New Forest DISTRICT COUNCIL

NOTICE OF MEETING

Meeting:	**CABINET**
Date and Time:	**TUESDAY, 18 DECEMBER 2018, AT 2.00 PM***
Place:	**COUNCIL CHAMBER, APPLETREE COURT, LYNDHURST**
Telephone enquiries to:	**Lyndhurst (023) 8028 5000 023 8028 5588 - ask for Jan Debnam Email: jan.debnam@nfdc.gov.uk**

PUBLIC PARTICIPATION:
***Members of the public may speak in accordance with the Council's public participation scheme:**
(a) immediately before the meeting starts, on items within the Cabinet's terms of reference which are not on the public agenda; and/or
(b) on individual items on the public agenda, when the Chairman calls that item.
Speeches may not exceed three minutes. Anyone wishing to speak should contact the name and number shown above.

Bob Jackson
Chief Executive

Appletree Court, Lyndhurst, Hampshire. SO43 7PA
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This Agenda is also available on audio tape, in Braille, large print and digital format

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AGENDA

Apologies

1. MINUTES

To confirm the minutes of the meeting held on 5 December 2018 as a correct record.

2. DECLARATIONS OF INTEREST

To note any declarations of interest made by members in connection with an agenda item. The nature of the interest must also be specified.

Members are asked to discuss any possible interests with Democratic Services prior to the meeting.

3. **PUBLIC PARTICIPATION**

To note any issues raised during the public participation period**.**

4. **NEW FOREST DISTRICT COUNCIL FINAL AIR QUALITY PLAN** (Pages 1 - 388)

To consider the draft plan for approval for submission to the Secretary of State.

To:	**Councillors**	**Councillors**
	Mrs D E Andrews	E J Heron (Vice-Chairman)
	J E Binns	J D Heron
	Mrs J L Cleary	Mrs A J Hoare
	M R Harris	B Rickman (Chairman)

CABINET – 18 DECEMBER 2018

PORTFOLIO: ENVIRONMENT AND REGULATORY SERVICES

NEW FOREST DISTRICT COUNCIL AIR QUALITY FINAL PLAN - DECEMBER 2018

1. INTRODUCTION

1.1 New Forest District Council was issued with a Ministerial Direction as directed under the Environment Act 1995 requiring the submission to the Secretary of State of an Initial Plan by 31 March 2018 and an Air Quality Final Plan by 31 December 2018.

1.2 The Initial Plan was submitted to the Secretary of State on 29 March 2018.

1.3 The Air Quality Final Plan advises a preferred option which details how compliance with the EU Ambient Air Quality Directive for nitrogen dioxide as an annual mean will be delivered in the New Forest in the shortest possible time.

2. BACKGROUND

2.1 Air pollution is a national public health priority and of all environmental factors, it has the largest impact on health in the UK. Being attributed to over 40,000 deaths nationally, it has health effects across the life course; from underdevelopment of the unborn baby through to dementia in the later years of life.

2.2 Nitrogen dioxide and particulates are the pollutants mostly associated with road transport. Public health data[1] advises approximately 100 deaths per year in the New Forest are attributable to long term exposure to particulate matter alone.

2.3 Southampton City Council was named as one of five cities in the Government's 2015 Air Quality Plan[2] required to deliver compliance in the shortest possible time and has been working since then to develop a suitable scheme.

2.4 In July 2017, the Government published the UK Plan for tackling roadside nitrogen dioxide concentrations[3]. The Plan used national modelling to identify a further 23 local authorities, including New Forest District Council, who were in exceedance of the annual mean nitrogen dioxide concentration (>40µgm^{-3}) in relation to the EU Ambient Air Quality Directive.

2.4 The UK Plan required the identified local authorities to develop local plans to detail how compliance with the EU Ambient Air Quality Directive would be delivered in the shortest possible time.

2.5 The national model identified an exceedance in the New Forest on a short stretch (less than 1km) of the A35 at Totton up to the boundary with Southampton City Council on the Redbridge Causeway.

3. NEW FOREST BACKGROUND

3.1 The exceedance identified in the New Forest is viewed as an extension of the exceedance identified on the Western Approach into Southampton City. New Forest District Council and Southampton City Council have been working closely as part of an agreement through a Memorandum of Understanding, to develop plans to deliver nitrogen dioxide compliance in the shortest time possible in their own areas.

3.2 New Forest District Council is only responsible for ensuring compliance is met in its own area. Any implemented options to reduce nitrogen dioxide concentrations must not have a detrimental air quality impact on surrounding areas including neighbouring authorities.

3.3 Detailed and complex local air quality modelling has been undertaken to determine local nitrogen dioxide roadside concentrations around Totton; A35, A326 and A36. The local model predicts concentrations in subsequent years up to 2020 when compliance with the EU Ambient Air Quality Directive is expected.

3.4 The Final Plan has been developed in accordance with Government guidance and consultation with the Joint Air Quality Unit (a body comprising of the department of the Environment, Food and Rural Affairs and the Department of Transport). The Final Plan contains evidence of the work completed and conclusions reached.

3.5 New Forest District Council has engaged with stakeholders throughout the development of the Final Plan, including Hampshire County Council, Totton and Eling Town Council, Members, local businesses and residents.

4. KEY OUTCOMES

4.1 The local model determined:

- lower roadside nitrogen dioxide concentrations in the model domain compared to the national model which originally identified the exceedance on the A35.
- New Forest District Council will be compliant with the EU Ambient Air Quality Directive for nitrogen dioxide by 2019 in a business as usual scenario.
- the introduction of additional options will not bring forward compliance.

4.2 New Forest District Council's preferred option is to continue with a **business as usual scenario**.

4.3 New Forest District Council has identified additional work which will progress local air quality further including;

- Monitoring and evaluating nitrogen dioxide levels on the A35 in Totton to ensure compliance is met.
- Developing working partnerships with interested stakeholders, other authorities including Southampton City Council and Hampshire County Council, local businesses and communities.
- Forwarding schemes across the district with the aim to improve local air quality.

5. CONCLUSIONS

5.1 New Forest District Council is under Ministerial Direction to deliver an Air Quality Final Plan to show how compliance with the EU Ambient Air Quality Directive for nitrogen dioxide will be met.

5.2 Detailed local modelling has determined that compliance with the EU Ambient Air Quality Directive will be met in 2019 in a business as usual scenario, and the introduction of additional measures will not bring forward compliance any earlier.

5.3 New Forest District Council's preferred option is a business as usual scenario.

6. FINANCIAL IMPLICATIONS

6.1 There are no direct financial implications from adopting this Final Plan.

7. CRIME & DISORDER IMPLICATIONS

7.1 There are none.

8. ENVIRONMENTAL IMPLICATIONS

8.1 Any implications are addressed in the Final Plan.

9. EQUALITY & DIVERSITY IMPLICATIONS

9.1 There are none.

10. ENVIRONMENT OVERVIEW AND SCRUTINY PANEL COMMENTS

10.1 The comments of the Environment Overview and Scrutiny Panel will be reported orally at the meeting. The Panel met on 13 December 2018, after the publication of this report.

11. PORTFOLIO HOLDERS COMMENTS

11.1 For our environment and our health there are few things more important than the air we breathe. I see this report and the submission of the related Final Plan, not as the end point with the achievement of meeting compliance with the European Air Quality directive in the shortest time possible but as the beginning.

As stated in our Final Plan we will continue to work to maintain and improve air quality throughout the New Forest District and take the opportunity to work with neighbouring authorities in relation to air quality for the benefit of our residents.

I wish to thank Rachel Higgins and Joanne McClay for their dedication and commitment throughout the last year to complete this report and associated Final Plan.

12. RECOMMENDATIONS

12.1 That the Air Quality Final Plan for New Forest District Council (December 2018), as attached as Annex A and it supporting Appendices, is supported and commended to the Portfolio Holder for submission to the Secretary of State before 31 December 2018.

For further information contact:

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Background papers:
The Final Plan (Attached)

References:

[1] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/332854/PHE_CRCE_010.pdf
[2] https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions
[3] https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017

New Forest District Council

Clean Air Zone Draft Final Plan

December 2018

Version Control

Version	Author	Date
1.0 working draft	Rachel Higgins	26 November 2018
2.0 working draft	Rachel Higgins	30 November 2018
1.0 final draft	Rachel Higgins	4 December 2018
2.0 final plan	Rachel Higgins	

Review Control

Version Review	Reviewer	Date
2.0 working draft	Joanne McClay	3 December 2018
1.0 final draft	Joanne McClay	5 December 2018
2.0 final plan	Joanne McClay	

EXECUTIVE SUMMARY

In 2017 the Government published an air quality plan to reduce roadside nitrogen dioxide to ensure compliance with the EU Ambient Air Quality Directive. The Plan required a number of Local Authorities including New Forest District Council to produce their own Local Plan detailing how compliance with the Directive would be delivered in the shortest possible time.

New Forest District Council has been issued with a Ministerial Direction requiring the submission of Final Local Plan to the Secretary of State by the end of 2018. **This report details the Final Local Plan for the Council.**

The area identified by Government as exceeding the EU Ambient Air Quality Directive in the New Forest is a short stretch of the A35 on the boundary with Southampton City Council. The issue in the New Forest is seen as an extension of the air quality issue identified in Southampton in 2015. Whilst each Council is only responsible for the exceedance identified in their own area, New Forest District Council and Southampton City Council have been working in partnership to understand the regional issues further and formulate their own plans by following guidance laid out by Government and working with the Joint Air Quality Unit (a Government unit comprising of Department for the Environment Food and Rural Affairs and the Department of Transport) to ensure compliance is met in the shortest possible time.

Detailed and complex local air quality modelling has been undertaken in the New Forest which has determined that compliance will be met at the relevant locations by 2019 in a business as usual scenario. Furthermore, it has been concluded that the introduction of additional measures will not bring forward compliance, therefore, New Forest District Council's preferred option is to continue with a **business as usual scenario**.

However, through the Clean Air Zone project, New Forest District Council has identified additional work which will progress local air quality further including;

- Monitoring and evaluating nitrogen dioxide levels on the A35 in Totton, with particular reference to the relevant locations identified by Government;
- Developing working partnerships with interested stakeholders, other authorities including Southampton City Council and Hampshire County Council, local businesses and communities, and;
- Forwarding schemes across the district with the aim to improve local air quality.

CONTENTS

1.0 STRATEGIC CASE

1.1 Overview

In July 2017 the Government published the UK Plan for tackling roadside nitrogen dioxide (NO_2) concentrations[1]. The Plan used national modelling to identify 28 local authorities, including New Forest District Council, who were in exceedance of the annual mean NO_2 concentration (>40µgm^{-3}) in relation to the EU's Ambient Air Quality Directive (EU AAQD). The Plan required the identified local authorities to develop local plans to detail how compliance with the EU AAQD would be delivered in the shortest possible time.

The national Pollution Climate Mapping (PCM) model identified an exceedance in the New Forest on a short stretch (less than 1km) of the A35 at Totton up to the boundary with Southampton City Council on the Redbridge Causeway. Southampton City Council was named as one of five cities in the Government's 2015 Air Quality Plan[2] as being required to deliver compliance in the shortest possible time and has been working since then to develop a suitable scheme. The exceedance identified in the New Forest is viewed as an extension to the exceedance identified on the Western Approach in Southampton City Council in 2015[2]. Therefore due to the close proximity of the two areas and associated exceedances, both New Forest District Council and Southampton City Council have been working very closely as part of an agreement through the Memorandum of Understanding to develop plans to deliver NO_2 compliance in the shortest time possible.

New Forest District Council was directed under the Environment Act 1995 to produce a Local Plan to identify measures to deliver compliance in the shortest time possible. The Ministerial Direction required New Forest District Council to submit an Initial Plan in the form of a Strategic Outline Case by 31 March 2018 and a Final Plan to be submitted by 31 December 2018. Southampton City Council were required as part of the 2017 Plan[1] to submit a Final Plan to Government by 15 September 2018.

Local modelling has shown that in the business as usual (baseline) scenario, New Forest study area will be compliant in 2019 without the implementation of any additional measures. This document (Final Plan) details the methodology and air quality analysis evidence leading to the conclusion that no additional measures can be implemented to bring forward compliance of the NO_2 EU AAQD. Whilst Southampton City Council and New Forest District Council remain in close working partnership on air quality, this document and the supporting evidence focuses on **New Forest District Council only.**

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[1] https://www.gov.uk/government/publications/air-quality-plan-for-nitrogen-dioxide-no2-in-uk-2017
[2] https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions

Table 1 summaries the work completed to date by New Forest District Council working in partnership with Southampton City Council.

Table 1 New Forest District Council completed work

Work	Date	Comments
Revised National Plan for improving roadside NO_2 concentrations published	July 2017	28 Local Authorities required to produce a 'Local Plan' to bring about compliance with EU AAQD within the shortest possible time, including New Forest District Council
Southampton City Council and New Forest District Council Clean Air Zone Partnership work starts	September 2017	Understanding SCC position and completed work. Devising how the authorities can work together to ensure compliance, the extent of a CAZ and the sharing procurement.
Submission of **Initial Feasibility Plan** to Government	28 November 2017	Outlining how work will be undertaken and the procurement of consultants to forward local modelling assessments.
Memorandum of Understanding (MoU) between NFDC and SCC	Throughout 2018	Signed up to by Chief Executives from both authorities
Submission of **Initial Plan** to Government	29 March 2018	Joint submission report with SCC but satisfies Ministerial Direction of 31 March 2018 for NFDC
Extensive joint consultation with SCC on the Preferred Option to ensure compliance with EU AAQD within SCC	21 June 2018 - 13 September 2018	Consultation includes New Forest residents and businesses, some of whom may be impacted by the preferred option being considered by SCC. Consultation included survey, public / business meetings and media campaign
Submission of Final Plan to Government for NFDC	By 31 December 2018	Following New Forest District Council Cabinet approval

1.2 Local context

The New Forest district is a diverse environment covering 75,100 hectares (290 sq. miles) with a population of 176,500[3]. The District includes the New Forest (and associated New Forest National Park) covering approximately three quarters of the district and comprises protected heathlands and forests, a coastline of 64km, areas of industry, towns and villages. The industry within the District includes a refinery, one of the largest in Europe, whilst other industrial processes include a gas fired power station, a number of energy recovery facilities and chemical installations. Furthermore, there are significant areas of sand and gravel extraction in the district to support local businesses. Along Southampton Water, much of the shoreline is influenced by urban and industrial development including Southampton Port, which is operated within the neighbouring authority of Southampton City Council. As such many residents and businesses commute and operate between the New Forest district and Southampton city, contributing to the local air pollution through vehicle emissions.

Furthermore the New Forest district and New Forest National Park draws tourism from across the globe, which also generate large volumes of traffic movements. It is estimated that over 13 million day visits are made annually to the District with 96% of visitors arriving in cars or coaches[4].

Public Health

Air pollution is a national public health priority and of all environmental factors, it has the largest impact on health in the UK. It can be attributed to over 40,000 deaths nationally and has health effects across the life course; from the underdevelopment of the unborn baby through to dementia in the later years of life. The strongest evidence of health impact is worsening symptoms of respiratory diseases and cardio-vascular disease. Furthermore, the health impact is greatest for those at higher risk; people living in areas of highest deprivation are more likely to suffer these health problems than people living in more affluent areas[5].

Currently, nitrogen dioxide and particulates are the pollutants causing the largest health impacts in the UK. These pollutants are mostly associated with road transport. The public health outcome framework indicator for air pollution is mortality attributable to particulate matter. For the New Forest, this equates to approximately 100 deaths per year caused by long term exposure to particulate air pollution[5].

Published local data[6] from the 3 doctors surgeries in Totton details the prevalence of the common respiratory diseases, asthma and chronic obstructive pulmonary disease (COPD), are slightly above the national average as detailed in Table 2, and Figures 1 and 2.

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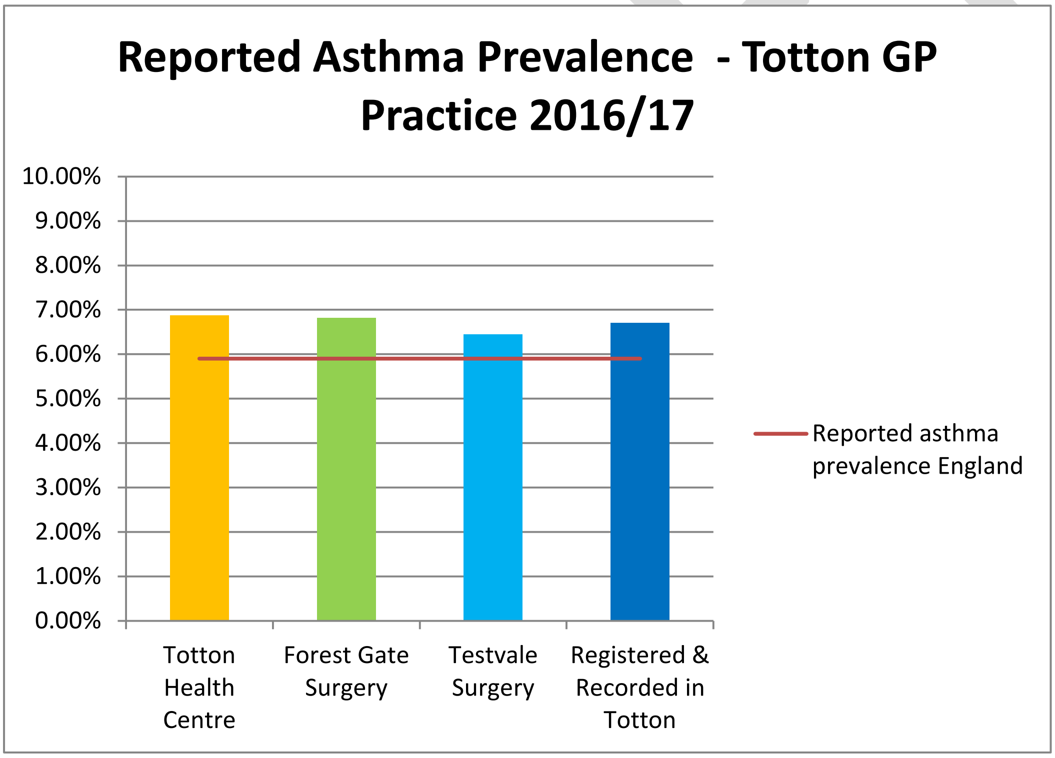
[3] http://www.newforest.gov.uk/article/730/Facts-Figures-and-Research
[4] https://www.newforestnpa.gov.uk/app/uploads/2018/01/aboutus1_keyfacts.pdf
[5] https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/332854/PHE_CRCE_010.pdf

Table 2 Reported data from GP surgeries in Totton detailing asthma and COPD prevalence, for all ages. Comparison with the national reported figures (2016/17)[6]

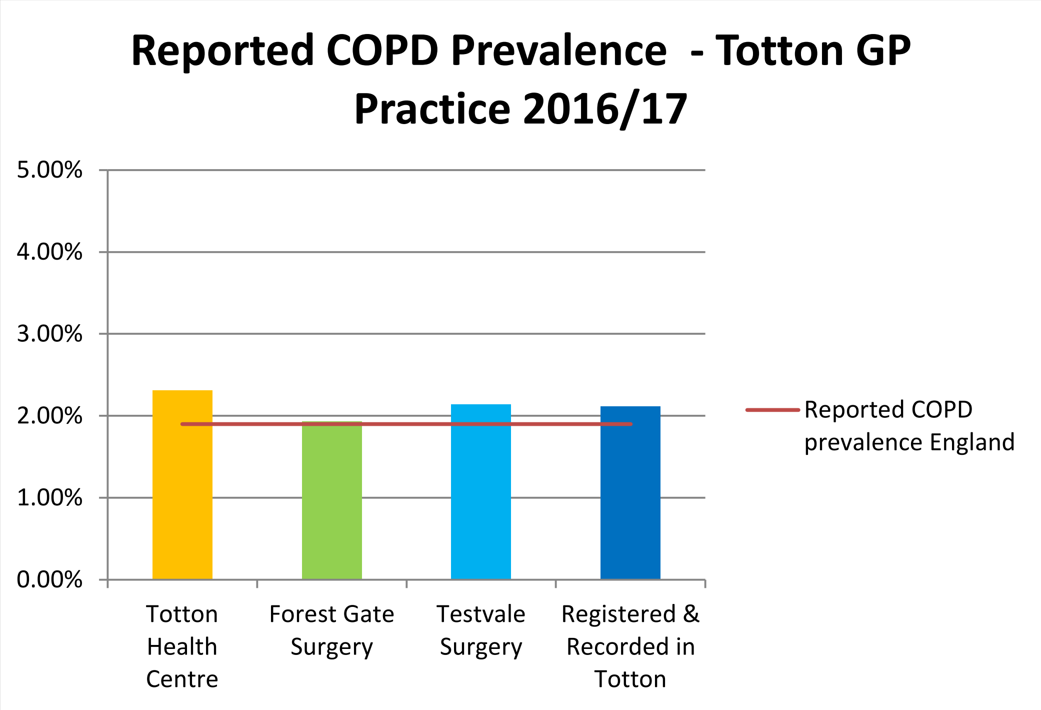
Parameter	Registered and recorded in Totton
Registered total patient list in Totton	38,061
Registered no. of asthma patients in Totton	2,554
Reported asthma prevalence in Totton	6.71%
Reported asthma prevalence in England	5.90%
Registered no. of COPD patients in Totton	805
Reported COPD prevalence in Totton	2.12%
Reported COPD prevalence in England	1.90%

Figure 1 Reported prevalence of asthma in Totton GP surgeries 2016/17[6]



6 https://digital.nhs.uk/data-and-information/publications/statistical/quality-and-outcomes-framework-achievement-prevalence-and-exceptions-data/quality-and-outcomes-framework-qof-2016-17

Figure 2 Reported prevalence of COPD in Totton GP surgeries 2016/17[6]



The local health data[7] reports the mortality rates for various diseases, including respiratory disease. This data advises of the number of deaths where respiratory disease is the underlying cause of death.

The latest reported figures (2011-2015) for Totton advises that within the assessment period, 157 Totton residents died with respiratory disease being the underlying cause of death for all ages. This is a higher number of deaths when compared to deaths from stroke (75) and coronary heart disease (142) in Totton for the same reporting period.

To enable statistical comparisons to be made, a standardised mortality rate (SMR) is utilised. A figure of 100 is the expected number of deaths when respiratory disease is the underlying cause of death for all ages. Totton, for the period 2011-2015, has a SMR of 81.1 which equates to ~19% below what is expected and is therefore summarised as being significantly better than England which is encouraging.

However the SMR for the New Forest is 70 for respiratory disease, therefore Totton has a reported higher mortality rate for respiratory disease compared to the New Forest as a whole. Furthermore, when considering all reported diseases for Totton and the New Forest, it is only respiratory disease which is noticeably higher in Totton than elsewhere in the New Forest as shown in Table 3.

[7] http://www.localhealth.org.uk/#v=map13;l=en

Table 3 Causes of death, all ages, SMR (2011-2015)[7]

Indicator	Totton	New Forest	Hampshire	Expected
All causes	82.9	83.0	89.4	100
All cancers	92.8	87.1	90.7	100
All circulatory disease	77.9	83.7	87.2	100
Coronary heart disease	83.1	82.5	81.5	100
Stroke	75.8	90.8	91.7	100
Respiratory disease	81.1	70.0	82.7	100

It can be concluded from the figures presented, that GP surgeries in Totton report a slightly higher prevalence of respiratory disease (asthma and COPD) when compared to the national average. The standardised mortality rates for respiratory disease for all ages in Totton is significantly better than England however it is notably higher when compared to the rest of the New Forest.

Local air quality

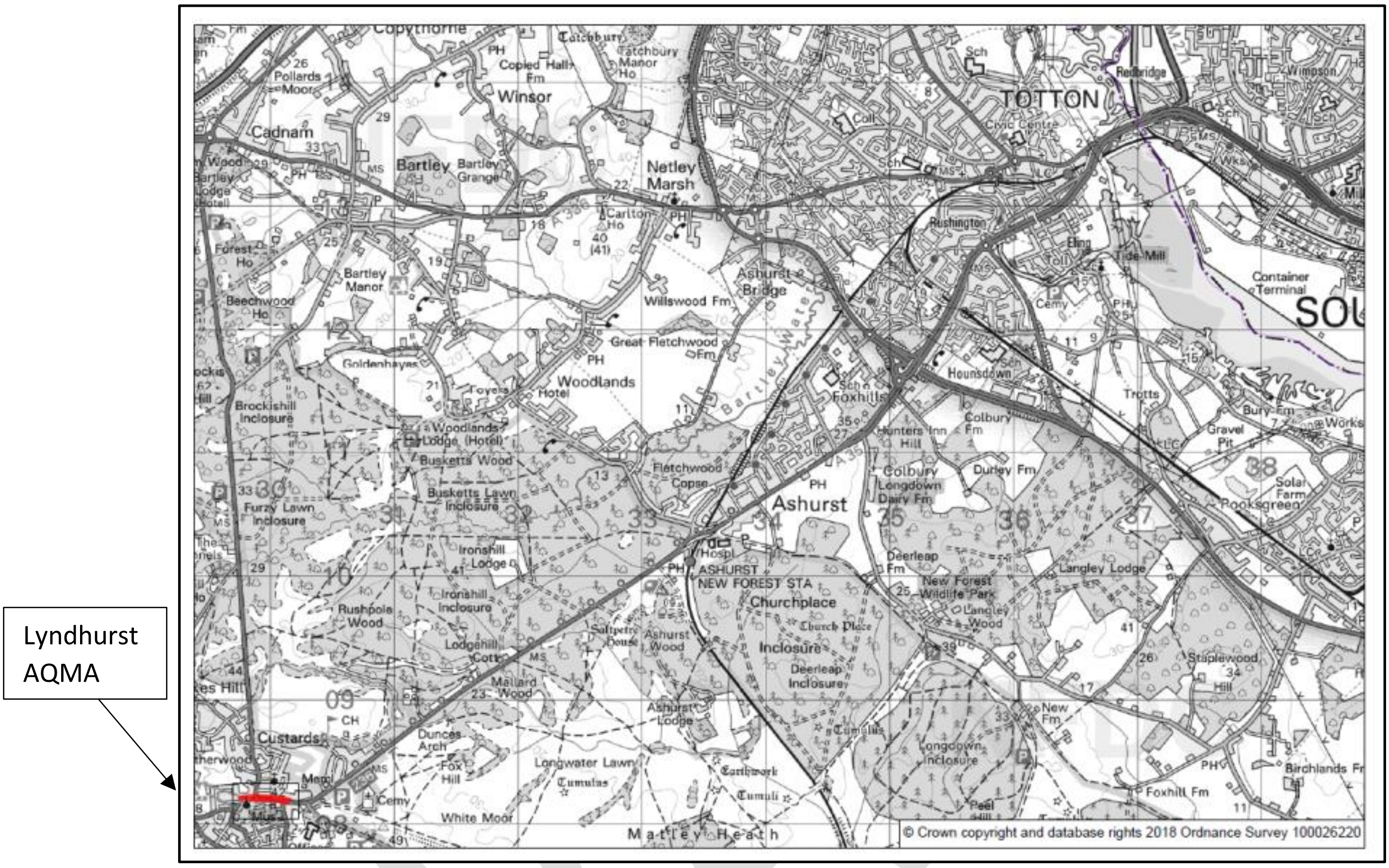
Local Authorities have a statutory duty under the Environment Act 1995, Local Air Quality Management (LAQM) regime to review and assess local air quality. As such, New Forest District Council has been monitoring air pollution across the district since 2004. Three Air Quality Management Area's (AQMA's) were declared in 2005; 2 for exceedances of the annual mean objective for NO_2 in Totton and Lyndhurst and 1 for an exceedance of the 15 min mean objective for sulphur dioxide in Fawley.

Air Quality Action Plans outlined measures to reduce pollutant concentrations in pursuit of the objectives and were adopted for each area in 2008. The AQMA's in Fawley and Totton were subsequently revoked in 2013 and 2016 respectively due to reductions in sulphur dioxide emissions from the refinery (Fawley) and in nitrogen dioxide emissions on the local road network (Totton). The supporting evidence from monitoring data had shown that air quality objectives were being met, and had persistently done so over a number of years. The AQMA in Lyndhurst remains and is shown in Figure 3 in relation to Totton. The Lyndhurst Action Plan[8] is due to be updated in 2019.

In addition, New Forest District Council submits required local air quality reports to Government (Defra) annually. The 2018 report was accepted by Government in August.

[8] http://www.newforest.gov.uk/airquality

Figure 3 Lyndhurst AQMA (highlighted red) for annual mean NO_2



In addition to the annually submitted local air quality reports, New Forest District Council has produced a number of additional reports as directed by the LAQM regime. A summary of these reports is shown in Table 4.

Table 4 New Forest District Council Air Quality Review and Assessment in addition to annual reports to Government

Year	Action	Description
2005	Declaration of Air Quality Management Area's (AQMA's)	Totton – NO_2 (annual mean) Lyndhurst – NO_2 (annual mean) Fawley – SO_2 (15 min mean)
2006	Modelling Report (AEA Technology)	For predicted NO_2 concentrations concerning proposed traffic scenarios within Lyndhurst AQMA
2008	Formal adoption of Action Plans	Totton – NO_2 Lyndhurst – NO_2 Fawley – SO_2
2008	Modelling Report (AEA Technology)	For proposed traffic scenarios within Lyndhurst Air Quality Action Plan – recommendation to forward 2 options

Year	Action	Description
2008	Monitoring Report (AEA Technology)	6 month survey of PM_{10} in Totton and Lyndhurst. No requirement for further action.
2010	Feasibility Study (Hampshire County Council)	Assessing transport options for Totton to improve air quality within the Air Quality Management Area – concluded no feasible transport scheme is appropriate.
2011	Modelling Report (AEA Technology)	For proposed traffic scenarios within Lyndhurst Air Quality Action Plan – some reductions in NO_2 predicted but at the expense of vehicle flow.
2013	Revocation of AQMA	Fawley AQMA (SO_2 15 min mean objective) revoked in April 2013
2013	Progress Report	Current AQMA's in Lyndhurst and Totton (NO_2 annual mean objective) On advice from air quality helpdesk to consider revoking Totton AQMA (NO_2 annual mean objective) due to no recent exceedances at monitoring sites
2016	Revocation of AQMA	Totton AQMA (NO_2 annual mean objective) revoked in June 2016
2018	Updating Lyndhurst Action Plan	Work started, completion due spring 2019

Current measures

In addition to the work being undertaken to improve local air quality in Lyndhurst through the Action Plan[8], New Forest District Council is working to implement District wide measures to improve local air quality. These measures are summarised in Table 5.

Table 5 Current district wide measures to improve air quality

Type	Action	Description	Status
Council Fleet Emissions	To increase numbers of low emission vehicles within the Council fleet	Procurement of low emission vehicles in Council fleet. A task and finish group is working to forward this measure. No current details on figures for additional vehicles and timeline.	Active
Council Fleet Emissions	Eco-safe driver training for NFDC fleet drivers	Provision of eco driving for NFDC Council fleet drivers to improve efficiency and reduce emissions	Completed
Electric vehicle charge points	Installation of electric charge points on Council owned land	Council working with Hampshire County Council scheme to review Council owned land and car parks with a view to install electric vehicle charge points by 2020	Active
Hospital bus scheme	Provision of a dedicated bus route between Totton and Southampton Hospital	Scheme under development by local Councillor with support from a local bus company.	Under development
Engagement	Council departments, New Forest National Park Authority, Local Authorities and external bodies such as Environment Agency, industry	Working in partnership to promote schemes to improve local and regional air quality, for example linking air quality and health and well-being schemes (increasing activity) by providing and promoting local walking and cycling routes	Active
Engagement	Schools	Working in partnership with Hampshire County Council to engage in sustainable transport plans, clean air walking route and local air quality monitoring schemes	Active

Type	Action	Description	Status
Engagement	Anti-idling campaign	Campaign to reduce unnecessary engine idling at key locations around the District – currently active in Totton and Lyndhurst. Banner, signs and media campaign	Active
Engagement	Clean Air Network	To support Southampton City Council in the Clean Air Network scheme for residents and businesses within New Forest	Active
Planning policy	Air quality supplementary planning document	Setting the minimum standard for good air quality practices for new developments	Regional document under development
Council Strategy	Clean Air Strategy	A long term strategy outlining the Council's aims, objectives and actions to improve air quality across the district	To be developed
Council Strategy	Health and Wellbeing Strategy	A long term strategy outlining the Council's aims, objectives and actions to improve health and wellbeing across the district which link in to the Joint Strategy Assessment	To be developed
Sustainable travel	To implement cycling infrastructure as an extension of the western approach cycling scheme in Southampton to the A35, Totton.	This scheme is to encourage increased cycling between New Forest and Southampton, encourage active travel and reduce car trips on the A35.	Being implemented

Strategic Fit

Whilst it is acknowledged that air quality in the New Forest is generally good, New Forest District Council is committed to continued improvements to local air quality with the available resource. Being named as a second tier local authority has increased interest in the local air quality agenda (politically, and with business and the public) and highlighted additional work areas to be investigated , such as further joint working with neighbouring authorities (including Southampton) and businesses, improving education and implementing measures to lead by example.

As advised in Table 5 and through the Local Air Quality Management regime, the Council continues to contribute towards the wider public health agenda by identifying work streams where it can lead or participate in, which will improve local air quality. An Environment Strategy is to be drafted which supports the priorities in the Corporate Plan 2016-2020 and will include a specific New Forest Air Quality Strategy which covers the whole of the district.

