtry Way B1090	OUT	59601-59610	262	252	-9	-4%	0.6	✓	✓	✓
4	Sawtry Way B1090	IN	59610-59601	266	224	-43	-16%	2.7	✓	✓	✓
5	Somersham Road B1040	OUT	56008-56904	253	257	5	2%	0.3	✓	✓	✓
6	Somersham Road B1040	IN	56904-56008	624	619	-4	-1%	0.2	✓	✓	✓
7	Needingworth Road A1123	OUT	51302-51308	394	393	-1	0%	0.1	✓	✓	✓
8	Needingworth Road A1123	IN	51308-51302	776	804	27	4%	1.0	✓	✓	✓
9	Harrison Way A1096	IN	51805-56101	1128	1127	-2	0%	0.0	✓	✓	✓
10	Harrison Way A1096	OUT	56101-51805	1019	1036	17	2%	0.5	✓	✓	✓

C.1.10. St. Ives East-West Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Hill Rise	WB	56303-56001	231	244	13	5%	0.8	✓	✓	✓
2	Hill Rise	EB	56001-56303	323	338	15	5%	0.8	✓	✓	✓
3	Ramsey Road	WB	56003-56002	98	78	-20	-21%	2.2	✓	✓	✓
4	Ramsey Road	EB	56002-56003	254	229	-25	-10%	1.6	✓	✓	✓
5	Somersham Road	WB	56208-51301	553	552	0	0%	0.0	✓	✓	✓
6	Somersham Road	EB	51301-56208	770	752	-18	-2%	0.7	✓	✓	✓

C.1.11. St. Neots Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	142	139	-3	-2%	0.2	✓	✓	✓
2	Potton Road	EB	56602-58801	327	328	1	0%	0.0	✓	✓	✓
3	A428, between B1043 and B1428	EB	91002-91003	616	616	0	0%	0.0	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	674	680	6	1%	0.2	✓	✓	✓
5	Cambridge Road	EB	56604-59701	216	346	130	60%	7.8	×	×	×
6	Cambridge Road	WB	59701-56604	261	246	-15	-6%	0.9	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	488	500	12	3%	0.6	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	418	418	0	0%	0.0	✓	✓	✓

C.1.12. Ely Cordon – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road	IN	40204-40702	274	136	-138	-50%	9.7	×	×	×
2	Cambridge Road	OUT	40702-40204	229	182	-47	-21%	3.3	✓	✓	✓
3	Witchford Road	IN	40203-40702	349	350	1	0%	0.1	✓	✓	✓
4	Witchford Road	OUT	40702-40203	253	260	7	3%	0.5	✓	✓	✓
5	West Fen Road	IN	40701-40406	90	108	18	20%	1.8	✓	✓	✓
6	West Fen Road	OUT	40406-40701	44	47	3	6%	0.4	✓	✓	✓
7	Downham Road	OUT	40403-40402	438	444	6	1%	0.3	✓	✓	✓
8	Downham Road	IN	40402-40403	571	565	-6	-1%	0.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	Lynn Road	OUT	40302-41305	250	138	-112	-45%	8.0	×	×	×
10	Lynn Road	IN	41305-40302	377	407	30	8%	1.5	✓	✓	✓
11	Kings Avenue	OUT	40302-40305	201	218	18	9%	1.2	✓	✓	✓
12	Kings Avenue	IN	40305-40302	211	267	56	26%	3.6	✓	✓	✓
13	Prickwillow Road	OUT	40102-40304	148	16	-132	-89%	14.6	×	×	×
14	Prickwillow Road	IN	40304-40102	269	53	-216	-80%	17.1	×	×	×
15	Station Road	IN	40501-40512	569	647	78	14%	3.2	✓	✓	✓
16	Station Road	OUT	40512-40501	730	634	-96	-13%	3.7	✓	✓	✓

C.1.13. A14 South – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	The Avenue	NB	21708-23901	46	45	-1	-2%	0.1	✓	✓	✓
2	The Avenue	SB	23901-21708	97	142	45	46%	4.1	✓	✓	✓
3	Oakington Road	NB	21109-21110	259	258	-1	0%	0.1	✓	✓	✓
4	Oakington Road	SB	21110-21109	298	301	3	1%	0.2	✓	✓	✓
5	A14 Junction 29 On Slip (Northbound)	NB	21002-92118	219	219	0	0%	0.0	✓	✓	✓
6	A14 Junction 29 Off Slip (Northbound)	SB	92118-21002	583	589	6	1%	0.2	✓	✓	✓
7	B1050	NB	21001-25102	722	697	-25	-3%	0.9	✓	✓	✓
8	B1050	SB	25102-21001	432	430	-2	-1%	0.1	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	High Street	NB	28602-28606	1	0	-1	-100%	1.7	✓	✓	✓
10	High Street	SB	28606-28602	4	4	0	11%	0.2	✓	✓	✓
11	Conington Road	NB	51809-51812	96	100	4	4%	0.4	✓	✓	✓
12	Conington Road	SB	51812-51809	107	101	-6	-6%	0.6	✓	✓	✓
13	Potton Road	NB	58801-56602	142	139	-3	-2%	0.2	✓	✓	✓
14	Potton Road	SB	56602-58801	327	328	1	0%	0.0	✓	✓	✓
15	A1198	NB	52112-52113	540	540	0	0%	0.0	✓	✓	✓
16	A1198	SB	52113-52112	723	690	-33	-5%	1.2	✓	✓	✓

C.1.14. A14 North – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road B1044	NB	51902-51903	521	527	6	1%	0.3	✓	✓	✓
2	Cambridge Road B1044	SB	51903-51902	390	366	-24	-6%	1.2	✓	✓	✓
3	A1096 London Road	NB	51801-51804	807	801	-6	-1%	0.2	✓	✓	✓
4	A1096 London Road	SB	51804-51801	766	825	59	8%	2.1	✓	✓	✓
5	Huntingdon Road	SB	51807-51802	67	67	0	0%	0.0	✓	✓	✓
6	A14 off-slip north of Fenstanton	SB	92035-51807	38	32	-6	-15%	0.9	✓	✓	✓
7	High Street	NB	51812-51813	146	237	91	62%	6.6	✓	×	✓
8	High Street	SB	51813-51812	163	195	33	20%	2.4	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	A14 On Slip, Fenstanton	SB	28605-92040	423	416	-8	-2%	0.4	✓	✓	✓
10	Cambridge Road	NB	26102-26103	69	71	2	3%	0.2	✓	✓	✓
11	Cambridge Road	SB	26103-26102	6	0	-6	-100%	3.4	✓	✓	✓
12	Bucking Way Road	NB	26401-26402	329	326	-3	-1%	0.2	✓	✓	✓
13	Bucking Way Road	SB	26402-26401	385	393	8	2%	0.4	✓	✓	✓
14	B1050	NB	21001-25102	722	697	-25	-3%	0.9	✓	✓	✓
15	B1050	SB	25102-21001	432	430	-2	-1%	0.1	✓	✓	✓
16	A14 Junction 29 Off Slip (Southbound)	NB	25104-25106	215	215	0	0%	0.0	✓	✓	✓
17	A14 Junction 29 On Slip (Southbound)	SB	25106-25104	1087	1090	3	0%	0.1	✓	✓	✓
18	Dry Drayton Road	NB	23203-23205	387	404	16	4%	0.8	✓	✓	✓
19	Dry Drayton Road	SB	23205-23203	573	582	8	1%	0.4	✓	✓	✓

C.2. 2015 Flow Calibration - IP

C.2.1. A14 Northern Bypass - IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road, Girton	NB	20205-23905	145	132	-13	-9%	1.1	✓	✓	✓
2	Cambridge Road, Girton	SB	23905-20205	155	126	-29	-19%	2.4	✓	✓	✓
3	B1049 Bridge Road	NB	24611-24609	692	677	-15	-2%	0.6	✓	✓	✓
4	B1049 Bridge Road	SB	24609-24614	704	706	2	0%	0.1	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
5	A10, just north of A14	NB	25602-97403	788	788	0	0%	0.0	✓	✓	✓
6	A10, just north of A14	SB	25603-25602	682	688	6	1%	0.2	✓	✓	✓
7	Cambridge Road (between Tesco and A14), Milton	NB	25703-25705	581	390	-191	-33%	8.7	×	×	×
8	Cambridge Road (between Tesco and A14), Milton	SB	25705-25703	579	558	-21	-4%	0.9	✓	✓	✓
9	Horningsea Road (just north of A14), Horningsea	NB	27702-27703	203	136	-67	-33%	5.2	✓	×	✓
10	Horningsea Road (just north of A14), Horningsea	SB	27703-27702	190	168	-21	-11%	1.6	✓	✓	✓
11	Newmarket Road (just north of A14)	NB	27803-27811	624	671	47	8%	1.9	✓	✓	✓
12	Newmarket Road (just north of A14)	SB	27807-27806	473	482	9	2%	0.4	✓	✓	✓

C.2.2. M11 Western Orbital – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A10 (just south of M11), Hauxton	EB	24101-24303	640	625	-15	-2%	0.6	✓	✓	✓
2	A10 (just south of M11), Hauxton	WB	24303-24101	606	600	-6	-1%	0.2	✓	✓	✓
3	Cambridge Road (just west of M11), Barton	EB	21404-21501	478	510	31	7%	1.4	✓	✓	✓
4	Cambridge Road (just west of M11), Barton	WB	21501-21404	451	456	4	1%	0.2	✓	✓	✓
5	Grantchester Road	EB	21604-21502	-	-	-	-	-	-	-	-
6	Grantchester Road	WB	21502-21604	-	-	-	-	-	-	-	-
7	A1303 Madingley Road	EB	21603-14001	-	-	-	-	-	-	-	-
8	A1303 Madingley Road	WB	14001-21603	-	-	-	-	-	-	-	-

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	A428, between A1303 and M11-A14	EB	91029-91031	568	557	-11	-2%	0.5	✓	✓	✓
10	A428, between M11-A14 and A1303	WB	91032-91030	600	607	7	1%	0.3	✓	✓	✓

