Solent Transport Model **12/12/2017**

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ROAD TRAFFIC MODEL

MODEL DEVELOPMENT AND VALIDATION REPORT

Solent Transport

SYSTRA

SOLENT TRANSPORT MODEL

ROAD TRAFFIC MODEL

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1. INTRODUCTION

1.1.1 SYSTRA was commissioned, as part of a wider team, to support Solent Transport with the development and application of a Sub-Regional Transport Model Suite (SRTM) for this nationally important area. The model was originally developed with a 2010 base year and has now been updated to a 2015 base year.

1.1.2 This Working Paper describes the development, calibration and validation of the Road Traffic Model (RTM) within the SRTM

1.2 Report Structure

1.2.1 In addition to confirmation of methodologies, the purpose of this Working Paper is to demonstrate the quality of the base year (2015) assignment model in terms of how closely it reproduces a set of observations.

1.2.2 The Working Paper can be regarded as having two parts, the first being Chapters 1-7 which deal with the context and methodologies and the second being Chapters 8-10 which focus on base year model outcomes. Chapters 8-10 include actions undertaken and results of model calibration and validation. The chapters are as follows:

- Chapter 2: Proposed Uses of the Model and Key Model Design Considerations;
- Chapter 3: Model Standards;
- Chapter 4: Key Features of the Model;
- Chapter 5: Calibration and Validation Data;
- Chapter 6: Network Development
- Chapter 7: Trip Matrix Development;
- Chapter 8: Network Calibration and Validation;
- Chapter 9: Assignment Calibration and Validation;
- Chapter 10: Summary of Model Development and Fitness for Purpose;
- Appendices

2. PROPOSED USES OF THE MODEL

2.1 Proposed Uses of the Model: Scenarios to be Forecast and Interventions to be Tested

2.1.1 The SRTM will be used to support a wide-ranging set of interventions across the Solent sub-region, and is specifically required to be capable of:

- forecasting changes in travel demand, road traffic, public transport patronage and active mode use over time as a result changing economic conditions, land-use policies and development, and transport improvement and interventions;
- testing the impacts of land-use and transport policies and strategies within a relatively short model run time; and
- testing the impacts of individual transport interventions in the increased detail necessary for preparing submissions for inclusion in funding programmes within practical (but probably longer) run times.

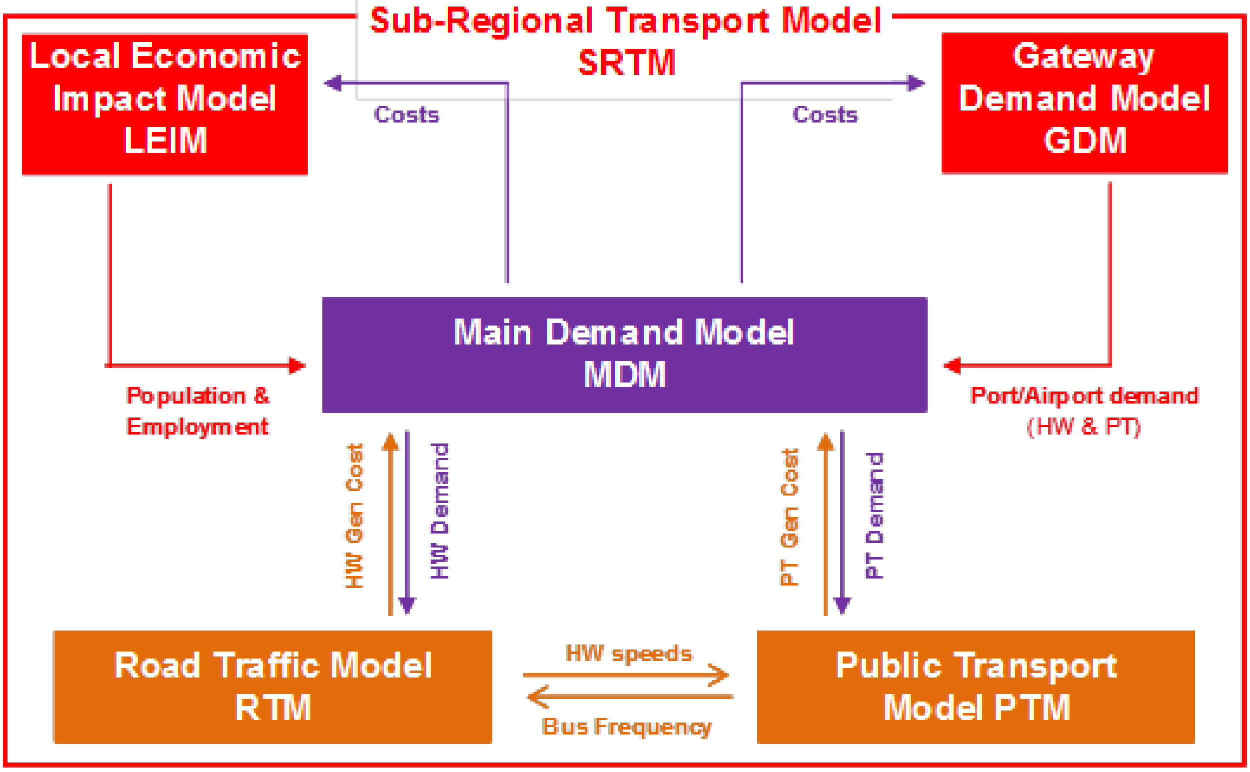
2.1.2 As the lead contractor SYSTRA takes overall responsibility for the RTM documented in this Working Paper, the models listed in the Foreword, and the associated project deliverables.

2.2 Context and Scope

2.2.1 SRTM is a suite of linked models comprising the following components as shown in Figure 1:

- the Main Demand Model (MDM) which predicts when (time of day), where (destination choice) and how (choice of mode) journeys are made;
- the Gateway Demand Model (GDM) which predicts demand for travel from ports and airports;
- the Road Traffic Model (RTM) which determines the routes taken by vehicles through the road network and journey times, accounting for congestion;
- the Public Transport Model (PTM) which determines routes and services chosen by public transport passengers; and
- an associated Local Economic Impact Model (LEIM) which uses inputs including transport costs to forecast the quantum and location of households, populations and jobs.

Figure 1. Solent Sub-Regional Transport Model



2.2.2 The RTM has been developed to represent the base year demand, route choices and costs on the highway network. In terms of future scenarios, it will represent the network impacts of different policy and infrastructure interventions.

2.2.3 It is important that the RTM includes the ability to model traffic behaviour at junctions, including flow metering downstream from bottlenecks as well as blocking-back through upstream junctions. As such SATURN was selected as the most appropriate software package to use. SATURN is perhaps the most commonly used highway modelling software in the UK, benefiting from a large user base, customer support and regular maintenance, and has been used successfully for many applications since its first release in 1981.

3. MODEL STANDARDS

3.1 Introduction

3.1.1 This chapter describes the criteria and acceptability guidelines against which the base year model will be assessed in Chapter 8 (Trip Matrix Calibration and Validation) and Chapter 9 (Assignment Calibration and Validation). The aim for the RTM is to achieve the validation criteria and acceptability guidelines set out in WebTAG Unit M3-1 https://www.gov.uk/government/publications/webtag-tag-unit-m3-1-highway-assignment-modelling

3.1.2 Whilst the Department for Transport requires that road traffic assignment models be validated against these standards, it does recognise that some relaxation of these acceptability guidelines may be appropriate for large scale models.

3.2 Validation Criteria and Acceptability Guidelines

3.2.1 Validation simply involves comparing modelled and observed data. Any adjustments to the model intended to reduce the differences between the modelled and observed data are regarded as calibration.

3.2.2 The differences between modelled and observed data are quantified (using some measures) and then assessed using some criteria. The acceptability of the proportion of instances where the criteria are met is then assessed.

3.2.3 The validation of a highway assignment model includes 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 as a check on the quality of the assignment; and
- modelled and observed journey times along routes, as a check on the quality of the network and the assignment.

3.2.4 For trip matrix validation, the measure used is: the absolute differences between modelled flows and counts.

3.2.5 For link flow validation, the measures used are:

- the absolute differences between modelled flows and counts; and
- the GEH statistic which is a form of the Chi-squared statistic that incorporates both relative and absolute errors, and is defined as follows:

$$GEH = \sqrt{\frac{(M-C)^2}{(0.5\times(M+C))}}$$

where:
M is the modelled flow; and
C is the observed flow.

3.2.6 For journey time validation, the measure used is: the percentage difference between modelled and observed journey times, subject to an absolute maximum difference.

3.2.7 The validation criteria and acceptability guidelines for each of these measures are as follows.

Trip Matrix Validation

3.2.8 Comparisons at screenline level provide information on the quality of the trip matrices. The validation criterion and acceptability guideline for screenline flows are defined in Table 1 (from TAG Unit 3-1). Screenline Flow Validation Criterion and Acceptability Guideline.

Table 1. Screenline Flow Validation Criterion and Acceptability Guideline

CRITERIA	DMRB ACCEPTABILITY GUIDELINE
Differences between modelled flows and counts should be less than 5% of the counts	All or nearly all screenlines

3.2.9 With regard to screenline validation, the following should be noted:

- screenlines should normally be made up of more than 5 links; for screenlines of fewer links, the acceptability guideline may be relaxed pro rata between 5% for 5 links and 15% for 1 link;
- the comparisons for screenlines containing high flow routes such as motorways should be presented both including and excluding such routes;
- the comparisons should be presented separately for (a) roadside interview screenlines; (b) the other screenlines used as constraints in matrix estimation (excluding the roadside interview screenlines even though they have been 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 or hour.

Link Flow Validation

3.2.10 The validation criteria and acceptability guidelines for link flows are defined in Table 2.

Table 2. Link Flow Validation Criteria and Acceptability Guidelines

CRITERIA	DMRB ACCEPTABILITY GUIDELINE
Individual flows within 15% of counts for flows from 700-2700 veh/h	> 85% of cases
Individual flows within 100 veh/h of counts for flows less than 700veh/h	> 85% of cases
Individual flows within 400 veh/h of counts for flows more than 2700 veh/h	> 85% of cases
GEH < 5 for individual flows	> 85% of cases

3.2.11 With regard to flow validation, the following should be noted:

- 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; and
- the comparisons should be presented separately for each modelled period or hour.

Journey Time Validation

3.2.12 The validation criterion and acceptability guideline for journey times are defined in Table 3.

Table 3. Journey Time Validation Criteria and Acceptability Guideline

CRITERIA	DMRB ACCEPTABILITY GUIDELINE
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher)	> 85% of routes

3.2.13 With regard to the journey time validation, the comparisons should be presented separately for each modelled period or hour.

3.3 Convergence Criteria and Standards

3.3.1 WebTAG Unit M3-1 states that before the results of any traffic assignment are used to influence decisions, the stability (or degree of convergence) of the assignment must be confirmed at the appropriate level. The importance of achieving convergence is related to the need to provide stable, consistent and robust model results. When the model outputs are being used to compare development or infrastructure options, it is important to be able to distinguish differences due to the scheme from those associated with different degrees of convergence, i.e. model 'noise'.

3.3.2 As recommended in WebTAG Unit M3-1 SATURN provides the ability to monitor and control stopping criteria using the '%GAP' statistic which is controlled in SATURN by the parameter 'STPGAP'. This is the difference between the costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as a percentage of the minimum costs. Section 9.4 provides more detail on the parameters used to control and monitor convergence.

3.3.3 Table 4 summarises the most appropriate convergence measures and the values generally considered acceptable for use in establishing a base model. Tighter levels of convergence may be required for option testing. To ensure that, during the development of the base year model, reasonable levels of assignment convergence are achieved, WebTAG Unit M3-1 states a target %GAP value of 0.1% is used – that is, sufficient iterations are carried out to achieve a %GAP of 0.1% or less on four consecutive assignment loops.

Table 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%

4. KEY FEATURES OF THE MODEL

4.1 Introduction

4.1.1 This chapter summarises the features of the RTM and includes the following sections:

- Geographic scope;
- Zoning system;
- Network structure;
- Centroid connectors;
- Time periods;
- Modelled years;
- User classes;
- Assignment methodology;
- Generalised cost formulations and parameter values; and
- Junction modelling and speed/flow relationships.

4.2 Geographic Scope

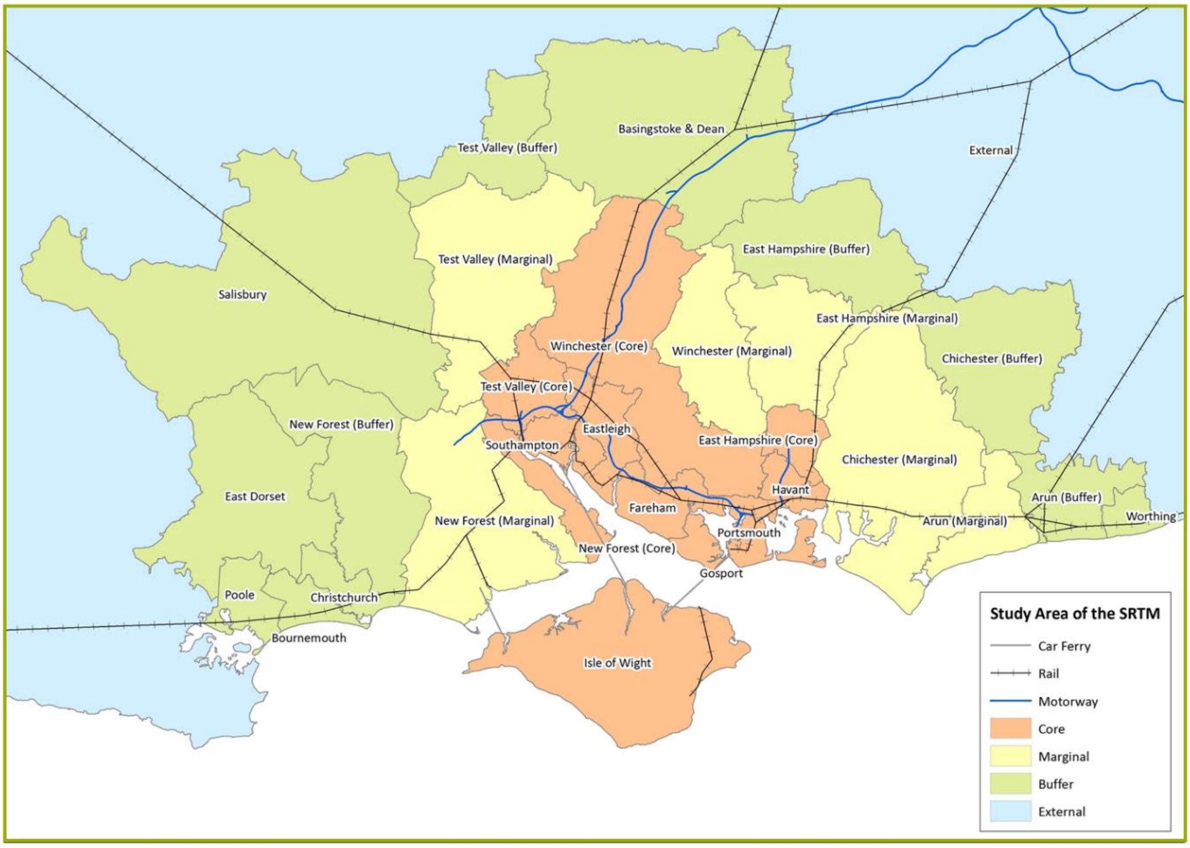
4.2.1 The modelled area of the RTM is sub-divided into four regions which differ by zone aggregation and modelling detail, as follows:

- Core Fully Modelled Area (detailed zoning);
- Marginal Fully Modelled Area (normally based on MSOAs);
- Buffer Area (zones based on Districts); and
- External (zones based on Districts and Counties).

4.2.2 Figure 2 shows the four regions of the study area. The core fully modelled area has the finest level of zone detail and a junction modelled (simulation) network representation in the RTM.

4.2.3 The core fully modelled area is defined by the Transport for South Hampshire boundary. This is the area which has the finest level of detail in the zoning and, for the RTM, a simulation network representation

Figure 2. Study Area of the RTM



4.3 Zoning System

4.3.1 The choice of zone system dictates the level of spatial resolution of the models and hence the ability of the models to realistically represent the transport situation. Current guidance states that in the 'internal' area zone boundaries should seek to take account of the following:

- natural barriers (rivers, railways, motorways or other major roads);
- areas of similar land use that have clearly identifiable and unambiguous points of access onto the road network included in the model;
- existing zone boundaries, where an existing model is being used as the basis for the new model;
- administrative and planning data boundaries (wards, parishes, Census Output Areas);
- the location of the main parking areas, where town centres are included in the model; and
- the need for internal screenlines for trip matrix validation.

4.3.2 Within this study the zoning must also satisfy the requirements of all of the models within the model suite.

4.3.3 Table 5 shows the various zone system requirements for each of the models.

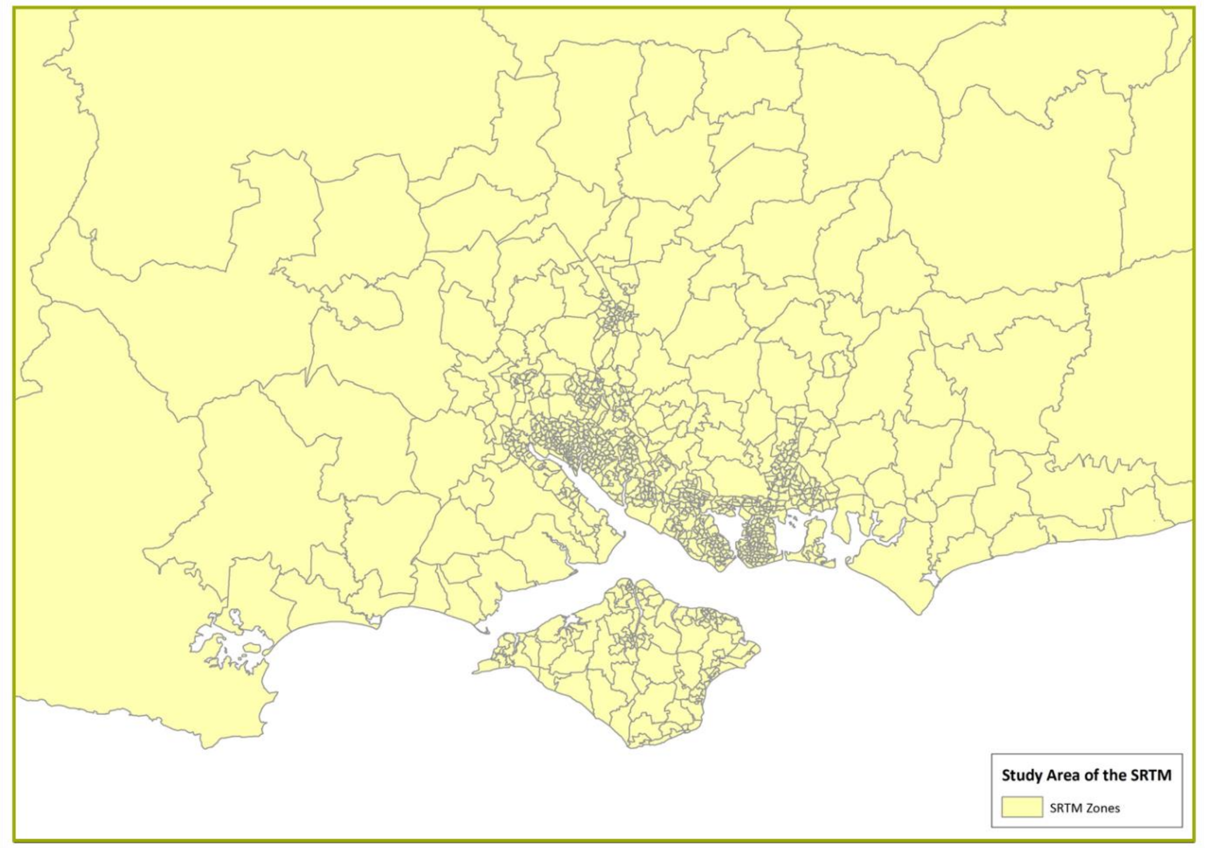
Table 5. Model Suite Zone System Requirements

MODEL	REQUIREMENT
MDM & LEIM	Land use characteristics for ensuring zones contain similar land use
	Known future development sites are not given their own exclusive zones. Instead zone numbers have been reserved for that purpose in future year modelling
RTM	Highway access can be realistically modelled
	RSI enclosure boundaries (RTM) and highway screenlines must be respected
PTM	Walk access/egress must be modelled in enough detail to ensure true differential between public transport and highway
	Bus stop catchments, bus stop 'clusters', bus corridors and fare zones must be taken into account
	Public transport screenlines must be respected
GDM	The GDM will work at the (air/sea) port level at one end of port-terminating trips but the different network access points for "gateway traffic" will be defined as zones

4.3.4 The SRTM zone system uses 2011 Census Output Areas (COAs) as building blocks in the fully modelled area. Elsewhere, the zone system uses aggregations of Census Wards. Consistency with other existing models such as the Solent Strategic Transport Model (SSTM) and the Portsmouth Western Corridor Study (PWCS) model has also been incorporated as required. In the fully modelled area, disaggregation was used to ensure that no zones have more than 400 highway trip origins or destinations per hour in the base year

4.3.5 Figure 3 shows the SRTM zone system around the study area.

Figure 3. SRTM Zone system around the Study Area



4.4 Network Structure

4.4.1 As discussed above, the study area of the RTM is broken down into the Core and Marginal Fully Modelled Areas, the Buffer Area and the External Area. These areas are represented by three levels of network detail, as shown in Table 6.

Table 6. RTM Network detail

NETWORK TYPE	MODEL AREA	MODELLING DESCRIPTION
Simulation network	Cored Fully Modelled Area	Junction capacity restraints are explicitly modelled for priority junctions, roundabouts, and signalised junctions considering the interaction of different movements
Speed/flow network	Marginal Fully Modelled Area	Capacity restraint is based on flow delay curves, where increased flows on a particular link result in increased travel times along that link
Fixed speed	Buffer Area External Area	Fixed speeds are modelled along each link

4.4.2 The core fully modelled area of the traffic model includes all Motorways, A roads, B roads and minor roads and other roads considered to carry high volumes of traffic. The 2004 base year SATURN Solent Strategic Transport Model (SSTM) and the Portsmouth Western Corridor Strategy Model (PWCM) were used to assess which minor roads have sufficiently high volumes of traffic to warrant inclusion using the professional judgment of the project team. In addition, all bus routes were added to the RTM to facilitate interface with the PTM and Demand Model. Furthermore, the network and zone connectors were modified, as appropriate, following a Client Steering Group review.

4.4.3 The marginal fully modelled area includes all motorways, A roads and B roads along strategic routes.

4.4.4 The buffer area includes all motorways and A roads along strategic routes.

4.4.5 The external area is a skeletal network, covering main routes into the sub-region. It includes only Motorways and major A roads.

4.4.6 The network representation of the RTM has been defined in such a way to ensure smooth transition of network representation from simulation to speed/flow relationships, and speed/flow relationships to fixed speed

4.5 Time Periods and Years

4.5.1 Three weekday periods are modelled in the RTM:

- AM peak;
- Inter peak; and
- PM peak.

4.5.2 These three periods cover a 12 hour period and allow the relative differentials in travel cost to be represented. The periods are defined in Table 7.

Table 7. Time Period Definitions

PERIOD	FULL PERIOD FOR DEMAND MODEL	RTM ASSIGNMENT PERIOD
AM peak	07:00-10:00	Peak hour (factored from period)
Inter peak	10:00-16:00	Average hour from full period
PM peak	16:00-19:00	Peak hour (factored from period)

4.5.3 The RTM is based on demand levels for one-hour periods, based on the distributions of the broader period. For the inter peak this is an average hour whilst the AM and PM peak periods are represented by the peak hours. AM and PM peak matrices have been obtained from the period matrices, by applying peak hour factors which have been calculated from an analysis of count data. The peak hour factors are shown in Table 8 below.

Table 8. Peak Hour Factors

	AM PEAK	INTER PEAK	PM PEAK
Period to 1 Hr Factor	0.405	0.167	0.368

4.5.4 In line with the Main Demand Model the RTM has a base year of 2015, and forecast years of 2019, 2026 and 2036. In addition LEIM provides forecasts through to 2041.

4.6 User Classes

4.6.1 The user classes for the RTM are based on the MDM trip purpose segments. The trip purpose segments are aggregated based on differentials in users' value of time (VoT) and differentials in vehicle operating cost (VoC). The RTM has the following assignment user classes:

- Car - Employer's Business;
- Car - Other;
- LGVs; and
- OGVs.

4.6.2 Travellers in the employer's business class have a higher value of time than in the other classes, which needs to be retained in the assignment model.

4.6.3 The 'Other' user class includes all car trips with purposes of commuting, shopping, education, leisure, personal business. These have been combined because the VoT:VoC relationship is considered to be sufficiently similar to not warrant the additional run times introduced by separate assignment segments.

4.6.4 Separate demand segments have been defined to represent LGV and OGV trips due to the assumed insensitivity of these types of trips to changes in travel cost, and also due to the differential in both their vehicle operation costs and users' value of time.

4.7 Assignment Methodology

4.7.1 The deterministic user equilibrium method implemented in the SATURN software is used. This assumes that users have perfect knowledge of the time taken to pass through the network from their origin to destination.

4.8 Junction Modelling and Speed/Flow Relationships

4.8.1 In models of congested areas, capacity restraint should be applied by the use of either:

- link-based speed/flow or flow/delay relationships; or
- flow/delay modelling of junctions.

4.8.2 The Core Fully Modelled Area contains the highest level of detail within the model and, hence, this is the area within which all significant junctions are modelled in detail (simulated).

4.8.3 Within the Marginal Fully Modelled Area capacity restraint is based on flow delay curves, where increased flows on a particular link result in increased travel times along that link.

4.8.4 Junction modelling is required where junction capacities have a significant impact on drivers' route choice, and where delays are not adequately represented by speed/flow relationships applied to network links. Care has been taken to specify realistic capacities throughout the Fully Modelled Area and in the choice of turning movements for which it is necessary to specify individual turn capacities. In selecting the Fully Modelled Area, the need for continuity and consistency of procedures such as flow metering and blocking back are important which is catered for in SATURN.

5. CALIBRATION AND VALIDATION DATA

5.1 Introduction

5.1.1 This chapter describes the data used to build, calibrate and validate the RTM. Data collected for the purpose of building, calibrating and validation the RTM includes:

- Roadside Interview Surveys (RSI);
- Screenline, manual classified and automatic traffic counts;
- Automatic number plate recognition (ANPR) surveys; and
- TrafficMaster™ data for journey times.

5.2 Roadside Interview (RSI) Surveys

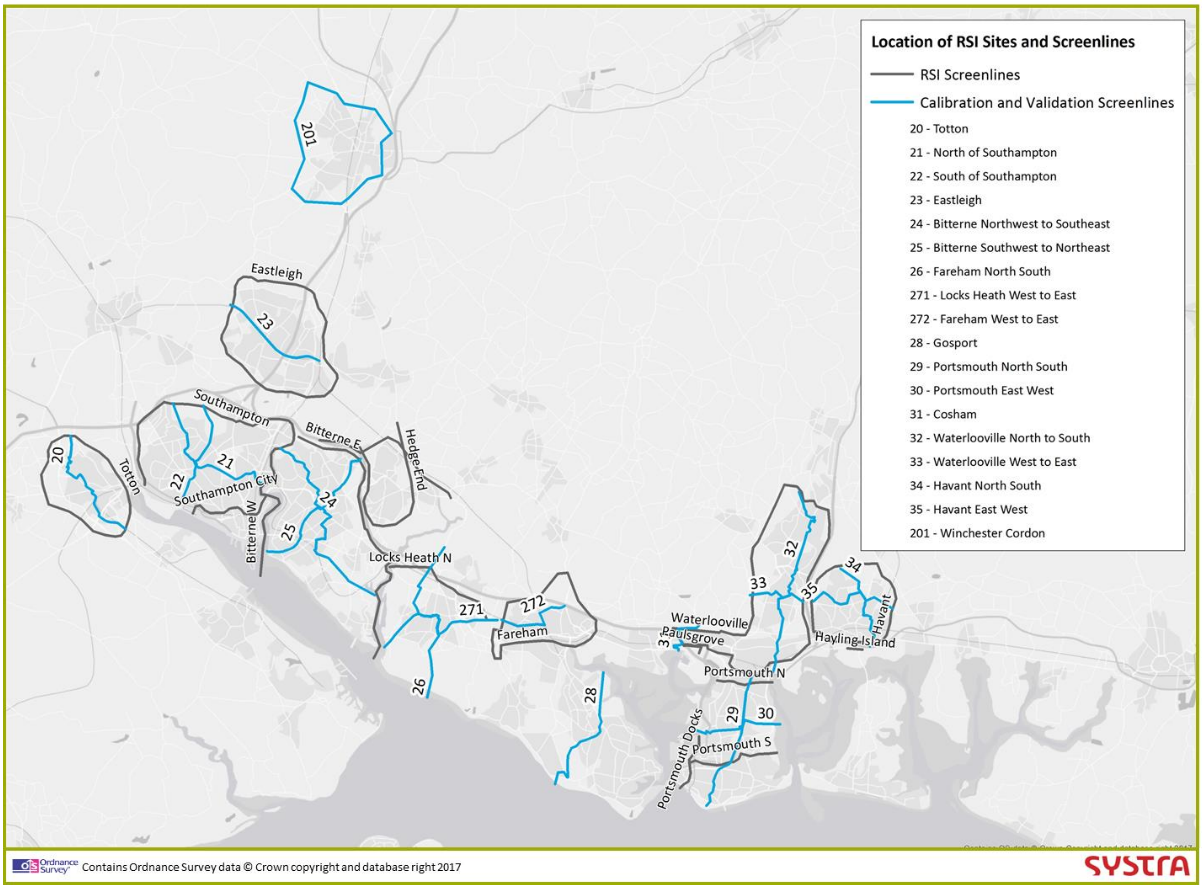
5.2.1 The Roadside Interview (RSI) Surveys used for the development of 2010 South Hampshire Traffic model[1] were uplifted appropriately as to be indicative of the 2015 travel patterns.

5.2.2 Details of the Roadside Interview (RSI) Surveys could be found in the relevant report (Transport for South Hampshire Evidence Base, Road Traffic Model Calibration and Validation Working Paper 9, September 2011).

5.2.3 Figure 4 shows the location of the RSI sites and screenlines.

[1] Transport for South Hampshire Evidence Base,Road Traffic Model Calibration and Validation Working Paper 9, September 2011

Figure 4. Location of RSI Sites and Screenlines



5.3 Traffic Counts

5.3.1 Automatic traffic counts were undertaken in both directions at the enclosure crossing points for a two week period encompassing the manual count days, to allow for adjustment for day to day variation. These control counts were used for sample expansion and trip reversal of the interview/postcard returns.

5.3.2 In addition to movements crossing enclosure cordons described above, flow and traffic composition data was also collected at a series of specified screenlines and cordons for use in the calibration and validation of the highway assignment model.

5.3.3 The counts at these screenlines included two way manual counts for a single day (07:00 to 19:00) accompanied by automatic traffic counters for a two week period encompassing the manual count date. This allowed adjustment for day to day variation, and brought counts to a common base.

5.3.4 The vehicle counts were recorded at 15 minute intervals and classified as follows:

- Car;
- Taxi;
- Van (car based);
- Van / Light Goods Vehicle;
- HGV 2 axles;
- HGV 3 axles;
- HGV 4+ axles;
- Public Service Bus;
- Coach or Private Bus;
- Motorcycle / Scooter;
- Pedal Cycle; and
- Other.

5.4 Automatic Number Plate Recognition Survey

5.4.1 The Automatic Number Plate Recognition (ANPR) survey figures used for the development of the Hampshire Evidence Base[2] were uplifted appropriately in order to be indicative of the 2015 travel patterns. These surveys estimate the traffic movements passing through the study area via the motorways, as these movements were not intercepted in the RSI programme.

5.4.2 An Automatic Number Plate Recognition (ANPR) survey was undertaken to estimate the traffic movements passing through the study area via the motorways, as these movements were not intercepted in the RSI programme.

5.4.3 Details of the Automatic Number Plate Recognition (ANPR) survey could be found in the relevant report (Transport for South Hampshire Evidence Base, Road Traffic Model Calibration and Validation Working Paper 9, September 2011).

[2] Transport for South Hampshire Evidence Base,Road Traffic Model Calibration and Validation Working Paper 9, September 2011

5.5 Journey Time

5.5.1 Journey times for 25 routes, in both directions, were obtained from the TrafficMaster 2014 dataset. The Part 1 routes are the same routes as those used for the 2010 Base Year (but using the 2014 data), and the Part 2 routes are new routes. These are listed in Table 9.

Table 9. List of Journey Time Routes

NO.	SET	MAP ID	DESCRIPTION	DISTANCE (KM)
1	Part 1 – 2010 routes	1	A336 RINGWOOD ROAD - A35 BURGESS ROAD	10.85
2	Part 1 – 2010 routes	2	A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE	11.44
3	Part 1 – 2010 routes	3	A33 DORSET STREET - A335 TWYFORD ROAD	9.98
4	Part 1 – 2010 routes	4	A33 DORSET STREET - A33	4.84
5	Part 1 – 2010 routes	5	A3024 BURSLEDON ROAD - A33 THE AVENUE	8.21
6	Part 1 – 2010 routes	6	A27 WEST END ROAD - A27 BASSETT GREEN ROAD	9.47
7	Part 1 – 2010 routes	7	A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD	7.91
8	Part 1 – 2010 routes	8	A27 WESTERN WAY - A27 BRIDGE ROAD	12.49
9	Part 1 – 2010 routes	9	A32 MUMBY ROAD - B3334 TITCHFIELD ROAD	10.71
10	Part 1 – 2010 routes	10	A32 FAREHAM ROAD - A27 WESTERN ROAD	12.57
11	Part 1 – 2010 routes	11	A397 NORTHERN ROAD - A3 LONDON ROAD	10.93
12	Part 1 – 2010 routes	12	B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD	11.74
13	Part 1 - Portsmouth	1	A2030 VELDER AVENUE - A2030 EASTERN ROAD	6.29
14	Part 1 - Portsmouth	2	A288 MILTON ROAD - A288 COPNOR ROAD	3.86
15	Part 1 - Portsmouth	3	M275 - A27	5.90
16	Part 1 - Portsmouth	4	A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD	6.05
17	Part 1 - Portsmouth	5	A3 MARKETWAY - A27 WESTERN ROAD	6.02
18	Part 2 – 2015 new	1	M3 Junction 11 - A32	10.08
19	Part 2 – 2015 new	2	M27 Junction 2 - A303	33.87
20	Part 2 – 2015 new	3	M27 Junction 2 - A34	27.46
21	Part 2 – 2015 new	Sec 1	Six Dials Junction to Windhover Roundabout	5.72
22	Part 2 – 2015 new	Sec 2	M27 Junction 7 to M3 Junction 11	14.67
23	Part 2 – 2015 new	Sec 3	M27 Junction 10 - M3 Junction 11	23.99

NO.	SET	MAP ID	DESCRIPTION	DISTANCE (KM)
24	Motorway		M27 Junction 3 – Junction 11	28.45
25	Motorway		M3 Junction 8 – Junction 14	32.23

5.5.2 Figure 5 to Figure 9show the locations of the routes.

Figure 5. Map of Journey Time Assessment Routes: Part 1

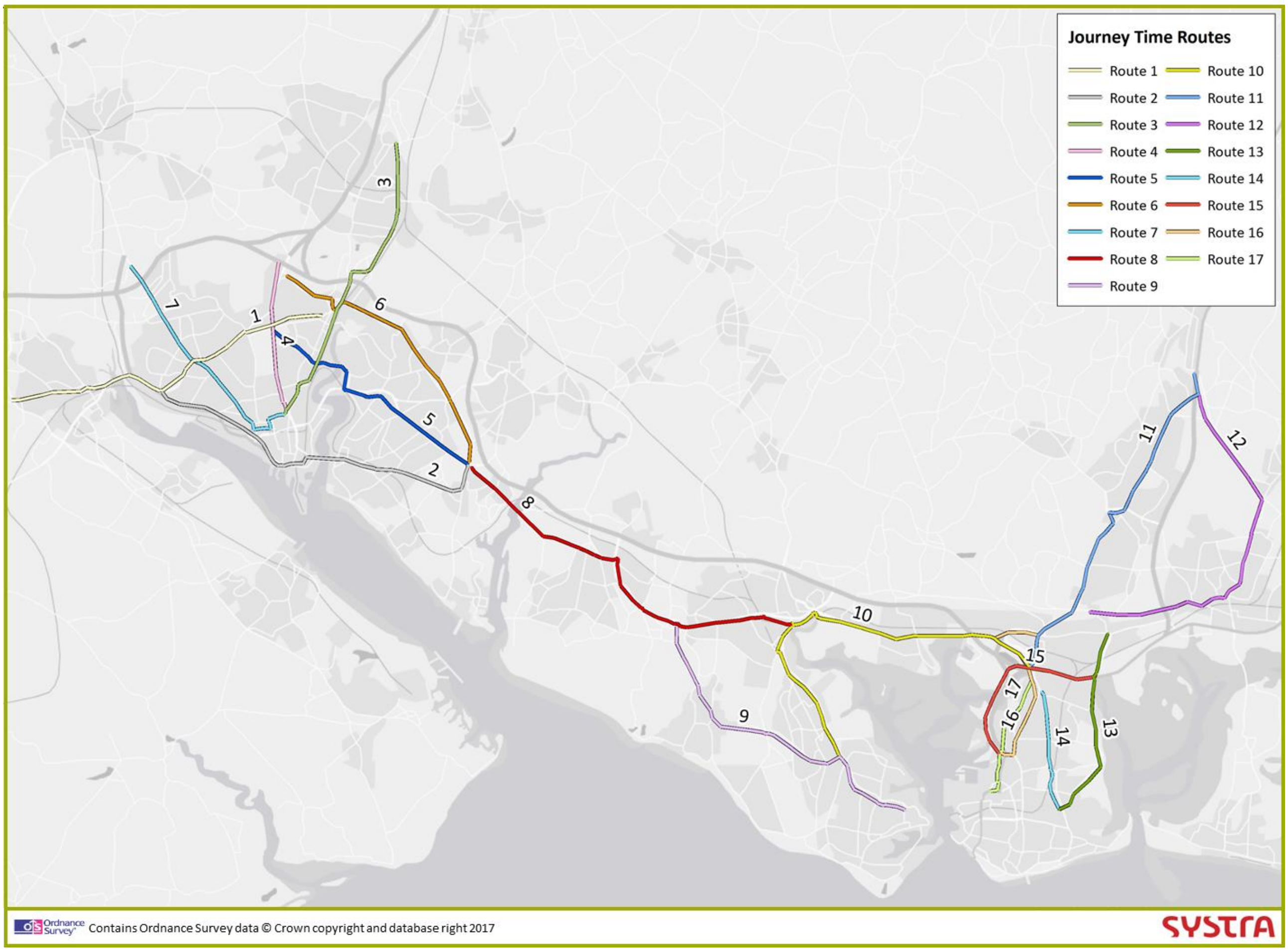


Figure 6. Map of Journey Time Assessment Routes: Part 2 – Route 18 to 20

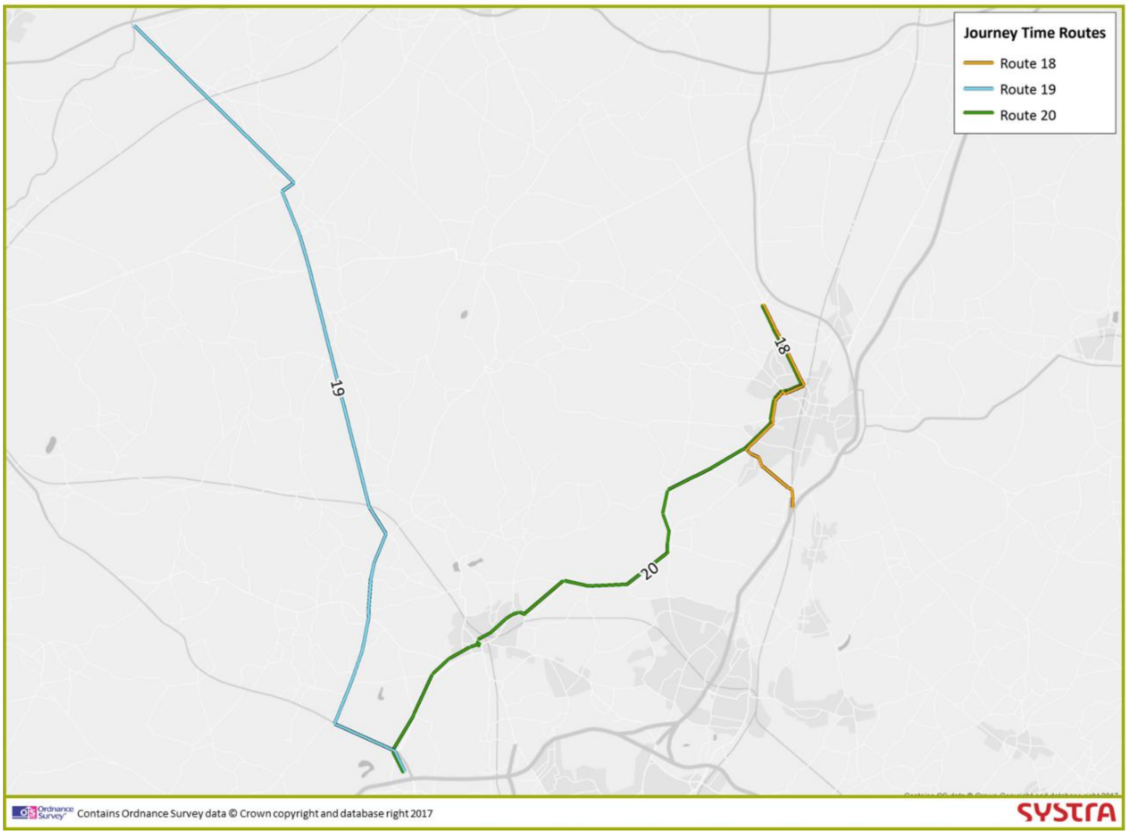


Figure 7. Map of Journey Time Assessment Routes: Part 2 – Route 21 to 23

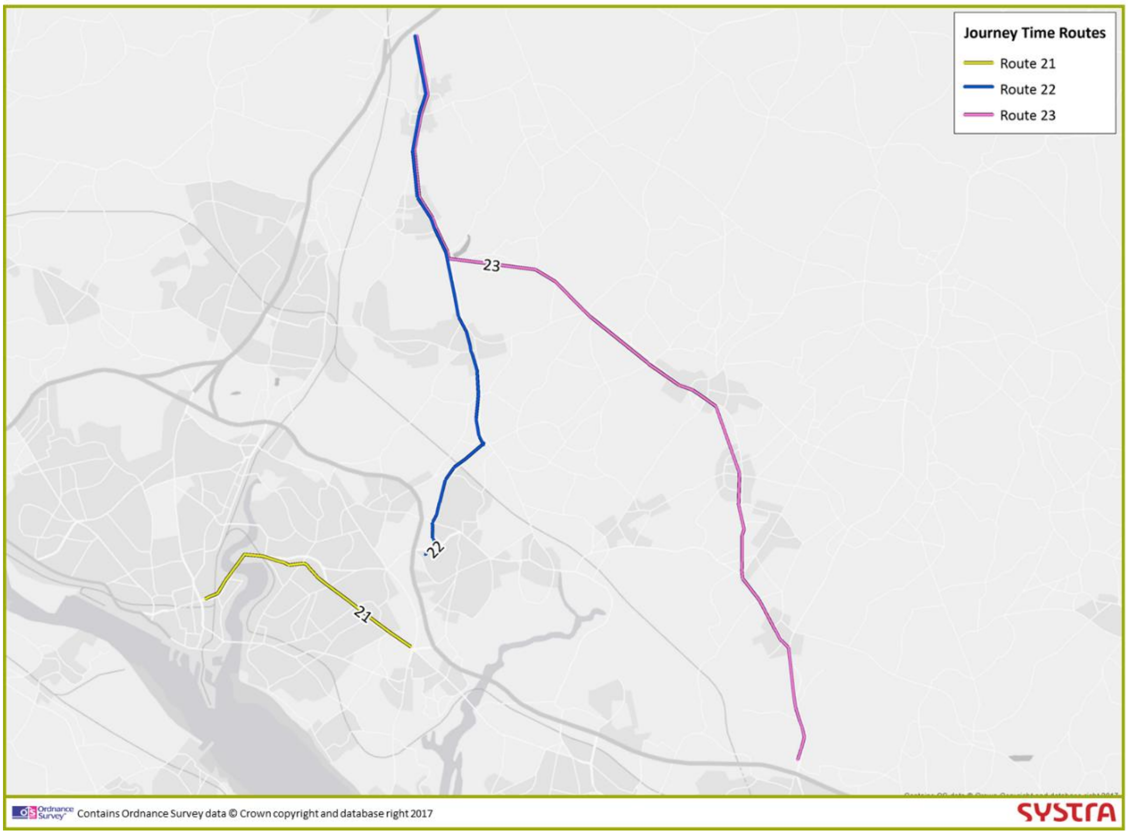


Figure 8. Map of Journey Time Assessment Routes: Motorways – Route 24

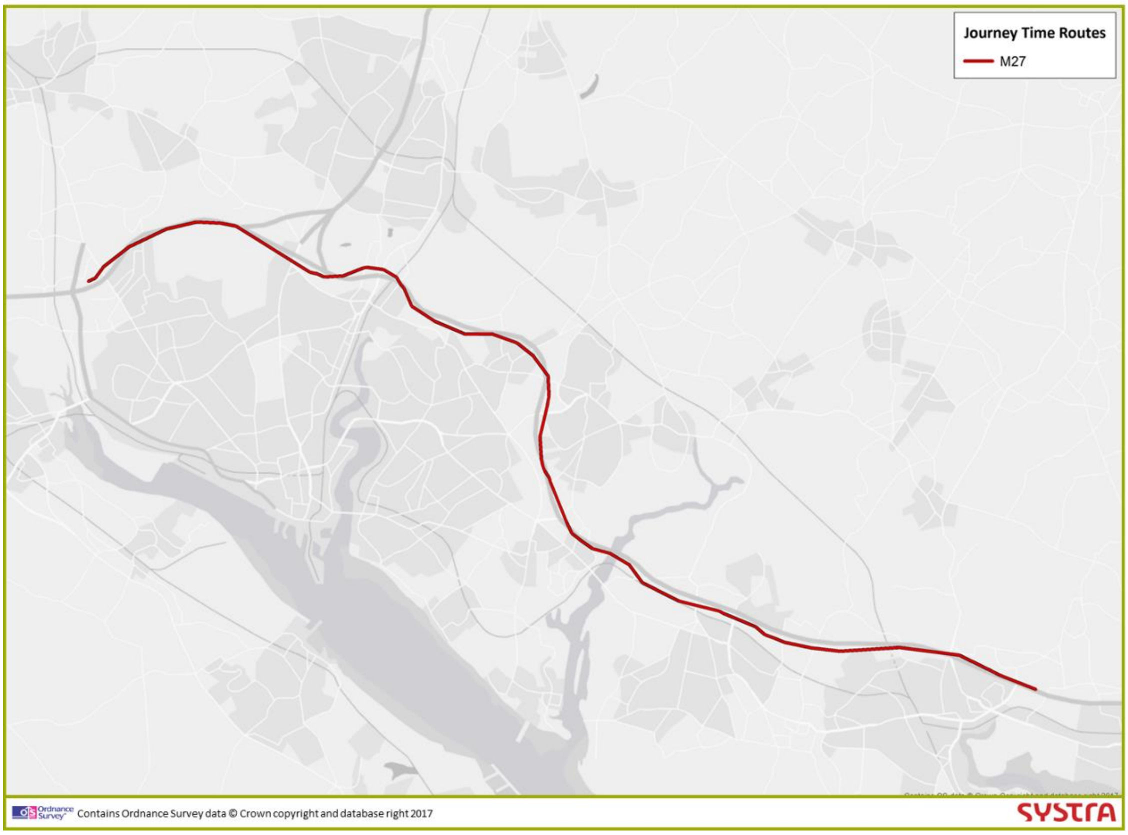
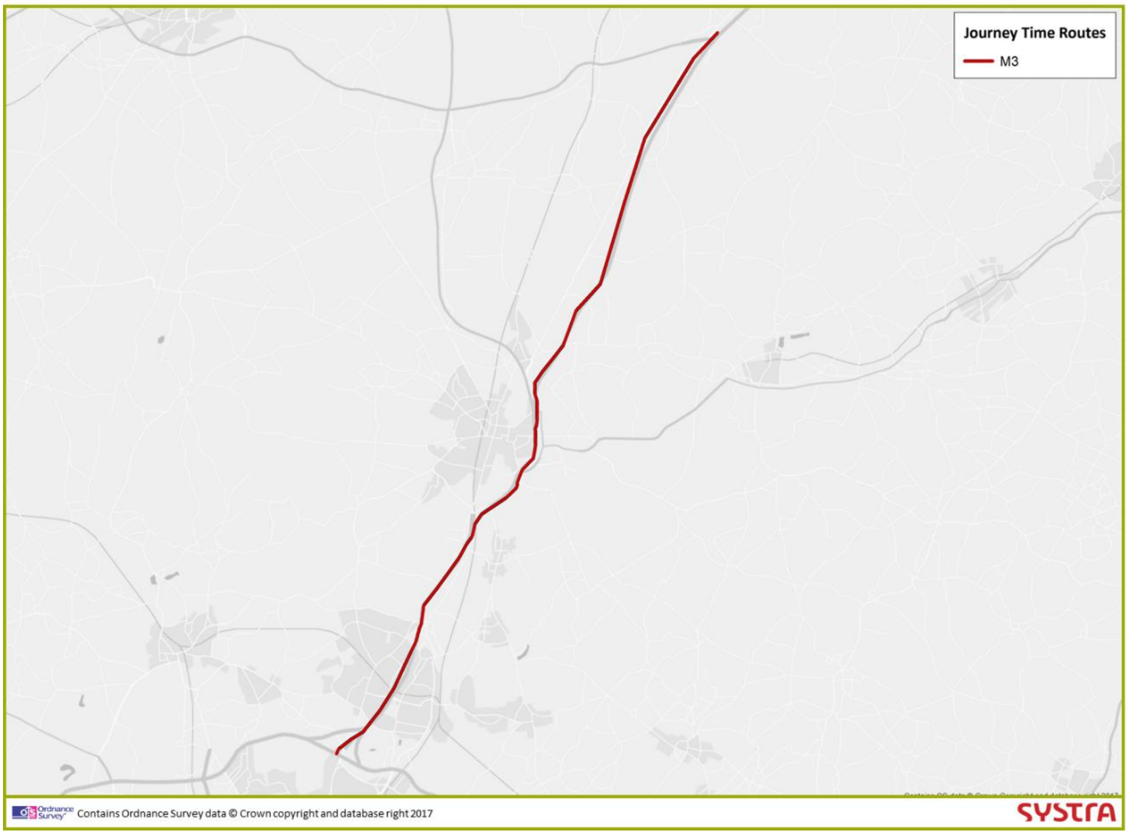


Figure 9. Map of Journey Time Assessment Routes: Motorways – Route 25



6. NETWORK DEVELOPMENT

6.1 Introduction

6.1.1 This chapter summarises the network building process, including how the basic structure of the network was developed, the data sources used and methodologies adopted.

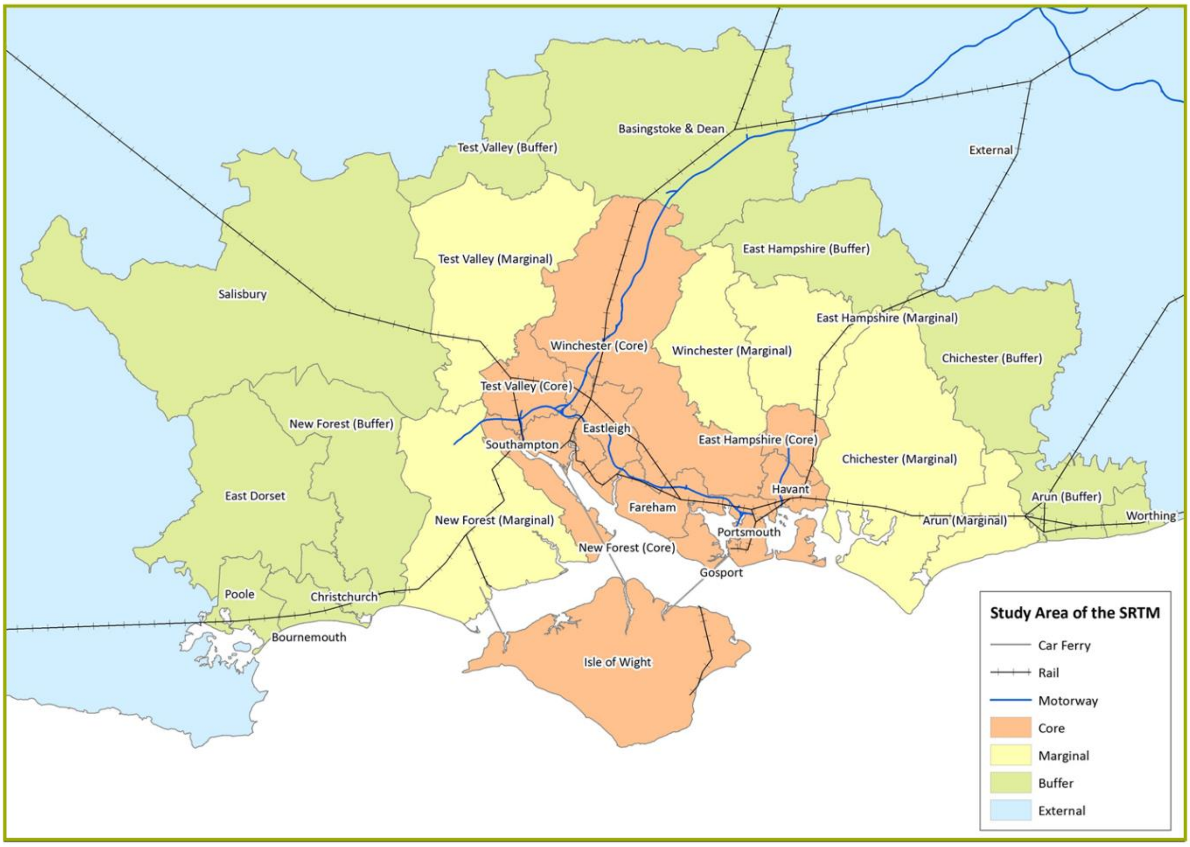
6.2 Network Structure

6.2.1 The RTM network is sub-divided into four regions which differ by zone aggregation and modelling detail, as follows:

- Core Fully Modelled Area (detailed zoning);
- Marginal Fully Modelled Area (normally based on census MSOAs);
- Buffer Area (zones based on Districts); and
- External (zones based on Districts and Counties).

6.2.2 Figure 10 shows the four regions of the study area.

Figure 10. RTM Study Area



6.2.3 The core fully modelled area is the area which will have the finest level of detail in the zoning and, for the RTM, a simulation network representation. The core modelled area includes full junction modelling. The core fully modelled area of the traffic model will include all Motorways, A roads, B roads and minor roads and other roads carrying high volumes of traffic.

6.2.4 The marginal fully modelled area includes all motorways, A roads and B roads along strategic routes.

6.2.5 Within the buffer area, which includes all motorways and A roads along strategic routes, capacity restraint is based on flow delay curves.

6.2.6 In the external area fixed speeds are modelled along each link. The external area is a skeletal network, covering main routes into the sub-region. It includes only Motorways and major A roads.

6.2.7 The SRTM zone system has been developed following current guidance principles. The zone system has been designed to satisfy the requirements of all of the models within the model suite. Throughout the development process the zoning system has been reviewed by Solent, and amended accordingly.

6.3 Simulation Area Coding

6.3.1 This section describes how the following main elements of the simulation area were coded:

- Network structure;
- Cruise speeds;
- Speed / flow relationships;
- Traffic signal coding;
- Saturation flows;
- Gap acceptance; and
- Bus routes and bus lanes.

Network Structure

6.3.2 The coding of the simulation network followed a systematic procedure designed to ensure consistent coding across the Solent network. The coding was undertaken within pre-defined parameters and constraints so that each link and junction type is coded in a consistent manner, independent of the analyst.

6.3.3 Initially a basic node-link network structure was coded, based on an ITN layer and associated coordinates. The procedure uses a detailed source network onto which junction coding can be superimposed, in this case road mapping and aerial photography, all sourced via web based portals.

6.3.4 Following on from the basic network structure, junctions are coded. The process uses a basic set of assumptions relating to saturation flows and cruise speeds that provides coders with limited and consistent options in coding individual junctions. It also adopts conventions on saturation flows and GAP parameters at different junction types. The coding is undertaken within a spreadsheet environment with cross reference made to aerial photography and mapping associated with each junction.