National and local modelling

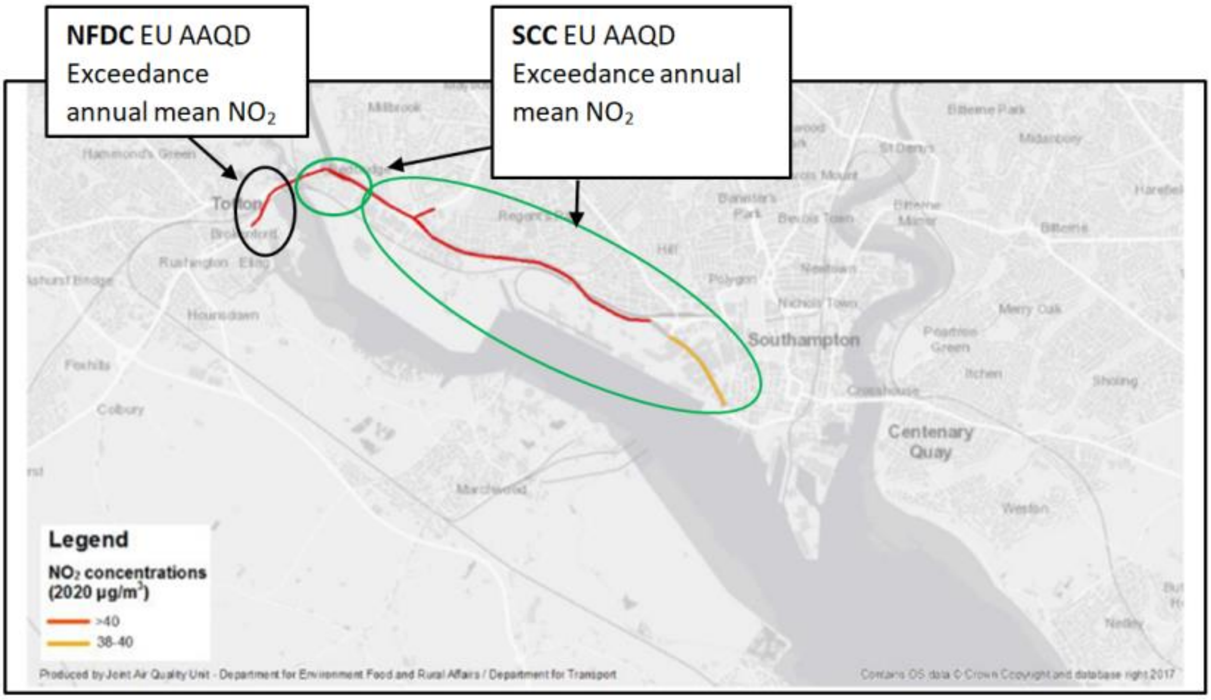
<u>National modelling</u>

As advised, in 2017 the Government published its' air quality plan[1] to reduce roadside NO_2. The plan named 23 (second tier) authorities, including New Forest District Council, and required the named authorities to devise their own 'local plans' to improve air quality. This section will advise on the work undertaken to determine the extent of the issue identified by Government.

The exceedance of concern is the annual mean NO_2 concentration in relation to the EU AAQD ($40µgm^{-3}$).

The area of concern within the New Forest is a short stretch of the A35 (less than 1km) on the boundary with Southampton City Council. The area identified by the PCM model within the New Forest is seen as an extension of the exceedances identified in Southampton in 2015. Figure 4 shows the location of the EU AAQD exceedances within the New Forest District Council and Southampton City Council boundaries as identified through the Government's Pollution Climate Mapping (PCM) model.

Figure 4 PCM projected Area of Exceedance (2020) for Southampton and New Forest (Defra 2017 National Plan)[1]



Southampton City Council was identified by Government in 2015[2] as one of 5 cities (first tier authorities) required to formulate a plan to improve local air quality. Areas in the City were identified by the Government plan as likely to exceed the EU AAQD for NO_2 in 2020, including the Western Approach (A33) which borders the A35 in New Forest. Southampton City Council has been working to improve local air quality within the City since the 2015 Plan.

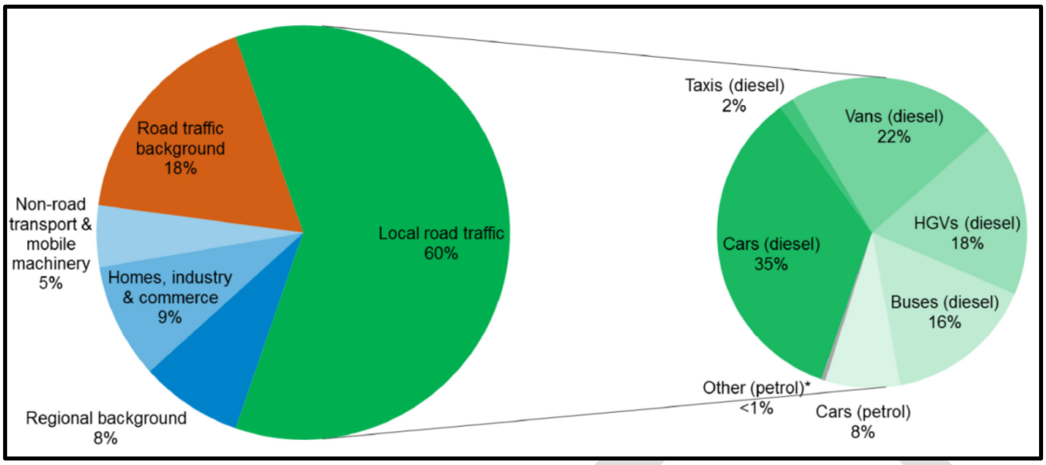
Following New Forest District Council being named in 2017 as a second tier authority in the Governments updated Plan[1] (but with the identified area being determined as an extension of the issue identified in Southampton City Council) the two authorities have been working in partnership to improve local air quality and ensure compliance with the EU AAQD. This partnership working has enabled the identified issues and solutions to be viewed across both authorities with the sharing of resource, services and knowledge. Whilst both local authorities have been working together it is advised that **each authority is only responsible to ensure compliance is met in their own authority's area.**

It is important that each authority ensures any implementation of measures to deliver compliance does not negatively impact on the air quality of surrounding areas. By working closely with Southampton City Council, New Forest District Council can be confident that any implementation of measures undertaken in Southampton will **not** negatively impact on local air quality in the New Forest area.

<u>Source apportionment</u>

As advised, transport is likely to be the main source of NO_2 at roadside locations, and is therefore the target when reductions in NO_2 emissions are required. Local source apportionment figures for the area of interest in the New Forest are not available, however the Government Plan[1] advises as a UK national average 60% of roadside NO_x is attributed to local road traffic. This 60% contribution is further apportioned to vehicle types, with ~92% of roadside NO_x emissions from local traffic being attributed to diesel vehicles as shown in Figure 5. This information was used in the national PCM model.

Figure 5 UK national average NOx roadside concentrations apportioned by source of NOx emissions, 2015[9]



Local modelling - New Forest

Whilst the PCM model identified a short stretch of the A35 in the New Forest, the local model domain was extended to include central Totton, as shown in Figure 6 (as detailed Appendix 2 - Southampton Clean Air Zone – Air Quality Modelling Methodology Report (AQ2)). This was to determine the air quality baseline on the adjacent local road network.

Figure 6 Local model domain – New Forest

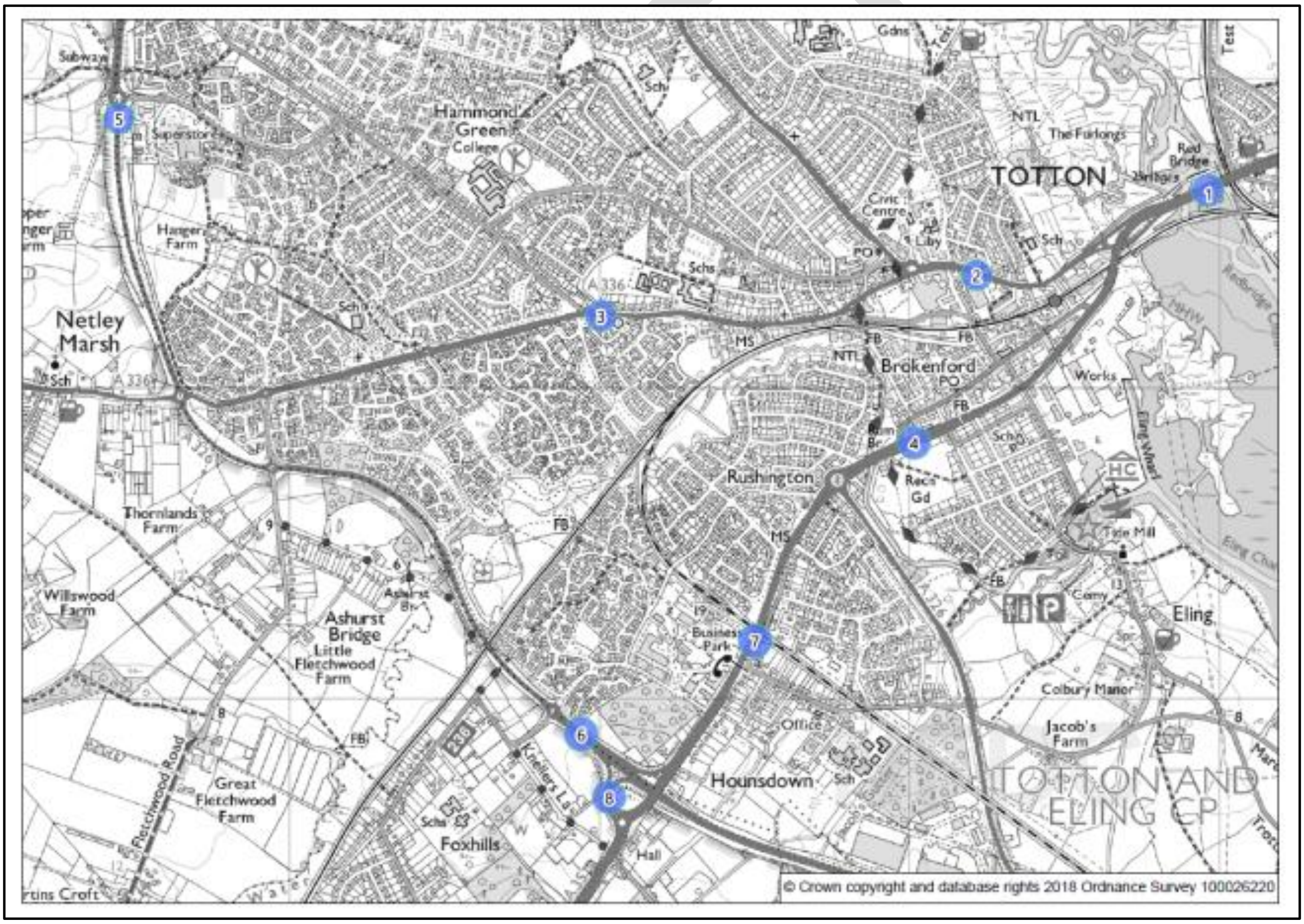
[9]https://assets.publishing.service.gov.uk/government/uploads/system/uploads/attachment_data/file/633270/air-quality-plan-detail.pdf

Local business as usual (baseline) results

The 2020 results represent a Business As Usual (BAU) scenario for the New Forest where only measures currently implemented to improve air quality were modelled. The local model also provides results for the annual mean NO_2 concentrations at EU AAQD relevant locations as advised in the PCM model, therefore enabling a comparison of the model output between the PCM and local models.

Figure 7 shows the locations of the reporting points within the PCM and therefore local model

Figure 7 PCM and local model reporting points



A summary of the national PCM model and local model results for NO_2 within the New Forest is shown in Table 6. The locations identified are based on those provided from the national PCM model.

Table 6 NFDC annual mean NO_2 at EU AAQD relevant receptors (PCM and Local Model comparison)

Census ID	ID location on map (Figure 4)	PCM			Local Model		
		NO_2 Annual Mean ($\mu g/m^3$) 2015	NO_2 Annual Mean ($\mu g/m^3$) 2019	NO_2 Annual Mean ($\mu g/m^3$) 2020	NO_2 Annual Mean ($\mu g/m^3$) 2015	NO_2 Annual Mean ($\mu g/m^3$) 2019	NO_2 Annual Mean ($\mu g/m^3$) 2020
36375	**1**	**57.3**	**47.7**	**45.0**	**44.1**	35.8	33.7
56960	**2**	32.5	28.8	27.4	**49.6**	38.0	35.1
48475	**3**	24.2	22.1	21.2	29.2	24.3	23.1
16341	**4**	**43.1**	36.4	34.5	39.9	32.8	31.0
78316	**5**	30.0	26.0	24.6	19.0	16.6	16.0
28356	**6**	27.8	24.0	22.7	23.4	19.9	19.0
38492	**7**	35.0	30.7	29.2	32.2	25.8	24.2
74832	**8**	21.4	18.7	17.8	30.0	25.0	23.8

Note: Results in red show exceedances of the annual mean NO_2. Compliance concentration is 40µgm^{-3}

PCM Model

The national PCM model identified;

- 1 exceedance at Location 1 (census ID 36375 - A33 Redbridge Causeway) in 2015 and 2020.
- 1 exceedance at Location 4 (census ID 16341 - A35 Totton Bypass) in 2015 but this is compliant in 2020.

Local Model

The local model identified;

- 1 exceedance at Location 1 (census ID 36375 - A33 Redbridge Causeway) in 2015 but this is compliant in 2019.
- 1 exceedance at Location 2 (census ID 56960 - A36 Commercial Road) in 2015 but this is compliant in 2019.

Further clarification has been obtained from the air quality consultants, Ricardo, with regards to a possible explanation to the differences between the PCM model and local model results, particularly with regards to the exceeding road link on the PCM model which showed compliance in the local model (link ID 1 as shown in Table 6). The PCM model predicted an exceedance of the NO_2 EU AAQD in 2020 with a value of 45µgm^{-3} however the local model predicted the maximum NO_2 concentration on this road link as being significantly lower at only 34µgm^{-3}.

A simple comparison of the input values in relation to vehicle flows and vehicles speed used in the national PCM model and the local model indicate why this difference arises. The input values are shown in Table 7.

Table 7 Traffic flows and speeds on PCM link ID36375 (ID location 1 as shown in Figure 7)

	PCM model (two way flows)			**Local Model (two way flows)**		
Parameter	**AADT[1]**	**Car pc[2]**	**Speed/kph**	**AADT[1]**	**Car pc[2]**	**Speed/kph**
2015 max link	62,759	0.96	34.4	42,844	0.91	71.5
2020 max link	63,610	0.96	34.5	68,530	0.92	64.0

Notes *[1]AADT = annual average daily traffic count*
[2]car pc = percentage of cars

The key difference is the much higher speeds estimated in the local model based on measured traffic master data. These speeds are located at a much lower point on the speed emission curve for these vehicles and hence generate much lower road emissions on these road links. There is also a lower annual average daily traffic count (AADT) in 2015 compared to the PCM model, but a similar value in 2020. The change in AADT in the local model is driven both by traffic growth and also a shift in location of the maximum concentration along the PCM road link.

Therefore, the baseline data from the local model confirms that both identified exceedances in 2015 are removed by 2019 and compliance with the EU AAQD at the PCM model locations is likely to be met. The local model also confirms the results in 2019 at the PCM modelled locations are predicted to be 38.0µgm^{-3} or less, and 35.1µgm^{-3} or less in 2020 as shown in Table 6. The local model has a margin of error of 3.3µgm^{-3} therefore no locations identified within the local model are outside the margin of error in 2020. **This provides additional reassurance and confidence that by 2020 New Forest District Council will be compliant with the EU AAQD.**

In addition to assessing the NO_2 concentrations at the PCM locations, the local model was extended around Totton. The results for the baseline in 2020 are shown in Figure 8 with results determined to be at or less than 35.1µgm^{-3} in 2020.

Figure 8 Local model results for assessment area showing 2020 baseline business as usual results

Due to the local modelling showing New Forest District Council being compliant with NO_2 concentrations in 2019, it is the duty of the council to explore any measures which can be implemented to bring forward compliance in a shorter timescale.

Spending objectives

Spending objectives have been laid out to ensure the requirements of the Government Plan are met. The Primary Spending Objective of the Local Plan is to achieve compliance with the EU AAQD for annual mean NO_2 in the <u>shortest possible time</u>. All measures explored to bring forward compliance must meet this primary spending objective.

Any measures that pass the Primary Spending Objective will be taken forward and Secondary Spending Objectives will be considered. The Secondary Spending Objectives include:

- Affordability
- Achievability
- Value for money
- Distributional impacts
- Contribution to public health
- Fit with local strategies

Having considered the spending objectives and completed options appraisal of the measures (as detailed in section 2.0 Economic Case) New Forest District Council has concluded that there are no additional measures that can be implemented to bring forward compliance quicker than the business as usual (baseline) scenario.

Conclusion

Based on the results of the local air quality modelling assessment which utilised local information, air quality and transport data, it is concluded that compliance with the EU AAQD for the NO_2 annual mean will be met by 2019 without the implementation of any additional measures to reduce NO_2 concentrations.

2.0 ECONOMIC CASE

2.1 Final plan methodology

The national PCM model which identified the road of concern (the A35 within the New Forest) provided the Council with a starting point to assess local air quality. In order to better understand the issue, a more detailed model was required to provide a local level of understanding of the potential air quality issue. The aim of the local model was to;

- deliver a more accurate baseline of air quality levels in the New Forest area of concern, comparing them with the PCM model, and;
- assess any options being considered for implementation to ensure compliance with the EU AAQD and delivery of the pollutant reductions required.

In order to achieve the above, further detailed air quality modelling work with a finer resolution than the PCM model was undertaken using localised input parameters such as local emission sources, local air quality monitoring and fleet composition information. New Forest District Council procured the services of two consultants currently working on the exceedances in Southampton; Ricardo (air quality) and Systra (transport) to complete this work.

Local air quality assessment methodology

Full details of the air quality assessment methodology are provided in Appendix 2 (AQ2), (Southampton Clean Air Zone – Air Quality Modelling Methodology Report (AQ2)), however this section summaries the air quality assessment methodology.

The modelling report (AQ2) is a result of the joint working partnership with Southampton City Council and includes details of the modelling work completed within Southampton City Council's boundary.

It is advised that Southampton City Council is currently working to update the model and options appraisals detailed for the city and therefore at this time the report (AQ2) only applies to the work completed for New Forest District Council.

<u>Dispersion model</u>

The air quality consultants, Ricardo, utilised a modelling system known as RapidAir to undertake the local model for the New Forest. This is the same system used to model the Southampton City Council local model area.

The purpose of the local model was to obtain a finer resolution of air pollution over the assessment domain. The RapidAir model enables a 1m resolution therefore modelled results can be extracted at receptor points anywhere on each of the 1m model output grid.

The RapidAir model has been developed for urban air pollution assessment, taking into account surface roughness and road variations such as street canyons, road gradients and fly-overs. A compliance assessment, detailed in Appendix 1 (Air quality tracker table – AQ1)), has been completed to ensure the local model meets Government requirements. Further information concerning the RapidAir model is detailed in Appendix 2 (AQ2).

The local model output provides NO_2 concentrations for the base year and projects the pollutant concentrations at the same locations in subsequent years. The local model therefore provides details of any non-compliant locations within the local domain and indicates, with a business as usual scenario, in which years those locations will become compliant. If required, the local model can also be run to take into account any additional scheme's to determine if the air quality compliance will be met or brought forward at particular locations.

Assessment years

There are two key years for the air quality assessment, the base year (2015) and target compliance year (2020). The year 2015 was selected for the base year as it covers the latest air quality and transport data and is the base year for the transport model. The air quality model also assesses the interim years 2016-2019 (inclusive).

Additional local model inputs

In addition to the model set up as advised above, a number of local input parameters were required to determine the local scenario. These included vehicle emissions, other local pollution sources, weather data and local monitoring data.

The local monitoring data was as follows;

a) Road transport - vehicle emissions

Whilst contributions to local air quality are derived from multiple sources, road transport is the main source of pollution identified in the Southampton Clean Air Zone area and the focus of the local model. This local road transport information was therefore input into the air quality assessment.

The local air quality model determines the emissions from vehicles on the road network by using the latest published vehicle emission rates (COPERT v5 NO_x). These emission rates are dependent on a number of factors including;

- vehicle number, presented as an annual average daily traffic (AADT) count,
- vehicle type (buses and coaches, taxi's, rigid heavy goods vehicles (HGV's), articulated HGV's, light goods vehicles (LGV's), cars and motorcycles), using traffic counts and automatic number plate recognition (ANPR) camera survey (5-11 December 2016),
- vehicle speeds,
- fuel use, and;
- Euro classification of the vehicle, obtained from ANPR camera survey.

These vehicle details required for the air quality local model were provided from the transport model (provided by Systra) and are detailed further in the local transport assessment section.

b) Other sources

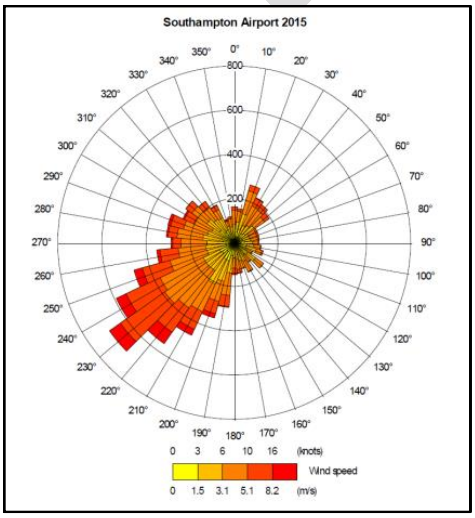
Pollution from other large sources was also included in the local model and these local sources were:

- Emissions from Southampton Port, including vessels and onshore port activities,
- Industrial emissions from a waste incinerator and gas power station both located at Marchwood Industrial Park in the New Forest. Both these industries are permitted to operate by the Environment Agency, and
- Local rail emissions

c) Weather data

The 2015 meteorological dataset from Southampton Airport was assessed and used within the local model to present local weather details. Figure 9 details the wind rose from the Southampton airport dataset and shows a predominately SW wind during 2015.

Figure 9 2015 wind rose – Southampton airport

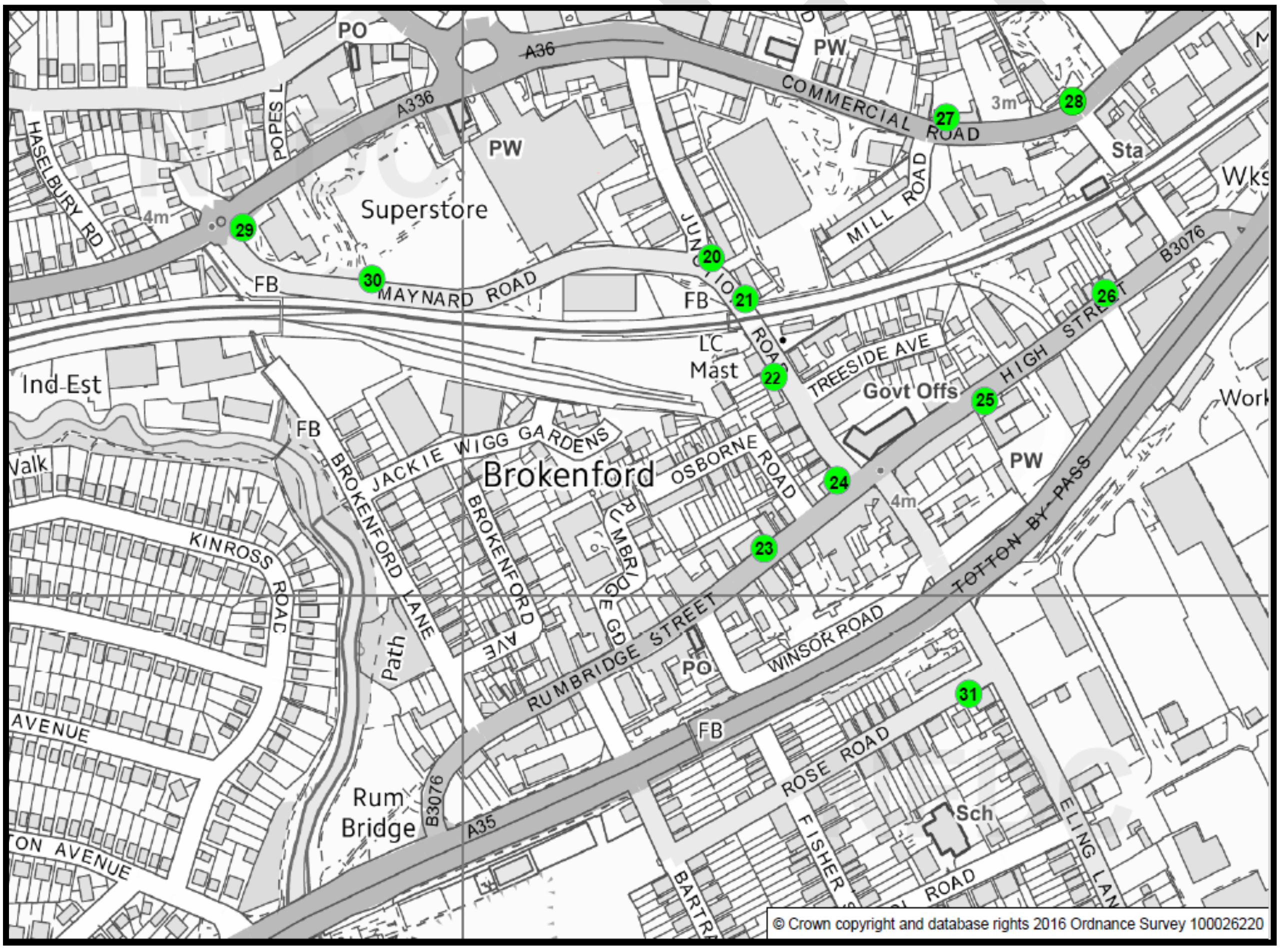


d) Local monitoring

New Forest District Council has been undertaking local monitoring of nitrogen dioxide (NO_2) over a number of years. This was due primarily to the declaration of an Air Quality Management Area (AQMA) for the likely exceedance of the annual mean NO_2 objective in central Totton. The AQMA in Totton was declared in 2005 with additional real time monitoring and passive diffusion tube monitoring set up within the town. The AQMA was subsequently revoked in 2016, however monitoring in Totton has continued.

The local (ratified) monitoring data from 2015 was used in the local model as model receptor locations and to verify the local model outputs. Figure 10 shows the local monitoring locations used in Totton in 2015. Further details of the local monitoring, including the local model (New Forest) verification are provided in Appendix 2 (AQ2, New Forest local monitoring, model verification and adjustment advised in Appendix 2).

Figure 10 Local monitoring locations in 2015



Transport assessment methodology

Full details of the transport assessment methodology are provided in Appendix 8 (Transport Modelling Methodology Report (T3)) and Appendix 9 (Model Forecasting Report (T4)), however this section summaries the transport assessment methodology.

The modelling reports (T3 and T4) are a result of the joint working partnership with Southampton City Council and include details of the modelling work completed within Southampton City Council's area. It is advised that Southampton City Council is currently working to update their local air quality model and options appraisals detailed for Southampton City and therefore at this time the transport reports (T3 and T4) only applies to the work completed for New Forest District Council.

The transport consultants, Systra developed a Sub-Regional Transport Model (SRTM) on behalf of Solent Transport to support a wide ranging set of interventions across the region, such as forecasting changes in travel demand, public transport use, and testing impacts of transport policies and interventions. This is the basis of the transport model used in the Southampton Clean Air Zone work.

The SRTM is a suite of transport models linking a variety of components such as journey choices, road traffic routes, public transport and local economic impacts. The base year survey data (e.g. traffic counts) has been updated to 2015, and therefore this is the year used as the air quality local model base year.

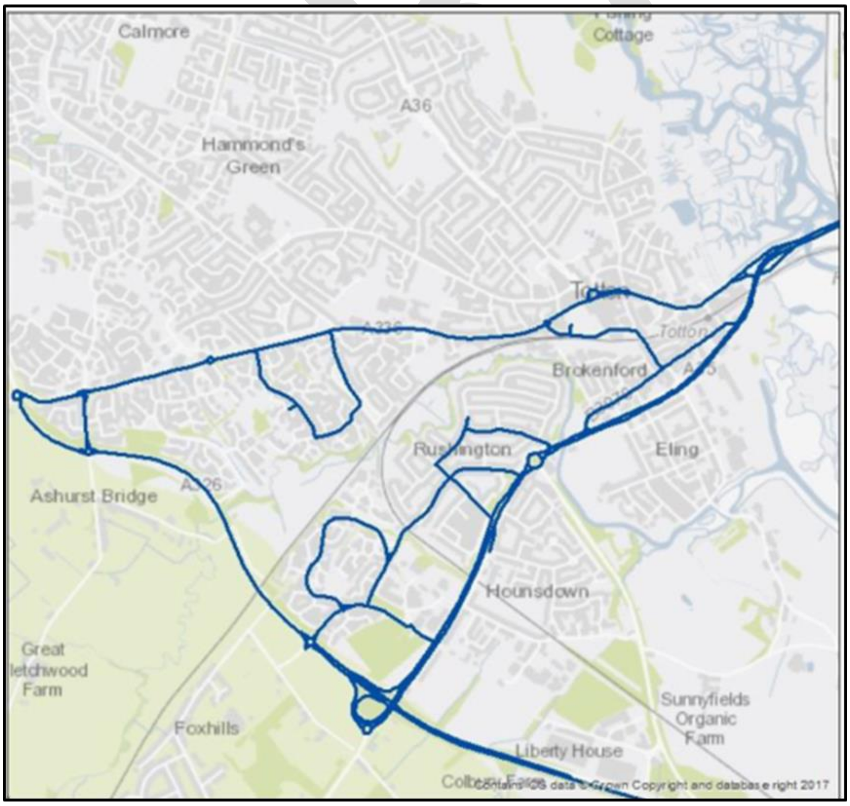
As previously advised, detailed vehicle information such as vehicle numbers, vehicle types, fuel use and Euro classifications are required to input into the air quality local model to obtain reliable outputs. This local vehicle information was determined from local transport counts and an automatic number plate recognition (ANPR) camera survey undertaken between 5 and 11 December 2016. This information was used in the determination of the transport baseline data.

Figure 11 shows the survey points in New Forest and Southampton used in 2015 to collate survey data in 2015.

Figure 11 Survey points in New Forest used to update base data in 2015

The New Forest road links used in the traffic model (as provided by Systra) are shown in Figure 12.

Figure 12 Road links in New Forest used in model domain



Once the baseline data (2015) was determined, the future year's annual average daily traffic (AADT) flows and vehicle types for each of the modelled road links could be obtained from the transport model. This data was then used within the local air quality model for the New Forest.

2.2 Options appraisal

As outlined in the Strategic Case, the UK has a legal requirement to achieve compliance with the EU AAQDs (annual mean NO_2 concentration of $40 \mu g m^{-3}$) in the shortest possible time. Therefore, any option under consideration must bring forwards compliance from the 'business as usual' situation. A 'long list' of options should be considered and assessed to create a 'short list' for further consideration to identify a preferred option to ensure the primary objective (compliance in the shortest time possible) is achieved. Only options meeting the primary objective will be taken forward into the short list for further detailed consideration against the secondary objectives (if required). Any options which fail the primary objective will be eliminated from the long list of options being considered further.

2.3 Long list

The baseline local model concluded that compliance in the New Forest would be met by 2019 in a business as usual scenario. However, an options appraisal assessment was also undertaken to determine if the implementation of any other available option(s) would bring compliance forward in the New Forest.

Through the joint partnership working with Southampton City Council a long list of options for New Forest has been considered. Table 8 advises of the long list of options for further consideration and includes the list of options being considered or currently implemented by Southampton City Council that may impact on the New Forest. Through the partnership working with Southampton, New Forest District Council has been able to assess such schemes and confirm, **if implemented, that there would be no adverse impact on air quality the New Forest.**

Table 8 Long list of options considered for New Forest

Scope options	Business as usual in NFDC	Impact of SCC proposed current options – (1) city wide charging CAZ B	Impact of SCC proposed current options – (1a) city wide charging CAZ HGV's only	Impact of SCC proposed current options – (2) city centre charging CAZ A	Impact of SCC proposed current options – (3) Additional non-charging measures	Bus retrofit in SCC and surrounding area including Totton	SCC cycling network – Western Approach	SCC / Eastleigh taxi incentive scheme
Additional information		Current short list of options being considered further by SCC				Agreed or implemented non-charging options (SCC)		
Estimated date of compliance in NFDC	2019	2019	2019	2019	2019	2019	2019	2019
Shortest possible time	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**
Comment		**All schemes due to be implemented in 2019 (if forwarded) but not before. Therefore nothing delivers compliance before the business as usual scenario.**						
Decision		**Taken forward for further assessment by SCC** but the scheme will not bring forward compliance for NFDC. If implemented the option would be implemented in 2019	**Rejected by SCC**	**Rejected by SCC**	**Taken forward for further assessment by SCC** but the scheme will not bring forward compliance for NFDC. If implemented the option would be implemented in 2019	**Taken forward**- by SCC. This scheme will lower emissions from buses accessing A35 in NFDC. However compliance will not be brought forward due to implementation dates in 2019	**Taken forward**- by SCC. This scheme will lower emissions by encouraging cycling into SCC including from NFDC and along the A35. However compliance will not be brought forward due to implementation dates in 2019	**Taken forward**- by SCC. This scheme has been **implemented** and provides funding to upgrade to lower emission vehicles. This will lower vehicle emissions from SCC and Eastleigh taxi's accessing A35 in NFDC. However compliance will not be brought forward as a stand-alone scheme due to the numbers of taxi's involved. Currently ~90 vehicles have upgraded within a year.

Scope options	Development of feasibility study for improvement cycling network from NFDC into SCC	Updating NFDC taxi policy to consider a vehicle age limit on licensed vehicles, and potential taxi incentive schemes	Hospital bus scheme	No-idling campaign	Upgrade NFDC fleet	Electric vehicle charging points	Engagement with schools and businesses to educate and communicate air quality issues	Supporting low emission transport schemes – My Journey Hampshire, Clean Air Network and Hants Lift Share	SCC / NFDC partnership working	Working with ABP on container port at Eling Wharf, Totton
Additional information	**Options to be implemented (New Forest)**			**Options currently implemented (New Forest)**						
Estimated date of compliance	Post 2020	Post 2020	n/a	n/a	Post 2020	Post 2020	n/a	Post 2020	n/a	n/a
Shortest possible time	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**	**Fail**
Decision	**Taken forward** by NFDC with HCC. Funding obtained (£50k) to produce a feasibility study to improve the local cycle network in NFDC in the Totton / Waterside area. However compliance will not be brought forward due to implementation dates post 2019	**Taken forward** by NFDC to update the taxi policy (currently no age limit for licensed vehicles) to potentially introduce an age limit or link to Euro classification Also interest in implement a similar taxi incentive scheme to the SCC / Eastleigh. Compliance will not be brought forward due to implementation dates post 2019	**To be taken forward** by NFDC. Scheme requires forwarding for a new local bus route to transport Southampton Hospital staff between Totton and Southampton. Requires development and implementation will be post 2019	**Scheme already active** by NFDC. Scheme implemented in central Totton and Lyndhurst AQMA encouraging drivers to turn off their engines whilst stationary. This scheme will not impact directly on vehicles accessing the A35 which is a free flowing route. Expansion of the option is unlikely to yield a significant change in the time required.	**Scheme already active** by NFDC. Expansion of the option is unlikely to yield a significant change in the time required due to the number of vehicles involved.	**Scheme already active** by NFDC. NFDC linking with HCC scheme in install additional electric charge points on Council owned land by 2020 to reduce vehicle emissions by encouraging uptake of low emission vehicles. Implementation of this option is unlikely to yield a significant change in driver behaviour in the time required.	**Scheme already active** by NFDC and HCC sustainable transport scheme. Work will continue but expansion of the option is unlikely to yield a significant change in the time required.	**Scheme already active** by NFDC and SCC. These schemes will lower vehicle emissions by encouraging reductions in vehicle use into SCC including from NFDC and along the A35. However Expansion of the option is unlikely to yield a significant change in the time required due to the number of vehicles involved	**Taken forward.** This scheme will enable the two authorities to work together to achieve regional AQ improvements. However this scheme will not directly impact on compliance with the primary objective	**Taken forward** by NFDC. ABP owns a container port in NFDC adjacent to the A35 highlighted by the PCM model. NFDC is working with ABP to improve this site including vehicle (typically HGV) movements to and from Southampton Port

2.4 Short list

As advised above, any options which achieve compliance with the EU directive for the annual mean NO_2 objective **AND** ensure compliance is met in the shortest time possible will be taken forward into the short list.