C.2.3. Cambridge Radial Cordon – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Babraham Rd.	OUT	14714-27611	439	410	-29	-7%	1.4	✓	✓	✓
2	Babraham Rd.	IN	27611-14714	453	455	2	0%	0.1	✓	✓	✓
3	Granhams Rd.	IN	27606-27618	113	67	-46	-41%	4.9	✓	✓	✓
4	Granhams Rd.	OUT	27618-27606	113	113	0	0%	0.0	✓	✓	✓
5	Shelford Rd.	OUT	15518-27601	378	350	-27	-7%	1.4	✓	✓	✓
6	Shelford Rd.	IN	27601-15518	384	362	-22	-6%	1.1	✓	✓	✓
7	Hauxton Rd.	OUT	15506-15505	897	849	-48	-5%	1.6	✓	✓	✓
8	Hauxton Rd.	IN	15504-15506	994	781	-213	-21%	7.1	×	×	×
9	Coton Rd.	IN	21406-21503	96	190	94	98%	7.9	✓	×	✓
10	Coton Rd.	OUT	21503-21406	80	126	46	58%	4.6	✓	✓	✓
11	Barton Rd.	IN	21406-21605	432	437	6	1%	0.3	✓	✓	✓
12	Barton Rd.	OUT	21605-21406	379	378	-1	0%	0.1	✓	✓	✓
13	Madingley Rd.	OUT	14003-14002	438	417	-21	-5%	1.0	✓	✓	✓
14	Madingley Rd.	IN	14002-14003	478	496	18	4%	0.8	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
15	Huntingdon Rd.	OUT	20202-23906	284	262	-22	-8%	1.3	✓	✓	✓
16	Huntingdon Rd.	IN	23906-20202	316	304	-12	-4%	0.7	✓	✓	✓
17	Girton Rd.	OUT	20205-23905	139	132	-7	-5%	0.6	✓	✓	✓
18	Girton Rd.	IN	23905-20205	128	126	-2	-1%	0.2	✓	✓	✓
19	Histon Rd.	OUT	24612-20301	728	701	-27	-4%	1.0	✓	✓	✓
20	Histon Rd.	IN	20301-24612	729	727	-1	0%	0.1	✓	✓	✓
21	Milton Rd.	IN	20405-20406	948	918	-30	-3%	1.0	✓	✓	✓
22	Milton Rd.	OUT	20406-20405	914	907	-7	-1%	0.2	✓	✓	✓
23	Horningsea Rd.	OUT	27904-27701	446	456	10	2%	0.5	✓	✓	✓
24	Horningsea Rd.	IN	27701-27904	501	476	-25	-5%	1.1	✓	✓	✓
25	Newmarket Rd.	OUT	29010-27801	701	692	-8	-1%	0.3	✓	✓	✓
26	Newmarket Rd.	IN	27801-29010	693	680	-13	-2%	0.5	✓	✓	✓
27	High St. Teversham	OUT	26604-26501	109	74	-35	-32%	3.7	✓	✓	✓
28	High St. Teversham	IN	26501-26604	106	99	-6	-6%	0.6	✓	✓	✓
29	Fulbourn	IN	20104-20102	279	273	-6	-2%	0.4	✓	✓	✓
30	Fulbourn	OUT	20102-20104	308	300	-8	-2%	0.4	✓	✓	✓
31	Worts' Causeway	OUT	27614-11601	62	67	5	8%	0.6	✓	✓	✓
32	Worts' Causeway	IN	11601-27614	64	65	1	1%	0.1	✓	✓	✓
33	Cherry Hinton Rd. (N)	IN	27611-27613	46	254	208	457%	17.0	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
34	Cherry Hinton Rd. (N)	OUT	27613-27611	46	363	317	695%	22.2	×	×	×

C.2.4. Cambridge Inner Cordon – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A1307 Huntingdon Rd.	IN	11404-11104	507	494	-12	-2%	0.5	✓	✓	✓
2	A1307 Huntingdon Rd.	OUT	11104-11404	431	365	-66	-15%	3.3	✓	✓	✓
3	Histon Rd.	IN	10802-10801	360	349	-11	-3%	0.6	✓	✓	✓
4	Histon Rd.	OUT	10801-10802	403	381	-23	-6%	1.1	✓	✓	✓
5	Harvey Goodwin Avenue	IN	10808-10807	45	22	-23	-51%	4.0	✓	✓	✓
6	Harvey Goodwin Avenue	OUT	10807-10808	57	10	-47	-83%	8.1	✓	×	✓
7	Gilbert Rd.(N)	IN	16207-16210	251	237	-14	-6%	0.9	✓	✓	✓
8	Gilbert Rd.(N)	OUT	16210-16207	207	171	-36	-18%	2.6	✓	✓	✓
9	Highworth Avenue	IN	16303-16405	13	57	44	340%	7.4	✓	×	✓
10	Highworth Avenue	OUT	16405-16303	7	46	39	540%	7.5	✓	×	✓
11	Milton Rd.(N)	IN	16306-16405	636	603	-33	-5%	1.3	✓	✓	✓
12	Milton Rd.(N)	OUT	16405-16306	619	591	-27	-4%	1.1	✓	✓	✓
13	High St.	IN	12303-16407	381	386	5	1%	0.2	✓	✓	✓
14	High St.	OUT	16407-12303	360	362	1	0%	0.1	✓	✓	✓
15	Newmarket Rd.	IN	10203-10202	1024	942	-81	-8%	2.6	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
16	Newmarket Rd.	OUT	10202-10203	1153	1254	101	9%	2.9	✓	✓	✓
17	Coldhams Ln. / New St.	OUT	12804-10204	-	-	-	-	-	-	-	-
18	Coldhams Ln. / New St.	IN	10204-12804	-	-	-	-	-	-	-	-
19	Mill Rd.	IN	14206-14205	353	333	-20	-6%	1.1	✓	✓	✓
20	Mill Rd.	OUT	14205-14206	340	315	-26	-7%	1.4	✓	✓	✓
21	Hills Rd.	IN	16104-16011	371	321	-50	-13%	2.7	✓	✓	✓
22	Hills Rd.	OUT	16011-16104	188	192	4	2%	0.3	✓	✓	✓
23	Panton St. (one-way)	IN	16009-16008	68	325	257	378%	18.3	×	×	×
24	Trumpington Rd. / Lensfield Rd. / Fen Causeway	IN	16003-16002	784	634	-150	-19%	5.6	×	×	×
25	Trumpington Rd. / Lensfield Rd. / Fen Causeway	OUT	16002-16003	726	621	-105	-14%	4.0	✓	✓	✓
26	Barton Rd.	IN	13605-13606	-	-	-	-	-	-	-	-
27	Barton Rd.	OUT	13606-13605	-	-	-	-	-	-	-	-
28	Madingley Rd.	OUT	11102-14006	-	-	-	-	-	-	-	-
29	Madingley Rd.	IN	14006-11102	-	-	-	-	-	-	-	-

C.2.5. River Cam Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	778	768	-10	-1%	0.4	✓	✓	✓
2	Fen Causeway	WB	13201-13610	766	757	-9	-1%	0.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
3	Silver St	EB	13907-13101	44	7	-37	-83%	7.2	✓	×	✓
4	Silver St	WB	13101-13907	30	7	-22	-75%	5.2	✓	×	✓
5	Bridge St	WB	13001-11002	50	141	91	181%	9.3	✓	×	✓
6	Bridge St	EB	11002-13001	42	191	148	349%	13.7	×	×	×
7	Victoria Ave	WB	12901-16209	387	379	-8	-2%	0.4	✓	✓	✓
8	Victoria Ave	EB	16209-12901	406	420	14	3%	0.7	✓	✓	✓
9	Elizabeth Way	WB	12909-16502	867	824	-43	-5%	1.5	✓	✓	✓
10	Elizabeth Way	EB	16502-12909	1000	992	-8	-1%	0.3	✓	✓	✓

C.2.6. County East-West Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	South of Sawtry	NB	94004-94014	1945	1990	44	2%	1.0	✓	✓	✓
2	South of Sawtry	SB	94014-94004	2012	2052	40	2%	0.9	✓	✓	✓
3	Warboys - Ramsey	NB	57603-57702	219	217	-2	-1%	0.2	✓	✓	✓
4	Warboys - Ramsey	SB	57702-57603	227	227	0	0%	0.0	✓	✓	✓
5	South of Sawtry Relief Road	NB	56801-94003	67	53	-14	-21%	1.8	✓	✓	✓
6	South of Sawtry Relief Road	SB	94003-56801	94	16	-78	-83%	10.6	✓	×	✓
7	Chatteris - Somersham	NB	57002-70103	59	59	0	1%	0.0	✓	✓	✓
8	Chatteris - Somersham	SB	70103-57002	58	64	6	10%	0.8	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	Chatteris - Mepal	NB	41601-70103	323	293	-29	-9%	1.7	✓	✓	✓
10	Chatteris - Mepal	SB	70103-41601	335	314	-21	-6%	1.2	✓	✓	✓
11	Ely Littleport Bypass	NB	40402-40411	336	329	-7	-2%	0.4	✓	✓	✓
12	Ely Littleport Bypass	SB	40411-40402	359	332	-27	-7%	1.4	✓	✓	✓
13	Chettisham	NB	40302-41305	137	169	32	23%	2.6	✓	✓	✓
14	Chettisham	SB	41305-40302	124	218	94	76%	7.2	✓	×	✓
15	Queen Adelaide	NB	40601-41306	116	132	17	15%	1.5	✓	✓	✓
16	Queen Adelaide	SB	41306-40601	101	105	4	4%	0.4	✓	✓	✓

C.2.7. Huntingdon North – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Spittals Way	NB	55203-50301	680	676	-3	0%	0.1	✓	✓	✓
2	Spittals Way	SB	50301-55203	700	704	4	1%	0.2	✓	✓	✓
3	St. Peters Rd., Huntingdon	NB	53503-53502	666	664	-2	0%	0.1	✓	✓	✓
4	St. Peters Rd., Huntingdon	SB	53502-53503	599	594	-5	-1%	0.2	✓	✓	✓
5	A141 between Kings Ripton Rd. and A1123	SB	53403-52910	575	515	-60	-10%	2.6	✓	✓	✓
6	A141 between Kings Ripton Rd. and A1123	NB	52910-53403	564	562	-1	0%	0.1	✓	✓	✓
7	A141 South of B1090	NB	52910-57502	491	491	0	0%	0.0	✓	✓	✓
8	A141 South of B1090	SB	57502-52910	524	520	-5	-1%	0.2	✓	✓	✓