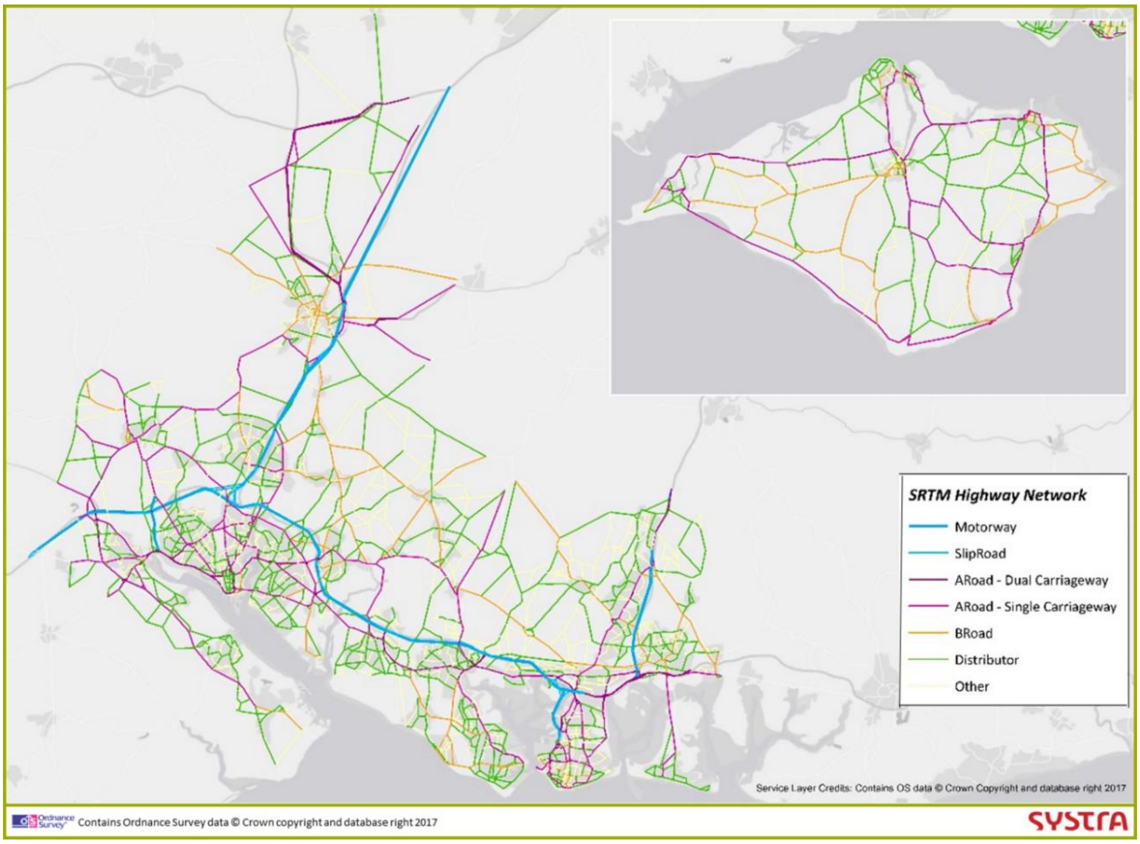
6.3.5 The use of this technique improves both coding speed and accuracy.

6.3.6 Links are defined according to the following classification:

- Motorway;
- Slip road;
- A Road - dual carriageway;
- A Road – single carriageway;
- B Road;
- Distributor Road (generally over 4m wide);
- Other Road (generally less than 4m wide);
- Buffer; and
- Spigot (Linking to Centroid Connectors).

6.3.7 Figure 11 shows the RTM network by aggregated link type.

Figure 11. RTM Network by Aggregated Link Type (Core Area only)



Gap Acceptance

6.3.8 The following gap values have been used for the RTM simulation network;

- 1.50 seconds for priority junctions;
- 0.75 seconds for merges; and
- 1.25 seconds for roundabouts.

6.3.9 These values have been adopted based on practical experience of calibrating and validating SATURN based sub regional models in the South of England, including the West London Sub Regional Model and the M25 Highway Assignment Model.

Generalised Cost Formulations and Parameter Values

6.3.10 The generalised cost parameters that are used to influence drivers' route choice are as follows:

- VOT and VOC by vehicle type derived from WebTAG. Appropriate growth factors have been applied to the VOT to get 2015 VOT and fuel price changes applied to get 2015 VOC. RPI applied to rebase prices to 2015;
- Occupancies applied for 2015 as per guidance from WebTAG; and

6.3.11 Values converted to pence per minute/pence per kilometre as required by SATURN.

Bus Routes and Bus Lanes

6.3.12 Bus lanes are coded within the simulation area, the locations of which were identified through road mapping and aerial photography sourced via web based portals and Traffic Road Orders (TRO) data.

6.4 Network Checking Process

6.4.1 At the outset of the network building process standard procedures were developed in order to minimise the incidence of serious errors later in the process, and a consistent coding framework developed. This included the specification of the structure of the network to be coded within the fully modelled area (the SATURN simulation area), link types and other key assumptions such as gap acceptance and saturation flow rates. Whilst changes to the network structure can occur during the network development process, spending time at the outset to determine the scope of the task and clarifying key assumptions within the coding team is beneficial. The coding framework ensures consistency of approach to coding by the coding team. In addition the need to measure link lengths, which is a common source of error, has been removed as this information is pre-coded at the outset using GIS.

6.4.2 Whilst the approach seeks to make the coding process more efficient and less error-prone, the following is a basic checklist of items that has been designed to further minimise problems during network development:

- check for appropriate junction types;
- check that the appropriate number of entry lanes have been coded and that flaring of approaches, where appropriate, are accounted for;
- check that turn restrictions have been correctly identified (these may vary by time period);
- check that one-way roads and no entries have been correctly specified;
- check that saturation flows are appropriate (particularly if turn rates appear excessively high or low compared to straight ahead);
- check that link lengths, link types and cruise speeds for both directions of a link are consistent, and that the link type and cruise speed coding does not vary unjustifiably along a series of links; and
- compare crow-fly link lengths against actual lengths and check that the coded link lengths in the core modelled area for links greater than 500m in length are not greater than 1.3 times the crow-fly distance, and inspect links which fall outside this range.

7. TRIP MATRIX DEVELOPMENT

7.1 Introduction

7.1.1 This section describes the methodology for the development of the base year trip matrices. These matrices were later subjected to matrix estimation as part of the process of calibrating the model; the matrix estimation process and results are reported in Section 8.2. The matrices described in this section are referred to as 'prior' matrices.

7.2 Summary of Base Year Matrix Construction

7.2.1 The key steps in developing the base year matrices were:

- Development of the partial matrices;
- Development of trip ends;
- Development of origin / destination demand; and
- Development of the one hour RTM assignment matrices.

7.2.2 The development of origin/destination demand has three components, corresponding to the three different types of movement that are being modelled, as shown in Table 10.

Table 10. Matrix Development Method Summary Demand by Modelled Area

AREA	CORE	MARGINAL	BUFFER	EXTERNAL
Core FMA	*Full [GrM/GD]*	*Full [GrM/GD/ NHTM]*	*Full [GrM/GD/ NHTM]*	*Full [GrM/GD/NHTM]*
Marginal FMA	*Full [GrM/GD/NHTM]*	*Full [GrM / ANPR]*	*Full [GrM/ ANPR]*	*Full [GrM / ANPR/NHTM]*
Buffer	*Full [GrM/GD/ NHTM]*	*Full [GrM/ ANPR]*	*Through FMA [ANPR]*	*Through FMA [ANPR]*
External	*Full [GrM/GD/NHTM]*	*Full [GrM / ANPR]*	*Through FMA [ANPR]*	*Through FMA [ANPR]*

Abbreviations: FMA – Full Modelled Area
GrM – Gravity Model
JTW – Census Journey to Work matrix
ANPR – Automatic Number Plate Recognition surveys
GD- Gateway Demand ANPR – Automatic Number Plate Recognition surveys
NHTM- North Hampshire Traffic Model

7.2.3 The table shows the coverage of the base year demand for cars, LGVs and HGVs. The base year demand in the Core and Marginal Fully Modelled Areas (FMAs) is modelled in full. Although the SRTM is only configured to model the Core FMA in detail, movements to and from the FMA from the marginal areas are influenced not only by travel costs within the FMA but also those in the marginal area that surrounds it. In addition the Local Economic Impact Model needs the travel cost responses from the RTM in both the Core and Marginal FMA to establish changes in population and employment. Trips to and from the Buffer and External areas and not terminating in the FMA are not modelled in full; only those trips that travel through the FMA are modelled.

7.2.4 As also shown in the table, the development of origin/destination demand is different for the three areas described above:

- Trips to/from the Core FMA were developed using a Gravity model (GrM);
- Trips between Winchester and the Core area of the NHTM estimated during the matrix synthesis process were replaced with the growthed demand from NHTM model.
- through-FMA trips with both their origin/destination trip ends either in the Buffer and External areas were developed by matching number plates from the Automatic Number Plate Recognition (ANPR) surveys.

7.2.5 These processes are described in Section 7.5.

7.2.6 The origin/destination demand matrices are defined at the period level: AM (07:00-10:00), IP (10:00-16:00), PM (16:00-19:00), and Off Peak (19:00-07:00). They include four home-based and two non home-based personal trip purposes for car, as well as LGV and HGV trip matrices. The origin/destination trip matrices were developed in person-trip units before being converted to one-hour RTM prior matrices.

7.2.7 The RTM prior matrices were obtained from the corresponding demand matrices for cars, LGVs and HGVs by:

- applying peak-hour or average hour factors as appropriate;
- applying trip purpose-specific vehicle occupancy factors to convert the person matrices to vehicle matrices;
- applying passenger car units (PCUs) to the HGV demand matrices; and
- aggregating the demand matrices into the assignment purposes, as shown in Table 11.

Table 11. Trip Purpose Segmentations

VEHICLE TYPE	ABBREVIATION	OD DEMAND MATRICES	RTM ASSIGNMENT MATRICES
Car	HBB	HB Employers Business	Employers Business
Car	NHB	Non HB Employers Business	
Car	HBW	HB Work	Commuting and Other
Car	HBE	HB Education	
Car	HBO	HB Other	
Car	NHO	NHB Other	
LGV	LGV	Light Goods Vehicles	LGVs
HGV	HGV	Other Goods Vehicles	OGVs

7.2.8 Following the development of the prior matrices a validation exercise was undertaken to determine whether matrix estimation was required. The need for matrix estimation was confirmed and this process, to refine the prior matrices and better match assigned flows to counts, is described in Section 8.

7.3 Development of Partial Matrices

7.3.1 The 2015 partial matrices were created by:

- expanding the original (2010) enclosure data to new (2015) ATC controls for the movement within the Mainland;
- expanding the original (2010) Ferries data to the new (2015) Ferries Data for the movements from/to the Mainland and the Isle of Wight (and vice versa);
- adding 2013 the IoW Matrix expanded to the new (2015) ATC controls for the movements within the Isle of Wight (IoW).

7.3.2 New ATC expansion factors replaced those calculated in 2010. These factors were calculated at a site level considering all the possible direction, period and vehicle type combinations.

7.3.3 The methodology has some limitations as it is based on the 2010 pattern of OD movements. Any potential variations of these movements could be captured by the matrix estimation process.

7.3.4 The vehicle types and purposes from the RSI records required aggregation to the Solent matrix segments; These are shown in Table 12 and Figure 12.

Table 12. Aggregation of RSI Vehicle Types to Solent Vehicle Types

RSI VEHICLE TYPE	SOLENT VEHICLE TYPE
1 Car	Car
2 Taxi	Car
3 Van (Car Based)	Car
4 Van/ Light Goods	LGV
5 Other Goods Vehicle 1	HGV
6 Other Goods Vehicle 2	HGV
7 HGV (2 Axles)	HGV
8 HGV (3 Axles)	HGV
9 Large HGV (4+ Axles)	HGV

Figure 12. Aggregation of RSI Origins and Destinations to Solent Trip Purposes

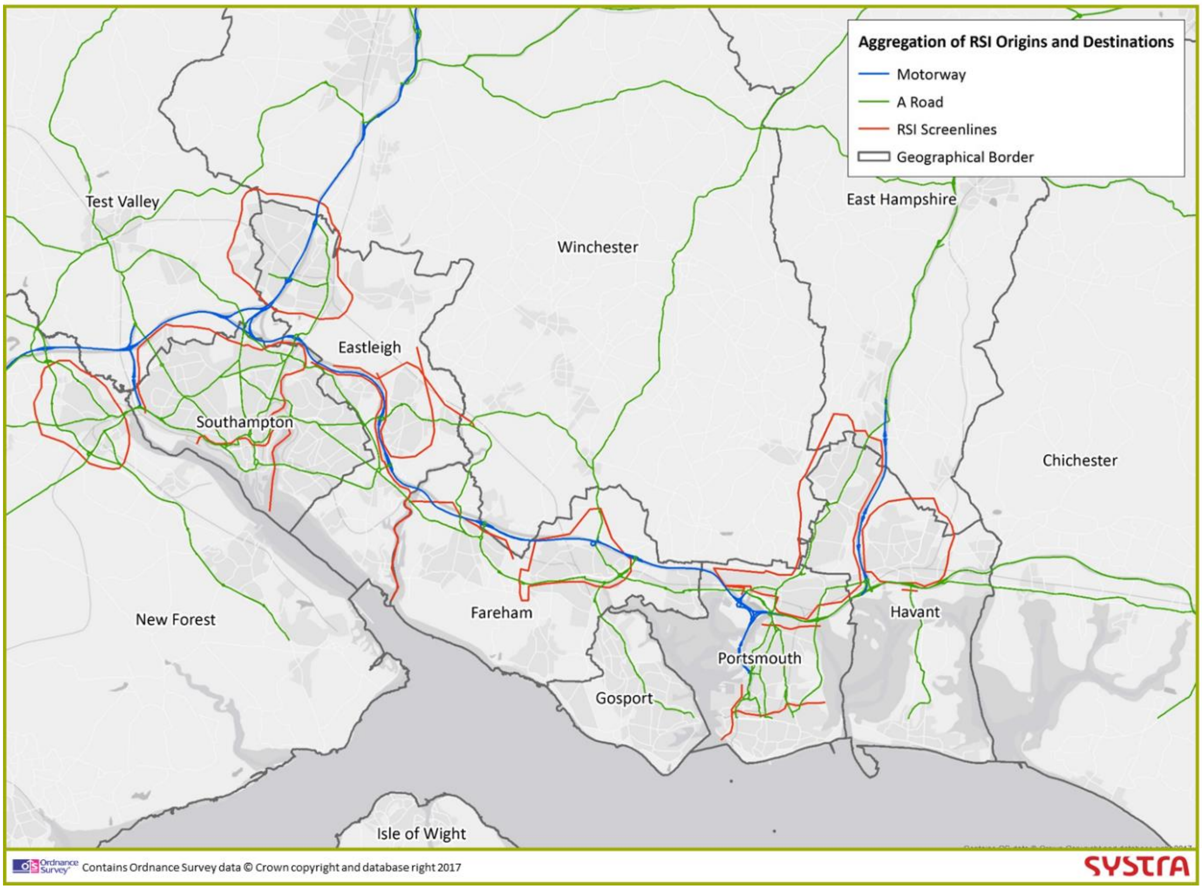
RSI Origin Purpose	RSI Destination Purpose: Home	Holiday Home/hotel	Normal place of work	Employers business	Education	Shopping	Personal business	Visit friends	Recreation/Leisure
Home	HBO	HBO	HBW	HBB	HBE	HBO	HBO	HBO	HBO
Holiday Home/hotel	HBO	NHO	NHB	NHB	NHO	NHO	NHO	NHO	NHO
Normal place of work	HBW	NHB	NHB	NHB	NHO	NHO	NHO	NHO	NHO
Employers business	HBB	NHB	NHB	NHB	NHO	NHO	NHO	NHO	NHO
Education	HBE	NHO	NHO	NHO	NHO	NHO	NHO	NHO	NHO
Shopping	HBO	NHO	NHO	NHO	NHO	NHO	NHO	NHO	NHO
Personal business	HBO	NHO	NHO	NHO	NHO	NHO	NHO	NHO	NHO
Visit friends	HBO	NHO	NHO	NHO	NHO	NHO	NHO	NHO	NHO
Recreation/Leisure	HBO	NHO	NHO	NHO	NHO	NHO	NHO	NHO	NHO

TfSH Trip Purposes	
Home Based Work	HBW
Home Based Employers Business	HBB
Non Home Based Employers Business	NHB
Home Based Education	HBE
Home Based Other (leisure, personal business)	HBO
Non Home Based Other	NHO

7.3.5 The sector system used for partial matrix construction (Figure 13) is defined by the RSI screenlines and other suitable boundaries, including:

- enclosure cordons;
- natural barriers - such as the River Itchen;
- the 'Core Area' boundary; and
- Motorways.

Figure 13. Aggregation of RSI Origins and Destinations to Solent Trip Purposes



7.4 Development of Trip Ends

7.4.1 The home-based purpose origin/destination person trip ends for zones within the FMA were produced using the following steps:

- Home-based production trip ends were estimated for all FMA zones by applying the NTEM production trip rates to the population data. These trip ends represent the 'outbound' trip only;
- Home-based attraction trip ends within the FMA were estimated by applying the NTEM trip attraction trip rates to the employment data, and scaling total attractions to match total productions for each purpose, mode (including active modes), time period and car availability across the FMA;

- The Outbound/Return factors were used to calculate the ratio of from-home and to-home trips in each time period; these ratios were used to generate return trip ends from the NTEM-based outbound trip ends;
- Origin/Destination trip ends were then derived from the production/attraction trip ends by re-applying the Outbound/Return factors.

7.4.2 The non-home-based purpose origin/destination trip ends for zones within the FMA were developed using home-based to non-home based trip rate factors derived from National Travel Survey (NTS) data which has information on how many non-home based trips are made after or before any home based trips.

7.4.3 A full set of origin/destination trip ends for all model zones and purposes was therefore produced by combining these three sets of trip ends (FMA home based, FMA non-home based and all zones outside the FMA).

7.5 Origin/Destination Demand Matrices

7.5.1 The origin/destination matrices were created separately for two parts of the matrix: the Core FMA, and the Marginal FMA and the Buffer/External areas (see Table 13):

- a Gravity model (GrM) was used for the Core FMA demand;
- trip ends obtained from TEMPRO were used during the furnessing process.
- ANPR Number plate matching based technique was used for the through-FMA external demand.
- trips From/To Winchester were compared and replaced if it was considered proper using the uplifted demand from NHTM as it is considered to be a more reliable estimate of these trips.
- Demand from/to airports and ports (Gateway Demand) was considered for the External areas

Core FMA Demand - Destination Choice Model

7.5.2 The trip distribution for the development of the synthetic matrices was derived using a gravity model. Person trip matrices were synthesised and then converted to vehicle matrices using the vehicle occupancy factors derived from WebTAG 2016.

7.5.3 The occupancy factors were assumed to be the same for all time periods. Table 13 presents the Occupancy factors by trip purpose.

Table 13. Vehicle Occupancies by Trip Purpose

HBW	HBB	HBE	HBO	NHB	NHO
1.113	1.128	1.697	1.512	1.181	1.467

7.5.4 The gravity model considered:

- the generalised cost of highway travel between two zones;
- trip ends data from TEMPRO;
- observed sector-to-sector movements.

7.5.5 The initial phases of the synthetic matrix development costs derived from the Solent Strategic Transport Model (SSTM) model were used. Later, when costs from the RTM became available, the SSTM costs were replaced.

7.5.6 The synthetic matrices were developed using all the observed destination choices from the RSI surveys to estimate the parameters of the gravity model. Synthetic matrix development can be broken down into three procedures: estimation, calibration and application of a destination choice model. For clarity:

- "estimation" refers to the statistical estimation of model parameters and their associated standard errors;
- "calibration" refers to the adjustment of model parameters post-estimation to ensure that the model forecasts adhere to a set of constraints that were not imposed during estimation, i.e. the trip end constraints and sector-to-sector trip observations from the RSI surveys; and
- "application" refers to the application of the calibrated parameters to populate the matrices and, as necessary, merge these matrices with partial matrices to represent some unrepresented external-to-external trips, particularly the through-FMA demand.

7.5.7 An important aspect of the estimation process was the analysis of variation in travel behaviour across different time periods. Parameters were calibrated to match observed trip cost distributions, segmented by period and purpose.

7.5.8 A Gamma distribution considered that best represents the travel behaviour based on the generalised cost for trips between two zones.

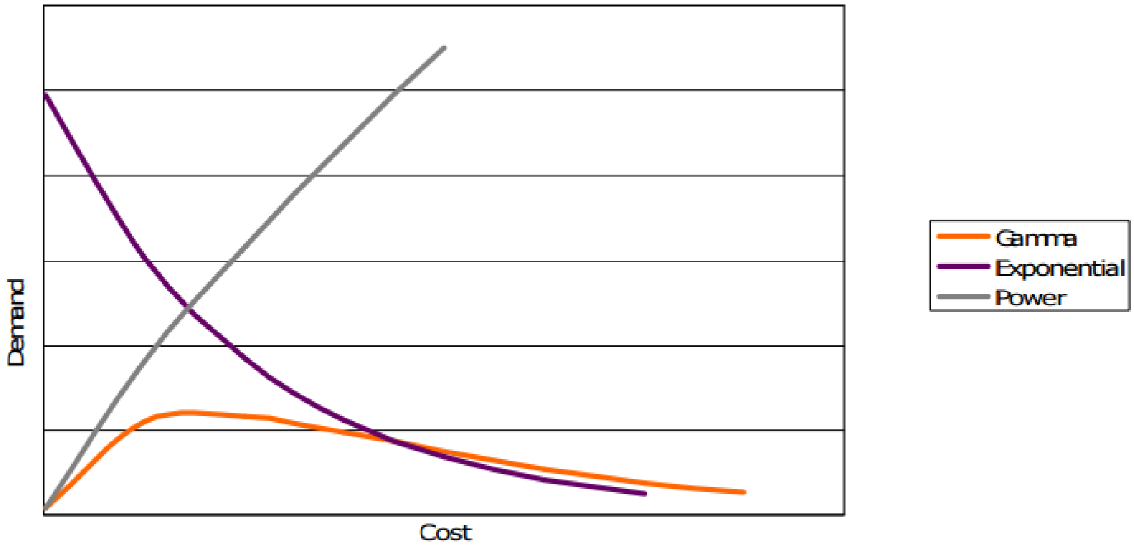
7.5.9 The cost deterrence function (Gamma distribution) requires manual calibration and takes the form:

$$F(C_{ij}) = {C_{ij}}^{X_1}\exp(X_2 C_{ij})$$

Where $F(C_{ij})$ is the cost deterrence from zone i to zone j, C_{ij} is the generalised cost from zone i to zone j and X_1 and X_2 are coefficients to be calibrated.

7.5.10 The form of the cost deterrence function is shown in Figure 14.

Figure 14. Cost Deterrence Functions



7.5.11 According to WebTAG[3] doubly constrained models should be used for commuting and education in order to reflect the relative confidence in the measures of attraction for commuting and educational trips, as well as the relatively fixed nature of these attraction values in the short term. Other purposes such as shopping, social and leisure trips are typically modelled as singly production-end constrained. For these purposes, the trip end factors reflect the attraction of destinations, not the actual numbers of trips attracted.

7.5.12 For a doubly constrained trip distribution zonal origins and destinations match trip ends.

7.5.13 For a singly constrained trip distribution zonal destinations match trip ends.

7.5.14 For the calibration of the cost deterrence function a doubly or singly constrained trip distribution was used. Table 17 presents the optimised X1 and X2 values of the cost deterrence function.

7.5.15 Trip Cost Distributions for the doubly or singly constrained demand were calibrated against the trip end model.

7.5.16 The following the following trips were doubly constrained during the calibration process

- Car Home Based Work (HBW);
- Car Home Base Education (HBE);
- LGVs;
- HGVs.

7.5.17 The following trips were considered simply constrained during the calibration process

- Car Home Based Business (HBB);
- Car Home Based Other (HBO);
- Car Non-Home Based Business (NHB);
- Car Non-Home Based Other (NHO).

[3] TAG Unit M2 Variable Demand Modelling 4.6 Trip Frequency

7.5.18 A third constraint was applied to consider the `fully observed' sector to sector movements. Zone to zone matrices were factored based on factors computed at the sector level.

7.5.19 The "fully observed" movements represent the observed movements of the Road Survey Interviews(RSI). The RSI surveys from a previous study4 were used and uplifted properly in order to be indicative of the 2015 travel patterns.

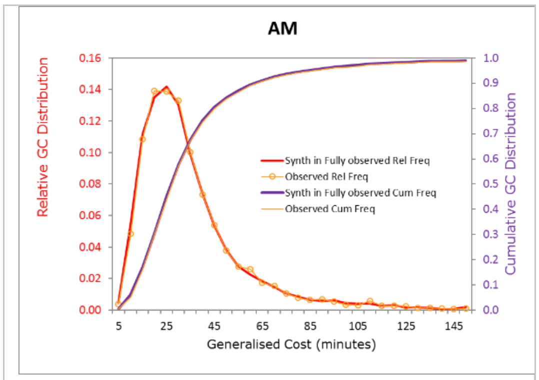
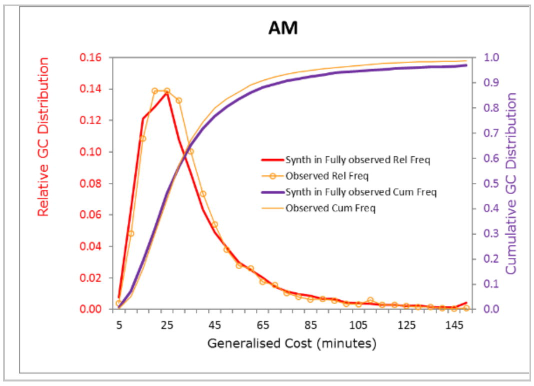
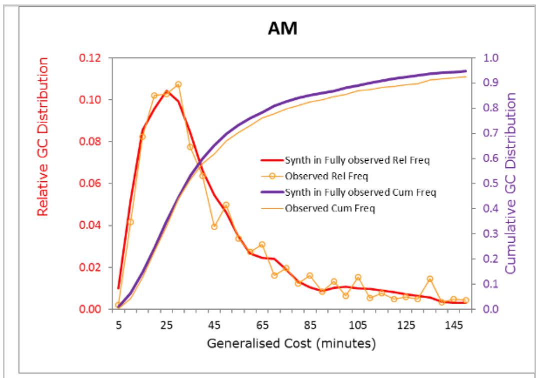
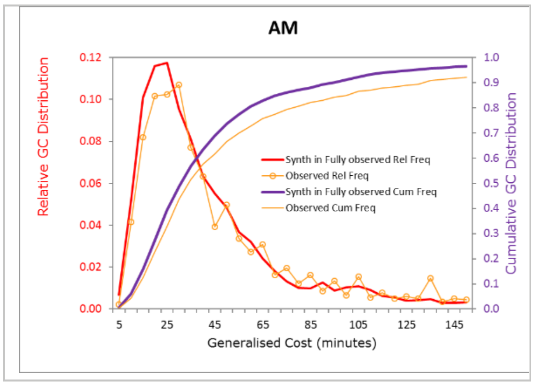
7.5.20 Zero survey movements were not constrained.

7.5.21 Due to the lack of data in Isle of Wight(IoW), movements to the IoW were spread across destinations and movements from the IoW were spread across origins.

7.5.22 Table 14, 0, and 0 present a comparison of the relative and cumulative frequency between the observed and the synthesised demand.

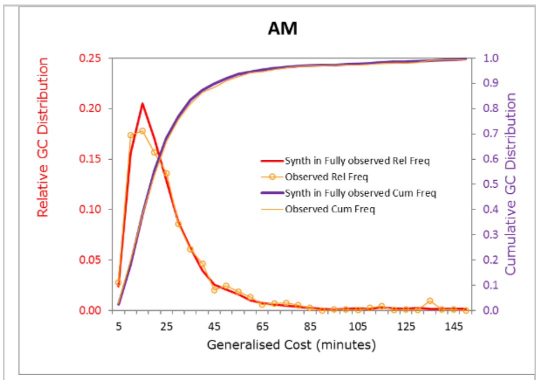
7.5.23 Generally, there is a good fit of observed and modelled trip cost distributions.

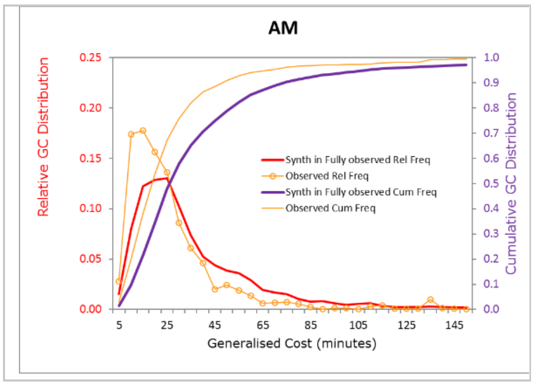
Table 14. Synthesised vs Observed relative and cumulative frequency distribution AM

PURPOSE VEHICLE	SINGLY OR DOUBLY	TRIPLY
HBW CAR		
HBB CAR		

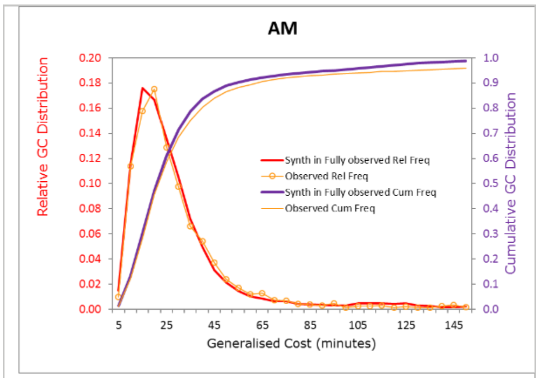
4 Transport for South Hampshire Evidence Base,Road Traffic Model Calibration and Validation Working Paper 9, September 2011

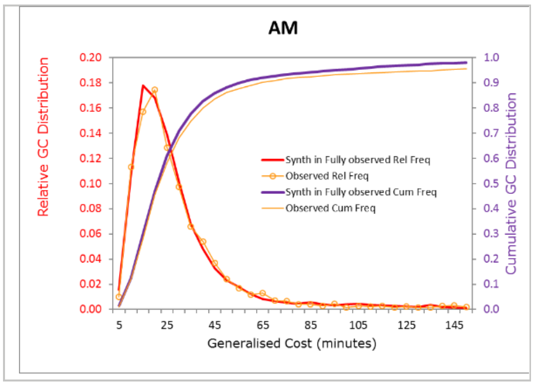
HBE CAR



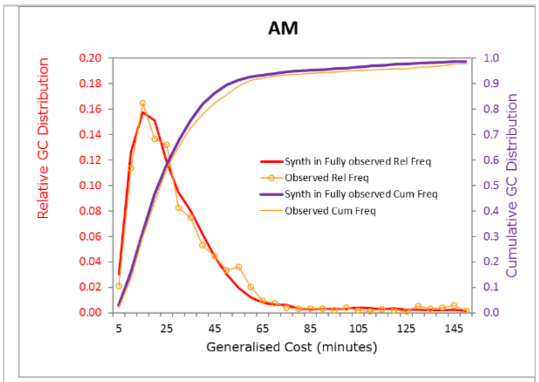


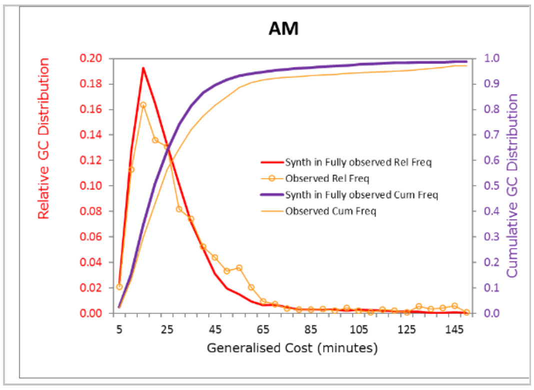
HBO CAR



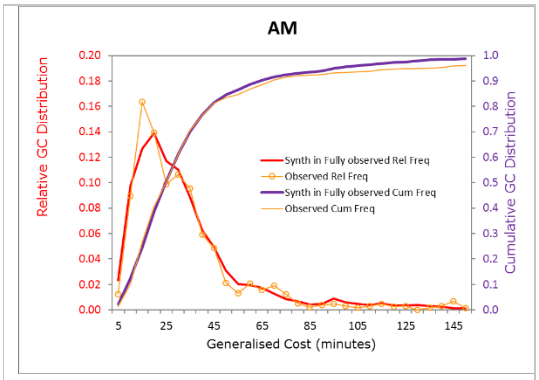


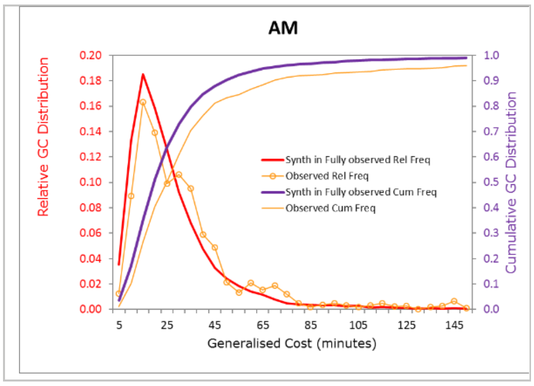
NHO CAR



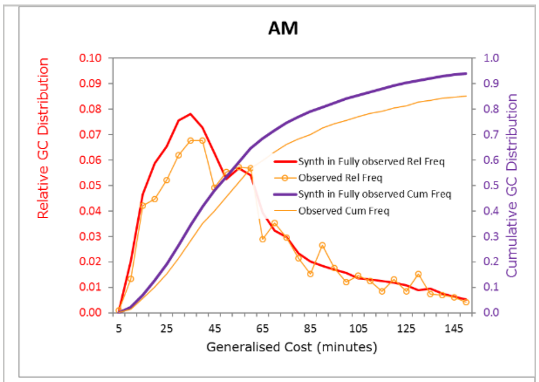


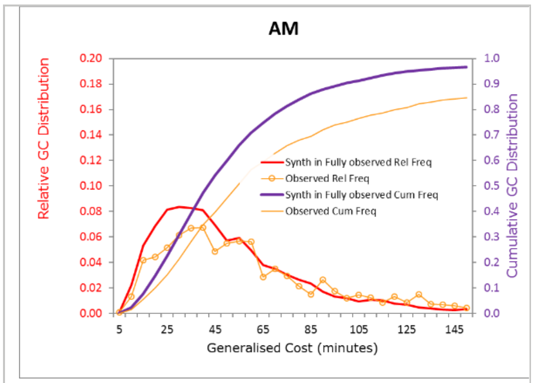
NHB CAR



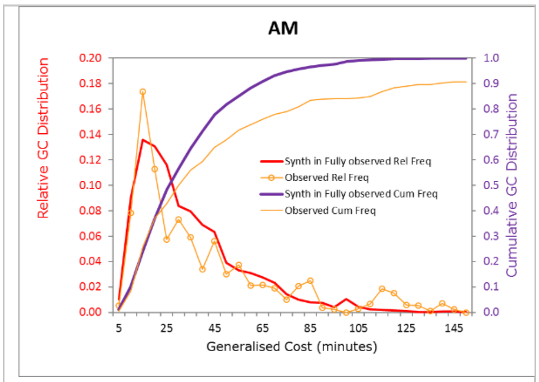


NOP LGV





NOP HGV



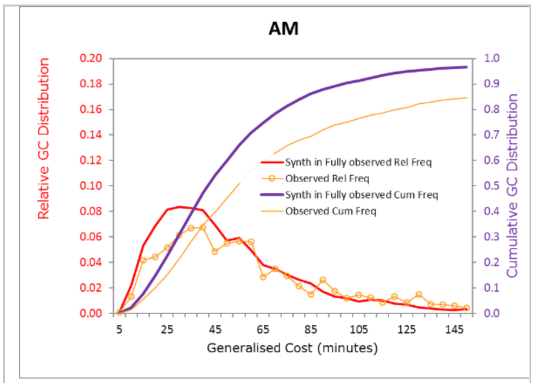
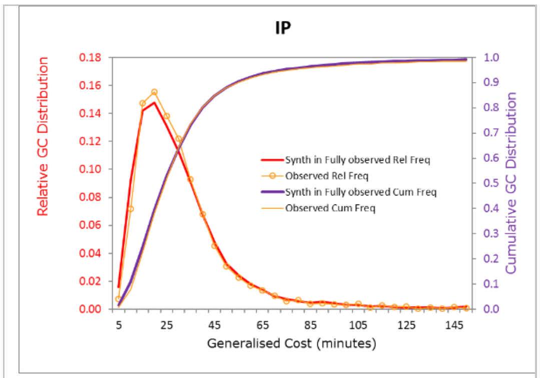
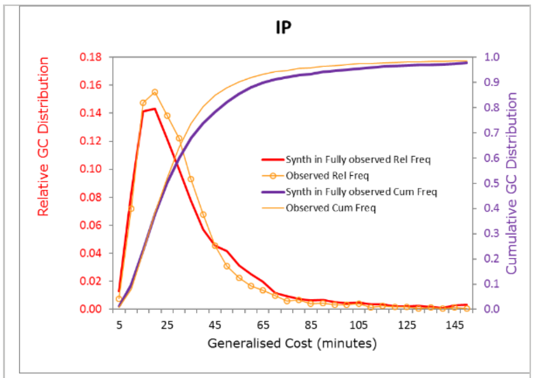
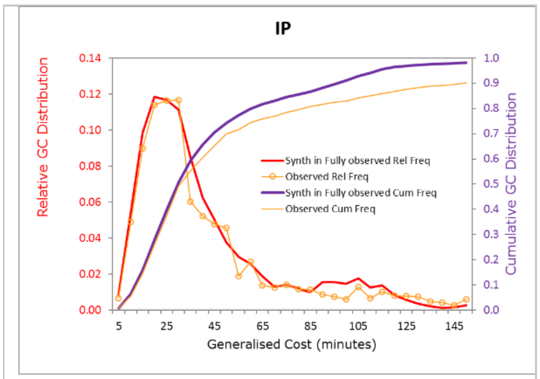
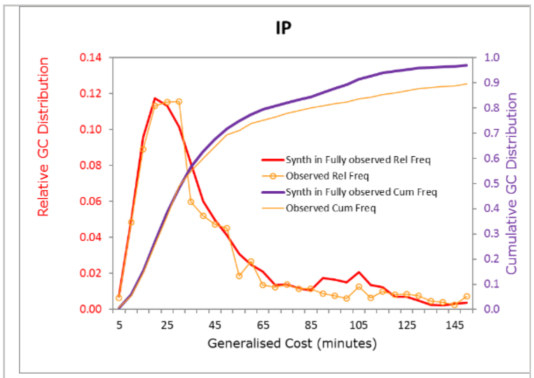
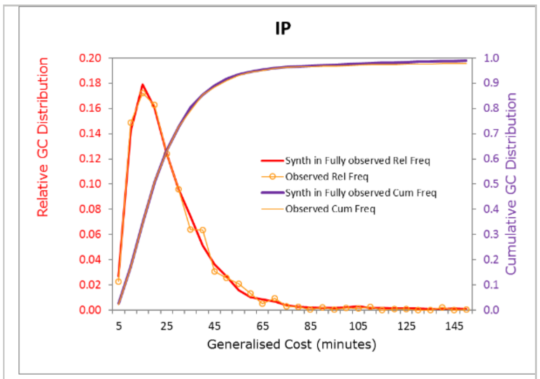
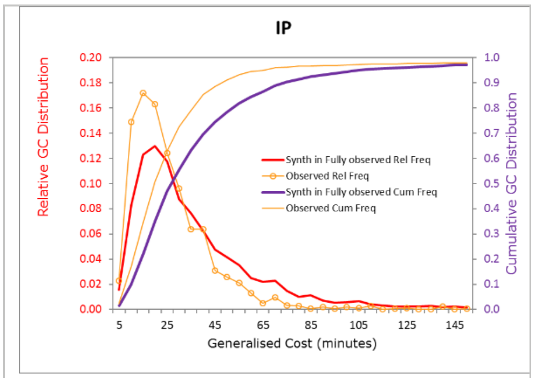


Table 15. Synthesised vs Observed relative and cumulative frequency distribution IP

<table>
<tr><th>PURPOSE VEHICLE</th><th>SINGLY OR DOUBLY</th><th>TRIPLY</th></tr>
<tr><td>HBW CAR</td><td>
</td><td>
</td></tr>
<tr><td>HBB CAR</td><td>
</td><td>
</td></tr>
<tr><td>HBE CAR</td><td>
</td><td>
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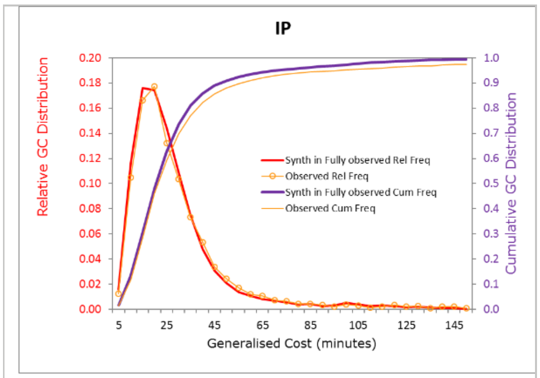
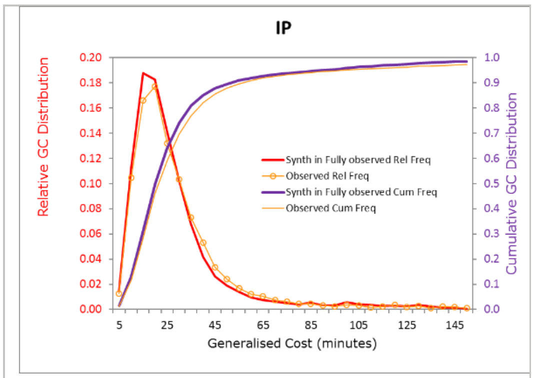
<tr><td>HBO CAR</td><td>
</td><td>
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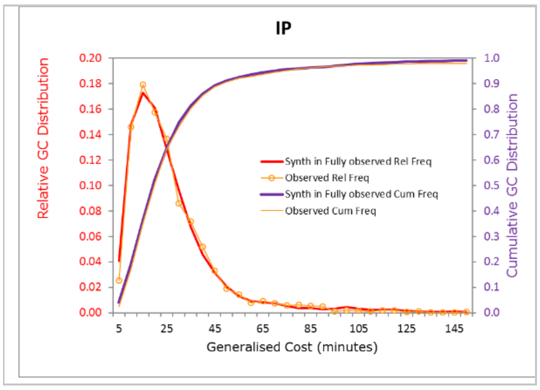
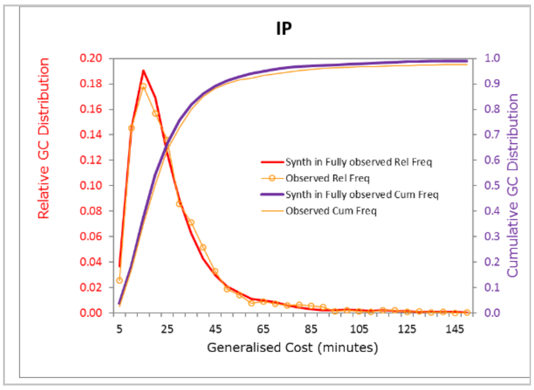
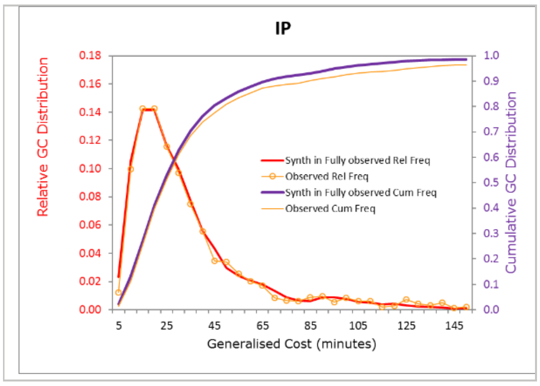
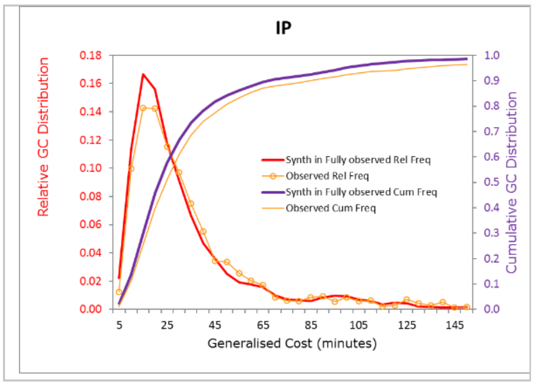
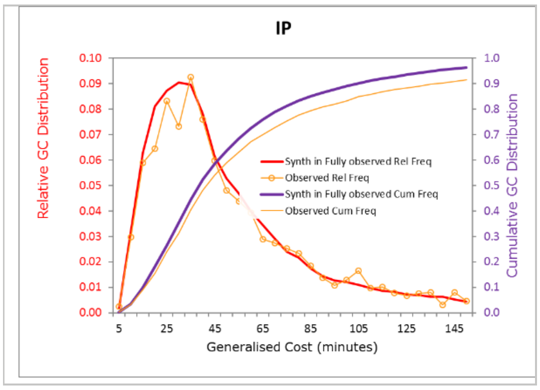
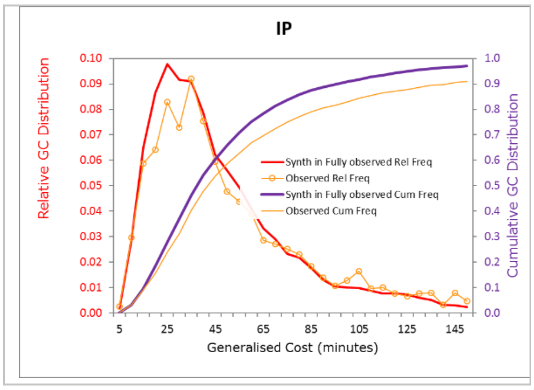
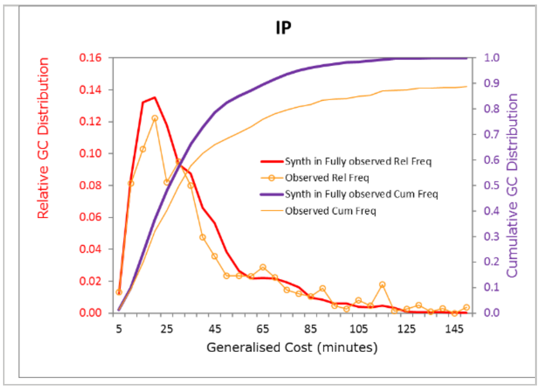
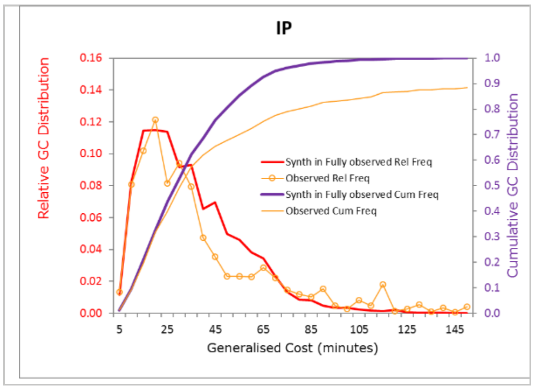
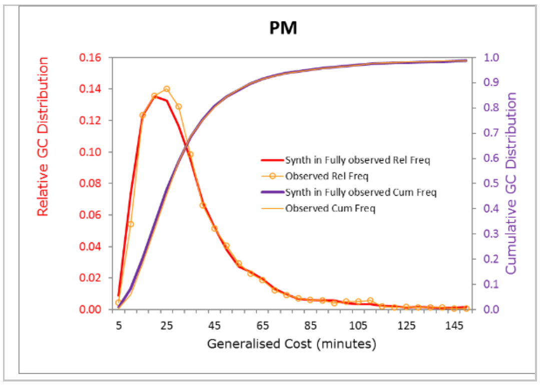
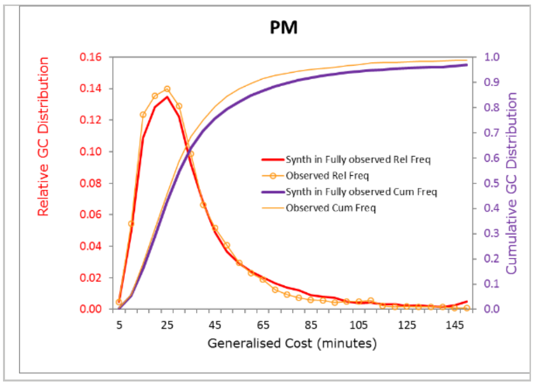
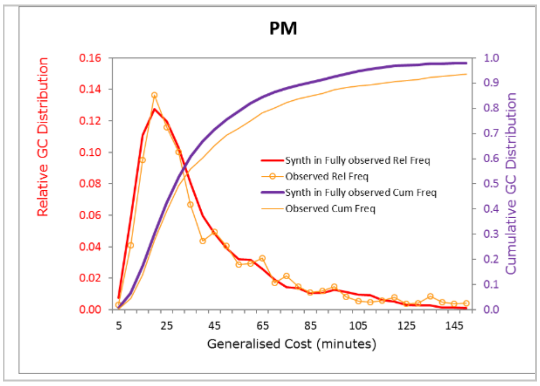
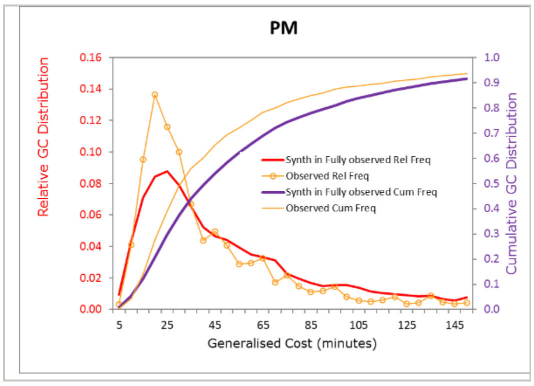
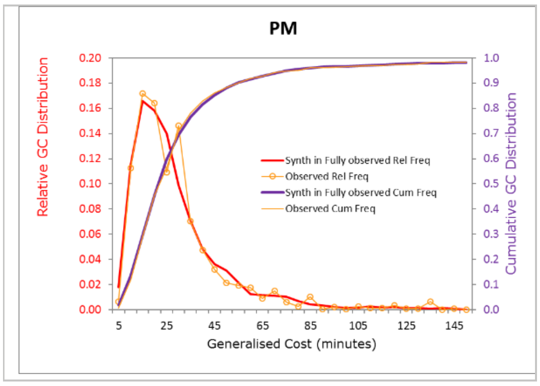
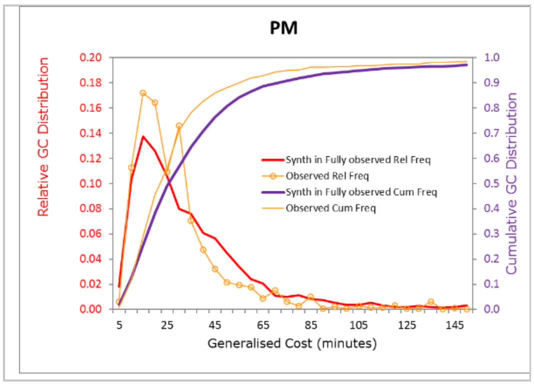
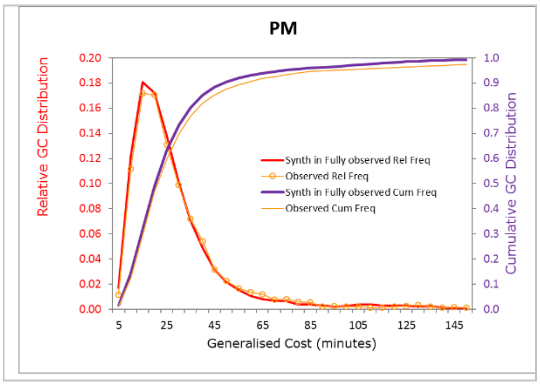
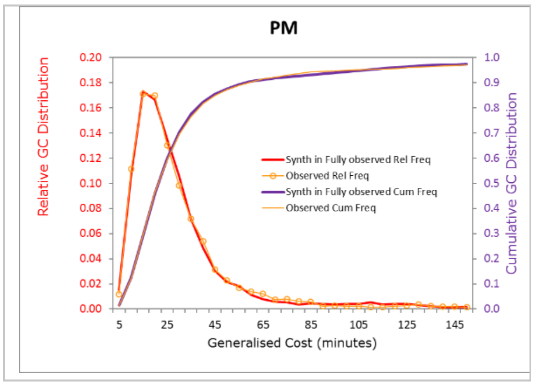
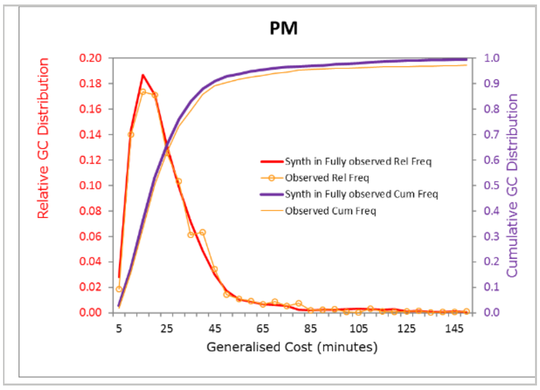
NHO CAR		
NHB CAR		
NOP LGV		
NOP HGV		

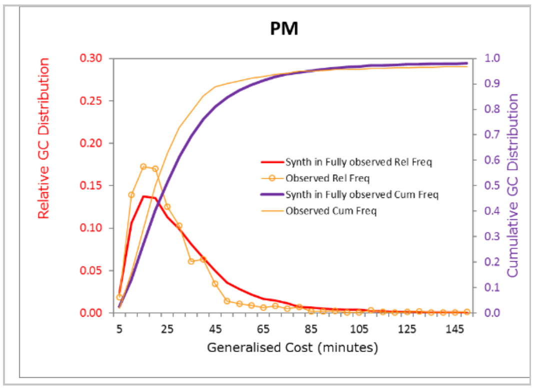
Table 16. Synthesised vs Observed relative and cumulative frequency distribution PM

PURPOSE VEHICLE	SINGLY OR DOUBLY	TRIPLY
HBW CAR		
HBB CAR		
HBE CAR		
HBO CAR		

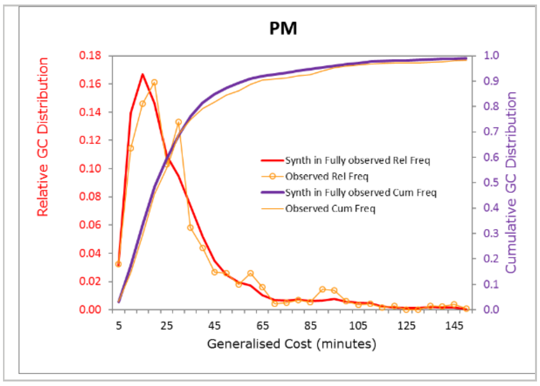
Solent Transport SYSTRA

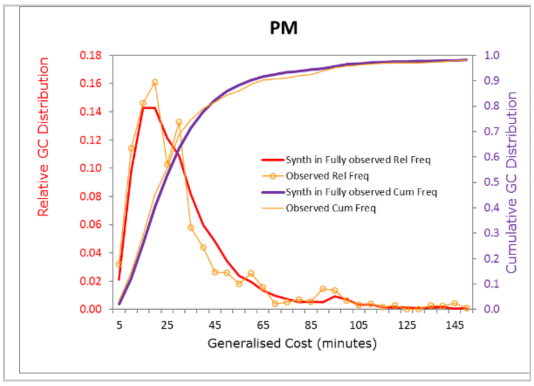
NHO CAR





NHB CAR





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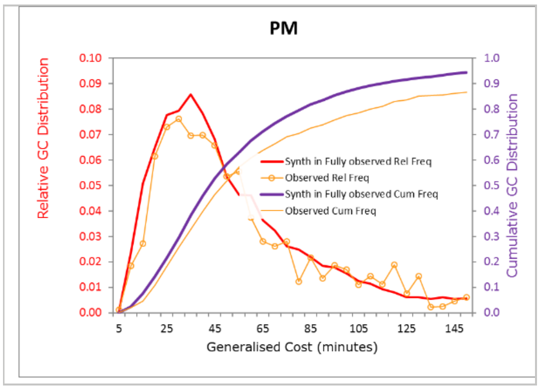
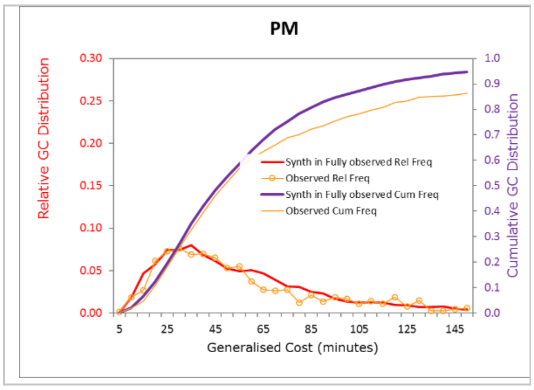
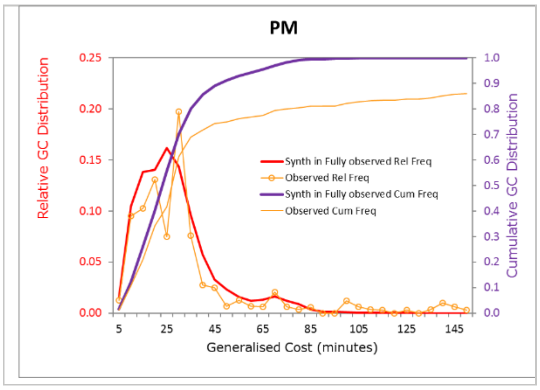




NOP HGV



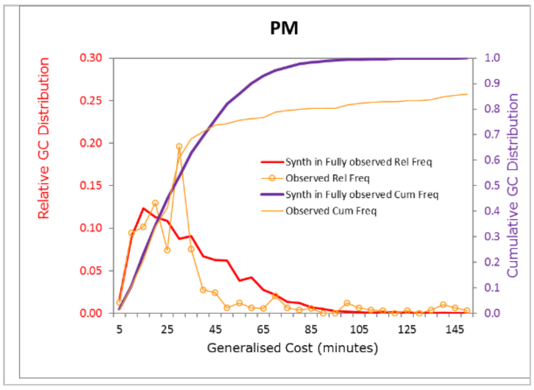


Table 17. Gravity model calibration parameters

	HBW	HBB	HBE	HBO	NHB	NHB	LGV	HGV
AM	X1 = 0.175 X2 = -0.075	X1 = -1.3 X2 = 0	X1 = -0.8 X2 = -0.1	X1 = -0.3 X2 = -0.1	X1 = -0.7 X2 = -0.05	X1 = -0.9 X2 = -0.05	X1 = 0.425 X2 = -0.05	X1 = -0.19 X2 = -0.09
IP	X1 = -0.6 X2 = -0.05	X1 = -0.2 X2 = -0.05	X1 = -1 X2 = -0.05	X1 = -0.1 X2 = -0.1	X1 = -0.7 X2 = -0.05	X1 = -1 X2 = -0.05	X1 = 0 X2 = -0.05	X1 = 0.3 X2 = -0.1
OP	X1 = -0.6 X2 = -0.05	X1 = -0.2 X2 = -0.05	X1 = -1 X2 = -0.05	X1 = -0.1 X2 = -0.1	X1 = -0.7 X2 = -0.05	X1 = -1 X2 = -0.05	X1 = 0 X2 = -0.05	X1 = 0.3 X2 = -0.1
PM	X1 = -0.4 X2 = -0.05	X1 = -0.2 X2 = -0.05	X1 = -1 X2 = -0.05	X1 = -0.2 X2 = -0.1	X1 = -0.9 X2 = -0.05	X1 = -0.2 X2 = -0.1	X1 = 0.3 X2 = -0.05	X1 = 0.2 X2 = -0.1

Utilisation of Demand from North Hampshire Transport Model (NHTM)

7.5.24 Trips between Winchester and the Core area of the NHTM estimated during the matrix synthesis process were replaced with the growthed demand from NHTM model. The 2010 NHTM demand was uplifted by 2% as an estimate of the year 2015.