The local model for the New Forest determined that compliance with the EU directive would be met with a business as usual scenario in 2019, therefore any additional options being taken forward into the short list would have to also ensure compliance would be met in 2019. Table 8 advises of a number of options, as detailed below.

- Business as usual;
- Option 1 - city wide Class B Clean Air Zone (CAZ) through which non-compliant coaches, buses, taxis and HGV’s are charged to enter the zone;
- Option 1a - city wide charging CAZ for non-compliant HGV’s only;
- Option 2 - city centre Class A charging CAZ for non-compliant coaches, buses and taxis;
- Option 3 - implementation of additional measures – a non-charging CAZ;
- Bus retrofit;
- SCC / Eastleigh taxi incentive scheme, and;
- SCC cycling network improvements.

Despite the business as usual scenario delivering compliance in 2019, these options were considered as part of the short list with the joint working with Southampton City Council.

Of particular interest are the 4 options (Option 1, 1a, 2 and 3) considered by Southampton City Council to achieve their own compliance within the city. These options were also modelled in the New Forest local model to ensure if any were implemented in Southampton that there would be no adverse impact in the New Forest. The local model results are presented in Appendices 3 and 4 (AQ3).

The impact of each of the 4 proposed options for Southampton in the New Forest is similar, with an average reduction in NO_2 concentrations in the New Forest (at the PCM identified locations) of about 2%. Therefore, all the proposed Southampton options should reduce NO_2 further in the New Forest, although only slightly. However due to the date of implementation of 2019 for any of these options (Options 1, 1a, 2 and 3) compliance in the New Forest would not be brought forward, therefore these options are discounted from the short list for New Forest.

The impact of the additional Southampton options which will be or have been implemented have not been modelled further in the New Forest. These options should have a positive impact in the New Forest due to their outcome of reducing vehicle emissions, however due to the scale of the scheme (for example the taxi incentive scheme) or schemes with an implementation date in 2019 compliance in the New Forest would not brought forward compared to a business as usual scenario. Therefore these options are also discounted from the short list.

2.5 Preferred option

From the conclusions determined above, no options within the short list would achieve compliance prior to 2019. This is due to;

- the time to implement additional options such as a charging CAZ in Southampton (to be implemented in 2019 if forwarded as Southampton City Council's preferred option); or,
- the current implemented schemes (i.e. the taxi incentive scheme) not being taken up to the extent that the impact would ensure compliance in the New Forest is brought forward.

As such, **the preferred option for New Forest District Council to achieve compliance in the shortest time possible is a business as usual scenario**.

2.6 Sensitivity analysis

Sensitivity analysis is a further modelled analysis technique used to determine how sensitive the proposed options are to the assumptions made within the model. On the advice of the air quality consultants (Ricardo) additional sensitivity analysis has not been undertaken for the New Forest local model. Ricardo has provided the following statement to support their advice:

The maximum NO_2 concentration in 2020 for the current baseline modelling in New Forest is 35 µgm^{-3} on link ID56960 (road link 2 as shown in Figure 7) and is comfortably below the compliance limit value for NO_2. Any sensitivity test that would be carried out would need to change this outcome (i.e. increase concentrations) by more than 5µgm^{-3}. The key sensitivity tests recommended by JAQU on the air quality modelling of the baseline cover: adjusting the light duty fleet composition with regards the Euro 6 real driving emissions stages, adjusting fNO_2 in the NOx to NO_2 conversion and considering gradients and canyon affects. The first 2 of these are unlikely to affect the NO_2 results by as much as 5µgm^{-3}. The latter two tests are not appropriate as there are no canyons or gradients in the areas of concern.

Given these considerations, Ricardo does not consider any of the sensitivity tests proposed would change the overall outcome of the analysis and therefore do not see any value in conducting these tests.

2.7 Conclusion

It is determined that the local model has demonstrated that a business as usual scenario in the New Forest will deliver compliance with the EU Air Quality directive for the annual mean NO_2 objective in 2019 on the PCM road links identified and throughout the model domain. This is detailed in section 2.0 above and evidenced in detail in Appendix 3 and 4 (AQ3).

The further analysis of additional options being proposed and implemented in Southampton City (to ensure compliance with their identified exceedances) and within New Forest has concluded that they will not deliver compliance earlier than 2019 in the New Forest. Therefore a business as usual scenario in the New Forest will deliver compliance in the shortest possible time, and this is the preferred option being forwarded by New Forest District Council. This is because no other option can feasibly bring forward compliance.

It should be noted that New Forest District Council is committed to continue to work in partnership with Southampton City Council to ensure options and measures being considered to achieve compliance in Southampton in the shortest possible time will not have an adverse impact on pollutant levels in the New Forest.

3.0 COMMERCIAL CASE

New Forest District Council is not submitting any evidence with regards to the Commercial Case. This is due to the preferred option being a business as usual scenario therefore no additional options are being forwarded and the Council is not seeking any additional funding to forward specific measures.

4.0 FINANCIAL CASE

4.1 Additional funding requirements

New Forest District Council is not seeking any funding to forward any additional options due to the preferred option being a business as usual scenario. As such no additional evidence is being submitted as part of the Financial Case.

4.2 Current funding

New Forest District Council has some funds available from the grant awarded to second tier named Authorities in 2017 to complete Feasibility Plans to deliver their Local Plan. This funding has been utilised to date to fund the local modelling work and officer resources. The remaining budget (~£28,000) has been highlighted to fund a real time analyser set up and operational costs as part of the planned evaluation and monitoring regime to ensure compliance with the EU AAQD is met on the A35 (as detailed in the Management Case section 5.0). It is anticipated that a real time analyser will be operational until 2023, unless it is deemed appropriate to extend the monitoring period.

New Forest District Council is intending to utilise one of our current NO_x real time analysers in the new site on the A35. Due to upgrades of our NO_x analysers, the Council will have 3 analysers available for its sites (Lyndhurst, Totton (central) and A35). As such the following costs have been obtained for set-up and operation of a new real time analyser on the A35:

- Set-up costs to include base, cabinet, air conditioning unit, data set-up
  £11,000 (funded through current grant funding)
- Site maintenance and data management for 4 years (as per existing contracts)
  £10,000 (funded through current grant funding)
- Local service officer for 4 years (either supplied under maintenance contract or New Forest District Council officer)
  £3,200 - £4,800 (funded through current grant funding)

5.0 MANAGEMENT CASE

5.1 Delivering the preferred option

It has been concluded that a business as usual scenario will deliver compliance with the EU AAQD in the shortest time possible. This does not mean that New Forest District Council will not undertake any further work and therefore a management case for a business as usual scenario is required.

Partnership working

Partnership working has been vital throughout the Clean Air Zone process, not only at a local Government level but with local residents and businesses to access resources, knowledge and views in order to forward a variety of options. Through the Clean Air Zone work New Forest District Council has developed working partnerships which will be continued to ensure the business as usual scenario successfully delivers compliance and also to forward further schemes which improve local air quality. The working partnerships include:

Southampton City Council

It is noted that New Forest District Council and Southampton City Council are quite different authorities in terms of type (District and Unitary) and location (rural and city centre) however we share the common issue of traffic related air pollution, particularly from residents and businesses accessing Southampton city. During the Clean Air Zone process New Forest District Council has worked well with Southampton City Council undertaking local modelling work, developing potential options to improve local air quality and an extensive consultation exercise. This working partnership will continue at the relevant level (typically Service and Team Managers) to ensure compliance is met in both authorities and beyond by sharing resources and knowledge, and developing and delivering regional consistency with the overall aim to improve local air quality.

Hampshire County Council

As a District Authority, New Forest support Hampshire County Council who led on delivering transport and public health schemes. Throughout the Clean Air Zone process this partnership working has developed and will be continued in order to design and implement future local schemes, such as the cycling feasibility scheme for the Totton area, as well as collaborating further with public health colleagues and assessing the local health impact due to air quality.

Local residents and businesses

Through the joint consultation with Southampton City Council it was apparent that local residents and businesses are interested in and passionate about local air quality. It is the intention that future engagement with these groups will continue throughout the development of a New Forest Air Quality

Strategy and in developing local schemes such as improving transport links and encouraging the uptake of public transport.

Monitoring and evaluation

New Forest District Council needs to ensure the concentrations of NO_2 are compliant with the EU AAQD, as determined by the local model in a business as usual scenario. As such it is essential that monitoring in Totton is undertaken and the results compared against the local model, to evaluate whether the local model is performing as advised and therefore compliance will be met. Furthermore local monitoring data can be used to feed into any future local modelling assessments which can cover a larger area than the monitoring work alone.

From the PCM model, the PCM road link identified within the New Forest exceeding the EU AAQD is detailed in Figure 7 as road link 1 which has a link length of 800m. Discussions have been progressing to ensure monitoring and evaluation is undertaken correctly. New Forest District Council has started work with Ricardo (air quality consultants), ESU 1 (air quality equipment suppliers) and Southampton City Council to ensure the correct monitoring is undertaken in the most appropriate locations (avoiding micro-climate environments) to enable the collation of robust and reliable data representing the local area. It is proposed that the monitoring will include the use of diffusion tubes throughout Totton (in addition to the current local monitoring regime) and a real time analyser located on the A35 (should a suitable location be identified) as close to the identified exceedance in the PCM model as possible. Funding is currently available to install and operate the analyser for 4 years as advised in the Financial Case (section 4.0) above.

In accordance with Government Guidance[10] the operation of a real time analyser on the A35 relies on a maintenance engineer and data management team to ensure the data produced is robust. New Forest District Council currently operates 3 real time analyser sites within its district and holds contracts with maintenance and data management contractors. The current contracts, which run until 2020 with a potential plus 2 years, allow the addition of further analysers, therefore the proposed A35 analyser can be added onto the current analyser contracts held by New Forest District Council.

In the interim, New Forest District Council has undertaken some additional monitoring in Totton using diffusion tubes which (after appropriate correction in accordance with Guidance[10]) give an annual mean NO_2 concentration for the monitoring location. Considering the road link of concern is link 1 (as shown in Figure 7) the local monitoring undertaken to date has concentrated along the A35 (roadside) between PCM road links 1 and 4.

The monitoring locations are shown in Figure 13 as locations 32, 33, 34 and 35 alongside additional local monitoring sites in Totton. It was not possible to install a secure monitoring site within road link 1 on the Redbridge Causeway bridge due to no appropriate street furniture being available to ensure a monitoring position of 2-4m and when diffusion tubes were placed in a lower position they were stolen from site. The other monitoring sites installed are able to provide some indication to NO_2 concentrations along the A35.

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[10] https://laqm.defra.gov.uk/documents/LAQM-TG16-February-18-v1.pdf

Figure 13 New Forest PCM road locations and local diffusion monitoring sites

The annual results (to date, after local bias correction for 2018 and distance adjustment to 4m) are shown in Table 9.

Table 9 Local diffusion monitoring results 2018 (03.01.18 – 30.10.18)

Site	NO_2 annual mean / µgm^{-3}
32	29.2
33	40.1
34	34.8
35	39.2

When the monitoring results are rounded to the whole number (as expected for the reporting of annual mean air quality figures) all the monitoring results to date show compliance with the EU AAQD for the monitoring period during 2018.

It is noted that 2 sites (33 and 35) are reporting a being close to the EU AAQD, however monitoring for the whole of 2018 has not been completed to date (only 83% of data has been collated over 2018). The monitoring results should therefore only be viewed as indicative at the monitoring sites. The PCM and local model both conclude that nitrogen dioxide roadside concentrations within the model domain will decrease year on year, therefore it would be expected that the monitored nitrogen dioxide concentrations at these locations will decrease and therefore compliance with the EU AAQD will be met.

Resource

New Forest District Council will still have to deliver a business as usual scenario to ensure compliance is met in the New Forest. As advised above further work will be required, for example monitoring and evaluating NO_2 concentrations on the PCM road links in Totton and forwarding partnership work to improve local air quality.

In order to deliver and maintain the required work, New Forest District Council will ensure sufficient officer resource is delivered within the Environmental and Regulation Service. Currently there is no requirement to increase officer numbers to undertake and deliver this work, and it is not envisaged to change in the future. However, if circumstances do change, the Council will consider an increase in officer resource where deemed appropriate. With regards to the funding of a real time analyser on the A35, further detail is provided in the financial case (section 4.0).

Project Risks

Whilst a business as usual scenario should have limited risks in order to ensure compliance with the EU AAQD, there are some risks to note;

- *Failure to achieve AAQD compliance within the timescale*
  The local model clearly advises compliance with the EUAAQD will be met by 2019, however monitoring and evaluation may not provide the supporting evidence that determines compliance is met. This could be due to;

  - inaccuracies in the local model;
  - changes in the local vehicle fleet;
  - planned road works unaccounted for in the local model; or,
  - other pollutant sources which were not accounted for in the model.

  Evidence to support the local model, including model verification and assumptions are provided in Appendices 1, 2, 3, 4 and 5 (AQ1, AQ2, AQ3 and Analytical Assurance Statement), the details of the local model and the assumptions have been thoroughly assessed. Furthermore, to date, JAQU has been advised of the local model assumptions and the modelling outcomes have been accepted.

  The evaluation of nitrogen dioxide concentrations using a real time analyser and partnership working with other agencies including Southampton City Council and Hampshire County Council will ensure any potential risks of failure to achieve compliance with the EU AAQD such as significant changes in fleet composition or higher than expected monitoring results are identified early and appropriate mitigation measures can be actioned. Appropriate mitigation measures could include the delivery method of planned roadworks to reduce congestion along the A35 over long periods and working together to identify changes in fleet composition which may result in unexpected monitoring data.

- *Lack of resource*
  There is a risk that officer resource allocated to air quality, may reduce following the delivery of the Final Plan, particularly since this work to date has been undertaken as part of normal officer workloads. However, it is vital the Clean Air Zone work, including working partnerships, is maintained and forwarded. The Governance structure needs to keep the Clean Air Zone and local air quality high on the Council's agenda to ensure the momentum behind local air quality is maintained and resource levels are appropriate to deliver the required work. As such management regularly meets (typically on a monthly basis) to discuss workloads and resource, and this will include the requirement to deliver the air quality agenda.

- *Negative impact on NO_2 concentrations in New Forest due to Southampton City Council's preferred option*
  There is a risk that the preferred option implemented by Southampton City Council may have a detrimental impact on the NO_2 roadside concentrations in New Forest. However, Southampton City Council would not propose a preferred option for sign off by the Secretary of State which would result in a worsening of NO_2 concentrations in the New Forest. Furthermore, the local modelling work undertaken modelled 4 charging Clean Air Zone options and none of these options resulted in a worsening of NO_2 in the New Forest. These models in fact delivered a slight reduction in concentrations on the modelled New Forest links of ~2%. Southampton City Council and New Forest District Council continue to work together on any proposals for new schemes considered in Southampton and therefore any potential impact on surrounding routes into the New Forest would be identified at the design stage. As such this risk is deemed to be negligible.

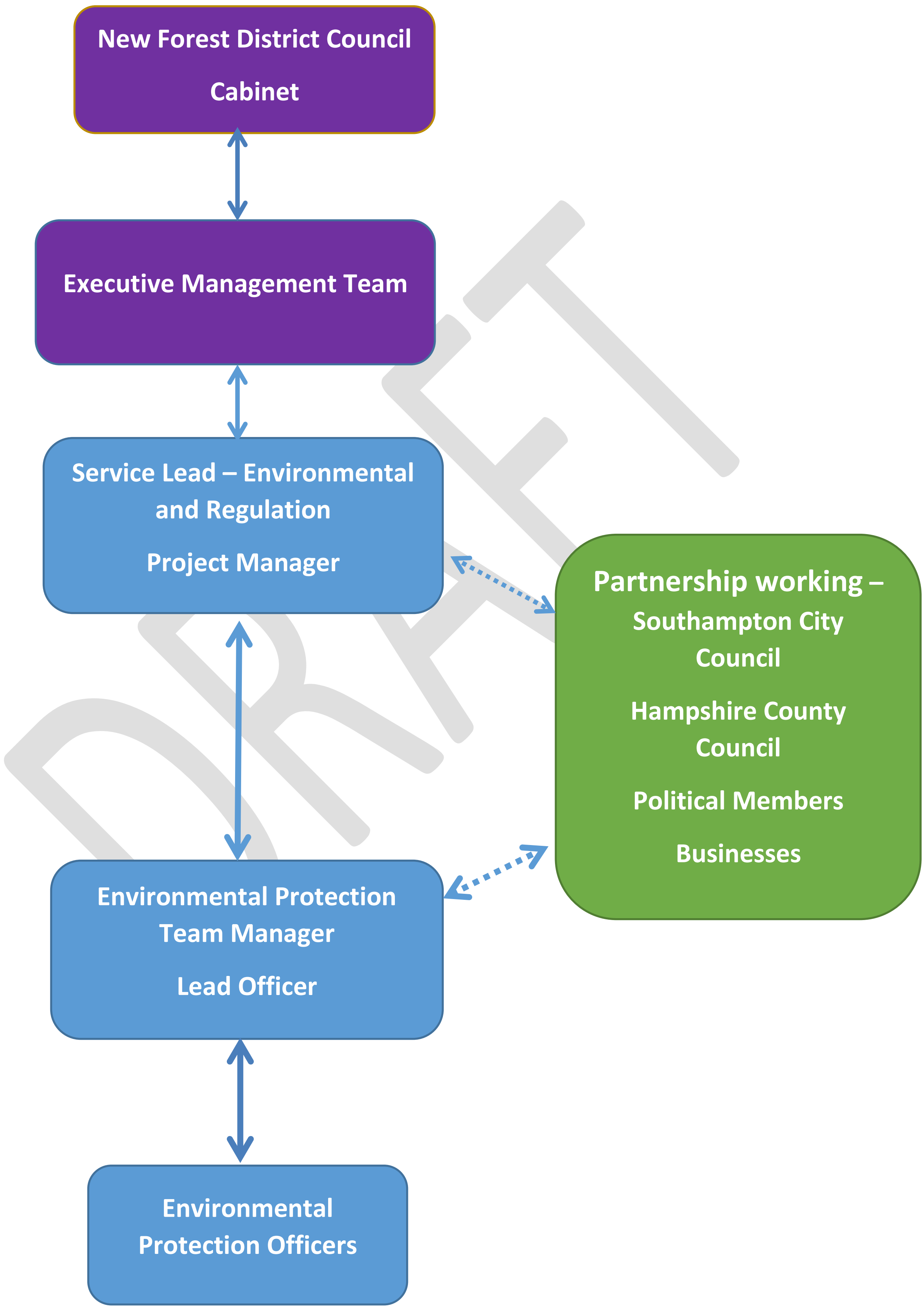
5.2 Governance

The Governance structure for New Forest District Council to deliver compliance with the EU AAQD is illustrated in Figure 14.

The Senior Manager responsible for the project is the Service Manager for Environment and Regulation and the Project Manager is the Environmental Protection Team Manager. The project manager has been responsible for delivery of the project in line with key milestones and reporting results and findings to the Service Manager. Both managers are members of Southampton Clean Air Implementation Project Board which has the purpose of ensuring a shared, continued and focused effort to implement the chosen solution for a Clean Air Zone in Southampton. The Board provide oversight and scrutiny for the Clean Air Zone Project Board to ensure that outcomes and benefits are realised within the agreed parameters.

Figure 14 identifies the decision making structure within the Authority. Progress on the air quality project has been fed back to the Environment Overview and Scrutiny Panel on a quarterly basis. Decisions have been taken through the Executive Management Team to the Portfolio Holder and Cabinet prior to submission of key documents (namely the Initial Plan and draft Final Plan) to JAQU and the Secretary of State.

Figure 14 Governance structure to deliver compliance with EU AAQD (New Forest)



5.3 Consultation

A joint consultation exercise was undertaken with Southampton City Council from 21 June to 13 September 2018. The aim of the consultation was to communicate the proposals for Southampton City Council's preferred option of a charging city wide Class B CAZ and ensure residents, businesses and stakeholders could make comments and raise any impacts the proposals could have. The consultation also gave respondents the opportunity to propose alternative suggestions for consideration which they felt could achieve the objective in a different way.

The consultation specifically targeted residents and businesses in Totton and parishes along Southampton water (as well as Southampton businesses and residents), due to the potential impact a charging CAZ would have on local businesses within the New Forest (a Class B CAZ would have charged non-compliant taxi's, buses, coaches and HGV's entering the city).

The consultation ran for 12 weeks and included media coverage, public and targeted meetings, a detailed questionnaire and leaflet campaign. There were over 9309 written responses to the Clean Air Zone consultation with 19% of these originating from New Forest residents and businesses.

Whilst the consultation focused on the preferred option for Southampton City Council, the comments and views of New Forest residents and businesses have highlighted the importance of public engagement on local air quality and the impact potential schemes could have on individuals and businesses. Generally, there was widespread support for improving local air quality and an understanding of the public health implications of air pollution. There were a range of views on how to improve local air quality and these ranged from the Local Authority doing nothing and improvement happening naturally to a charging scheme which targeted all non-compliant vehicles.

As a result of the consultation and the significant interest shown with the number of responses, New Forest District Council will build future engagement with those groups and key contacts who took part in the consultation process. The Council will continue to work with the local community to develop realistic local plans which improve air quality and public health.

Definitions

Abbreviation	Definition
Business Case	SCC and NFDC must produce a business case that supports the preferred option using the HM Treasury Green Book Five Case Model. Developing the business case will require consideration of a range of options taking into consideration the feasibility study (AQ and economic modelling) alongside their deliverability (e.g. how possible is the option to implement).
CAZ	Clean Air Zone, a geographical area where specific measures are taken to improve local air quality.
DEFRA	Government Department for the Environment, food and rural affairs
EU AAQD	European Union Ambient Air Quality Directive
Feasibility Study	Work undertaken to determine what air quality improvement measures (e.g. a charging CAZ) are feasible to deliver and assess the impact they will have.
Final Local Plan	A term to describe the Council's overall plan to improve local air quality to an extent that reaches compliance with the EU AAQD requirement (this may include a charging CAZ, non-charging CAZ or other measures).
JAQU	Joint Air Quality Unit (DEFRA and DfT)
Local model	A model with a higher resolution when compared to the PCM model to determine a more accurate local air quality assessment
National Plan/UK AQ Plan	DEFRA's plan for tackling roadside concentrations of NO_2 (latest publication July 2017, previous iteration in 2015).
Option	A scenario or group of measures that undergo air quality modelling to determine impact (e.g. Citywide Class A Charging CAZ)
Preferred Option	The option which meets all objectives of the local plan, i.e. delivers compliance with the EU AAQD within the shortest possible time, increases likelihood of compliance and best meets the strategic, economic, commercial, and financial and management needs of the Local Plan.
PCM model	Pollution Climate Mapping Model. The model Government used nationally to identified roads which exceeded the EU AAQD

Appendices

Important note;

The appendices include joint reports with Southampton City Council. Southampton City Council is currently reviewing the work completed to date for Southampton and therefore the joint reports (AQ2, AQ3, T2, T3 and T4) should only be read in relation to New Forest District Council only.

Appendix 1	Air Quality Tracker Table (AQ1)
Appendix 2	Air Quality Modelling Methodology (AQ2)
Appendix 3	Air Quality Results Report (AQ3)
Appendix 4	Air Quality Baseline and Options Results (AQ3 – Appendix 4)
Appendix 5	Analytical Assurance Statement
Appendix 6	Transport Modelling Tracker (T1)
Appendix 7	Transport Calibration Validation Report (T2)
Appendix 8	Transport Modelling Methodology Report (T3)
Appendix 9	Transport Model Forecasting Report (T4)

Air Quality Tracker Table

Version: 3 (New Forest)

Date: 12/11/18

Ref	Requirement	Proposal
	Air Quality model specification	
	Model selection	
1.1.1	Details of air quality dispersion model to be used	RapidAir has been used for the study- this is Ricardo's proprietary modelling system developed for urban air pollution assessment. The model is based on convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD[1] model. The physical parameterisation (release height, initial plume depth and area source configuration) closely follows guidance provided by the USEPA in their statutory road transport dispersion modelling guidance[2]. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies (it is one of only two mandated models in the US and is widely used overseas for this application). The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir fit for purpose for this study. The model produces high resolution concentration fields at the city scale (1 to 3m scale) so is ideal for spatially detailed compliance modelling. Further details are given in section 3 of the main methodology report (AQ2).
1.1.2	Canyon effects included?	Yes. The model includes a canyon treatment based on the USEPA 'Stanford' model[3]. The canyon model algorithms are essentially the same as those recommended by the European Environment Agency for modelling canyons in compliance assessment[4]. Our model has terms to deal with canyon height, width, vehicle length, receptor height, emission strength, wind speed and direction (taken from the same met record as the main RapidAir model). Further details given in section 3 of the main report (AQ2).

[1] https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod
[2] https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses
[3] USEPA., Estimating Mobile Source Pollutants in Microscale Exposure Situations, EPA-460/3-81-021
[4] http://www.eea.europa.eu/publications/TEC11a/page014.html

1.1.3	Gradient effects included?	Further to the update/clarification of the gradient method in TG16 we confirm that we have applied the gradient impact to all pre Euro VI HGVs in the emissions processing step. In order to do this, we will carry out a GIS gradient analysis of our modelling domain to identify any road links with gradients greater 2.5%. The gradient adjustment will then be applied to the proportion pre Euro VI HGV movements on identified links.
	Air Quality model domain	
1.2.1	Please provide a map showing model domain in relation to exceedance locations identified in PCM model	See Figure 3 in main report (AQ2) for model domain in relation to all PCM links in the area. The latest updated exceedance data in relation to these links is not yet available.
1.2.2	Locally identified exceedance locations included?	Yes, the high resolution nature of RapidAir and its inclusion of street canyons will make the model outputs naturally align with hotspots/exceedance locations.
1.2.3	Domain includes displacement routes?	Yes. See description of model in main report (AQ2) and relationship between proposed traffic model and modelling domain in Figure 5 (AQ2)
	Air Quality model receptor locations	
1.3.1	Details of receptor grid size	For the New Forest domain (which is small) we have set RapidAir to model down to 1m. The model can comfortably deal with about 500 million locations which provides for over 20,000 cells in the x and y axes. So we can model 20km x 20km at 1m resolution which covers the New Forest domain. The canyon model is set to the same resolution as the grid model so that they align perfectly spatially. See section 3 of main report (AQ2) for further details
1.3.2	Details of receptors at monitoring site locations	New Forest has a network of monitoring locations comprising a mix of passive and active sampling. RapidAir run time is not sensitive to the number of receptors so all available monitoring locations will be included.
1.3.3	Details of receptors at exceedance locations identified in PCM model (include distance from kerb and height above ground level)	For comparison with PCM model results, annual mean concentrations at the roadside exceedance locations identified in the PCM model can be extracted from the RapidAir dispersion model results and presented as a separate model output file. These receptor locations will be at a distance of 4m from the kerb and 2m height.
1.3.4	Details of receptors at locally identified exceedance locations, if any	There are no locally identified exceedance locations within the New Forest domain. However RapidAir, by virtue of its very high resolution outputs, will produce estimates for every single residential property in the New Forest domain.

1.3.5	Methods to be used to assign subset of receptors for AQD assessment requirements	Annex III of the AQD specifies that macroscale siting of sampling points should be representative of air quality for a street segment of no less than 100 m length at traffic-orientated sites. To provide results relevant to this requirement, for roadside locations where there is public access and the directive applies; road links with exceedances of the NO_2 annual mean objective stretching over link lengths of 100m or greater can be presented as a separate GIS layer of model results. Annex III of the AQD also specifies that microscale sampling should be at least 25 m from the edge of major junctions. When reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain will therefore be excluded.
	Base Year modelling	
	General	
2.1.1	Base year to be used	The modelling base year is 2015 in line with the latest traffic and air quality data and the base year of the proposed transport model.
2.1.2	Details of Meteorological data to be used	We have used surface meteorological data from Southampton Airport processed in house using our own meteorological data management system. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere- we will derive this from the closest radiosonde site and process in the USEPA AERMET model. We will utilise data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). Our modelling will be supplied with full meteorological discussion and if required we can supply the computer code used to process the data and details of any data filling that was required.
	Traffic input data	
2.2.1	Source of traffic activity data	The key source of traffic data is the Sub-Regional Transport Model (SRTM) for Southampton, Portsmouth and South Hampshire. Details of this are provided in section 4 of the main report (AQ2). The transport model data will be complemented by local traffic counts, ANPR data and traffic master data in the base year. This is described in detail in section 4 of the main report (AQ2).
2.2.2	Vehicle types explicitly included in air quality emissions and concentrations modelling	The core vehicle categories are cars, taxis, LGVs, rigid HGVs. Artic HGVs and buses. The standard Euro and technology categories will be used in line with COPERT 5. Details in section 4 of the main report (AQ2).
2.2.3	Details of representation of road locations (achieved through use of a georeferenced	See Figure 4 in main report (AQ2) for map of transport model road network. All modelling links are snapped to the OS ITN road network for the best spatial representation.

	transport model or another approach?)	
2.2.4	Source of vehicle fleet composition information (local/EFT)	Detailed fleet composition data are derived from an ANPR survey. This will be complemented by local count data and NAEI fleet data as necessary.
2.2.5	Source of vehicle speed information	Traffic speeds are taken from the traffic master data set for the base year and will be adjusted for future years in relation to changes in link travel times from the transport model. This is described in section 4.2 (AQ2)
	NOx/NO_2 emissions assumptions	
2.3.1	Source of emission factors for NOx	COPERT 5 data either in the form of an update EFT or with JAQU's agreement our in-house emission calculation tool pyCOPERT which is fully compatible with COPERT 5.
2.3.2	Source of primary NO_2 emission fractions (f-NO_2)	Defra f-NO2 fractions which we understand will be released in time to support this work. See also section 4.3.3 in the main report (AQ2).
2.3.3	Details of method used to calculate projections for f-NO_2	See section 4.3.3 in main report (AQ2)
2.3.4	Details of methods to be used to calculate NO_2 concentrations from NOx concentrations	The Defra NOx:NO2 model has been used. See section 4.3.3 for details (AQ2).
	Non-road transport modelling	
2.4.1	Details of modelling for non-road transport sources	Three key local background sources will be modelled explicitly: • Vessel and port activity at the port of Southampton • The Marchwood incinerator • The Marchwood power station Details of these are provided in section 4.4 and Appendix 2 of the main report (AQ2).
	Measurement data for model calibration	
2.5.1	Details of the date, locations and type of monitoring data (automatic and/or diffusion tubes) used for the model calibration	Air quality monitoring data collected by New Forest for 2015. Diffusion tube and real time analyser see Figure 10 of Final Plan for monitoring locations.

	<u>Projections modelling</u>	
	Baseline projections modelling	
3.1.1	Years to be modelled (to include 2020; please include explanation for any additional years)	Modelling years are: • 2019 – as an interim year between the base year and the implementation year of 2020. This year was chosen as it aligns with the first forecast year in the traffic model. • 2020 – CAZ implementation year See section 1.3 for full details (AQ2).
3.1.2	Details of method for projected vehicle fleet composition	See section 4 (AQ2) for base year fleet data See section 5 (AQ2) for forecast fleet data
3.1.3	Details of method for projected vehicle activity	Future vehicle traffic will be derived from the transport model described in section 5.
3.1.4	Impact of RDE included?	This is included only in relation to the COPERT emissions data.
	With measures projections modelling	
3.2.1	Years to be modelled	2020 as described in section 1.3 in main report (AQ2)
3.2.2	Details of method for projected vehicle fleet composition	The fleet composition has been assessed separately for complaint and non-compliant vehicles. See section 5 in main report (AQ2).
3.2.3	Details of method for projected vehicle activity	Projected vehicle traffic is done by the traffic model. Within the traffic model the vehicle matrices will be split between complaint and non-complaint vehicles so that the behaviours of these groups will be modelled separately. The details of this is provided in transport methodology report.