C.2.8. Huntingdon South-East – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A14, between J24 and J23	WB	92011-92106	2436	2446	10	0%	0.2	✓	✓	✓
2	A14, between J23 and J24	EB	92108-92012	2201	2220	20	1%	0.4	✓	✓	✓
3	Castle Moat Rd.	WB	52705-52703	1264	1169	-95	-8%	2.7	✓	✓	✓
4	Nursery Rd.	EB	53103-53104	1048	974	-74	-7%	2.3	✓	✓	✓
5	Hartford Rd.	WB	53106-52911	576	556	-20	-3%	0.8	✓	✓	✓
6	Hartford Rd.	EB	52911-53106	569	553	-16	-3%	0.7	✓	✓	✓
7	Huntingdon Rd. A1123	EB	52910-59601	609	453	-155	-25%	6.7	×	×	×
8	Huntingdon Rd. A1123	WB	59601-52910	579	505	-74	-13%	3.2	✓	✓	✓

C.2.9. St. Ives Cordon – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Houghton Hill Road A1123	IN	52910-59601	480	453	-26	-6%	1.2	✓	✓	✓
2	Houghton Hill Road A1123	OUT	59601-52910	507	505	-2	0%	0.1	✓	✓	✓
3	Sawtry Way B1090	OUT	59601-59610	113	104	-9	-8%	0.9	✓	✓	✓
4	Sawtry Way B1090	IN	59610-59601	124	112	-12	-9%	1.1	✓	✓	✓
5	Somersham Road B1040	OUT	56008-56904	285	272	-13	-5%	0.8	✓	✓	✓
6	Somersham Road B1040	IN	56904-56008	269	269	0	0%	0.0	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
7	Needingworth Road A1123	OUT	51302-51308	423	428	5	1%	0.3	✓	✓	✓
8	Needingworth Road A1123	IN	51308-51302	429	445	17	4%	0.8	✓	✓	✓
9	Harrison Way A1096	IN	51805-56101	760	774	14	2%	0.5	✓	✓	✓
10	Harrison Way A1096	OUT	56101-51805	731	749	18	2%	0.6	✓	✓	✓

C.2.10. St. Ives East-West Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Hill Rise	WB	56303-56001	157	197	39	25%	3.0	✓	✓	✓
2	Hill Rise	EB	56001-56303	169	182	13	7%	1.0	✓	✓	✓
3	Ramsey Road	WB	56003-56002	144	27	-117	-81%	12.6	×	×	×
4	Ramsey Road	EB	56002-56003	152	29	-123	-81%	12.9	×	×	×
5	Somersham Road	WB	56208-51301	481	454	-27	-6%	1.3	✓	✓	✓
6	Somersham Road	EB	51301-56208	465	456	-9	-2%	0.4	✓	✓	✓

C.2.11. St. Neots Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	102	101	-1	-1%	0.1	✓	✓	✓
2	Potton Road	EB	56602-58801	85	85	0	0%	0.0	✓	✓	✓
3	A428, between B1043 and B1428	EB	91002-91003	591	498	-93	-16%	4.0	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	556	556	-1	0%	0.0	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
5	Cambridge Road	EB	56604-59701	207	194	-12	-6%	0.9	✓	✓	✓
6	Cambridge Road	WB	59701-56604	224	215	-9	-4%	0.6	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	214	215	1	1%	0.1	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	215	212	-3	-1%	0.2	✓	✓	✓

C.2.12. Ely Cordon – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road	IN	40204-40702	209	298	90	43%	5.7	✓	×	✓
2	Cambridge Road	OUT	40702-40204	158	133	-25	-16%	2.1	✓	✓	✓
3	Witchford Road	IN	40203-40702	236	236	0	0%	0.0	✓	✓	✓
4	Witchford Road	OUT	40702-40203	198	199	1	1%	0.1	✓	✓	✓
5	West Fen Road	IN	40701-40406	64	81	17	27%	2.0	✓	✓	✓
6	West Fen Road	OUT	40406-40701	55	39	-15	-28%	2.3	✓	✓	✓
7	Downham Road	OUT	40403-40402	271	271	0	0%	0.0	✓	✓	✓
8	Downham Road	IN	40402-40403	278	276	-1	0%	0.1	✓	✓	✓
9	Lynn Road	OUT	40302-41305	252	169	-83	-33%	5.7	✓	×	✓
10	Lynn Road	IN	41305-40302	232	218	-14	-6%	0.9	✓	✓	✓
11	Kings Avenue	OUT	40302-40305	109	152	43	39%	3.8	✓	✓	✓
12	Kings Avenue	IN	40305-40302	130	162	32	25%	2.6	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
13	Prickwillow Road	OUT	40102-40304	180	23	-157	-87%	15.6	×	×	×
14	Prickwillow Road	IN	40304-40102	156	43	-113	-72%	11.3	×	×	×
15	Station Road	IN	40501-40512	458	543	85	19%	3.8	✓	✓	✓
16	Station Road	OUT	40512-40501	575	704	128	22%	5.1	×	×	×

C.2.13. A14 South – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	The Avenue	NB	21708-23901	51	45	-6	-12%	0.9	✓	✓	✓
2	The Avenue	SB	23901-21708	48	42	-6	-12%	0.9	✓	✓	✓
3	Oakington Road	NB	21109-21110	166	168	2	1%	0.1	✓	✓	✓
4	Oakington Road	SB	21110-21109	159	167	8	5%	0.6	✓	✓	✓
5	A14 Junction 29 On Slip (Northbound)	NB	21002-92118	202	202	0	0%	0.0	✓	✓	✓
6	A14 Junction 29 Off Slip (Northbound)	SB	92118-21002	611	614	3	1%	0.1	✓	✓	✓
7	B1050	NB	21001-25102	732	725	-8	-1%	0.3	✓	✓	✓
8	B1050	SB	25102-21001	307	306	0	0%	0.0	✓	✓	✓
9	High Street	NB	28602-28606	1	0	-1	-100%	1.3	✓	✓	✓
10	High Street	SB	28606-28602	2	4	2	87%	1.0	✓	✓	✓
11	Conington Road	NB	51809-51812	62	77	15	24%	1.8	✓	✓	✓
12	Conington Road	SB	51812-51809	53	50	-3	-5%	0.4	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
13	Potton Road	NB	58801-56602	102	101	-1	-1%	0.1	✓	✓	✓
14	Potton Road	SB	56602-58801	85	85	0	0%	0.0	✓	✓	✓
15	A1198	NB	52112-52113	358	357	0	0%	0.0	✓	✓	✓
16	A1198	SB	52113-52112	303	295	-8	-3%	0.5	✓	✓	✓

C.2.14. A14 North – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
f1	Cambridge Road B1044	NB	51902-51903	300	303	3	1%	0.2	✓	✓	✓
2	Cambridge Road B1044	SB	51903-51902	345	348	3	1%	0.1	✓	✓	✓
3	A1096 London Road	NB	51801-51804	557	567	10	2%	0.4	✓	✓	✓
4	A1096 London Road	SB	51804-51801	545	553	8	1%	0.3	✓	✓	✓
5	Huntingdon Road	SB	51807-51802	44	47	2	5%	0.4	✓	✓	✓
6	A14 off-slip north of Fenstanton	SB	92035-51807	35	32	-3	-8%	0.5	✓	✓	✓
7	High Street	NB	51812-51813	130	169	39	30%	3.2	✓	✓	✓
8	High Street	SB	51813-51812	75	93	17	23%	1.9	✓	✓	✓
9	A14 On Slip, Fenstanton	SB	28605-92040	172	172	-1	0%	0.1	✓	✓	✓
10	Cambridge Road	NB	26102-26103	39	39	0	0%	0.0	✓	✓	✓
11	Cambridge Road	SB	26103-26102	5	0	-5	-100%	3.2	✓	✓	✓
12	Bucking Way Road	NB	26401-26402	188	187	-1	-1%	0.1	✓	✓	✓
13	Bucking Way Road	SB	26402-26401	211	218	7	4%	0.5	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
14	B1050	NB	21001-25102	732	725	-8	-1%	0.3	✓	✓	✓
15	B1050	SB	25102-21001	307	306	0	0%	0.0	✓	✓	✓
16	A14 Junction 29 Off Slip (Southbound)	NB	25104-25106	174	174	0	0%	0.0	✓	✓	✓
17	A14 Junction 29 On Slip (Southbound)	SB	25106-25104	581	584	3	1%	0.1	✓	✓	✓
18	Dry Drayton Road	NB	23203-23205	222	223	1	0%	0.1	✓	✓	✓
19	Dry Drayton Road	SB	23205-23203	212	213	1	1%	0.1	✓	✓	✓

C.3. 2015 Flow Calibration - PM

C.3.1. A14 Northern Bypass - PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road, Girton	NB	20205-23905	342	208	-134	-39%	8.1	×	×	×
2	Cambridge Road, Girton	SB	23905-20205	174	180	5	3%	0.4	✓	✓	✓
3	B1049 Bridge Road	NB	24611-24609	1119	1153	34	3%	1.0	✓	✓	✓
4	B1049 Bridge Road	SB	24609-24614	877	882	4	0%	0.1	✓	✓	✓
5	A10, just north of A14	NB	25602-97403	1204	1051	-153	-13%	4.5	✓	✓	✓
6	A10, just north of A14	SB	25603-25602	741	733	-8	-1%	0.3	✓	✓	✓
7	Cambridge Road (between Tesco and A14), Milton	NB	25703-25705	651	660	9	1%	0.4	✓	✓	✓
8	Cambridge Road (between Tesco and A14), Milton	SB	25705-25703	595	592	-3	0%	0.1	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	Horningsea Road (just north of A14), Horningsea	NB	27702-27703	346	350	4	1%	0.2	✓	✓	✓
10	Horningsea Road (just north of A14), Horningsea	SB	27703-27702	182	174	-8	-4%	0.6	✓	✓	✓
11	Newmarket Road (just north of A14)	NB	27803-27811	1544	1515	-30	-2%	0.8	✓	✓	✓
12	Newmarket Road (just north of A14)	SB	27807-27806	535	572	37	7%	1.6	✓	✓	✓