Through FMA Demand – Number Plate Matching

7.5.25 Trips with both the origin and destination trip ends outside the FMA but going through the FMA were intercepted using ANPR Surveys on the key routes to Urban South Hampshire, the A27, A3(M), M3, A36 and M27 (Section 5.4). A number plate matching exercise was then used to establish the through-FMA demand. The ANPR data was collected for three classes of vehicles, Cars LGVs and HGVs.

7.5.26 The 2010 ANPR trip end data was uplifted and furnessed in order to match the 2015 TRADS data. Census Journey to Work distributions for trips travelling through the ANPR catchment were used to split the trip ends across the zones beyond the ANPR sites.

7.5.27 Table 18 presents the ANPR through traffic vehicles by period and vehicle class.

Table 18. ANPR Through Traffic Vehicles by Period and Vehicle Class

VEHICLE	AM (07:00-10:00)	INTER PEAK (10:00-16:00)	PM (16:00-19:00)	TOTAL (12HR)
CARS	2,308	2,157	2,386	6,851
LGV	260	220	99	579
HGV	1,099	835	751	2,685
TOTAL	**3,667**	**3,212**	**3,236**	**10,115**

7.6 Demand from Gateway Zones (Airport & Docks) from the GDM

7.6.1 Demand to and from 5 zones replaces synthesised values for:

- Southampton Airport;
- Southampton Port (three zones); and
- Portsmouth Port (Continental & Commercial).

7.6.2 In order to estimate the 2015 Gateway demand, the 2010 Gateway demand matrices derived from surveys were uplifted using factors based on the growth of traffic counts.

7.6.3 Table 19-23 present the growth factors applied.

Table 19. Origin Car Growth Factors

ORIGIN	CAR		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	0.67	1.02	1.66
SOUTHAMPTON PORT GATE 10	1.59	1.22	1.14
SOUTHAMPTON PORT GATE 20	0.73	0.57	0.61
PORTSMOUTH AIRPORT	1.64	0.78	0.71
SOUTHAMPTON AIRPORT	0.92	1.12	0.96

Table 20. Origin LGV Growth Factors

ORIGIN	LGV		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	1.11	1.57	1.06
SOUTHAMPTON PORT GATE 10	0.76	0.65	0.27
SOUTHAMPTON PORT GATE 20	1.35	1.12	0.66
PORTSMOUTH AIRPORT	0.68	0.77	0.55
SOUTHAMPTON AIRPORT	1.74	1.74	1.27

Table 21. Origin HGV Growth Factors

ORIGIN	HGV		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	1.85	1.75	1.12
SOUTHAMPTON PORT GATE 10	0.85	0.82	0.93
SOUTHAMPTON PORT GATE 20	0.67	0.88	1.01
PORTSMOUTH AIRPORT	0.52	0.70	0.69
SOUTHAMPTON AIRPORT	0.96	0.78	0.55

Table 22. Destination Car Growth Factors

DESTINATION	CAR		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	1.25	0.82	1.37
SOUTHAMPTON PORT GATE 10	1.36	1.28	0.93
SOUTHAMPTON PORT GATE 20	0.95	0.82	1.01
PORTSMOUTH AIRPORT	1.09	1.28	1.01
SOUTHAMPTON AIRPORT	0.79	1.12	1.01

Table 23. Destination LGV Growth Factors

DESTINATION	LGV		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	1.79	1.86	1.93
SOUTHAMPTON PORT GATE 10	0.52	0.59	0.73
SOUTHAMPTON PORT GATE 20	0.88	1.12	0.58
PORTSMOUTH AIRPORT	0.82	1.43	0.70
SOUTHAMPTON AIRPORT	2.11	2.55	3.00

Table 24. Destination HGV Growth Factors

DESTINATION	HGV		
	AM	IP	PM
SOUTHAMPTON PORT GATE 4	1.33	1.24	1.10
SOUTHAMPTON PORT GATE 10	0.52	0.59	0.73
SOUTHAMPTON PORT GATE 20	0.88	1.12	0.58
PORTSMOUTH AIRPORT	0.82	1.43	0.70
SOUTHAMPTON AIRPORT	2.11	2.55	3.00

7.6.4 Table 25 presents the Gateway Demand by period and vehicle class.

Table 25. Gateway Demand Vehicles by Period and Vehicle class

VEHICLE	AM (07:00-10:00)	INTER PEAK (10:00-16:00)	PM (16:00-19:00)	TOTAL (12HR)
CARS	5,058	6,830	3,425	15,313
LGV	739	1,470	445	2,654
HGV	935	2,639	749	4,323
TOTAL	**6,732**	**10,939**	**4,619**	**22,290**

7.7 Assignment Matrices

7.7.1 The assignment matrices were derived from the demand matrices by:

- aggregating the demand matrix trip purposes by assignment purposes;
- applying period- and purpose-specific vehicle occupancy factors; and
- applying peak hour factors calculated from the RSI and count data for the AM/PM peaks and developed average hour matrices for assignment in the inter peak periods.

The mapping from demand to assignment purposes is given in Table 11. The peak hour factors used are shown in Table 8 .

7.7.2 The prior matrix was tested by assigning it on the network and comparing the total assigned flows and total counts (in both directions) across RSI, calibration and validation screenlines for each modelled hour.

7.7.3 Assignment and validation of the one hour RTM matrices showed that matrix estimation was necessary to refine the prior matrices, particularly for trips crossing the calibration screenlines and not sampled using the OD surveys. The changes after matrix estimation are carried back to the Main Demand Model.

7.8 Prior - Trip Matrix Validation

7.8.1 Table 26 shows the results of the RSI cordon and screenline validation analysis for each of the modelled periods for vehicles, for the prior matrix. **Appendix A** shows the validation performance of each cordon and screenline.

7.8.2 In both the AM and PM peak periods, over 85% of the RSI screenlines are within 15% of the observed counts, which is considered an adequate starting point to proceed to matrix estimation.

Table 26. Prior Matrix – RSI Cordon and Screenline Validation: Vehicles

Measure	Criteria	AM Peak	Inter Peak	PM Peak
Matrix Validation	*Differences between modelled flows and counts should be less than **5%** of the counts*	**53%**	**80%**	**73%**
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*83%*	*87%*	*87%*
	*Differences between modelled flows and counts should be less than **15%** of the counts*	*93%*	*97%*	*100%*
	*Differences between modelled flows and counts should be less than **20%** of the counts*	*100%*	*100%*	*100%*

8. MATRIX CALIBRATION AND VALIDATION

8.1 Introduction

8.1.1 This chapter describes:

- trip matrix estimation, including checks of significance of differences between prior and estimated trip matrices; and
- trip matrix validation, including checks of screenline flow against DMRB guidelines.

8.2 Trip Matrix Estimation Process

The Purpose of Matrix Estimation

8.2.1 The primary purpose of matrix estimation is to refine estimates of trips not intercepted in surveys and which have therefore been synthesised. This is why counts on screenlines independent of the roadside interview cordons and screenlines are required. The refinements should be sufficiently small that they are not regarded as significant.

8.2.2 Matrix estimation only either increases or decreases non-zero cell values in the prior trip matrix. The technique cannot be used, therefore, to provide estimates of trips not intercepted in surveys or trips that have not been synthesised. Such situations are very rare however, as the Solent matrices are inherently “full” due to the manner in which they were constructed.

Applying Matrix Estimation

8.2.3 Count constraints should generally be grouped and applied at the short screenline level; these are referred to later as ‘mini-screenlines’. The use of counts at individual sites as constraints has been avoided where possible. The reason for this is that the mismatch between modelled flows and counts at any one location may be due to a number of reasons and not due solely to deficiencies in the trip matrices. Where individual sites, or a small number of sites do form a screenline, the calibration criteria have been adjusted. In adjusting the prior matrices, matrix estimation may well compensate (undesirably) for other errors arising from the design of the zoning system, network structure, centroid connectors, network coding and route choice coefficients, which is why all these aspects should be checked before applying matrix estimation. Applying constraints at individual sites is likely to exacerbate the tendency of the matrix estimation procedure to compensate for deficiencies in other aspects of the model.

8.2.4 The calibration and RSI screenlines were subdivided into mini-screenlines. The screenlines used for matrix estimation were derived based on the principle of isolating major conurbations and activity centres, with particular emphasis on the two major, and distinct centres of Southampton and Portsmouth.

8.2.5 The counts used as constraints in the matrix estimation have been derived from two-week ATCs, and the vehicle type proportions for the four user classes (Car Business, Car Non Business, LGV and HGV) have been obtained from MCCs. Note because control counts were available at a three vehicle class level, the car user class needed to be divided between Car business and Car Non Business in order that matrix estimation could be applied at the Solent four user class assignment level. This was achieved by applying the Business/Non Business splits derived from the Pre Matrix Estimation assignment.

8.2.6 The process was undertaken using six loops between the assignment and matrix estimation. An additional process of optimising signalised junction timings was undertaken using the SIGOPT function before the first and after the sixth loop for signalised junctions for which timing data was not available.

8.2.7 The Matrix Estimation process was constrained using the XAMAX = 2.5 to restrict individual cell value changes to a factor of 2.5 to prevent excessive distortion of the matrix.

Matrix Estimation Process

8.2.8 The matrix estimation process uses the SATURN program SATME2 in conjunction with the supplementary program SATPIJA. It is based on the theoretical procedure generally referred to as ME2 - Matrix Estimation from Maximum Entropy. SATME2 essentially tries to improve the fit between modelled and observed flows by selectively factoring individual cells of the input trip matrix. SATPIJA creates a file used by SATME2 which represents the proportion of trips between origin-destination pairs which uses the counted link (from SATURN Manual Section 13).

8.2.9 The inputs to the process are:

- highway networks, AM, IP and PM;
- highway prior matrices AM, IP, PM by user class; and
- SATME2 inputs – calibration counts divided into mini-screenlines.

8.3 Trip Matrix Estimation Outcomes

8.3.1 This section describes the trip matrices before and after matrix estimation using the following analyses:

- matrix size by user class;
- statistical analysis of change in trip ends;
- statistical analysis of change in trip cost distributions.

Matrix size

8.3.2 Table 27 presents matrix sizes by user class before and after matrix estimation.

Table 27. Prior and Estimated Matrix Sizes

USER CLASS	1 Car Business	2 Car Non Business	3 LGV	4 OGV	TOTAL All Vehicles
AM peak hour					
Prior	14,757	142,211	13,577	10,830	181,376
Calibrated	16,344	152,625	14,381	16,354	199,703
% Diff	11%	7%	6%	51%	10%
Inter peak average hour					
Prior	12,448	105,871	10,249	9,468	138,037
Calibrated	13,030	112,671	11,021	12,875	149,596
% Diff	5%	6%	8%	36%	8%
PM peak hour					
Prior	12,133	151,982	11,604	5,704	181,423
Calibrated	13,152	165,346	12,697	8,934	200,129
% Diff	8%	9%	9%	57%	10%

Analysis of Matrix Differences Pre/Post Matrix Estimation

8.3.3 Figure 16-26 show scatter plots of the pre and post ME matrix row and column totals by period for cars. All time periods show a good correlation with R^2 values, and the graph intercept is reasonably close to zero.

Figure 16. Scatter Plot of Pre and Post ME AM Peak Car Matrix Row Totals

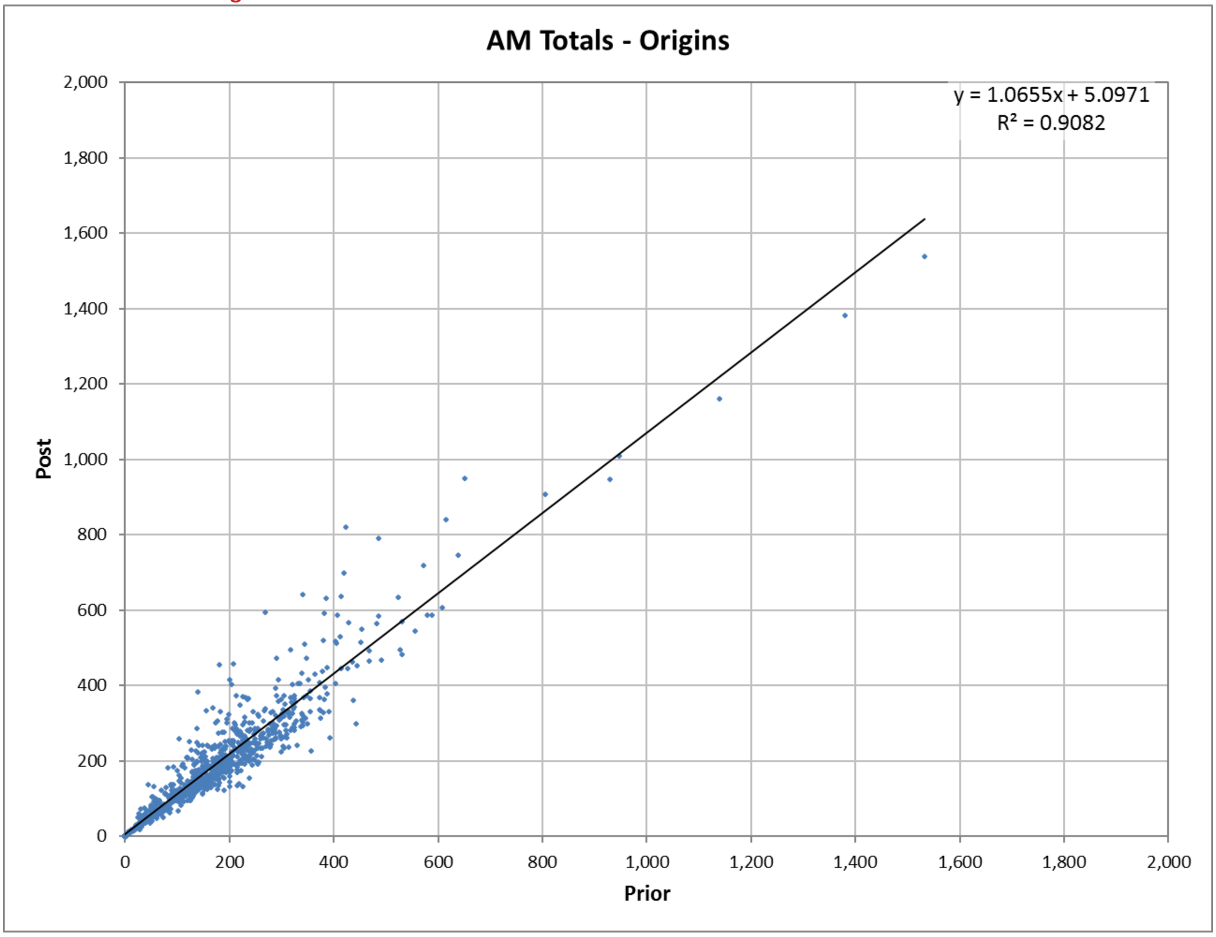


Figure 17. Scatter Plot of Pre and Post ME AM Peak Car Matrix Column Totals

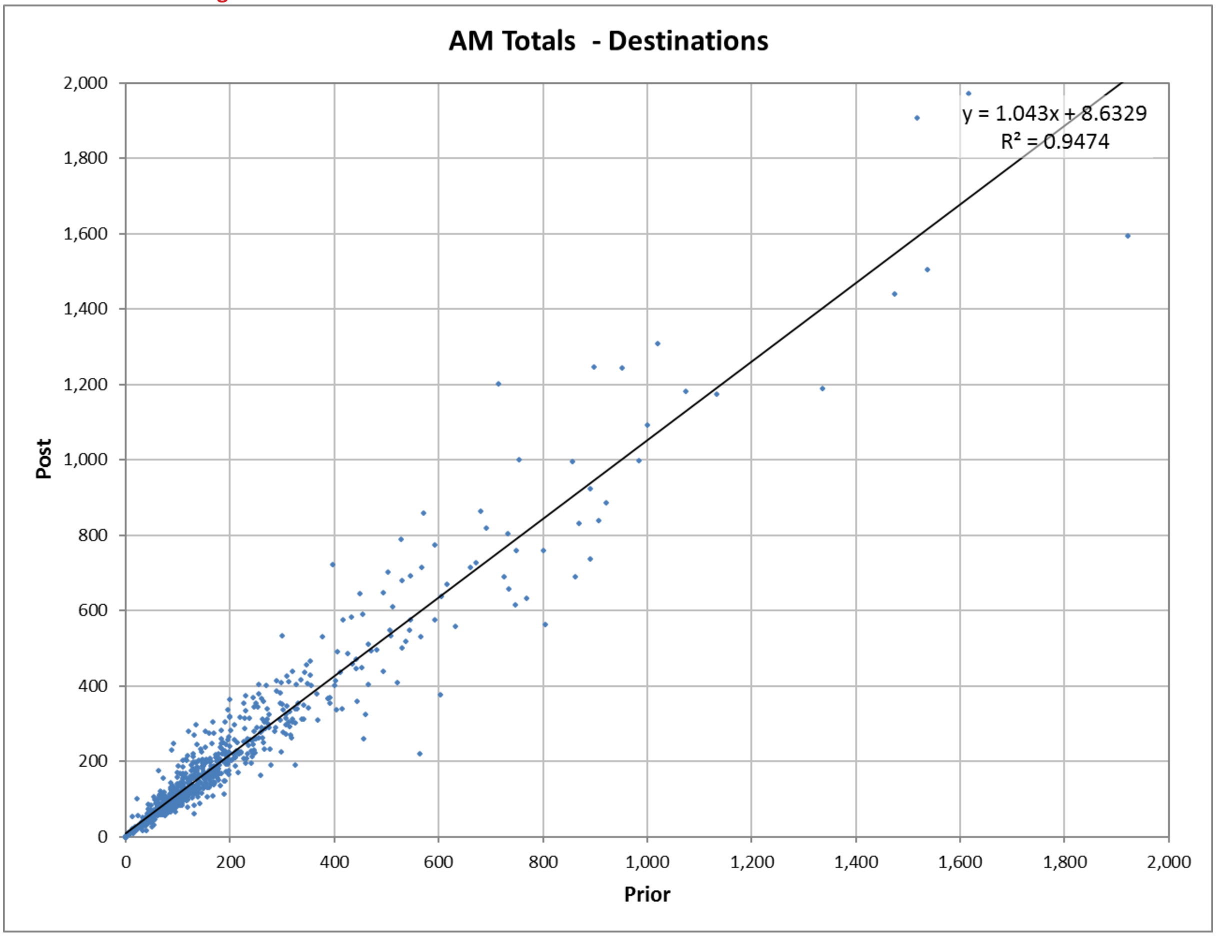


Figure 18. Scatter Plot of Pre and Post ME Inter Peak Car Matrix Row Totals

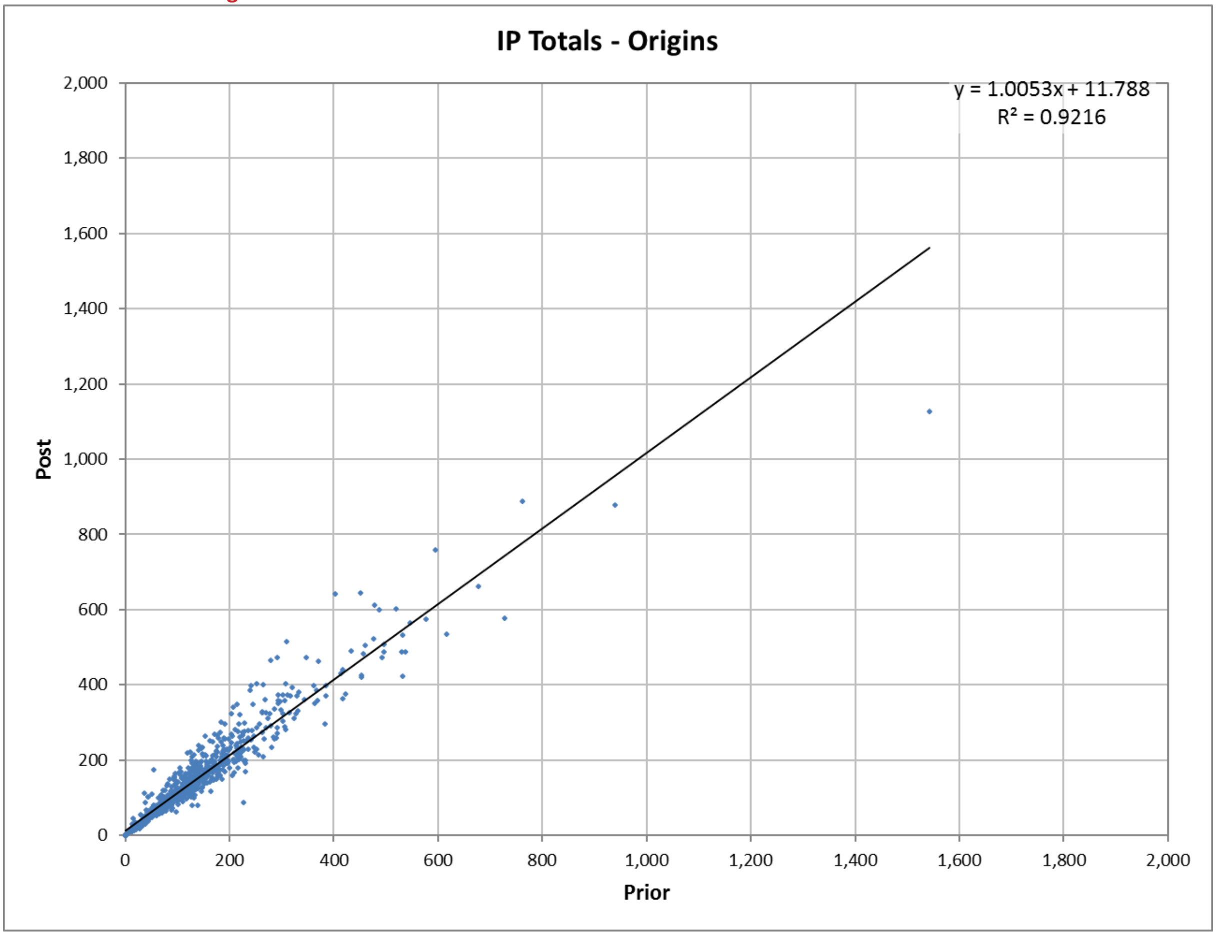


Figure 19. Scatter Plot of Pre and Post ME Inter Peak Car Matrix Column Totals

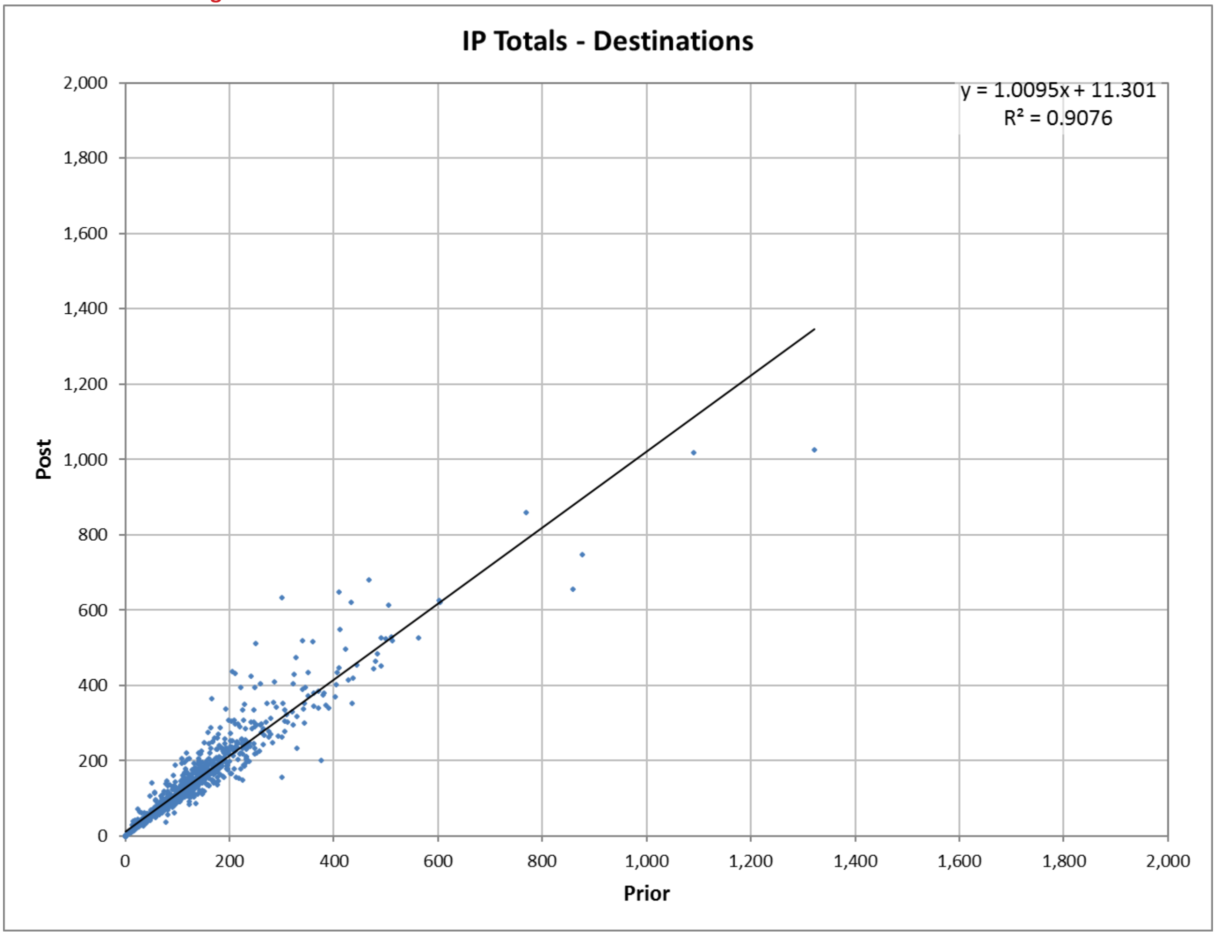


Figure 20. Scatter Plot of Pre and Post ME PM Peak Car Matrix Row Totals

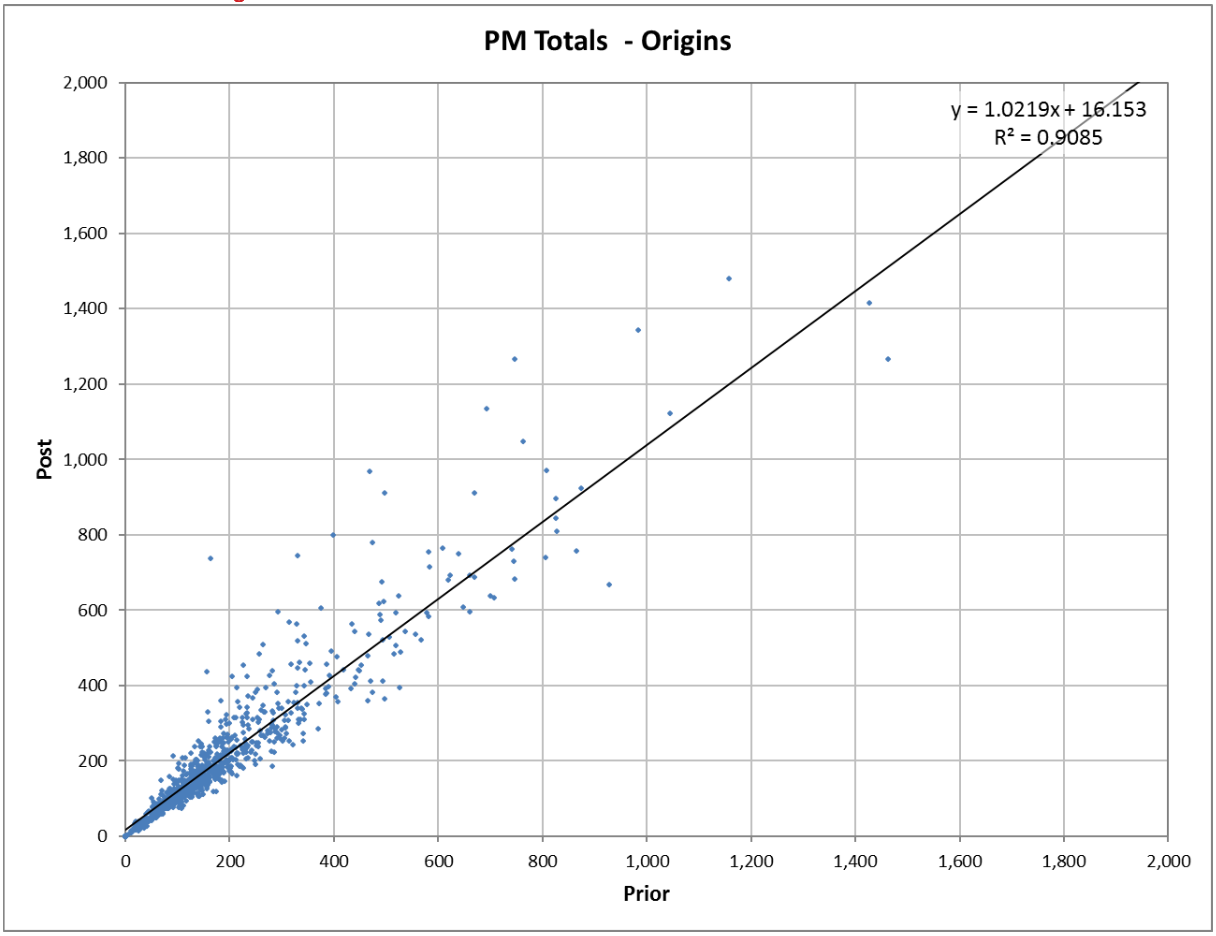
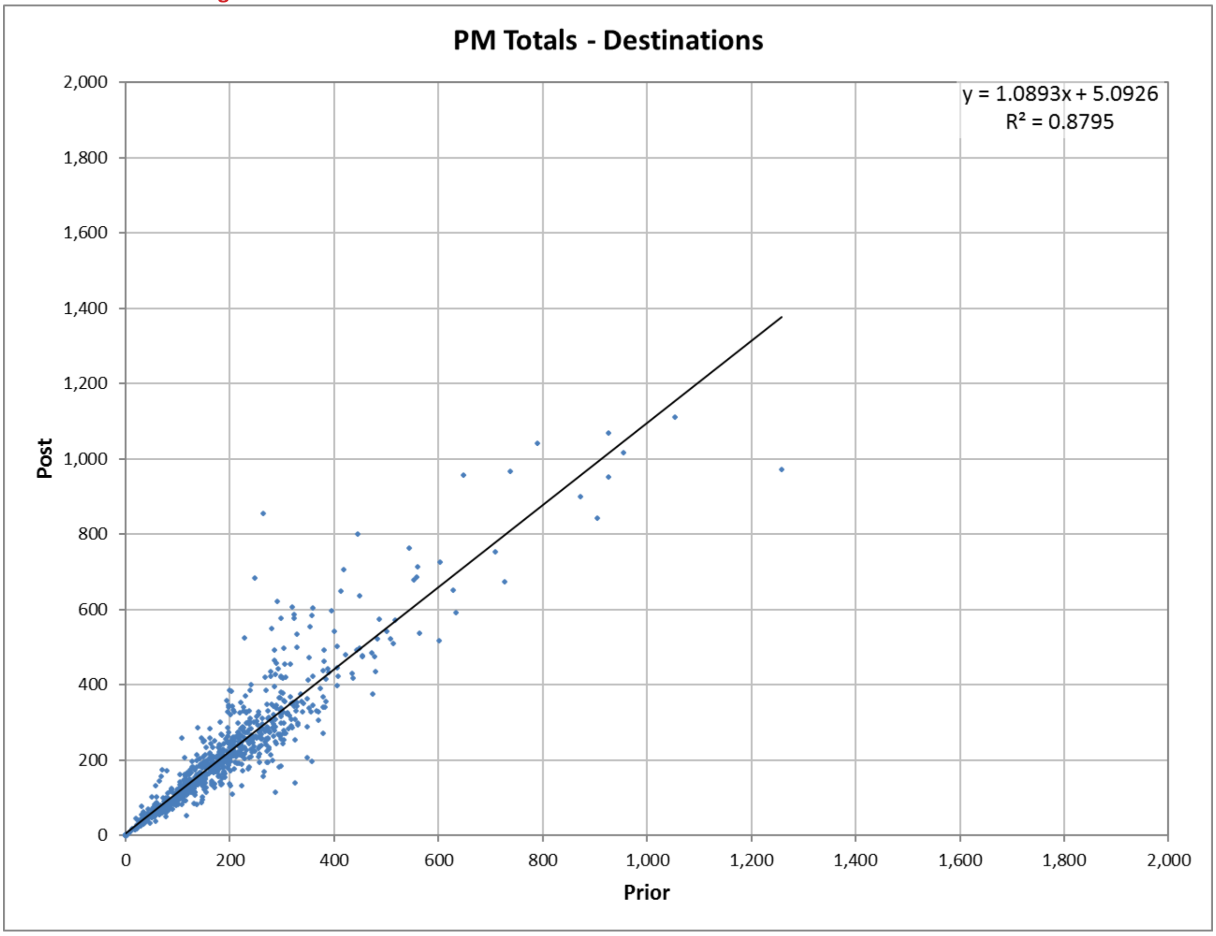


Figure 21. Scatter Plot of Pre and Post ME PM Peak Car Matrix Column Totals



Trip Length Distributions

8.3.4 Figure 22-29 show trip length frequency distributions for all vehicles, showing the number of trips lying within each distance band pre and post matrix estimation, by period. Table 28 shows the mean trip length for the prior and post estimation matrices.

8.3.5 The shape of the curves in Figure 22, Figure 23, and Figure 24 are in line with expectations for a model representing both urban and interurban trips, with short trips dominating the distribution, but a significant number of longer distance trips forming the tail of the distribution. The results show that the matrix estimation process has not significantly distorted the distribution in any of the AM, IP or PM periods.

Figure 22. Trip Frequency Distribution Pre/Post ME AM Peak Hour, All Vehicles – Relative frequency

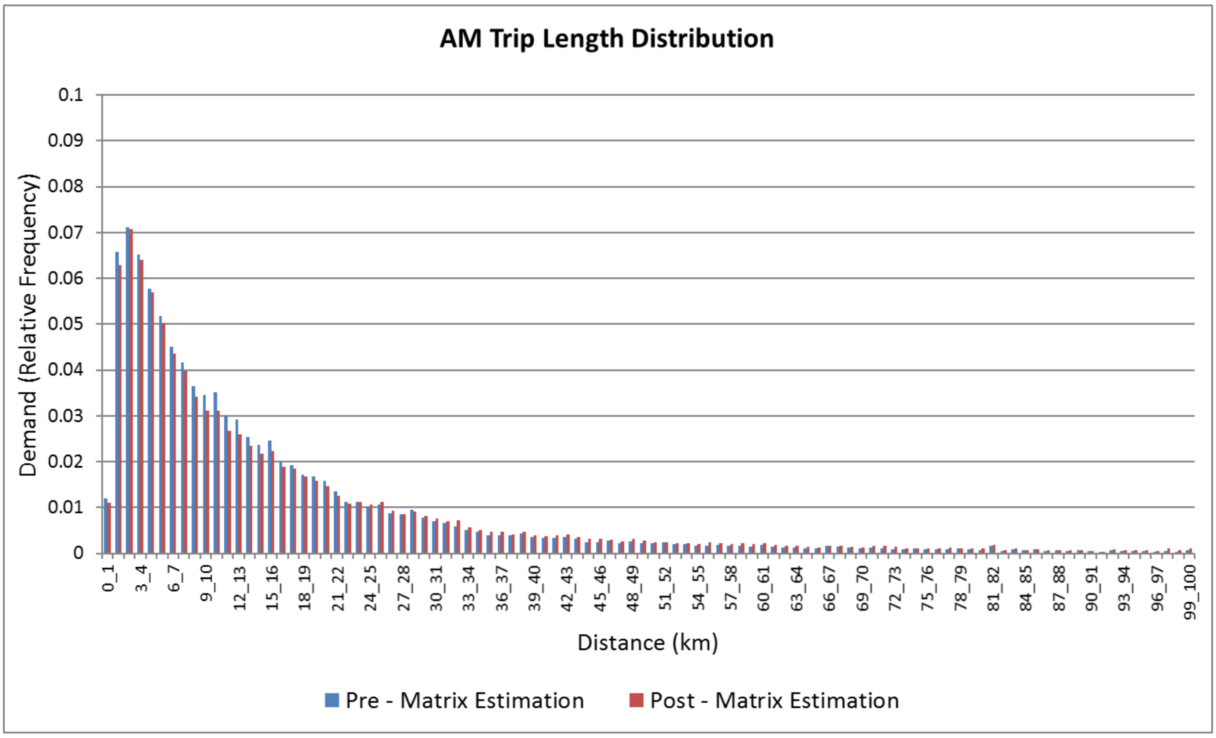


Figure 23. Trip Frequency Distribution Pre/Post ME Inter-Peak Hour, All Vehicles – Relative frequency

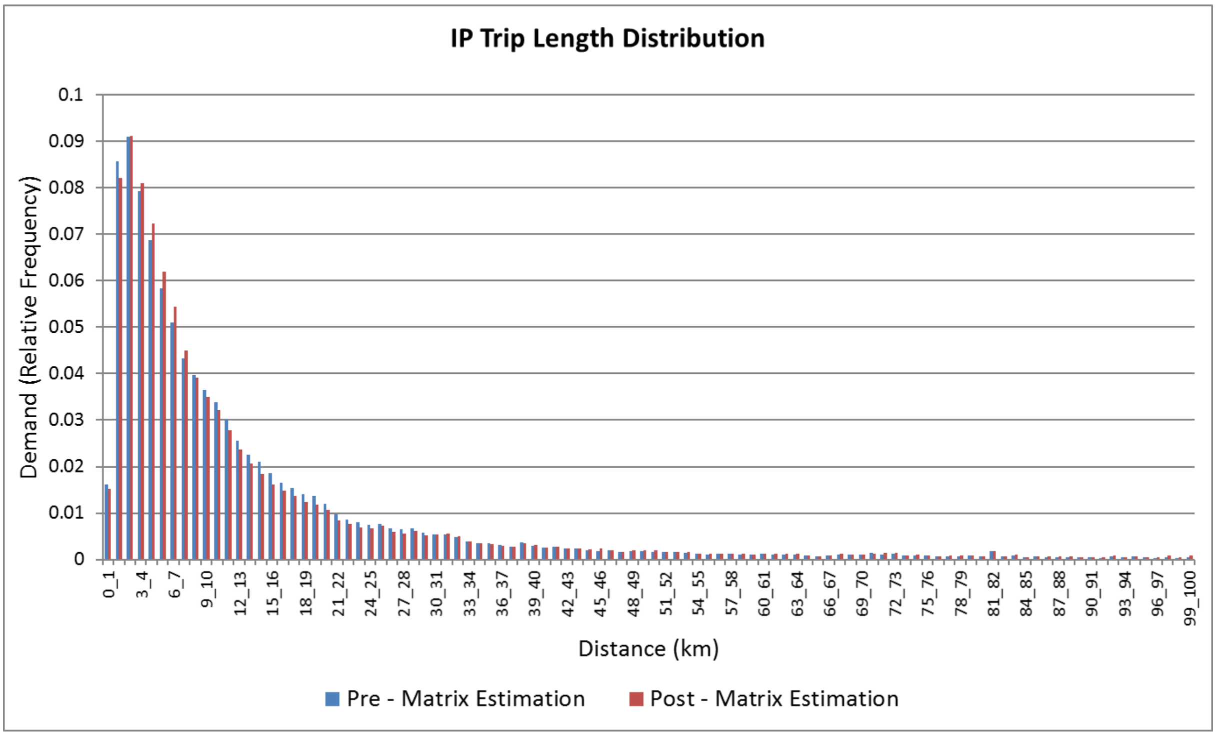
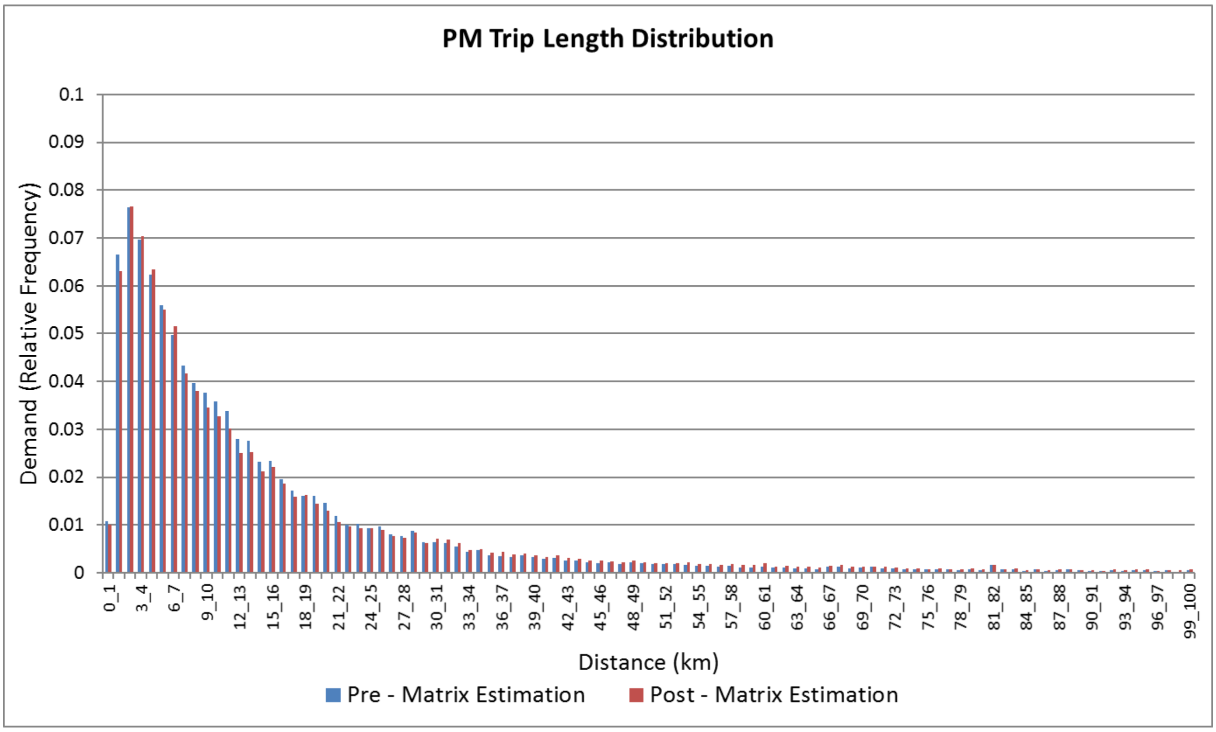


Figure 24. Trip Frequency Distribution Pre/Post ME PM Peak Hour, All Vehicles – Relative frequency



8.3.6 The mean trip length (for within the Core area) changes between 10% and 16%, with average trip length increasing in all cases.

Table 28. Mean Trip Length (km)

MODEL PERIOD	PRIOR	POST	%
AM Peak Hour	21.39	24.70	15.5%
IP Hour	19.12	20.95	9.6%
PM Peak Hour	20.66	23.08	11.7%

8.4 Post - Trip Matrix Validation

8.4.1 Chapter 3 described the WebTAG validation standards. The screenline flow criteria and acceptability guidelines are reproduced in Table 29.

Table 29. 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

8.4.2 Table 30 and Table 31 show the results of the cordon and screenline validation analysis for each of the modelled periods, for vehicles and cars respectively. **Appendix B** shows the validation performance of each cordon and screenline.

Table 30. Cordon and Screenline Flow Validation: Vehicles

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Matrix Validation	**Differences between modelled flows and counts should be less than 5% of the counts**	**All or nearly all screenlines (WebTAG)**	**83%**	**89%**	**80%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*82%*	*94%*	*85%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*97%*	*100%*	*98%*

Table 31. Cordon and Screenline Flow Validation: Cars

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Matrix Validation	**Differences between modelled flows and counts should be less than 5% of the counts**	**All or nearly all screenlines (WebTAG)**	**77%**	**92%**	**77%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*82%*	*94%*	*88%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*91%*	*97%*	*98%*

9. NETWORK CALIBRATION AND VALIDATION

9.1 Introduction

9.1.1 This chapter describes:

- link flow validation;
- journey time validation; and
- convergence and stability.

9.2 Link Flow Validation

9.2.1 Chapter 3 described the WebTAG validation standards. Table 32 reproduces the validation criteria and acceptability guidelines for link flows.

Table 32. Link Flow Validation Criteria and Acceptability Guidelines

CRITERIA	ACCEPTABILITY GUIDELINE
Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	> 85% of cases
Individual flows within 100 veh/h of counts for flows less than 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
GEH < 5 for individual flows	> 85% of cases

9.2.2 0 and Table 34 show the results of the network validation analysis for each of the modelled periods, for vehicles and cars respectively. **Appendix B** shows the validation performance of each cordon and screenline.

Table 33. Link Flow Validation: Vehicles

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Link Flow Validation	**Individual flows within 15% of counts for flows from 700 to 2700 veh/h**	**>85% of cases (WebTAG)**	**66%**	**74%**	**66%**
	Individual flows within 100 veh/h of counts for flows less than 700 veh/h				
	Individual flows within 400 veh/h of counts for flows more than 2700 veh/h				
	GEH < 5 for individual flows	**> 85% of cases (WebTAG)**	**58%**	**65%**	**58%**
	*GEH < **10** for individual flows*	*N/A*	*85%*	*87%*	*81%*

Table 34. Link Flow Validation: Cars

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Link Flow Validation	**Individual flows within 15% of counts for flows from 700 to 2700 veh/h**	**>85% of cases (WebTAG)**	**69%**	**77%**	**67%**
	Individual flows within 100 veh/h of counts for flows less than 700 veh/h				
	Individual flows within 400 veh/h of counts for flows more than 2700 veh/h				
	GEH < 5 for individual flows	**> 85% of cases (WebTAG)**	**59%**	**67%**	**60%**
	*GEH < **10** for individual flows*	*N/A*	*86%*	*87%*	*83%*

9.3 Journey Time Validation

9.3.1 The acceptability guideline for journey times are reproduced in Table 35.

Table 35. Journey Time Validation Criteria and Acceptability Guideline

CRITERIA	ACCEPTABILITY GUIDELINE
Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher)	> 85% of routes

9.3.2 Table 36 below shows the number of journey time routes meeting the criteria. **Appendix C** shows the validation performance of each route.

Table 36. Journey Time Validation

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Journey Times Validation	**Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher)**	**>85% of routes (WebTAG)**	**82%**	**82%**	**64%**
	*Modelled times along routes should be within **20%** of surveyed times (or 1 minute, if higher)*	*N/A*	*90%*	*88%*	*70%*

9.3.3 **Appendix D** shows the journey time validation time versus distance profiles. Detailed investigation of journey time validation results by route showed that the slope of the observed and modelled journey times are generally similar and that the model representation of observed conditions on the surveyed network is appropriate despite falling short of the criteria for the full extent of the journey on some routes.

9.4 Convergence and Stability

9.4.1 The acceptability guideline for journey times are reproduced in Table 37.

Table 37. 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%

9.4.2 There are several important parameters in SATURN that are used to ensure convergence is acceptable. These are:

KONSTP "KONtrol of SToPping Criteria"

This defines the type of the conditions required for the assignment to end. The stopping criteria for assignment – simulation loops are based on either: ISTOP (KONSTP = 0); %GAP value (1); CPU time (2); RSTOP and/or CPU (3); %GAP and/or CPU (4); %GAP and RSTOP (5); %GAP or (6) %ISTOP. The assignment will also end when the number of assignment loops reaches MASL (see below).

WebTAG: N/A *SATURN Default: 5* *Solent Model: 5*

Therefore unless MASL is reached the assignment will only stop if %GAP and RSTOP criteria are reached.

MASL

This the maximum number of assignment/simulation loops.

WebTAG: N/A *SATURN Default: 15* *Solent Model: 150*

NISTOP

The number of successive loops which must satisfy the RSTOP criteria in the test for convergence of the assignment/simulation loops.

WebTAG: 4 *SATURN Default: 4* *Solent Model: 4*

STPGAP

WebTAG: 0.1% *SATURN Default: 1.0%* *Solent Model: 0.05%*

PCNEAR

Percentage change in flows judged to be "near" in successive assignments.

WebTAG: 1.0% *SATURN Default: 1.0%* *Solent Model: 1.0%*

RSTOP

Used in the test for convergence of the assignment/simulation loops. The loops stop automatically if RSTOP % of the link flows change by less than "PCNEAR" percent (default 5%) from one assignment to the next.

WebTAG: 98% *SATURN Default: 97.5%* *Solent Model: 98%*

9.4.3 Table 38 shows the performance of the model for the criteria. The stopping criteria set for the model are also shown; these exceed the guidelines and setting these ensured that the model iterations continued until all the set criteria were satisfactorily met.

Table 38. Convergence and Stability Model Results

MEASURE OF CONVERGENCE	SATURN PARAMETER	BASE MODEL ACCEPTABLE VALUES	STOPPING CRITERIA	AM PEAK	INTER-PEAK	PM PEAK
%GAP	**NISTOP** **STPGAP**	Less than **0.1%** or at least stable with convergence fully documented and all other criteria met	**<0.05%** (for base model)	0.023 0.038 0.050 0.025	0.016 0.017 0.012 0.011	0.031 0.046 0.035 0.050
Percentage of links with flow change (P)<1% **(for final four iterations)**	**NISTOP** **PCNEAR** **RSTOP**	Four consecutive iterations greater than **98%**	Four consecutive iterations greater than **98%**	99.5 99.6 98.8 98.8	98.1 98.5 98.7 98.8	98.6 99.1 98.6 99

MEASURE OF CONVERGENCE	SATURN PARAMETER	BASE MODEL ACCEPTABLE VALUES	STOPPING CRITERIA	AM PEAK	INTER-PEAK	PM PEAK
Percentage of links with cost change (P2)<1% **(for final four iterations)**	NONE	Four consecutive iterations greater than **98%**	Four consecutive iterations greater than **98%**	99.6 99.5 99.4 99.4	99.9 99.9 99.9 99.9	99.4 99.6 99.4 99.5

10. SUMMARY OF MODEL DEVELOPMENT AND FITNESS FOR PURPOSE

10.1 Summary of Model Development

General

10.1.1 The Transport for South Hampshire (Solent) Sub-Regional Transport Model (SRTM) is an evidence based Land-Use and Transport Interaction model. It contains a suite of transport models and an associated Local Economic Impact Model (LEIM). The suite of transport models comprises the Main Demand Model (MDM), the Gateway Demand Model (GDM), Road Traffic Model (RTM) and Public Transport Model (PTM).

Objective

10.1.2 The SRTM will be used to support the assessment of a wide-ranging set of interventions across the Solent sub-region, and is specifically required to be capable of:

- forecasting changes in travel demand, road traffic and public transport patronage over time as a result changing economic conditions, land-use policies and development, and transport improvement and interventions;
- testing the impacts of land-use and transport policies and strategies within a relatively short model run time; and
- testing the impacts of individual transport interventions in the increased detail necessary for supporting submissions for inclusion in funding programmes within practical (but probably longer) run times.

10.1.3 The RTM has been developed to represent the base year demand, route choices and costs on the highway network. In terms of future scenarios, it will be used to represent the network impacts of different policy and infrastructure interventions.

Geographic Scope

10.1.4 The modelled area of the RTM is sub-divided into four regions which differ by zone aggregation and modelling detail, as follows:

- Core Fully Modelled Area (detailed zoning);
- Marginal Fully Modelled Area (detailed zoning);
- Buffer Area (zones based on wards); and
- External (zones based on districts).

10.1.5 The core fully modelled area is defined by the Transport for South Hampshire boundary. This is the area which will have the finest level of detail in the zoning and, for the RTM, a simulation network representation.

Centroid Connectors

10.1.6 The placing of centroid connectors has been carefully designed in order to ensure the loading of traffic onto the network is realistic. The number of centroids per zone has been minimised to limit excessive reassignment effects through model calibration and forecasting.

10.1.7 The location of centroid connectors have been defined based on area photograph and professional judgment to identify patterns of traffic movement and feeding points of local traffic on the main model roads. This work was supported by client recommendations based on local knowledge.

Time Periods

10.1.8 The RTM is based on demand levels for one-hour periods, based on the distributions of the broader period. For the inter peak this is an average weekday hour between 10.00 and 16.00, whilst the AM (07.00-10.00) and PM (16.00-19.00) peak periods are represented by the peak hours. AM and PM peak matrices have been obtained from the period matrices, by applying peak hour factors which were calculated from an analysis of count data.

User Classes

10.1.9 The user classes for the RTM are based on the MDM trip purpose segments. The trip purpose segments are aggregated based on differentials in users' value of time (VoT) and differentials in vehicle operating cost (VoC). The RTM has the following assignment user classes:

- Car - Employer's Business;
- Car - Other;
- LGVs; and
- OGVs.

10.1.10 Travellers in the employer's business class have a higher value of time than in the other classes, which needs to be retained in the assignment model.

10.1.11 The 'Other' user class includes all car trips with purposes of commuting, shopping, education, leisure, personal business. These have been combined because the VoT:VoC relationship is considered to be sufficiently similar to not warrant the additional run times introduced by separate assignment segments.

Trip Matrices

10.1.12 The key steps in developing the base year matrices were:

- Development of the origin destination demand; and
- Development of the one hour RTM assignment matrices.

10.1.13 The origin/destination demand matrices are defined at the period level: AM (0700-1000), IP (1000-1600), PM (1600-1900), and Off Peak (1900-0700). They include four home-based and two non home-based personal trip purposes matrices.

10.1.14 The one-hour RTM assignment matrices were obtained from the corresponding origin/ destination demand matrices by:

- applying peak-hour or average hour factors;
- applying trip purpose-specific vehicle occupancy factors to convert the person matrices to vehicle matrices;
- applying passenger car units (PCUs) to the LGV and HGV demand matrices; and
- aggregating the demand matrices into the assignment purposes.

10.1.15 Assignment and validation of the one hour RTM matrices showed that matrix estimation was necessary to refine the prior matrices, particularly for trips crossing the calibration screenlines and not sampled using the OD surveys.

Assignment Methodology

10.1.16 The deterministic user equilibrium method implemented in the SATURN software is used. This assumes that users have perfect knowledge of the time taken to pass through the network from their origin to destination.

Calibration and Validation

10.1.17 Data was collected to calibrate and validate the RTM. The data is defined as either demand or supply. Demand data is any information used to calibrate and validate the demand matrices, and supply data is used for building the highway network.

10.1.18 Demand data collected for the purpose of calibrating and validation the RTM included:

- Roadside Interview Surveys (RSI);
- Screenline manual and automatic traffic counts; and
- Automatic number plate recognition (ANPR) survey.

10.1.19 Surveys were organised to collect the following supply data for the RTM:

- Journey time surveys; and
- Junction saturation flow surveys.

10.1.20 Further supply data included TrafficMaster data, signal data and speed limit information. In addition other existing models such as the PWCS were used for network validation.

10.2 Summary of Standards Achieved

10.2.1 Table 39 presents an overall view of the performance of the model against WebTAG criteria. The screenline validation in particular shows good results for the overall Road Traffic Model. The link flow and journey time validation do not meet the WebTAG criteria, however these overall criteria mask a reasonable performance, which is close to the meeting the acceptability guidelines.

Table 39. Summary of Validation Statistics

Measure	Criteria	Acceptability Guideline	AM Peak	Inter Peak	PM Peak
Matrix Validation	**Differences between modelled flows and counts should be less than 5% of the counts**	**All or nearly all screenlines (WebTAG)**	**83%**	**89%**	**80%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*82%*	*94%*	*85%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*97%*	*100%*	*98%*
Link Flow Validation	**Individual flows within 15% of counts for flows from 700 to 2700 veh/h**	**>85% of cases (WebTAG)**	**66%**	**74%**	**66%**
	Individual flows within 100 veh/h of counts for flows less than 700 veh/h				
	Individual flows within 400 veh/h of counts for flows more than 2700 veh/h				
	GEH < 5 for individual flows	**> 85% of cases (WebTAG)**	**58%**	**65%**	**58%**
	*GEH < **10** for individual flows*	*N/A*	*85%*	*87%*	*81%*
Journey Times Validation	**Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher)**	**>85% of routes (WebTAG)**	**82%**	**82%**	**64%**
	*Modelled times along routes should be within **20%** of surveyed times (or 1 minute, if higher)*	*N/A*	*90%*	*88%*	*70%*

10.2.2 Table 39 demonstrates that the model performance is in general good, and that the screenline validation performs particularly well. This is critical, as of the three validation measures the matrix validation screenlines are of particular importance, as discussed below:

- **Matrix Validation** – Highly important, as it ensures the demand in the model is correct for assessing interventions and future changes;
- **Link Flow Validation** – Less significant at an individual link level, because routing can be volatile and vary from day to day; and
- **Journey Times Validation** – Also less crucial because journey times can vary, and it is more important that changes can be represented in the model both within mode and relatively between modes.

10.2.3 It should be noted also that the Solent Steering Group view the matrix validation to be of more importance than the link flow validation, as the expected interventions to be tested generally cover mode shift changes rather than major highway improvements affecting traffic routing.

10.3 Conclusion

10.3.1 The SRTM model system covers a wide geographic area and contains a significant number of strategic motorways, primary routes and complex urban road networks. An unusual feature of the model is that it includes two main conurbations, Southampton and Portsmouth, significant district centres such as Fareham and Gosport, a number of peninsulas, and a third geographically distinct centre on the Isle of Wight. More typically traffic models are developed for either single corridors, free-standing cities or conurbations. The strategic validation of the Road Traffic Model needs to be considered in this context, i.e. a model of multiple, often parallel, corridors and multiple centres that generate urban and inter-urban trips combined with strategic road access routes using the Motorway and trunk road network.

10.3.2 The model has been constructed according to WebTAG recommendations, and validated against DMRB guidelines. The calibration process did not reveal any significant problems or shortcomings in the base year model. The quality of validation of the model is in general good, with the screenline validation performing particularly well. This is critical, as it ensures the demand in the model is correct for assessing multi-modal interventions and future changes.

10.3.3 The journey time validation and the patterns of junction delay appear consistent and plausible, although the link flow and journey time validation do not meet the WebTAG criteria. However, these recommended criteria mask a good model performance that is close to meeting the acceptability guidelines.