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Southampton Clean Air Zone – Air Quality Modelling Methodology Report (AQ2)

Report for Southampton City Council

ED 10107 | Issue Number 4 | Date 06/07/2018

Customer:

Southampton City Council

Customer reference:

Southampton CAZ Feasibility Study

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06 July 2018

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Appendices

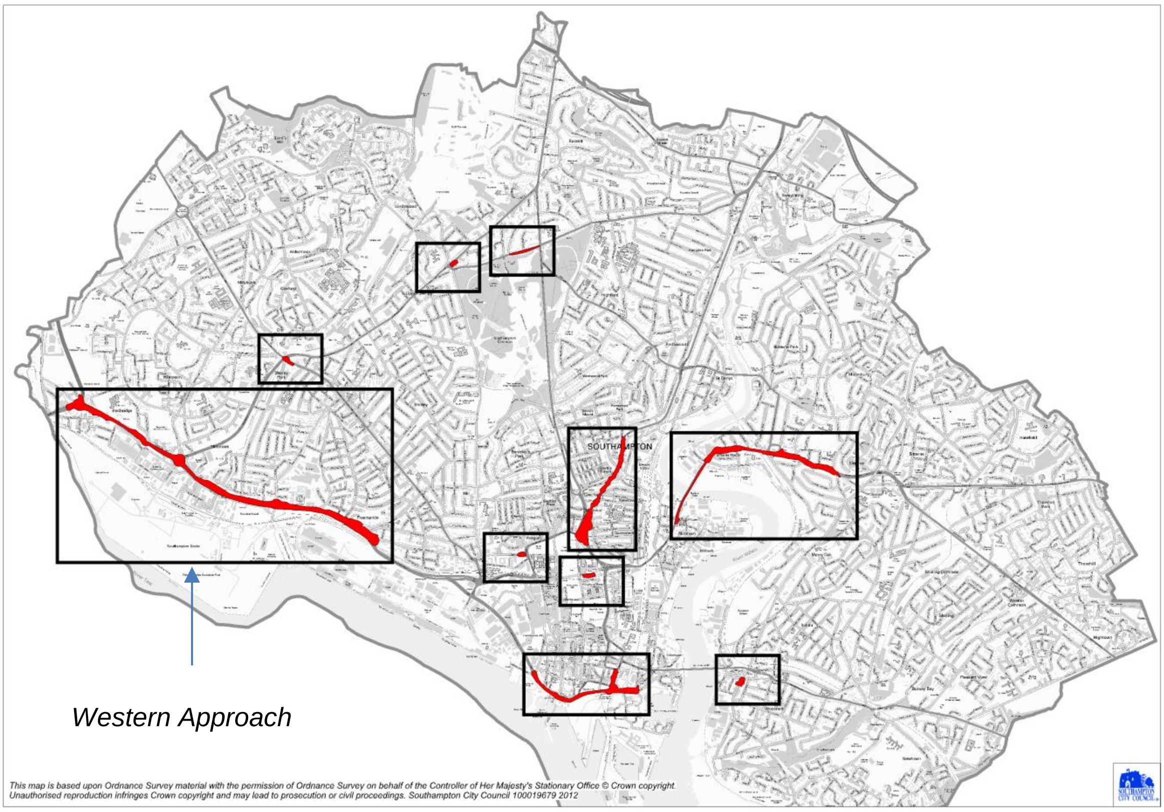
1 Introduction and outline modelling scope

Southampton City Council is one of the initial five cities that were required to carry out a Clean Air Zone (CAZ) Feasibility Study by the Government for non-compliance with the NO_2 limit values. Subsequently to this a small exceedance area was also identified in New Forest District Council adjoining Southampton, and the Councils were instructed to work jointly to assess the impact a potential CAZ in Southampton on the New Forest exceedance location. This report sets out the Air Quality modelling methodology used for this study covering both Southampton and New Forest.

1.1 Background

Southampton like many other urban areas, has elevated levels of Nitrogen Dioxide (NO_2) due mainly to road transport emissions. Emissions from the port also contribute significantly in key locations. As such Southampton City Council (SCC) has designated 10 Air Quality Management Areas (AQMA) across the City where concentrations of NO_2 breach Government, health-based air quality objectives as shown in Figure 1.

Figure 1 Southampton Air Quality Management Areas (AQMA)



At the national level the EU has commenced infraction proceedings against the UK Government and Devolved Administrations for their failure to meet the EU Limit Value for NO_2. In 2015, the Supreme Court ordered the Government to consult on new air pollution plans that had to be submitted to the European Commission no later than 31 December 2015. As such DEFRA released plans[1] to improve

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[1] https://www.gov.uk/government/publications/air-quality-in-the-uk-plan-to-reduce-nitrogen-dioxide-emissions

air quality, specifically tackling NO_2, in December 2015. The Plans identify 5 cities outside London, including Southampton, where the EU Limit Value for NO_2 are not expected to be met by 2020. The Plans state that each of the cities identified will be legally required to introduce a formal charging-based Clean Air Zone (CAZ) for specified classes of vehicles and European Vehicle Emission Standards (Euro Standards) as soon as practical but no later than 2020.

The key area identified by the DEFRA plan that will exceed in 2020 is the Western Approaches AQMA. This area was the focus of a study on a Low Emission Zone undertaken by Southampton City Council in 2014[2]. The study showed that road transport emissions accounted for between a third and two thirds of modelled levels of NOx in certain locations and port activities contributed to a third of levels at Millbrook.

Building on the 2014 study Southampton commissioned a wider based Low Emission Strategy study to assess options for reducing emissions from transport across the city. This study provided the basis for Southampton's approach to developing a Clean Air Zone, based on cost benefit assessment of potential emission reduction measures. The study set out a potential charging Clean Air Zone and a range of non-charging or supporting measures.

Subsequent work by DEFRA updated its air quality plan using more recent information on the expected real-world emission performance of vehicles. This latest analysis is suggesting that emission from vehicles will be higher than previously estimated and so breaches of the air quality limits are likely to persist for longer and over a wider area. This later analysis identified an exceedance area in neighbouring New Forest District Council that would be expected to be beneficially impacted by a CAZ in Southampton. As such NFDC were instructed to work jointly with Southampton City Council to assess the impact of the CAZ options being developed on the New Forest exceedance area.

1.2 Outline scheme options

The Low Emission Strategy (LES) study developed a package of measures to reduce emissions covering all key transport modes in the city: cars, freight, buses and taxis. This has formed the basis of the city wide Clean Air Zone that Southampton is pursuing, and although a formal Low Emission Zone (or charging CAZ) was not assessed in the study, potential elements of such a scheme were considered including:

- Euro VI standards for city centre deliveries
- A ULEV standard (Euro VI plus 30% lower CO2) for buses on key bus corridors
- Emission standards in taxi licensing

These elements would effectively constitute a class B CAZ based mainly around the city centre. In addition, specific measures were considered for targeting vehicle movements to and from the port. In developing these measures consultation was carried out with key stakeholders within the city council and with key external stakeholders such as the bus and freight companies and neighbouring authorities.

In defining options for the charging CAZ a long list of options has been considered and sifted down to a short list of 3 options for detailed assessment. The long list options considered are presented in Table 1. This was considered to provide a range of scheme options for a charging CAZ to allow for sifting and selecting the most appropriate. The potential boundaries are illustrated in Figure 2.

[2] Low Emission Zone Feasibility Study, Western Approaches, Ricardo AEA/LES Ltd 2014

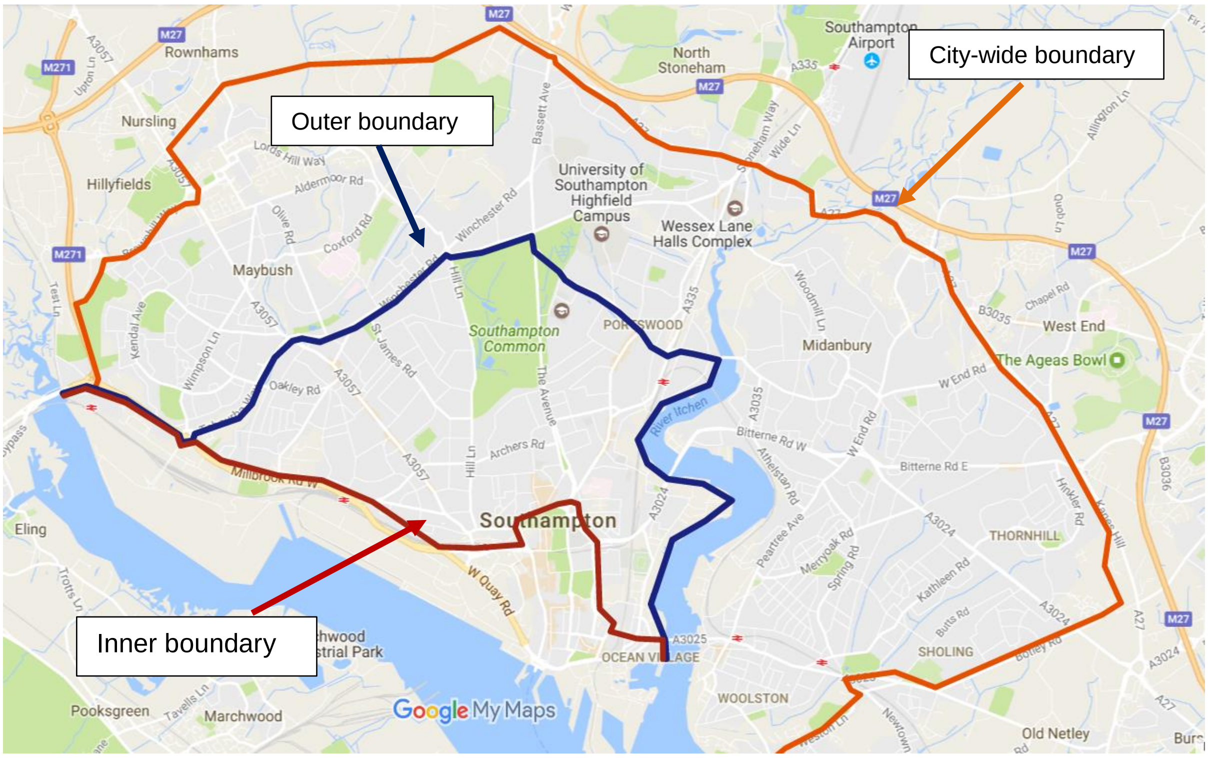
Table 1 – Long-list of CAZ options

	Scenario	Red Citywide	Blue Outer RR	Brown WA+CC inc Inner RR	Brown WA+CC exc Inner RR	Brown CC inc Inner RR	Brown CC exc Inner RR
1	Citywide B	B					
2	Citywide C	C					
3	Citywide D	D					
4	OuterRR B		B				
5	OuterRR C		C				
6	OuterRR D		D				
7	Inner WA+CC (Inc InnerRR) B			B			
8	Inner WA+CC (Inc InnerRR) C			C			
9	Inner WA+CC (Inc InnerRR) D			D			
10	Inner WA+CC (Exc InnerRR) B				B		
11	Inner WA+CC (Exc InnerRR) C				C		
12	Inner WA+CC (Exc InnerRR) D				D		
13	Citywide Doughnut BD	B				D	
14	Citywide Doughnut BC	B				C	

The sifting of the long list was based on simplified transport model runs covering:

- Changes in flows of compliant and non-compliant vehicles, weighted by average emissions, to provide an estimate of change in emissions:
- Transport impacts covering: change in total vkm on the network, Change in travel time on the network, change in delays at key junctions
- Simplified ranking of costs and revenues

Figure 2 Illustrative CAZ boundaries



As well as the charging CAZ potential packages of non-charging measures are being considered. These non-charging measures are based on the existing LES work and planned investment. The final four options that were agreed for assessment are:

- Option 1 – a citywide Class B CAZ;
- Option 1a – a city wide HGV charging scheme complemented by a buss traffic condition based on Euro VI for the city centre and incentives to upgrade taxis;
- Option 2 – a city centre Class A CAZ, complemented by bus retrofit grants, taxi upgrade incentives a expansion of the freight consolidation centre and related DSP initiative and worth with the port on promoting Euro VI HGVs
- Option 3 – a non-charging CAZ comprising a bus traffic condition for Euro VI buses in the city centre supported by retrofit grants, taxi upgrade incentives and the freight measures from option 2.

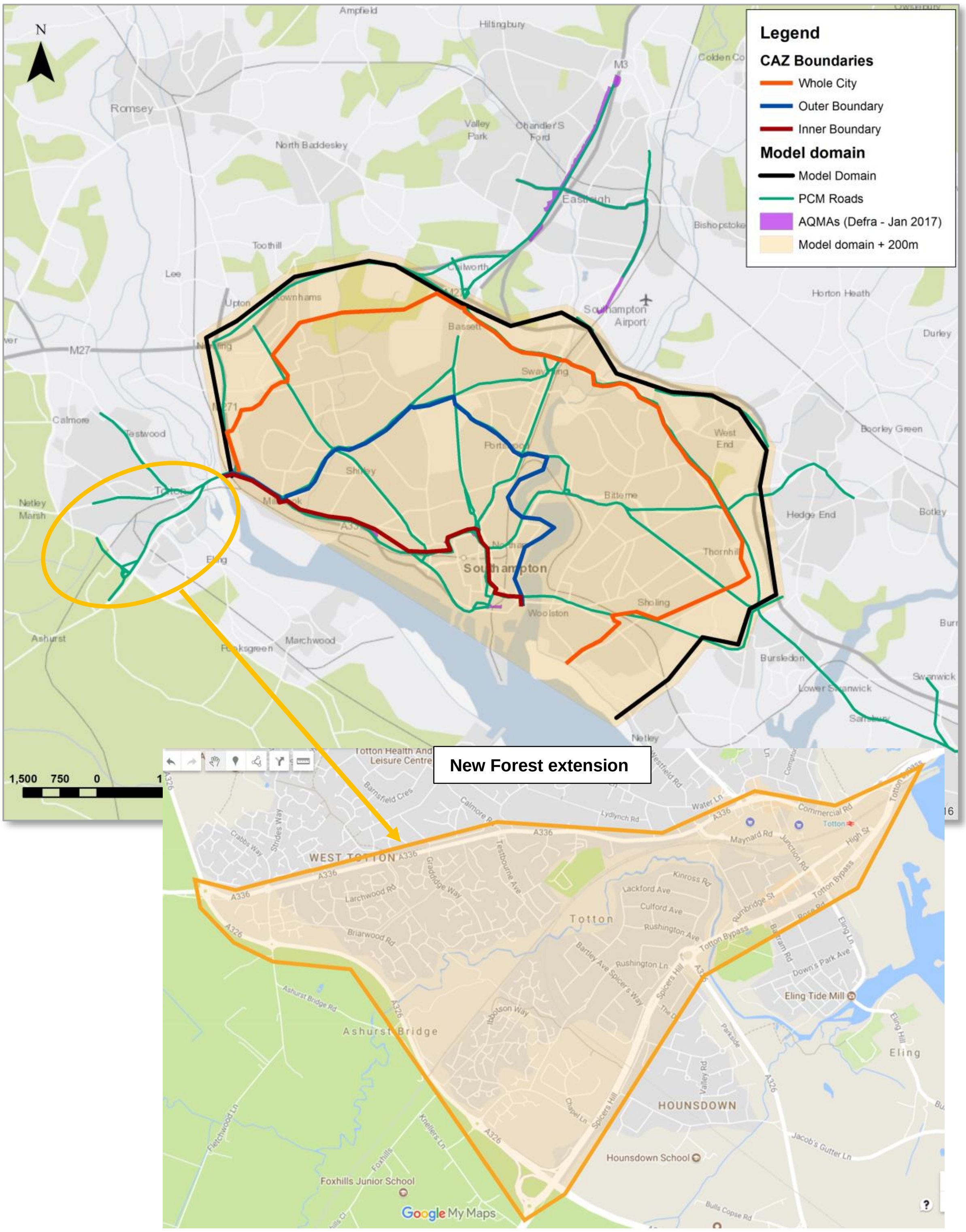
1.3 Modelling domain and years

In carrying out the modelling of the transport and air quality impacts of the scheme a model domain is required that covers the scheme options, relevant AQMAs and potential diversion routes. Therefore, the proposed model domain shown in Figure 3 has been chosen to cover the following:

- All the AQMAs in Southampton including the main area of concern from the national modelling assessment along the Western Approach;
- The wider transport network out to and including the M27 and M271 which will cover all the likely key diversion routes should vehicles seek to avoid the AQMA

In addition to this core modelling domain for Southampton we have extended the domain to cover the expected exceedance area in New Forest and surrounding roads. This additional area is illustrated in map extension in Figure 3. Further details in relation to the model domain are provided in section 2 of the air quality modelling assessment.

Figure 3 Model domain



There will be two key model years used in the modelling work: a 2015 base year and a target implementation year for the CAZ of 2020. The base year is taken as 2015 as this covers the latest air quality and transport data, and is the base year of the transport model being used. In addition, we have interpolated interim years between 2015 and 2020.

Table 2 Model years

Year	Description
2015	**Base year** – using latest available data on air quality and transport.
2016-2019	**Interim years** – interpolated between the base and implementation year.
2020	**Implementation year** – latest date when CAZ scheme is due to be in place.

1.4 Background modelling

The primary cause of the air pollution problems in Southampton and New Forest are related to traffic activity and the impact of the CAZ will be in relation to this traffic activity. As such the focus of the modelling is the transport emissions. However, there are several other background sources that are important, particularly in Southampton, and will need to be covered specifically in the modelling work:

- Emissions from port related activity – including both vessels and onshore port activity;
- Industrial emissions related to the Viridor incinerator and the gas power station both located just opposite the port in the Marchwood industrial site.

The details of how these sources have been treated, particularly the port, and their relation to the wider background is described in section 4.3.

2 Details of the Modelling Domain

The core air quality model domain covers the area of Southampton bounded by the M271 and M27 motorways to the north and west (but includes these links), and extends south to Southampton Water and east as far as Netley. In addition to the core model domain we have included are area of New Forest bounded by the A336 to the North, the Totton Bypass and Spicers Hill to the south and the A326 to the West.

Displacement of traffic due to the implementation of CAZ measures is not expected to occur beyond the proposed model domain and the sub-regional traffic model proposed to support the study (discussed in ‘Transport Modelling Methodology Report’ and built and run by SYSTRA) has been chosen as it fully encompasses the affected areas.

A map showing the extent of the air quality domain relative to the proposed CAZ zones and the associated traffic model network is presented in Figure 4. A map showing the model domain relative to roads included in the national Pollution Climate Mapping (PCM) model is presented in Figure 5. All road links in the PCM model pertinent to Southampton are included in the model domain specification.

Southampton City Council has declared 10 Air Quality Management Areas (AQMA’s) across the city to date, all of which are within the proposed model domain. A map showing the locations of the AQMA’s relative to the model domain is presented in Figure **6**

All of Southampton City Council’s 2015 NO_2 roadside measurements will be used in the air quality modelling assessment to verify the model outputs, assuming data capture and QA/QC are satisfactory for the 2015 baseline year. A map showing the sites at which NO_2 concentrations were measured during 2015 is presented in Figure 7.

Figure 4: CAZ study domain and relationship to SYSTRA's sub-regional transport model links

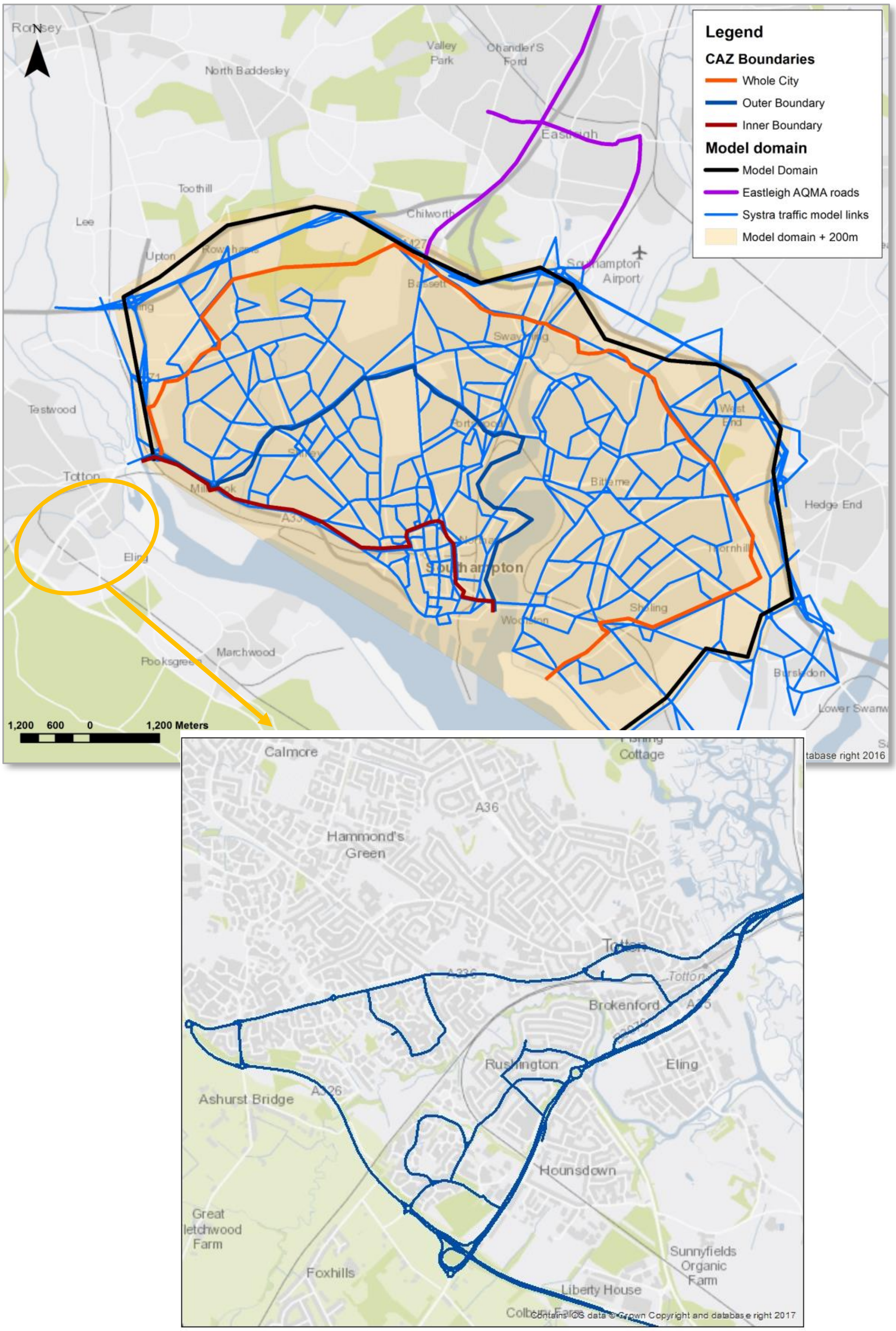


Figure 5: PCM model road links within the CAZ study domain 2015

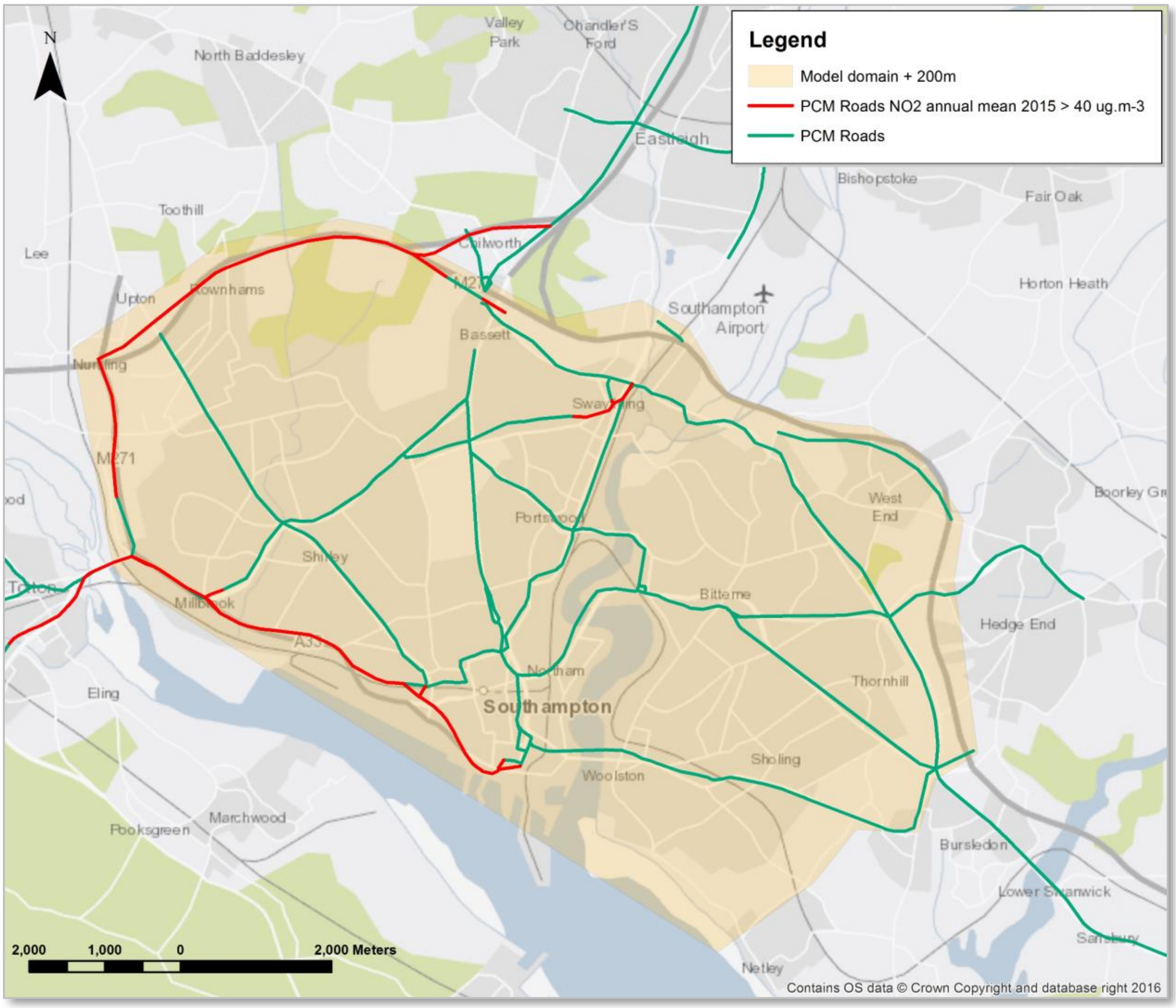


Figure 6: Southampton City Councils AQMA locations

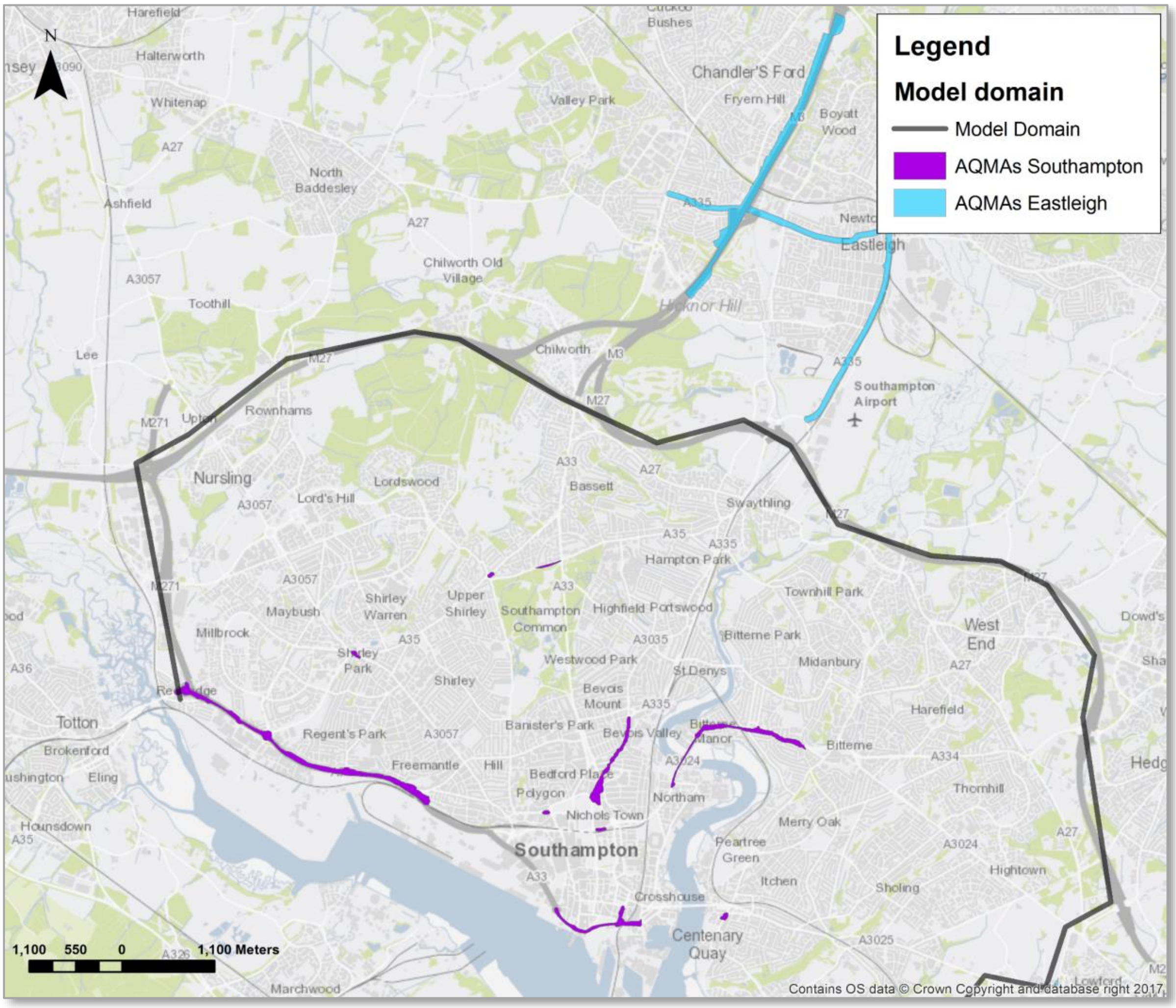
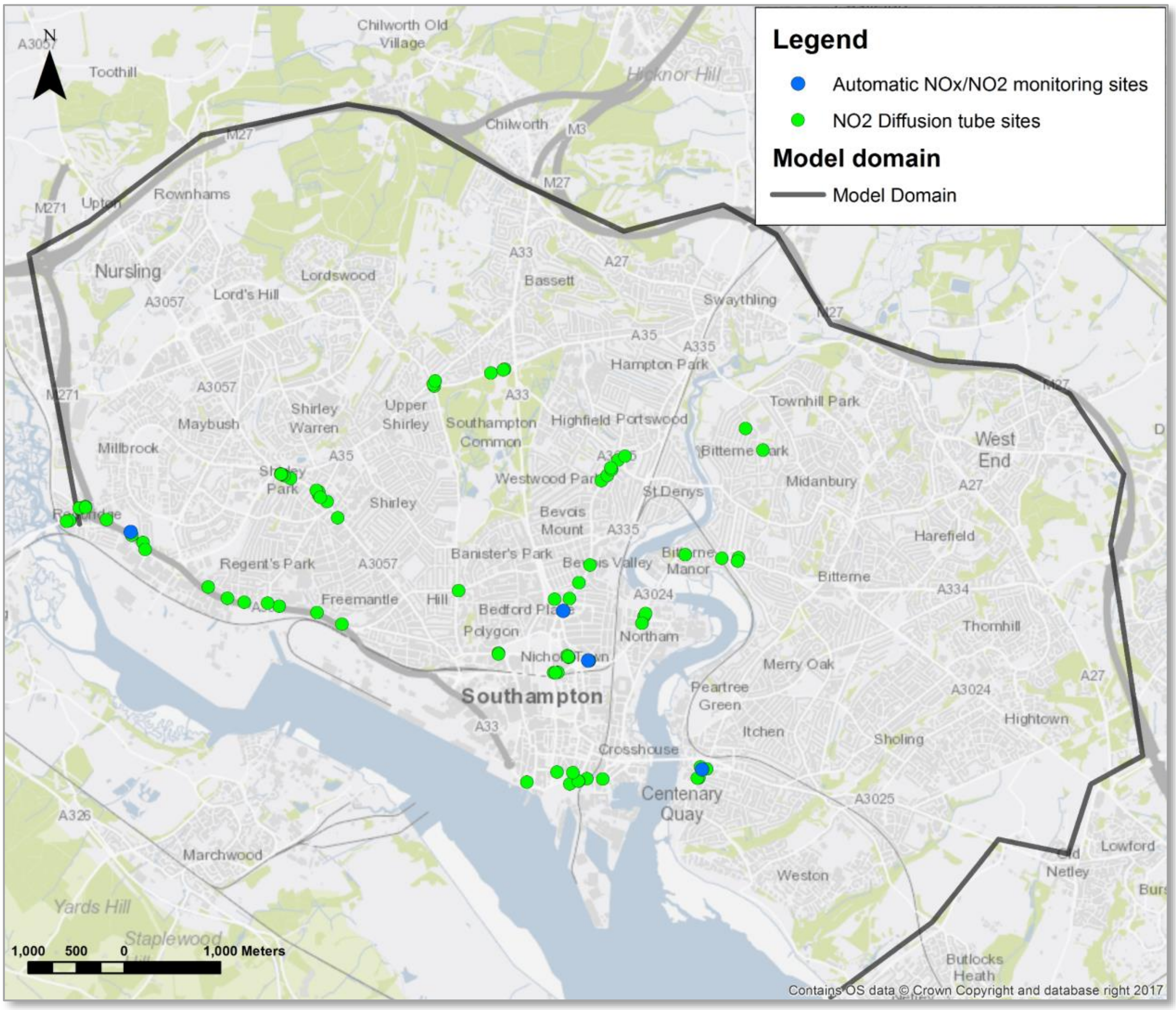


Figure 7 Southampton City Council NO_2 monitoring sites 2015



3 Model and receptor location selection

3.1 Dispersion model

We have used the RapidAir modelling system for the study. This is Ricardo Energy & Environment's proprietary modelling system developed for urban air pollution assessment and the model that was used previously in Southampton for the LES study. The compliance assessment for this model against the JAQU requirements is set out in Air Quality Tracker table th table with further description of the model provided here.

The model is based on convolution of an emissions grid with dispersion kernels derived from the USEPA AERMOD[3] model. The physical parameterisation (release height, initial plume depth and area source

[3] https://www3.epa.gov/ttn/scram/dispersion_prefrec.htm#aermod

configuration) closely follows guidance provided by the USEPA in their statutory road transport dispersion modelling guidance[4]. AERMOD provides the algorithms which govern the dispersion of the emissions and is an accepted international model for road traffic studies (it is one of only two mandated models in the US and is widely used overseas for this application). The combination of an internationally recognised model code and careful parameterisation matching international best practice makes RapidAir demonstrably fit for purpose for this study.

The USEPA have very strict guidelines on use of dispersion models and in fact the use of AERMOD is written into federal law in 'Appendix W' of the Guideline on Air Quality Models[5]. The RapidAir model uses AERMOD at its core and is evidently therefore based on sound principles given the pedigree of the core model.

The model produces high resolution concentration fields at the city scale (1 to 3m scale) so is ideal for spatially detailed compliance modelling. A validation study has been conducted in London using the same datasets as the 2011 Defra inter-comparison study[6]. Using the LAEI 2008 data and the measurements for the same time period the model performance is consistent (and across some metrics performs better) than other modelling solutions currently in use in the UK. A paper is currently being finalised for publication with our partners at Strathclyde University in a suitable journal (most likely Atmospheric Environment).