C.3.2. M11 Western Orbital – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A10 (just south of M11), Hauxton	EB	24101-24303	742	778	35	5%	1.3	✓	✓	✓
2	A10 (just south of M11), Hauxton	WB	24303-24101	952	964	12	1%	0.4	✓	✓	✓
3	Cambridge Road (just west of M11), Barton	EB	21404-21501	586	649	63	11%	2.5	✓	✓	✓
4	Cambridge Road (just west of M11), Barton	WB	21501-21404	1248	1245	-2	0%	0.1	✓	✓	✓
5	Grantchester Road	EB	21604-21502	75	130	55	74%	5.5	✓	×	✓
6	Grantchester Road	WB	21502-21604	130	230	100	77%	7.4	✓	×	✓
7	A1303 Madingley Road	EB	21603-14001	508	497	-11	-2%	0.5	✓	✓	✓
8	A1303 Madingley Road	WB	14001-21603	1185	869	-316	-27%	9.9	×	×	×
9	A428, between A1303 and M11-A14	EB	91029-91031	815	794	-21	-3%	0.7	✓	✓	✓
10	A428, between M11-A14 and A1303	WB	91032-91030	1357	1325	-32	-2%	0.9	✓	✓	✓

C.3.3. Cambridge Radial Cordon – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Babraham Rd.	OUT	14714-27611	878	711	-167	-19%	5.9	×	×	×
2	Babraham Rd.	IN	27611-14714	611	603	-8	-1%	0.3	✓	✓	✓
3	Granhams Rd.	IN	27606-27618	115	133	18	15%	1.6	✓	✓	✓
4	Granhams Rd.	OUT	27618-27606	231	216	-15	-6%	1.0	✓	✓	✓
5	Shelford Rd.	OUT	15518-27601	506	480	-26	-5%	1.2	✓	✓	✓
6	Shelford Rd.	IN	27601-15518	508	334	-174	-34%	8.5	×	×	×
7	Hauxton Rd.	OUT	15506-15505	1759	1543	-216	-12%	5.3	✓	×	✓
8	Hauxton Rd.	IN	15504-15506	1081	738	-343	-32%	11.4	×	×	×
9	Coton Rd.	IN	21406-21503	88	242	154	175%	12.0	×	×	×
10	Coton Rd.	OUT	21503-21406	238	490	252	106%	13.2	×	×	×
11	Barton Rd.	IN	21406-21605	499	455	-44	-9%	2.0	✓	✓	✓
12	Barton Rd.	OUT	21605-21406	989	857	-132	-13%	4.4	✓	✓	✓
13	Madingley Rd.	OUT	14003-14002	960	1065	105	11%	3.3	✓	✓	✓
14	Madingley Rd.	IN	14002-14003	409	428	19	5%	0.9	✓	✓	✓
15	Huntingdon Rd.	OUT	20202-23906	679	665	-14	-2%	0.5	✓	✓	✓
16	Huntingdon Rd.	IN	23906-20202	372	366	-6	-2%	0.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
17	Girton Rd.	OUT	20205-23905	264	208	-56	-21%	3.6	✓	✓	✓
18	Girton Rd.	IN	23905-20205	181	180	-1	-1%	0.1	✓	✓	✓
19	Histon Rd.	OUT	24612-20301	1594	1561	-33	-2%	0.8	✓	✓	✓
20	Histon Rd.	IN	20301-24612	1194	1168	-26	-2%	0.8	✓	✓	✓
21	Milton Rd.	IN	20405-20406	498	490	-8	-2%	0.3	✓	✓	✓
22	Milton Rd.	OUT	20406-20405	1772	1818	46	3%	1.1	✓	✓	✓
23	Horningsea Rd.	OUT	27904-27701	685	713	28	4%	1.1	✓	✓	✓
24	Horningsea Rd.	IN	27701-27904	994	644	-350	-35%	12.2	×	×	×
25	Newmarket Rd.	OUT	29010-27801	1603	1587	-16	-1%	0.4	✓	✓	✓
26	Newmarket Rd.	IN	27801-29010	782	804	22	3%	0.8	✓	✓	✓
27	High St. Teversham	OUT	26604-26501	152	144	-8	-5%	0.7	✓	✓	✓
28	High St. Teversham	IN	26501-26604	151	112	-39	-26%	3.4	✓	✓	✓
29	Fulbourn	IN	20104-20102	552	526	-26	-5%	1.1	✓	✓	✓
30	Fulbourn	OUT	20102-20104	634	666	32	5%	1.3	✓	✓	✓
31	Worts' Causeway	OUT	27614-11601	195	222	27	14%	1.9	✓	✓	✓
32	Worts' Causeway	IN	11601-27614	62	65	3	4%	0.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
33	Cherry Hinton Rd. (N)	IN	27611-27613	366	375	9	3%	0.5	✓	✓	✓
34	Cherry Hinton Rd. (N)	OUT	27613-27611	632	736	104	16%	4.0	×	✓	✓

C.3.4. Cambridge Inner Cordon – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A1307 Huntingdon Rd.	IN	11404-11104	510	504	-6	-1%	0.2	✓	✓	✓
2	A1307 Huntingdon Rd.	OUT	11104-11404	843	777	-66	-8%	2.3	✓	✓	✓
3	Histon Rd.	IN	10802-10801	337	334	-3	-1%	0.2	✓	✓	✓
4	Histon Rd.	OUT	10801-10802	602	549	-53	-9%	2.2	✓	✓	✓
5	Harvey Goodwin Avenue	IN	10808-10807	89	70	-19	-21%	2.1	✓	✓	✓
6	Harvey Goodwin Avenue	OUT	10807-10808	118	40	-78	-66%	8.8	✓	×	✓
7	Gilbert Rd.(N)	IN	16207-16210	279	127	-152	-55%	10.7	×	×	×
8	Gilbert Rd.(N)	OUT	16210-16207	361	294	-67	-19%	3.7	✓	✓	✓
9	Highworth Avenue	IN	16303-16405	11	73	62	574%	9.6	✓	×	✓
10	Highworth Avenue	OUT	16405-16303	5	51	46	934%	8.7	✓	×	✓
11	Milton Rd.(N)	IN	16306-16405	736	719	-17	-2%	0.6	✓	✓	✓
12	Milton Rd.(N)	OUT	16405-16306	727	721	-6	-1%	0.2	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
13	High St.	IN	12303-16407	446	438	-8	-2%	0.4	✓	✓	✓
14	High St.	OUT	16407-12303	517	518	1	0%	0.1	✓	✓	✓
15	Newmarket Rd.	IN	10203-10202	1070	828	-241	-23%	7.8	×	×	×
16	Newmarket Rd.	OUT	10202-10203	1163	1135	-28	-2%	0.8	✓	✓	✓
17	Coldhams Ln. / New St.	OUT	12804-10204	173	177	4	2%	0.3	✓	✓	✓
18	Coldhams Ln. / New St.	IN	10204-12804	138	157	19	13%	1.5	✓	✓	✓
19	Mill Rd.	IN	14206-14205	419	314	-105	-25%	5.5	×	×	×
20	Mill Rd.	OUT	14205-14206	483	499	16	3%	0.7	✓	✓	✓
21	Hills Rd.	IN	16104-16011	390	393	4	1%	0.2	✓	✓	✓
22	Hills Rd.	OUT	16011-16104	346	352	6	2%	0.3	✓	✓	✓
23	Panton St. (one-way)	IN	16009-16008	175	390	215	123%	12.8	×	×	×
24	Trumpington Rd. / Lensfield Rd. / Fen Causeway	IN	16003-16002	738	749	11	1%	0.4	✓	✓	✓
25	Trumpington Rd. / Lensfield Rd. / Fen Causeway	OUT	16002-16003	588	609	21	4%	0.9	✓	✓	✓
26	Barton Rd.	IN	13605-13606	441	467	26	6%	1.2	✓	✓	✓
27	Barton Rd.	OUT	13606-13605	912	781	-131	-14%	4.5	✓	✓	✓
28	Madingley Rd.	OUT	11102-14006	575	623	48	8%	1.9	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
29	Madingley Rd.	IN	14006-11102	536	561	25	5%	1.1	✓	✓	✓

C.3.5. River Cam Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	825	827	3	0%	0.1	✓	✓	✓
2	Fen Causeway	WB	13201-13610	813	743	-70	-9%	2.5	✓	✓	✓
3	Silver St	EB	13907-13101	42	7	-35	-82%	6.9	✓	×	✓
4	Silver St	WB	13101-13907	339	329	-9	-3%	0.5	✓	✓	✓
5	Bridge St	WB	13001-11002	97	186	89	92%	7.5	✓	×	✓
6	Bridge St	EB	11002-13001	45	197	152	340%	13.8	×	×	×
7	Victoria Ave	WB	12901-16209	566	524	-42	-7%	1.8	✓	✓	✓
8	Victoria Ave	EB	16209-12901	630	438	-192	-30%	8.3	×	×	×
9	Elizabeth Way	WB	12909-16502	1023	1003	-19	-2%	0.6	✓	✓	✓
10	Elizabeth Way	EB	16502-12909	837	904	67	8%	2.3	✓	✓	✓

C.3.6. County East-West Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	South of Sawtry	NB	94004-94014	3279	3376	97	3%	1.7	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
2	South of Sawtry	SB	94014-94004	2420	2419	-1	0%	0.0	✓	✓	✓
3	Warboys - Ramsey	NB	57603-57702	521	518	-3	-1%	0.1	✓	✓	✓
4	Warboys - Ramsey	SB	57702-57603	263	274	11	4%	0.7	✓	✓	✓
5	South of Sawtry Relief Road	NB	56801-94003	153	107	-46	-30%	4.0	✓	✓	✓
6	South of Sawtry Relief Road	SB	94003-56801	213	159	-54	-25%	3.9	✓	✓	✓
7	Chatteris - Somersham	NB	57002-70103	205	212	7	3%	0.5	✓	✓	✓
8	Chatteris - Somersham	SB	70103-57002	60	60	0	0%	0.0	✓	✓	✓
9	Chatteris - Mepal	NB	41601-70103	937	963	26	3%	0.8	✓	✓	✓
10	Chatteris - Mepal	SB	70103-41601	482	479	-3	-1%	0.2	✓	✓	✓
11	Ely Littleport Bypass	NB	40402-40411	669	650	-19	-3%	0.7	✓	✓	✓
12	Ely Littleport Bypass	SB	40411-40402	486	504	18	4%	0.8	✓	✓	✓
13	Chettisham	NB	40302-41305	245	253	8	3%	0.5	✓	✓	✓
14	Chettisham	SB	41305-40302	108	209	101	94%	8.0	×	×	×
15	Queen Adelaide	NB	40601-41306	326	358	32	10%	1.7	✓	✓	✓
16	Queen Adelaide	SB	41306-40601	136	137	1	1%	0.1	✓	✓	✓