10.3.4 It is often considered that the WebTAG thresholds of acceptability are more suited to smaller, less complex models, and as such it may be argued that a certain level of flexibility is acceptable given the scale and complexity of the SRTM.

10.3.5 The calibration and validation suggest that the model is fit for the purpose of representing the highway traffic patterns in the base year, as part of the SRTM.

10.3.6 The model encompasses a large geographic area at different levels of detail and is expected to be used to consider a range of strategic and specific interventions, e.g. representing the main highway movements, the impact of major highway and public transport interventions on those movements, and providing controlled and consistent inputs to local or more detailed models.

10.3.7 It is acknowledged that whilst fit for general purpose, depending on the nature and scope of the intervention being tested, additional local validation checks may be beneficial for model application for specific interventions at a local level.

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Washington

SYSTRA

APPENDIX A

CORDONS AND SCREENLINES

AM

Vehicles

Cordon and Screenlines Validation

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<=	WebTAG within				
								4	5%	7.5%	10%	15%	20%
RSI Cordons and Screenlines													
1 Fareham Enclosure	Outbound	16	10,764	9,055	-1,709	-15.9%	17.2	N	N	N	N	N	Y
1 Fareham Enclosure	Inbound	16	10,957	9,552	-1,405	-12.8%	13.9	N	N	N	N	Y	Y
2 Havant Enclosure	Outbound	10	5,055	4,735	-320	-6.3%	4.6	N	N	Y	Y	Y	Y
2 Havant Enclosure	Inbound	10	5,085	4,860	-225	-4.4%	3.2	Y	Y	Y	Y	Y	Y
3 Hayling Island Enclosure	Outbound	1	1,508	1,575	66	4.4%	1.7	Y	Y	Y	Y	Y	Y
3 Hayling Island Enclosure	Inbound	1	876	975	99	11.3%	3.3	Y	Y	N	N	Y	Y
4 Hedge End Enclosure	Outbound	8	5,382	4,997	-384	-7.1%	5.3	N	N	Y	Y	Y	Y
4 Hedge End Enclosure	Inbound	8	5,189	4,856	-332	-6.4%	4.7	N	N	Y	Y	Y	Y
5 Waterlooville Enclosure	Outbound	18	11,306	10,585	-721	-6.4%	6.9	N	N	Y	Y	Y	Y
5 Waterlooville Enclosure	Inbound	18	9,514	9,497	-16	-0.2%	0.2	Y	Y	Y	Y	Y	Y
71 Portsmouth South Enclosure	Outbound	6	4,559	4,691	132	2.9%	1.9	Y	Y	Y	Y	Y	Y
71 Portsmouth South Enclosure	Inbound	6	4,649	4,528	-121	-2.6%	1.8	Y	Y	Y	Y	Y	Y
72 Portsmouth North Enclosure	Outbound	7	4,334	4,029	-305	-7.0%	4.7	N	N	Y	Y	Y	Y
72 Portsmouth North Enclosure	Inbound	7	4,478	4,924	445	9.9%	6.5	N	N	N	Y	Y	Y
8 Southampton City Enclosure	Outbound	12	4,927	4,581	-346	-7.0%	5.0	N	N	Y	Y	Y	Y
8 Southampton City Enclosure	Inbound	12	7,743	7,841	99	1.3%	1.1	Y	Y	Y	Y	Y	Y
91 Bitterne West Screenline	Eastbound	5	2,978	3,457	479	16.1%	8.4	N	N	N	N	N	Y
91 Bitterne West Screenline	Westbound	5	5,625	6,164	538	9.6%	7.0	N	N	N	Y	Y	Y
92 Bitterne East Screenline	Eastbound	4	3,916	3,858	-58	-1.5%	0.9	Y	Y	Y	Y	Y	Y
92 Bitterne East Screenline	Westbound	4	3,353	3,215	-138	-4.1%	2.4	Y	Y	Y	Y	Y	Y
10 Locks Heath North Screenline	Outbound	9	6,695	6,999	304	4.5%	3.7	Y	Y	Y	Y	Y	Y
10 Locks Heath North Screenline	Inbound	9	6,839	6,540	-298	-4.4%	3.6	Y	Y	Y	Y	Y	Y
11 Totton Enclosure	Outbound	19	9,737	9,280	-457	-4.7%	4.7	N	Y	Y	Y	Y	Y
11 Totton Enclosure	Inbound	19	10,230	9,791	-439	-4.3%	4.4	N	Y	Y	Y	Y	Y
12 Eastleigh Enclosure	Outbound	11	5,307	4,992	-315	-5.9%	4.4	N	N	Y	Y	Y	Y
12 Eastleigh Enclosure	Inbound	11	6,033	5,699	-333	-5.5%	4.4	N	N	Y	Y	Y	Y
13 Southampton Enclosure	Outbound	14	11,508	11,453	-55	-0.5%	0.5	Y	Y	Y	Y	Y	Y
13 Southampton Enclosure	Inbound	14	15,397	15,792	395	2.6%	3.2	Y	Y	Y	Y	Y	Y
36 Solent RSI Cordon	Northbound	3	218	240	22	10.2%	1.5	Y	Y	N	Y	Y	Y
36 Solent RSI Cordon	Southbound	3	200	224	24	12.2%	1.7	Y	N	N	N	Y	Y
Overall		286	184,363	178,989	-5,374	-2.9%		50%	53%	73%	83%	93%	100%

APPENDIX A

CORDONS AND SCREENLINES

IP

Vehicles

Cordon and Screenlines Validation

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<=	WebTAG within				
								4	5%	7.5%	10%	15%	20%
RSI Cordons and Screenlines													
1 Fareham Enclosure	Outbound	16	7,571	6,449	-1,121	-14.8%	13.4	N	N	N	N	Y	Y
1 Fareham Enclosure	Inbound	16	7,844	6,523	-1,321	-16.8%	15.6	N	N	N	N	N	Y
2 Havant Enclosure	Outbound	10	3,964	3,824	-141	-3.5%	2.3	Y	Y	Y	Y	Y	Y
2 Havant Enclosure	Inbound	10	4,053	3,957	-95	-2.4%	1.5	Y	Y	Y	Y	Y	Y
3 Hayling Island Enclosure	Outbound	1	912	1,012	100	11.0%	3.2	Y	Y	N	N	Y	Y
3 Hayling Island Enclosure	Inbound	1	945	1,088	142	15.0%	4.5	N	Y	N	N	Y	Y
4 Hedge End Enclosure	Outbound	8	3,815	3,679	-136	-3.6%	2.2	Y	Y	Y	Y	Y	Y
4 Hedge End Enclosure	Inbound	8	4,328	4,151	-177	-4.1%	2.7	Y	Y	Y	Y	Y	Y
5 Waterlooville Enclosure	Outbound	18	7,469	7,261	-208	-2.8%	2.4	Y	Y	Y	Y	Y	Y
5 Waterlooville Enclosure	Inbound	18	7,630	7,574	-56	-0.7%	0.6	Y	Y	Y	Y	Y	Y
71 Portsmouth South Enclosure	Outbound	6	3,571	3,750	179	5.0%	3.0	Y	Y	Y	Y	Y	Y
71 Portsmouth South Enclosure	Inbound	6	3,833	3,788	-45	-1.2%	0.7	Y	Y	Y	Y	Y	Y
72 Portsmouth North Enclosure	Outbound	7	3,445	3,247	-199	-5.8%	3.4	Y	N	Y	Y	Y	Y
72 Portsmouth North Enclosure	Inbound	7	3,360	3,391	30	0.9%	0.5	Y	Y	Y	Y	Y	Y
8 Southampton City Enclosure	Outbound	12	4,983	4,994	11	0.2%	0.2	Y	Y	Y	Y	Y	Y
8 Southampton City Enclosure	Inbound	12	4,883	5,058	175	3.6%	2.5	Y	Y	Y	Y	Y	Y
91 Bitterne West Screenline	Eastbound	5	3,207	3,477	270	8.4%	4.7	N	N	N	Y	Y	Y
91 Bitterne West Screenline	Westbound	5	2,912	2,966	54	1.9%	1.0	Y	Y	Y	Y	Y	Y
92 Bitterne East Screenline	Eastbound	4	2,830	2,882	52	1.8%	1.0	Y	Y	Y	Y	Y	Y
92 Bitterne East Screenline	Westbound	4	2,518	2,594	76	3.0%	1.5	Y	Y	Y	Y	Y	Y
10 Locks Heath North Screenline	Outbound	9	4,635	4,324	-311	-6.7%	4.6	N	N	Y	Y	Y	Y
10 Locks Heath North Screenline	Inbound	9	4,698	4,423	-276	-5.9%	4.1	N	N	Y	Y	Y	Y
11 Totton Enclosure	Outbound	19	6,430	6,243	-187	-2.9%	2.3	Y	Y	Y	Y	Y	Y
11 Totton Enclosure	Inbound	19	6,824	6,709	-115	-1.7%	1.4	Y	Y	Y	Y	Y	Y
12 Eastleigh Enclosure	Outbound	11	3,776	3,660	-116	-3.1%	1.9	Y	Y	Y	Y	Y	Y
12 Eastleigh Enclosure	Inbound	11	3,636	3,456	-180	-4.9%	3.0	Y	Y	Y	Y	Y	Y
13 Southampton Enclosure	Outbound	14	9,677	9,271	-407	-4.2%	4.2	N	Y	Y	Y	Y	Y
13 Southampton Enclosure	Inbound	14	9,305	9,346	42	0.4%	0.4	Y	Y	Y	Y	Y	Y
36 Solent RSI Cordon	Northbound	3	161	169	8	5.1%	0.6	Y	Y	Y	Y	Y	Y
36 Solent RSI Cordon	Southbound	3	159	165	5	3.4%	0.4	Y	Y	Y	Y	Y	Y
Overall		286	133,375	129,429	-3,946	-3.0%		77%	80%	83%	87%	97%	100%

APPENDIX A

CORDONS AND SCREENLINES

PM

Vehicles

Cordon and Screenlines Validation

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<=	WebTAG within				
								4	5%	7.5%	10%	15%	20%
RSI Cordons and Screenlines													
1 Fareham Enclosure	Outbound	16	10,445	9,009	-1,436	-13.7%	14.6	N	N	N	N	Y	Y
1 Fareham Enclosure	Inbound	16	10,189	8,979	-1,210	-11.9%	12.4	N	N	N	N	Y	Y
2 Havant Enclosure	Outbound	10	5,228	4,981	-247	-4.7%	3.5	Y	Y	Y	Y	Y	Y
2 Havant Enclosure	Inbound	10	5,539	5,316	-223	-4.0%	3.0	Y	Y	Y	Y	Y	Y
3 Hayling Island Enclosure	Outbound	1	856	975	119	13.9%	3.9	Y	Y	N	N	Y	Y
3 Hayling Island Enclosure	Inbound	1	1,442	1,499	57	4.0%	1.5	Y	Y	Y	Y	Y	Y
4 Hedge End Enclosure	Outbound	8	4,735	4,583	-152	-3.2%	2.2	Y	Y	Y	Y	Y	Y
4 Hedge End Enclosure	Inbound	8	6,029	5,594	-435	-7.2%	5.7	N	N	Y	Y	Y	Y
5 Waterlooville Enclosure	Outbound	18	10,142	10,137	-4	0.0%	0.0	Y	Y	Y	Y	Y	Y
5 Waterlooville Enclosure	Inbound	18	11,576	11,089	-487	-4.2%	4.6	N	Y	Y	Y	Y	Y
71 Portsmouth South Enclosure	Outbound	6	4,326	4,655	329	7.6%	4.9	N	N	N	Y	Y	Y
71 Portsmouth South Enclosure	Inbound	6	5,376	5,133	-244	-4.5%	3.4	Y	Y	Y	Y	Y	Y
72 Portsmouth North Enclosure	Outbound	7	4,560	4,554	-7	-0.1%	0.1	Y	Y	Y	Y	Y	Y
72 Portsmouth North Enclosure	Inbound	7	4,223	4,296	73	1.7%	1.1	Y	Y	Y	Y	Y	Y
8 Southampton City Enclosure	Outbound	12	7,347	7,371	24	0.3%	0.3	Y	Y	Y	Y	Y	Y
8 Southampton City Enclosure	Inbound	12	5,548	5,778	231	4.2%	3.1	Y	Y	Y	Y	Y	Y
91 Bitterne West Screenline	Eastbound	5	5,545	6,106	561	10.1%	7.4	N	N	N	Y	Y	Y
91 Bitterne West Screenline	Westbound	5	2,908	3,202	293	10.1%	5.3	N	N	N	Y	Y	Y
92 Bitterne East Screenline	Eastbound	4	4,006	3,931	-75	-1.9%	1.2	Y	Y	Y	Y	Y	Y
92 Bitterne East Screenline	Westbound	4	2,739	2,990	252	9.2%	4.7	N	N	N	Y	Y	Y
10 Locks Heath North Screenline	Outbound	9	6,806	6,608	-198	-2.9%	2.4	Y	Y	Y	Y	Y	Y
10 Locks Heath North Screenline	Inbound	9	6,898	6,530	-369	-5.3%	4.5	N	Y	Y	Y	Y	Y
11 Totton Enclosure	Outbound	19	9,422	9,483	61	0.7%	0.6	Y	Y	Y	Y	Y	Y
11 Totton Enclosure	Inbound	19	10,338	9,934	-405	-3.9%	4.0	N	Y	Y	Y	Y	Y
12 Eastleigh Enclosure	Outbound	11	5,681	5,569	-112	-2.0%	1.5	Y	Y	Y	Y	Y	Y
12 Eastleigh Enclosure	Inbound	11	5,329	5,169	-160	-3.0%	2.2	Y	Y	Y	Y	Y	Y
13 Southampton Enclosure	Outbound	14	14,550	14,274	-276	-1.9%	2.3	Y	Y	Y	Y	Y	Y
13 Southampton Enclosure	Inbound	14	12,179	12,022	-157	-1.3%	1.4	Y	Y	Y	Y	Y	Y
36 Solent RSI Cordon	Northbound	3	201	209	9	4.3%	0.6	Y	Y	Y	Y	Y	Y
36 Solent RSI Cordon	Southbound	3	168	192	23	13.9%	1.7	Y	N	N	N	Y	Y
Overall		286	184,329	180,168	-4,161	-2.3%		67%	73%	73%	87%	100%	100%

APPENDIX B

CORDONS AND SCREENLINES

AM

Vehicles

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5%	7.5%	10%	WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
			Cordon and Screenlines Validation									**Link Validation**			
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	10,764	11,115	351	3.3%	3.4	Y	Y	Y	Y	88%	56%	81%	94%
1 Fareham Enclosure	Inbound	16	10,957	10,612	-345	-3.1%	3.3	Y	Y	Y	Y	88%	69%	88%	88%
2 Havant Enclosure	Outbound	10	5,055	4,900	-155	-3.1%	2.2	Y	Y	Y	Y	40%	40%	70%	70%
2 Havant Enclosure	Inbound	10	5,085	5,266	180	3.5%	2.5	Y	Y	Y	Y	30%	30%	40%	60%
3 Hayling Island Enclosure	Outbound	1	1,508	1,613	104	6.9%	2.6	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	876	839	-37	-4.2%	1.3	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	5,382	5,949	568	10.5%	7.5	N	N	N	N	25%	50%	88%	88%
4 Hedge End Enclosure	Inbound	8	5,189	5,133	-56	-1.1%	0.8	Y	Y	Y	Y	63%	63%	75%	75%
5 Waterlooville Enclosure	Outbound	18	11,306	10,887	-419	-3.7%	4.0	Y	Y	Y	Y	39%	39%	72%	89%
5 Waterlooville Enclosure	Inbound	18	9,514	9,100	-414	-4.4%	4.3	N	Y	Y	Y	67%	61%	72%	78%
71 Portsmouth South Enclosure	Outbound	6	4,559	4,559	0	0.0%	0.0	Y	Y	Y	Y	50%	50%	50%	67%
71 Portsmouth South Enclosure	Inbound	6	4,649	4,504	-145	-3.1%	2.1	Y	Y	Y	Y	33%	33%	83%	83%
72 Portsmouth North Enclosure	Outbound	7	4,347	4,178	-169	-3.9%	2.6	Y	Y	Y	Y	60%	60%	100%	100%
72 Portsmouth North Enclosure	Inbound	7	4,478	4,445	-33	-0.7%	0.5	Y	Y	Y	Y	86%	71%	86%	86%
8 Southampton City Enclosure	Outbound	12	4,927	4,990	63	1.3%	0.9	Y	Y	Y	Y	67%	67%	75%	83%
8 Southampton City Enclosure	Inbound	12	7,743	7,249	-493	-6.4%	5.7	N	N	Y	Y	33%	25%	25%	75%
91 Bitterne West Screenline	Eastbound	5	2,978	2,988	10	0.3%	0.2	Y	Y	Y	Y	80%	100%	100%	100%
91 Bitterne West Screenline	Westbound	5	5,625	5,789	163	2.9%	2.2	Y	Y	Y	Y	80%	80%	80%	100%
92 Bitterne East Screenline	Eastbound	4	3,949	3,829	-120	-3.0%	1.9	Y	Y	Y	Y	100%	100%	100%	100%
92 Bitterne East Screenline	Westbound	4	3,561	3,405	-156	-4.4%	2.6	Y	Y	Y	Y	33%	67%	67%	100%
10 Locks Heath North Screenline	Outbound	9	6,695	6,156	-539	-8.1%	6.7	N	N	N	Y	89%	78%	89%	89%
10 Locks Heath North Screenline	Inbound	9	6,839	6,863	25	0.4%	0.3	Y	Y	Y	Y	44%	44%	56%	78%
11 Totton Enclosure	Outbound	19	9,737	9,996	259	2.7%	2.6	Y	Y	Y	Y	61%	56%	61%	67%
11 Totton Enclosure	Inbound	19	10,232	10,490	258	2.5%	2.5	Y	Y	Y	Y	78%	61%	78%	89%
12 Eastleigh Enclosure	Outbound	11	5,307	5,462	155	2.9%	2.1	Y	Y	Y	Y	64%	64%	82%	91%
12 Eastleigh Enclosure	Inbound	11	6,033	6,062	30	0.5%	0.4	Y	Y	Y	Y	91%	73%	100%	100%
13 Southampton Enclosure	Outbound	14	11,508	12,060	552	4.8%	5.1	N	Y	Y	Y	64%	71%	86%	86%
13 Southampton Enclosure	Inbound	14	15,397	15,681	284	1.8%	2.3	Y	Y	Y	Y	50%	50%	71%	86%
36 Solent RSI Cordon	Northbound	3	218	214	-4	-2.0%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	200	194	-6	-2.8%	0.4	Y	Y	Y	Y	100%	100%	100%	100%
		286	184,618	184,529	-89	0.0%		83%	90%	93%	97%	63%	59%	75%	84%
Calibration Screenlines															
20 Totton	Eastbound	8	3,923	4,051	127	3.2%	2.0	Y	Y	Y	Y	75%	75%	88%	88%
20 Totton	Westbound	8	3,369	3,377	8	0.2%	0.1	Y	Y	Y	Y	75%	75%	75%	75%
21 North of Southampton	Eastbound	13	5,188	5,019	-169	-3.3%	2.4	Y	Y	Y	Y	38%	23%	46%	54%
21 North of Southampton	Westbound	13	5,530	5,594	63	1.1%	0.9	Y	Y	Y	Y	54%	38%	54%	77%
22 South of Southampton	Eastbound	7	5,068	5,307	240	4.7%	3.3	Y	Y	Y	Y	57%	43%	86%	100%
22 South of Southampton	Westbound	7	4,462	4,651	190	4.2%	2.8	Y	Y	Y	Y	57%	57%	86%	86%
23 Eastleigh	Eastbound	6	8,826	8,387	-439	-5.0%	4.7	N	Y	Y	Y	17%	17%	83%	100%
23 Eastleigh	Westbound	6	7,941	7,996	54	0.7%	0.6	Y	Y	Y	Y	33%	33%	33%	83%
24 Bitterne Northwest to Southeast	Eastbound	15	5,092	4,896	-196	-3.8%	2.8	Y	Y	Y	Y	64%	57%	64%	79%
24 Bitterne Northwest to Southeast	Westbound	15	5,718	5,673	-46	-0.8%	0.6	Y	Y	Y	Y	86%	64%	93%	93%
25 Bitterne Southwest to Northeast	Eastbound	10	4,488	4,567	78	1.7%	1.2	Y	Y	Y	Y	67%	67%	100%	100%
25 Bitterne Southwest to Northeast	Westbound	10	4,819	5,128	309	6.4%	4.4	N	N	Y	Y	67%	67%	89%	100%
26 Fareham North South	Eastbound	8	2,903	3,034	131	4.5%	2.4	Y	Y	Y	Y	50%	50%	63%	63%
26 Fareham North South	Westbound	8	2,418	2,537	119	4.9%	2.4	Y	Y	Y	Y	88%	63%	75%	100%
271 Locks Heath West to East	Northbound	11	5,067	4,759	-307	-6.1%	4.4	N	N	Y	Y	27%	36%	45%	55%
271 Locks Heath West to East	Southbound	11	3,024	3,108	85	2.8%	1.5	Y	Y	Y	Y	91%	73%	91%	100%
272 Fareham West to East	Northbound	4	1,899	1,800	-99	-5.2%	2.3	Y	Y	Y	Y	75%	75%	100%	100%
272 Fareham West to East	Southbound	4	2,056	2,056	0	0.0%	0.0	Y	Y	Y	Y	50%	75%	75%	75%
28 Gosport	Northbound	6	3,469	3,489	20	0.6%	0.3	Y	Y	Y	Y	100%	83%	100%	100%
28 Gosport	Southbound	6	2,787	2,746	-42	-1.5%	0.8	Y	Y	Y	Y	67%	50%	83%	83%
29 Portsmouth NorthSouth	Eastbound	15	4,733	4,248	-484	-10.2%	7.2	N	N	N	Y	67%	47%	73%	80%
29 Portsmouth NorthSouth	Westbound	16	5,355	5,011	-344	-6.4%	4.8	N	N	Y	Y	38%	25%	31%	69%
30 Portsmouth EastWest	Northbound	8	3,558	3,405	-152	-4.3%	2.6	Y	Y	Y	Y	63%	25%	38%	75%
30 Portsmouth EastWest	Southbound	8	3,160	2,945	-215	-6.8%	3.9	Y	N	Y	Y	88%	50%	63%	75%
31 Cosham	Eastbound	4	2,428	2,233	-195	-8.0%	4.0	N	N	N	Y	50%	50%	50%	50%
31 Cosham	Westbound	4	1,950	2,044	93	4.8%	2.1	Y	Y	Y	Y	50%	50%	50%	50%
32 Waterlooville North to South	Eastbound	14	5,189	4,967	-222	-4.3%	3.1	Y	Y	Y	Y	71%	71%	79%	79%
32 Waterlooville North to South	Westbound	14	5,112	5,075	-38	-0.7%	0.5	Y	Y	Y	Y	86%	57%	86%	93%
33 Waterlooville West to East	Northbound	4	1,345	1,264	-81	-6.0%	2.3	Y	N	Y	Y	100%	75%	75%	100%
33 Waterlooville West to East	Southbound	4	1,667	1,909	243	14.5%	5.7	N	N	N	N	75%	75%	75%	100%
34 Havant North South	Eastbound	6	1,989	1,900	-89	-4.5%	2.0	Y	Y	Y	Y	50%	50%	67%	83%
34 Havant North South	Westbound	6	2,082	2,110	28	1.3%	0.6	Y	Y	Y	Y	100%	83%	100%	100%
35 Havant East West	Northbound	9	1,964	1,931	-32	-1.6%	0.7	Y	Y	Y	Y	78%	44%	67%	89%
35 Havant East West	Southbound	9	2,581	2,582	1	0.0%	0.0	Y	Y	Y	Y	78%	44%	56%	89%
201 Winchester Cordon	Outbound	15	4,546	4,628	82	1.8%	1.2	Y	Y	Y	Y	93%	80%	100%	100%
201 Winchester Cordon	Inbound	15	5,956	6,085	129	2.2%	1.7	Y	Y	Y	Y	60%	60%	60%	60%
		327	141,662	140,512	-1,150	-0.8%		81%	78%	92%	97%	66%	55%	71%	82%
Motorways															
M27	Eastbound	14										80%	80%	80%	100%
M27	Westbound	14										80%	50%	80%	90%
M3	Eastbound	6										40%	20%	80%	100%
M3	Westbound	6										100%	100%	100%	100%
A3(M)	Northbound	4										100%	100%	100%	100%
A3(M)	Southbound	4										100%	100%	100%	100%
M275	Northbound	4										100%	100%	100%	100%
M275	Southbound	4										100%	100%	100%	100%
M271	Northbound	3										0%	50%	50%	100%
M271	Southbound	3										67%	0%	67%	67%
		62										79%	69%	85%	96%
Overall								82%	83%	92%	97%	66%	58%	74%	85%

APPENDIX B

CORDONS AND SCREENLINES

IP

Vehicles

Cordon and Screenlines Validation / **Link Validation**

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5%	7.5%	10%	WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	7,571	7,921	350	4.6%	4.0	Y	Y	Y	Y	81%	63%	94%	94%
1 Fareham Enclosure	Inbound	16	7,844	8,090	246	3.1%	2.8	Y	Y	Y	Y	81%	63%	81%	100%
2 Havant Enclosure	Outbound	10	3,964	3,776	-188	-4.8%	3.0	Y	Y	Y	Y	70%	70%	80%	80%
2 Havant Enclosure	Inbound	10	4,053	3,941	-111	-2.8%	1.8	Y	Y	Y	Y	60%	60%	70%	80%
3 Hayling Island Enclosure	Outbound	1	912	935	23	2.5%	0.8	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	945	996	50	5.3%	1.6	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	3,815	4,018	203	5.3%	3.2	Y	Y	Y	Y	75%	75%	75%	88%
4 Hedge End Enclosure	Inbound	8	4,328	4,331	3	0.1%	0.0	Y	Y	Y	Y	88%	88%	100%	100%
5 Waterlooville Enclosure	Outbound	18	7,469	7,099	-370	-5.0%	4.3	N	Y	Y	Y	61%	56%	72%	83%
5 Waterlooville Enclosure	Inbound	18	7,630	7,527	-103	-1.3%	1.2	Y	Y	Y	Y	72%	61%	72%	78%
71 Portsmouth South Enclosure	Outbound	6	3,571	3,586	14	0.4%	0.2	Y	Y	Y	Y	50%	50%	50%	67%
71 Portsmouth South Enclosure	Inbound	6	3,833	3,837	3	0.1%	0.1	Y	Y	Y	Y	67%	67%	67%	83%
72 Portsmouth North Enclosure	Outbound	7	3,471	3,239	-232	-6.7%	4.0	N	N	Y	Y	60%	60%	100%	100%
72 Portsmouth North Enclosure	Inbound	7	3,360	3,396	35	1.1%	0.6	Y	Y	Y	Y	100%	86%	100%	100%
8 Southampton City Enclosure	Outbound	12	4,983	5,032	49	1.0%	0.7	Y	Y	Y	Y	58%	58%	67%	67%
8 Southampton City Enclosure	Inbound	12	4,883	4,637	-246	-5.0%	3.6	Y	Y	Y	Y	33%	33%	50%	50%
91 Bitterne West Screenline	Eastbound	5	3,207	3,025	-182	-5.7%	3.3	Y	N	Y	Y	40%	40%	60%	80%
91 Bitterne West Screenline	Westbound	5	2,912	2,704	-208	-7.1%	3.9	Y	N	Y	Y	40%	60%	80%	100%
92 Bitterne East Screenline	Eastbound	4	2,694	2,783	89	3.3%	1.7	Y	Y	Y	Y	67%	67%	100%	100%
92 Bitterne East Screenline	Westbound	4	2,564	2,696	131	5.1%	2.6	Y	Y	Y	Y	100%	100%	100%	100%
10 Locks Heath North Screenline	Outbound	9	4,635	5,013	378	8.1%	5.4	N	N	N	Y	67%	67%	100%	100%
10 Locks Heath North Screenline	Inbound	9	4,698	4,777	78	1.7%	1.1	Y	Y	Y	Y	100%	89%	100%	100%
11 Totton Enclosure	Outbound	19	6,430	6,492	62	1.0%	0.8	Y	Y	Y	Y	67%	56%	61%	83%
11 Totton Enclosure	Inbound	19	6,824	6,767	-57	-0.8%	0.7	Y	Y	Y	Y	83%	67%	67%	78%
12 Eastleigh Enclosure	Outbound	11	3,776	3,608	-168	-4.4%	2.8	Y	Y	Y	Y	91%	73%	91%	91%
12 Eastleigh Enclosure	Inbound	11	3,636	3,579	-57	-1.6%	1.0	Y	Y	Y	Y	91%	91%	91%	100%
13 Southampton Enclosure	Outbound	14	9,677	9,739	62	0.6%	0.6	Y	Y	Y	Y	57%	57%	71%	86%
13 Southampton Enclosure	Inbound	14	9,305	9,182	-123	-1.3%	1.3	Y	Y	Y	Y	64%	64%	86%	93%
36 Solent RSI Cordon	Northbound	3	161	149	-12	-7.2%	0.9	Y	Y	Y	Y	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	159	161	2	1.1%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
		286	133,311	133,034	-278	-0.2%		90%	87%	97%	100%	71%	65%	79%	87%
Calibration Screenlines															
20 Totton	Eastbound	8	2,469	2,506	37	1.5%	0.7	Y	Y	Y	Y	75%	63%	75%	75%
20 Totton	Westbound	8	2,699	2,830	131	4.9%	2.5	Y	Y	Y	Y	75%	75%	75%	75%
21 North of Southampton	Eastbound	13	4,231	4,148	-83	-2.0%	1.3	Y	Y	Y	Y	38%	38%	46%	46%
21 North of Southampton	Westbound	13	4,117	4,076	-41	-1.0%	0.6	Y	Y	Y	Y	46%	31%	62%	62%
22 South of Southampton	Eastbound	7	3,812	3,946	134	3.5%	2.2	Y	Y	Y	Y	43%	43%	57%	86%
22 South of Southampton	Westbound	7	4,038	3,910	-128	-3.2%	2.0	Y	Y	Y	Y	57%	57%	86%	86%
23 Eastleigh	Eastbound	6	6,318	6,566	248	3.9%	3.1	Y	Y	Y	Y	67%	67%	100%	100%
23 Eastleigh	Westbound	6	6,417	6,619	202	3.1%	2.5	Y	Y	Y	Y	67%	67%	67%	100%
24 Bitterne Northwest to Southeast	Eastbound	15	4,159	3,887	-271	-6.5%	4.3	N	N	Y	Y	79%	57%	71%	86%
24 Bitterne Northwest to Southeast	Westbound	15	4,314	4,115	-199	-4.6%	3.1	Y	Y	Y	Y	71%	57%	86%	93%
25 Bitterne Southwest to Northeast	Eastbound	10	3,647	3,653	7	0.2%	0.1	Y	Y	Y	Y	89%	100%	100%	100%
25 Bitterne Southwest to Northeast	Westbound	10	3,548	3,484	-63	-1.8%	1.1	Y	Y	Y	Y	67%	78%	89%	100%
26 Fareham North South	Eastbound	8	1,906	1,983	77	4.0%	1.7	Y	Y	Y	Y	88%	63%	63%	100%
26 Fareham North South	Westbound	8	1,901	1,966	65	3.4%	1.5	Y	Y	Y	Y	88%	63%	88%	100%
271 Locks Heath West to East	Northbound	11	3,000	3,042	41	1.4%	0.7	Y	Y	Y	Y	73%	64%	64%	100%
271 Locks Heath West to East	Southbound	11	3,042	3,086	44	1.4%	0.8	Y	Y	Y	Y	82%	55%	82%	100%
272 Fareham West to East	Northbound	4	1,435	1,470	35	2.5%	0.9	Y	Y	Y	Y	50%	50%	75%	75%
272 Fareham West to East	Southbound	4	1,377	1,379	2	0.1%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
28 Gosport	Northbound	6	2,524	2,510	-14	-0.6%	0.3	Y	Y	Y	Y	83%	67%	83%	83%
28 Gosport	Southbound	6	2,472	2,454	-17	-0.7%	0.4	Y	Y	Y	Y	83%	67%	67%	83%
29 Portsmouth NorthSouth	Eastbound	15	4,309	4,116	-193	-4.5%	3.0	Y	Y	Y	Y	53%	33%	47%	73%
29 Portsmouth NorthSouth	Westbound	16	4,319	4,225	-94	-2.2%	1.4	Y	Y	Y	Y	44%	25%	56%	75%
30 Portsmouth EastWest	Northbound	8	2,705	2,620	-85	-3.2%	1.7	Y	Y	Y	Y	63%	38%	50%	100%
30 Portsmouth EastWest	Southbound	8	2,742	2,753	10	0.4%	0.2	Y	Y	Y	Y	75%	50%	63%	88%
31 Cosham	Eastbound	4	1,562	1,636	74	4.8%	1.9	Y	Y	Y	Y	50%	50%	50%	50%
31 Cosham	Westbound	4	1,518	1,543	25	1.7%	0.6	Y	Y	Y	Y	50%	50%	50%	50%
32 Waterlooville North to South	Eastbound	14	3,869	3,724	-145	-3.8%	2.4	Y	Y	Y	Y	86%	71%	71%	86%
32 Waterlooville North to South	Westbound	14	3,950	3,822	-128	-3.2%	2.1	Y	Y	Y	Y	86%	71%	71%	86%
33 Waterlooville West to East	Northbound	4	1,134	1,068	-67	-5.9%	2.0	Y	N	Y	Y	100%	75%	100%	100%
33 Waterlooville West to East	Southbound	4	1,186	1,158	-28	-2.4%	0.8	Y	Y	Y	Y	100%	75%	100%	100%
34 Havant North South	Eastbound	6	1,631	1,549	-81	-5.0%	2.0	Y	Y	Y	Y	50%	50%	67%	67%
34 Havant North South	Westbound	6	1,583	1,549	-34	-2.1%	0.8	Y	Y	Y	Y	83%	50%	100%	100%
35 Havant East West	Northbound	9	1,729	1,772	43	2.5%	1.0	Y	Y	Y	Y	67%	33%	78%	78%
35 Havant East West	Southbound	9	1,781	1,754	-27	-1.5%	0.6	Y	Y	Y	Y	100%	67%	78%	89%
201 Winchester Cordon	Outbound	15	3,678	3,590	-88	-2.4%	1.5	Y	Y	Y	Y	100%	93%	100%	100%
201 Winchester Cordon	Inbound	15	3,616	3,388	-228	-6.3%	3.9	Y	N	Y	Y	87%	80%	87%	100%
		327	108,737	107,897	-840	-0.8%		97%	92%	100%	100%	72%	59%	74%	86%
Motorways															
M27	Eastbound	14										100%	100%	100%	100%
M27	Westbound	14										100%	100%	100%	100%
M3	Eastbound	6										100%	100%	100%	100%
M3	Westbound	6										100%	100%	100%	100%
A3(M)	Northbound	4										100%	100%	100%	100%
A3(M)	Southbound	4										67%	67%	100%	100%
M275	Northbound	4										100%	100%	100%	100%
M275	Southbound	4										100%	100%	100%	100%
M271	Northbound	3										100%	100%	100%	100%
M271	Southbound	3										100%	100%	100%	100%
		62										98%	98%	100%	100%
Overall								94%	89%	98%	100%	74%	65%	78%	87%

APPENDIX B

CORDONS AND SCREENLINES

PM

Vehicles

Cordon and Screenlines Validation — **Link Validation**

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5%	7.5%	10%	WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	10,445	10,518	73	0.7%	0.7	Y	Y	Y	Y	88%	75%	81%	94%
1 Fareham Enclosure	Inbound	16	10,189	10,291	103	1.0%	1.0	Y	Y	Y	Y	88%	69%	88%	100%
2 Havant Enclosure	Outbound	10	5,228	5,178	-50	-1.0%	0.7	Y	Y	Y	Y	50%	60%	60%	70%
2 Havant Enclosure	Inbound	10	5,539	5,561	22	0.4%	0.3	Y	Y	Y	Y	50%	50%	50%	60%
3 Hayling Island Enclosure	Outbound	1	856	777	-79	-9.3%	2.8	Y	Y	N	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	1,442	1,438	-4	-0.3%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	4,735	4,884	149	3.1%	2.1	Y	Y	Y	Y	63%	63%	63%	63%
4 Hedge End Enclosure	Inbound	8	6,029	5,744	-285	-4.7%	3.7	Y	Y	Y	Y	38%	50%	50%	63%
5 Waterlooville Enclosure	Outbound	18	10,142	9,819	-323	-3.2%	3.2	Y	Y	Y	Y	72%	67%	83%	83%
5 Waterlooville Enclosure	Inbound	18	11,576	11,862	286	2.5%	2.6	Y	Y	Y	Y	67%	61%	78%	78%
71 Portsmouth South Enclosure	Outbound	6	4,326	4,275	-52	-1.2%	0.8	Y	Y	Y	Y	33%	33%	33%	50%
71 Portsmouth South Enclosure	Inbound	6	5,376	5,446	69	1.3%	0.9	Y	Y	Y	Y	50%	50%	67%	83%
72 Portsmouth North Enclosure	Outbound	7	4,558	4,457	-101	-2.2%	1.5	Y	Y	Y	Y	40%	20%	80%	80%
72 Portsmouth North Enclosure	Inbound	7	4,223	4,333	110	2.6%	1.7	Y	Y	Y	Y	57%	29%	71%	86%
8 Southampton City Enclosure	Outbound	12	7,347	7,131	-216	-2.9%	2.5	Y	Y	Y	Y	42%	50%	58%	67%
8 Southampton City Enclosure	Inbound	12	5,548	5,122	-425	-7.7%	5.8	N	N	N	Y	42%	33%	42%	58%
91 Bitterne West Screenline	Eastbound	5	5,545	5,648	103	1.9%	1.4	Y	Y	Y	Y	80%	80%	80%	80%
91 Bitterne West Screenline	Westbound	5	2,908	2,802	-107	-3.7%	2.0	Y	Y	Y	Y	60%	60%	60%	60%
92 Bitterne East Screenline	Eastbound	4	3,748	3,641	-107	-2.9%	1.8	Y	Y	Y	Y	33%	33%	33%	100%
92 Bitterne East Screenline	Westbound	4	2,951	2,975	24	0.8%	0.4	Y	Y	Y	Y	33%	33%	33%	33%
10 Locks Heath North Screenline	Outbound	9	6,806	6,454	-352	-5.2%	4.3	N	Y	Y	Y	89%	89%	89%	100%
10 Locks Heath North Screenline	Inbound	9	6,898	7,002	104	1.5%	1.2	Y	Y	Y	Y	67%	67%	89%	100%
11 Totton Enclosure	Outbound	19	9,420	9,515	95	1.0%	1.0	Y	Y	Y	Y	50%	50%	50%	67%
11 Totton Enclosure	Inbound	19	10,337	10,298	-40	-0.4%	0.4	Y	Y	Y	Y	61%	50%	61%	72%
12 Eastleigh Enclosure	Outbound	11	5,681	5,453	-228	-4.0%	3.1	Y	Y	Y	Y	55%	55%	82%	91%
12 Eastleigh Enclosure	Inbound	11	5,329	5,612	284	5.3%	3.8	Y	Y	Y	Y	55%	55%	91%	100%
13 Southampton Enclosure	Outbound	14	14,550	14,905	355	2.4%	2.9	Y	Y	Y	Y	71%	71%	86%	86%
13 Southampton Enclosure	Inbound	14	12,179	12,314	136	1.1%	1.2	Y	Y	Y	Y	64%	64%	71%	79%
36 Solent RSI Cordon	Northbound	3	201	190	-11	-5.5%	0.8	Y	Y	Y	Y	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	168	171	3	1.9%	0.2	Y	Y	Y	Y	100%	100%	100%	100%
		286	184,277	183,813	-465	-0.3%		93%	97%	93%	100%	62%	58%	70%	79%
Calibration Screenlines															
20 Totton	Eastbound	8	3,411	3,626	215	6.3%	3.6	Y	N	Y	Y	50%	50%	75%	88%
20 Totton	Westbound	8	4,218	4,399	181	4.3%	2.8	Y	Y	Y	Y	75%	75%	75%	75%
21 North of Southampton	Eastbound	13	5,754	5,658	-96	-1.7%	1.3	Y	Y	Y	Y	54%	46%	54%	54%
21 North of Southampton	Westbound	13	5,535	5,550	15	0.3%	0.2	Y	Y	Y	Y	38%	38%	46%	54%
22 South of Southampton	Eastbound	7	4,563	4,670	107	2.3%	1.6	Y	Y	Y	Y	71%	71%	86%	86%
22 South of Southampton	Westbound	7	4,997	4,962	-35	-0.7%	0.5	Y	Y	Y	Y	57%	57%	57%	71%
23 Eastleigh	Eastbound	6	8,112	8,225	113	1.4%	1.2	Y	Y	Y	Y	33%	33%	100%	100%
23 Eastleigh	Westbound	6	8,778	8,721	-58	-0.7%	0.6	Y	Y	Y	Y	50%	50%	67%	67%
24 Bitterne Northwest to Southeast	Eastbound	15	5,791	5,468	-323	-5.6%	4.3	N	N	Y	Y	64%	43%	57%	64%
24 Bitterne Northwest to Southeast	Westbound	15	5,857	5,610	-247	-4.2%	3.3	Y	Y	Y	Y	57%	50%	71%	93%
25 Bitterne Southwest to Northeast	Eastbound	10	5,101	5,499	398	7.8%	5.5	N	N	N	Y	67%	78%	78%	89%
25 Bitterne Southwest to Northeast	Westbound	10	4,690	4,198	-492	-10.5%	7.4	N	N	N	Y	67%	56%	89%	89%
26 Fareham North South	Eastbound	8	2,546	2,694	148	5.8%	2.9	Y	N	Y	Y	75%	50%	63%	100%
26 Fareham North South	Westbound	8	2,896	2,982	86	3.0%	1.6	Y	Y	Y	Y	88%	75%	75%	88%
271 Locks Heath West to East	Northbound	11	3,509	3,377	-132	-3.8%	2.3	Y	Y	Y	Y	64%	55%	55%	82%
271 Locks Heath West to East	Southbound	11	5,200	4,820	-380	-7.3%	5.4	N	N	Y	Y	36%	36%	45%	64%
272 Fareham West to East	Northbound	4	2,256	2,308	53	2.3%	1.1	Y	Y	Y	Y	100%	100%	100%	100%
272 Fareham West to East	Southbound	4	2,234	2,370	136	6.1%	2.8	Y	N	Y	Y	75%	75%	75%	100%
28 Gosport	Northbound	6	3,007	2,947	-60	-2.0%	1.1	Y	Y	Y	Y	83%	83%	83%	83%
28 Gosport	Southbound	6	3,499	3,543	44	1.3%	0.7	Y	Y	Y	Y	83%	83%	83%	83%
29 Portsmouth NorthSouth	Eastbound	15	5,537	5,315	-221	-4.0%	3.0	Y	Y	Y	Y	47%	33%	47%	73%
29 Portsmouth NorthSouth	Westbound	16	5,453	5,337	-116	-2.1%	1.6	Y	Y	Y	Y	38%	19%	63%	75%
30 Portsmouth EastWest	Northbound	8	3,185	3,615	430	13.5%	7.4	N	N	N	N	88%	63%	75%	88%
30 Portsmouth EastWest	Southbound	8	4,040	4,066	26	0.6%	0.4	Y	Y	Y	Y	63%	25%	38%	63%
31 Cosham	Eastbound	4	2,246	2,321	75	3.3%	1.6	Y	Y	Y	Y	50%	50%	50%	75%
31 Cosham	Westbound	4	2,214	2,432	218	9.8%	4.5	N	N	N	Y	50%	50%	75%	75%
32 Waterlooville North to South	Eastbound	14	5,216	5,266	50	1.0%	0.7	Y	Y	Y	Y	64%	57%	64%	93%
32 Waterlooville North to South	Westbound	14	5,589	5,686	98	1.7%	1.3	Y	Y	Y	Y	64%	50%	57%	79%
33 Waterlooville West to East	Northbound	4	1,712	1,842	129	7.6%	3.1	Y	N	N	Y	75%	25%	75%	100%
33 Waterlooville West to East	Southbound	4	1,640	1,661	21	1.3%	0.5	Y	Y	Y	Y	100%	75%	75%	100%
34 Havant North South	Eastbound	6	2,290	2,240	-50	-2.2%	1.0	Y	Y	Y	Y	67%	67%	67%	83%
34 Havant North South	Westbound	6	2,088	2,195	107	5.1%	2.3	Y	Y	Y	Y	100%	100%	100%	100%
35 Havant East West	Northbound	9	2,542	2,287	-254	-10.0%	5.2	N	N	N	Y	67%	44%	56%	67%
35 Havant East West	Southbound	9	2,362	2,403	42	1.8%	0.9	Y	Y	Y	Y	89%	78%	78%	78%
201 Winchester Cordon	Outbound	15	5,827	5,879	52	0.9%	0.7	Y	Y	Y	Y	100%	67%	80%	87%
201 Winchester Cordon	Inbound	15	5,050	4,694	-355	-7.0%	5.1	N	N	Y	Y	93%	80%	93%	93%
		327	148,943	148,866	-77	-0.1%		78%	67%	83%	97%	66%	55%	68%	80%
Motorways															
M27	Eastbound	14										70%	70%	90%	90%
M27	Westbound	14										100%	100%	100%	100%
M3	Eastbound	6										100%	100%	100%	100%
M3	Westbound	6										100%	100%	100%	100%
A3(M)	Northbound	4										100%	50%	100%	100%
A3(M)	Southbound	4										67%	67%	67%	67%
M275	Northbound	4										0%	0%	0%	100%
M275	Southbound	4										100%	100%	100%	100%
M271	Northbound	3										100%	50%	100%	100%
M271	Southbound	3										67%	67%	100%	100%
		62										83%	77%	89%	96%
Overall								85%	80%	88%	98%	66%	58%	71%	81%

APPENDIX C
Journey Time Validation

Part 1 **AM**
Routes Undertaken for Previous 2010 Base, and Updated to TrafficMaster 2014

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
1	1EB	**A336 RINGWOOD ROAD - A35 BURGESS ROAD**	1,509	1,510	1	0%	Y	Y	Y
1	1WB	**A35 BURGESS ROAD - A35 WINCHESTER ROAD**	1,552	1,639	87	6%	Y	Y	Y
2	2EB	**A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE**	1,473	1,226	-247	-17%	N	Y	Y
2	2WB	**A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST**	1,539	1,383	-156	-10%	Y	Y	Y
3	3NB	**A33 DORSET STREET - A335 TWYFORD ROAD**	1,219	1,118	-101	-8%	Y	Y	Y
3	3SB	**A335 TWYFORD ROAD - A33 DORSET STREET**	1,123	1,235	112	10%	Y	Y	Y
4	4NB	**A33 DORSET STREET - A33**	545	572	27	5%	Y	Y	Y
4	4SB	**A33 - A33 DORSET STREET**	731	712	-19	-3%	Y	Y	Y
5	5NB	**A3024 BURSLEDON ROAD - A33 THE AVENUE**	1,513	1,402	-111	-7%	Y	Y	Y
5	5SB	**A33 THE AVENUE - A3024 BURSLEDON ROAD**	992	1,190	197	20%	N	Y	Y
6	6NB	**A27 WEST END ROAD - A27 BASSETT GREEN ROAD**	965	1,051	86	9%	Y	Y	Y
6	6SB	**A27 BASSETT GREEN ROAD - A27 WEST END ROAD**	911	937	26	3%	Y	Y	Y
7	7NB	**A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD**	1,200	1,098	-102	-8%	Y	Y	Y
7	7SB	**A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE**	1,173	1,201	28	2%	Y	Y	Y
8	8WB	**A27 WESTERN WAY - A27 BRIDGE ROAD**	1,083	1,299	216	20%	N	Y	Y
8	8EB	**A27 BRIDGE ROAD - A27 WESTERN WAY**	1,277	1,356	79	6%	Y	Y	Y
9	9NB	**A32 MUMBY ROAD - B3334 TITCHFIELD ROAD**	1,159	1,178	19	2%	Y	Y	Y
9	9SB	**B3334 TITCHFIELD ROAD - A32 MUMBY ROAD**	1,138	1,094	-43	-4%	Y	Y	Y
10	10NB	**A32 FAREHAM ROAD - A27 WESTERN ROAD**	1,534	1,461	-73	-5%	Y	Y	Y
10	10SB	**A27 WESTERN ROAD - A27 WESTERN ROAD**	1,427	1,544	116	8%	Y	Y	Y
11	11NB	**A397 NORTHERN ROAD - A3 LONDON ROAD**	1,024	1,239	215	21%	N	N	Y
11	11SB	**A3 LONDON ROAD - A397 NORTHERN ROAD**	1,073	1,474	401	37%	N	N	N
12	12NB	**B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD**	908	1,314	405	45%	N	N	N
12	12SB	**B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD**	835	1,323	488	58%	N	N	N
13	13NB	**A2030 VELDER AVENUE - A2030 EASTERN ROAD**	743	594	-149	-20%	N	N	Y
13	13SB	**A2030 EASTERN ROAD - A2030 VELDER AVENUE**	631	568	-63	-10%	Y	Y	Y
14	14NB	**A288 MILTON ROAD - A288 COPNOR ROAD**	456	438	-18	-4%	Y	Y	Y
14	14SB	**A288 COPNOR ROAD - A288 MILTON ROAD**	527	476	-51	-10%	Y	Y	Y
15	15NB	**M275 - - A27**	224	275	50	22%	Y	Y	Y
15	15SB	**A27 - M275**	260	283	23	9%	Y	Y	Y
16	16NB	**A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD**	882	781	-101	-11%	Y	Y	Y
16	16SB	**A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT**	783	695	-88	-11%	Y	Y	Y
17	17NB	**A3 MARKETWAY - A27 WESTERN ROAD**	757	639	-118	-16%	N	Y	Y
17	17SB	**A27 WESTERN ROAD - A3 MARKETWAY**	714	727	13	2%	Y	Y	Y
	Total		33,881	35,030	1149	3%			

Part 2 **AM**
Routes Newly Analysed for 2015 Base

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	**M3J11 - A32**	922	915	-8	-1%	Y	Y	Y
18	1SB	**A32 - M3J11**	827	816	-11	-1%	Y	Y	Y
19	2NB	**M27J2 - A303**	1,930	2,050	120	6%	Y	Y	Y
19	2SB	**A303 - M27J2**	2,010	2,290	280	14%	Y	Y	Y
20	3NB	**M27J2 - A34**	1,937	2,107	170	9%	Y	Y	Y
20	3SB	**A34 - M27J2**	1,856	1,977	121	6%	Y	Y	Y
21	SEC1EB	**Six Dials Jun to Windhover Rbt**	689	760	72	10%	Y	Y	Y
21	SEC1WB	**Windhover Rbt to Six Dials Jun**	1,021	938	-83	-8%	Y	Y	Y
22	SEC2NB	**M27J7 to M3J11**	1,344	1,356	12	1%	Y	Y	Y
22	SEC2SB	**M3J11 - M27J7**	1,309	1,274	-35	-3%	Y	Y	Y
23	SEC3NB	**M27J10 - M3J11**	1,898	1,765	-133	-7%	Y	Y	Y
23	SEC3SB	**M3J11 - M27J10**	1,726	1,620	-106	-6%	Y	Y	Y
	Total		17,470	17,869	398	2%			

Part 3 **AM**
Motorways - M27 and M3

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24	24EB	**M27 Eastbound**	1,253	1,214	-39	-3%	Y	Y	Y
24	24WB	**M27 Westbound**	1,344	1,532	188	14%	Y	Y	Y
25	25SB	**M3 Southbound**	1,146	1,241	96	8%	Y	Y	Y
25	25NB	**M3 Northbound**	1,415	1,633	218	15%	Y	Y	Y
	Total		5,157	5,620	463	9%			

Percentage within criteria	**82%**	***90%***	***94%***

APPENDIX C
Journey Time Validation

Part 1 **IP**

Routes Undertaken for Previous 2010 Base, and Updated to TrafficMaster 2014

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
1	1EB	**A336 RINGWOOD ROAD - A35 BURGESS ROAD**	1,479	1,287	-193	-13%	Y	Y	Y
1	1WB	**A35 BURGESS ROAD - A35 WINCHESTER ROAD**	1,539	1,298	-241	-16%	N	Y	Y
2	2EB	**A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE**	1,454	1,122	-332	-23%	N	N	Y
2	2WB	**A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST**	1,437	1,128	-309	-22%	N	N	Y
3	3NB	**A33 DORSET STREET - A335 TWYFORD ROAD**	1,093	1,016	-77	-7%	Y	Y	Y
3	3SB	**A335 TWYFORD ROAD - A33 DORSET STREET**	1,090	1,095	5	0%	Y	Y	Y
4	4NB	**A33 DORSET STREET - A33**	472	424	-48	-10%	Y	Y	Y
4	4SB	**A33 - A33 DORSET STREET**	487	492	5	1%	Y	Y	Y
5	5NB	**A3024 BURSLEDON ROAD - A33 THE AVENUE**	1,176	1,132	-44	-4%	Y	Y	Y
5	5SB	**A33 THE AVENUE - A3024 BURSLEDON ROAD**	1,167	1,146	-22	-2%	Y	Y	Y
6	6NB	**A27 WEST END ROAD - A27 BASSETT GREEN ROAD**	880	892	12	1%	Y	Y	Y
6	6SB	**A27 BASSETT GREEN ROAD - A27 WEST END ROAD**	902	927	25	3%	Y	Y	Y
7	7NB	**A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD**	1,348	1,063	-285	-21%	N	N	Y
7	7SB	**A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE**	1,199	1,100	-99	-8%	Y	Y	Y
8	8WB	**A27 WESTERN WAY - A27 BRIDGE ROAD**	1,104	1,049	-56	-5%	Y	Y	Y
8	8EB	**A27 BRIDGE ROAD - A27 WESTERN WAY**	1,148	1,167	20	2%	Y	Y	Y
9	9NB	**A32 MUMBY ROAD - B3334 TITCHFIELD ROAD**	1,056	1,005	-51	-5%	Y	Y	Y
9	9SB	**B3334 TITCHFIELD ROAD - A32 MUMBY ROAD**	1,079	1,024	-55	-5%	Y	Y	Y
10	10NB	**A32 FAREHAM ROAD - A27 WESTERN ROAD**	1,401	1,314	-87	-6%	Y	Y	Y
10	10SB	**A27 WESTERN ROAD - A27 WESTERN ROAD**	1,360	1,193	-167	-12%	Y	Y	Y
11	11NB	**A397 NORTHERN ROAD - A3 LONDON ROAD**	1,107	1,162	55	5%	Y	Y	Y
11	11SB	**A3 LONDON ROAD - A397 NORTHERN ROAD**	1,133	1,258	125	11%	Y	Y	Y
12	12NB	**B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD**	946	1,178	232	25%	N	N	Y
12	12SB	**B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD**	858	1,146	288	34%	N	N	N
13	13NB	**A2030 VELDER AVENUE - A2030 EASTERN ROAD**	647	527	-120	-19%	N	Y	Y
13	13SB	**A2030 EASTERN ROAD - A2030 VELDER AVENUE**	594	539	-55	-9%	Y	Y	Y
14	14NB	**A288 MILTON ROAD - A288 COPNOR ROAD**	494	419	-75	-15%	Y	Y	Y
14	14SB	**A288 COPNOR ROAD - A288 MILTON ROAD**	610	456	-154	-25%	N	N	N
15	15NB	**M275 - - A27**	224	229	5	2%	Y	Y	Y
15	15SB	**A27 - M275**	256	231	-25	-10%	Y	Y	Y
16	16NB	**A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD**	778	711	-67	-9%	Y	Y	Y
16	16SB	**A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT**	759	630	-129	-17%	N	Y	Y
17	17NB	**A3 MARKETWAY - A27 WESTERN ROAD**	672	615	-57	-8%	Y	Y	Y
17	17SB	**A27 WESTERN ROAD - A3 MARKETWAY**	671	582	-89	-13%	Y	Y	Y
	Total		32,617	30,554	-2063	-6%			

Part 2 **IP**

Routes Newly Analysed for 2015 Base

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	**M3J11 - A32**	775	770	-5	-1%	Y	Y	Y
18	1SB	**A32 - M3J11**	790	806	16	2%	Y	Y	Y
19	2NB	**M27J2 - A303**	2,017	1,960	-57	-3%	Y	Y	Y
19	2SB	**A303 - M27J2**	2,020	2,022	2	0%	Y	Y	Y
20	3NB	**M27J2 - A34**	1,815	1,957	142	8%	Y	Y	Y
20	3SB	**A34 - M27J2**	1,825	1,959	135	7%	Y	Y	Y
21	SEC1EB	**Six Dials Jun to Windhover Rbt**	783	728	-55	-7%	Y	Y	Y
21	SEC1WB	**Windhover Rbt to Six Dials Jun**	740	749	10	1%	Y	Y	Y
22	SEC2NB	**M27J7 to M3J11**	1,235	1,160	-75	-6%	Y	Y	Y
22	SEC2SB	**M3J11 - M27J7**	1,272	1,237	-35	-3%	Y	Y	Y
23	SEC3NB	**M27J10 - M3J11**	1,710	1,614	-97	-6%	Y	Y	Y
23	SEC3SB	**M3J11 - M27J10**	1,659	1,593	-66	-4%	Y	Y	Y
	Total		16,640	16,557	-84	-1%			

Part 3 **IP**

Motorways - M27 and M3

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24	24EB	**M27 Eastbound**	945	966	21	2%	Y	Y	Y
24	24WB	**M27 Westbound**	956	1,015	59	6%	Y	Y	Y
25	25SB	**M3 Southbound**	1,092	1,160	68	6%	Y	Y	Y
25	25NB	**M3 Northbound**	1,081	1,185	105	10%	Y	Y	Y
	Total		4,074	4,327	253	6%			