3.2 Core aspects of the modelling

3.2.1 Chemistry, meteorology and topology

NOx to NO_2 chemistry was modelled using the Defra NOx/NO_2 calculator. Modelled annual mean road NOx concentrations were combined with background NOx and a receptor specific (i.e. at each receptor) fNO_2 fraction to calculate NO_2 annual mean concentrations. The receptor specific fNO_2 fraction was calculated by dividing the modelled road NOx by modelled road NO_2 at each receptor.

3.2.2 Meteorology

Modelling was conducted using the 2015 annual surface meteorological dataset measured at Southampton Airport. The dataset was processed in house using our own meteorological data gathering and processing system. We use freely available overseas meteorological databases which hold the same observations as supplied by UK meteorological data vendors. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; this was obtained from the closest radiosonde site and process with the surface data in the USEPA AERMET model. We have utilised data filling where necessary following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). AERMET processing was conducted following the USEPA guidance. To account for difference between the meteorological site and the dispersion site, surface parameters at the met site were included as recommended in the guidance and the urban option specified for the dispersion site.; land use parameters were accessed from the CORINE land cover datasets[7].

A uniform surface roughness value of 1.0 m was modelled to represent a typical city/urban environment.

[4] https://www.epa.gov/state-and-local-transportation/project-level-conformity-and-hot-spot-analyses
[5] 40 CFR Part 51 Revision to the Guideline on Air Quality Models: Adoption of a Preferred General Purpose (Flat and Complex Terrain) Dispersion Model and Other Revisions; Final Rule, Environmental Protection Agency, 2005
[6] https://uk-air.defra.gov.uk/research/air-quality-modelling?view=intercomparison

[7] EEA (2018) https://www.eea.europa.eu/publications/COR0-landcover

3.2.3 Canyon modelling

The platform includes two very well-known street canyon algorithms with significant pedigree in the UK and overseas. The first replicates the functionality of the USEPA 'STREET' model. The code was developed by the Office of Mobile Source Air Pollution Control at the USEPA and published in a series of technical articles aimed at operational dispersion modellers in the regulatory community[8,9]. The STREET model has been used for many years and has been adopted in dispersion modelling software such as AirViro. The USEPA canyon model algorithms are essentially the same as those recommended by the European Environment Agency for modelling canyons in compliance assessment[10].

The RapidAir model also includes the AEOLIUS model which was developed by the UK Met Office in the 1990s. The AEOLIUS model was originally developed as a nomogram procedure[11]. The scientific basis for the model is presented in a series of papers by the Met Office[12,13,14,15,16.] The model formulation shares a high level of commonality with the Operational Street Pollution Model[1718] (OSPM) which in turn forms the basis of the basic street canyon model included in the ADMS-Roads software. Therefore, the AEOLIUS based canyon suite in RapidAir aligns well with industry standards for modelling dispersion of air pollutants in street canyons.

The systems of equation used in each street canyon model are provided in Appendix 3.

3.2.4 Gradient, tunnels and flyovers

Gradient effects have been included for relevant road links during emissions calculations. LIDAR Composite Digital Terrain Model (DTM) datasets at 1m and 2m resolution are available over the proposed model domain[19]. Link gradients across the model domain can be calculated using GIS spatial analysis of LIDAR DTM datasets.

The method described in TG(16) provides a method of adjusting road link emission rates for gradients greater than 2.5%; it is applicable to broad vehicle categories for heavy vehicles only. As per the guidance and clarification provided by JAQU this adjustment has been applied to all pre Euro VI HGVs and buses.

No modelling of tunnels or flyovers was included as the RapidAir kernel approach applies the same source height across the model domain. If modelling of flyovers was considered to be beneficial for this assessment, we could have modelled road link at a higher elevation using a dispersion kernel created with a different source height in AERMOD. It was not however considered beneficial to do this for this assessment.

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[8] Ingalls., M. M., 1981. Estimating mobile source pollutants in microscale exposure situations. US Environmental Protection Agency. EPA-460/3-81-021
[9] USEPA Office of Air Quality Planning and Standards., 1978. Guidelines for air quality maintenance planning and analysis, Volume 9: Evaluating indirect sources. EPA-450/4-78-001
[10] http://www.eea.europa.eu/publications/TEC11a/page014.html
[11] Buckland AT and Middleton DR, 1999, Nomograms for calculating pollution within street canyons, Atmospheric Environment, 33, 1017-1036.
[12] Middleton DR, 1998, Dispersion Modelling: A Guide for Local Authorities (Met Office Turbulence and Diffusion Note no 241: ISBN 0 86180 348 5), (The Meteorological Office, Bracknell, Berks).
[13] Buckland AT, 1998, Validation of a street canyon model in two cities, Environmental Monitoring and Assessment, 52, 255-267.
[14] Middleton DR, 1998, A new box model to forecast urban air quality, Environmental Monitoring and Assessment, 52, 315-335.
[15] Manning AJ, Nicholson KJ, Middleton DR and Rafferty SC, 1999, Field study of wind and traffic to test a street canyon pollution model, Environmental Monitoring and Assessment, 60(2), 283-313.
[16] Middleton DR, 1999, Development of AEOLIUS for street canyon screening, Clean Air, 29(6), 155-161, (Nat. Soc for Clean Air, Brighton, UK).
[17] Hertel O and Berkowicz R, 1989, Modelling pollution from traffic in a street canyon: evaluation of data and model development (Report DMU LUFT A129), (National Environmental Research Institute, Roskilde, Denmark).
[18] Berkowicz R, Hertel O, Larsen SE, Sørensen NN and Nielsen M, 1997, Modelling traffic pollution in streets, (Ministry of Environment and Energy, National Environmental Research Institute, Roskilde, Denmark).
[19] http://environment.data.gov.uk/ds/survey/#/survey

3.3 Receptor locations

Southampton has a wide network of monitoring locations comprising a mix of passive and active sampling. All available monitoring locations for 2015 will be treated as receptors in the model as the 2015 NO_2 annual mean measurements will be used for model verification and producing model performance statistics. A map of these monitoring locations is shown above in Figure 7 in relation to the modelling domain. In addition we have used monitoring data that is available in the New Forest modelling domain as both receptor location and for local verification.

The RapidAir model can comfortably deal with about 500 million gridded locations which provides for over 20,000 cells in the 'x' and 'y' axes. We can therefore model 20km x 20km, which is roughly the size of the Southampton modelling domain, down to a 1m resolution. Therefore we have used this 1m resolution for our work in Southampton and New Forest. The canyon model is set to the same resolution as the grid model so that they align perfectly spatially.

As RapidAir produces concentration grids (in raster format), modelled NO_2 concentrations can be extracted at receptor locations anywhere on the 1m resolution model output grid. For comparison with PCM model results, annual mean concentrations at a distance of 4m from the kerb have been extracted from the RapidAir data and presented as a separate model output file. This will allow the selected locations to be assessed according to the Air Quality Directive (AQD) requirements Annex III A, B, and C3.

Southampton has several AQMAs all of which contain numerous residential receptors. RapidAir, by virtue of its very high resolution outputs, can produce discrete estimates at every single residential property in Southampton (every 1m 'square' in actual fact); any location where there is a risk of the objective being exceeded can therefore be included in the modelling and outlined during post processing. There are no AQMAs in the New Forest modelling domain.

To aid interpretation of the outcomes of the study when considering compliance with the air quality directive (AQD), annual mean concentrations at the roadside exceedance locations identified in the PCM model will be extracted from the RapidAir dispersion model results and presented as a separate model output file. Roadside receptor locations in the PCM model are at a distance of 4m from the kerb and at 2m height. A subset of the OS Mastermap GIS dataset provided spatially accurate polygons representing the road carriageway, receptor locations were then placed at 50m intervals along relevant road links using a 4m buffer around the carriageway polygons.

Annex III of the AQD specifies that macroscale siting of sampling points should be representative of air quality for a street segment of no less than 100 m length at traffic-orientated sites. To provide results relevant to this requirement, for roadside locations where there is public access and the Directive applies; road links with exceedances of the NO_2 annual mean objective stretching over link lengths of 100m or greater can be presented as a separate GIS layer of model results.

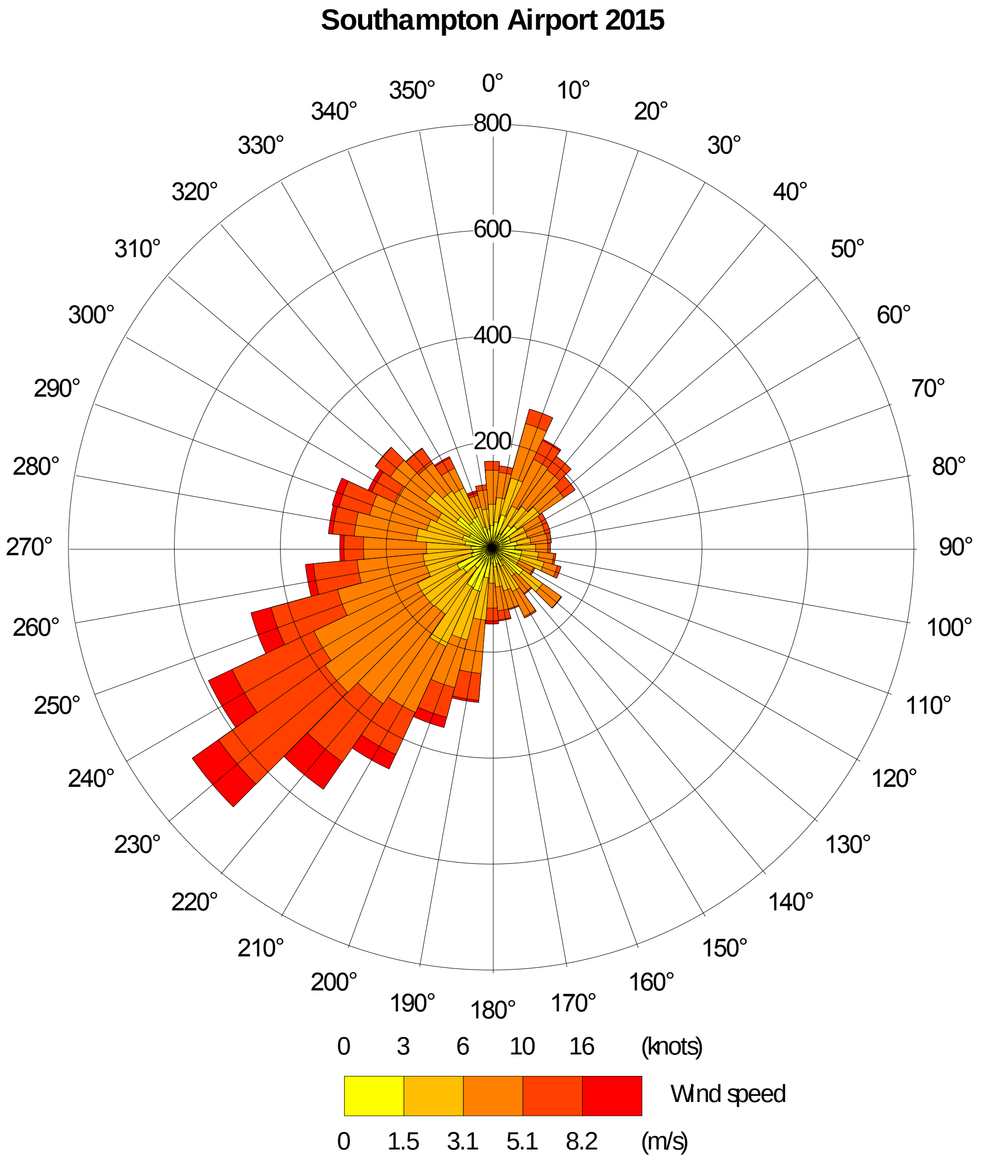
Annex III of the AQD also specifies that microscale sampling should be at least 25 m from the edge of major junctions. When reporting model results relevant to compliance with the AQD, locations up to 25m from the edge of major junctions in the model domain have also been excluded.

4 Base year modelling

4.1 Base year and meteorological dataset

As described in section 1.3 we have modelled a baseline year of 2015. We have used the 2015 annual surface meteorological dataset measured at Southampton Airport which has been processed in house using our own meteorological data gathering and processing system. We use open overseas meteorological databases which hold the same observations as supplied by UK meteorological data vendors. Our RapidAir model also takes account of upper air data which is used to determine the strength of turbulent mixing in the lower atmosphere; we have derived this from the closest radiosonde site and process with the surface data in the USEPA AERMET model. Where necessary we have utilised data filling following USEPA guidance which sets out the preferred hierarchy of routines to account for gaps (persistence, interpolation, substitution). A wind rose for the 2015 Southampton airport met dataset is presented in Figure 8.

Figure 8: Windrose

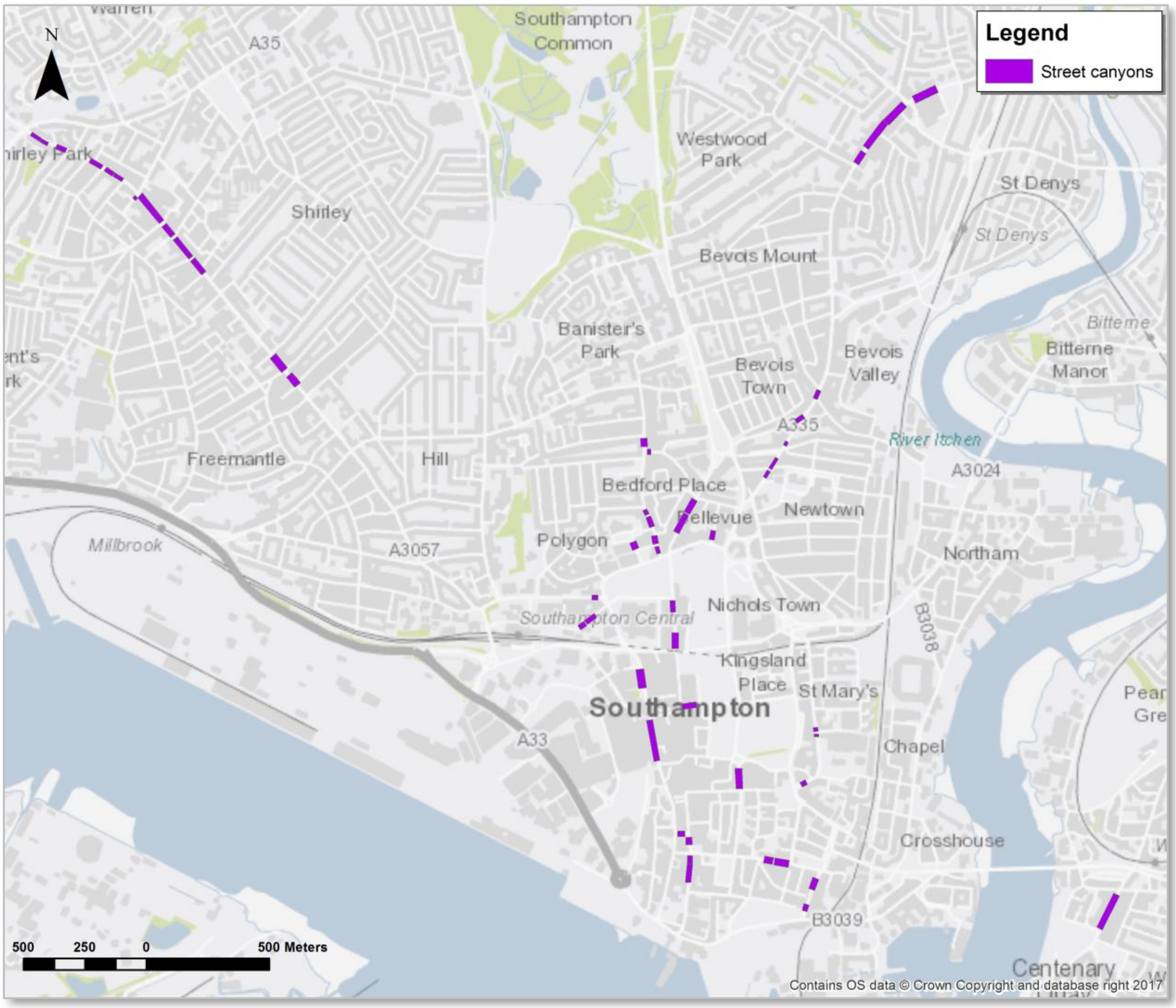


4.2 Representation of road locations and canyons

A realistic representation of road locations has been modelled by assigning emissions to the road links represented in the Ordnance Survey ITN Roads GIS dataset; it contains spatially accurate road centreline locations for various road categories e.g. Motorway, A road, B road, minor road, local street etc. Link gradients across the model domain were calculated using LIDAR DTM datasets.

A map showing the locations where canyon effects were modelled is presented in Figure 9.

Figure 9: Location of street canyons modelled



4.3 Road traffic modelling

4.3.1 Average daily vehicle flow and speeds

Baseline and future year annual average daily traffic (AADT) link flows for each model link will be provided by SYSTRA using outputs from the Sub-Regional Transport Model (SRTM) that covers the areas of Southampton, Portsmouth and South Hampshire.

Baseline daily average link speeds were calculated using the DfT Traffic Master GPS measured datasets cross referenced with the Ordnance Survey ITN roads GIS dataset. This will provide observed average speed data over defined road links at a fairly well resolved spatial resolution. It should also provide a reasonable representation of the change in emissions at locations where typical vehicle speeds are reduced e.g. approaching junctions. A typical UK week day diurnal profile[20] was assumed and applied as time varying emissions in AERMOD when creating the RapidAir dispersion kernel.

4.3.2 Vehicle fleet composition

Vehicle emission rates for the vehicle categories buses (including coaches), taxis, rigid HGVs, articulated HGVs, LGVs, cars and motorcycles can be calculated using the latest COPERT v5 NOx emission functions.

The traffic model will provide vehicle flows for four highway user classes which are: Car, HGV, LGV and Buses. A further breakdown of the HGV into rigid and articulated categories and an estimate of the proportion of car traffic that are taxis has been conducted using local traffic count data and ANPR data. An assessment of the ANPR data indicated that the rigid/artic split and proportion of taxis across the city was not constant. To account for this two distinct zoning approaches has been used to reflect the key differences:

- *Rigid/artic split* – this has been zoned as the Western approach to the port and the rest of the city. The splits used are as follows:
    - Western approach: 28.5% rigid, 71.5% artic
    - Rest of city: 69.9% rigid, 30.1% artic
- *Taxi split* – this has been zoned as city centre, with 6.3% of car movements as taxis and rest of the city with 2.4% of car movements as taxis.

Emission calculations for each vehicle category will be based on vehicle fuel type and Euro classification. Information on the local fuel type mix and Euro standard distribution has been collected from the ANPR surveys conducted over one week from the 5th to 11th December 2016. An assessment of the ANPR suggested that for light duty vehicles the Euro class distribution was consistent across the monitoring locations, and for the heavy duty vehicles there was greater variation but not clear pattern as was seen for the rigid/artic split data. Based on this a common distribution of fuel types and euro classifications was used across the whole model domain for each vehicle type. The distribution of fuel type and Euro classification from the local data is shown in figures 8 to 13 below compared to the national average data taken from the NAEI.

Modelling coach emissions

When using the EFT or our in-house equivalent road traffic emissions calculator RapidEms; the assumed fraction of coaches in the bus fleet is 28%. This is the coach fraction specified for Urban/rural UK roads (outside London) in the 2013 and 2015 base year NAEI rtp fleet projections[21]. We are however aware that coach movements were not included in the traffic model outputs so all bus movements would be passenger service vehicles. To account for this when calculating bus emissions, we used an identical local euro fleet breakdown for both the bus and coach vehicle categories. This will however mean that emissions from the additional bus/coach AADT not represented in the traffic model have not been included.

[20] DfT (2018) Table TRA0307_2015 Traffic distribution on all roads by time of day and day of the week in Great Britain

[21] NAEI (2014) rtp_fleet_projection_Base2013_v3.0_final -

Figure 10 Car fuel type split

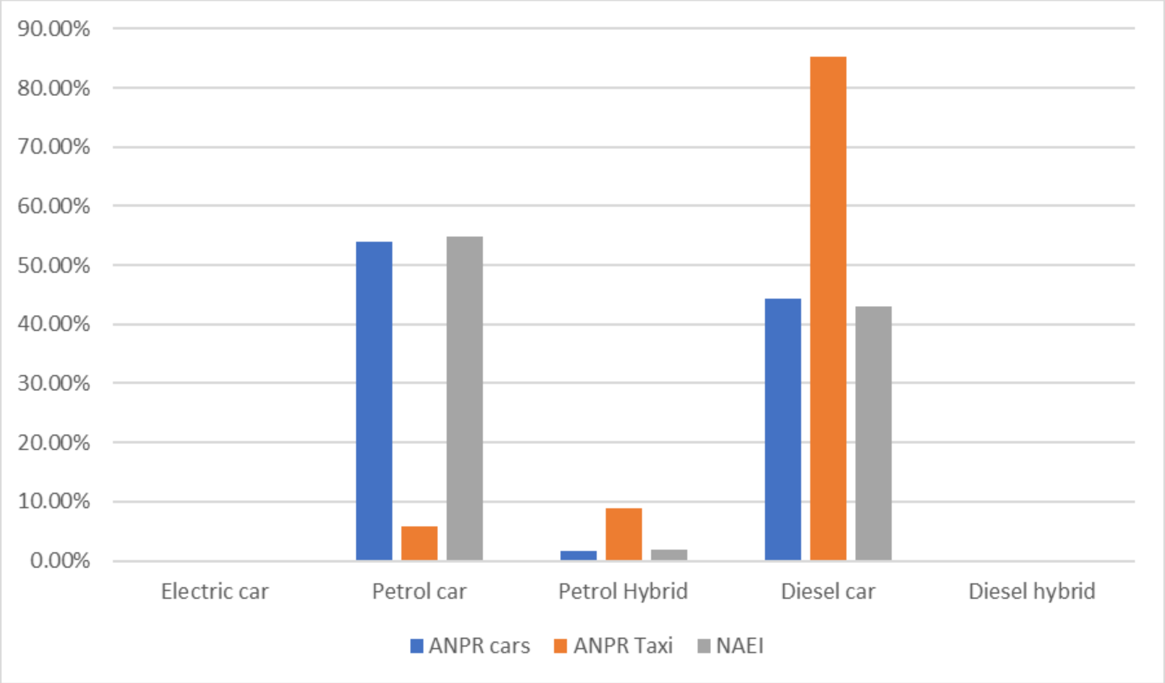


Figure 11 Diesel car Euro classification distribution

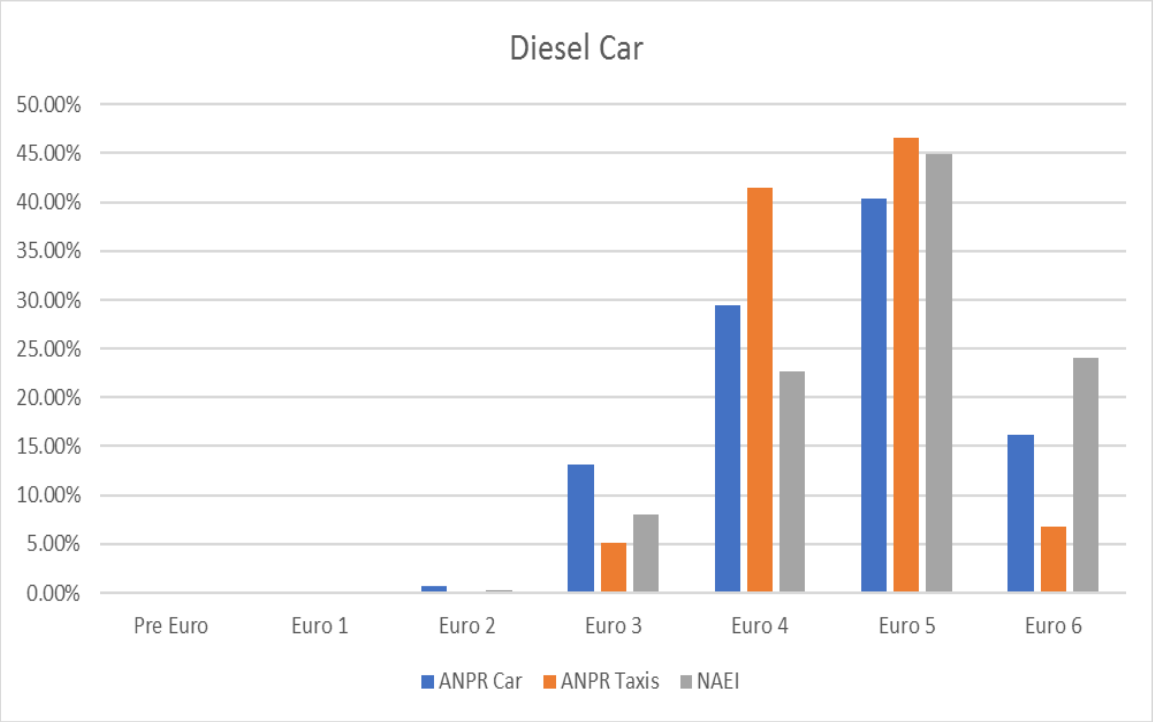
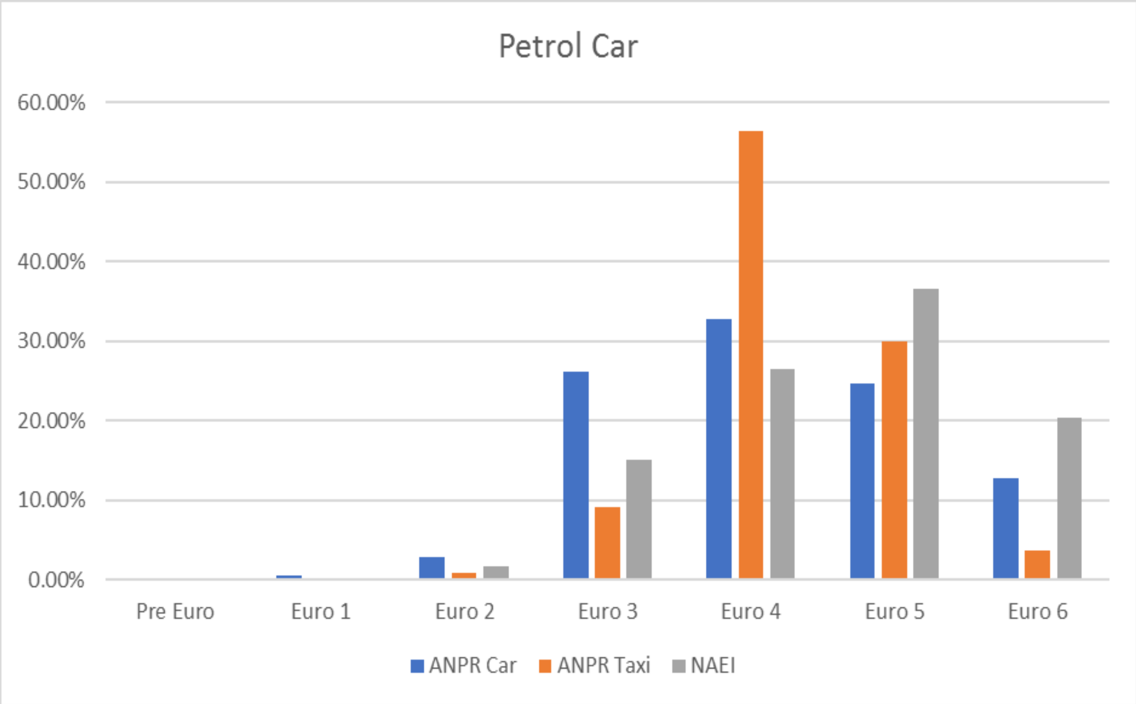


Figure 12 Petrol car Euro classification distribution



The data for cars shows that the fuel type is pretty consistent with the national average, but with taxis having a much higher proportion of diesel as would be expected. The taxis also have a higher proportion of hybrids which is a trend seen in many cities. In relation to Euro classification the local fleet is slightly older than the national average.

Figure 13 Diesel van Euro classification distribution

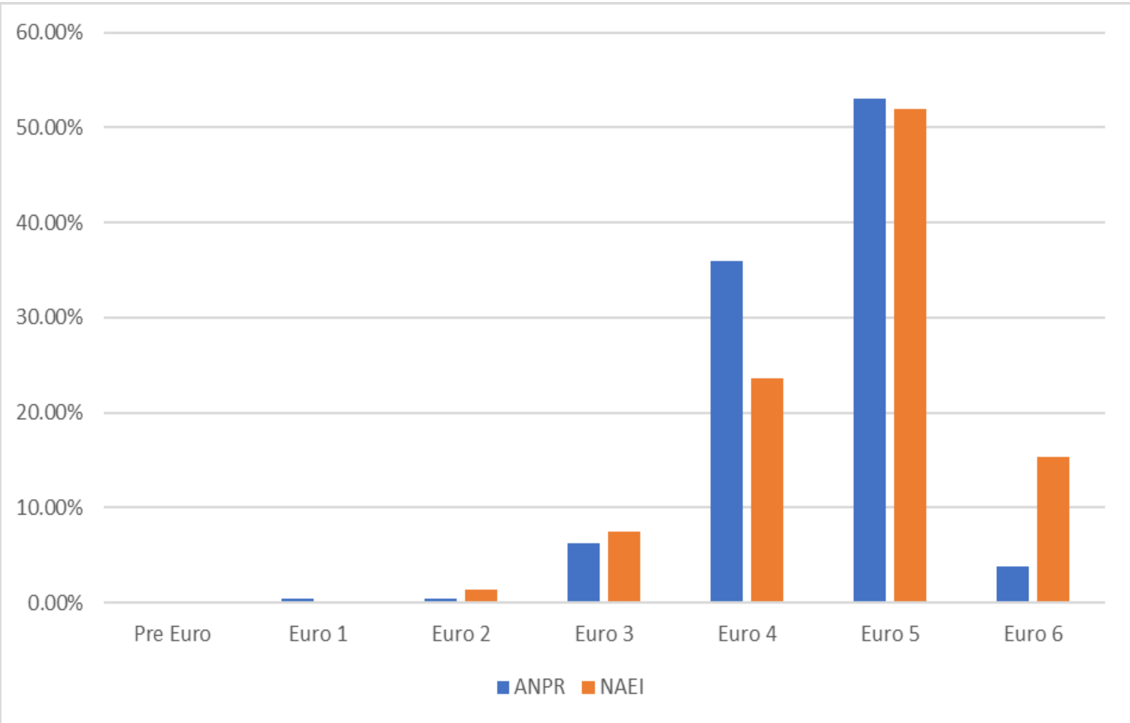


Figure 14 Rigid HGV Euro Classification distribution

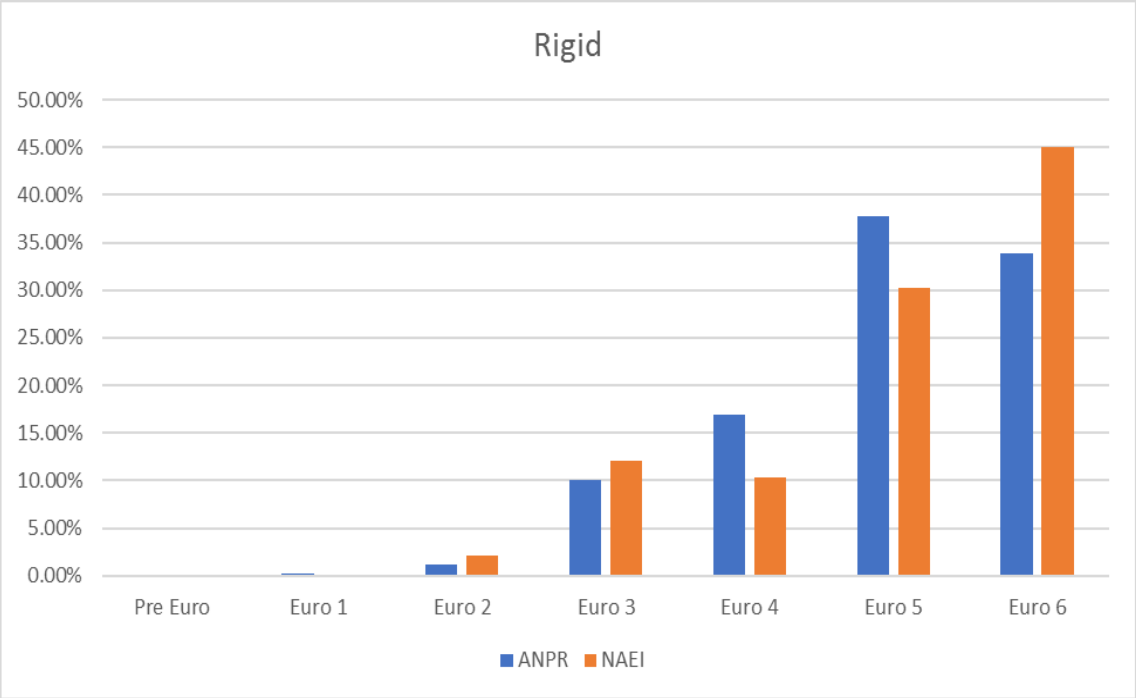
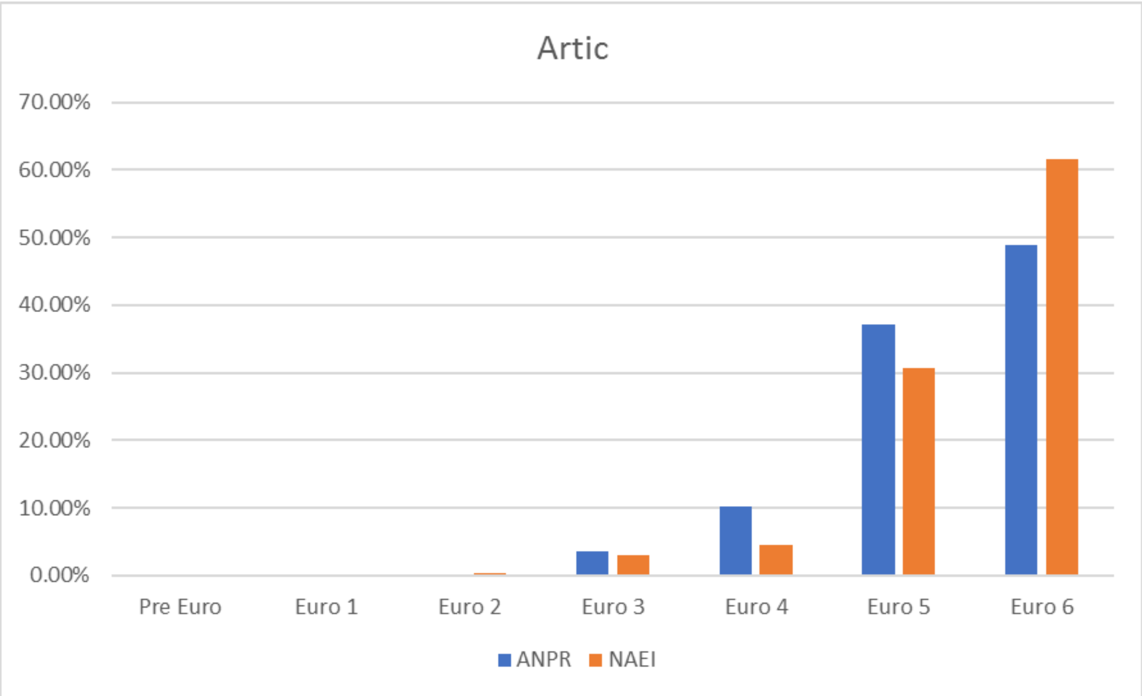


Figure 15 Artic HGV Euro Classification



Like the cars the Euro classification taken from the ANPR data shows a somewhat older van and HGV fleet in Southampton compared to the national data.