C.3.7. Huntingdon North – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Spittals Way	NB	55203-50301	987	698	-290	-29%	10.0	✗	✗	✗
2	Spittals Way	SB	50301-55203	744	824	80	11%	2.9	✓	✓	✓
3	St. Peters Rd., Huntingdon	NB	53503-53502	981	959	-22	-2%	0.7	✓	✓	✓
4	St. Peters Rd., Huntingdon	SB	53502-53503	811	785	-26	-3%	0.9	✓	✓	✓
5	A141 between Kings Ripton Rd. and A1123	SB	53403-52910	823	719	-103	-13%	3.7	✓	✓	✓
6	A141 between Kings Ripton Rd. and A1123	NB	52910-53403	596	631	36	6%	1.4	✓	✓	✓
7	A141 South OF B1090	NB	52910-57502	919	828	-91	-10%	3.1	✓	✓	✓
8	A141 South OF B1090	SB	57502-52910	629	628	-1	0%	0.0	✓	✓	✓

C.3.8. Huntingdon South-East – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	A14, between J24 and J23	WB	92011-92106	2996	3041	46	2%	0.8	✓	✓	✓
2	A14, between J23 and J24	EB	92108-92012	2725	2855	130	5%	2.5	✓	✓	✓
3	Castle Moat Rd.	WB	52705-52703	1542	1531	-11	-1%	0.3	✓	✓	✓
4	Nursery Rd.	EB	53103-53104	1897	1735	-162	-9%	3.8	✓	✓	✓
5	Hartford Rd.	WB	53106-52911	1006	910	-96	-10%	3.1	✓	✓	✓
6	Hartford Rd.	EB	52911-53106	643	625	-18	-3%	0.7	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
7	Huntingdon Rd. A1123	EB	52910-59601	922	757	-165	-18%	5.7	×	×	×
8	Huntingdon Rd. A1123	WB	59601-52910	672	716	44	7%	1.7	✓	✓	✓

C.3.9. St. Ives Cordon – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Houghton Hill Road A1123	IN	52910-59601	844	757	-87	-10%	3.1	✓	✓	✓
2	Houghton Hill Road A1123	OUT	59601-52910	685	716	31	5%	1.2	✓	✓	✓
3	Sawtry Way B1090	OUT	59601-59610	262	269	7	3%	0.5	✓	✓	✓
4	Sawtry Way B1090	IN	59610-59601	301	255	-46	-15%	2.7	✓	✓	✓
5	Somersham Road B1040	OUT	56008-56904	695	717	22	3%	0.8	✓	✓	✓
6	Somersham Road B1040	IN	56904-56008	302	299	-3	-1%	0.2	✓	✓	✓
7	Needingworth Road A1123	OUT	51302-51308	848	858	10	1%	0.3	✓	✓	✓
8	Needingworth Road A1123	IN	51308-51302	558	564	7	1%	0.3	✓	✓	✓
9	Harrison Way A1096	IN	51805-56101	1217	1247	31	3%	0.9	✓	✓	✓
10	Harrison Way A1096	OUT	56101-51805	934	924	-10	-1%	0.3	✓	✓	✓

C.3.10. St. Ives East-West Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Hill Rise	WB	56303-56001	330	325	-6	-2%	0.3	✓	✓	✓
2	Hill Rise	EB	56001-56303	377	416	38	10%	1.9	✓	✓	✓
3	Ramsey Road	WB	56003-56002	267	108	-158	-59%	11.6	×	×	×
4	Ramsey Road	EB	56002-56003	261	60	-201	-77%	15.9	×	×	×
5	Somersham Road	WB	56208-51301	873	907	33	4%	1.1	✓	✓	✓
6	Somersham Road	EB	51301-56208	640	631	-8	-1%	0.3	✓	✓	✓

C.3.11. St. Neots Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	245	246	1	1%	0.1	✓	✓	✓
2	Potton Road	EB	56602-58801	130	128	-2	-1%	0.1	✓	✓	✓
3	A428, between B1043 and B1428	EB	91002-91003	847	727	-120	-14%	4.3	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	789	793	3	0%	0.1	✓	✓	✓
5	Cambridge Road	EB	56604-59701	273	270	-3	-1%	0.2	✓	✓	✓
6	Cambridge Road	WB	59701-56604	475	472	-3	-1%	0.2	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	371	362	-9	-2%	0.5	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	482	479	-3	-1%	0.2	✓	✓	✓

C.3.12. Ely Cordon – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road	IN	40204-40702	607	476	-131	-22%	5.6	×	×	×
2	Cambridge Road	OUT	40702-40204	144	158	14	10%	1.2	✓	✓	✓
3	Witchford Road	IN	40203-40702	283	286	3	1%	0.2	✓	✓	✓
4	Witchford Road	OUT	40702-40203	459	336	-123	-27%	6.1	×	×	×
5	West Fen Road	IN	40701-40406	91	108	17	18%	1.7	✓	✓	✓
6	West Fen Road	OUT	40406-40701	39	26	-13	-32%	2.2	✓	✓	✓
7	Downham Road	OUT	40403-40402	429	442	13	3%	0.6	✓	✓	✓
8	Downham Road	IN	40402-40403	396	401	5	1%	0.2	✓	✓	✓
9	Lynn Road	OUT	40302-41305	330	253	-77	-23%	4.5	✓	✓	✓
10	Lynn Road	IN	41305-40302	270	209	-61	-23%	3.9	✓	✓	✓
11	Kings Avenue	OUT	40302-40305	184	260	75	41%	5.1	✓	×	✓
12	Kings Avenue	IN	40305-40302	164	228	64	39%	4.6	✓	✓	✓
13	Prickwillow Road	OUT	40102-40304	279	26	-253	-91%	20.5	×	×	×
14	Prickwillow Road	IN	40304-40102	218	40	-178	-82%	15.7	×	×	×
15	Station Road	IN	40501-40512	639	401	-238	-37%	10.5	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
16	Station Road	OUT	40512-40501	584	908	324	56%	11.9	×	×	×

C.3.13. A14 South – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	The Avenue	NB	21708-23901	83	110	27	33%	2.8	✓	✓	✓
2	The Avenue	SB	23901-21708	140	135	-6	-4%	0.5	✓	✓	✓
3	Oakington Road	NB	21109-21110	324	325	1	0%	0.1	✓	✓	✓
4	Oakington Road	SB	21110-21109	254	255	1	0%	0.1	✓	✓	✓
5	A14 Junction 29 On Slip (Northbound)	NB	21002-92118	278	280	1	0%	0.1	✓	✓	✓
6	A14 Junction 29 Off Slip (Northbound)	SB	92118-21002	1239	1238	-1	0%	0.0	✓	✓	✓
7	B1050	NB	21001-25102	1530	1518	-12	-1%	0.3	✓	✓	✓
8	B1050	SB	25102-21001	350	361	10	3%	0.6	✓	✓	✓
9	High Street	NB	28602-28606	1	0	-1	-100%	1.1	✓	✓	✓
10	High Street	SB	28606-28602	3	5	2	75%	1.1	✓	✓	✓
11	Conington Road	NB	51809-51812	163	184	20	13%	1.6	✓	✓	✓
12	Conington Road	SB	51812-51809	76	72	-4	-5%	0.4	✓	✓	✓
13	Potton Road	NB	58801-56602	245	246	1	1%	0.1	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
14	Potton Road	SB	56602-58801	130	128	-2	-1%	0.1	✓	✓	✓
15	A1198	NB	52112-52113	763	740	-23	-3%	0.8	✓	✓	✓
16	A1198	SB	52113-52112	528	528	-1	0%	0.0	✓	✓	✓

C.3.14. A14 North – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Cambridge Road B1044	NB	51902-51903	513	528	14	3%	0.6	✓	✓	✓
2	Cambridge Road B1044	SB	51903-51902	572	601	29	5%	1.2	✓	✓	✓
3	A1096 London Road	NB	51801-51804	596	807	211	35%	8.0	×	×	×
4	A1096 London Road	SB	51804-51801	756	717	-39	-5%	1.4	✓	✓	✓
5	Huntingdon Road	SB	51807-51802	58	56	-3	-5%	0.4	✓	✓	✓
6	A14 off-slip north of Fenstanton	SB	92035-51807	114	69	-45	-40%	4.7	✓	✓	✓
7	High Street	NB	51812-51813	553	547	-5	-1%	0.2	✓	✓	✓
8	High Street	SB	51813-51812	93	207	114	122%	9.3	×	×	×
9	A14 On Slip, Fenstanton	SB	28605-92040	207	206	-1	-1%	0.1	✓	✓	✓
10	Cambridge Road	NB	26102-26103	103	106	3	3%	0.3	✓	✓	✓
11	Cambridge Road	SB	26103-26102	2	0	-2	-100%	2.2	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
12	Bucking Way Road	NB	26401-26402	310	312	2	1%	0.1	✓	✓	✓
13	Bucking Way Road	SB	26402-26401	391	415	24	6%	1.2	✓	✓	✓
14	B1050	NB	21001-25102	1530	1518	-12	-1%	0.3	✓	✓	✓
15	B1050	SB	25102-21001	350	361	10	3%	0.6	✓	✓	✓
16	A14 Junction 29 Off Slip (Southbound)	NB	25104-25106	251	249	-2	-1%	0.1	✓	✓	✓
17	A14 Junction 29 On Slip (Southbound)	SB	25106-25104	777	902	125	16%	4.3	×	✓	✓
18	Dry Drayton Road	NB	23203-23205	458	468	10	2%	0.5	✓	✓	✓
19	Dry Drayton Road	SB	23205-23203	375	366	-9	-2%	0.5	✓	✓	✓