Percentage within criteria	**82%**	***88%***	***96%***

APPENDIX C
Journey Time Validation

Part 1 — **PM**

Routes Undertaken for Previous 2010 Base, and Updated to TrafficMaster 2014

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
1	1EB	**A336 RINGWOOD ROAD - A35 BURGESS ROAD**	1,734	1,355	-379	-22%	N	N	Y
1	1WB	**A35 BURGESS ROAD - A35 WINCHESTER ROAD**	1,771	1,520	-251	-14%	Y	Y	Y
2	2EB	**A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE**	1,513	1,299	-213	-14%	Y	Y	Y
2	2WB	**A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST**	1,530	1,394	-136	-9%	Y	Y	Y
3	3NB	**A33 DORSET STREET - A335 TWYFORD ROAD**	1,470	1,062	-408	-28%	N	N	N
3	3SB	**A335 TWYFORD ROAD - A33 DORSET STREET**	1,469	1,157	-312	-21%	N	N	Y
4	4NB	**A33 DORSET STREET - A33**	676	448	-228	-34%	N	N	N
4	4SB	**A33 - A33 DORSET STREET**	613	603	-10	-2%	Y	Y	Y
5	5NB	**A3024 BURSLEDON ROAD - A33 THE AVENUE**	1,239	1,314	74	6%	Y	Y	Y
5	5SB	**A33 THE AVENUE - A3024 BURSLEDON ROAD**	1,589	1,279	-310	-20%	N	Y	Y
6	6NB	**A27 WEST END ROAD - A27 BASSETT GREEN ROAD**	915	959	44	5%	Y	Y	Y
6	6SB	**A27 BASSETT GREEN ROAD - A27 WEST END ROAD**	1,159	946	-212	-18%	N	Y	Y
7	7NB	**A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD**	1,516	1,114	-402	-27%	N	N	N
7	7SB	**A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE**	1,221	1,150	-71	-6%	Y	Y	Y
8	8WB	**A27 WESTERN WAY - A27 BRIDGE ROAD**	1,505	1,135	-369	-25%	N	N	Y
8	8EB	**A27 BRIDGE ROAD - A27 WESTERN WAY**	1,366	1,344	-22	-2%	Y	Y	Y
9	9NB	**A32 MUMBY ROAD - B3334 TITCHFIELD ROAD**	1,066	1,076	10	1%	Y	Y	Y
9	9SB	**B3334 TITCHFIELD ROAD - A32 MUMBY ROAD**	1,277	1,156	-122	-10%	Y	Y	Y
10	10NB	**A32 FAREHAM ROAD - A27 WESTERN ROAD**	1,534	1,453	-81	-5%	Y	Y	Y
10	10SB	**A27 WESTERN ROAD - A27 WESTERN ROAD**	1,643	1,404	-239	-15%	Y	Y	Y
11	11NB	**A397 NORTHERN ROAD - A3 LONDON ROAD**	1,102	1,364	262	24%	N	N	Y
11	11SB	**A3 LONDON ROAD - A397 NORTHERN ROAD**	1,118	1,398	280	25%	N	N	N
12	12NB	**B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD**	955	1,219	263	28%	N	N	N
12	12SB	**B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD**	889	1,337	448	50%	N	N	N
13	13NB	**A2030 VELDER AVENUE - A2030 EASTERN ROAD**	792	560	-232	-29%	N	N	N
13	13SB	**A2030 EASTERN ROAD - A2030 VELDER AVENUE**	768	559	-209	-27%	N	N	N
14	14NB	**A288 MILTON ROAD - A288 COPNOR ROAD**	535	420	-115	-21%	N	N	Y
14	14SB	**A288 COPNOR ROAD - A288 MILTON ROAD**	637	479	-159	-25%	N	N	Y
15	15NB	**M275 - - A27**	217	339	121	56%	N	N	N
15	15SB	**A27 - M275**	247	258	11	4%	Y	Y	Y
16	16NB	**A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD**	897	837	-60	-7%	Y	Y	Y
16	16SB	**A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT**	832	698	-134	-16%	N	Y	Y
17	17NB	**A3 MARKETWAY - A27 WESTERN ROAD**	704	714	9	1%	Y	Y	Y
17	17SB	**A27 WESTERN ROAD - A3 MARKETWAY**	731	680	-51	-7%	Y	Y	Y
	Total		37,229	34,029	-3201	-9%			

Part 2 — **PM**

Routes Newly Analysed for 2015 Base

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	**M3J11 - A32**	889	780	-109	-12%	Y	Y	Y
18	1SB	**A32 - M3J11**	988	843	-146	-15%	Y	Y	Y
19	2NB	**M27J2 - A303**	1,995	1,959	-36	-2%	Y	Y	Y
19	2SB	**A303 - M27J2**	1,986	2,050	63	3%	Y	Y	Y
20	3NB	**M27J2 - A34**	1,924	1,976	52	3%	Y	Y	Y
20	3SB	**A34 - M27J2**	2,086	1,986	-101	-5%	Y	Y	Y
21	SEC1EB	**Six Dials Jun to Windhover Rbt**	902	881	-21	-2%	Y	Y	Y
21	SEC1WB	**Windhover Rbt to Six Dials Jun**	827	884	57	7%	Y	Y	Y
22	SEC2NB	**M27J7 to M3J11**	1,315	1,324	9	1%	Y	Y	Y
22	SEC2SB	**M3J11 - M27J7**	1,400	1,333	-67	-5%	Y	Y	Y
23	SEC3NB	**M27J10 - M3J11**	1,681	1,643	-39	-2%	Y	Y	Y
23	SEC3SB	**M3J11 - M27J10**	1,736	1,657	-79	-5%	Y	Y	Y
	Total		17,731	17,315	-416	-2%			

Part 3 — **PM**

Motorways - M27 and M3

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24	24EB	**M27 Eastbound**	1,195	1,304	109	9%	Y	Y	Y
24	24WB	**M27 Westbound**	1,164	1,343	179	15%	Y	Y	Y
25	25SB	**M3 Southbound**	1,462	1,348	-114	-8%	Y	Y	Y
25	25NB	**M3 Northbound**	1,093	1,228	136	12%	Y	Y	Y
	Total		4,913	5,223	310	6%			

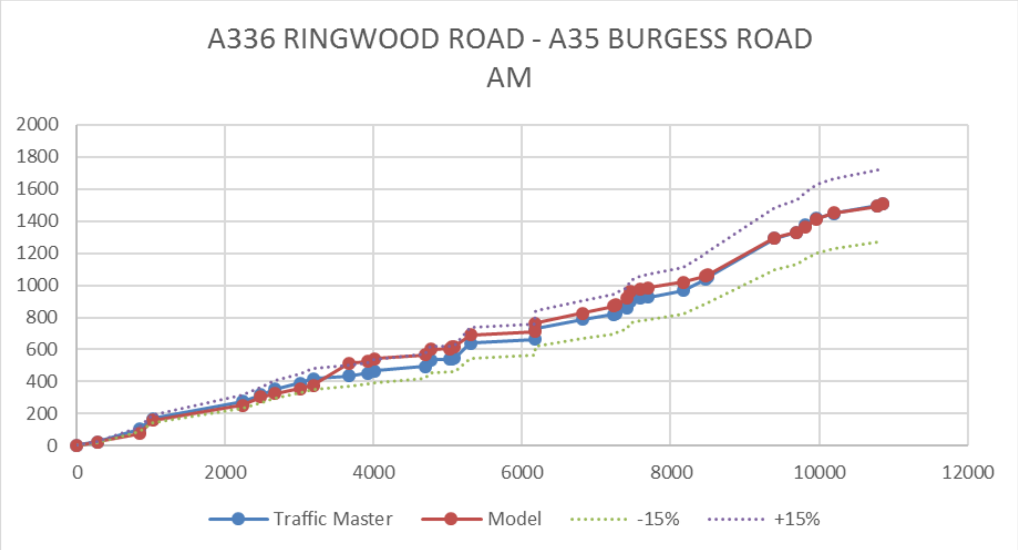
Percentage within criteria	**64%**	***70%***	***82%***

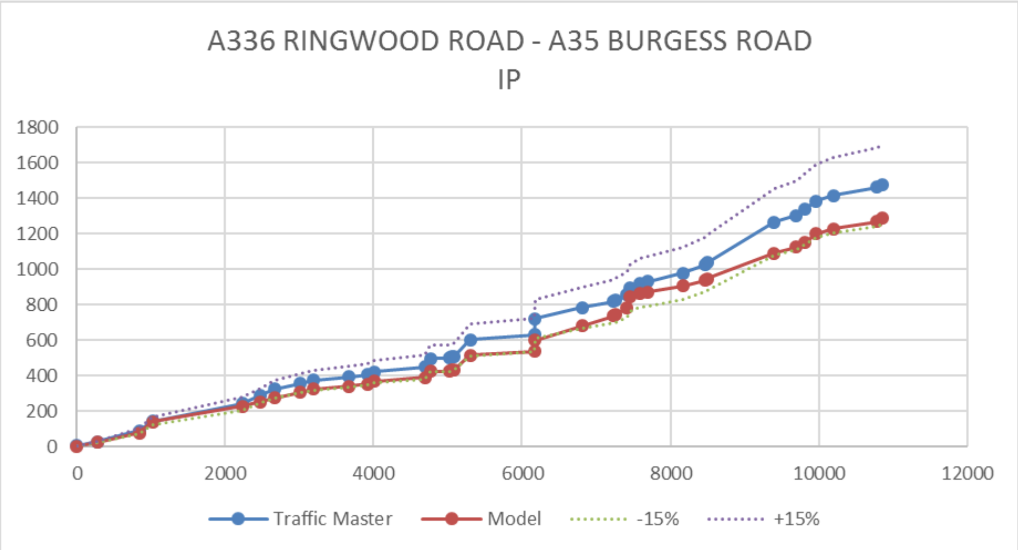
APPENDIX D

TIME-DISTANCE CHARTS

TIME-DISTANCE CHARTS (X-axis distance: meters, Y- axis time: seconds)

Figure 1. 1EB A336 RINGWOOD ROAD - A35 BURGESS ROAD





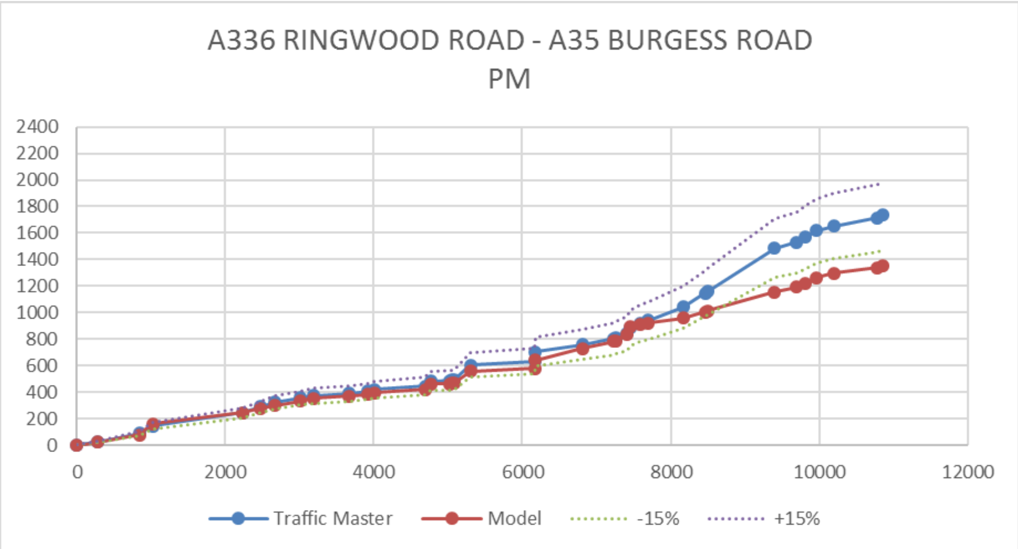
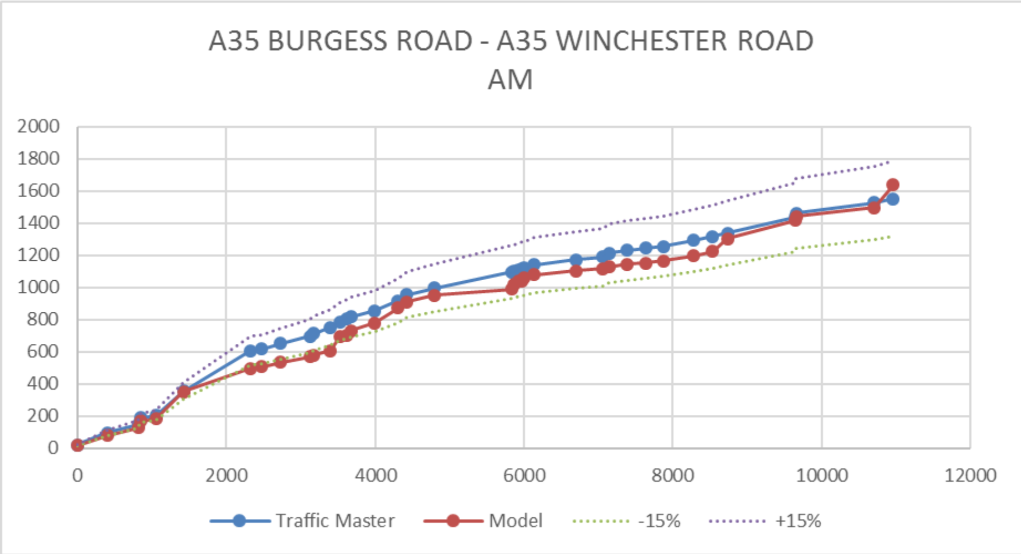
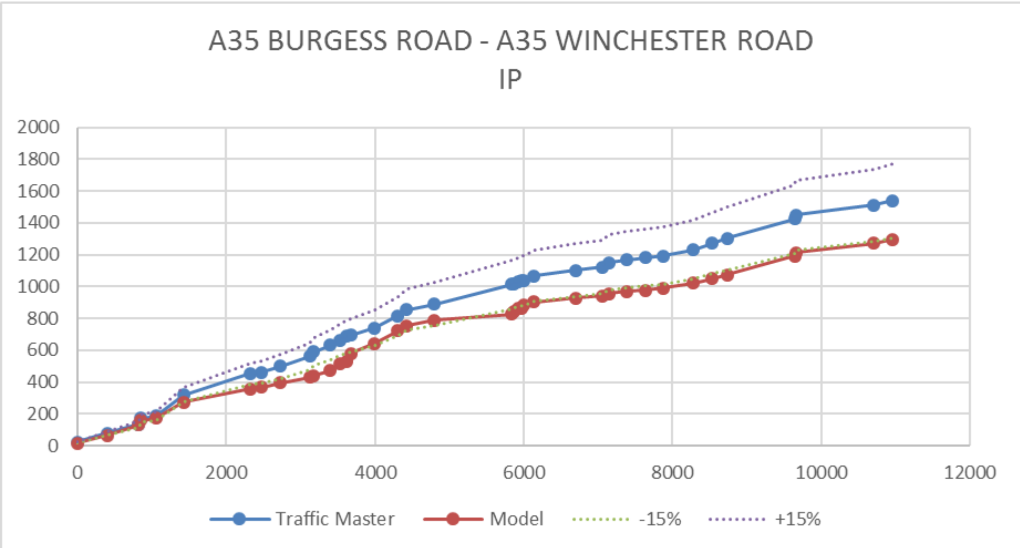


Figure 2. 1WB A35 BURGESS ROAD - A35 WINCHESTER ROAD





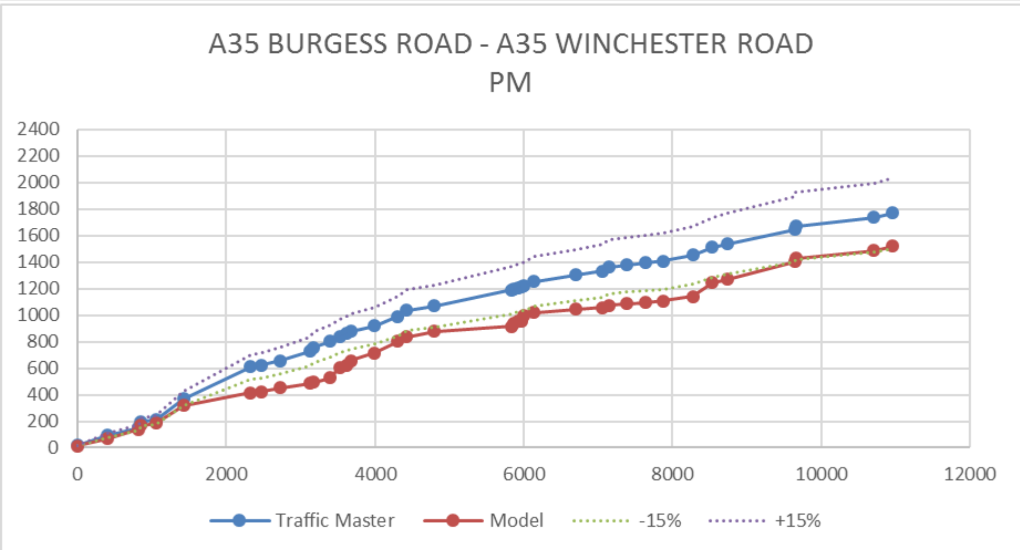
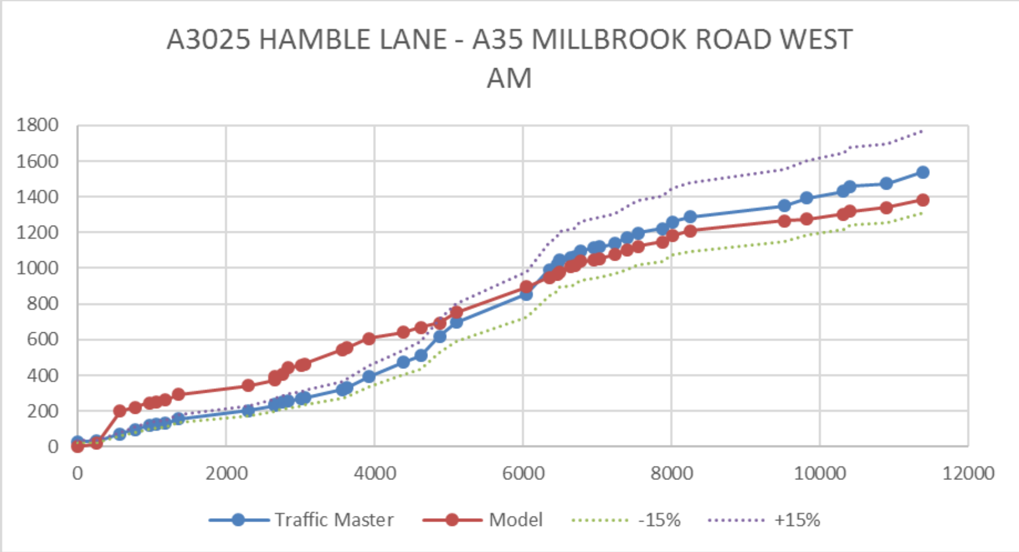
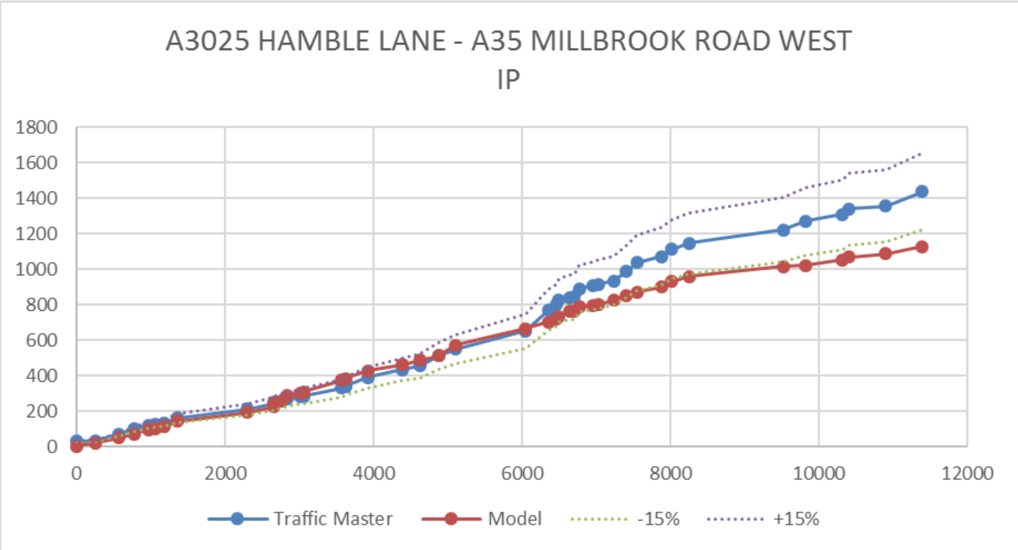


Figure 3. 2EB A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE

Figure 4. 2WB A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST





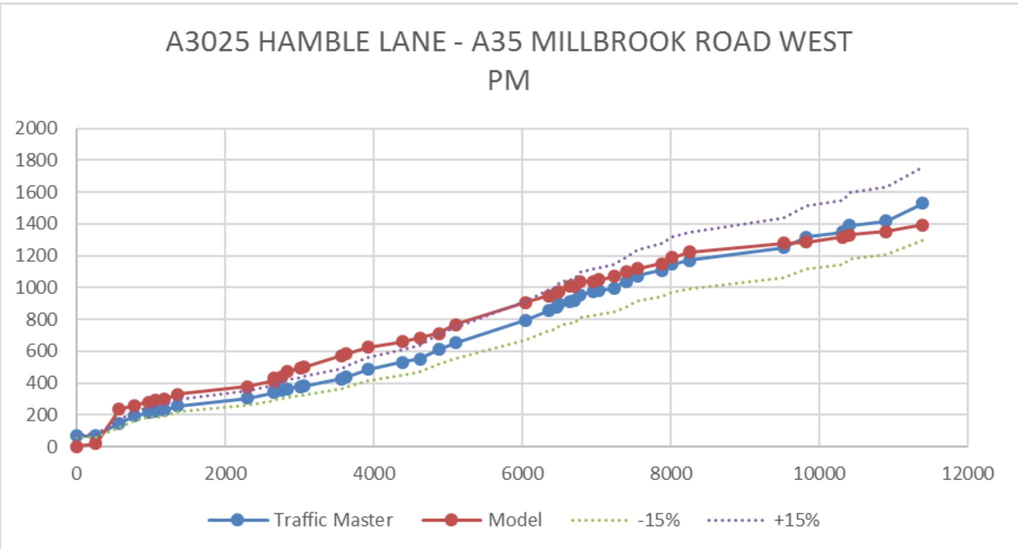
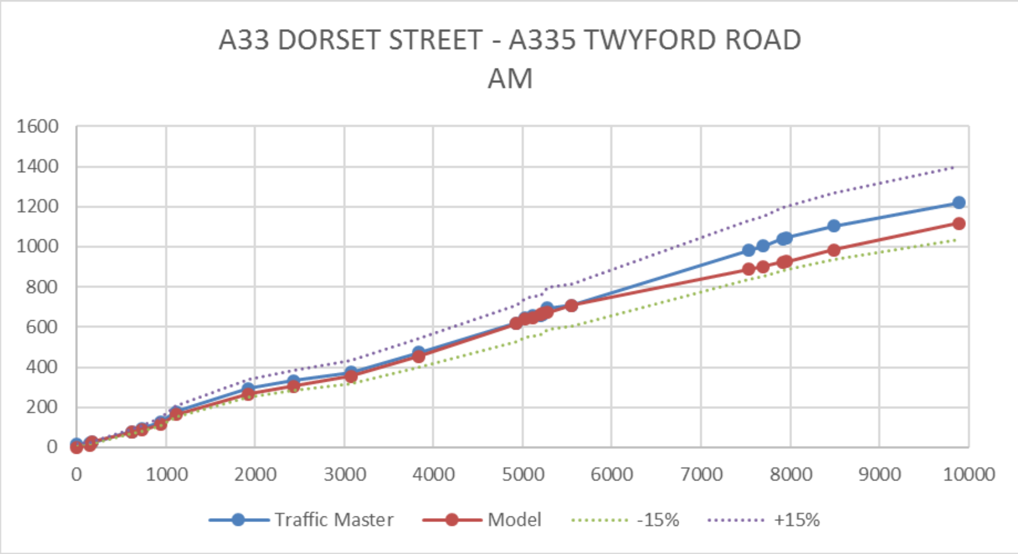
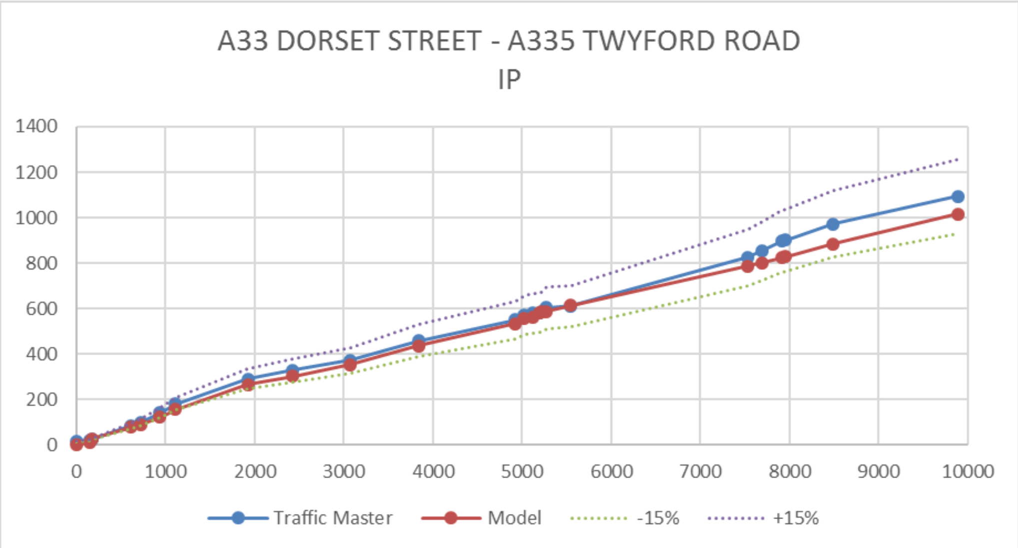


Figure 5. 3NB A33 DORSET STREET - A335 TWYFORD ROAD





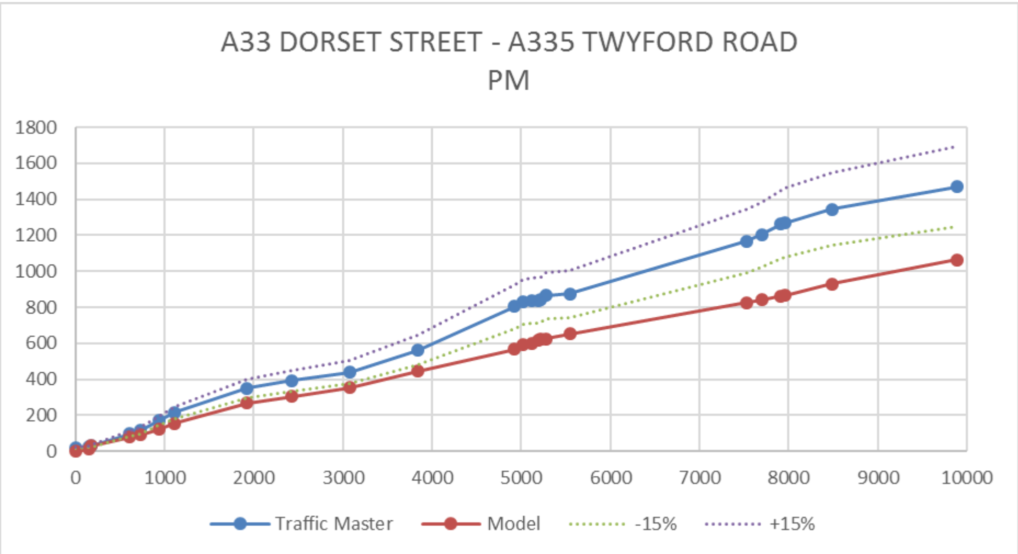


Figure 6. 3SB A335 TWYFORD ROAD - A33 DORSET STREET

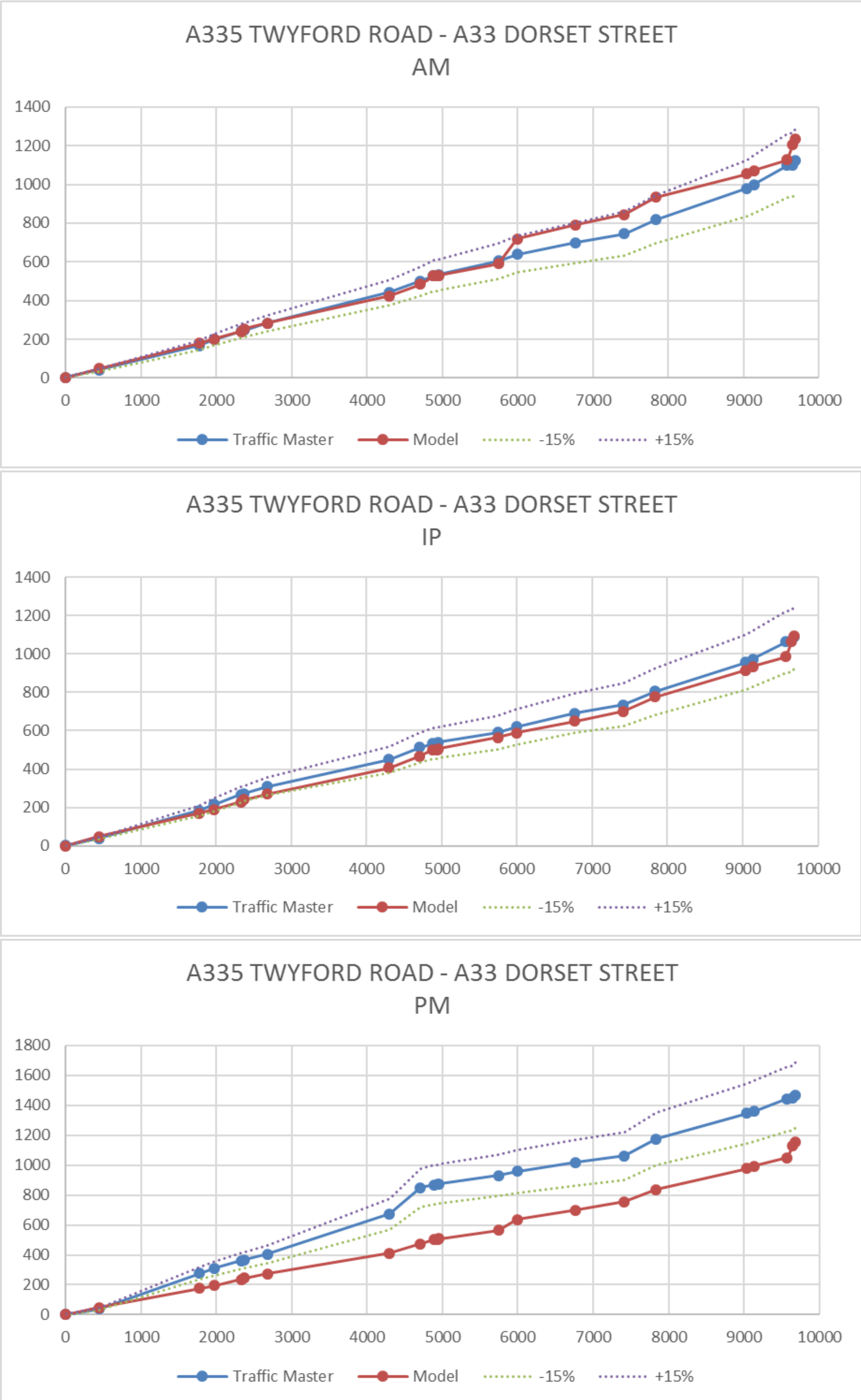
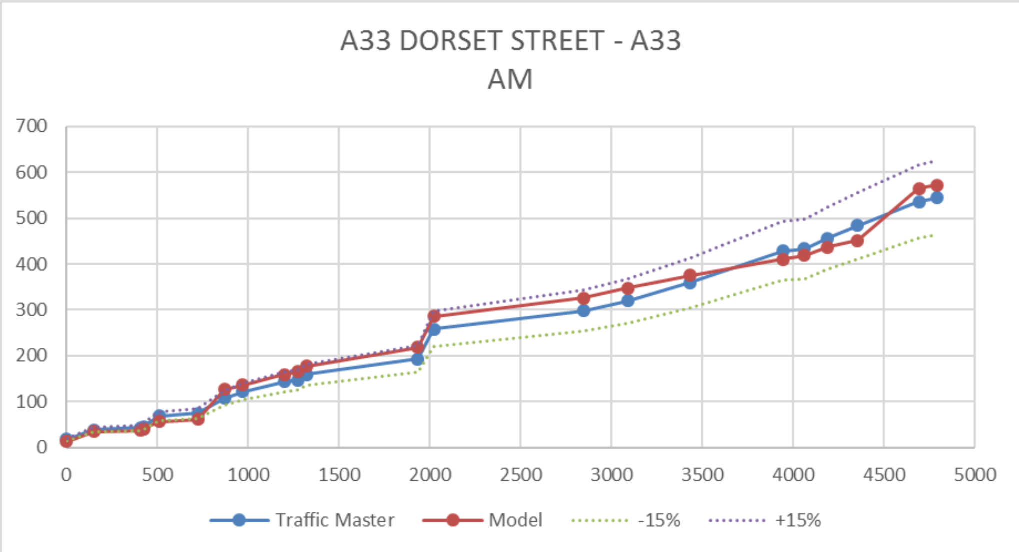
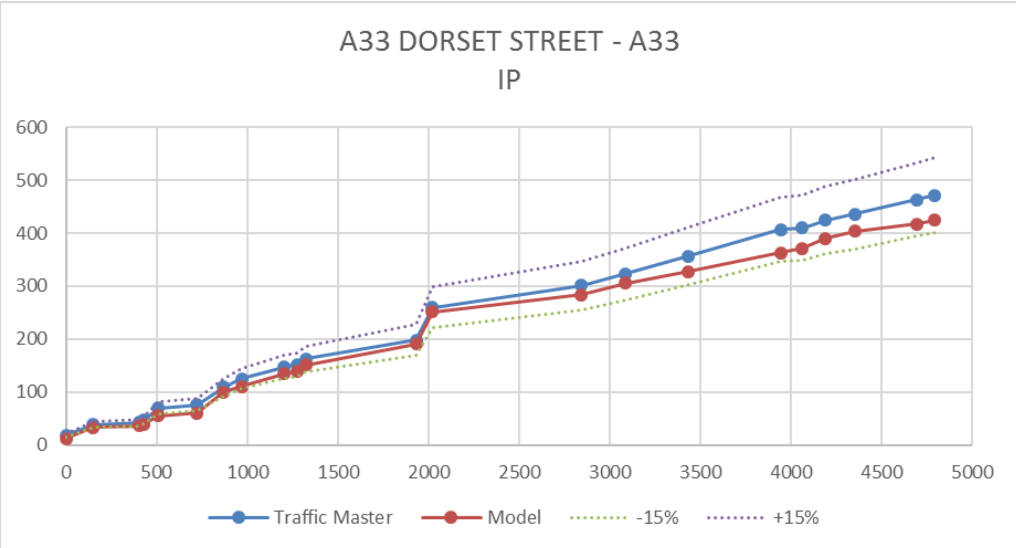


Figure 7. 4NB A33 DORSET STREET - A33





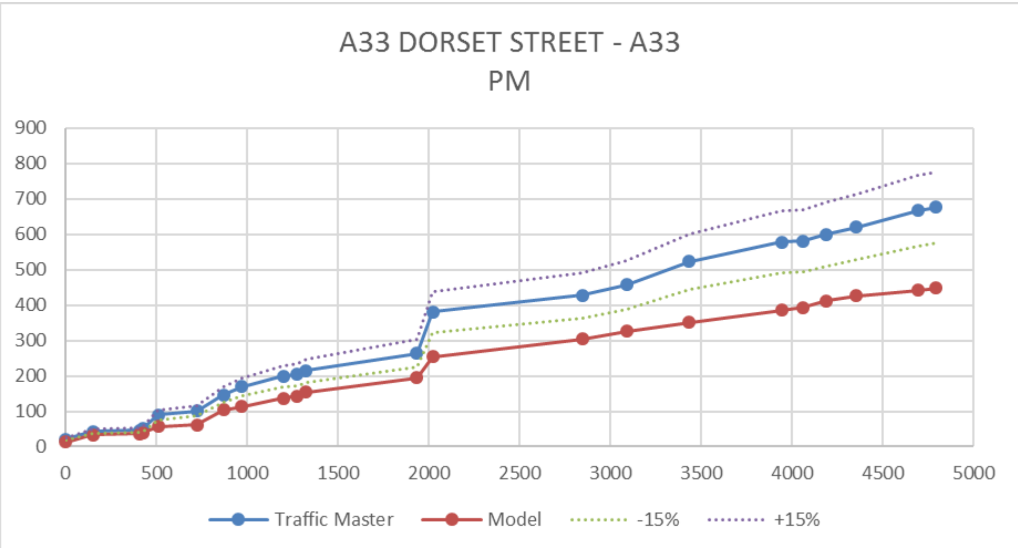
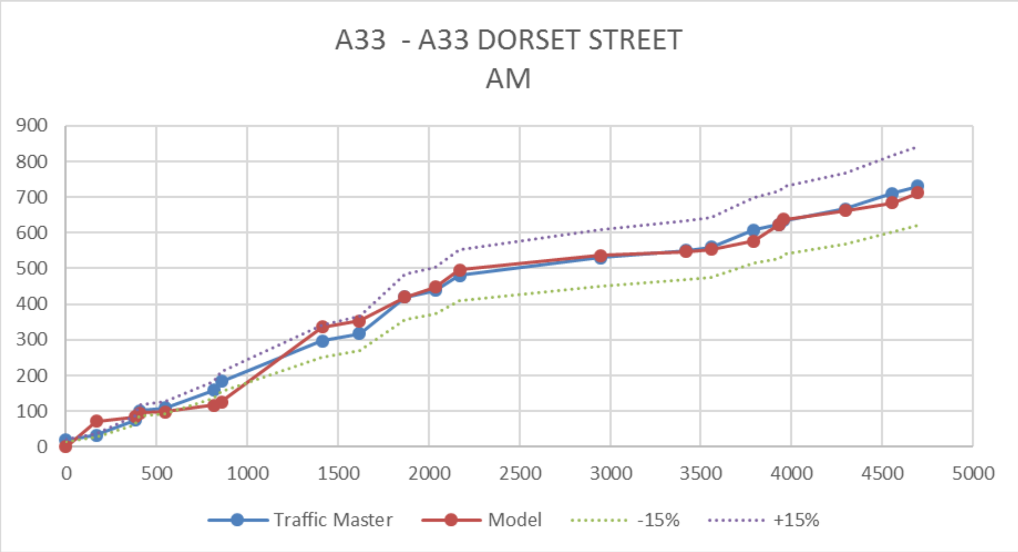
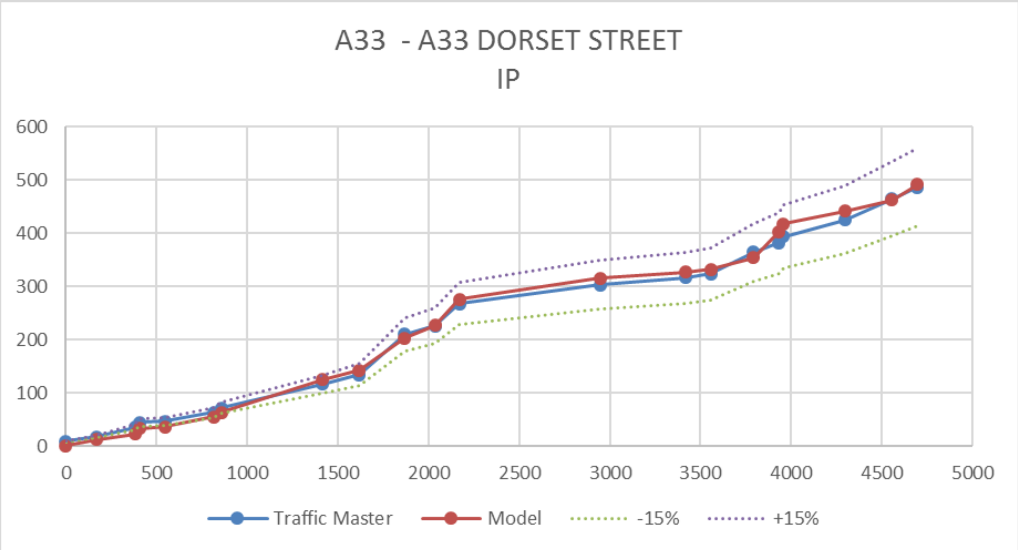


Figure 8. 4SB A33 - A33 DORSET STREET





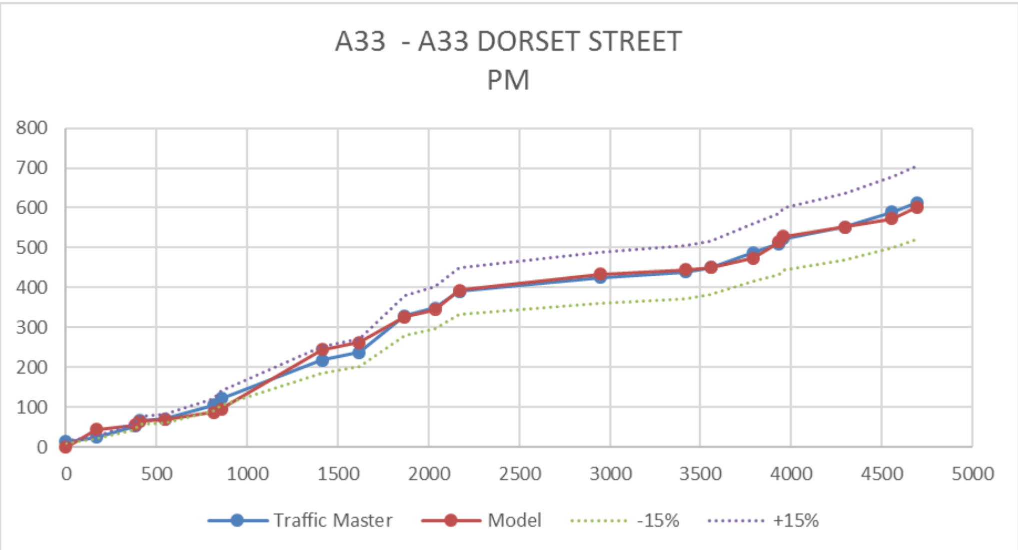
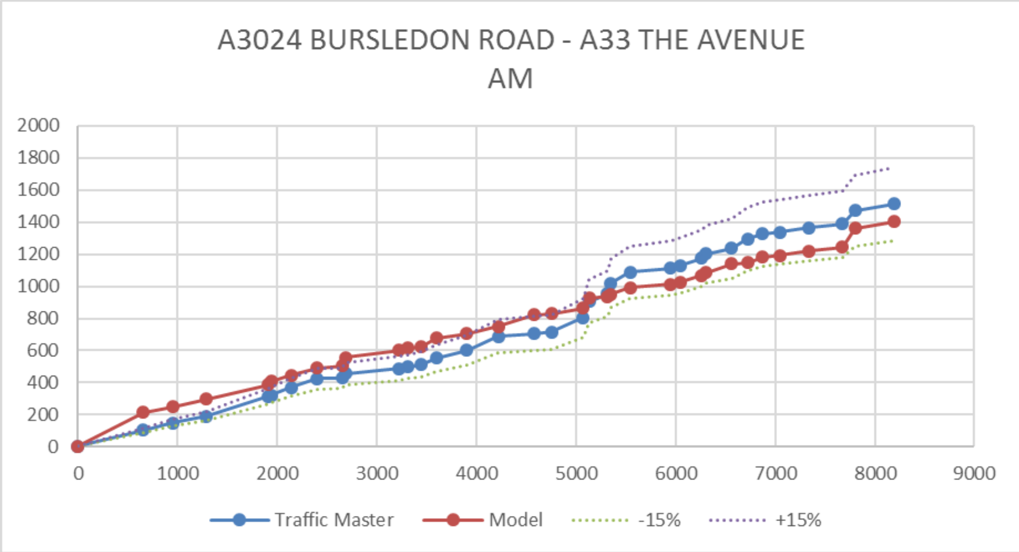
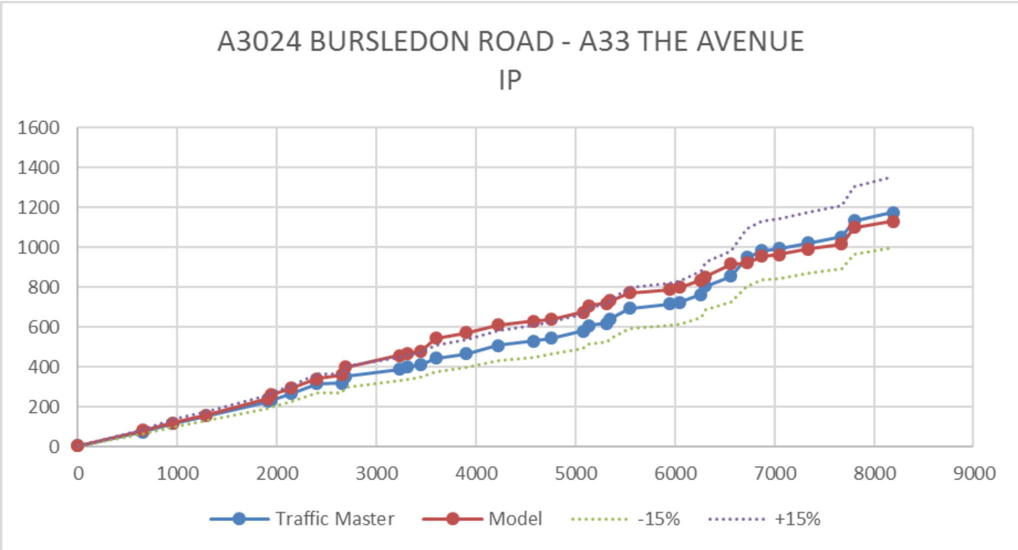


Figure 9. 5NB A3024 BURSLEDON ROAD - A33 THE AVENUE





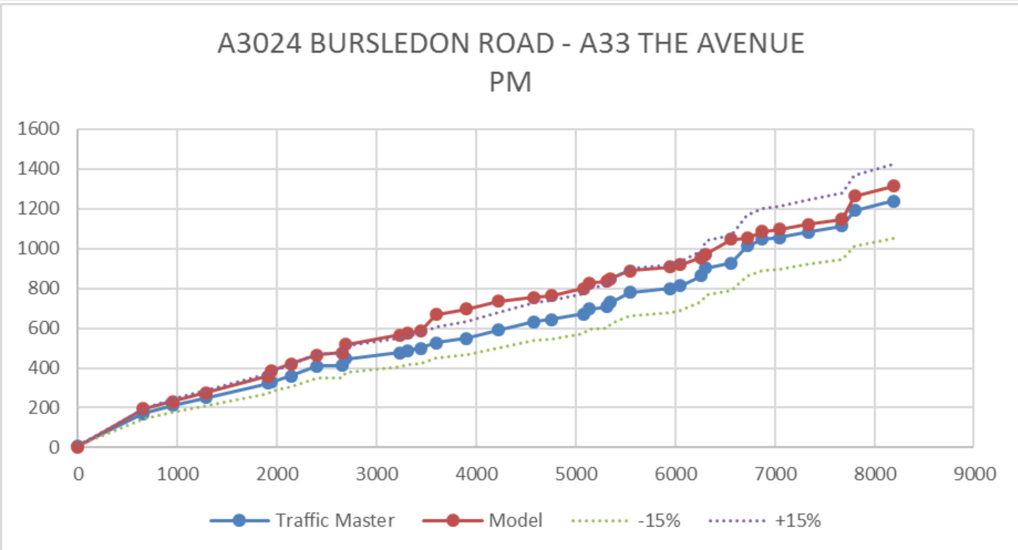
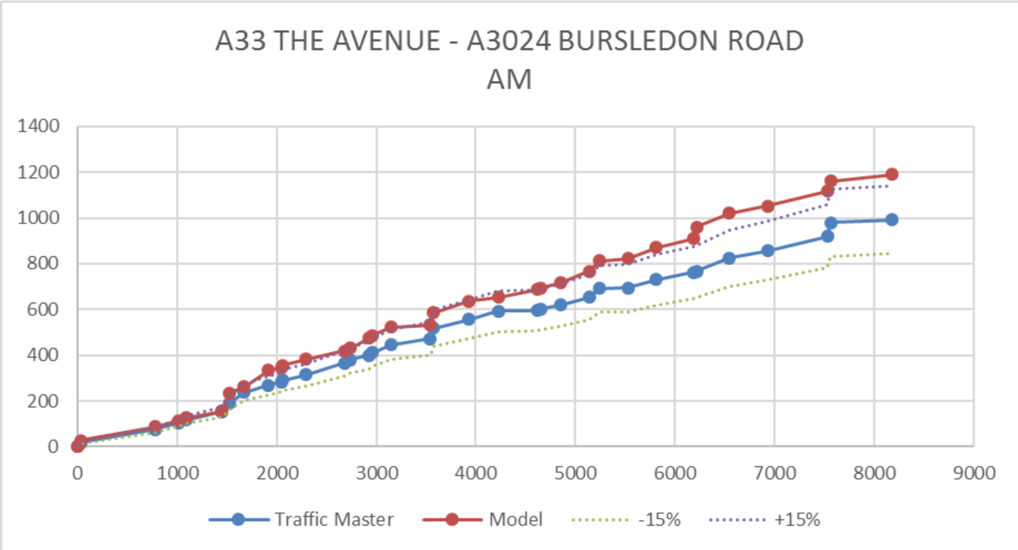
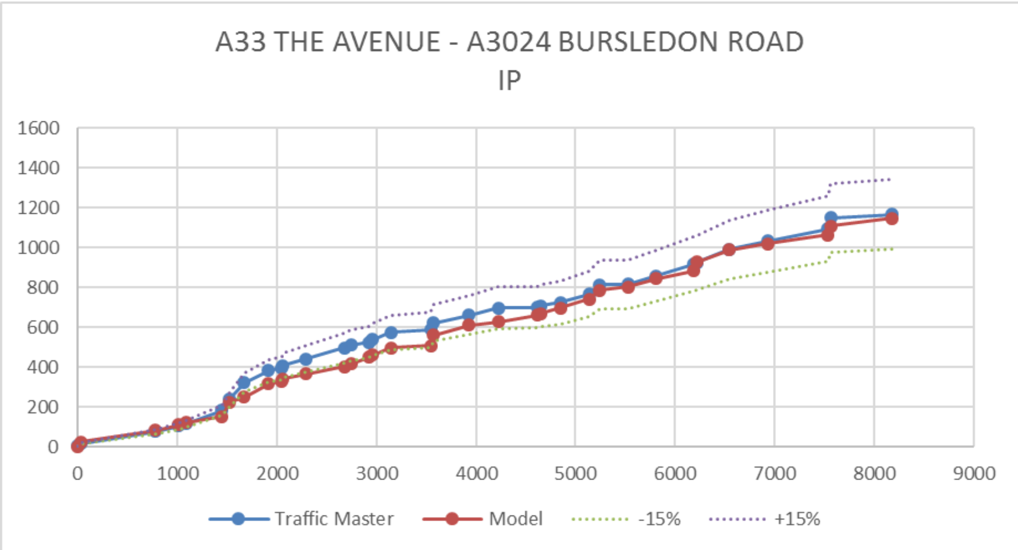


Figure 10. 5SB A33 THE AVENUE - A3024 BURSLEDON ROAD





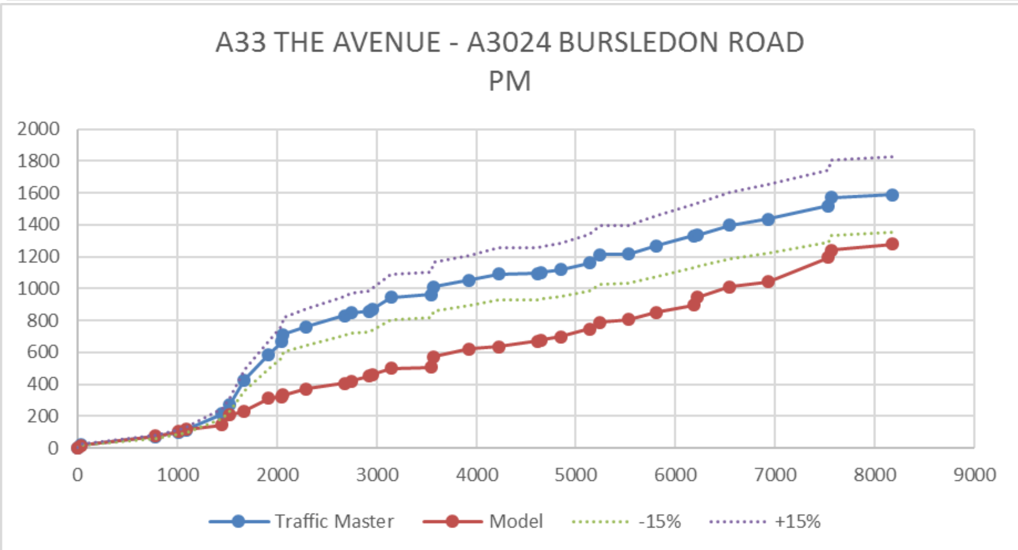
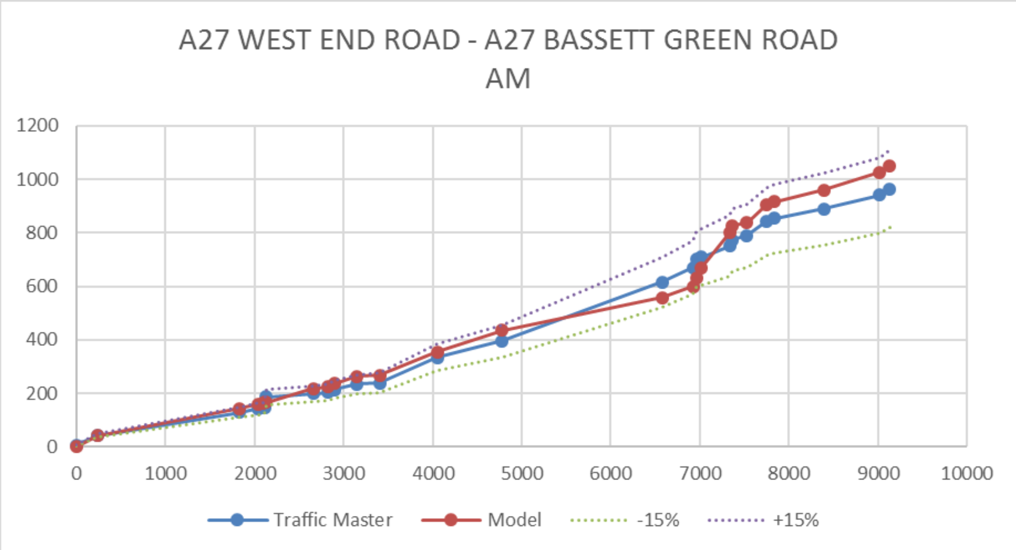
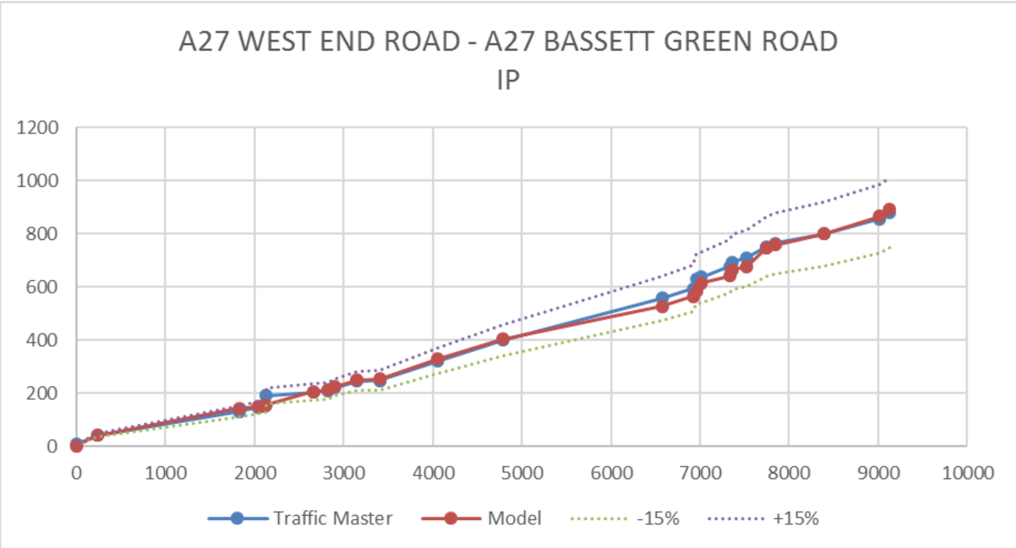