Since no additional ANPR data was collected specifically in the New Forest area the fleet composition assumptions will be the same as those in Southampton.

4.3.3 NOx/NO_2 emissions assumptions

Link specific NOx emission factors have been calculated using the COPERT v5 emission functions for all vehicles up to and including Euro 6/VI. Emission rates have been calculated with our in-house emission calculation tool pyCOPERT as agreed by JAQU, which is fully consistent with COPERT v5 and links directly to our RapidAir dispersion modelling system.

JAQU recommend the use of data on primary NO_2 emissions (fNO_2) by vehicle type which is available via the NAEI website (based on 2014 NAEI) to provide a more detailed breakdown than the LAQM NOx to NO2 convertor. This suggests a link specific f-NO_2 emissions estimate for use in the NO_2 modelling.

Based on this requirement, the pyCOPERT road emissions calculation tool now includes additional functionality to calculate fNO_2 emission rates for each road link. Link specific fNO_2 fractions can then be calculated for each link by dividing fNO_2 by total road NOx emission rate.

Calculating link specific fNO_2 emission rates also facilitates dispersion modelling of both road NOx and fNO_2 across the entire model domain to produce separate concentration rasters, which can then be combined with background concentrations to calculate NO_2 concentrations in each grid cell.

The recently updated version (v5.3) of the LAQM NO_x to NO_2 conversion spreadsheet has been used to convert road NOx, fNO_2 and background NOx into NO_2 concentrations where results at discrete receptor locations are required. This currently includes all NO_2 monitoring site locations and receptors placed at 4m from the PCM road links.

To model NOx/NO_2 chemistry across the entire model domain. The city wide domain has been modelled at 1m resolution, the modelled concentration grid rasters have approximately 188 million cells. The JAQU guidance note for assigning fNO_2 when calculating NO_2 acknowledges that for large model domains and high resolution models, use of the spreadsheet tool will not be practical because the calculator is limited to a maximum of 64.6K lines in the excel spreadsheet. The guidance note recommends that it may be possible to use the calculator to define statistical relationships between NO_2 concentrations and the input parameters and use these relationships to calculate NO_2.

In this case the statistical relationship was derived using an ordinary least squares (OLS) regression model. The OLS model was derived by defining background NOx, road NOx and road fNO_2 as the independent variables, and total NO_2 as the dependent variable.

4.4 Non-road transport modelling and background concentrations

We proposed to model non-road transport sources of NO_x emissions using three types of emission (and background concentration) data.

1. **Southampton port related emissions**: these are perhaps the most important non-road transport source, particularly for the Western Approaches AQMA a key area of concern, and covering emissions from vessels whilst travelling to and berthed at the port and emissions from on-shore port operations, including from road vehicles on private port roads not otherwise captured by the public road transport modelling. Further details of our approach to the port related sources are provided in appendix 4.

2. **Large local point sources**: Emissions from two nearby industrial sources categorised as large point sources in the NAEI have been modelled explicitly using the AERMOD dispersion model at 10m grid resolution. Modelling these sources explicitly aims to provide a more resolved footprint of each sources' contributions to background NOx/NO_2 concentrations than are available from the 1km LAQM background maps. The point sources modelled were:

- Marchwood Power Station
- Marchwood Incinerator

The stack parameters for these large point sources as modelled for the PCM were provided by Defra. Emission rates were calculated using 2015 data from the large combustion plant (LCP) inventory[22]. In the absence of site specific, or published European data on temporal emission profiles, typical operating profiles and weighting factor files as found on the USEPA Clearinghouse for Inventories and Emissions Factors (CHIEF)[23] website were applied to calculate daily and seasonal time varying profiles in AERMOD.

3. **Rail emissions:** As port rail sources were being modelled, it was also necessary to model the national rail network. The latest available (2013) NAEI annual NOx emissions data for the rail network within the model domain was provided by Defra. Dispersion of rail emissions were modelled using rapid air with a bespoke dispersion kernel at 1m resolution. The kernel was created using a release height and initial vertical dimension of the area plume representative of a typical diesel locomotive.

4. **General background sources:** The 1km resolution LAQM background maps were used to provide estimates of all sources not modelled individually as described above.

Road sector contributions from the 2013 base year maps were adjusted to take into account new COPERT 5 emissions using adjustment factors provided by JAQU. The contribution from all road source sectors that were modelled explicitly were subtracted from the background maps.

To avoid double counting of any explicitly modelled non-road transport sources**;** gridded concentrations modelled at fine resolution were resampled to represent average concentrations from these sources over the equivalent 1km background map resolution. The contribution from each source type could then be discounted from the relevant sector in the background maps.

4.5 Measurement data for model calibration

Southampton City Council's 2015 automatic and diffusion tube annual mean NO_2 measurements from roadside sites were used for model verification. Information on monitoring data QA/QC, diffusion tube bias adjustment factors etc. will be as presented in the Southampton City Council 2016 LAQM Annual Progress Report. This has been complemented by available data for the New Forest model domain.

5 Projected future year scenario modelling

5.1 Road transport future year baseline

Future year baseline scenarios have currently been modelled in the year 2020. The main modelling issues for the future year baseline scenarios are:

- **AADT flows for future baseline years** will be provided from the SYSTRA sub-regional traffic model. Further information on how these traffic flows will be derived and how local growth in traffic will be calculated is presented in 'Transport Modelling Methodology Report'.

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[22] European Environment Agency (2017) LCP inventory – available at http://cdr.eionet.europa.eu/Converters/run_conversion?file=gb/eu/lcpes/envwrwsia/LCP__Summary_of_emission_inventory__1.xml&conv=538&source=remote

[23] USEPA(2017) https://www.epa.gov/chief

- **Projected fleet split (vehicle type):** All future year scenarios will have the 4 core vehicle category fleet splits provided from the traffic model in the same breakdown as provided for the 2015 base year. The further split of HGV's into artic and rigid, and for taxis will use the same ratios as derived for the 2015 baseline.
- **Projected fuel type and Euro class distribution:** a local fuel type and Euro class distribution has been projected forward from the local ANPR results to provide Euro class distributions for each of the future modelling years. This project has been carried out in line with the draft methodology provided by JAQU. This has been done by deriving future scaling factors from the national NAEI data, applying these to the local ANPR results and then normalising to 100%. This gives an evolution of the local fleet that is slightly behind the national fleet.
- **Future year scenarios average vehicle speed data:** Average link speeds for all future year scenarios will be calculated by adjusting the observed baseline speed data (Traffic Master) by the ratio of the 2015 baseline vs future baseline journey times calculated by the traffic model
- **Projected vehicle NOx emission rates** will be calculated using the latest COPERT v5 NOx emission functions applied to the projected average flows, fleet and vehicle age composition for each future baseline year being modelled.

5.2 Non-road transport projections

5.2.1 Vessels travelling to and berthed at the port

The updated NAEI shipping emissions inventory described in section 4.4 will also include annual projections from its base year of 2014 to 2035. With agreement from BEIS (the sponsors of the projections work) and Defra these projections will be used for modelling vessel emissions. These projections account for the following four changes over time from the base year:

- Changes in activity levels, with assumptions specific for Southampton (up to approximately 5km from the port), and other standard assumptions for shipping activity outside of this distance. The assumptions specific to Southampton of annual average growth rates for specific vessel categories are taken from the Port of Southampton Master Plan 2016 consultation document section on trade and demand forecasts[24].
- Changes in fuel types of vessels. The impacts of the tighter fuel sulphur limit of 0.1% within the SECA from 2015 is accounted for by assuming that vessel operators that used 1.0% S heavy fuel oil in 2014 comply by switching to marine distillate fuel. This is relevant for NO_X due to the slightly lower NO_X emission factor for marine distillates. No LNG is assumed to be used in vessels until from year 2021 onwards in this baseline projection (and then at a rate of 1/3 of new vessels built from 2021 operating in the North Sea and English Channel from year 2021 are assumed to be LNG).
- Changes in vessel fuel efficiency (with consequent impacts on emissions), of annual improvement in vessel energy efficiency of 1% per year. This accounts for improvements from the Energy Efficiency Design Index, as well as changes over time in vessel capacities.
- Changes in emission factors. In relation to NO_X, this accounts for an annual reduction of 0.68% of NO_X emission factors up to 2020 due to the ongoing fleet turnover and thus increasing proportions of newer vessels meeting IMO NO_X Technical Code Tier II levels. Also for NO_X this accounts from 2021 onwards for the expected NO_X emission control area designation of the North Sea and English Channel which includes Southampton Water. This

[24] http://www.southamptonvts.co.uk/admin/content/files/New%20capital%20projects/Master%20Plan%202016/Master%20Plan%202016%20-%202035%20Consultation%20Document%20Oct%202016.pdf

will have only a very minor influence on NO_X emission levels for the post-implementation model year of 2022.

5.2.2 Port operations

For projecting the business-as-usual changes in emissions from port operations, the emissions from each of the sources separately listed in section 4.4 will be subject to two changes over time, implemented as scaling factors relative to the base year:

- Activity level changes. Similarly, to the vessels projections, the activity level changes will be based on the projected demand changes at the port as set out in the Port of Southampton Master Plan[24]. The emission sources related to containers – e.g. straddle carriers etc. – will be scaled according to the forecast changes in demand. For example, the Master Plan includes two container growth scenarios of 2.5% annual compound growth and 3.5% compound annual growth – for this example we will assume that future straddle carrier activity in 2020 is $(1.03)^4$ times larger than the activity level in 2016. The other emission sources will similarly be scaled with the appropriate commodity type demand forecasts.
- Emission factor changes. We have consulted with DP World and have obtained assumptions to make to reflect their planned fleet turnover of straddle carriers. Aside from straddle carriers (estimated as the largest NOx emission source in the port other than vessels), no other equipment fleet turnover will be accounted. The planned straddle carrier fleet turnover will enable us to account for baseline reductions in the NO_X emission factors that will occur. For the modelling of vehicle emissions on in-port roads that arrive/depart through the dock gates, the same assumptions relating to turnover in the vehicle fleet for in-port roads will be made as for public roads.

5.3 Scheme option modelling projections

Four CAZ options have been modelled in detail as described in section 1.2 above. The scheme options will be modelled in 2020 the target implementation. The core fleet categories used in the modelling will comprise cars, taxis, vans, rigid HGVs, artic HGVs and buses will remain the same as the baseline forecasts. The detailed technology and Euro split for the vehicles will be derived separately for the compliant and non-complaint fleet as follows:

- Compliant fleet this will comprise of:
  - naturally compliant vehicles from the baseline forecast;
  - non-complaint vehicles that upgrade based on the JAQU assumption set out in **Error! Reference source not found.**;
  - for the non-compliant vehicles that upgrade we will also use the JAQU assumption in relation to diesel/petrol split for upgrading vehicles;
  - in addition, all upgraded vehicles will be assumed to match the Euro distribution of those in the naturally complaint fleet.
- Non-compliant vehicles – these will have the fleet Euro distribution of the non-compliant vehicles in the baseline forecast

Following the traffic model run the compliant and non-compliant vehicles will be modelled as two separate fleets in the emission model with their own Euro standard distribution. The emissions from each of these fleets will then be added up for each link to give link specific emissions representing the mix of compliant and non-complaint vehicles on that link. Working in this way we are able to capture the behavioural response to the CAZ both in terms of how people upgrade their vehicles and any travel behaviour changes on a link specific basis.

The details of the CAZ options being modelled and the primary modelling assumptions are shown below in Table 3

Table 3 Final list of options for assessment

Option	Components	Modelling approach
Option 1 City Wide CAZ B	City Wide CAZ B	City Wide CAZ B in transport model, feed into AQ model
	Bus grants	Not modelled explicitly as scheme forces uptake
	Taxi incentives	Not modelled explicitly as scheme forces uptake
Option 1A City Wide HGV charging	City wide CAZ for HGVs only	Using transport modelling for CAZ B but only update HGV fleet
	Bus traffic condition	Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre.
	Taxi incentives	Assume 20% of non-compliant vehicles upgrade, 1/3 of JAQU assumption
Option 2 City centre CAZ A Plus LES HGV	City centre Class A	Use base 2020 transport model results Buses- Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre Taxis - Assume JAQU compliance assumptions in centre (upgrade and VKM reduction), Assume 38% upgrade elsewhere (JAQU upgrade X ratio of city centre/rest of city Tax proportions)
	Bus grants	Not modelled explicitly as scheme forces uptake
	Taxi incentives	Not modelled explicitly as scheme forces uptake
	Freight DSP and consolidation	Assume 5% reduction of HGV and LGV traffic in centre, Assume 2.5% reduction in rest of city (reduced LES assumption, alternative is look at using transport model)
	Freight Eco, Port booking, 24hr	Assume 30% non-compliant HGVs upgrade (1/3 of JAQU assumption)
Option 3 Non-charging CAZ	Bus traffic condition plus grant	Use base 2020 transport model results Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre
	Taxi incentives	Assume 20% of non-compliant vehicles upgrade, 1/3 of JAQU assumption
	Freight DSP and consolidation	Assume 5% reduction of HGV and LGV traffic in centre, Assume 2.5% reduction in rest of city (reduced LES assumption, alternative is look at using transport model)
	Freight Eco, Port booking, 24hr	Assume 30% non-compliant HGVs upgrade (1/3 of JAQU assumption)

All background concentration data will remain the same as in the baseline forecasts.

Appendices

Appendix 1: RapidAir street canyon equations

Appendix 2: Details of port modelling

Appendix 1 - RapidAir street canyon equations

The formulations for both models are described below.

USEPA STREET model

The STREET model assumes that the concentration of pollutants within a street canyon location consist of the urban background concentrations and a concentration from vehicle emissions within the street being modelled. The recommendation by the USEPA is to use the concentration from the model at 3m height as background concentrations at the actual receptor height being modelled. Since the canyons are expected to be well mixed over longer averaging periods it is sensible that we use the RapidAir kernel model to provide boundary conditions to the STREET model. Concentrations on the leeward (CL) and windward (CW) side of the canyon are calculated in this method, using the equations below:

$$CL = \frac{K * Q}{(U + 0.5) * \left[(x^2 + z^2)^{1/2} + L_0\right]}$$

$$CW = \frac{K * Q * (H - z)}{W * (U + 0.5) * H}$$

Where K is an empirical constant (usually set between 10 and 14); Q is the emission rate (g/m/s); U is the wind speed (m/s); L_0 is the length of individual vehicles (set to 3 m in this case); W is the width of the canyon (m); H is the average building height of the canyon (m); x is the distance from emission source to receptor (m); and z is the receptor height.

AEOLIUS/OSPM

There are three principal contributions in the AEOLIUS model, a direct contribution from the source to the receptor, a recirculating component within a vertex caused by winds flowing across the top of the canyon, and the urban background. The RapidAir model only take the recirculating component from the canyon and sums this with the kernel derived concentrations.

The RapidAir implementation of AEOLIUS is written in python 2.7 and uses the same equations described in the referenced Met Office papers.

During the coding of the canyon model we tested the outputs of our code with calibration data provided with the FORTRAN version of AEOLIUS. Our implementation agrees almost (R^2 = 0.97) perfectly with the version supplied by the Met Office (which is in any case now out of circulation).

The AEOLIUS model is more complex than the STREET model. Concentrations are calculated for the windward and leeward sides of the road using the equations detailed below (based on equations from the Met Office). The leeward and windward concentrations described below are only calculated for streets that were perpendicular to the direction of the wind. Concentrations calculated in ppb, and for NOx/NO_2 models are converted to µg/m^3 by multiplication by 1.91. The system of equations in RapidAir's implementation of the AEOLIUS model are shown below.

Inputs:

Emission rates (Q, µg/m/s); traffic speeds (v_t, mph), traffic density (f, vehicles per hour), % of cars and heavy good vehicles (f_c and f_h respectively), wind speed at roof level (u_r, m/s), street canyon width (w, m), street canyon height (h, m), and angle of street (θ).

Leeward concentrations:

The leeward concentrations = sum(C_{dlee} + C_{rec}) where C_{dlee} is the direct contribution from vehicles and C_{rec} is the pollution associated with recirculation.

Direct contribution (C_{dlee}):

$$Recirculation\ zone\ (l_r) = \min(w, l_v * \sin(\theta)) \quad \text{(meters)}$$

Where:

$$vortex\ length\ (l_v) = 2 * r * h \quad \text{(meters)}$$

And r = wind speed dependence factor = 1 if u_r > 2 m/s and = $u_r/2$ otherwise.

If the recirculation zone is greater than the width of the canyon:

$$C_{dlee} = \sqrt{\frac{2}{\pi} * \frac{Q}{(w * \sigma_w)} * \ln\left[\left(\frac{\sigma_w * w}{h_o * u_s}\right) + 1\right]}$$

Where:

σ_w = mechanical turbulence from wind and traffic (m/s) = $\sqrt{(\lambda * u_s)^2 + \sigma_{wo}{}^2}$

λ = constant for removal at the top of the canyon = 0.1

σ_{wo} = traffic-created turbulence (m/s) = $b * \sqrt{\frac{v_t * f_c * s_c + v_t * f_h * s_h}{w}}$

where s_c = mean surface area of cars (4 m^2), s_h = mean surface area of heavy vehicles (16 m^2) and b = aerodynamic constant (0.18)

u_s = wind speed at street level (m/s) = $u_r \left(\frac{\ln\left(\frac{h_o}{zo}\right)}{\ln\left(\frac{h}{zo}\right)}\right)(1 - d * \sin(\theta))$

h_o = effective height of emissions (2 m)

z_o = effective roughness length (0.6 m)

d = model dependence (0.45)

If the recirculation zone is less than the width of the canyon:

$$C_{dlee} = \sqrt{\frac{2}{\pi}}\frac{Q}{(w * \sigma_w)}\left[ln\left[\left(\frac{\sigma_w * d_1}{h_o * u_s}\right) + 1\right] + R * \ln\left(\frac{h_o + \sigma_w * \frac{d_6}{u_s}}{\frac{\sigma_w * l_r}{u_s} + h_o}\right) + \frac{\sigma_w}{\omega_t}\left[1 - e^{\left(\frac{-\omega_t d_7}{u_s h}\right)}\right]\right]$$

Where:

d_1 (m) = min(w, l_r)

R = max(0, C_{ang})

C_{ang} = cos(2*r* θ)

d_6 (m)= min(max(l_{max}, l_r), x_1)

l_{max} = w/sin(θ)

x_1 = vertical distance (m) at which pollutants can escape canyon = $\frac{u_s(h - h_o)}{\sigma_w}$

ω_t = removal at top of the canyon (m/s) = $\sqrt{(\lambda * u_r)^2 + 0.4(\sigma_{wo})^2}$

d_7 (m) = max(l_{max}, x_1)-x_1

Recirculation contribution (C_{rec}):

$$C_{lee} = \frac{\left[\left(\frac{Q}{W}\right) d_1\right]}{\omega_t * d_2 + \omega_s * d_3}$$

Where

d_2 (m) = min(w, 0.5*l_r)

d_3 (m) = $l_s \left(\max(0, \frac{2w}{l_r} - 1\right)$

l_s (m) = $\sqrt{(0.5 * l_r)^2 + h^2}$

ω_s = removal speed at the side of the canyon (m/s) = $\sqrt{{u_s}^2 + {\sigma_{wo}}^2}$

Windward concentrations (C_{dwind}):

Final windward concentrations = C_{dwind} + C_{rec}. C_{dwind} = 0 if l_r ≥ w, else:

$$C_{dwind} = \sqrt{\frac{2}{\pi}} \frac{Q}{w * \sigma_w} \left[ln\left(\frac{\sigma_w + d_4}{u_s + h_o} + 1\right) + \frac{\sigma_w}{\omega_t}\left[1 - e^{\left(\frac{-\omega_t d_5}{u_s h}\right)}\right]\right]$$

d_4 (m) = min[(w – l_r), x_1]

d_5 (m) = [max[(w – l_r),x_1]]-x_1

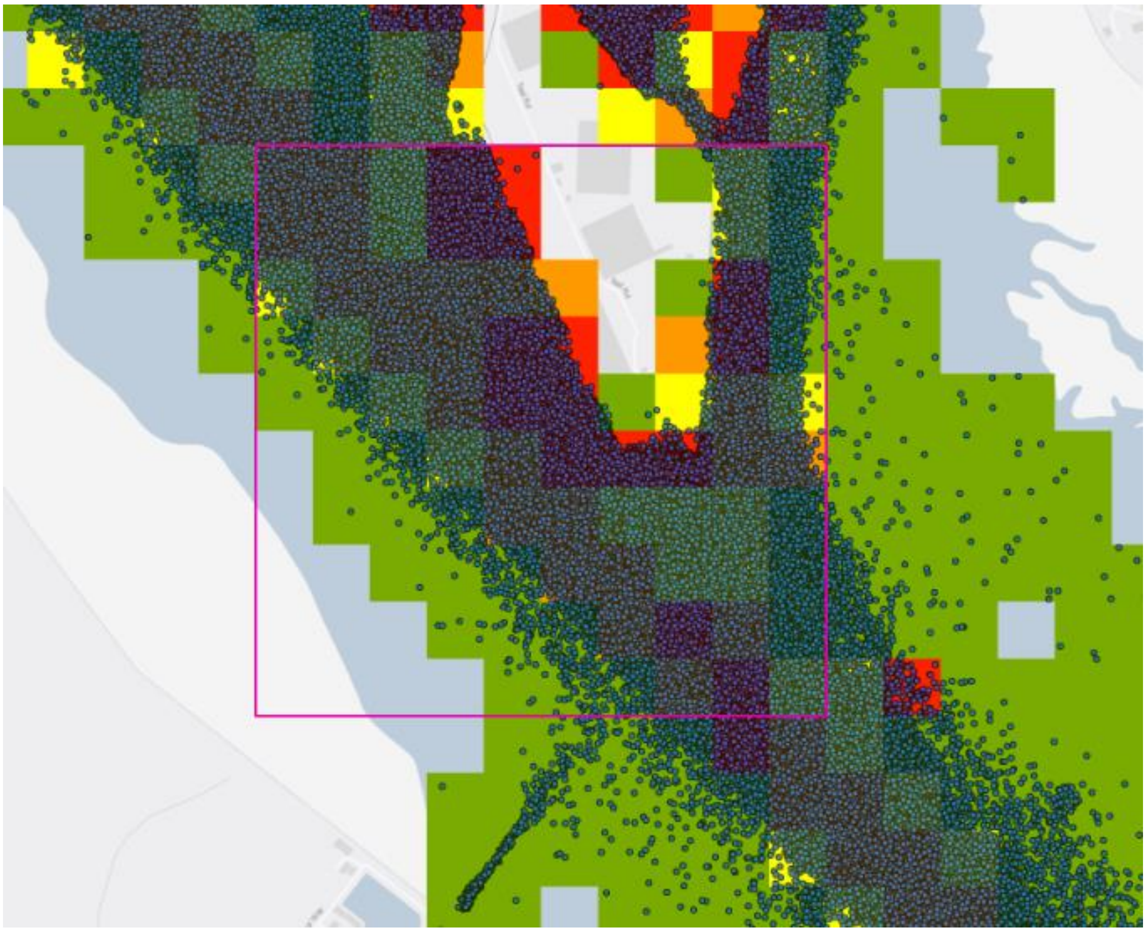
Appendix 2 – Details of port modelling

A2.1 Vessels travelling to, from and berthed at the port

NO_X emissions from vessels travelling to, from and berthed at the port will be taken from the latest estimates in the National Atmospheric Emissions Inventory (NAEI). There is currently an update being made to the estimation of emissions from shipping in the NAEI. Permission has been obtained from the sponsor (the Department for Business, Energy and Industrial Strategy, BEIS) and data provider (the Maritime and Coastguard Agency, MCA) in order to use the latest estimates in advance of their official inclusion into the NAEI.

The updated spatially disaggregated shipping emissions inventory is derived nationally from Automatic Identification System (AIS) data that was provided by the Maritime and Coastguard Agency to Ricardo Energy & Environment. This inventory is for the year 2014, and will be assumed to represent the base year 2015 in terms of quantity and spatial distribution of emissions. The inventory includes annual NO_X emissions per 1km by 1km grid resolution; however, for the purposes of this analysis for Southampton this has been refined to NO_X emissions per 100m by 100m resolution (Figure 16). All vessels that are in scope of the inventory are included, regardless of whether they are undertaking international or domestic voyages.

Figure 16 AIS positions of vessels around the Eastern docks, with purple outline showing 1km resolution, which has been refined to 100m resolution for the purposes of the modelling.



The inventory aims to provide complete coverage of most vessel activity in Southampton Water. It covers all vessels that transmit positions via AIS, with the exception of some vessel types. The vessel types covered and not covered by the updated inventory are shown in Table 4. The emissions from vessel types not included in the updated NAEI shipping inventory (recreational, military) will not be estimated or modelled. However, these are assumed to be negligible compared to the large vessels docking at Southampton port.

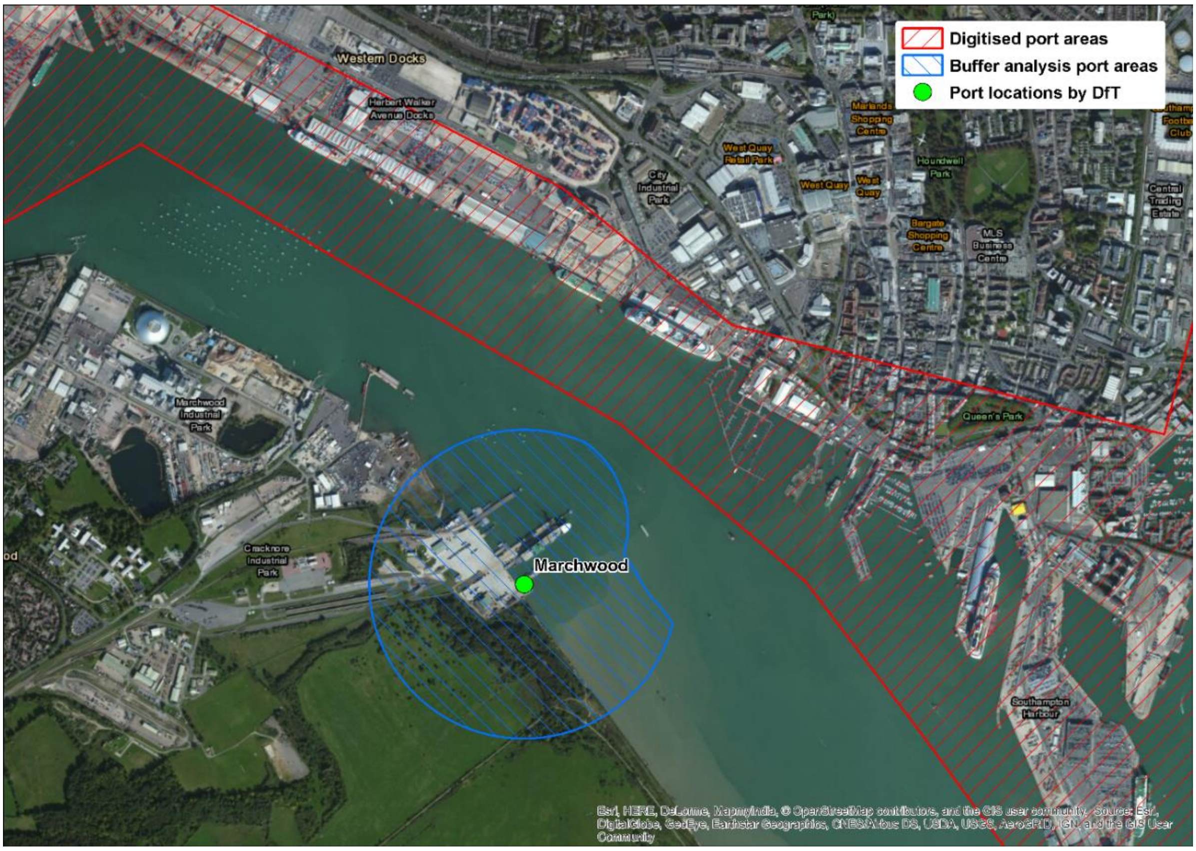
The inventory includes estimates of emissions from vessel main engines as well as their auxiliary engines (generators) and auxiliary boilers if relevant for the vessel type. Cruise ship incinerators are assumed not to be operated whilst in port.

The inventory includes vessels whilst steaming, manoeuvring and whilst at berth. The inventory defines vessels as being at berth when they are reported under AIS as moving at less than 1knot, and when their coordinates are within a port boundary (example shown in Figure 17). The port area for Southampton is considered to be the boundary of the red zone of Figure 17 (zoom only shows western and eastern docks, container terminal not shown but is included). The inventory includes emissions from vessels' auxiliary engines and boilers running whilst the vessel is at berth, capped at a maximum of 24 hours, i.e. if vessels are deemed to be at berth for longer than 24 hours then all their engines are assumed to be off.

Table 4 Vessel types covered and excluded from the updated NAEI shipping emissions inventory

Vessel types included in the spatially disaggregated NAEI inventory		Vessel types excluded from the spatially disaggregated NAEI inventory
• Bulk carrier • Chemical tanker • Container • General cargo • Liquefied gas tanker • Oil tanker • Other liquids tankers • Ferry-pax only • Cruise	• Refrigerated bulk • Ro-Ro • Vehicle • Service - tug • Miscellaneous - fishing • Offshore • Service – other (including e.g. dredgers) • Miscellaneous - other	Recreational vessels – pleasure craft and other inland waterway vessels Military vessels. Noting Marchwood Military Port is on south side of Southampton Water. Any other vessels that did not operate AIS

Figure 17 Sample port boundaries used to define when vessels are at berth



The emission release heights that will be assumed per vessel type are shown in Table 5. These are based on:

- For cruise ships, inspection of planned cruise ship calls at Southampton in 2017, and literature research on vessel heights excluding draught.
- For container ships, inspection of recent container ship calls at Southampton, and weighted average according to vessels over 300m length (assumed funnel height of 57m), vessels 200-300m length (assumed funnel height 39m) and vessels less than 200m (assumed funnel height above water 26m)
- All other merchant vessels assumed 30m based on EC study[25]
- Ferry-pax based on average estimated heights of Red funnel ferries and Hythe ferry
- Other vessel types estimated.

[25] http://ec.europa.eu/environment/enveco/taxation/ship_emissions/pdf/app2final.pdf

Table 5 Assumed vessel emission release heights

Vessel type	Height above waterline (m)
Bulk carrier	30
Chemical tanker	30
Container	44
General cargo	30
Liquefied gas tanker	30
Oil tanker	30
Ferry-pax only	10
Cruise	61
Refrigerated bulk	30
Ro-Ro	30
Service - tug	5
Miscellaneous - fishing	5
Offshore	10
Service - other	5
Miscellaneous – other	5

A2.2 Rail

Emissions from freight and passenger trains operating on the mainline through Southampton City Centre will be taken from the background NAEI maps as the emissions in the NAEI for rail freight have been spatially disaggregated across the core rail network which includes the main line at Southampton.

The NAEI base maps of emissions from rail will be used. However, rather than including these at the 1km resolution, they will be refined to instead represent the emissions as line sources along the Network Rail Strategic Route networks, for each of rail freight, intercity and regional.

A2.3 Port operations

The assessment of port operation emission sources needs to identify the main sources of NO_X emissions from the port, and assign them as point, line (mobile) or area sources to be modelled. The following emission sources will be estimated:

- Cargo handling equipment:
  - Straddle carriers
  - Freight Trains
  - HGVs-containers
  - Car transporters
  - HGVs – other goods e.g. foodstuffs
- Other service vehicles:
  - Forklifts
  - Any top/side loaders
  - Other port vehicles
- Emissions from vehicles driven off (import) and driven on (export) to RoRo vessels
- Employee and visitor (e.g. cruise customer) private vehicles
- On site power generation (combustion plant) e.g. engines

Shore-side and rail freight container terminal gantry cranes are 100% electric powered and do not need to be included in the port inventory. No on-site power plants or

Straddle carriers

NO_X emissions from straddle carriers will be taken from real-world estimates in a Ricardo study for DP World which measured NO_X and NO2 emissions for six types of non-road mobile machinery (NRMM) straddle carrier diesel engines in use at the port of Southampton. From these measurements it generated total annual emission estimates for the fleet, accounting for each emission standard of straddle carrier. This work already has a complete inventory of straddle carriers.

The straddle carriers will be modelled as two area sources, one area for the 4-high straddle carriers (assumed emission release height 15 metres) which operate landside only (not shipside, nor to the freightliner terminal), and one area for the 3-high carriers (assumed emission release height 12 metres) which also operate shipside and to the freightliner terminal.

Freight Trains

The emissions associated with freight train operation when departing from the mainline and whilst idling during loading/unloading will be specifically modelled as line sources, and will be additional to the rail emissions in the NAEI which do not account for specific rail terminal operation.

The emissions from the freight trains (container, vehicle and gypsum) servicing each terminal will be estimated. Activity rates per terminal (number of train services per week) have been obtained through consultation with a rail freight operator (Deutsche Bahn) at the port, and are shown in Table 6. All activity is assumed to be carried out by line haul locomotives without additional shunting locomotives.

The fuel consumption rates in litres/hour for both idling and for arrival/departure from the port have been identified from engineers in a rail freight operator (9.1kg/hr whilst idling, and 38.6kg/hr during arrival/departure from the port). NO_X emissions will be estimated from the fuel consumption using the NO_X emission factor taken from the existing NAEI (105.5kg NOx/ tonne of fuel). Estimates of the time taken for travel into and out of the port from the mainline have been agreed through consultation with a rail freight operator. The extent of the class 66 locomotives deploying start-stop technology (to turn engines off whilst idling) will also be taken into account.