C.4. 2015 Flow Validation Screenlines

C.4.1. County North-South Screenline - AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Carters Bridge	EB	57702-70102	201	150	-51	-25%	3.8	✓	✓	✓
2	Carters Bridge	WB	70102-57702	211	204	-7	-3%	0.5	✓	✓	✓
3	Chatteris - Warboys	EB	57605-70101	304	261	-43	-14%	2.5	✓	✓	✓
4	Chatteris - Warboys	WB	70101-57605	655	661	6	1%	0.2	✓	✓	✓
5	Somersham	EB	57001-57002	251	266	15	6%	0.9	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
6	Somersham	WB	57002-57001	442	357	-85	-19%	4.2	✓	✓	✓
7	Bluntisham	EB	51401-58401	362	276	-86	-24%	4.8	✓	✓	✓
8	Bluntisham	WB	58401-51401	528	597	69	13%	2.9	✓	✓	✓
9	Swavesey Rd, East	EB	26103-26405	89	82	-7	-8%	0.8	✓	✓	✓
10	Swavesey Rd, West	WB	26405-26103	179	133	-47	-26%	3.8	✓	✓	✓
11	Swavesey	WB	92110-92044	2258	2459	201	9%	4.1	✓	✓	✓
12	Swavesey	EB	92047-92111	2421	2110	-311	-13%	6.5	✓	×	✓
13	High Street, Boxworth	EB	21303-21307	157	182	25	16%	1.9	✓	✓	✓
14	High Street, Boxworth	WB	21307-21303	128	130	3	2%	0.2	✓	✓	✓
15	A428 Cambridge Rd	EB	26208-22801	226	255	29	13%	1.9	✓	✓	✓
16	A428 Cambridge Rd	WB	22801-26208	186	118	-68	-37%	5.5	✓	×	✓
17	Bourn Airfield	EB	91016-91017	1981	1825	-156	-8%	3.6	✓	✓	✓
18	Bourn Airfield	WB	91018-91015	1155	1240	85	7%	2.5	✓	✓	✓
19	Bourn	EB	22303-22501	209	304	95	45%	5.9	✓	×	✓
20	Bourn	WB	22501-22303	159	250	91	57%	6.4	✓	×	✓
21	Orwell	EB	25901-25902	813	511	-302	-37%	11.7	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
22	Orwell	WB	25902-25901	319	326	7	2%	0.4	✓	✓	✓
23	Meldreth	EB	25401-25202	127	262	135	107%	9.7	×	×	×
24	Meldreth	WB	25202-25401	107	223	116	108%	9.0	×	×	×
25	Melbourn Bypass	EB	25402-25502	520	605	85	16%	3.6	✓	✓	✓
26	Melbourn Bypass	WB	25502-25402	550	563	13	2%	0.5	✓	✓	✓
27	West of Flint Cross	EB	72704-25201	859	1130	271	32%	8.6	×	×	×
28	West of Flint Cross	WB	25201-72704	729	759	30	4%	1.1	✓	✓	✓

C.4.2. County North-South Screenline - IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Carters Bridge	EB	57702-70102	111	111	0	0%	0.0	✓	✓	✓
2	Carters Bridge	WB	70102-57702	110	81	-28	-26%	2.9	✓	✓	✓
3	Chatteris - Warboys	EB	57605-70101	276	192	-84	-30%	5.5	✓	×	✓
4	Chatteris - Warboys	WB	70101-57605	280	198	-82	-29%	5.3	✓	×	✓
5	Somersham	EB	57001-57002	210	223	13	6%	0.9	✓	✓	✓
6	Somersham	WB	57002-57001	209	218	9	4%	0.6	✓	✓	✓
7	Bluntisham	EB	51401-58401	259	333	74	28%	4.3	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
8	Bluntisham	WB	58401-51401	251	333	82	33%	4.8	✓	✓	✓
9	Swavesey Rd, East	EB	26103-26405	58	43	-15	-26%	2.1	✓	✓	✓
10	Swavesey Rd, West	WB	26405-26103	70	73	3	4%	0.3	✓	✓	✓
11	Swavesey	WB	92110-92044	2478	2174	-304	-12%	6.3	✓	×	✓
12	Swavesey	EB	92047-92111	2229	2124	-106	-5%	2.3	✓	✓	✓
13	High Street, Boxworth	EB	21303-21307	58	82	23	40%	2.8	✓	✓	✓
14	High Street, Boxworth	WB	21307-21303	60	76	16	26%	1.9	✓	✓	✓
15	A428 Cambridge Rd	EB	26208-22801	121	109	-12	-10%	1.1	✓	✓	✓
16	A428 Cambridge Rd	WB	22801-26208	121	64	-57	-47%	6.0	✓	×	✓
17	Bourn Airfield	EB	91016-91017	825	897	73	9%	2.5	✓	✓	✓
18	Bourn Airfield	WB	91018-91015	853	985	132	15%	4.3	×	✓	✓
19	Bourn	EB	22303-22501	82	103	21	26%	2.2	✓	✓	✓
20	Bourn	WB	22501-22303	79	163	84	106%	7.6	✓	×	✓
21	Orwell	EB	25901-25902	265	235	-30	-11%	1.9	✓	✓	✓
22	Orwell	WB	25902-25901	251	192	-59	-24%	4.0	✓	✓	✓
23	Meldreth	EB	25401-25202	64	128	64	101%	6.6	✓	×	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
24	Meldreth	WB	25202-25401	70	127	57	81%	5.7	✓	×	✓
25	Melbourn Bypass	EB	25402-25502	449	295	-154	-34%	8.0	×	×	×
26	Melbourn Bypass	WB	25502-25402	430	300	-130	-30%	6.8	×	×	×
27	West of Flint Cross	EB	72704-25201	443	599	156	35%	6.8	×	×	×
28	West of Flint Cross	WB	25201-72704	440	575	135	31%	6.0	×	×	×

C.4.3. County North-South Screenline - PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Carters Bridge	EB	57702-70102	274	275	1	0%	0.0	✓	✓	✓
2	Carters Bridge	WB	70102-57702	244	140	-104	-43%	7.5	×	×	×
3	Chatteris - Warboys	EB	57605-70101	708	751	43	6%	1.6	✓	✓	✓
4	Chatteris - Warboys	WB	70101-57605	302	426	124	41%	6.5	×	×	×
5	Somersham	EB	57001-57002	497	375	-122	-25%	5.9	×	×	×
6	Somersham	WB	57002-57001	333	292	-41	-12%	2.3	✓	✓	✓
7	Bluntisham	EB	51401-58401	563	612	49	9%	2.0	✓	✓	✓
8	Bluntisham	WB	58401-51401	432	389	-43	-10%	2.1	✓	✓	✓
9	Swavesey Rd, East	EB	26103-26405	138	113	-25	-18%	2.2	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
10	Swavesey Rd, West	WB	26405-26103	120	209	89	75%	7.0	✓	×	✓
11	Swavesey	WB	92110-92044	2411	2762	351	15%	6.9	✓	×	✓
12	Swavesey	EB	92047-92111	2190	2545	355	16%	7.3	×	×	×
13	High Street, Boxworth	EB	21303-21307	132	149	17	13%	1.4	✓	✓	✓
14	High Street, Boxworth	WB	21307-21303	128	138	10	8%	0.9	✓	✓	✓
15	A428 Cambridge Rd	EB	26208-22801	175	166	-9	-5%	0.7	✓	✓	✓
16	A428 Cambridge Rd	WB	22801-26208	203	154	-50	-24%	3.7	✓	✓	✓
17	Bourn Airfield	EB	91016-91017	1253	1268	15	1%	0.4	✓	✓	✓
18	Bourn Airfield	WB	91018-91015	2301	2024	-277	-12%	5.9	✓	×	✓
19	Bourn	EB	22303-22501	132	189	57	43%	4.5	✓	✓	✓
20	Bourn	WB	22501-22303	148	417	269	182%	16.0	×	×	×
21	Orwell	EB	25901-25902	334	367	33	10%	1.8	✓	✓	✓
22	Orwell	WB	25902-25901	603	467	-136	-22%	5.9	×	×	×
23	Meldreth	EB	25401-25202	113	209	96	85%	7.6	✓	×	✓
24	Meldreth	WB	25202-25401	147	242	95	65%	6.8	✓	×	✓
25	Melbourn Bypass	EB	25402-25502	471	489	18	4%	0.8	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
26	Melbourn Bypass	WB	25502-25402	657	726	69	10%	2.6	✓	✓	✓
27	West of Flint Cross	EB	72704-25201	686	1007	321	47%	11.0	×	×	×
28	West of Flint Cross	WB	25201-72704	851	829	-22	-3%	0.8	✓	✓	✓

C.5. 2019 PYV Traffic Counts - AM

C.5.1. River Cam Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	660	819	159	24%	5.9	×	×	×
2	Fen Causeway	WB	13201-13610	711	789	78	11%	2.8	✓	✓	✓
3	Silver St	EB	13907-13101	457	708	251	55%	10.4	×	×	×
4	Silver St	WB	13101-13907	57	8	-49	-86%	8.6	✓	×	✓
5	Bridge St	WB	13001-11002	61	102	41	66%	4.5	✓	✓	✓
6	Bridge St	EB	11002-13001	70	227	157	224%	12.9	×	×	×
7	Victoria Ave	WB	12901-16209	357	478	121	34%	5.9	×	×	×
8	Victoria Ave	EB	16209-12901	465	694	229	49%	9.5	×	×	×
9	Elizabeth Way	WB	12909-16502	890	712	-178	-20%	6.3	×	×	×
10	Elizabeth Way	EB	16502-12909	1103	1021	-82	-7%	2.5	✓	✓	✓

C.5.2. St. Neots Screenline – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	124	153	29	23%	2.4	✓	✓	✓
2	Potton Road	EB	56602-58801	448	445	-3	-1%	0.1	✓	✓	✓
3	A428, between B1043 and B1428	EB	91002-91003	600	664	64	11%	2.6	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	692	695	2	0%	0.1	✓	✓	✓
5	Cambridge Road	EB	56604-59701	284	410	126	44%	6.7	×	×	×
6	Cambridge Road	WB	59701-56604	275	272	-3	-1%	0.2	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	518	503	-15	-3%	0.7	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	448	503	55	12%	2.5	✓	✓	✓