Figure 11. 6NB A27 WEST END ROAD - A27 BASSETT GREEN ROAD





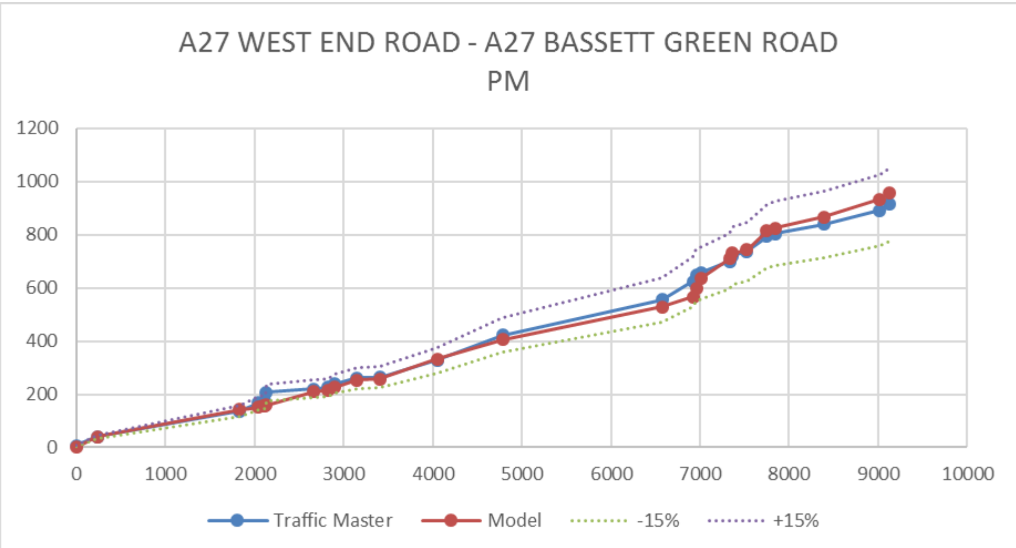
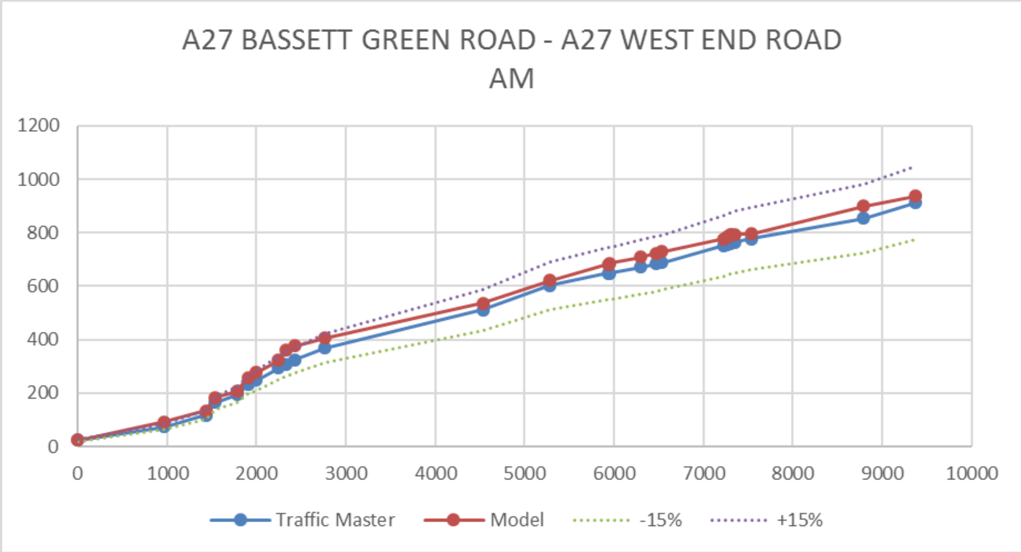
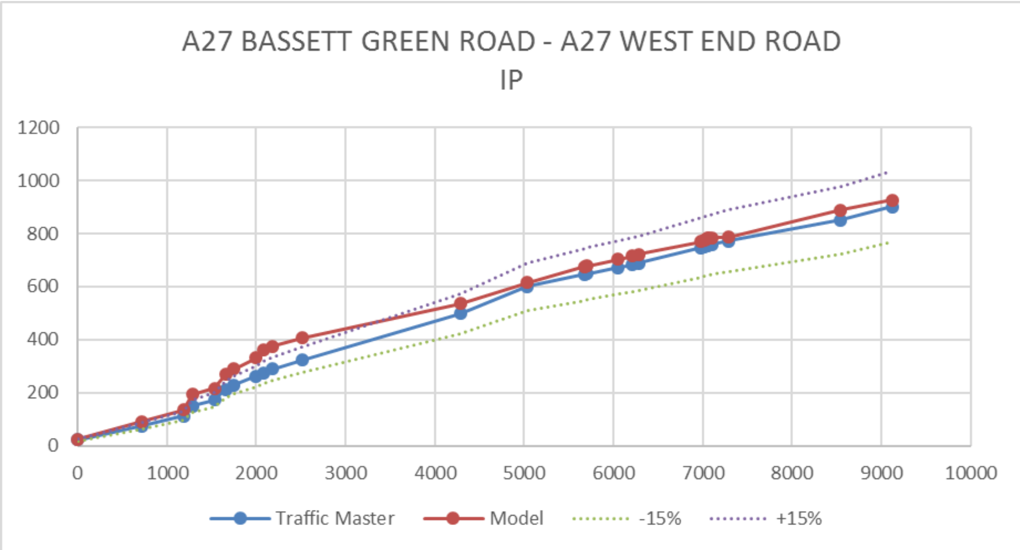


Figure 12. 6SB A27 BASSETT GREEN ROAD - A27 WEST END ROAD





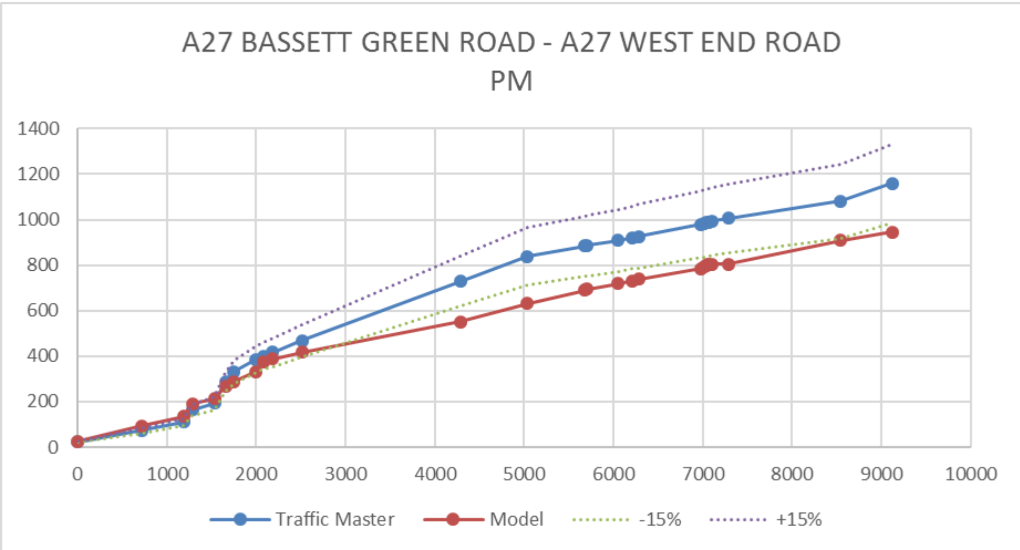
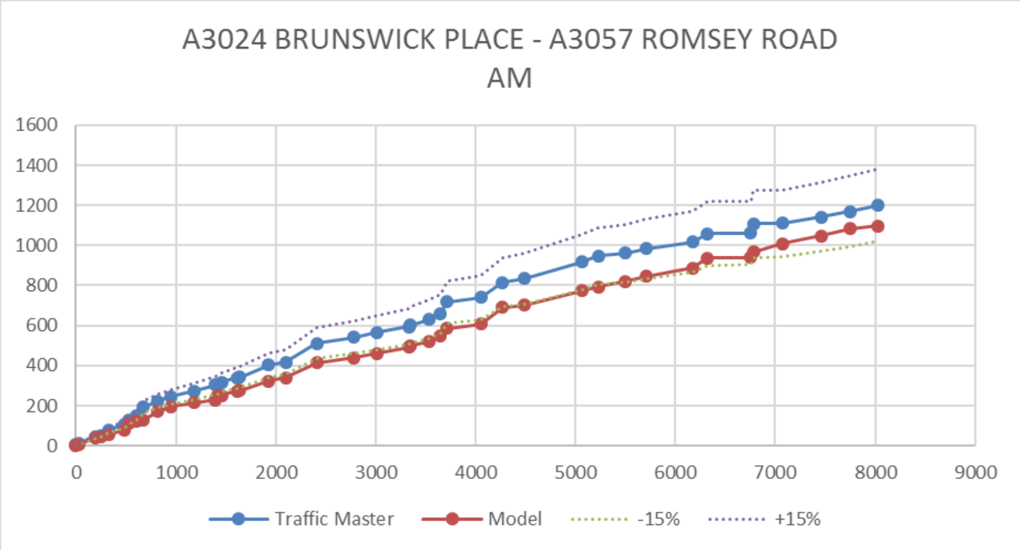
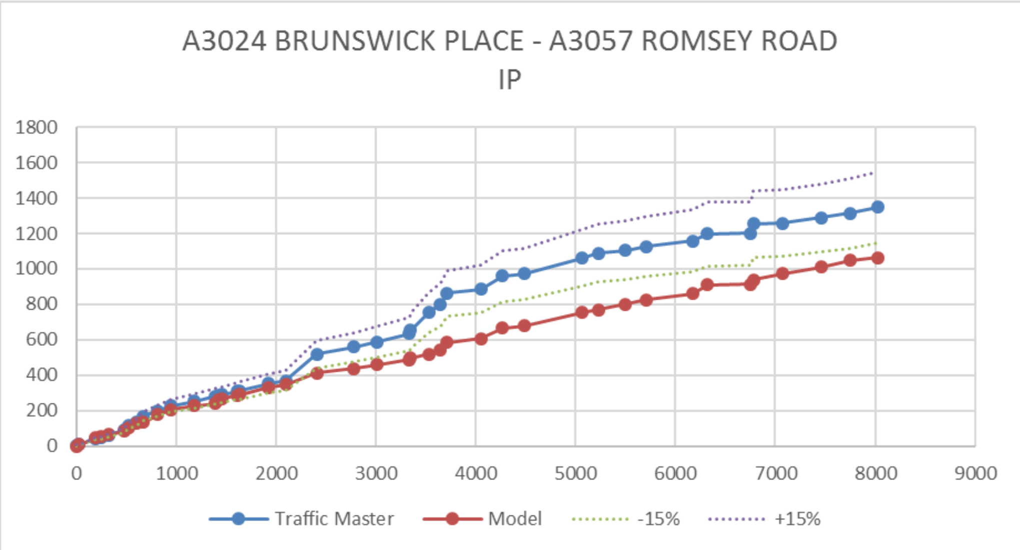


Figure 13. 7NB A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD





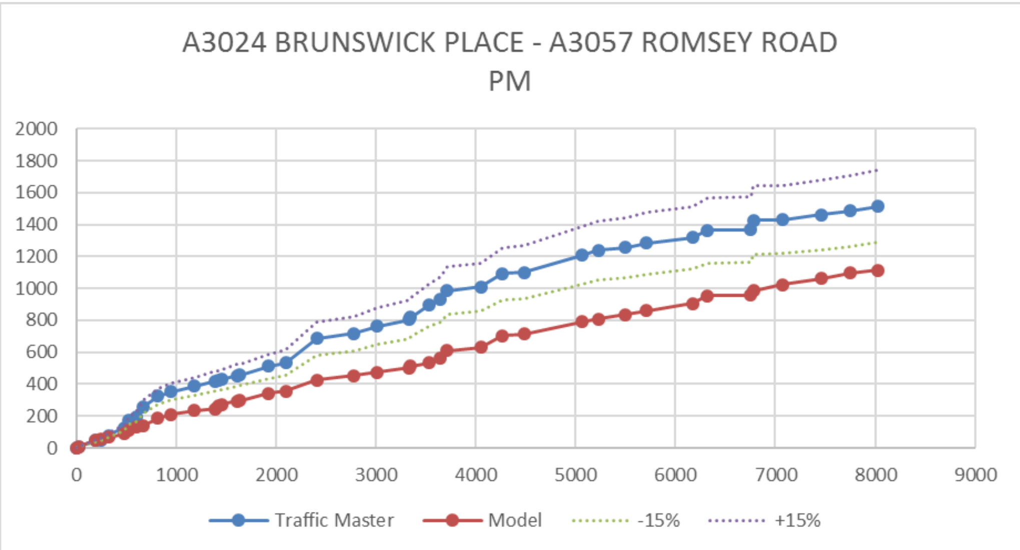


Figure 14. 7SB A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE

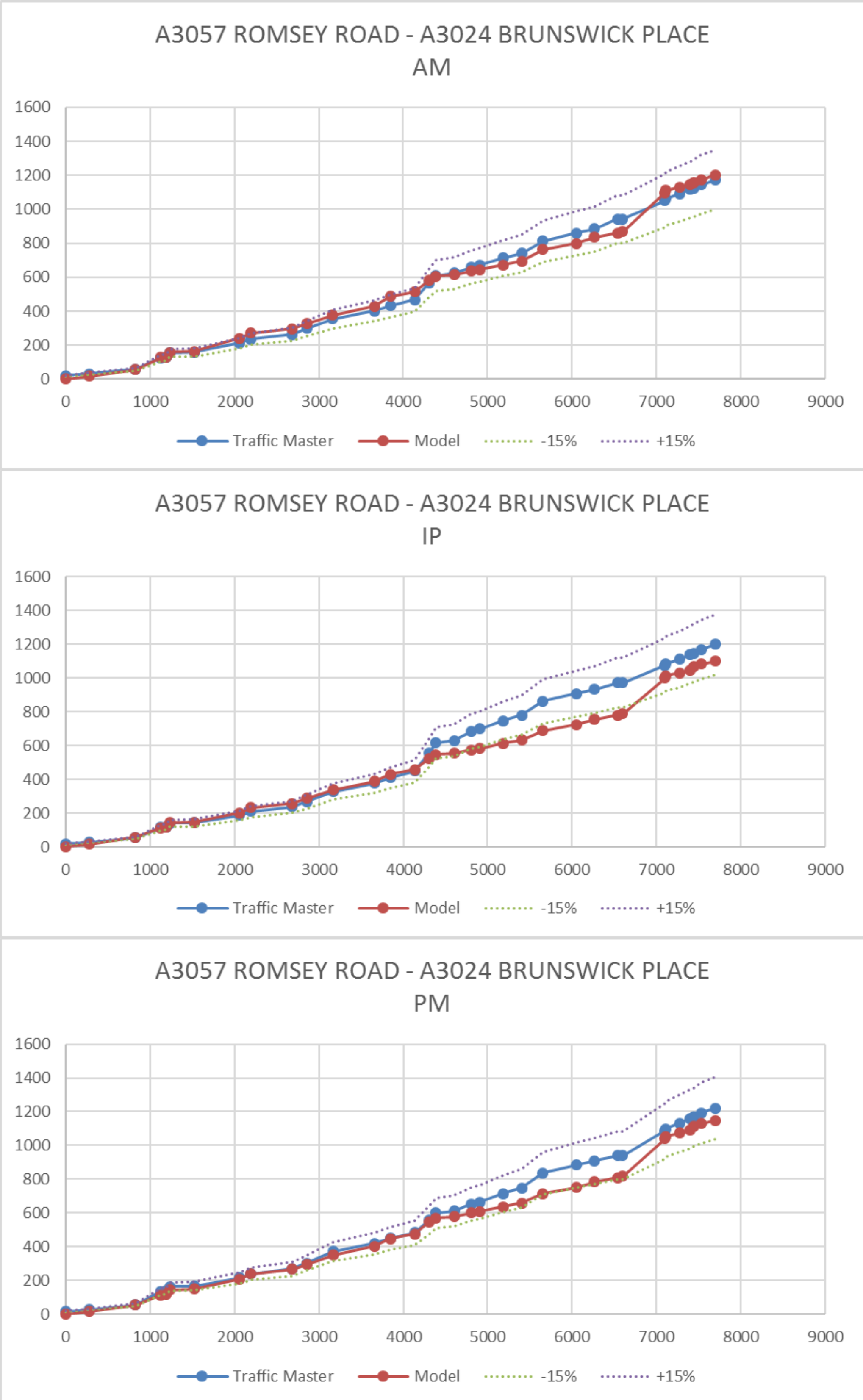
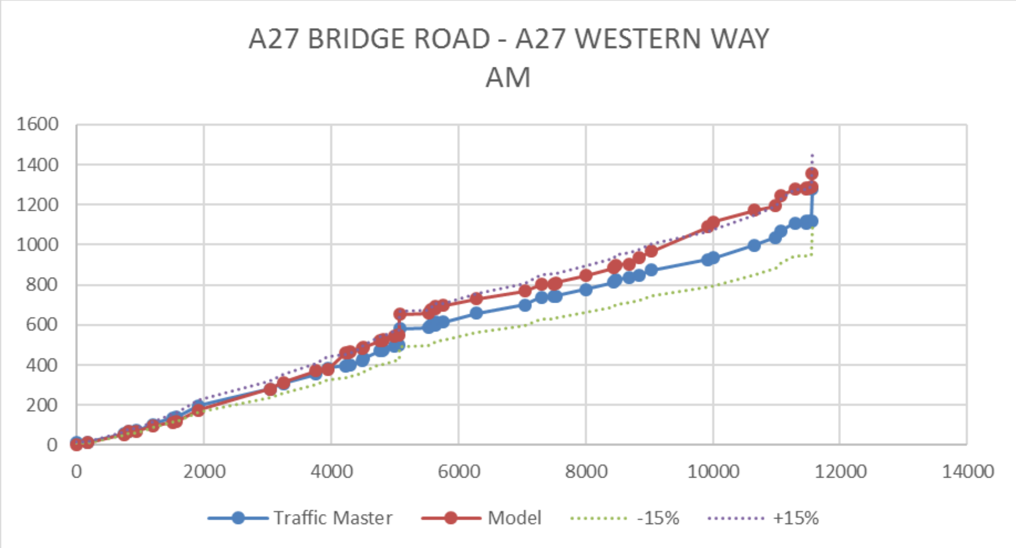
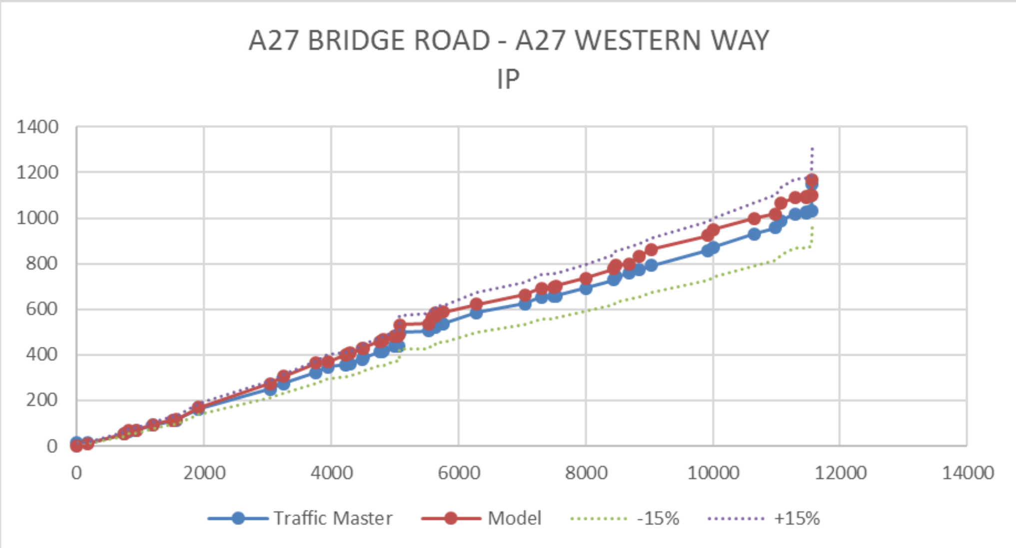


Figure 15. 8EB A27 BRIDGE ROAD - A27 WESTERN WAY





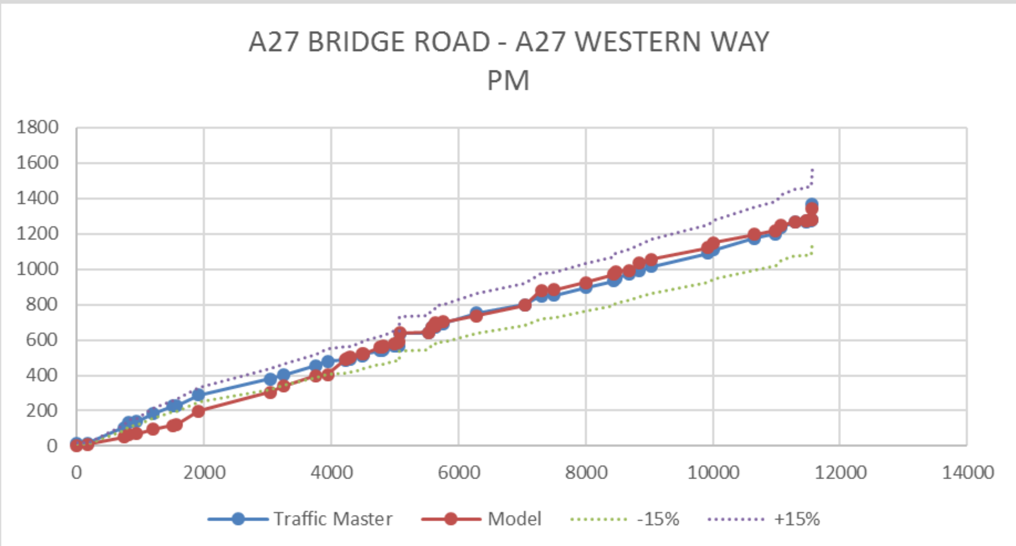
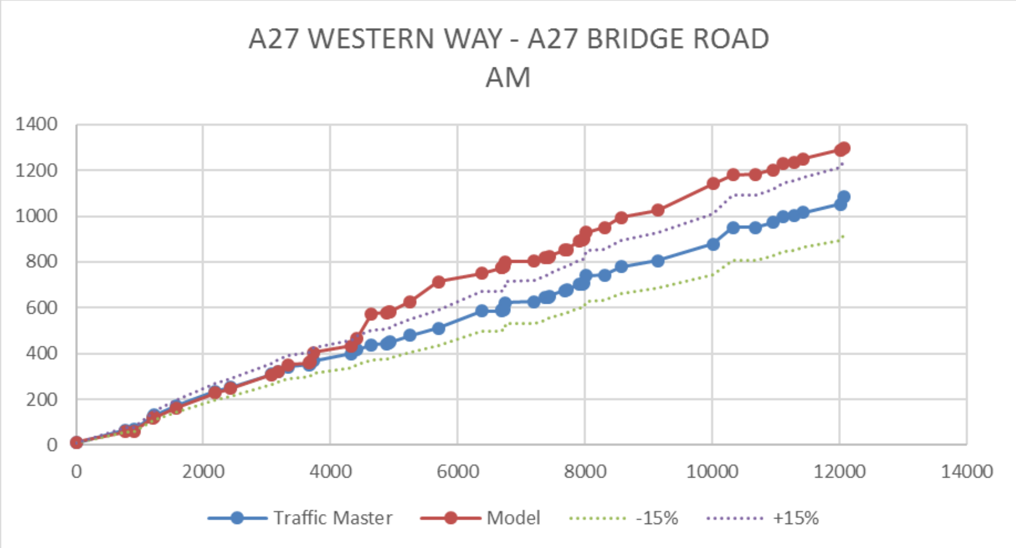
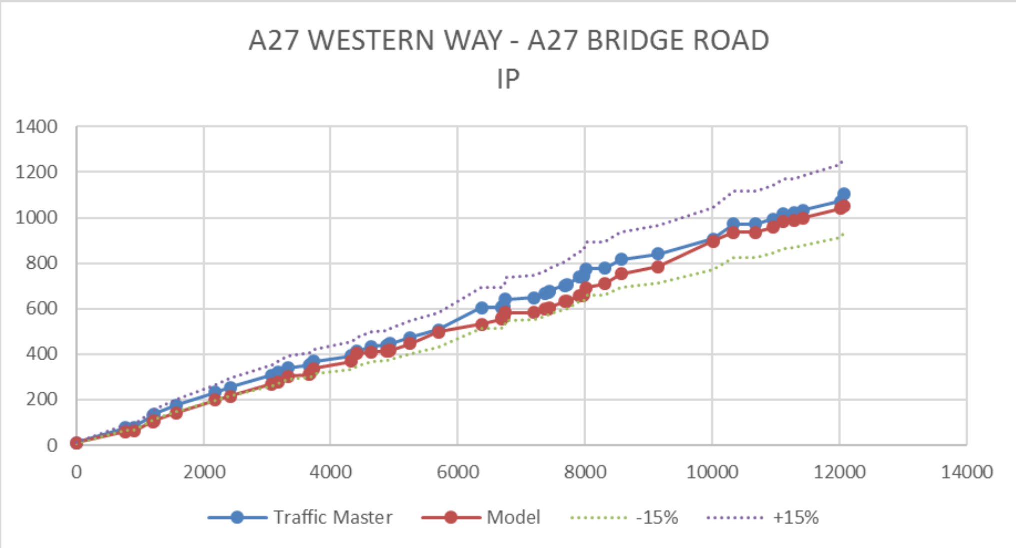


Figure 16. 8WB A27 WESTERN WAY - A27 BRIDGE ROAD





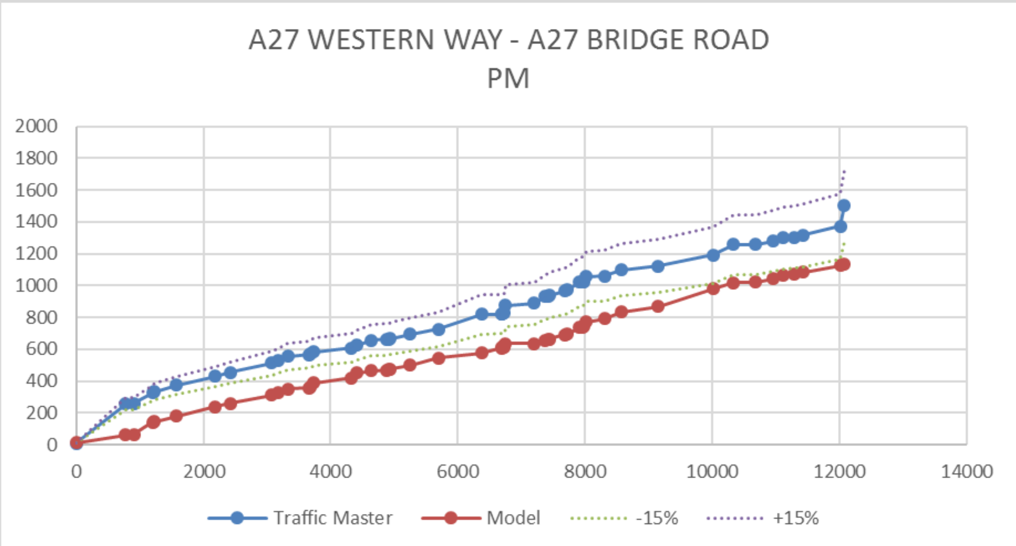
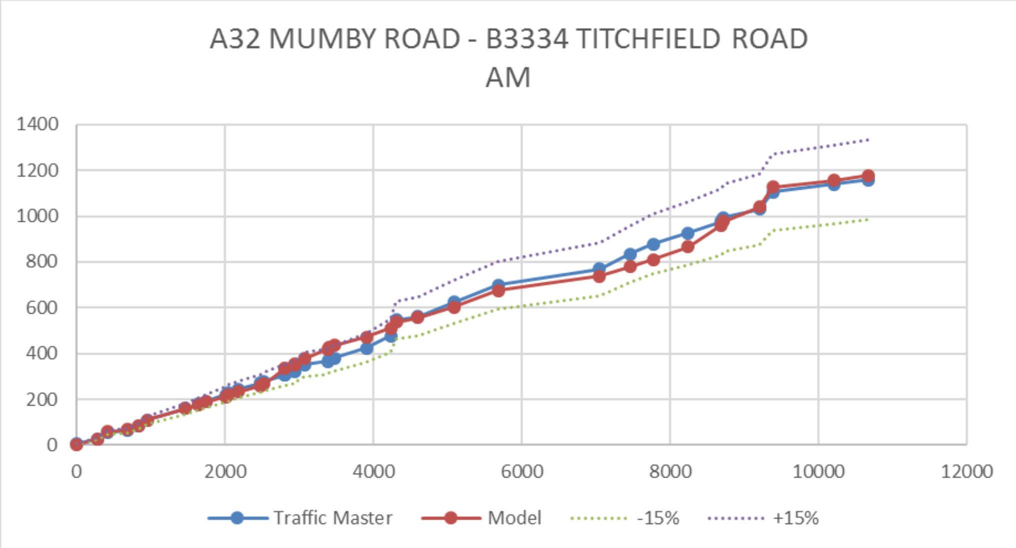
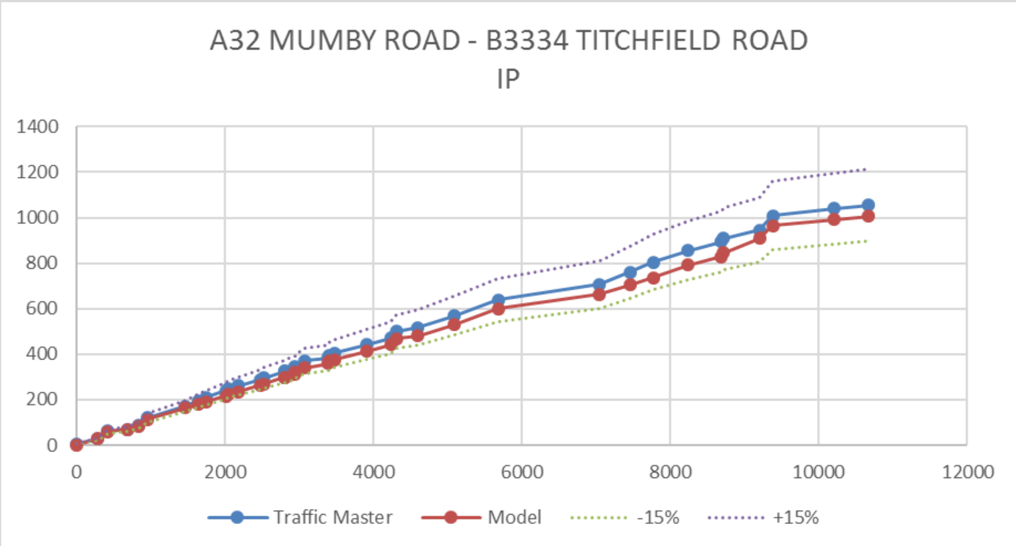


Figure 17. 9NB A32 MUMBY ROAD - B3334 TITCHFIELD ROAD





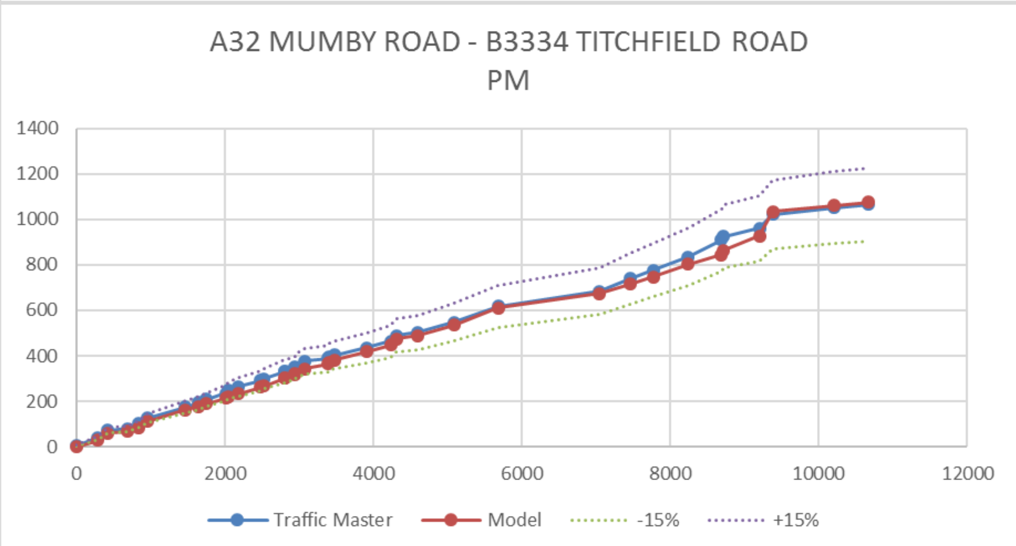


Figure 18. 9SB B3334 TITCHFIELD ROAD - A32 MUMBY ROAD

Figure 19. 10NB A32 FAREHAM ROAD - A27 WESTERN ROAD

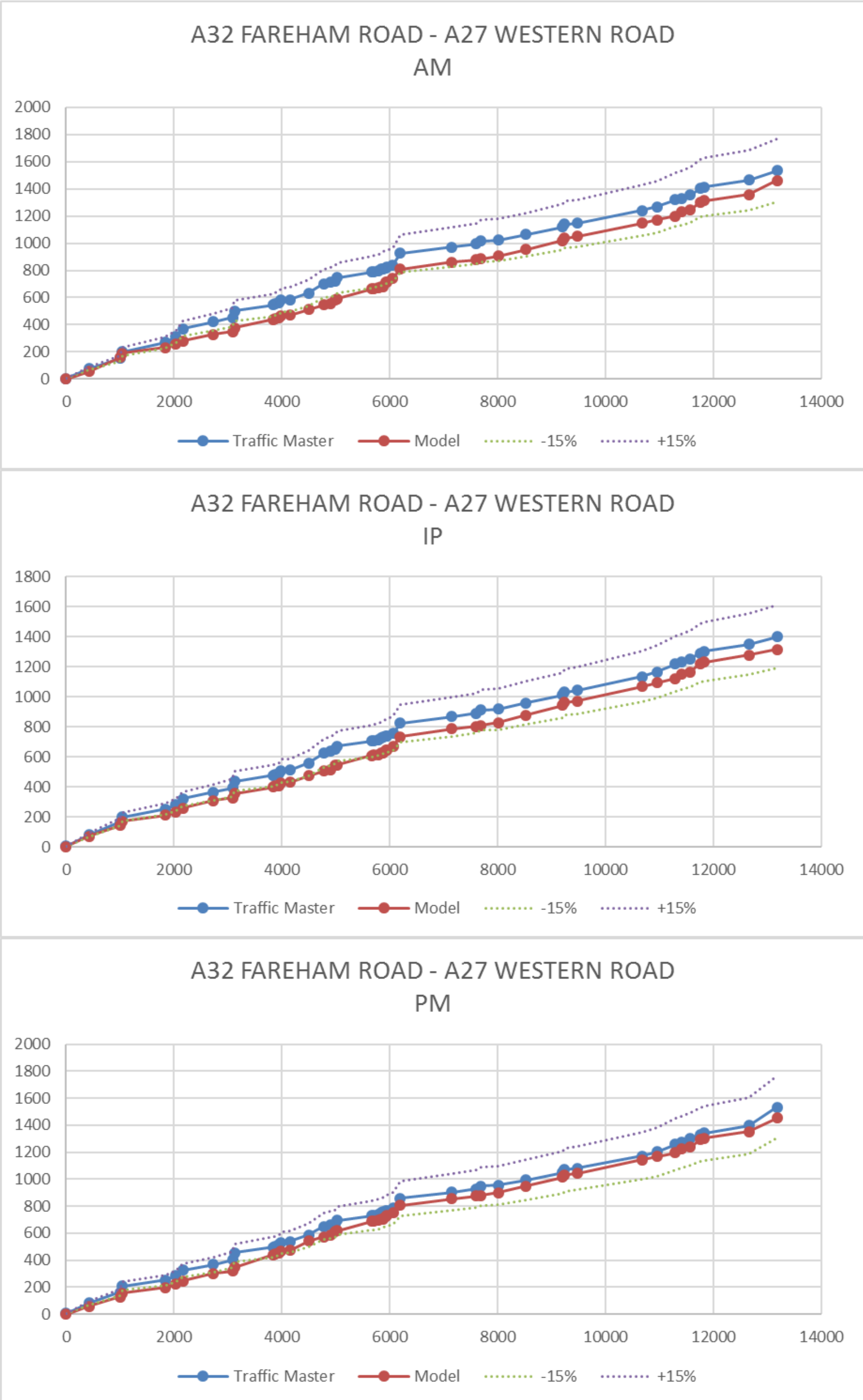
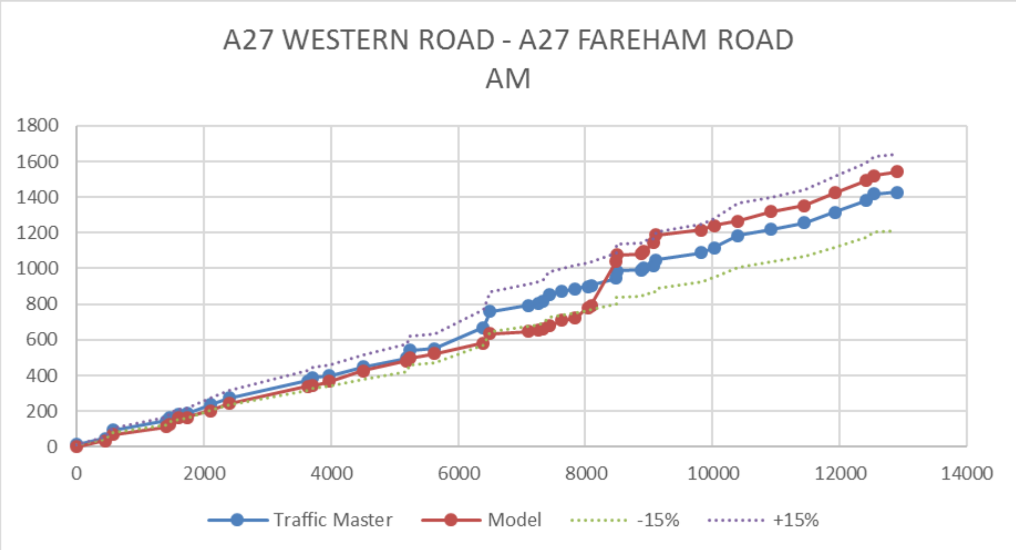
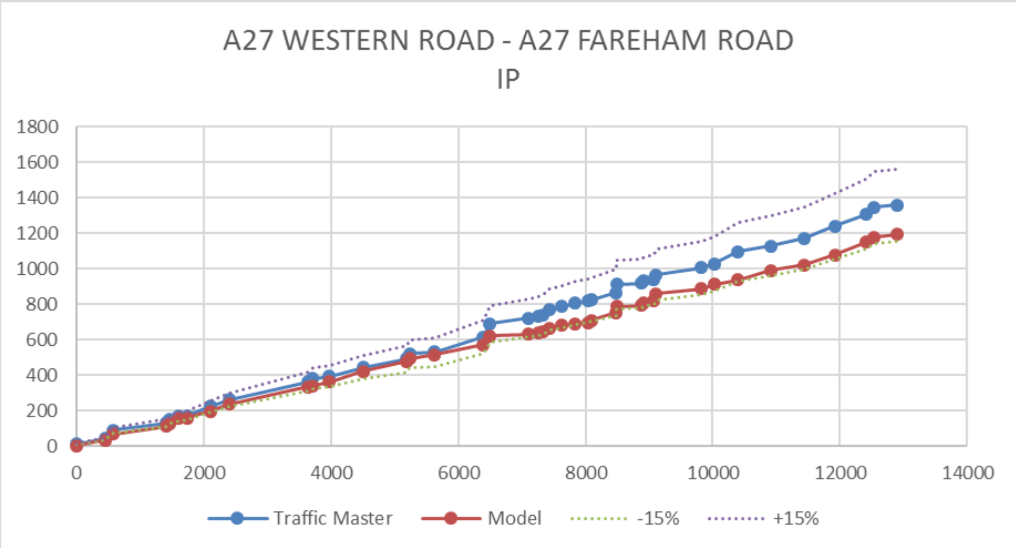


Figure 20. 10SB A27 WESTERN ROAD- A27 WESTERN ROAD





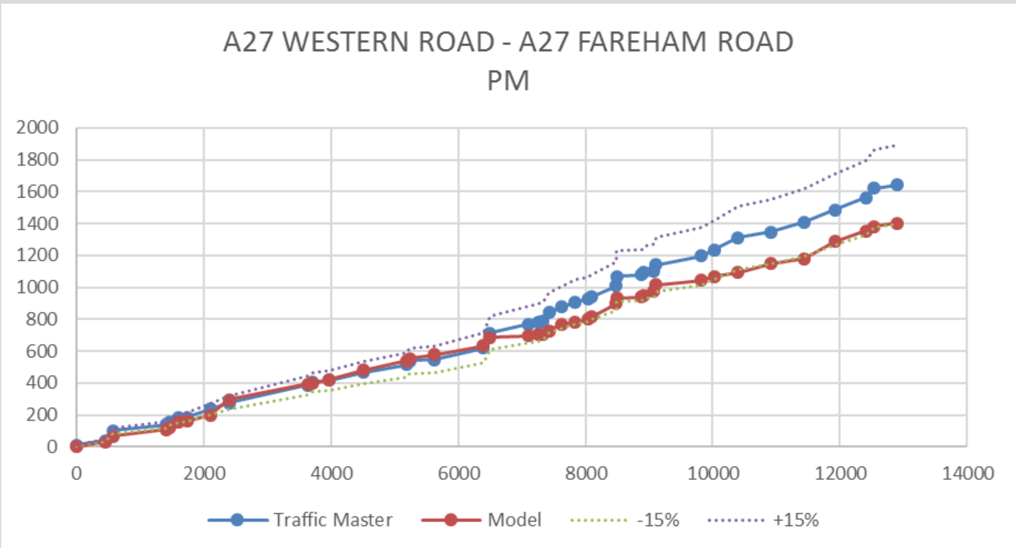
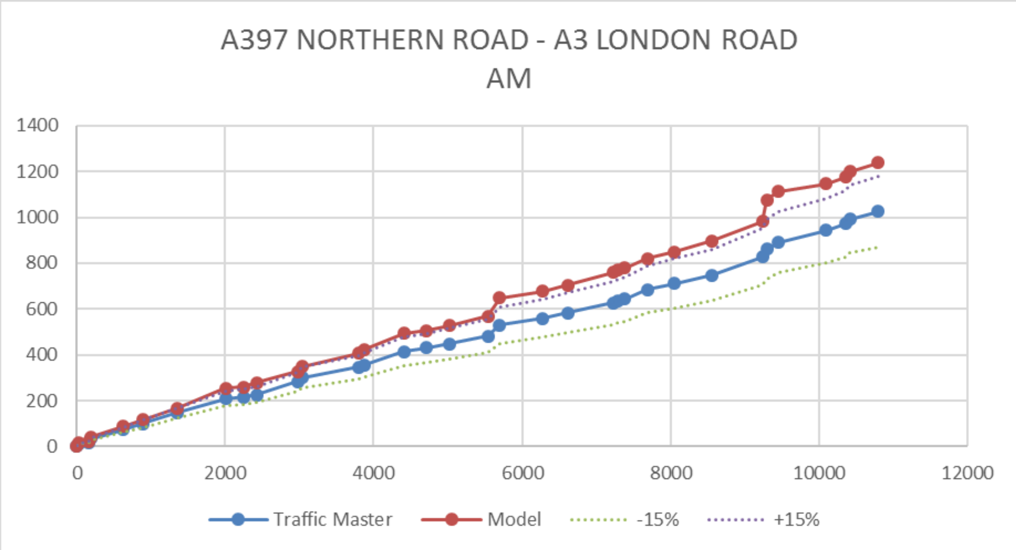
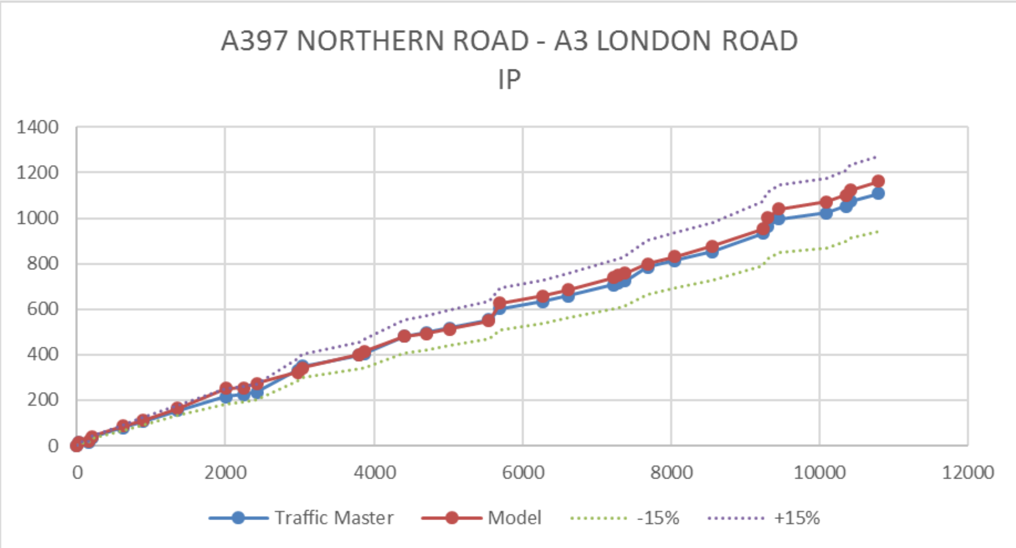


Figure 21. 11NB A397 NORTHERN ROAD- A3 LONDON ROAD





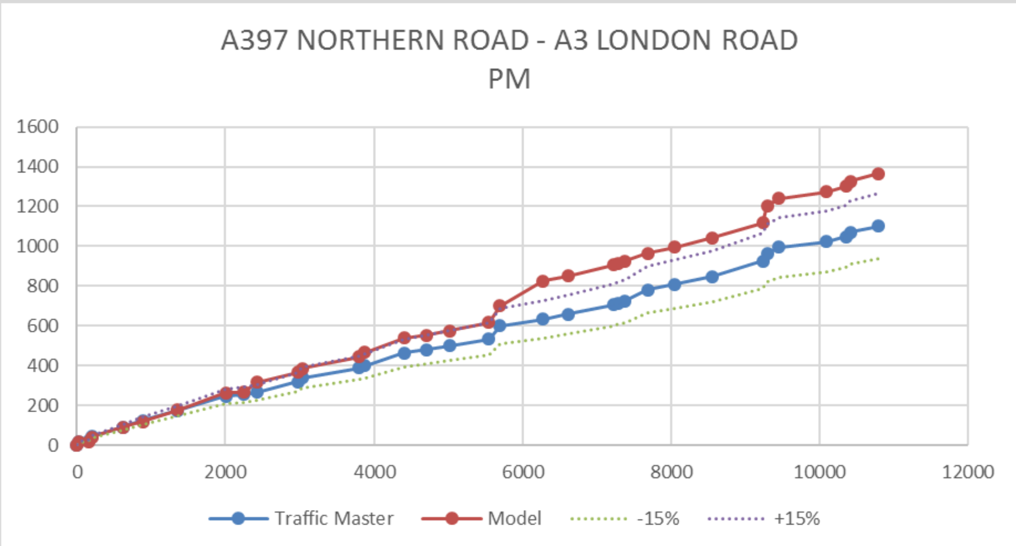
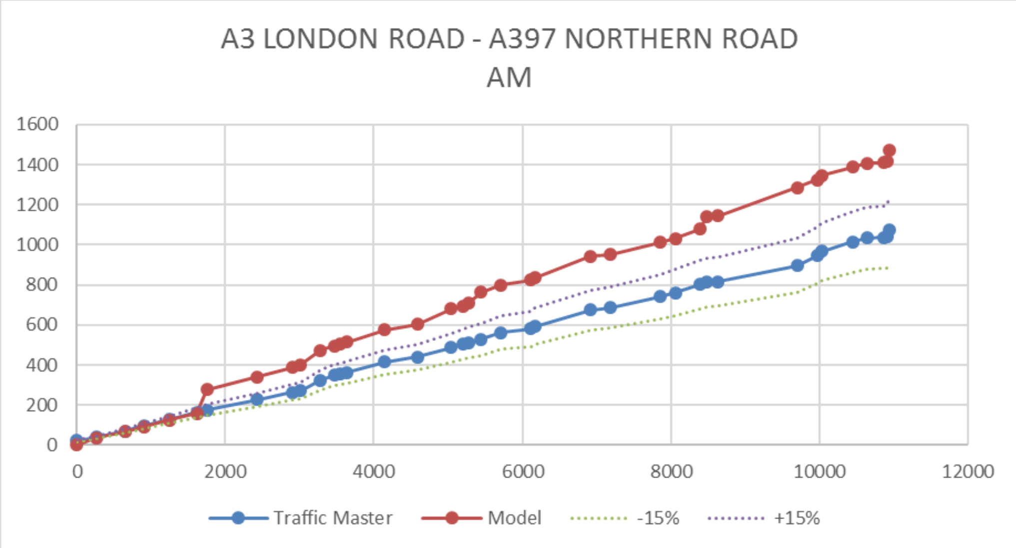
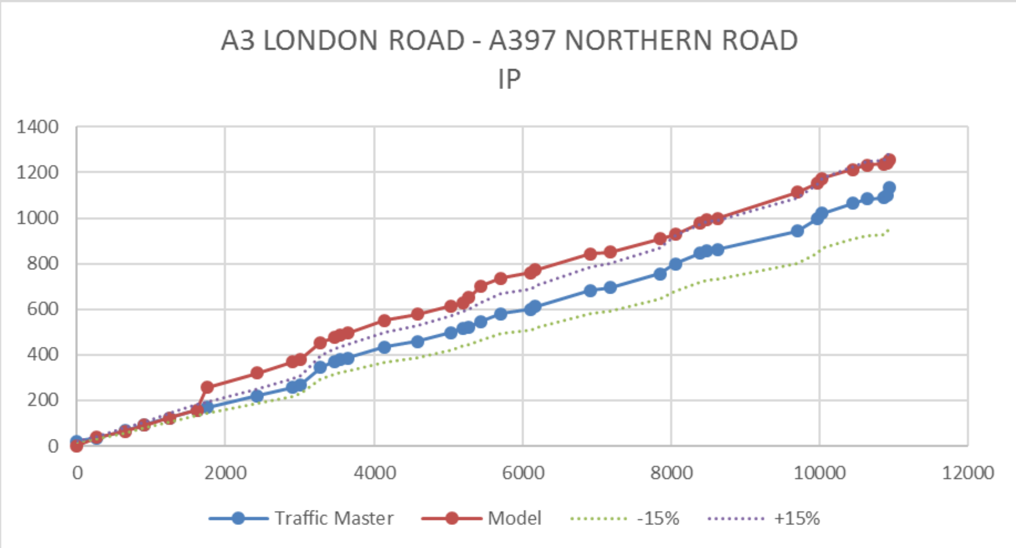


Figure 22. 11SB A3 LONDON ROAD- A397 NORTHERN ROAD





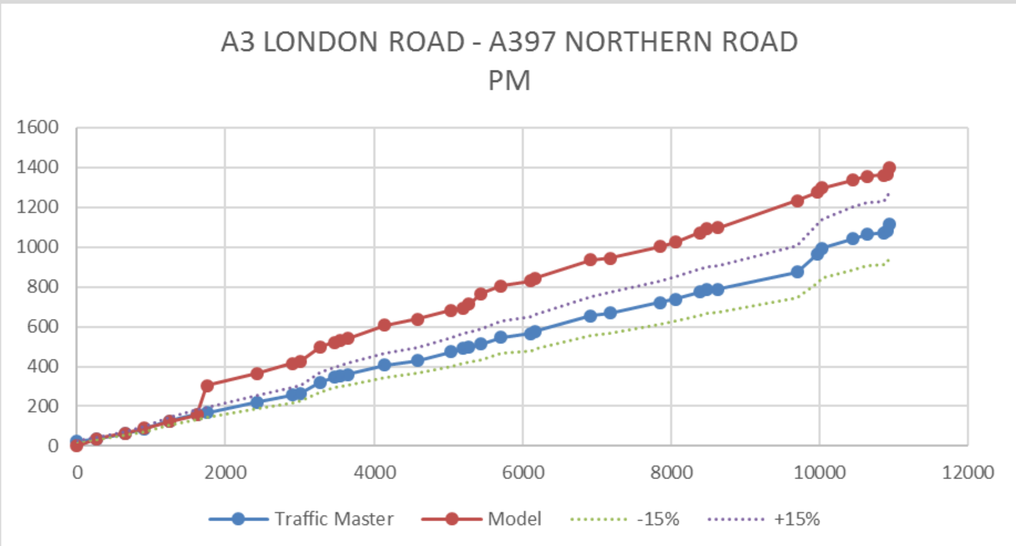


Figure 23. 12NB B2177 PORTSDOWN HILL ROAD – B2149 HAVANT ROAD

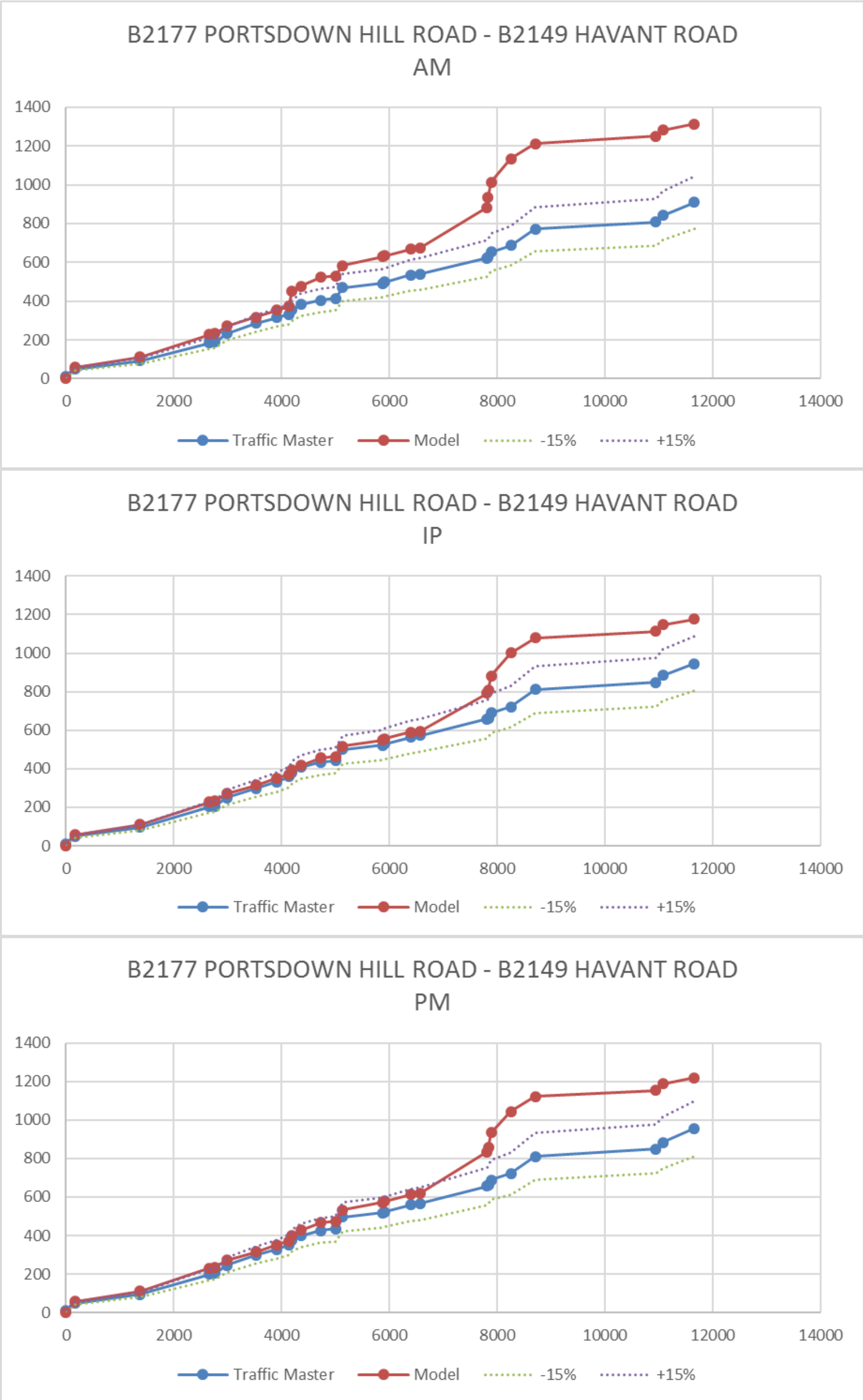
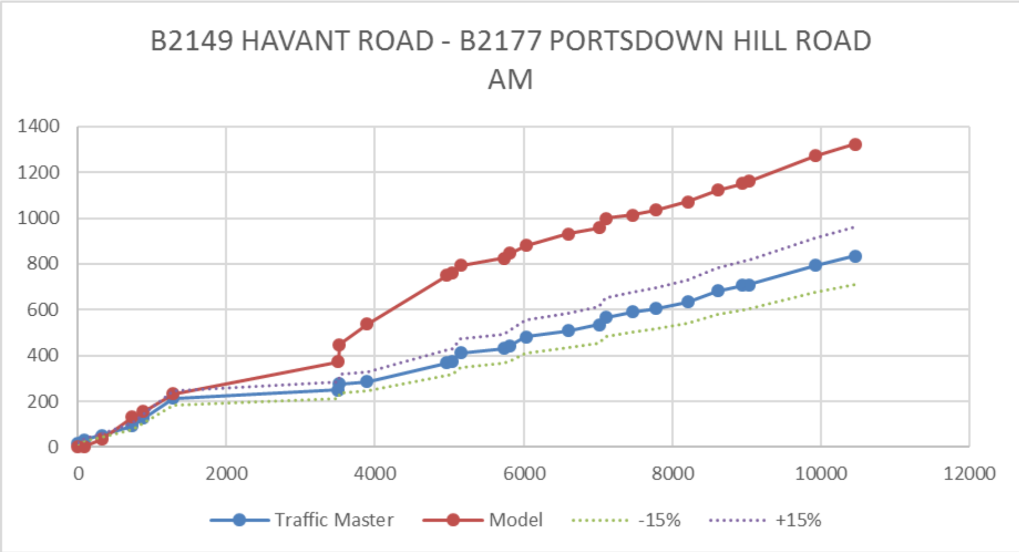
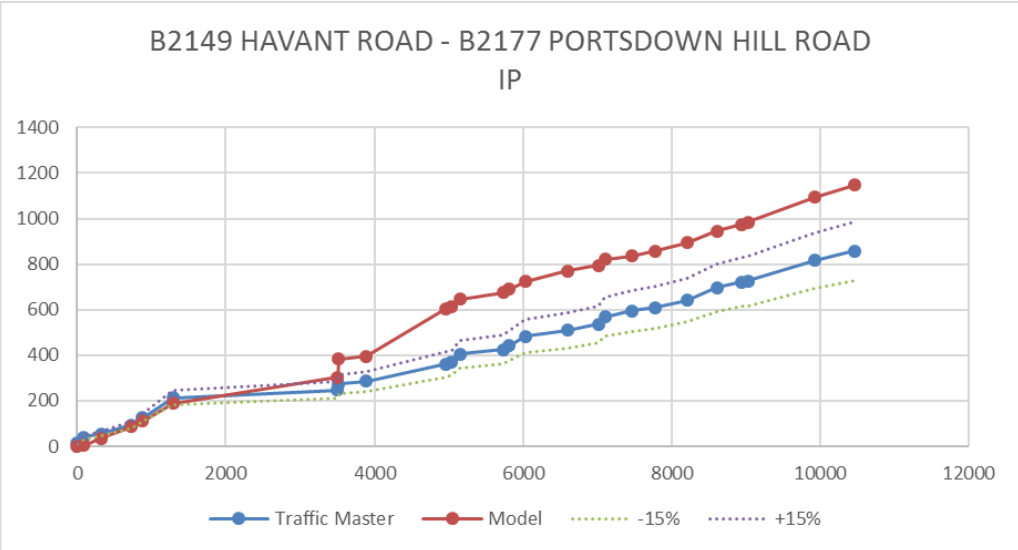