The activity will be assumed to be spread equally through the year. The emission source will be modelled as a line source, assumed to be emitted at 4m height above land. The specific sources to be considered are summarised in Table 6:

Table 6 Summary of Southampton port rail services. The maritime terminal is assumed to be used in preference to the Millbrook terminal.

Cargo	Location	Operator	Number of services	Idling time / service	Duration of travel from and return to mainline
Cars	Eastern docks (Figure 18)	Deutsche Bahn	25-30/week, 46 weeks/year	1.25 hours*	0.5 hours
Vans	Western docks Ro-Ro terminal (19)	Deutsche Bahn	3/week, 46 weeks/year	1.25 hours*	0.5 hours
Gypsum	Bulk terminal, Herbert Walker Avenue (19)	GB Rail Freight	2/week, 46 weeks/year	1.25 hours	0.5 hours
Containers	Maritime terminal (Figure 20)	Freightliner	60/week, 50 weeks/year	1.25 hours	0.25 hours

Containers	Rail terminal, Herbert Walker Avenue (19)	Deutsche Bahn	26/week, 50 weeks/year	1.25 hours*	0.5 hours

** 90% of idling time is with engines off, due to stop-start technology retrofitted to Deutsche Bahn Class 66 locomotives*

Figure 18 Location of terminal in Eastern docks. Emissions estimated from departure from mainline, shown by red line

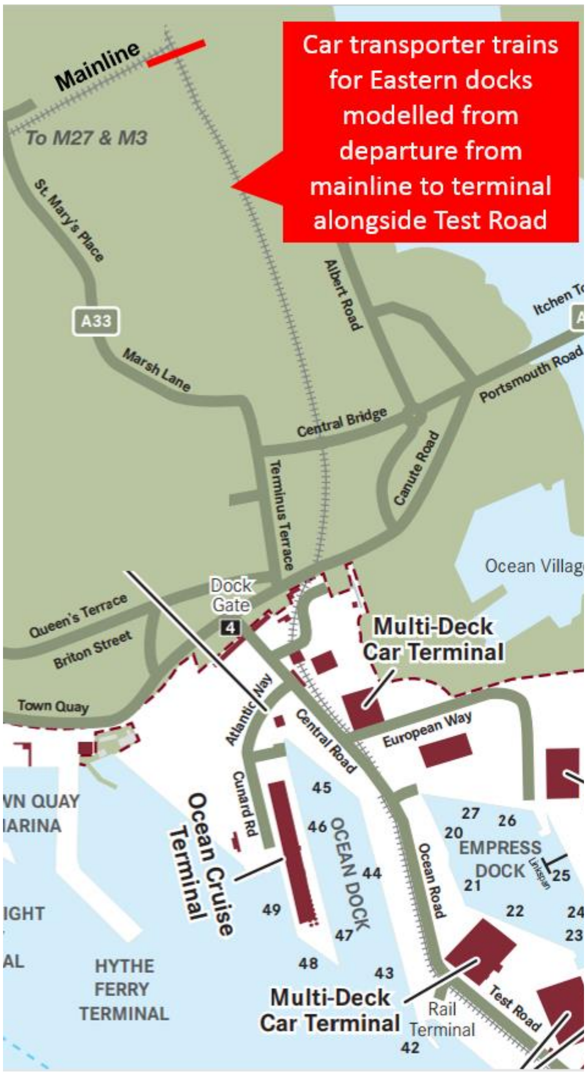


Figure 19 Location of terminal at Herbert Walker Avenue. Emissions estimated from departure from mainline, shown by red line

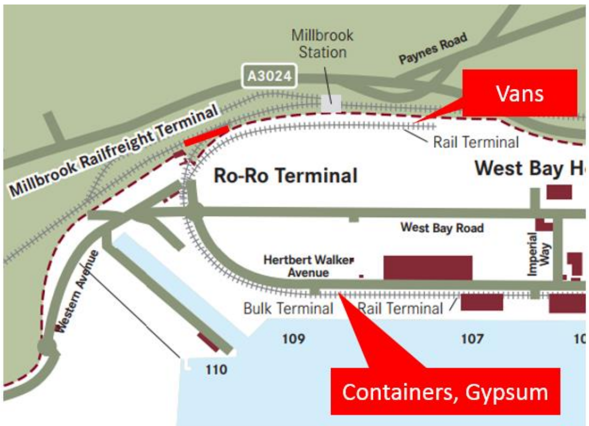


Figure 20 Location of freightliner terminal. Emissions estimated from departure from mainline, shown by red lines

No assessment will be made of the railway network running to the Marchwood military port on the south side of the River Test estuary.

Vehicles operating within the port having entered from public roads

NO_X emissions from vehicles that operate within the port having entered to the dock via dock gates will be modelled as an extension of the road traffic modelling. The modelling includes motorbikes, cars (and taxis), light goods vehicles, heavy goods vehicles (including containers and car/van transporters) and coaches. The same fleet (Euro standard) mix of vehicles as are assumed in the road traffic modelling to operate on nearby public roads will be adopted.

Annual average daily flows per road link will be estimated from:

- Count data per vehicle type from a fortnight in 2015 from SCC, multiplied up to represent one year (Table 7)
- Assumptions related to which road links within the port each vehicle type will travel on depending on the dock gate entered (Table 9).

This assumes no idling during unloading/loading. The resulting estimated annual vehicle flow rates are shown in Table 8.

Table 7 Number of journeys via each dock gate per vehicle type in 2015 (estimated from 2 weeks of SCC count data from summer 2015

Entry/exit	Motorbike	Car/taxi	LGV	Rigid HGV	Artic HGV	Bus/coach
Dock gates 4+5	12,168	343,311	139,191	77,467	42,718	4,752
Dock gate 8	1,300	58,773	26,741	5,083	1,313	878
Dock gate 10	11,622	263,673	109,031	52,546	72,852	4,849
Dock gate 20	17,433	285,032	79,313	182,806	234,338	2,015

Table 8 Flows assumed per year per road link, excluding exclusively in-port vehicles

Road link	Motor-bike	Car	LGV	Rigid HGV	Artic HGV	Coach / Bus
Central road N of roundabout	12,168	343,311	139,191	77,467	42,718	4,752
Central road S of roundabout to junction with European Way	6,692	188,821	92,794	51,645	35,598	2,376
Central road from junction with European Way to Ocean Road	5,476	154,490	46,397	25,822	21,359	2,376
Old road	0	0	0	0	7,120	0
Atlantic way	12,168	343,311	139,191	77,467	42,718	4,752
Cunard road	10,951	308,979	46,397	25,822	0	2,376
Ocean road	5,476	154,490	46,397	25,822	21,359	2,376
Test road	5,476	154,490	46,397	25,822	21,359	2,376
European Way	1,217	34,331	46,397	25,822	14,239	0
Eastern end of Herbert Walker Avenue to T junction with Solent Road	1,300	58,773	26,741	5,083	1,313	878

Road link	Motor-bike	Car	LGV	Rigid HGV	Artic HGV	Coach / Bus
Solent road (between roundabout and T junction)	0	0	13,371	2,542	657	0
Southern road	11,622	263,673	109,031	52,546	72,852	4,849
Eastern end of Herbert Walker Avenue to T junction with Solent Road	3,874	87,891	0	0	0	0
Solent road (between roundabout and T junction)	3,874	87,891	54,516	26,273	36,426	4,849
Herbert Walker Avenue between Solent road and Imperial Way	3,874	87,891	54,516	26,273	36,426	4,849
Herbert Walker Avenue between Imperial Way and roundabout meeting West Bay road	0	0	54,516	26,273	36,426	0
West Bay road east of junction with Imperial Way	7,748	175,782	109,031	52,546	72,852	4,849
West Bay road west of junction with Imperial Way	0	0	54,516	26,273	36,426	0
Imperial way	7,748	175,782	109,031	52,546	72,852	4,849
First avenue from A33 to roundabout	17,433	285,032	79,313	182,806	234,338	2,015
Western avenue west of roundabout junction with First Avenue	8,717	142,516	0	0	140,603	0
Western avenue east of roundabout junction with First Avenue to roundabout with T3	8,717	142,516	79,313	182,806	234,338	2,015
Western avenue east of roundabout with T3 until roundabout with West Bay Road	8,717	142,516	79,313	182,806	23,434	2,015
West Bay road east of junction with Imperial Way	8,717	142,516	0	0	0	0
Herbert Walker Avenue between Imperial Way and roundabout meeting West Bay road	0	0	79,313	182,806	23,434	2,015

Table 9 Assumptions for traffic routes within the port.

Dock Gate	Road link	Comments-car and motorbike	Comments-Artic HGV	Comments rigid HGV and LGV	Comments buses and coaches
Dock Gates 4+5	Central road N of roundabout	Assume that 10% of car traffic that enters at dock gate 4 is to the campus, and 90% for the cruise, which is then 50:50 split of car traffic between two cruise termini. Doesn't cover parking areas.	Assume all artic HGV traffic is car transporters, split 50% along ocean road (3 of 6 multi decks are here), 33% European way (2 multidecks) and 17% to old road (1 multideck).	Assumed rigid HGV traffic is equally split along Cunard, Ocean and European Way	Assume half service QEII terminal and half service the Ocean cruise terminal
	Central road S of roundabout to junction with European Way				
	Central road from junction with European Way to Ocean Road				
	Old road				
	Atlantic way				
	Cunard road				
	Ocean road				
	Test road				
	European Way				
Dock Gate 8	Eastern end of Herbert Walker Avenue to T junction with Solent Road	Assume passengers will only enter dock gate 8 for city cruise terminal	Assume half go to City Cruise terminal and half to near the Hovis mill		Assume all go to City Cruise terminal
	Solent road (between roundabout and T junction)				
Dock Gate 10	Southern road	Assume passengers will be 1/3 City Cruise and 2/3 Mayflower cruise terminal. Assume half of Mayflower customers use drop off along quayside.	Assume half LGV+HGV traffic loops <Southern road-Solent road-Herbert Walker avenue-Imperial way-West Bay Road-Southern Road>, and the other half loop <Southern Road-WestBay Road-Imperial Way-Herbert Walker Avenue-West Bay road-Southern Road>		Assume all loop <Southern road-Solent road-Herbert Walker avenue-Imperial way-West Bay Road-Southern Road>
	Eastern end of Herbert Walker Avenue to T junction with Solent Road				
	Solent road (between roundabout and T junction)				
	Herbert Walker Avenue between Solent road and Imperial Way				
	Herbert Walker Avenue between Imperial Way and roundabout meeting West Bay road				
	West Bay road east of junction with Imperial Way				
	West Bay road west of junction with Imperial Way				
	Imperial way				
Dock Gate 20	First avenue from A33 to roundabout	Assume 50% cars and motorbikes entering at dock gate 20 are destined to park in western most car parks, west of Container port, rest travel through to West Bay Road	Assume 90% of artic-HGV traffic is containers, split equally to T1, T2 and T3. Remaining 10% travels through to Herbert Walker Ave.	Assume rigid HGVs travel to scrap operator in western docks	Assume bus/coaches travel to Mayflower cruise terminal
	Western avenue west of roundabout junction with First Avenue				
	Western avenue east of roundabout junction with First Avenue to roundabout with T3				
	Western avenue east of roundabout with T3 until roundabout with West Bay Road				
	West Bay road east of junction with Imperial Way				
	Herbert Walker Avenue between Imperial Way and roundabout meeting West Bay road				

HGV tug/tractor units operating exclusively inside the port

NO_X emissions from HGVs tractor units that deliver containers between the DP World container terminal and the Herbert walker avenue rail freight container terminal will be modelled as a line source along in-port roads – assumed to travel along Western Avenue, West Bay Road east of the junction with Imperial Way, and on Herbert Walker Avenue between Imperial Way and the junction with West Bay road. Data provided by DP World suggested 834 such movements for one week in June 2015. This was assumed to be representative of a typical week, and assuming 51 working weeks per year yielded an estimate of 42,500 movements per year. The emissions for these articulated HGV tractor units will be modelled as part of the road traffic modelling, with the same fleet mix of Euro standards.

This assumes no idling during unloading/loading.

Miscellaneous sources: cranes, NRMM, and vehicles driven on/off RoRo vessels

This category includes stevedoring equipment and vehicles operated and driven within the port and which are not driven outside of the port gates. This emission source will be modelled as two area sources: one area source covering the Eastern Docks and a second covering the Western Docks. For all of the above except vehicles driven on/off RoRO vessels, fuel consumption records or estimates from port operators have been sought. Where fuel consumption records were not identified, fuel consumption was estimated either from other similar equipment inventoried or from fuel consumption factors in the EMEP/EEA air pollutant emission inventory guidebook[26]. NOx emissions are estimated from the annual fuel consumption using NOx emission factors expressed per unit of fuel consumption, selected appropriately to match the equipment in question. It includes the sources listed in Table 10.

Table 10 Stevedoring emission sources accounted for

Operator	Source	Location	Data source
Wallenius Wilhelmsen Logistics (WWL)	Crew buses, forklifts, tractor units	Eastern docks	Fuel records
WWL	Mobile harbour cranes	Eastern docks	Estimated from operating profile
Southampton cargo handling	Various	Eastern docks	Assumed equal to WWL
Williams shipping	Temporary generators, crawler crane and forklift	Eastern docks	Estimated from annual average operational profiles
ABP	Equipment, including CIL harbour cranes. Vehicles including NRMM	Assume split equally Eastern and Western docks	Fuel records
Fruit terminal	Cranes [began operation 2016]	Western docks	Fuel records

[26] https://www.eea.europa.eu/publications/emep-eea-guidebook-2016

S Norton (scrap operations)	Excavators, material handlers	Western docks	Fuel records
Solent stevedoring	Mobile harbour cranes, excavators, bobcats	Assume split equally Eastern and Western docks	Fuel records
Solent stevedoring	Tugs/tractor units, reach stackers	Western docks	Operational profile

The emissions from vehicles which are driven on to and off from Ro-Ro vessels are estimated. The total number of vehicles imported and exported in 2015 was 908,000 as reported in DfT statistics[27] of which the number of "high and heavy" NRMM vehicles imported and exported is around 37,000/yr[28] and it is assumed that the remaining vehicles are 90% cars and 10% vans. The distances travelled to vehicle storage compounds (including multi-decks) in both Eastern and Western Docks are estimated based on the identified locations of Ro-Ro berths and the appropriate vehicle storage facilities. The emission factors will be applied with the EFs from the EEA Guidance for road transport or NRMM as appropriate. All vehicles will be assumed to be of latest applicable euro standard in 2015.

Table 11 Assumptions for estimating NOx emissions from vehicles imported and exported

Vehicle type and storage location	Number imported / exported in 2015	Distance each vehicle driven in port from road/rail transporter to RoRo vessel or from RoRo vessel to road transporter	NOx emission factor
Cars – stored in Eastern docks	621,000	1km	Euro 6. Assumed 50% petrol (average medium, large: 0.06g/km), 50% diesel (any size: 0.5g/km).
Cars – stored in Western docks	162,900	3km	
Vans – Western docks	87,100	3km	Euro 6 diesel (0.5g/km).
NRMM ("high and heavy") – Eastern docks	37,000	0.5km	Fuel consumption assumed to be 5 mpg. NOx emissions factor taken as NRMM Stage V (Tier 2, Agriculture): 1861g/t fuel.
Sources	*DfT, ABP*	*Assumption*	*EEA Guidance 2016*[29]

[27] Port Freight Statistics , Table PORT0211

[28] Personal communication with ABP

[29] https://www.eea.europa.eu/publications/emep-eea-guidebook-2016

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Southampton Clean Air Zone – Air Quality Results Report (AQ3)

Report for Southampton City Council and New Forest District Council

ED 10107 | Issue Number 4.1 | Date 06/07/2018

Customer:

Southampton City Council

Customer reference:

Southampton CAZ Feasibility Study

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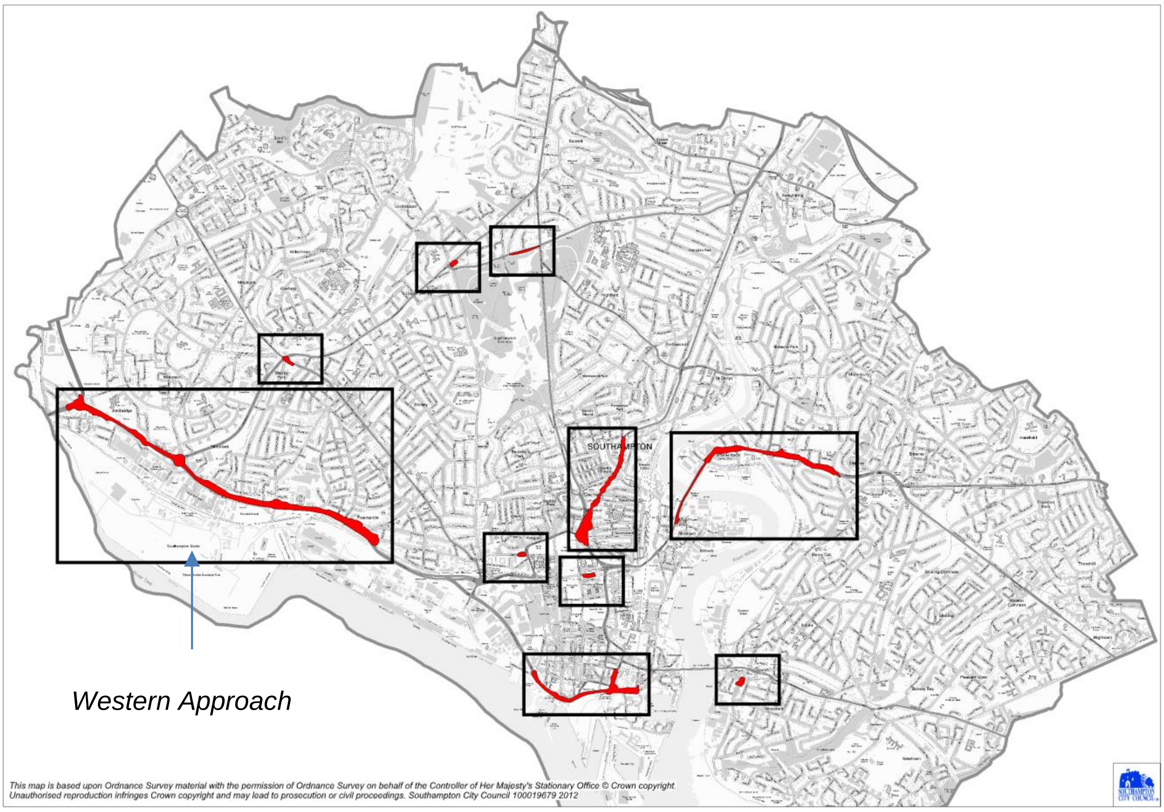
Appendices

1 Introduction

Southampton, like many other urban areas, has elevated levels of Nitrogen Dioxide (NO_2) due mainly to road transport emissions. As such Southampton City Council (SCC) has designated 10 Air Quality Management Areas (AQMA) across the City, as shown in Figure 1 below, where concentrations of NO_2 breach Government, health-based air quality objectives and has undertaken reviews of current and predicted levels in the future, including assessments of measures to reduce pollution levels.

Figure 1 Southampton Air Quality Management Areas (AQMA)



In addition, Southampton was identified as one of the 5 cities in the UK where the EU Limit Value for NO_2 are not expected to be met by 2020 in DEFRA's 2015 Air Quality Plan. The key area identified by the DEFRA plan that will exceed in 2020 is the Western Approaches AQMA. The Plan also stated that each of the cities identified will be legally required to introduce a formal charging-based Clean Air Zone (CAZ), or equivalent, for specified classes of vehicles and European Vehicle Emission Standards (Euro Standards) as soon as practical but no later than 2020.

Subsequent work by DEFRA updated its air quality plan using more recent information on the expected real-world emission performance of vehicles. This later analysis identified an exceedance area in neighbouring New Forest District Council (NFDC) that would be expected to be beneficially impacted by a CAZ in Southampton. As such NFDC were instructed to work jointly with Southampton City Council to assess the impact of the CAZ options being developed on the New Forest exceedance area.

Following a sifting exercise and assessment of the AQ quality results for the 2020 baseline under business as usual conditions a list of the CAZ schemes was identified to take forward for detailed air quality modelling. The options that have been assessed are:

- Option 1 – a citywide Class B CAZ covering buses, taxis and HGVs;
- Option 1a – a city wide HGV charging scheme complemented by a bus traffic condition based on Euro VI for the city centre and incentives to upgrade taxis;
- Option 2 – a city centre Class A CAZ covering buses and taxis, complemented by bus retrofit grants, taxi upgrade incentives, an expansion of the freight consolidation centre and related DSP initiative and working with the port on promoting Euro VI HGVs;
- Option 3 – a non-charging CAZ comprising a bus traffic condition for Euro VI buses in the city centre supported by retrofit grants, taxi upgrade incentives and the freight measures from option 2.

This report sets out the details of these options, how they have been assessed and the air quality results for NO_2 in relation to the nationally modelled PCM road links and local monitoring locations. The results are provided for both the Southampton and New Forest modelling domains.

In addition to the option results an updated set of baseline results for 2020 are provided. This includes the baseline results for the New Forest modelling domain, which have not been reported before, and an update to the Southampton baseline which includes a correction to LGV emissions, the split of Euro 6 stages in the fleet in 2020 and an adjustment to the background maps that was discovered whilst running the CAZ options.

2 Options assessed and modelling assumptions

2.1 Description of options

The CAZ options have been developed for Southampton and though they do not cover specific measures in New Forest they will impact on New Forest in terms of changes in traffic flows and vehicle fleet composition. The CAZ options considered cover both formal charging-based CAZ schemes and non-charging measures. The boundaries for the charging CAZ schemes are illustrated in Figure 2 below. For the final options that were assessed only the city-wide boundary and the city centre boundary were considered.

Each of the CAZ schemes modelled are described in more detail below.

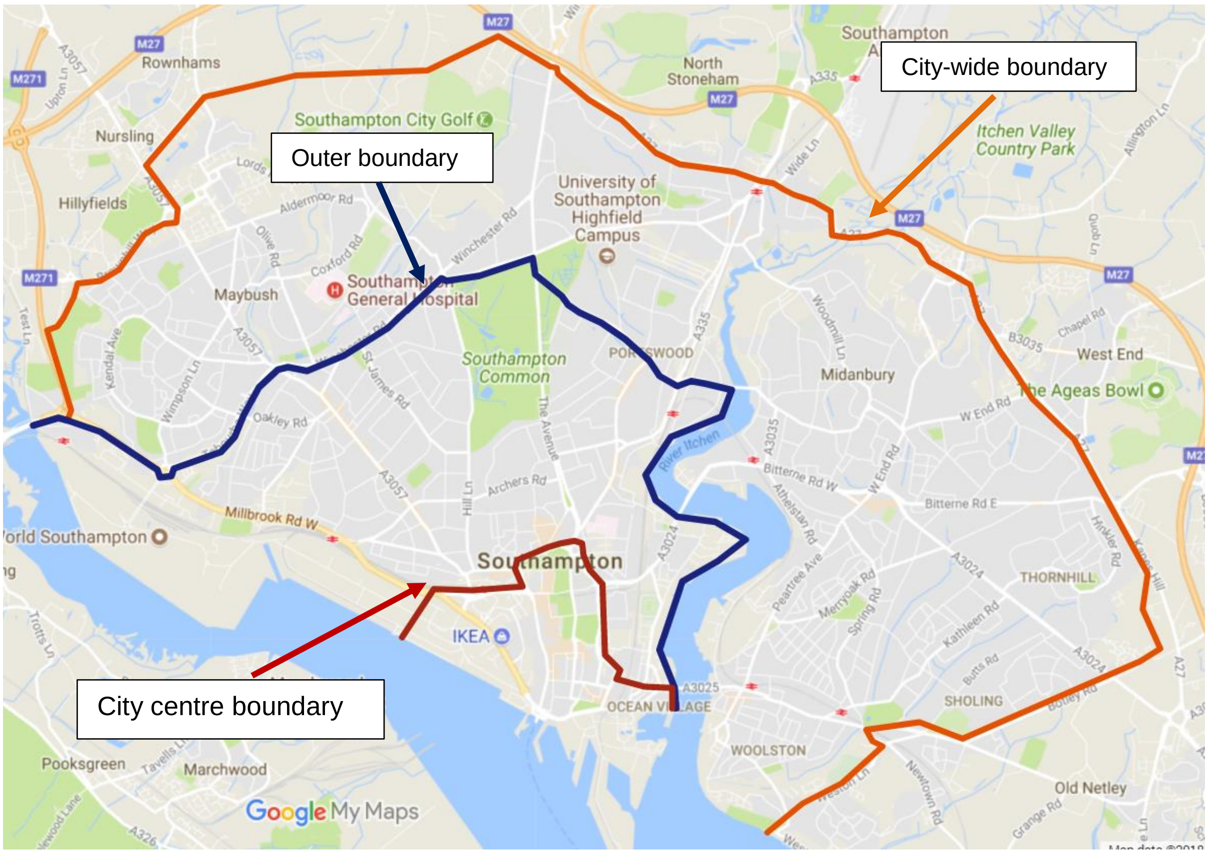
2.1.1 Option 1 – City wide CAZ B

The first option considered is a formal Class B charging CAZ with a boundary set covering the whole Southampton city area. The Class B CAZ covers buses (including coaches), taxis and HGVs, where vehicles not meeting the Euro 6/VI standard for diesel (or Euro 4 for Petrol) are charged for entering the city. Vehicles that are passing through the city would have the option of diverting around, which in this case is essentially a diversion around the M27.

The charge for assessment purposes has been set at the same level as the London ULEZ; £100/day for HGVs and buses, and £12.50 per day for taxis. This charge has been used as the modelling uses vehicle upgrade assumptions provided by JAQU and based on the evidence from the London ULEZ.

This option has been modelled in the transport model to assess potential diversionary or destination shifts as a result of the scheme. Within the transport model buses are fixed and taxis are not directly included (they have been estimated as a proportion of car traffic). As such the traffic response to the CAZ B is largely limited to changes in HGV traffic. However, this may have a knock-on effect to other vehicles classes if journey times change as a results of HGV behaviour and then affect route choices for other vehicle types. A description of the outcomes of the transport modelling of the city-wide CAZ B option is included in Appendix 2.

Figure 2 Illustrative CAZ boundaries



2.1.2 Option 1a – city-wide HGV charging scheme

This is a variant of the city-wide CAZ B option. In this scheme only HGV's are covered under the formal charging scheme, with buses (excluding coaches) and taxis influenced as follows:

- Buses would be subject to a traffic condition cover the city centre where they would be required to meet a Euro VI standard to operate in the area affected. This is consistent with the bus LEZ approach used in Oxford and Brighton. This traffic condition would be complemented by grants to support bus operators to upgrade their vehicles to meet the Euro VI standard.
- Taxis would not have a formal restriction applied to them but would have incentives to encourage them to upgrade including:
    - Less stringent vehicle age requirements for licencing CAZ compliant vehicles
    - Cash incentives to upgrade vehicles to CAZ standards
    - Priority access for CAZ compliant taxis to buses lanes and taxi ranks

This approach is designed to work more collaboratively with the bus and taxi industry. In relation to taxis this approach is a 'carrot' rather than a 'stick' approach and recognises the difficulty and high cost of upgrading an oldish taxi fleet in response to formal CAZ charges.

For the bus operators the scheme is intended to achieve high level of compliance with the Euro VI standard without having to use charges which could impact on fares and patronage of bus services. In addition, it recognises that there is a major bus depot within the city that serves many regional bus operations not directly operating though the city that could be viewed as being ‘unfairly’ impacted by a city-wide charging scheme.

Lastly it should be noted that this option would not impact on coach services which would be un-affected by the traffic condition. The impact of this is not considered in the transport and air quality modelling as coaches are not included, as they were not identified separately from any of the traffic count or ANPR data. That said, this was considered an appropriate approach as it is assumed that coaches undertake only a relatively small amount of vkm within the CAZ boundaries – hence any option impacting coaches would only have limited effect on emissions in Southampton. However, given the economic impacts are more in line with vehicles than kms affected, some consideration of coaches is being taking in the economic modelling comparing data on unique vehicles in the ANPR data with the registered local bus service vehicles.

2.1.3 Option 2 - City centre CAZ A plus additional HGV measures

This option focuses on reducing emissions from buses and taxis, while taking forward some additional HGV measures that were considered in Southampton’s Low Emission Strategy (LES) study. The components of this scheme are then:

- A city centre charging CAZ A covering buses, coaches and taxis and limited to the city centre boundary illustrated in Figure 2;
- Complementing the CAZ A scheme with retrofit funding for buses and the upgrade funding for taxis;
- Taking forward the HGV measures from the Southampton LES covering:
    - Increased uptake of the city centre freight consolidation centre;
    - Further development of delivery and servicing plans (DSPs) for organisations in the city;
    - Working with the port, primarily through the HGV arrival booking system, to encourage CAZ compliant HGVs for accessing the port;
    - A city-wide freight EcoStars scheme to encourage efficient operation of freight fleets and newer vehicles;
    - Relaxing freight regulations to allow 24-hour delivery for CAZ compliant vehicles.

The key intention with this scheme option is to influence the majority of buses through a much smaller charging scheme, as most will operate through the city centre. This again recognises the issue of a city-wide scheme targeting all buses and its impact on a regional bus depot. This scheme would also impact on coaches that access the city centre. For the taxis the scheme uses a mixture of ‘carrot’ in terms of the upgrade grant and ‘stick’ in terms of charging those accessing the city centre if non-complaint.

With the HGVs the consolidation centre and DSP’s are primarily designed to reduce HGV traffic movements in the city centre and surrounding area. These schemes will also potentially have an impact on the fleet composition through the use of CAZ complaint vehicles for the last leg of delivery for the consolidation centre and encouraging CAZ complaint vehicles for deliveries via the DSP. The work with the port would aim to increase the proportion of Euro VI complaint HGVs accessing the port, in particular the container port and car transport terminal.

2.1.4 Option 3 – Non-charging CAZ

The final option doesn’t include any charging mechanism and is based around a bus-based traffic condition and incentives. The core elements of this option are:

- A bus traffic condition restricting buses operating in the city centre to Euro VI as described in option 1a
- A set of taxi incentives as described in option 1a
- The HGV measures described in option 2

This group of measures is designed more to encourage the uptake of CAZ compliant and low emission vehicles rather than use any formal regulations or charges. Again, no explicit measure affecting coaches is included.

2.2 Modelling assumptions

A summary of the assumptions used in modelling each of the options is provided in Table 1 below, with further details of the assumptions given in the following sections. Additional details on the full air quality modelling and transport modelling methods is given in the air quality and transport modelling methodology reports.

Table 1 Final list of options for assessment

Option	Components	Modelling approach
Option 1 City Wide CAZ B	City Wide CAZ B	City Wide CAZ B in transport model, feed into AQ model
	Bus grants	No additional assumption modelled as charge CAZ drives uptake
	Taxi incentives	No additional assumption modelled as charge CAZ drives uptake
Option 1A City Wide HGV charging	City wide CAZ for HGVs only	Using transport modelling for CAZ B but only update HGV fleet
	Bus traffic condition	Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre.
	Taxi incentives	Assume 20% of non-compliant vehicles upgrade, 1/3 of JAQU assumption
Option 2 City centre CAZ A Plus LES HGV	City centre Class A	Use base 2020 transport model results Buses- Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre Taxis - Assume JAQU compliance assumptions in centre (upgrade and VKM reduction), Assume 38% upgrade elsewhere (JAQU upgrade X ratio of city centre/rest of city Tax proportions)
	Bus grants	No additional assumption modelled as charge CAZ drives uptake
	Taxi incentives	No additional assumption modelled as charge CAZ drives uptake
	Freight DSP and consolidation	Assume 5% reduction of HGV and LGV traffic in centre, Assume 2.5% reduction in rest of city (reduced LES assumption, alternative is look at using transport model)
	Freight Eco, Port booking, 24hr	Assume 30% non-compliant HGVs upgrade (1/3 of JAQU assumption)
Option 3 Non-charging CAZ	Bus traffic condition plus grant	Use base 2020 transport model results Assume 100% buses in centre comply, 80% elsewhere comply - accounts for fact that most buses pass centre
	Taxi incentives	Assume 20% of non-compliant vehicles upgrade, 1/3 of JAQU assumption

	Freight DSP and consolidation	Assume 5% reduction of HGV and LGV traffic in centre, Assume 2.5% reduction in rest of city (reduced LES assumption, alternative is look at using transport model)
	Freight Eco, Port booking, 24hr	Assume 30% non-compliant HGVs upgrade (1/3 of JAQU assumption)

2.2.1 Option 1 – City-wide CAZ B

The CAZ B option is first modelled in the transport model to assess traffic responses to the scheme. In doing this the traffic model assesses the behaviour of both complaint vehicles (those that naturally meet the standard or are upgraded to do so) and non-complaint vehicles. The proportion of vkm that upgrade in response to the scheme is taken from guidance provided by JAQU as shown in Table 2 below. This upgrade response assumption is based on data developed for the London ULEZ with a charge of £100/day for the heavy-duty vehicles. This same charge is assumed in the traffic model to assess the response of non-compliant vehicles in terms of paying the charging, avoiding the zone or cancelling the trip. The details of the CAZ B transport modelling results are provided in Appendix 2.

Table 2 JAQU assumptions on behavioural response to the CAZ (vkm)

Proportions of non-compliant vehicle kilometres which react to the zone								
	Petrol Cars	Diesel Cars	Petrol LGVs	Diesel LGVs	RHGVs	AHGVs	Buses	Coaches
Pay charge – Continue into zone	7.1%	7.1%	20.3%	20.3%	8.7%	8.7%	0.0%	15.6%
Avoid Zone – Vkms removed, modelled elsewhere	21.4%	21.4%	10.0%	10.0%	0.0%	0.0%	0.0%	0.0%
Cancel journey – vkms removed completely	7.1%	7.1%	6.0%	6.0%	8.7%	8.7%	6.4%	12.5%
Replace Vehicle – vkms replaced with compliant vkms	**64.3%**	**64.3%**	**63.8%**	**63.8%**	**82.6%**	**82.6%**	**93.6%**	**71.9%**

Source: JAQU, CAZ Technical working group minutes – 15/2/17

This traffic data is then used in the air quality model to model the emissions from the vehicle fleet for both compliant and non-compliant vehicles. The detailed fleet split for compliant vehicles is generated from using the baseline 2020 vehicle fleet split and applying the JAQU upgrade assumption shown above. An additional upgrade assumption applied is that 75% of diesel vehicles that upgrade will switch to petrol (where possible – i.e. affecting cars, taxis and LGVs). The remaining vehicles then give the fleet split for the non-complaint vehicles. In the case of the Class B CAZ these assumptions are only applied to buses, HGVs and taxis which are affected by the scheme.