C.5.3. Other Counts – AM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Girton Rd	NB	20205-23905	77	155	78	102%	7.3	✓	×	✓
2	Girton Rd	SB	23905-20205	454	360	-94	-21%	4.7	✓	✓	✓
3	A428, between A1303 and M11-A14	EB	91029-91031	1061	1541	481	45%	13.3	×	×	×
4	A428, between M11-A14 and A1303	WB	91032-91030	722	706	-16	-2%	0.6	✓	✓	✓
5	Babraham Rd	OUT	14714-27611	610	441	-169	-28%	7.4	×	×	×
6	Babraham Rd	IN	27611-14714	387	765	378	98%	15.7	×	×	×
7	Granhams Rd	IN	27606-27618	213	170	-43	-20%	3.1	✓	✓	✓
8	Granhams Rd	OUT	27618-27606	69	95	26	37%	2.8	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
9	Shelford Rd	OUT	15518-27601	494	321	-173	-35%	8.6	×	×	×
10	Shelford Rd	IN	27601-15518	455	592	137	30%	6.0	×	×	×
11	Hauxton Rd	OUT	15506-15505	804	689	-115	-14%	4.2	✓	✓	✓
12	Hauxton Rd	IN	15504-15506	2048	1883	-165	-8%	3.7	✓	✓	✓
13	Coton Rd	IN	21406-21503	397	292	-105	-26%	5.6	×	×	×
14	Coton Rd	OUT	21503-21406	83	82	-1	-1%	0.1	✓	✓	✓
15	Barton Rd	IN	21406-21605	676	819	143	21%	5.2	×	×	×
16	Barton Rd	OUT	21605-21406	343	281	-62	-18%	3.5	✓	✓	✓
17	Madingley Rd	OUT	14003-14002	418	333	-85	-20%	4.4	✓	✓	✓
18	Madingley Rd	IN	14002-14003	1174	904	-270	-23%	8.4	×	×	×
19	Huntingdon Rd	OUT	20202-23906	245	200	-45	-18%	3.0	✓	✓	✓
20	Huntingdon Rd	IN	23906-20202	464	604	140	30%	6.0	×	×	×
21	Girton Rd	OUT	20205-23905	77	155	78	102%	7.3	✓	×	✓
22	Girton Rd	IN	23905-20205	454	360	-94	-21%	4.7	✓	✓	✓
23	Histon Rd	OUT	24612-20301	923	848	-75	-8%	2.5	✓	✓	✓
24	Histon Rd	IN	20301-24612	1453	1826	373	26%	9.2	×	×	×
25	Milton Rd	IN	20405-20406	2049	2356	307	15%	6.5	✓	×	✓
26	Milton Rd	OUT	20406-20405	647	473	-174	-27%	7.4	×	×	×
27	Horningsea Rd	OUT	27904-27701	745	604	-141	-19%	5.4	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
28	Horningsea Rd	IN	27701-27904	712	633	-79	-11%	3.1	✓	✓	✓
29	Newmarket Rd	OUT	29010-27801	547	410	-137	-25%	6.3	×	×	×
30	Newmarket Rd	IN	27801-29010	1337	1449	112	8%	3.0	✓	✓	✓
31	High St Teversham	OUT	26604-26501	96	55	-41	-43%	4.7	✓	✓	✓
32	High St Teversham	IN	26501-26604	257	280	23	9%	1.4	✓	✓	✓
33	Fulbourn	IN	20104-20102	739	734	-5	-1%	0.2	✓	✓	✓
34	Fulbourn	OUT	20102-20104	507	486	-21	-4%	0.9	✓	✓	✓
35	St Peters Rd	NB	53503-53502	659	637	-22	-3%	0.9	✓	✓	✓
36	St Peters Rd	SB	53502-53503	729	768	39	5%	1.4	✓	✓	✓
37	A14, between J24 and J23	WB	92011-92106	2759	2790	31	1%	0.6	✓	✓	✓
38	A14, between J23 and J24	EB	92108-92012	1926	2220	293	15%	6.4	×	×	×
39	Cambridge Rd	IN	40204-40702	241	198	-43	-18%	2.9	✓	✓	✓
40	Cambridge Rd	OUT	40702-40204	283	348	65	23%	3.7	✓	✓	✓
41	Witchford Rd	IN	40203-40702	285	356	71	25%	3.9	✓	✓	✓
42	Witchford Rd	OUT	40702-40203	436	244	-192	-44%	10.4	×	×	×
43	West Fen Rd	IN	40701-40406	96	159	63	66%	5.6	✓	×	✓
44	West Fen Rd	OUT	40406-40701	51	79	28	55%	3.5	✓	✓	✓
45	Downham Road	OUT	40403-40402	453	429	-24	-5%	1.1	✓	✓	✓
46	Downham Road	IN	40402-40403	622	519	-103	-17%	4.3	×	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
47	Lynn Rd	OUT	40302-40414	277	52	-225	-81%	17.5	×	×	×
48	Lynn Rd	IN	40414-40302	334	166	-168	-50%	10.7	×	×	×
49	Prickwillow Rd	OUT	40102-40304	133	19	-114	-86%	13.1	×	×	×
50	Prickwillow Rd	IN	40304-40102	203	100	-103	-51%	8.3	×	×	×
51	Station Rd	IN	40501-40512	456	704	248	54%	10.3	×	×	×
52	Station Rd	OUT	40512-40501	485	496	11	2%	0.5	✓	✓	✓
53	Potton Rd	NB	58801-59807	124	153	29	23%	2.4	✓	✓	✓
54	Potton Rd	SB	59807-58801	448	445	-3	-1%	0.1	✓	✓	✓

C.6. 2019 PYV Traffic Counts - IP

C.6.1. River Cam Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	741	843	102	14%	3.6	✓	✓	✓
2	Fen Causeway	WB	13201-13610	831	814	-16	-2%	0.6	✓	✓	✓
3	Silver St	EB	13907-13101	81	10	-71	-88%	10.6	✓	×	✓
4	Silver St	WB	13101-13907	86	10	-76	-88%	10.9	✓	×	✓
5	Bridge St	WB	13001-11002	90	144	54	60%	5.0	✓	✓	✓
6	Bridge St	EB	11002-13001	74	199	125	170%	10.7	×	×	×
7	Victoria Ave	WB	12901-16209	457	426	-30	-7%	1.4	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
8	Victoria Ave	EB	16209-12901	367	425	58	16%	2.9	✓	✓	✓
9	Elizabeth Way	WB	12909-16502	1002	848	-154	-15%	5.1	×	×	×
10	Elizabeth Way	EB	16502-12909	1095	1007	-89	-8%	2.7	✓	✓	✓

C.6.2. St. Neots Screenline – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	131	127	-5	-3%	0.4	✓	✓	✓
2	Potton Road	EB	56602-58801	121	101	-19	-16%	1.8	✓	✓	✓
3	A428, between B1043 and B1428	EB	91002-91003	645	545	-100	-15%	4.1	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	635	587	-47	-7%	1.9	✓	✓	✓
5	Cambridge Road	EB	56604-59701	239	239	1	0%	0.1	✓	✓	✓
6	Cambridge Road	WB	59701-56604	291	256	-35	-12%	2.1	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	248	234	-13	-5%	0.9	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	253	228	-25	-10%	1.6	✓	✓	✓

C.6.3. Other Counts – IP

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Girton Rd	NB	20205-23905	141	177	36	25%	2.8	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
2	Girton Rd	SB	23905-20205	184	163	-21	-12%	1.6	✓	✓	✓
3	A428, between A1303 and M11-A14	EB	91029-91031	607	568	-39	-6%	1.6	✓	✓	✓
4	A428, between M11-A14 and A1303	WB	91032-91030	684	599	-85	-12%	3.4	✓	✓	✓
5	Babraham Rd	OUT	14714-27611	516	389	-127	-25%	6.0	×	×	×
6	Babraham Rd	IN	27611-14714	509	431	-78	-15%	3.6	✓	✓	✓
7	Granhams Rd	IN	27606-27618	113	98	-14	-12%	1.4	✓	✓	✓
8	Granhams Rd	OUT	27618-27606	123	86	-37	-30%	3.6	✓	✓	✓
9	Shelford Rd	OUT	15518-27601	399	293	-106	-27%	5.7	×	×	×
10	Shelford Rd	IN	27601-15518	412	291	-121	-29%	6.5	×	×	×
11	Hauxton Rd	OUT	15506-15505	1013	829	-185	-18%	6.1	×	×	×
12	Hauxton Rd	IN	15504-15506	955	922	-33	-3%	1.1	✓	✓	✓
13	Coton Rd	IN	21406-21503	88	217	129	147%	10.5	×	×	×
14	Coton Rd	OUT	21503-21406	89	164	75	84%	6.7	✓	×	✓
15	Barton Rd	IN	21406-21605	424	514	90	21%	4.2	✓	✓	✓
16	Barton Rd	OUT	21605-21406	394	447	53	14%	2.6	✓	✓	✓
17	Madingley Rd	OUT	14003-14002	542	469	-73	-13%	3.2	✓	✓	✓
18	Madingley Rd	IN	14002-14003	519	559	40	8%	1.7	✓	✓	✓
19	Huntingdon Rd	OUT	20202-23906	271	276	6	2%	0.4	✓	✓	✓
20	Huntingdon Rd	IN	23906-20202	165	256	91	56%	6.3	✓	×	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
21	Girton Rd	OUT	20205-23905	141	177	36	25%	2.8	✓	✓	✓
22	Girton Rd	IN	23905-20205	184	163	-21	-12%	1.6	✓	✓	✓
23	Histon Rd	OUT	24612-20301	755	682	-73	-10%	2.7	✓	✓	✓
24	Histon Rd	IN	20301-24612	655	780	125	19%	4.7	×	✓	✓
25	Milton Rd	IN	20405-20406	860	896	36	4%	1.2	✓	✓	✓
26	Milton Rd	OUT	20406-20405	959	913	-46	-5%	1.5	✓	✓	✓
27	Horningsea Rd	OUT	27904-27701	578	382	-195	-34%	8.9	×	×	×
28	Horningsea Rd	IN	27701-27904	484	450	-33	-7%	1.5	✓	✓	✓
29	Newmarket Rd	OUT	29010-27801	787	702	-85	-11%	3.1	✓	✓	✓
30	Newmarket Rd	IN	27801-29010	712	858	146	20%	5.2	×	×	×
31	High St Teversham	OUT	26604-26501	90	79	-11	-12%	1.2	✓	✓	✓
32	High St Teversham	IN	26501-26604	89	98	9	10%	1.0	✓	✓	✓
33	Fulbourn	IN	20104-20102	296	356	60	20%	3.3	✓	✓	✓
34	Fulbourn	OUT	20102-20104	319	426	107	34%	5.5	×	×	×
35	St Peters Rd	NB	53503-53502	776	599	-176	-23%	6.7	×	×	×
36	St Peters Rd	SB	53502-53503	700	574	-126	-18%	5.0	×	✓	✓
37	A14, between J24 and J23	WB	92011-92106	2586	2427	-159	-6%	3.2	✓	✓	✓
38	A14, between J23 and J24	EB	92108-92012	2209	2227	18	1%	0.4	✓	✓	✓
39	Cambridge Rd	IN	40204-40702	269	385	116	43%	6.4	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
40	Cambridge Rd	OUT	40702-40204	181	280	99	55%	6.5	✓	×	✓
41	Witchford Rd	IN	40203-40702	302	243	-60	-20%	3.6	✓	✓	✓
42	Witchford Rd	OUT	40702-40203	312	229	-83	-27%	5.1	✓	×	✓
43	West Fen Rd	IN	40701-40406	78	130	52	67%	5.1	✓	×	✓
44	West Fen Rd	OUT	40406-40701	51	48	-3	-6%	0.4	✓	✓	✓
45	Downham Road	OUT	40403-40402	417	321	-96	-23%	5.0	✓	×	✓
46	Downham Road	IN	40402-40403	358	270	-88	-25%	5.0	✓	✓	✓
47	Lynn Rd	OUT	40302-40414	257	15	-243	-94%	20.8	×	×	×
48	Lynn Rd	IN	40414-40302	245	22	-223	-91%	19.3	×	×	×
49	Prickwillow Rd	OUT	40102-40304	201	57	-144	-72%	12.7	×	×	×
50	Prickwillow Rd	IN	40304-40102	155	79	-76	-49%	7.0	✓	×	✓
51	Station Rd	IN	40501-40512	478	585	107	22%	4.6	×	✓	✓
52	Station Rd	OUT	40512-40501	537	590	53	10%	2.2	✓	✓	✓
53	Potton Rd	NB	58801-59807	131	127	-5	-3%	0.4	✓	✓	✓
54	Potton Rd	SB	59807-58801	121	101	-19	-16%	1.8	✓	✓	✓