Figure 24. 12SB B2149 HAVANT ROAD – B2177 PORTSDOWN HILL ROAD





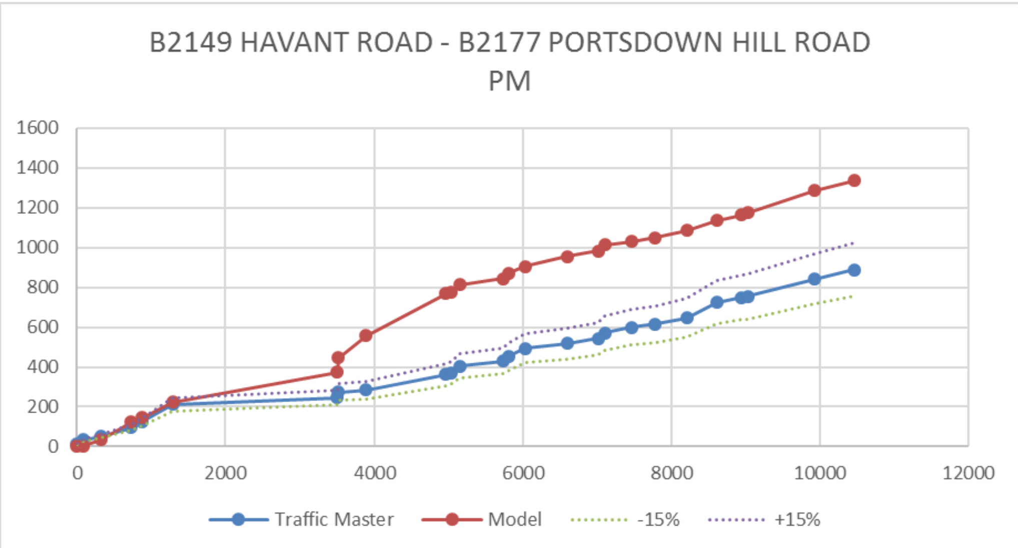
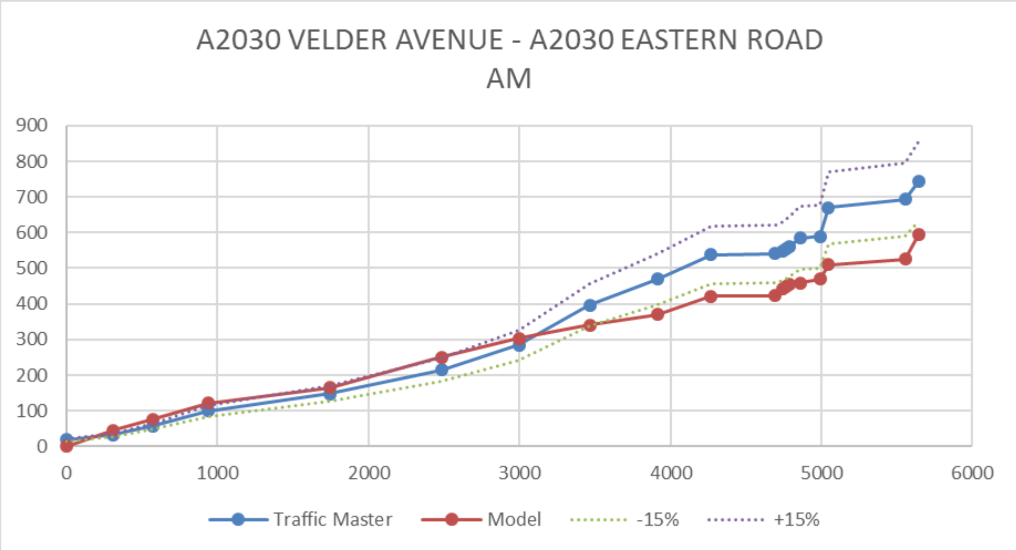
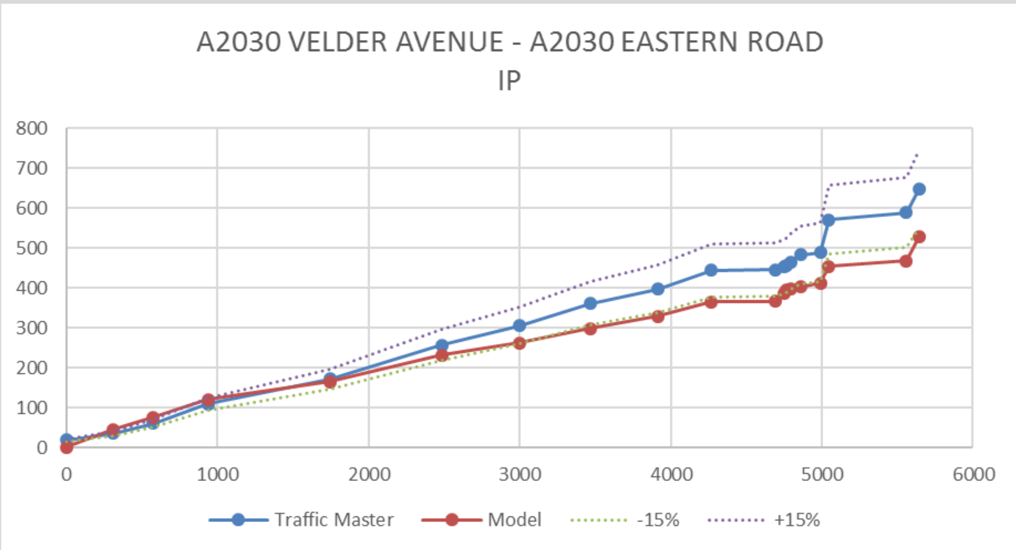


Figure 25. 13NB A2030 VELDER AVENUE- A2030 EASTERN ROAD





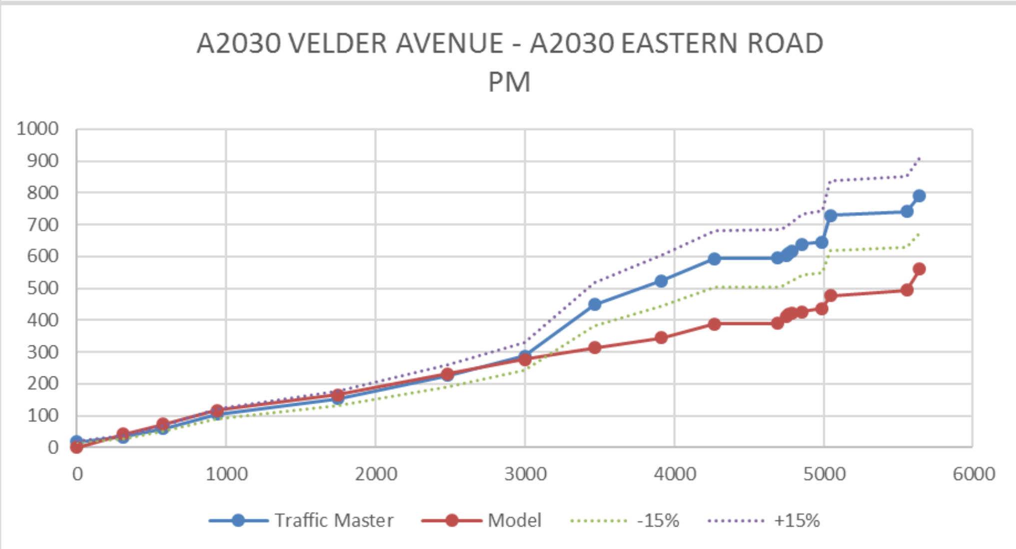
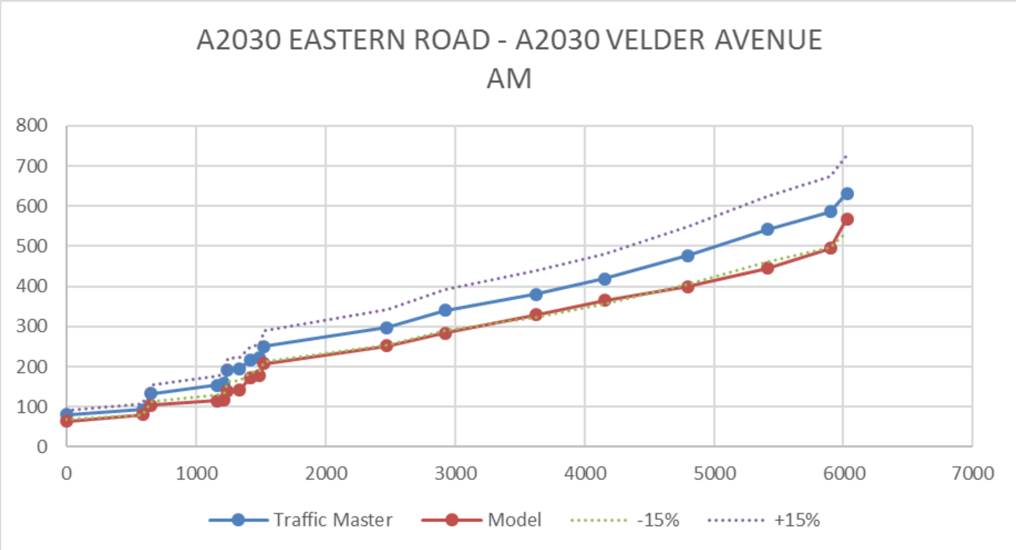
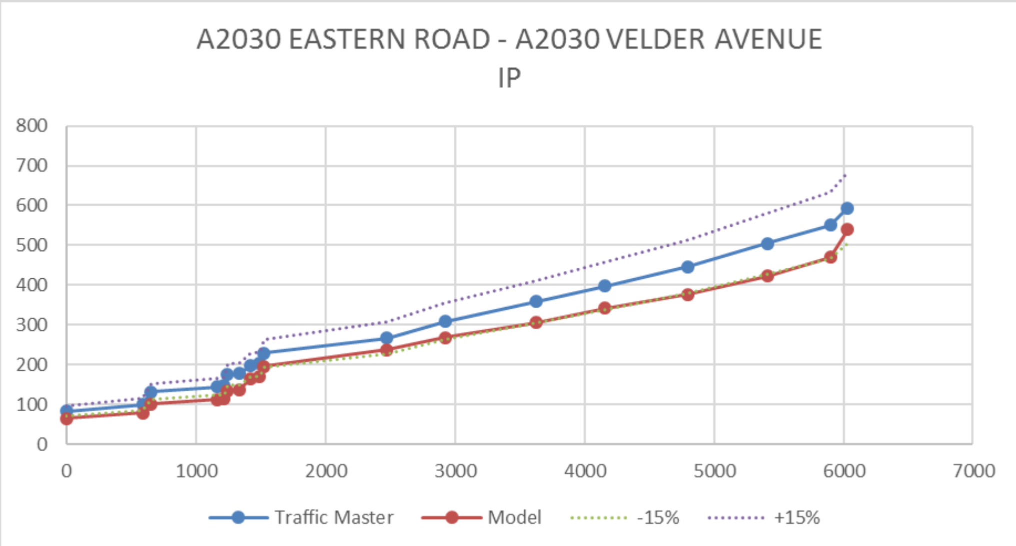


Figure 26. 13SB A2030 EASTERN ROAD – A2030 VELDER AVENUE





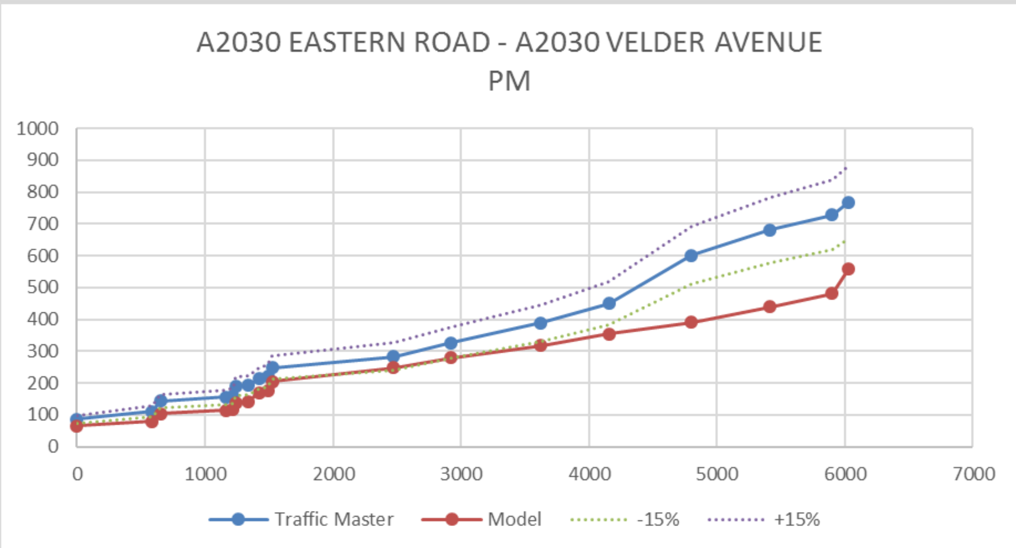


Figure 27. 14NB A288 MILTON ROAD – A288 COPNOR ROAD

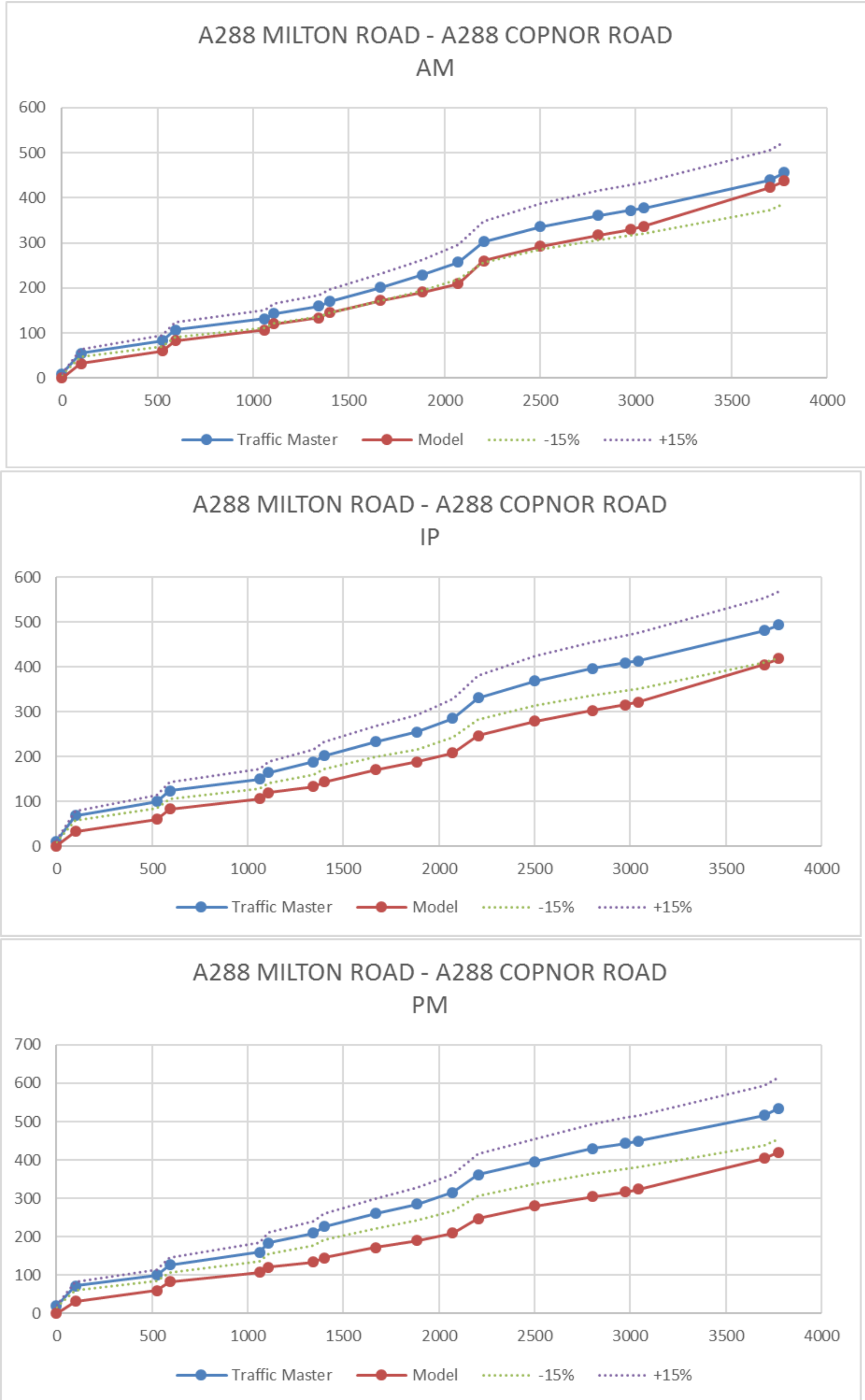


Figure 28. 14SB A288 COPNOR ROAD -A288 MILTON ROAD

Figure 29. 15NB M275- A27

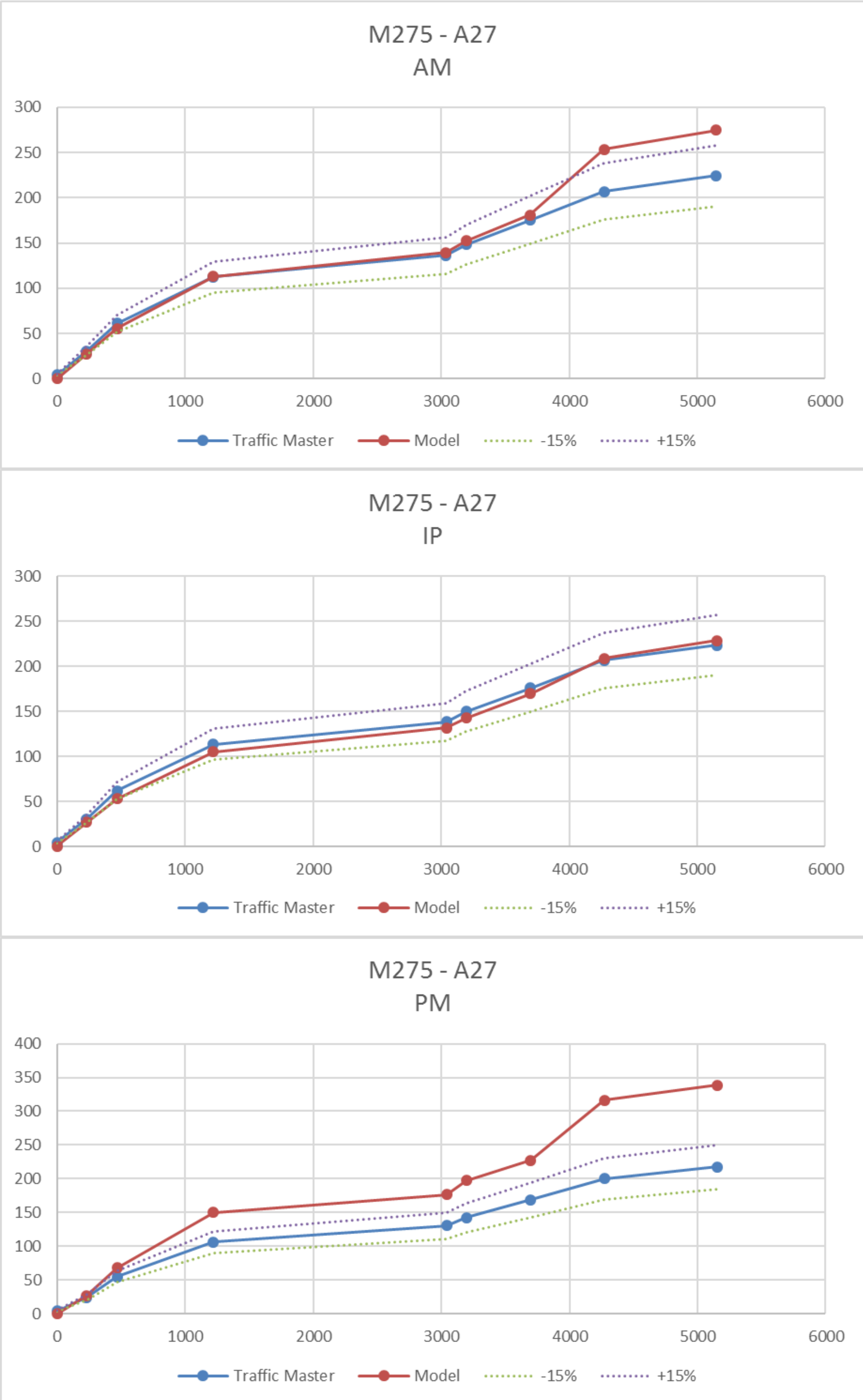
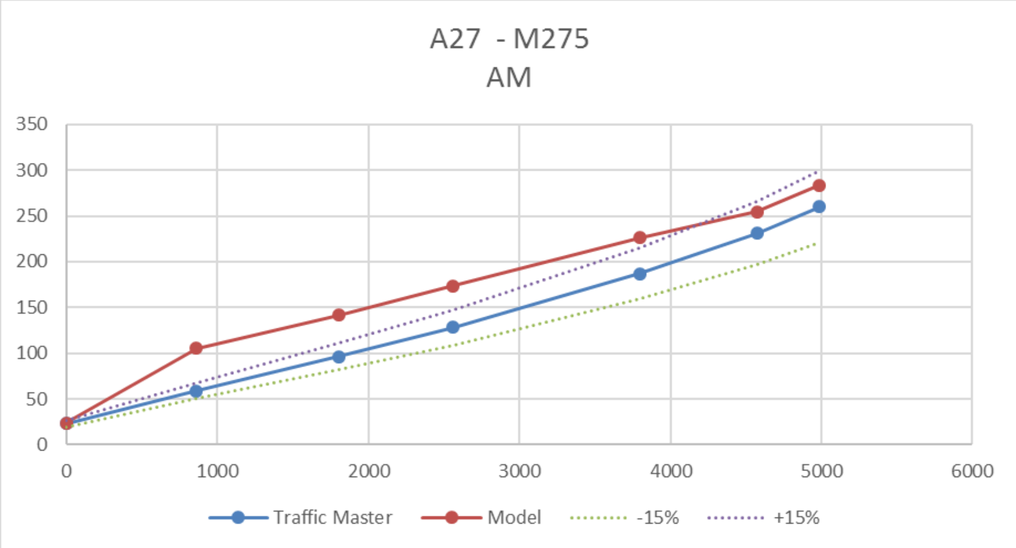
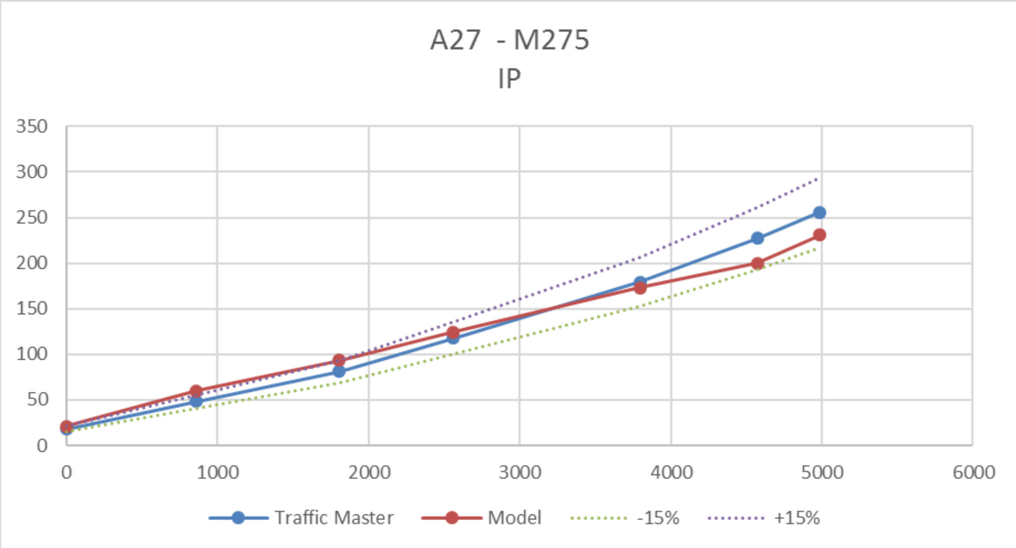


Figure 30. 15SB A27 – M275





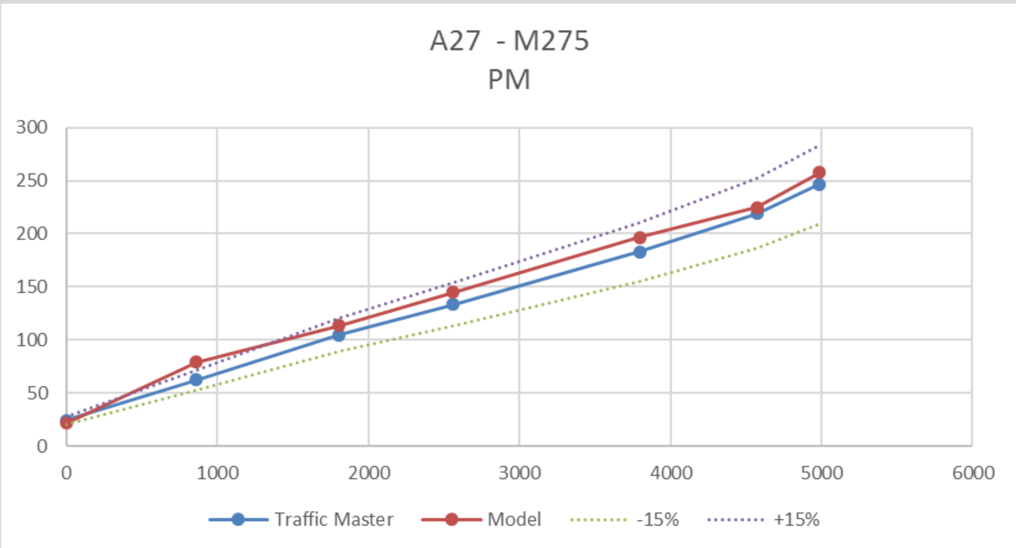
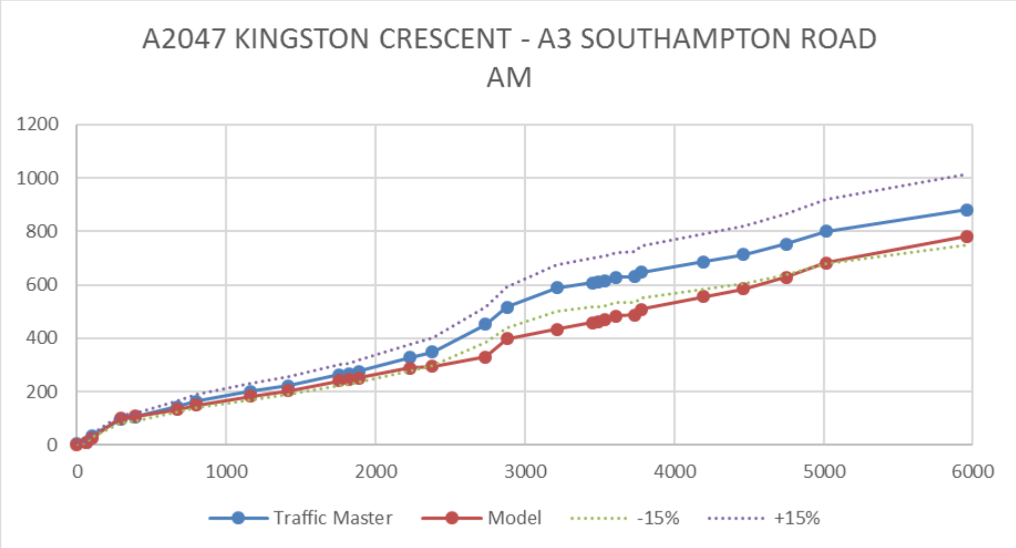
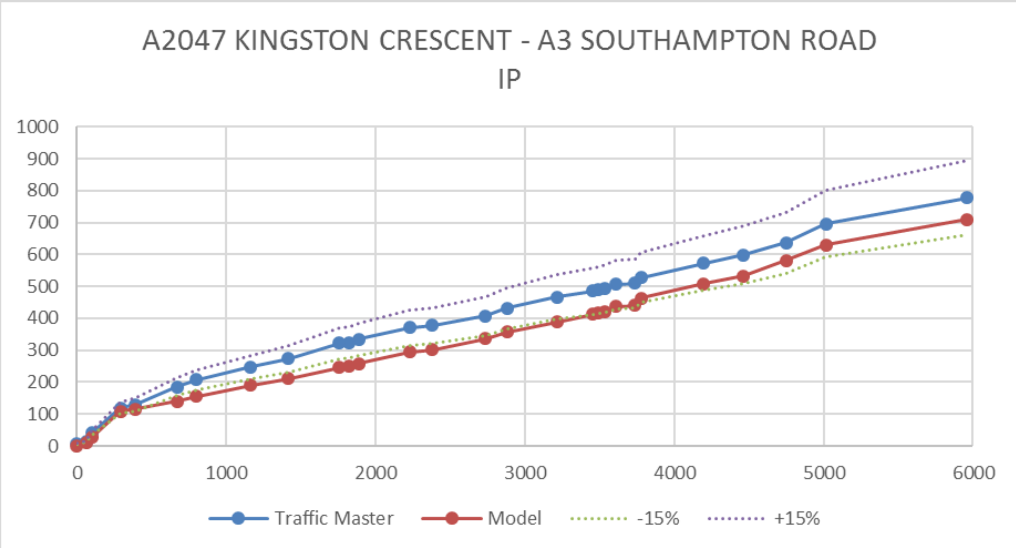


Figure 31. 16NB A2047 KINGSTON CRESCENT – A3 SOUTHAMPTON ROAD





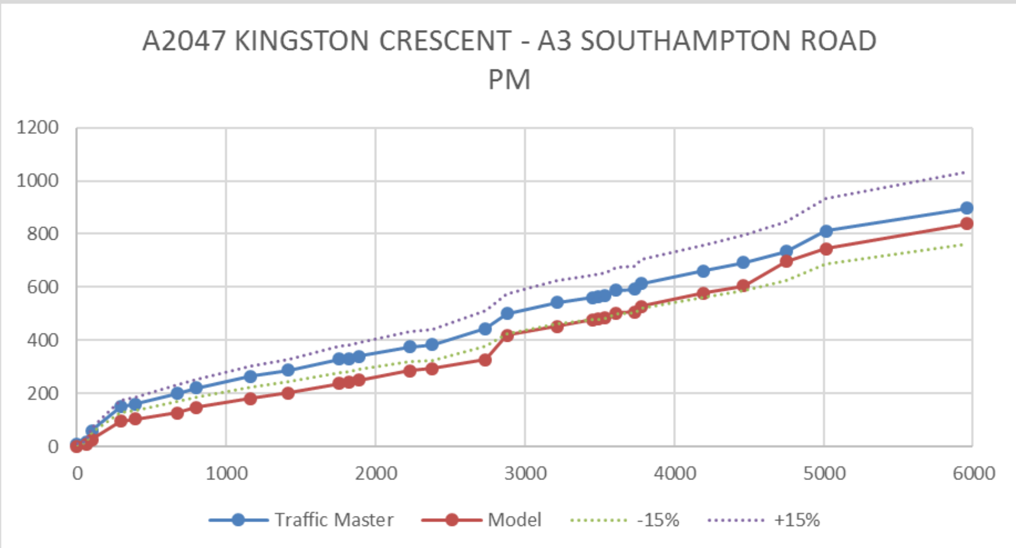
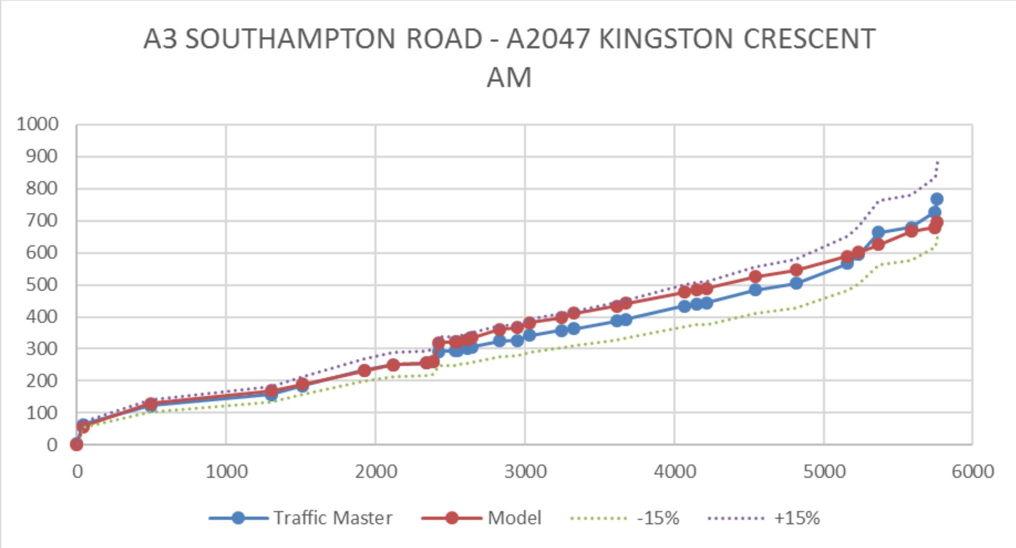
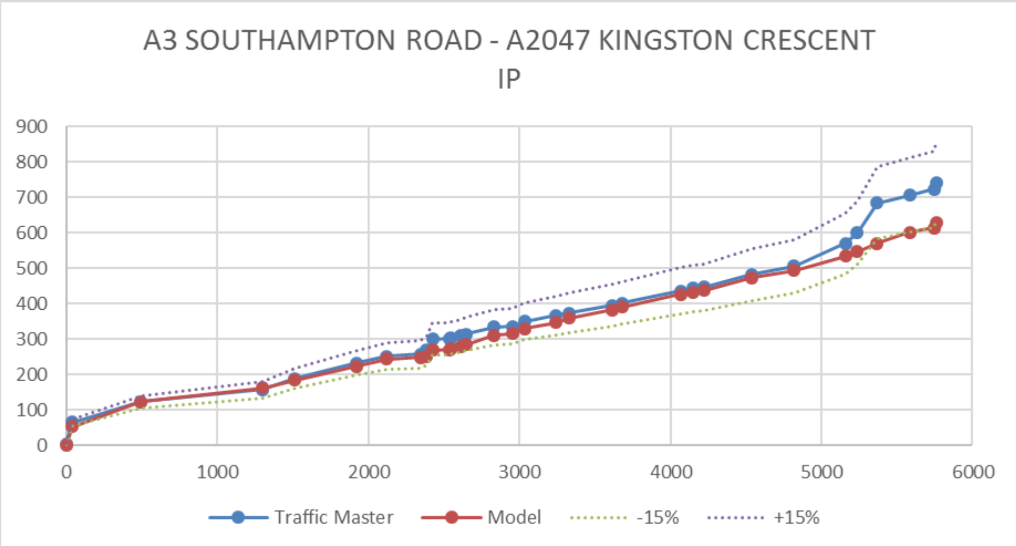


Figure 32. 16SB A3 SOUTHAMPTON ROAD – A2047 KINGSTON CRESCENT





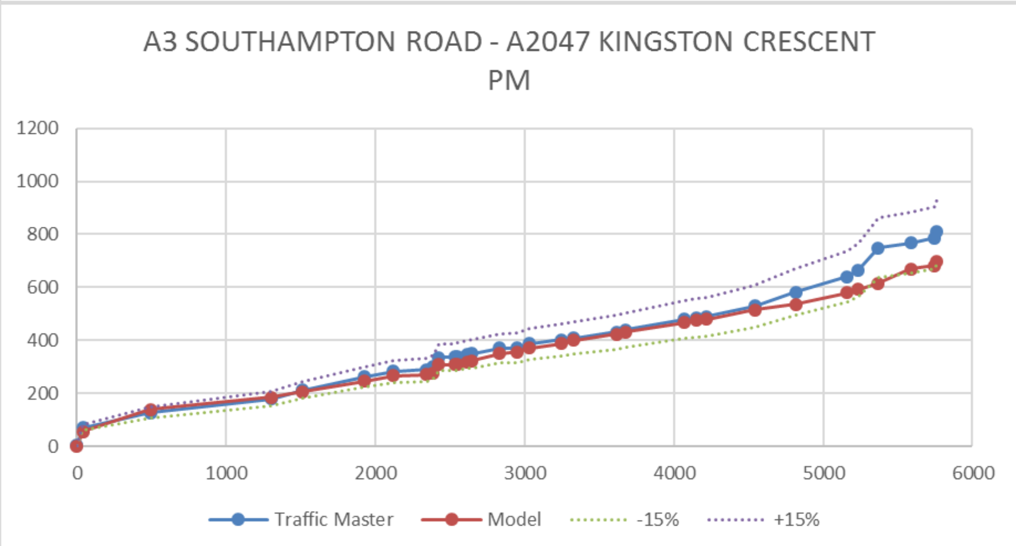
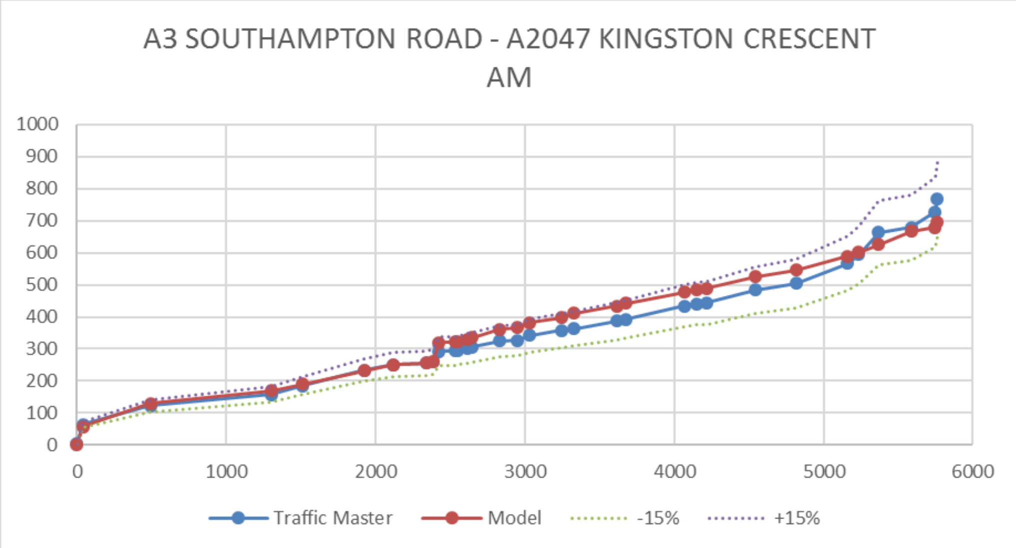
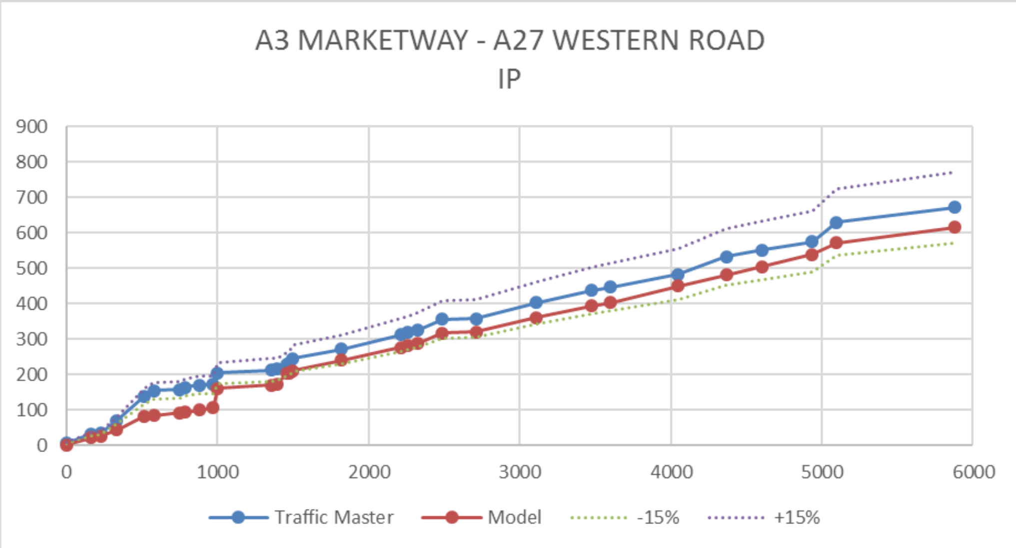


Figure 33. 17 NB A3 MARKETWAY – A27 WESTERN ROAD





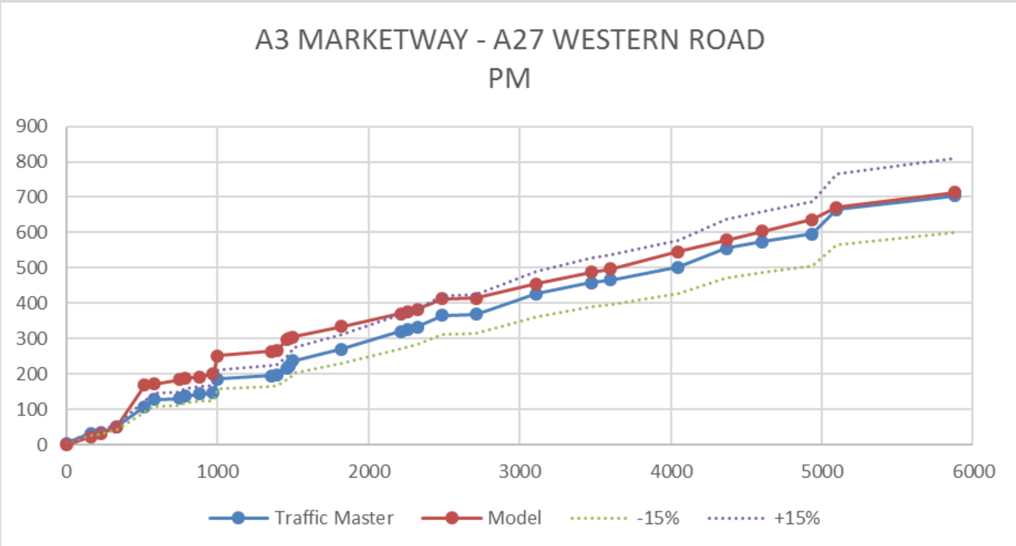
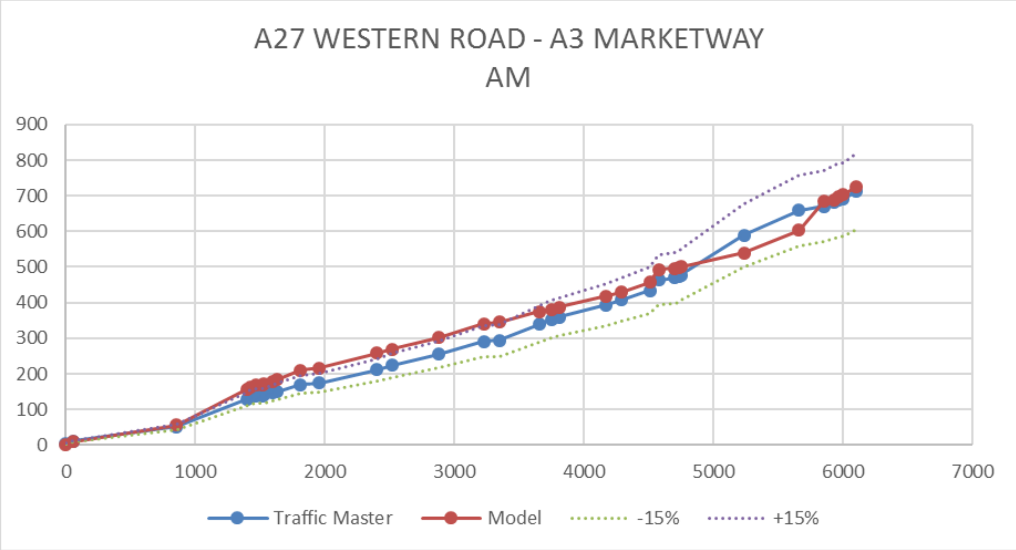
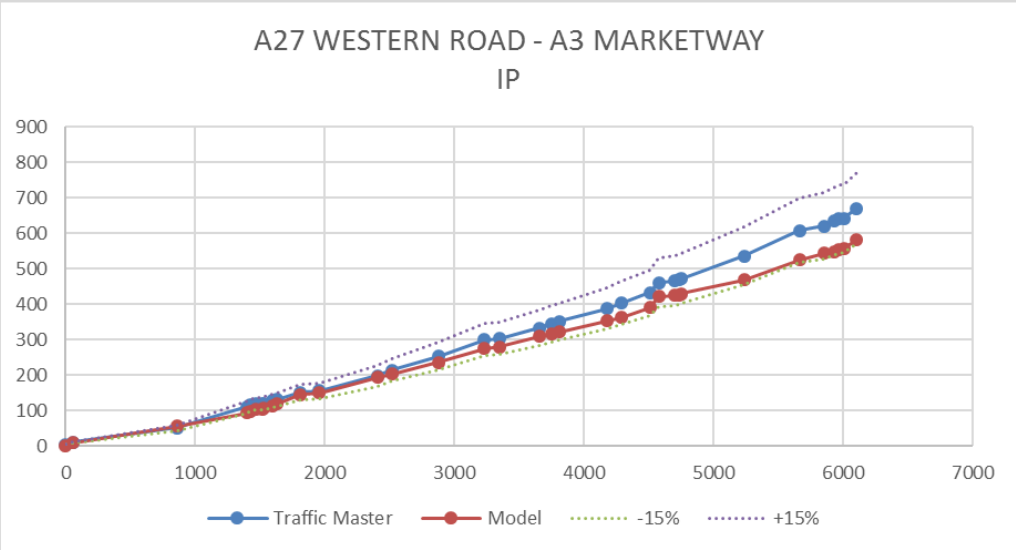


Figure 34. 17SB A27 WESTERN ROAD- A3 MARKETWAY





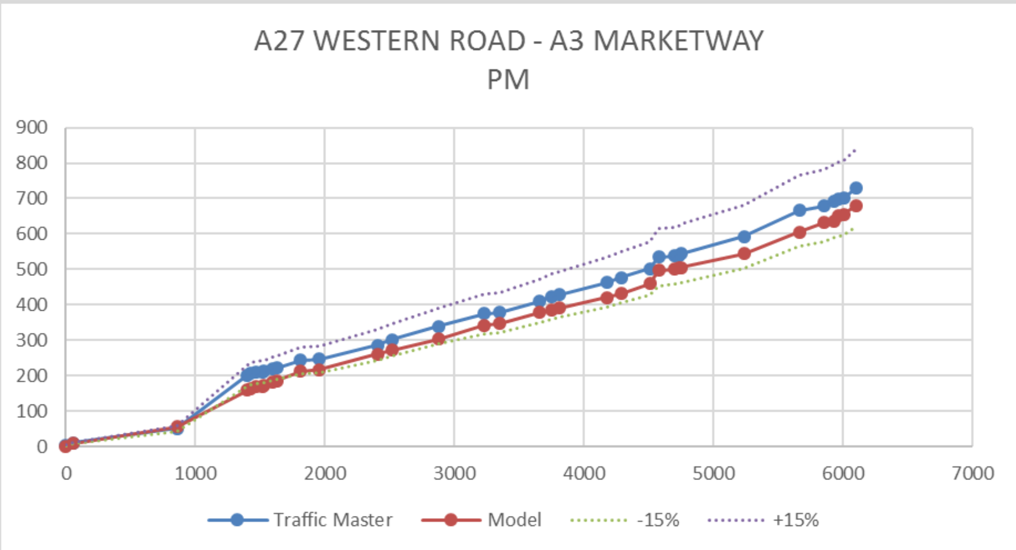


Figure 35. 18NB M3J11- A32

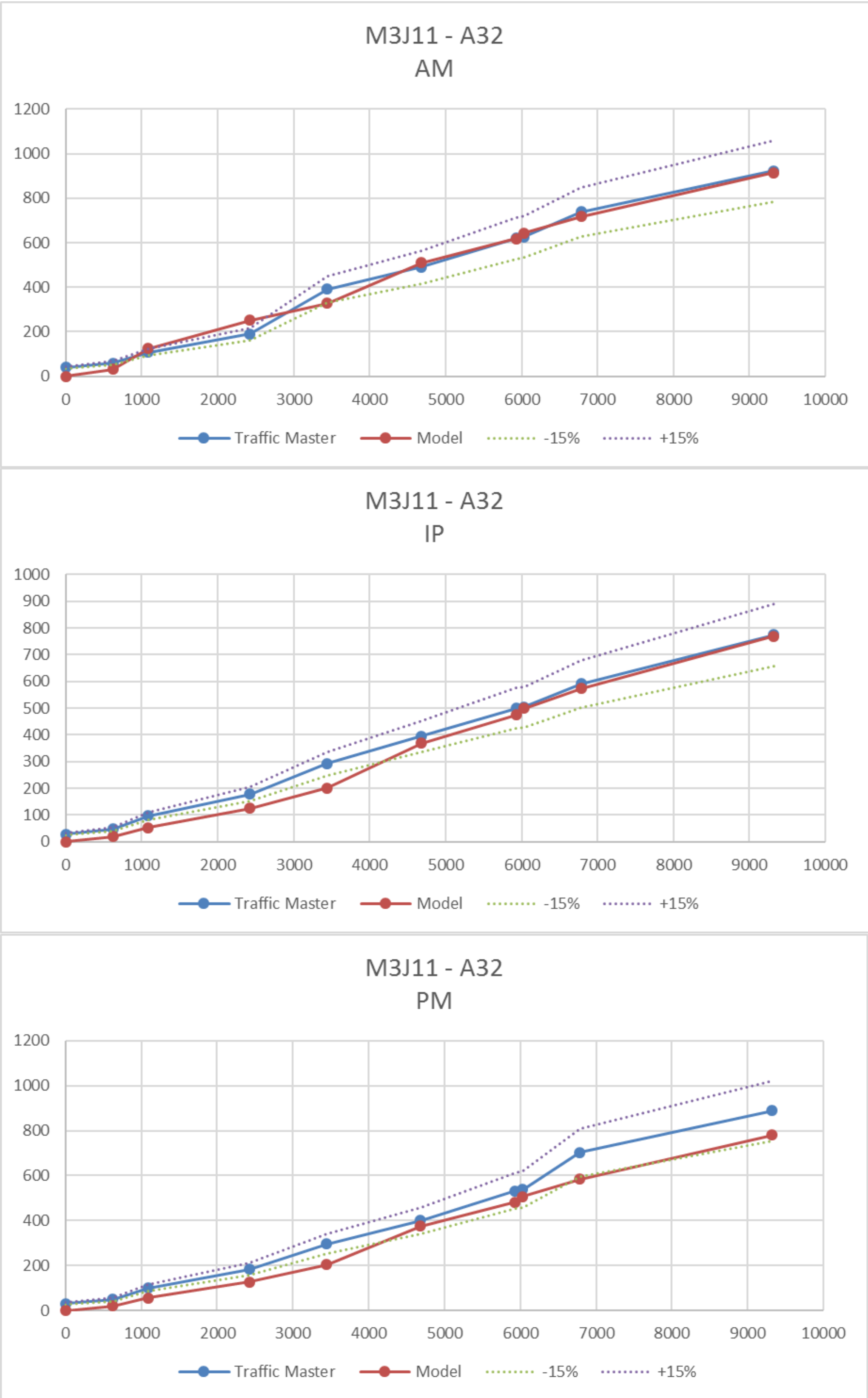


Figure 36. 18SB A32- M3J11

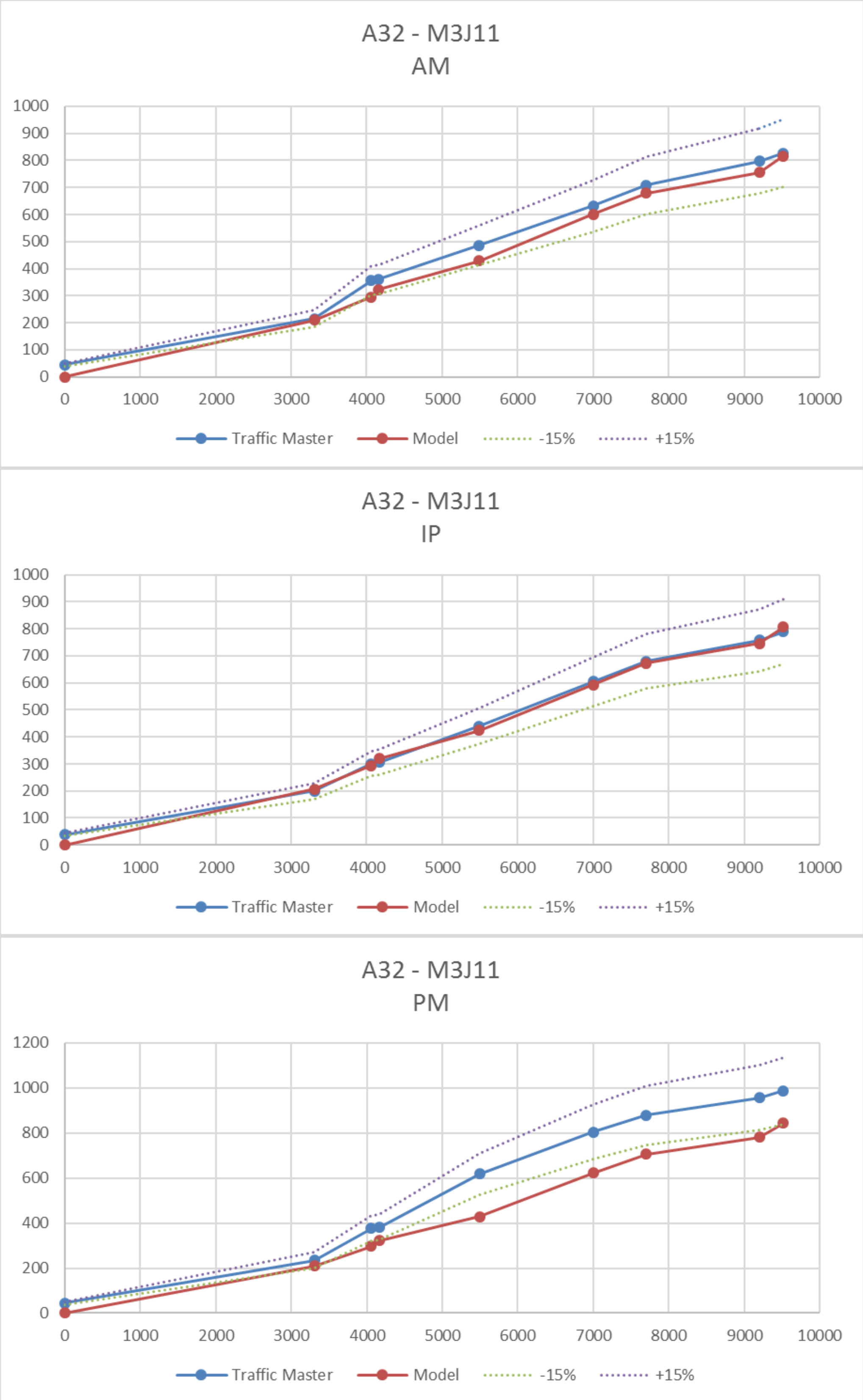


Figure 37. 19NB M27J2 – A303

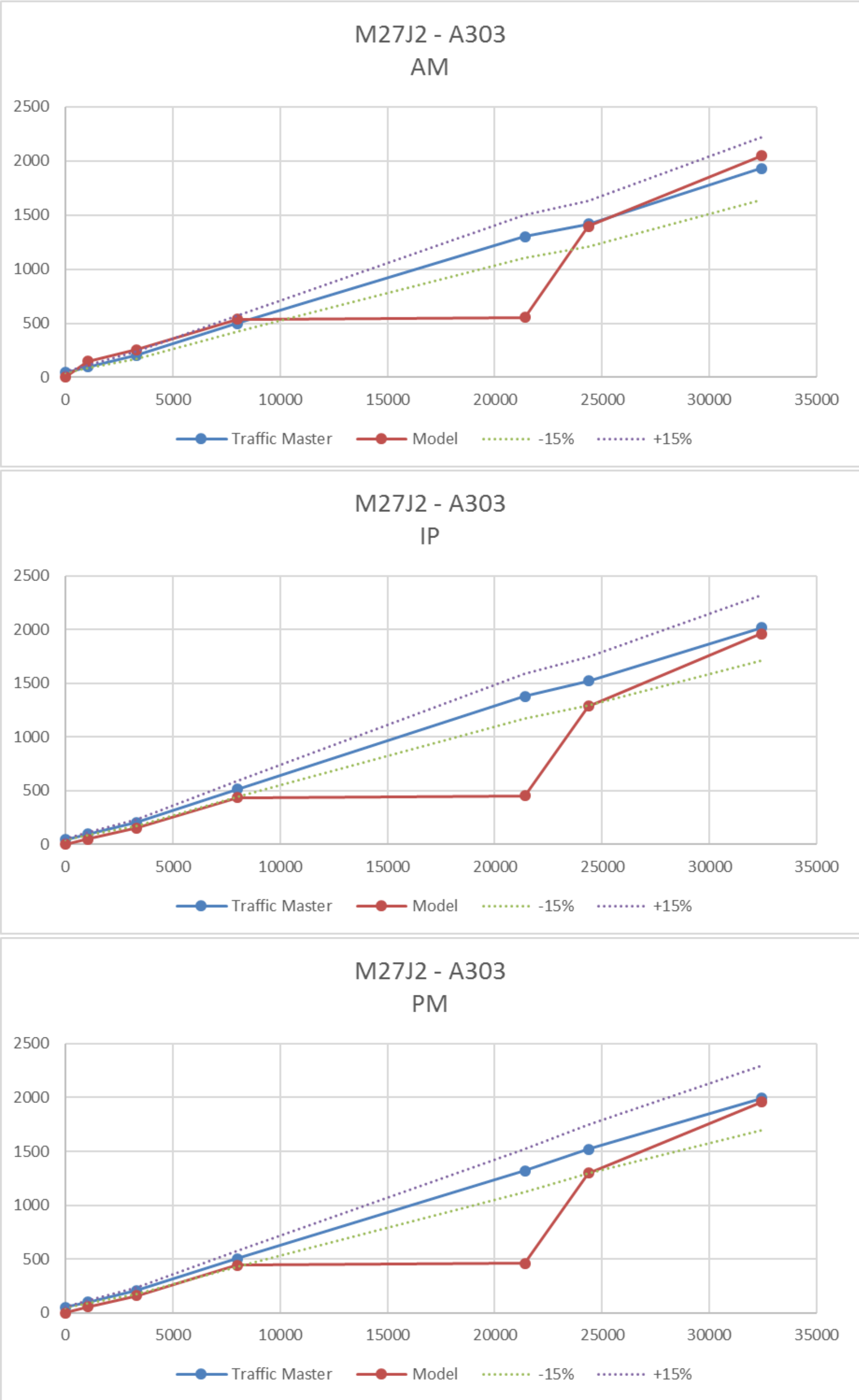
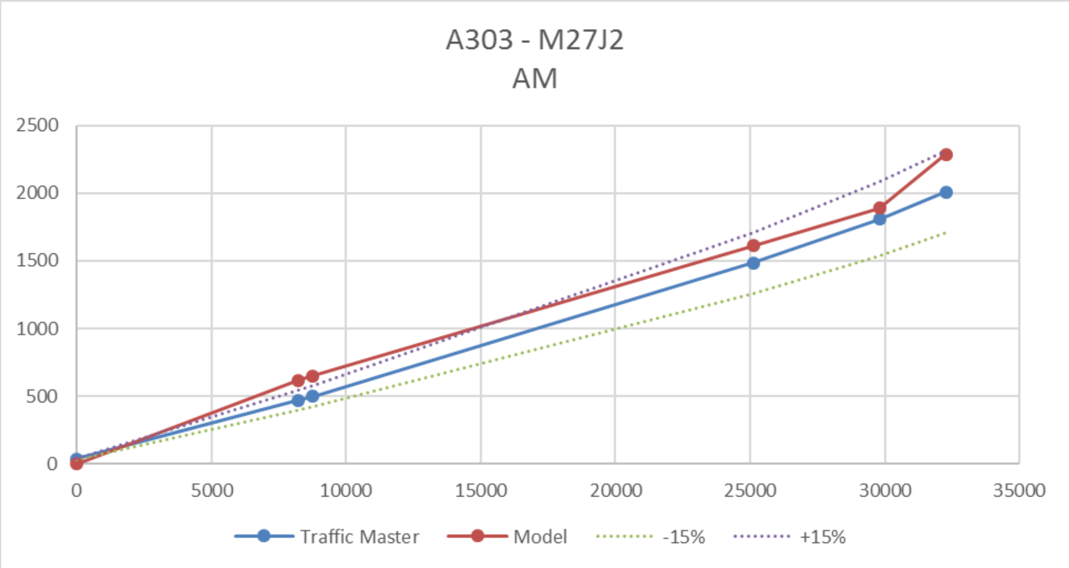
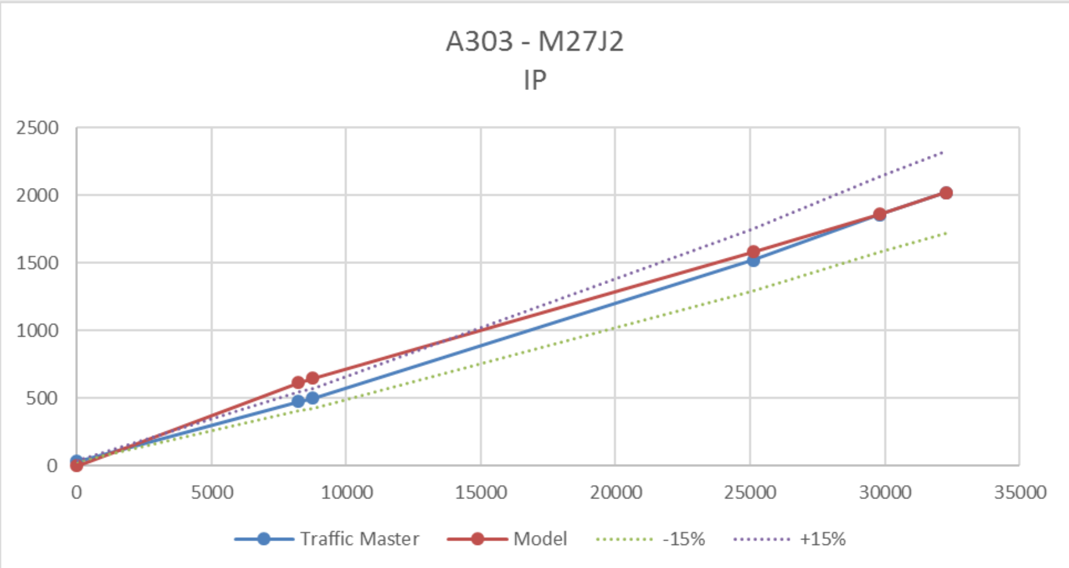


Figure 38. 19SB A303 – M27J2





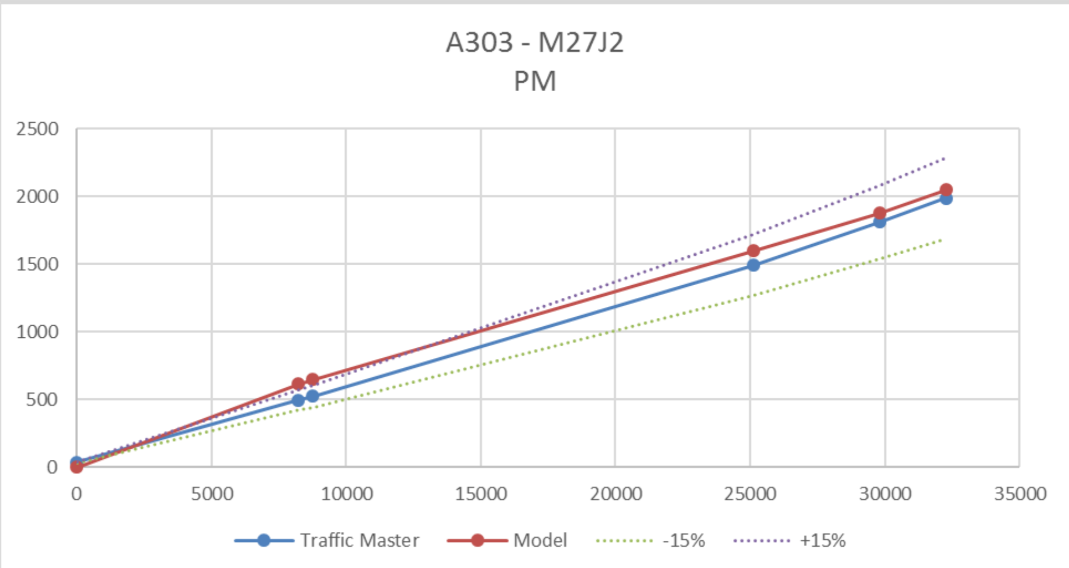
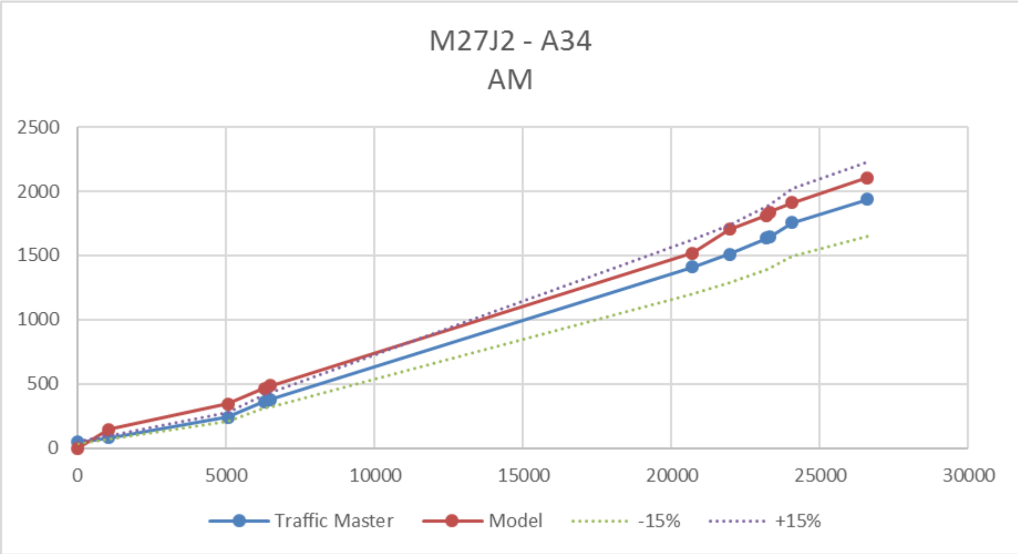
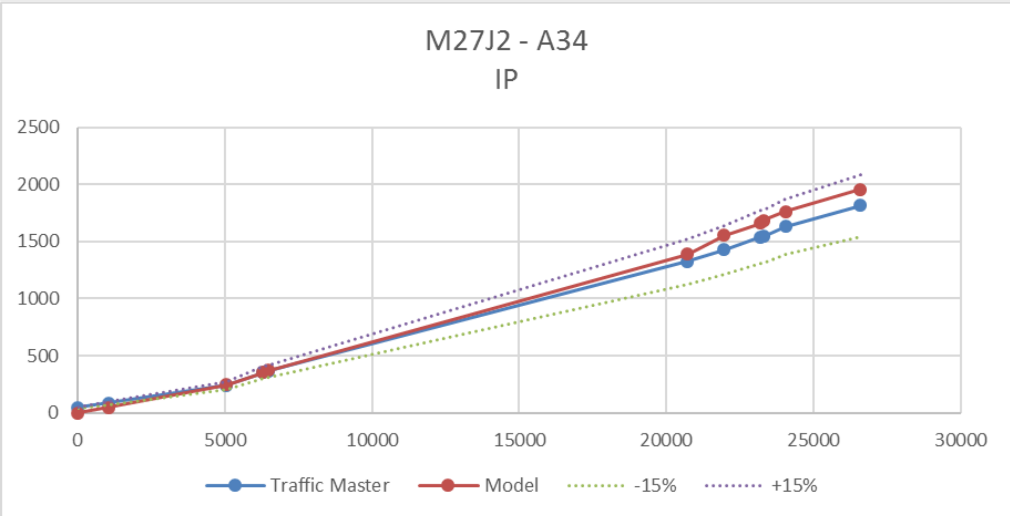


Figure 39. 20NB M27J2 – A34





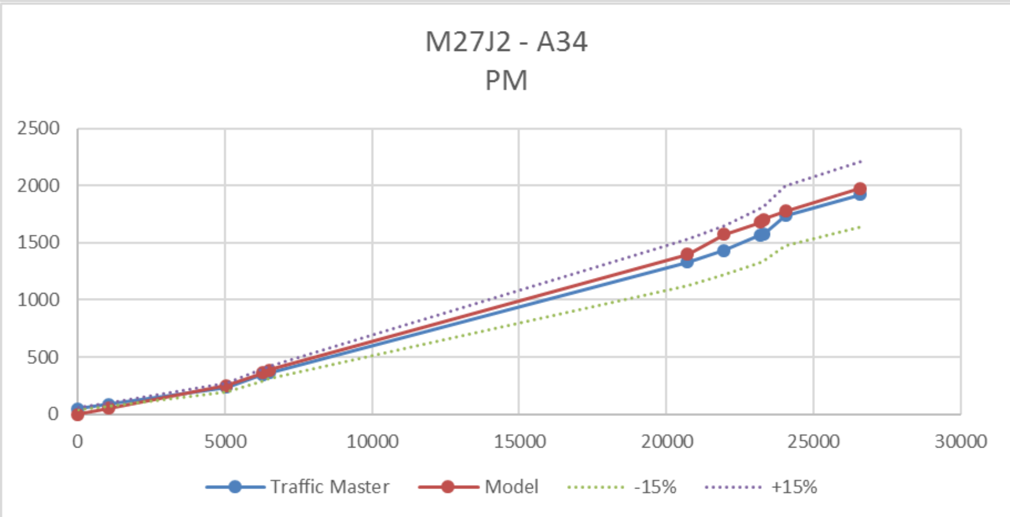


Figure 40. 20SB A34 – M27J2

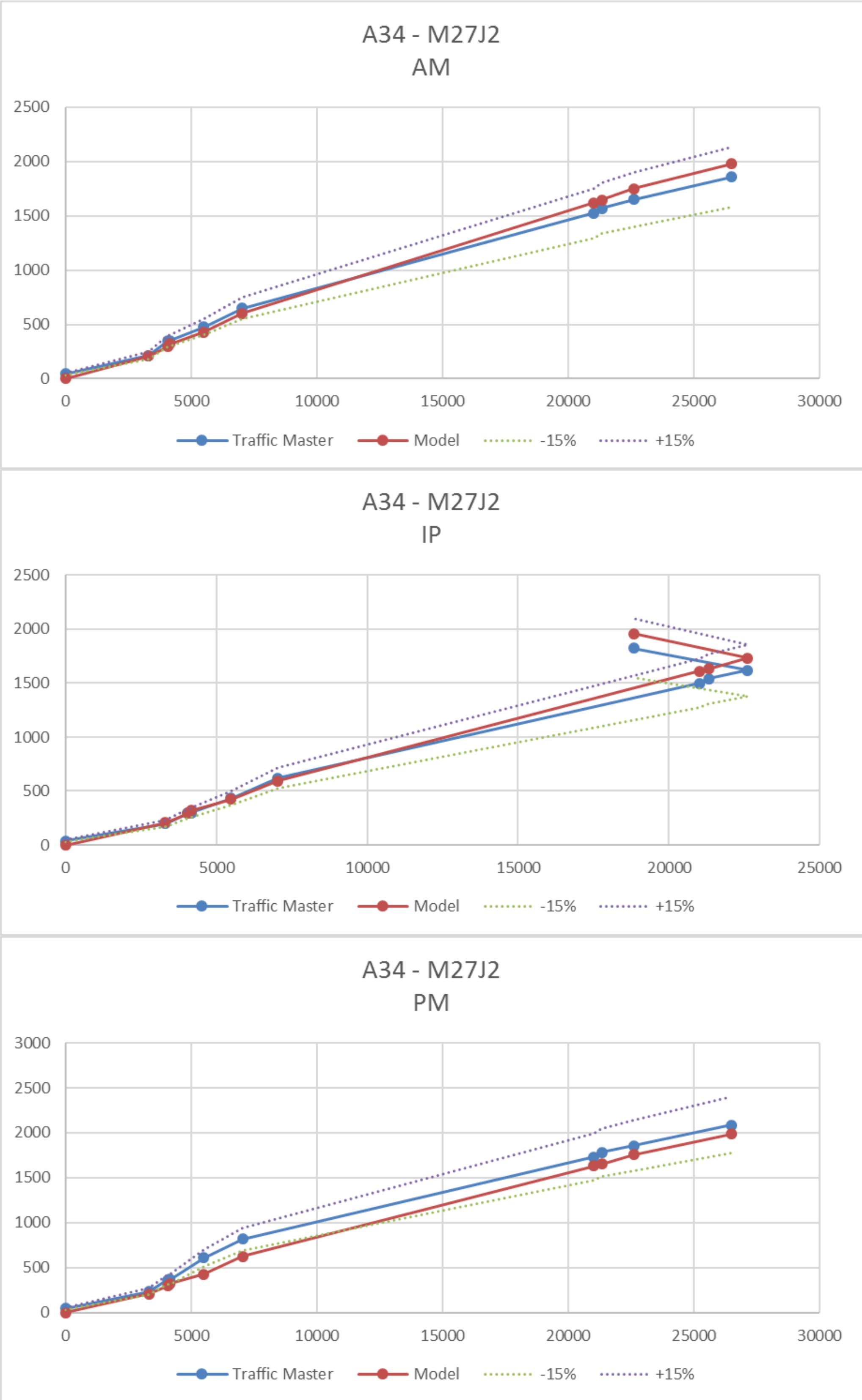
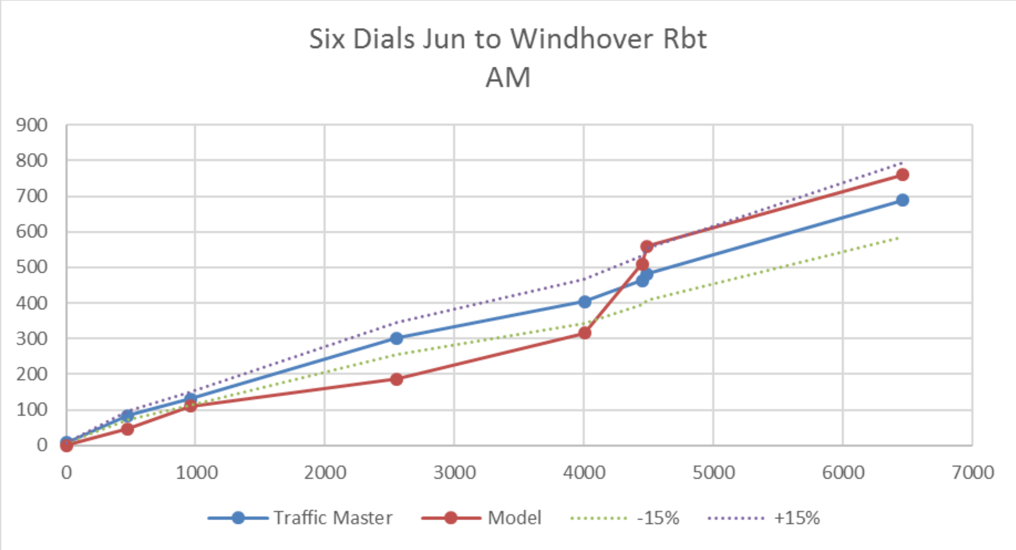
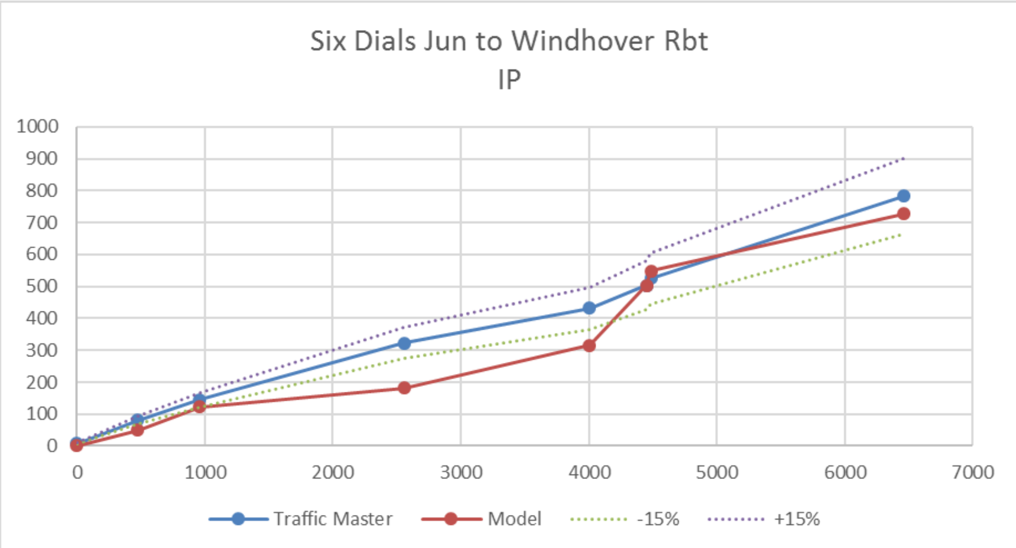


Figure 41. 21NB Six Dials Jum to Windover Rbt





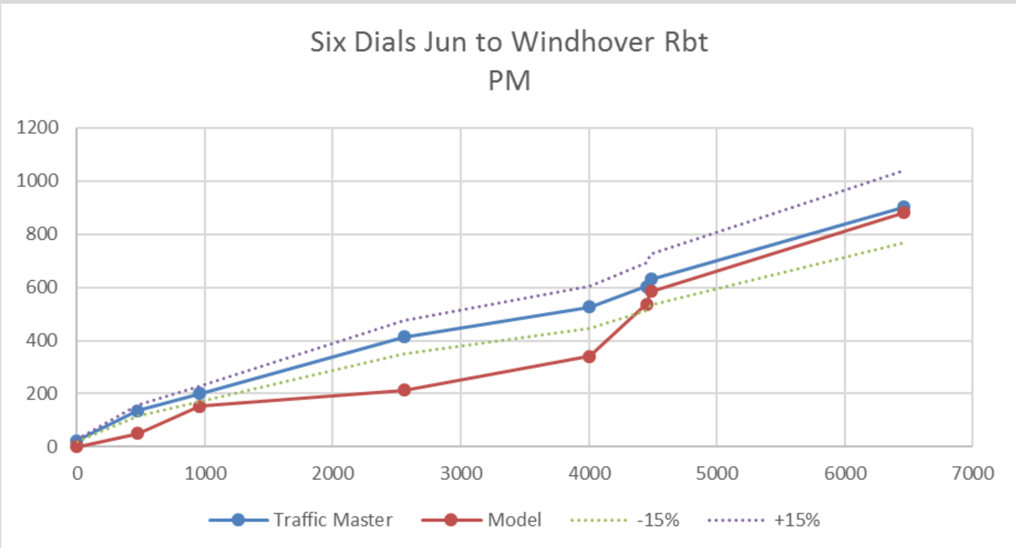
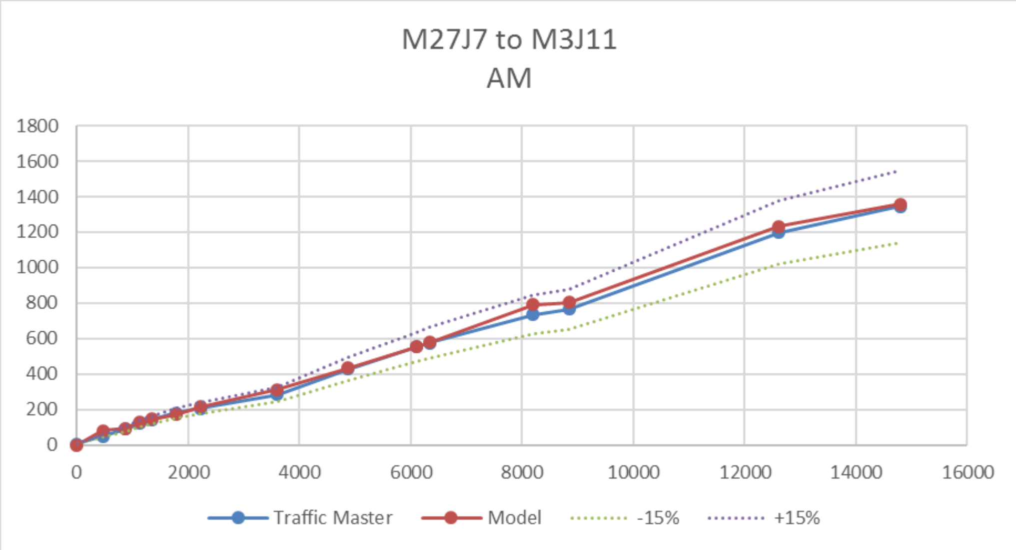
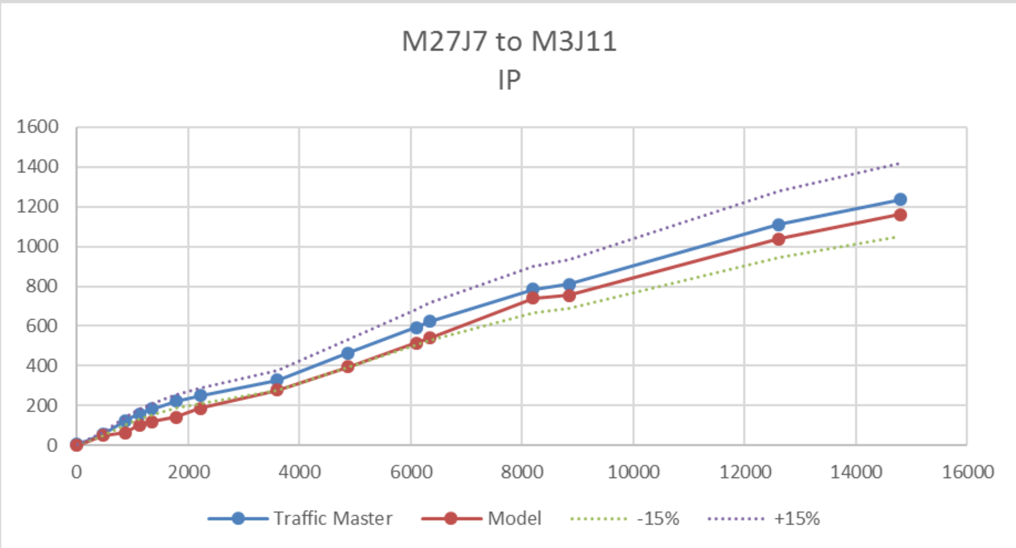


Figure 42. 21SB Windhover Rbt to Six Dials Jun

Figure 43. 22NB M27J7 to M3J11





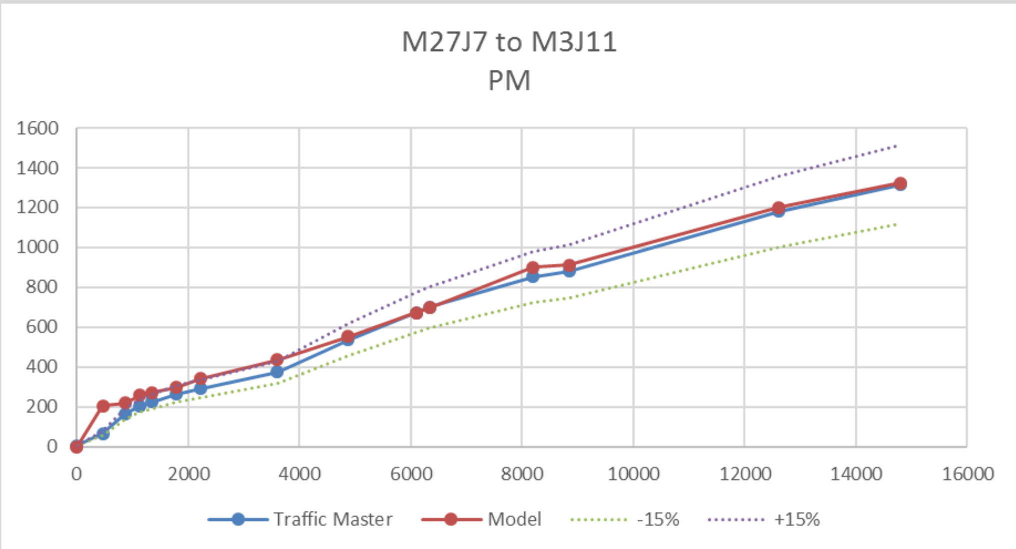
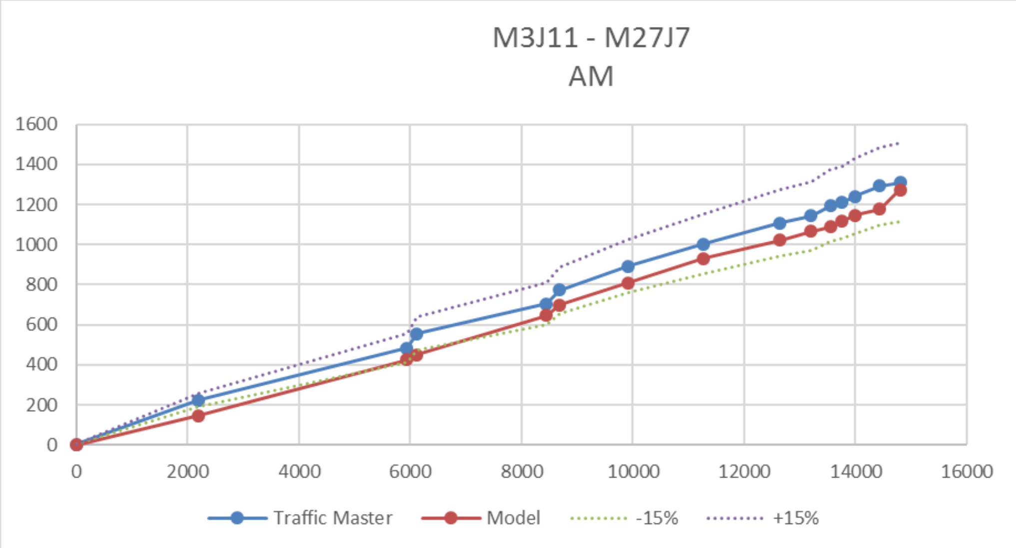
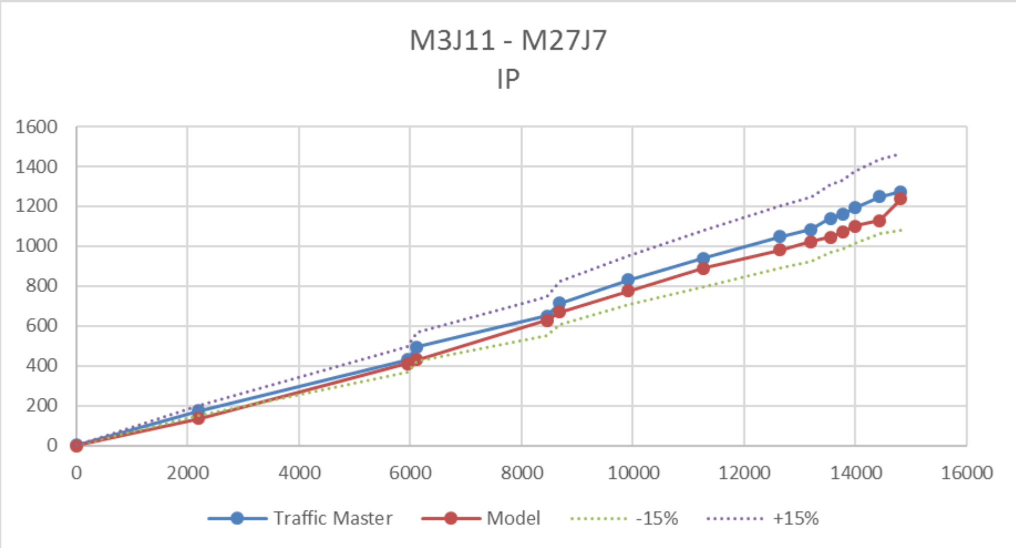


Figure 44. 22SB M3J11 – M27J7





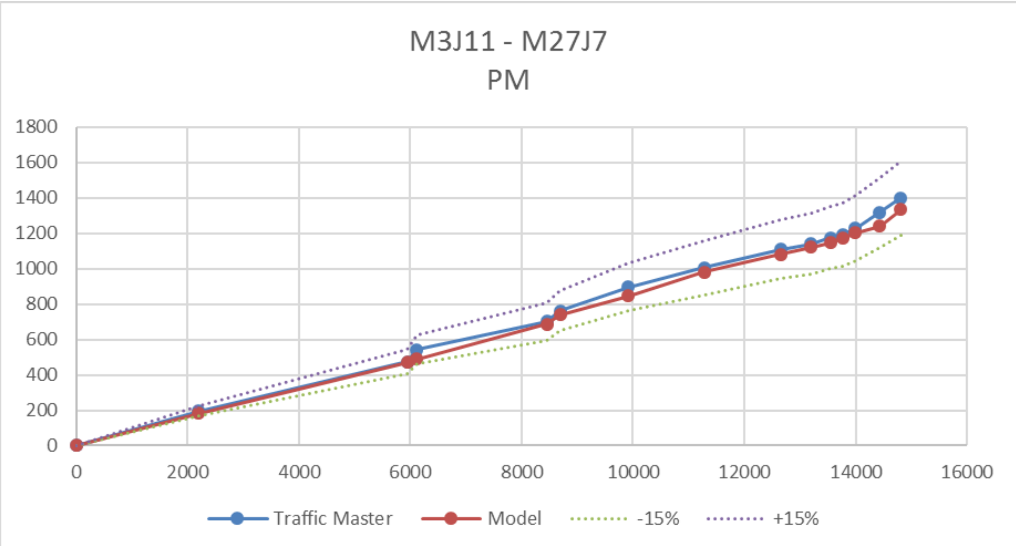


Figure 45. 23NB M27J10 – M3J11

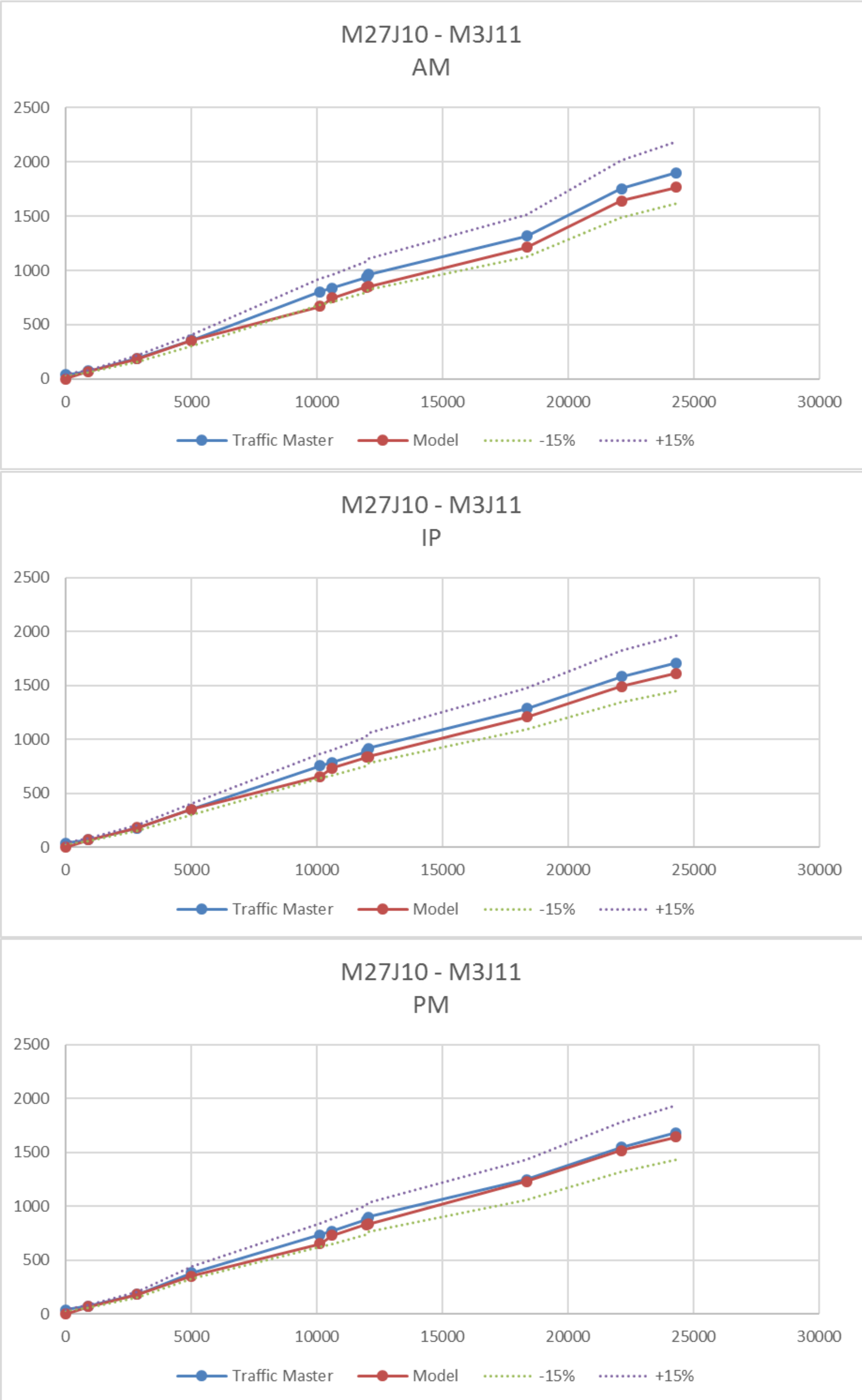


Figure 46. 23SB M3J11 – M27J10

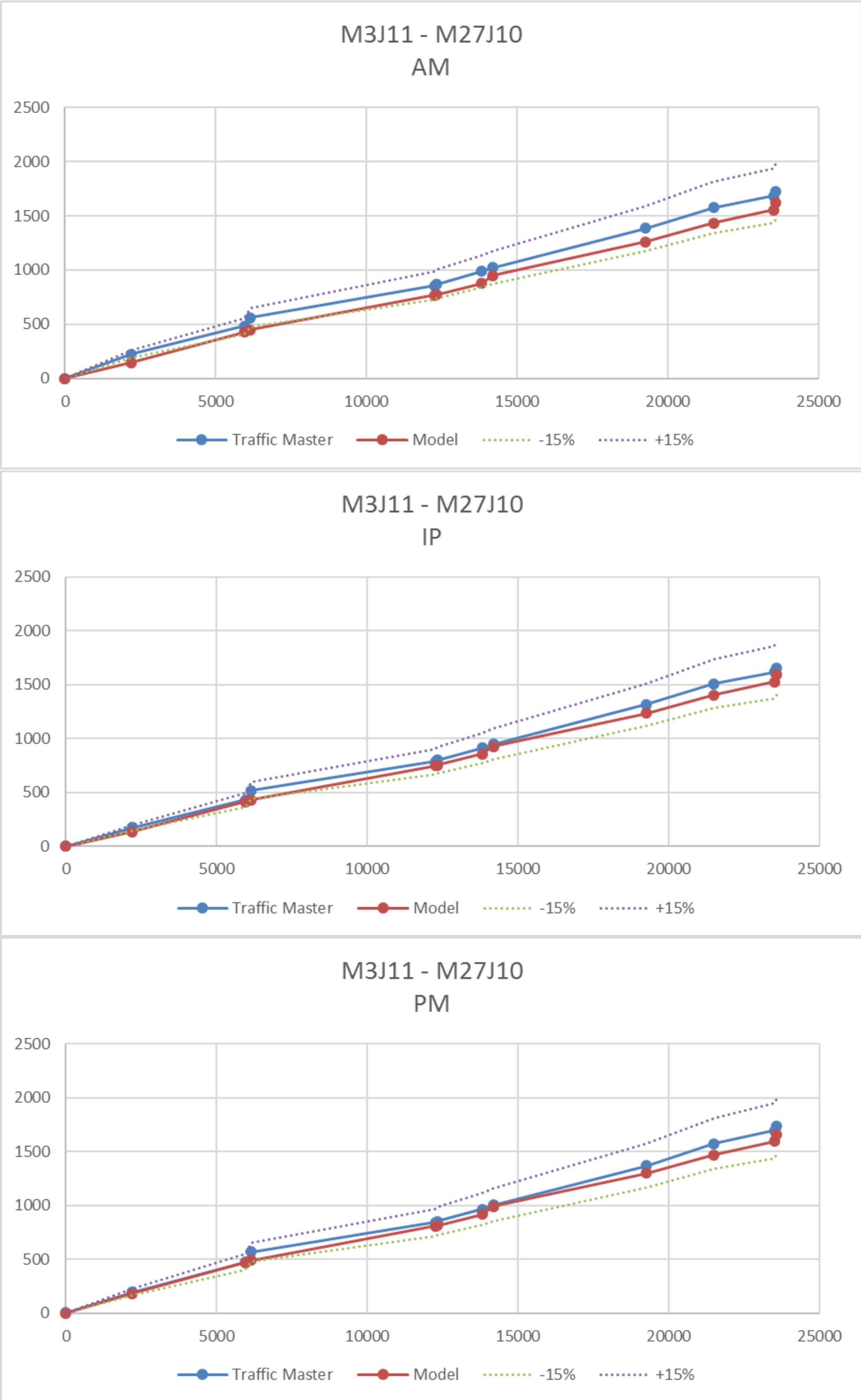


Figure 47. AM M27 Eastbound

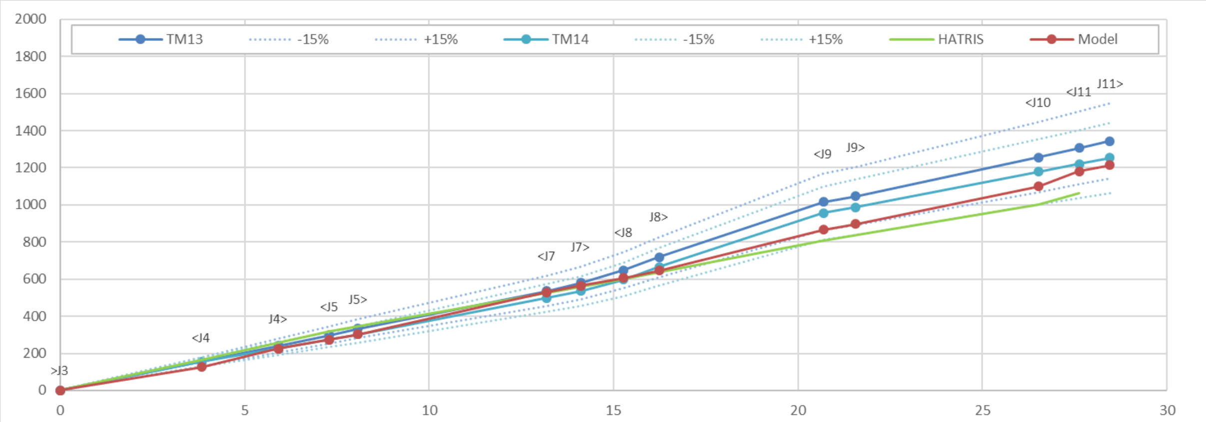


Figure 48. IP M27 Eastbound

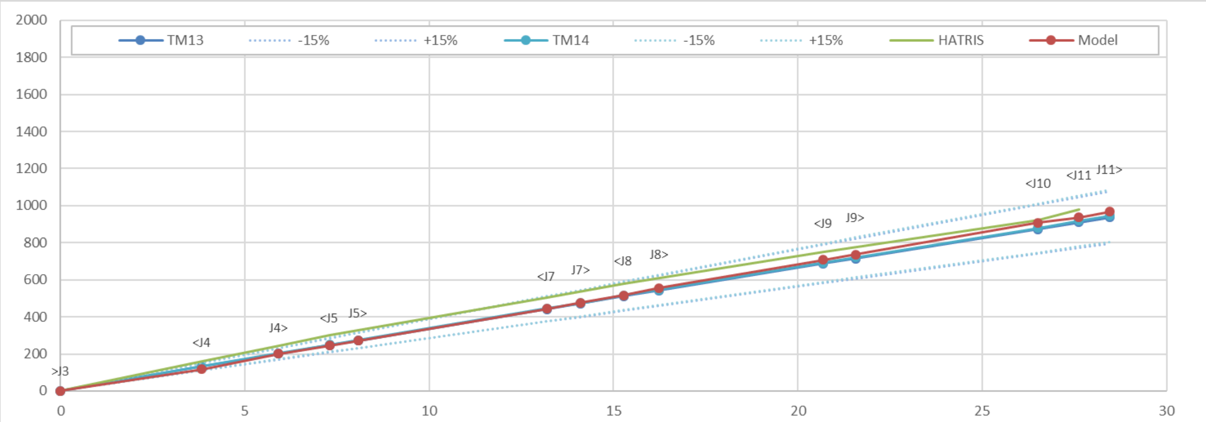


Figure 49. PM M27 Eastbound

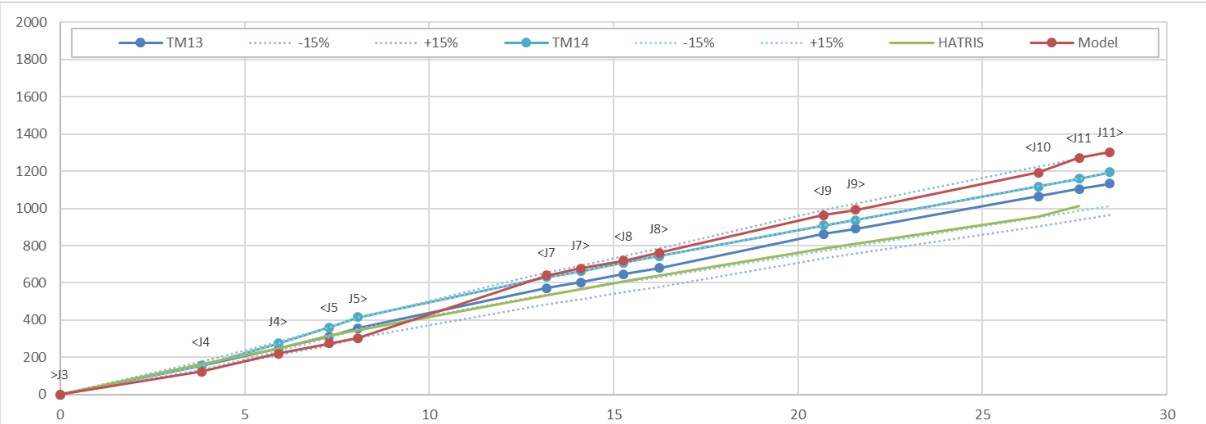


Figure 50. AM M27 Westbound

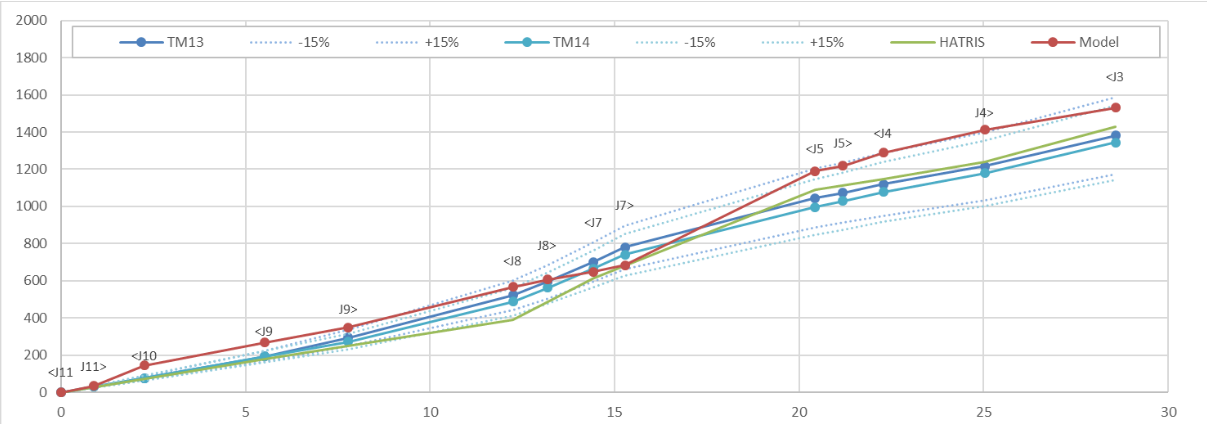


Figure 51. IP M27 Westbound

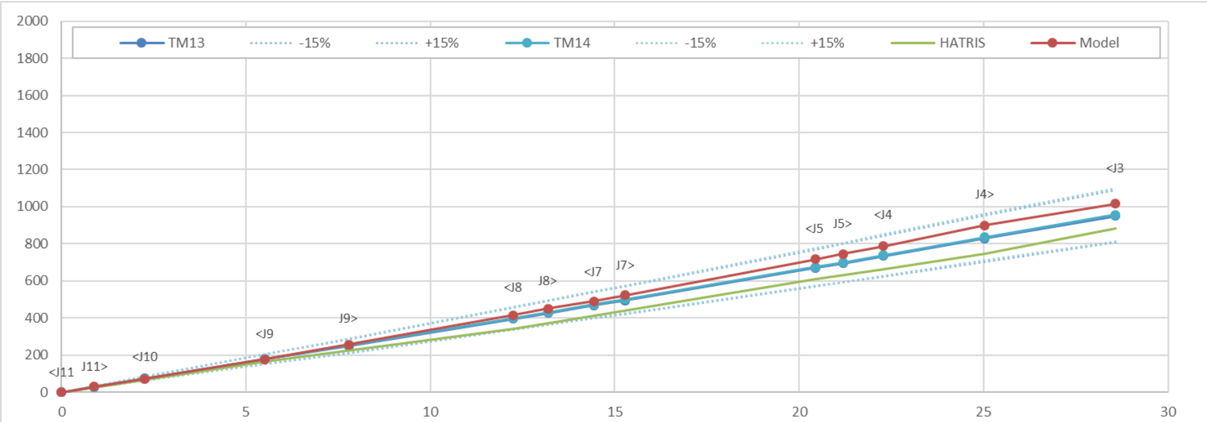


Figure 52. PM M27 Westbound

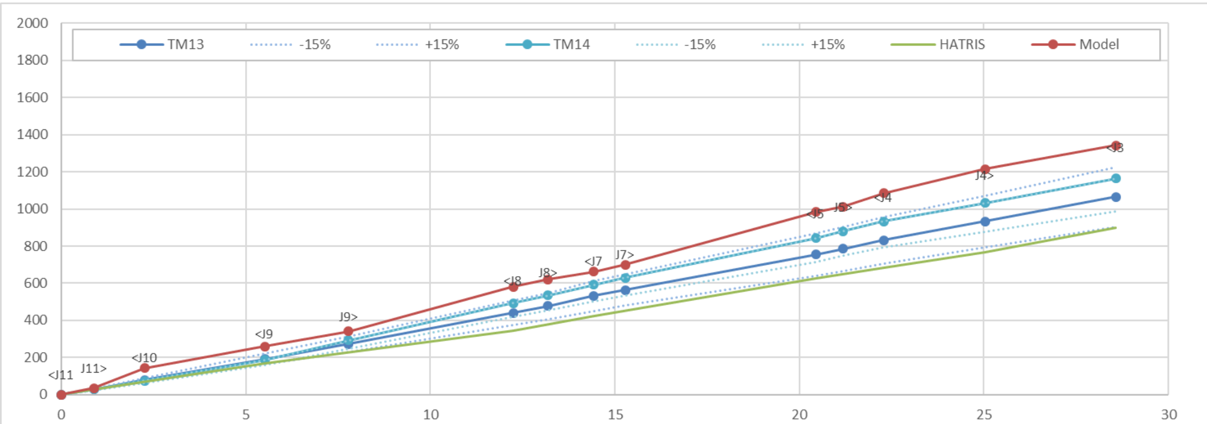


Figure 53. AM M3 Eastbound

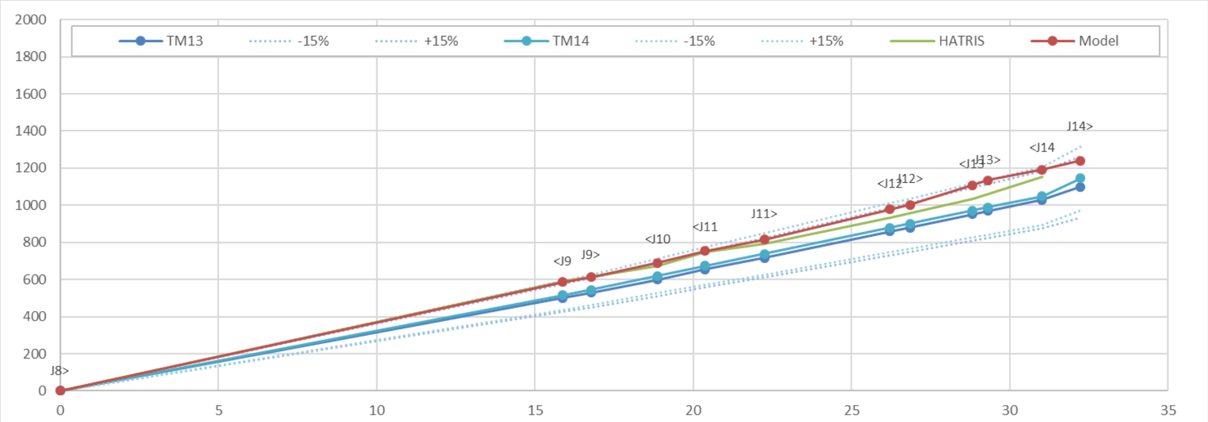


Figure 54. IP M3 Eastbound

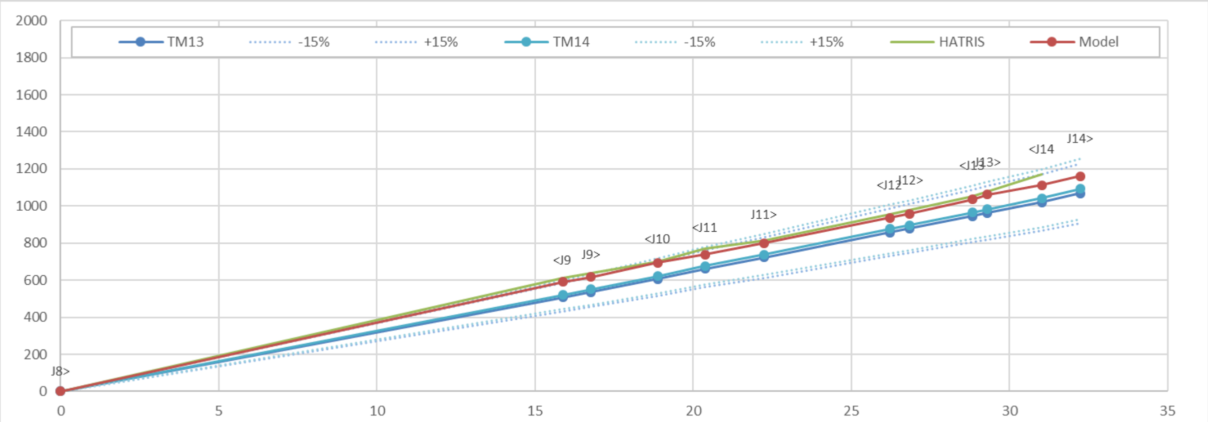


Figure 55. PM M3 Eastbound

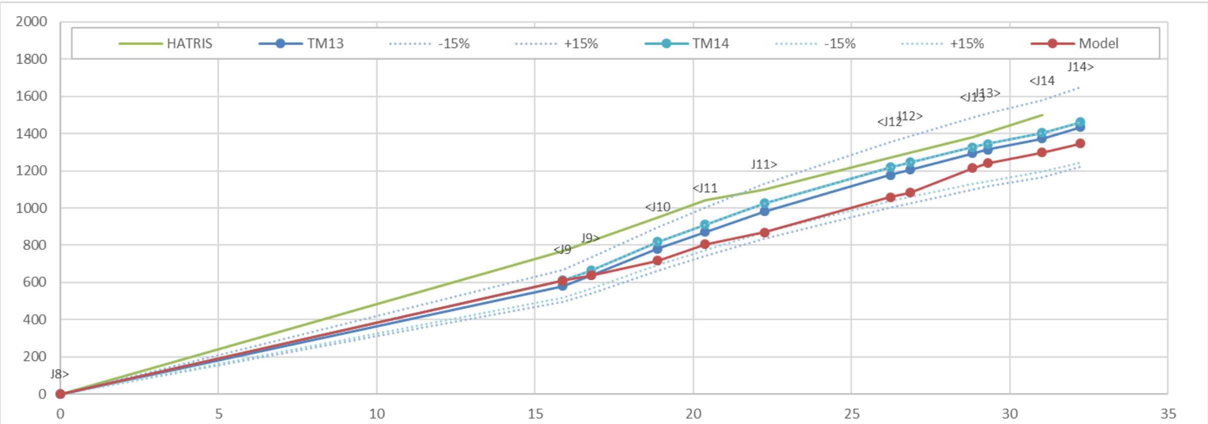


Figure 56. AM M3 Westbound

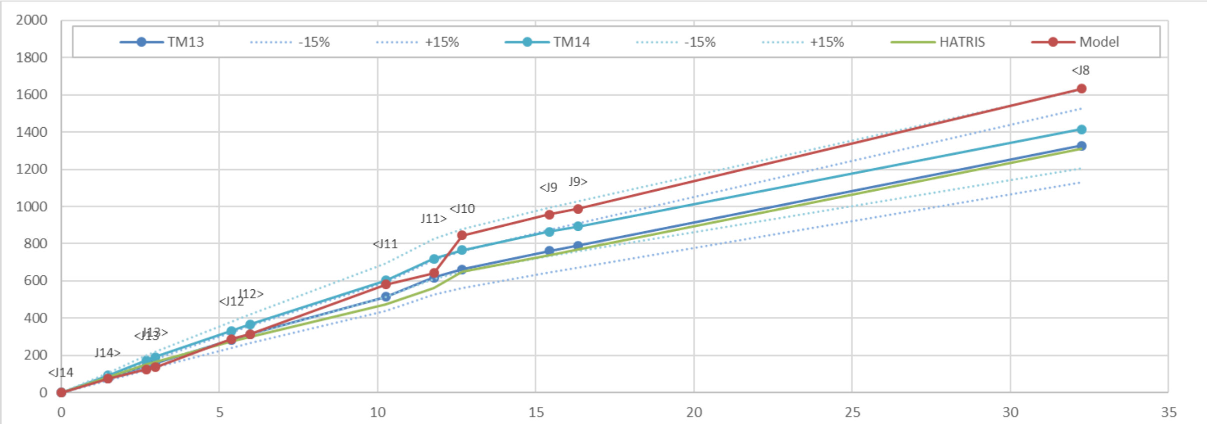


Figure 57. IP M3 Westbound

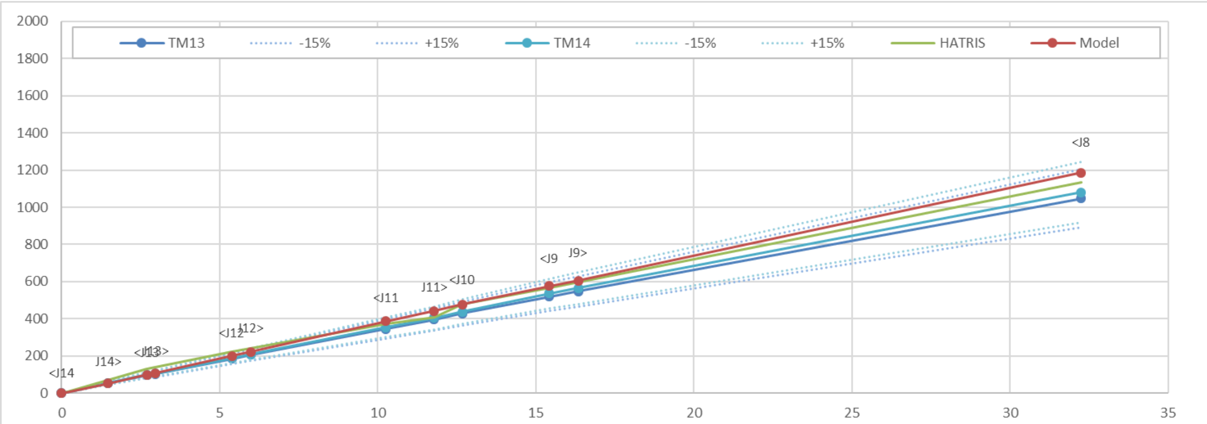


Figure 58. PM M3 Westbound