C.7. 2019 PYV Traffic Counts - PM

C.7.1. River Cam Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Fen Causeway	EB	13610-13201	708	860	152	21%	5.4	✓	✓	✓
2	Fen Causeway	WB	13201-13610	826	781	-45	-5%	1.6	×	×	×
3	Silver St	EB	13907-13101	66	8	-58	-87%	9.5	✓	✓	✓
4	Silver St	WB	13101-13907	280	306	26	9%	1.5	✓	×	✓
5	Bridge St	WB	13001-11002	114	185	71	63%	5.8	✓	✓	✓
6	Bridge St	EB	11002-13001	69	207	138	200%	11.7	✓	×	✓
7	Victoria Ave	WB	12901-16209	555	645	90	16%	3.7	×	×	×
8	Victoria Ave	EB	16209-12901	395	396	1	0%	0.1	✓	✓	✓
9	Elizabeth Way	WB	12909-16502	1106	1051	-55	-5%	1.7	✓	✓	✓
10	Elizabeth Way	EB	16502-12909	1140	942	-198	-17%	6.1	✓	✓	✓

C.7.2. St. Neots Screenline – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Potton Road	WB	58801-56602	310	336	26	8%	1.4	✓	✓	✓
2	Potton Road	EB	56602-58801	153	148	-5	-3%	0.4	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
3	A428, between B1043 and B1428	EB	91002-91003	804	762	-41	-5%	1.5	✓	✓	✓
4	A428, between B1428 and B1043	WB	91003-91002	688	829	141	20%	5.1	×	×	×
5	Cambridge Road	EB	56604-59701	241	324	83	34%	4.9	✓	✓	✓
6	Cambridge Road	WB	59701-56604	583	494	-89	-15%	3.8	✓	✓	✓
7	Huntingdon Road	EB	56608-51105	377	451	74	20%	3.6	✓	✓	✓
8	Huntingdon Road	WB	51105-56608	525	577	52	10%	2.2	✓	✓	✓

C.7.3. Other Counts – PM

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
1	Girton Rd	NB	20205-23905	319	288	-31	-10%	1.8	✓	✓	✓
2	Girton Rd	SB	23905-20205	151	219	68	45%	5.0	✓	×	✓
3	A428, between A1303 and M11-A14	EB	91029-91031	896	666	-229	-26%	8.2	×	×	×
4	A428, between M11-A14 and A1303	WB	91032-91030	1362	1371	9	1%	0.2	✓	✓	✓
5	Babraham Rd	OUT	14714-27611	688	716	28	4%	1.1	✓	✓	✓
6	Babraham Rd	IN	27611-14714	600	666	66	11%	2.6	✓	✓	✓
7	Granhams Rd	IN	27606-27618	117	161	44	37%	3.7	✓	✓	✓
8	Granhams Rd	OUT	27618-27606	170	245	75	44%	5.2	✓	×	✓
9	Shelford Rd	OUT	15518-27601	613	476	-137	-22%	5.9	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
10	Shelford Rd	IN	27601-15518	556	383	-173	-31%	8.0	×	×	×
11	Hauxton Rd	OUT	15506-15505	1801	1632	-169	-9%	4.1	✓	✓	✓
12	Hauxton Rd	IN	15504-15506	1129	855	-274	-24%	8.7	×	×	×
13	Coton Rd	IN	21406-21503	91	274	183	201%	13.5	×	×	×
14	Coton Rd	OUT	21503-21406	269	508	239	89%	12.1	×	×	×
15	Barton Rd	IN	21406-21605	471	440	-31	-7%	1.5	✓	✓	✓
16	Barton Rd	OUT	21605-21406	902	835	-67	-7%	2.3	✓	✓	✓
17	Madingley Rd	OUT	14003-14002	1165	1252	87	7%	2.5	✓	✓	✓
18	Madingley Rd	IN	14002-14003	503	517	14	3%	0.6	✓	✓	✓
19	Huntingdon Rd	OUT	20202-23906	566	750	184	33%	7.2	×	×	×
20	Huntingdon Rd	IN	23906-20202	208	331	123	59%	7.5	×	×	×
21	Girton Rd	OUT	20205-23905	319	288	-31	-10%	1.8	✓	✓	✓
22	Girton Rd	IN	23905-20205	151	219	68	45%	5.0	✓	×	✓
23	Histon Rd	OUT	24612-20301	1349	1641	292	22%	7.5	×	×	×
24	Histon Rd	IN	20301-24612	1001	1108	107	11%	3.3	✓	✓	✓
25	Milton Rd	IN	20405-20406	703	579	-124	-18%	4.9	×	✓	✓
26	Milton Rd	OUT	20406-20405	2054	1807	-247	-12%	5.6	✓	×	✓
27	Horningsea Rd	OUT	27904-27701	837	683	-154	-18%	5.6	×	×	×
28	Horningsea Rd	IN	27701-27904	657	592	-65	-10%	2.6	✓	✓	✓

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
29	Newmarket Rd	OUT	29010-27801	1627	1678	51	3%	1.2	✓	✓	✓
30	Newmarket Rd	IN	27801-29010	853	749	-104	-12%	3.7	✓	✓	✓
31	High St Teversham	OUT	26604-26501	152	139	-13	-9%	1.1	✓	✓	✓
32	High St Teversham	IN	26501-26604	104	124	20	19%	1.8	✓	✓	✓
33	Fulbourn	IN	20104-20102	537	685	148	28%	6.0	×	×	×
34	Fulbourn	OUT	20102-20104	592	742	150	25%	5.8	×	×	×
35	St Peters Rd	NB	53503-53502	853	931	78	9%	2.6	✓	✓	✓
36	St Peters Rd	SB	53502-53503	769	740	-29	-4%	1.0	✓	✓	✓
37	A14, between J24 and J23	WB	92011-92106	3173	3058	-115	-4%	2.1	✓	✓	✓
38	A14, between J23 and J24	EB	92108-92012	2710	2787	77	3%	1.5	✓	✓	✓
39	Cambridge Rd	IN	40204-40702	629	495	-134	-21%	5.6	×	×	×
40	Cambridge Rd	OUT	40702-40204	171	283	112	66%	7.4	×	×	×
41	Witchford Rd	IN	40203-40702	313	277	-36	-11%	2.1	✓	✓	✓
42	Witchford Rd	OUT	40702-40203	504	389	-115	-23%	5.4	×	×	×
43	West Fen Rd	IN	40701-40406	129	122	-7	-5%	0.6	✓	✓	✓
44	West Fen Rd	OUT	40406-40701	45	60	15	33%	2.1	✓	✓	✓
45	Downham Road	OUT	40403-40402	622	550	-72	-12%	3.0	✓	✓	✓
46	Downham Road	IN	40402-40403	476	365	-111	-23%	5.4	×	×	×
47	Lynn Rd	OUT	40302-40414	335	29	-306	-91%	22.7	×	×	×

Link ID	Link Name	Dir.	SATURN Link	Obs.	Mod.	Diff.	% Diff.	GEH	Flow	GEH	Overall
48	Lynn Rd	IN	40414-40302	245	23	-222	-91%	19.2	×	×	×
49	Prickwillow Rd	OUT	40102-40304	272	63	-209	-77%	16.2	×	×	×
50	Prickwillow Rd	IN	40304-40102	198	68	-130	-66%	11.3	×	×	×
51	Station Rd	IN	40501-40512	731	456	-275	-38%	11.3	×	×	×
52	Station Rd	OUT	40512-40501	534	785	251	47%	9.8	×	×	×
53	Potton Rd	NB	58801-59807	310	336	26	8%	1.4	✓	✓	✓
54	Potton Rd	SB	59807-58801	153	148	-5	-3%	0.4	✓	✓	✓

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