It is noted that one of the key assumptions in the modelling of the city-wide CAZ B scheme is the assumed upgrade % for non-compliant vehicles accessing the zone. The current assumption, as set out above, is based on data for London provided by JAQU. We recognise that the response locally may differ from this. To test the robustness of the CAZ B solution to achieve compliance we propose to do a sensitivity test as part of the final business.

The test proposed is a 50% reduction in response rate to represent a lower level of upgrade to the scheme. Only a reduction is being considered as the current assumption already shows compliance. This 50% reduction in response to upgrade would first be applied to the compliant/non-complaint split in the transport model and the model re-run. This would be expected to show a slightly higher level of diverting traffic and more non-compliant vehicles in the zone paying the charge. This updated traffic model run would them be put through the emissions and air quality model as was done for the original CAZ B assessment but accounting for the lower upgrade assumption in assessing the detailed fleet mix for the compliant and non-complaint fleets.

2.2.2 Option 1a – City-wide HGV charging scheme

In this case the same traffic data is used as for option 1 above. This is because the transport model is only modelling the impact of the CAZ B on HGVs (buses are fixed and taxis are not directly included). Within the air quality modelling the impact of the scheme on the fleet composition is as follows:

- HGV's – modelled exactly the same as the CAZ B as they see the same charge;
- Buses – we assume that 100% of bus vkm in the city centre meet the Euro VI standard, as this is the basis of the bus condition, and that 80% meet the standard elsewhere based on the assumption that not all buses will need to operate in the city centre.
- Taxis – we assume that 20% of non-complaint vehicles will upgrade as a result of the incentives, which is 1/3 of the JAQU assumption for in Table 2. This was based on judgement and agreed between the consultant and city. It was a pragmatic approach given the time and resources available, and reflecting the limited evidence available relating to behavioural responses, both locally and in general.

2.2.3 Option 2 – City Centre CAZ A plus HGV incentives

For this option the traffic data from the baseline 2020 traffic model run is used. This is because HGV's are not affected by the CAZ A scheme, buses are fixed and taxis are not included in the traffic model. The air quality modelling then applies the following impacts to each of the vehicle fleets:

- Buses – the same assumption is applied as for Option 1a with full compliance in the city centre and 80% compliance in the rest of the city. This impact is assumed to be generated by both the charge and the upgrade funding.
- Taxis – the JAQU upgrade % for cars is applied to taxis in the city centre, with a 38% upgrade applied to the rest of the city. The 38% assumption represents the product of JAQU upgrade percentage and the ratio of taxi traffic in the city centre and the rest of the city. This is designed to reflect the proportion of taxi vkm affected by the scheme outside the city centre. The taxi incentives are assumed to support this impact but have no additional impact.
- HGVs – the work with the port and the Ecostars scheme is assumed to increase the level of CAZ compliance in the HGV fleet. A simple assumption is made that 30% of non-compliant vehicles would upgrade, which is again about a 1/3 of the upgrade effect of a formal CAZ. This was based on judgement and agreed between the consultant and city. It was a pragmatic approach given the time and resources available, and reflecting the limited evidence available relating to behavioural responses, both locally and in general.

In addition to the impacts of the HGV measures on the fleet composition the consolidation centre and DSP measures are assumed to reduce HGV traffic in the city centre by 5% and the rest of the city by 2.5%. These assumptions are based on a review of such schemes carried out for the Southampton Low Emission Strategy study and taking a conservative view of how this would translate to Southampton.

2.2.4 Option 3 - Non-charging CAZ

Option 3 again uses the baseline 2020 traffic model traffic data and fleet assumptions from elements of the previous options as follows:

- Buses – the same assumption is applied as for Option 1a as it is the same bus traffic condition;
- Taxis – the same assumption as for Option 1a as it is the same set of incentives;
- HGVs – the same assumptions as for Option 2, including the vkm reductions.

3 Updated baseline results

This section provides an update to the baseline results for the Southampton Study area, which includes a correction to LGV emissions in 2020 that was discovered whilst running the CAZ options, and the new baseline results for the New Forest study area. For the New Forest study additional model verification work has been carried out which is reported in Appendix 1.

3.1 Comparison with PCM

For comparison with PCM model results, annual mean NO_2 concentrations at the roadside locations assessed in the national compliance PCM model have been extracted from the RapidAir dispersion model results; the results have been presented in both tabular form and using graduated colours on a map of the study area.

Roadside receptor locations in the PCM model are at a distance of 4m from the kerb and at 2m height. To represent this in our city scale modelling, a subset of the OS Mastermap GIS dataset provided spatially accurate polygons representing the road carriageway, receptor locations were then placed at 100m intervals along relevant road links using a 4m buffer around the carriageway polygons.

Each PCM link has a unique Census ID number and a grid reference assigned which is typically the co-ordinates describing the location of the DfT traffic count points on each link; this location may not however be where the highest roadside concentrations are occurring along the entire link length when using a more detailed local scale modelling method with observed average vehicle speeds on shorter road sections. The PCM links within our model domain range in length from approximately 120m to 3.25km; we have therefore reported the highest of the modelled concentrations from the city scale model receptors spaced at 100m intervals, 4m from the carriageway.

A full list of tabulated results comparing the PCM baseline results with the local modelled results from 2015 to 2020 is shown in Table 3. The table is in three sections:

- Section 1 is the main PCM links for Southampton council area;
- Section 2 is additional PCM links in the wider Southampton model domain;
- Section 3 is the PCM links in the New Forest model domain.

Mapped results are provided in Figures 3 and 4. They are provided for the 2015 base year and the 2020 target year, separately for the Southampton and New Forest modelled areas.

The 2020 results in the Southampton study area show a total of 9 links that are exceeding the limit value, of which 3 are in the Southampton City Council area and 6 in surrounding areas. The main areas of exceedance are on the motorway network around the city and into Eastleigh. The exceedance area not on the motorway network is on the Western Approach at Millbrook Road West on the A33 (census ID 56347). There are also some points along the Western Approaches, at the end of the M271 and the A33 around Dorset Street that are that are between 36 and 40 $\mu g/m^3$ so potentially at risk of exceeding within model error.

The results for New Forest show none of the PCM links as at risk of exceeding.

Table 3 Comparison of PCM and local NO2 Annual mean concentrations 2015 to 2020

CensusID	LA Name	Length (m)	PCM Baseline					Local Baseline					
			2015	2017	2018	2019	2020	2015	2016	2017	2018	2019	2020
Southampton Links													
16340	Southampton Council	1,082	27.6	26.8	26.0	25.2	24.2	30.2	29.0	27.8	26.6	25.4	24.3
16891	Southampton Council	2,346	32.8	31.7	30.6	29.6	28.4	39.0	37.5	36.0	34.6	33.1	31.6
16892	Southampton Council	454	38.7	37.1	35.7	34.4	32.9	31.3	30.6	29.9	29.2	28.5	27.8
17531	Southampton Council	1,701	28.0	26.6	25.6	24.6	23.5	30.2	28.4	26.5	24.6	22.8	20.9
17532	Southampton Council	531	33.2	32.1	31.2	30.3	29.4	33.7	32.7	31.7	30.8	29.8	28.8
17974	Southampton Council	403	29.9	28.6	27.6	26.6	25.4	40.0	38.2	36.4	34.7	32.9	31.1
18113	Southampton Council	1,374	23.0	22.3	21.6	21.0	20.2	25.3	24.4	23.5	22.6	21.7	20.8
26062	Southampton Council	585	38.7	36.2	34.5	33.0	31.3	52.2	50.5	48.7	47.0	45.2	43.5
26296	Southampton Council	3,195	30.9	29.9	28.9	28.0	26.8	38.8	37.3	35.8	34.3	32.7	31.2
26351	Southampton Council	805	36.9	35.7	34.6	33.5	32.0	40.9	39.3	37.7	36.1	34.5	32.9
26371	Southampton Council	1,552	27.7	26.8	26.0	25.2	24.3	32.0	30.8	29.6	28.4	27.2	26.0
27635	Southampton Council	1,340	24.4	23.6	22.8	22.1	21.2	27.2	26.3	25.4	24.5	23.7	22.8
36987	Southampton Council	1,657	30.2	29.2	28.2	27.2	26.1	24.8	24.2	23.6	23.0	22.4	21.8
37658	Southampton Council	2,303	27.4	26.2	25.2	24.4	23.3	34.7	33.8	32.9	32.0	31.1	30.2
38212	Southampton Council	734	40.1	38.6	37.5	36.5	35.5	41.5	40.5	39.5	38.5	37.6	36.6
46375	Southampton Council	1,394	30.0	29.1	28.2	27.4	26.3	33.5	32.4	31.2	30.0	28.9	27.7
46963	Southampton Council	1,663	37.2	35.8	34.5	33.3	32.0	41.1	39.5	38.0	36.4	34.9	33.4
46964	Southampton Council	1,151	36.1	34.6	33.3	32.1	30.7	31.8	31.0	30.2	29.4	28.6	27.8
48317	Southampton Council	498	31.2	30.4	29.6	28.9	28.1	26.8	26.2	25.5	24.9	24.3	23.7
48456	Southampton Council	195	30.5	29.5	28.8	28.0	27.2	35.3	33.1	30.9	28.7	26.5	24.4
48513	Southampton Council	285	28.8	28.1	27.6	27.1	26.6	31.8	31.0	30.2	29.5	28.7	28.0
56347	Southampton Council	3,252	54.8	52.0	50.1	48.3	46.3	47.3	46.1	44.9	43.6	42.4	41.1
56374	Southampton Council	711	33.1	32.0	31.0	30.0	28.7	29.0	28.0	27.0	26.0	25.1	24.1
57434	Southampton Council	153	33.4	32.0	30.9	29.9	28.5	39.8	38.2	36.5	34.8	33.1	31.4
57672	Southampton Council	162	35.8	35.3	34.9	34.6	34.2	33.3	32.6	32.0	31.3	30.6	29.9
6292	Southampton Council	1,062	32.4	31.5	30.4	29.4	28.2	29.6	28.6	27.5	26.5	25.5	24.4

6349	Southampton Council	1,506	33.5	32.1	30.9	29.9	28.6		37.7	36.4	35.0	33.7	32.3	31.0
6367	Southampton Council	1,743	29.3	28.3	27.3	26.4	25.4		30.6	29.5	28.4	27.4	26.3	25.2
6368	Southampton Council	1,678	57.7	52.0	48.9	46.3	43.6		46.7	45.0	43.2	41.5	39.8	38.1
6933	Southampton Council	2,249	34.7	33.4	32.4	31.4	30.3		46.4	45.1	43.8	42.5	41.2	39.9
70064	Southampton Council	239	34.3	32.7	31.7	30.7	29.6		26.1	25.4	24.8	24.2	23.6	22.9
70066	Southampton Council	219	30.1	29.0	28.2	27.5	26.7		35.5	34.5	33.5	32.5	31.5	30.6
70108	Southampton Council	421	25.4	24.5	23.7	22.9	21.9		18.2	17.7	17.2	16.7	16.1	15.6
70109	Southampton Council	772	24.0	23.0	22.2	21.4	20.5		24.7	23.8	22.8	21.8	20.9	19.9
73605	Southampton Council	750	24.2	23.2	22.4	21.8	20.9		25.1	24.2	23.3	22.4	21.5	20.6
73613	Southampton Council	166	22.6	21.7	21.0	20.3	19.5		23.1	22.4	21.7	21.0	20.2	19.5
73615	Southampton Council	289	62.5	57.6	54.5	51.8	48.9		46.5	44.9	43.3	41.6	40.0	38.4
75250	Southampton Council	293	31.9	31.1	30.3	29.5	28.6		39.5	38.2	36.9	35.6	34.4	33.1
75251	Southampton Council	275	41.8	40.3	39.2	38.3	37.2		41.4	40.2	39.0	37.8	36.6	35.4
75252	Southampton Council	987	42.7	41.3	40.2	39.3	38.2		40.8	39.8	38.8	37.8	36.8	35.8
75253	Southampton Council	1,010	39.5	37.8	36.4	35.0	33.5		28.7	27.8	27.0	26.1	25.3	24.4
75258	Southampton Council	569	44.2	42.7	40.9	39.3	37.4		54.9	53.6	52.4	51.2	49.9	48.7
7569	Southampton Council	2,011	30.0	29.1	28.1	27.2	26.1		30.7	29.7	28.7	27.7	26.8	25.8
7580	Southampton Council	3,057	30.4	28.9	27.8	26.8	25.7		46.7	43.2	39.7	36.2	32.7	29.2
86003	Southampton Council	276	37.1	35.8	34.9	34.1	33.2		41.4	40.2	39.0	37.8	36.6	35.4
99871	Southampton Council	1,401	36.9	35.7	34.6	33.6	32.4		53.4	50.5	47.6	44.8	41.9	39.0
99872	Southampton Council	2,089	33.6	32.4	31.3	30.3	29.1		44.6	42.0	39.4	36.8	34.2	31.6
37658	Southampton Council	447	27.4	26.2	25.2	24.4	23.3		34.7	33.8	32.9	32.0	31.1	30.2
46963	Southampton Council	239	37.2	35.8	34.5	33.3	32.0		41.1	39.5	38.0	36.4	34.9	33.4
46964	Southampton Council	246	36.1	34.6	33.3	32.1	30.7		31.8	31.0	30.2	29.4	28.6	27.8
6292	Southampton Council	892	32.4	31.5	30.4	29.4	28.2		29.6	28.6	27.5	26.5	25.5	24.4
73613	Southampton Council	678	22.6	21.7	21.0	20.3	19.5		23.1	22.4	21.7	21.0	20.2	19.5
7569	Southampton Council	119	30.0	29.1	28.1	27.2	26.1		30.7	29.7	28.7	27.7	26.8	25.8
Other links in Southampton study area														
7988	Eastleigh Borough Council	264	27.4	26.5	25.7	24.8	23.9		27.9	26.4	24.9	23.4	21.9	20.4
7992	Eastleigh Borough Council	121	37.0	35.6	34.2	32.9	31.5		27.1	26.2	25.2	24.3	23.4	22.4

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8129	Eastleigh Borough Council	58	24.2	23.2	22.4	21.8	20.9	21.2	20.5	19.8	19.2	18.5	17.9
8559	Eastleigh Borough Council	642	35.5	34.2	33.0	31.9	30.5	44.9	43.4	41.9	40.5	39.0	37.5
16269	Eastleigh Borough Council	126	23.3	22.6	21.9	21.2	20.4	25.5	24.6	23.7	22.9	22.0	21.1
16321	Eastleigh Borough Council	1211	35.5	33.8	32.4	31.0	29.5	47.4	46.3	45.2	44.1	43.0	41.9
17793	Test Valley Borough Council	876	44.9	43.3	41.5	39.7	37.8	82.1	77.9	73.7	69.5	65.3	61.1
28018	Test Valley Borough Council	387	52.6	50.1	47.8	45.6	43.3	44.3	41.9	39.5	37.2	34.8	32.5
29041	Test Valley Borough Council	579	31.5	30.8	29.7	28.6	27.3	41.5	40.0	38.4	36.8	35.2	33.6
36039	Eastleigh Borough Council	552	37.0	35.3	33.9	32.6	31.1	43.6	41.0	38.5	35.9	33.3	30.8
36293	Eastleigh Borough Council	647	26.0	25.3	24.6	23.9	22.9	25.7	24.7	23.8	22.9	21.9	21.0
38107	Test Valley Borough Council	140	55.0	53.5	51.1	48.9	46.5	59.7	58.0	56.4	54.7	53.1	51.4
47635	Test Valley Borough Council	62	25.2	24.3	23.4	22.5	21.5	24.1	23.3	22.5	21.7	20.9	20.1
48064	Eastleigh Borough Council	1212	40.9	39.9	38.5	37.1	35.4	84.8	82.9	81.1	79.3	77.4	75.6
56058	Test Valley Borough Council	327	46.6	43.9	41.7	39.7	37.6	39.5	38.3	37.1	35.9	34.7	33.5
56931	Eastleigh Borough Council	470	40.8	39.0	37.5	36.0	34.4	40.5	38.6	36.6	34.6	32.7	30.7
73606	Eastleigh Borough Council	285	27.8	26.3	25.3	24.3	23.2	30.4	28.9	27.5	26.0	24.5	23.0
73607	Eastleigh Borough Council	12	27.4	26.6	25.8	25.0	23.9	26.1	25.2	24.2	23.3	22.4	21.4
73609	Eastleigh Borough Council	343	40.2	38.8	37.4	36.0	34.5	69.5	67.0	64.6	62.1	59.7	57.2
73614	Test Valley Borough Council	476	44.0	41.7	39.8	38.1	36.2	26.5	25.5	24.6	23.7	22.7	21.8
75259	Test Valley Borough Council	704	51.7	50.3	48.1	46.1	43.8	78.4	74.3	70.3	66.2	62.1	58.0
New Forest links													
36375	New Forest District Council	30.625	57.3	52.9	50.1	47.7	45.0	44.1	42.0	39.9	37.8	35.8	33.7
56960	New Forest District Council	24.84	32.5	31.1	29.9	28.8	27.4	49.6	46.7	43.8	40.9	38.0	35.1
48475	New Forest District Council	224.51	24.2	23.5	22.8	22.1	21.2	29.2	28.0	26.8	25.5	24.3	23.1
16341	New Forest District Council	211.45	43.1	40.1	38.1	36.4	34.5	39.9	38.1	36.3	34.6	32.8	31.0
78316	New Forest District Council	993.25	30.0	28.3	27.1	26.0	24.6	19.0	18.4	17.8	17.2	16.6	16.0
28356	New Forest District Council	590.92	27.8	26.1	25.0	24.0	22.7	23.4	22.5	21.6	20.8	19.9	19.0
38492	New Forest District Council	163.64	35.0	33.3	32.0	30.7	29.2	32.2	30.6	29.0	27.4	25.8	24.2
74832	New Forest District Council	370.45	21.4	20.3	19.5	18.7	17.8	30.0	28.8	27.5	26.3	25.0	23.8

Figure 3 Local modelled annual NO_2 concentrations in Southampton in 2015

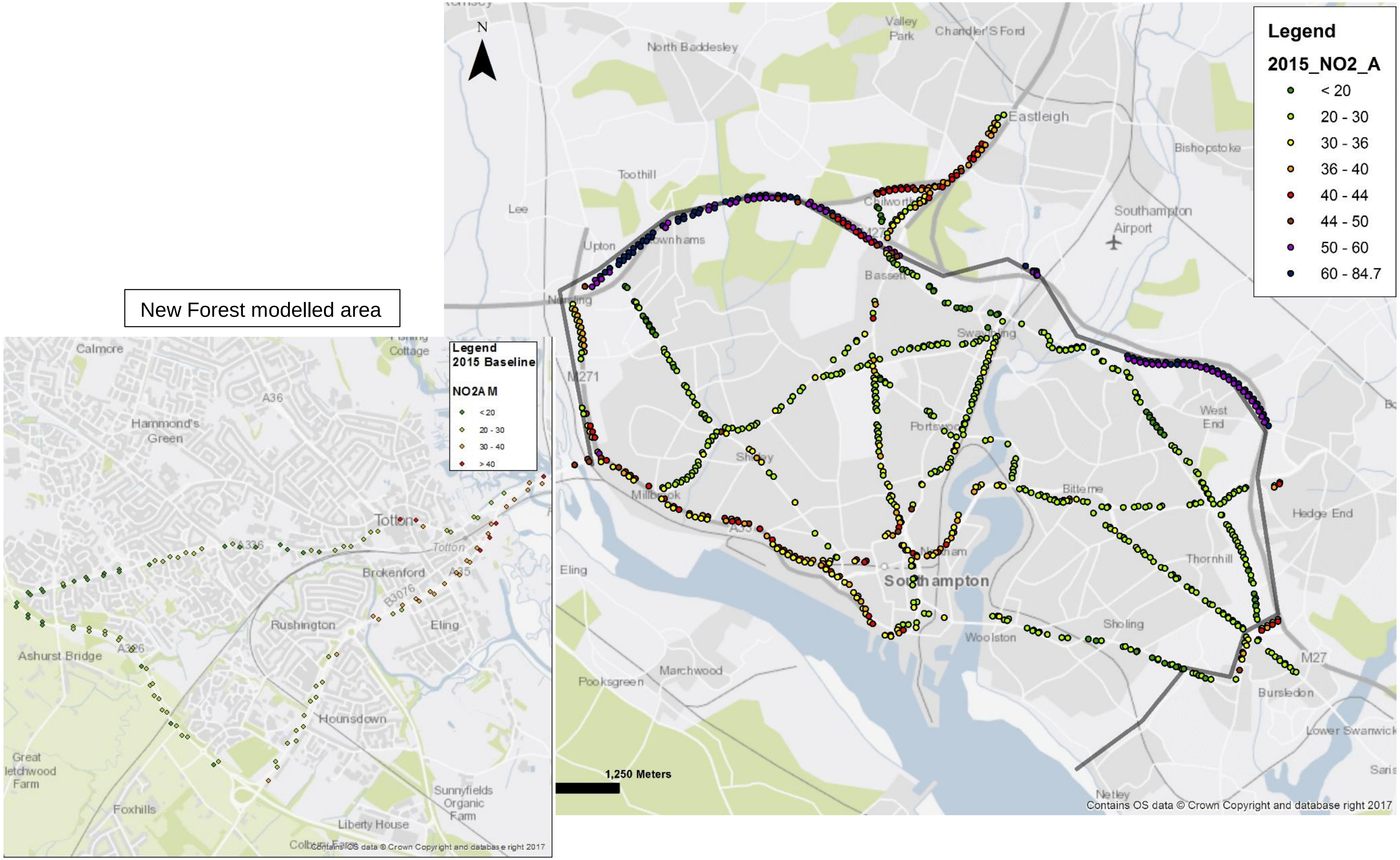

Figure 4 Local modelled annual NO_2 concentrations in 2020

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3.2 Results at local monitoring points

The annual mean NO_2 concentrations measured in 2015 and modelled for 2015 and 2020 are shown in Table 4 below. The results for Southampton indicate that in 2020, compliance with the 40 µg.m^{-3} NO_2 annual mean objective will be achieved at all locations.

For the New Forest area all the measured and modelled results show compliance with the 40 µg.m^{-3} NO_2 annual mean objective

Table 4: Predicted NO_2 annual mean concentrations at monitoring site locations in 2015 and 2020

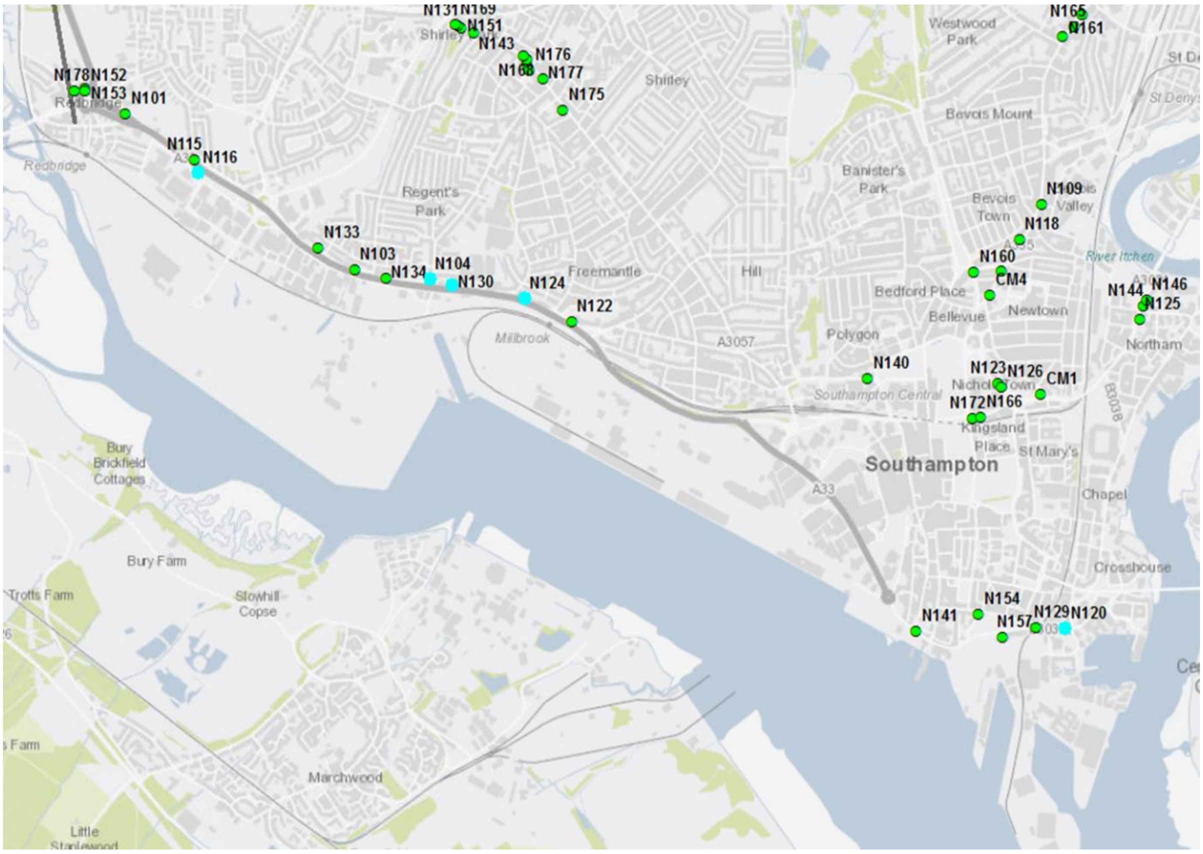
Monitoring site name	Site ID	Site type	NO_2 annual mean (µg.m^{-3}) Measured 2015	Modelled 2015	Modelled 2020
Southampton Monitoring Locations					
CM1 AURN Brintons Road	CM1	Urban Centre	32.0	35.3	29.0
CM4 Onslow Road	CM4	Roadside	42.0	40.6	34.6
CM6 Victoria Road	CM6	Roadside	42.0	22.3	19.1
Redbridge School Fence	N101	Roadside	44.7	40.3	31.4
64 Burgess Road	N102	Roadside	29.8	23.0	19.1
485 Millbrook Road	N103	Roadside	31.7	36.9	31.0
Regents Park Junction	N104	Roadside	38.4	36.7	31.5
2 Romsey Road	N106	Roadside	37.9	28.2	21.7
Cranbury Place	N107	Roadside	51.9	37.3	30.5
72 Bevois Valley Road	N109	Roadside	37.2	31.2	26.4
206 Bitterne Road	N113	Roadside	34.9	29.9	24.0
Bitterne Library, Bitterne Road	N114	Roadside	32.8	32.0	25.8
54 Redbridge Road	N115	Roadside	36.4	37.3	31.9
57 Redbridge Road	N116	Roadside	38.1	30.5	26.1
3 Rockstone Place	N118	Roadside	32.3	28.5	23.2
6-9 Canute Road	N120	Roadside	38.0	42.0	35.5
151 Paynes Road	N122	Roadside	31.5	39.6	33.8
102 St Andrews Road	N123	Roadside	32.8	30.2	27.1
305 Millbrook Road	N124	Roadside	37.3	41.3	35.8
Princes Court	N125	Roadside	35.3	37.4	29.9
107 St. Andrews Road	N126	Roadside	32.8	31.8	28.3
Canute Road	N129	Roadside	28.8	42.7	37.1
367A Millbrook Road	N130	Roadside	44.8	40.4	35.0
142 Romsey Road 1	N131	Roadside	37.9	46.7	29.3
539 Millbrook Road	N133	Roadside	30.7	28.9	24.1
433-435 Millbrook Road	N134	Roadside	37.6	36.1	31.0
24 Victoria Road	N135	Roadside	31.4	25.7	20.1
23 Victoria Road	N136	Roadside	31.1	25.6	20.1
66 Burgess Road 1	N138	Roadside	43.8	36.3	25.5
5 Commercial Road	N140	Roadside	44.8	40.1	29.1

Town Quay	N141	Kerbside	30.5	42.7	37.8
102 Romsey Road	N143	Roadside	34.4	36.9	25.7
208 Northam Road	N144	Roadside	31.8	39.2	31.9
222 Northam Road	N146	Roadside	28.7	35.1	28.6
44B Burgess Road	N149	Roadside	32.5	25.0	20.8
134 Romsey Road	N151	Roadside	37.4	41.5	26.3
M271	N152	Roadside	36.9	44.7	33.8
Coniston Road	N153	Roadside	31.2	34.3	28.1
Oceana Boulevard,	N154	Roadside	32.9	31.5	26.3
4 Platform Road	N157	Roadside	27.8	33.4	28.9
24 Portsmouth Road	N158	Roadside	36.8	23.4	20.4
35 Portsmouth Road	N159	Roadside	25.9	20.8	18.2
2 Dorset Street	N160	Roadside	32.6	33.4	28.6
30 Addis Square	N161	Roadside	32.5	25.5	19.0
263A Portswood Road	N162	Roadside	37.7	27.8	22.3
285 Portswood Road	N163	Roadside	27.8	23.8	19.8
168-174 Portswood Road	N164	Roadside	32.3	25.5	20.6
8 The Broadway	N165	Roadside	32.3	25.5	20.7
14 New Road	N166	Roadside	38.1	39.7	30.7
13 Romsey Road	N167	Roadside	33.5	29.8	22.6
23 Romsey Road	N168	Roadside	36.4	30.1	22.8
150 Romsey Road	N169	Roadside	40.6	46.7	29.3
4 New Road	N172	Roadside	42.9	41.6	32.1
19A Burgess Road	N173	Roadside	27.3	32.7	27.0
166A Bitterne Road	N174	Roadside	37.6	34.3	27.9
38 Shirley High Street	N175	Roadside	38.0	37.8	26.4
126 Shirley High Street	N176	Roadside	38.0	36.1	22.8
95 Shirley High Street	N177	Roadside	36.7	30.1	24.2
2 Gover Road	N178	Roadside	25.9	26.6	22.0
New Forest monitoring locations					
Junction Rd (analyser)	20	Roadside	23.89	22.37	19.11
30, Junction Rd	21	Kerbside	24.48	23.55	20.11
25, Junction Rd	22	Roadside	24.96	20.46	17.49
26, Rumbridge St.	23	Roadside	26.13	23.04	19.66
2, Eling Lane	24	Roadside	25.67	20.75	17.79
Elingfield Court, High St.	25	Roadside	22.97	23.98	19.81
55, High St.	26	Roadside	22.07	18.26	14.95
114, Commercial Rd	27	Kerbside	25.31	29.56	22.69
Commercial Rd	28	Roadside	23.31	28.61	22.05
Ringwood Rd / Maynard Rd rbt	29	Roadside	27.21	28.36	22.17
Asda rbt	30	Roadside	23.4	22.85	18.87
1, Rose Rd	31	Roadside	19.23	16.2	13.37

3.3 Source apportionment

For both the 2015 and 2020 base years we have conducted source apportionment for a number of monitoring locations to provide an indication of the key sources contributing to pollution levels. The locations are indicated in Figure 5 and are focused on the Western Approach, one of the key areas of concern, and alongside the port near the city centre. These areas have been selected to provide an understanding of the contribution of emissions associated with the Port to air quality levels.

Figure 5 Location of source apportionment results



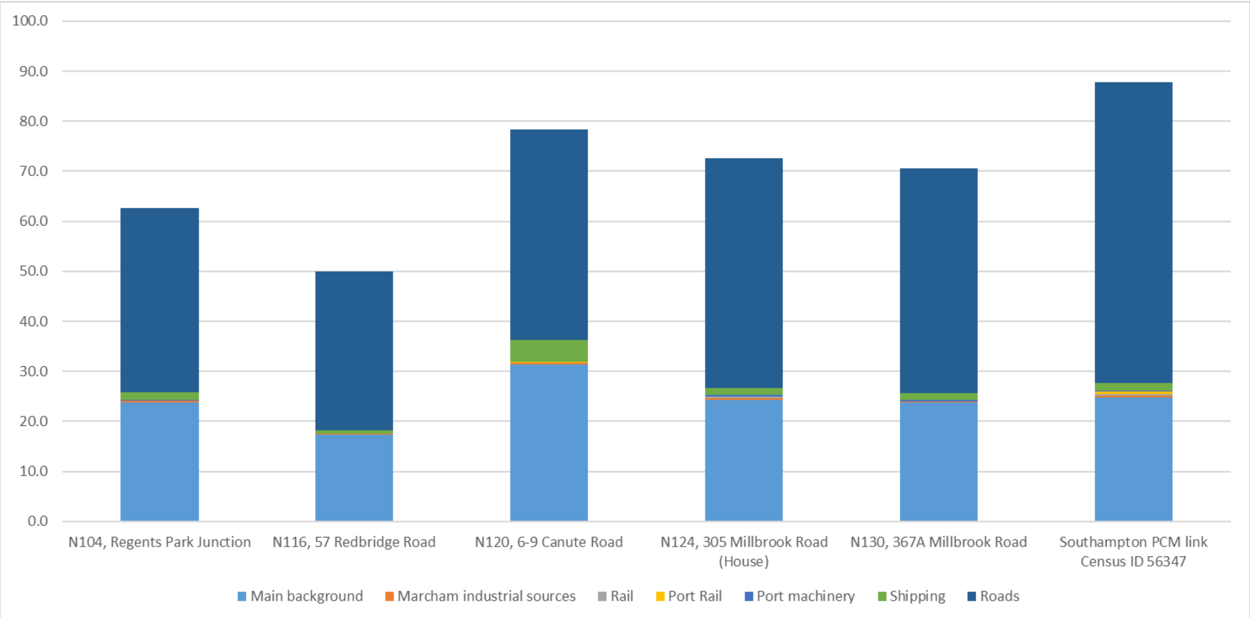
3.3.1 2015 baseline source apportionment

The source apportionment results for these locations are shown below in Table 5. The results are shown in terms of NOx concentrations. These show that the main source of air pollution is road traffic some 60-70%. The majority of the remaining contribution is general background, about 25-30%, comprising commercial and residential emissions. The activity on the port in terms of machinery and rail movements accounts for only about 0.5% of emissions, which is similar to the contribution associated with the emissions from the incinerator and power plant in Marcham. The contribution from ships at dock and accessing the port is somewhat larger at between 2 to 6%

Table 5 NOx concentrations in 2015 for each source modelled (μg/m^3)

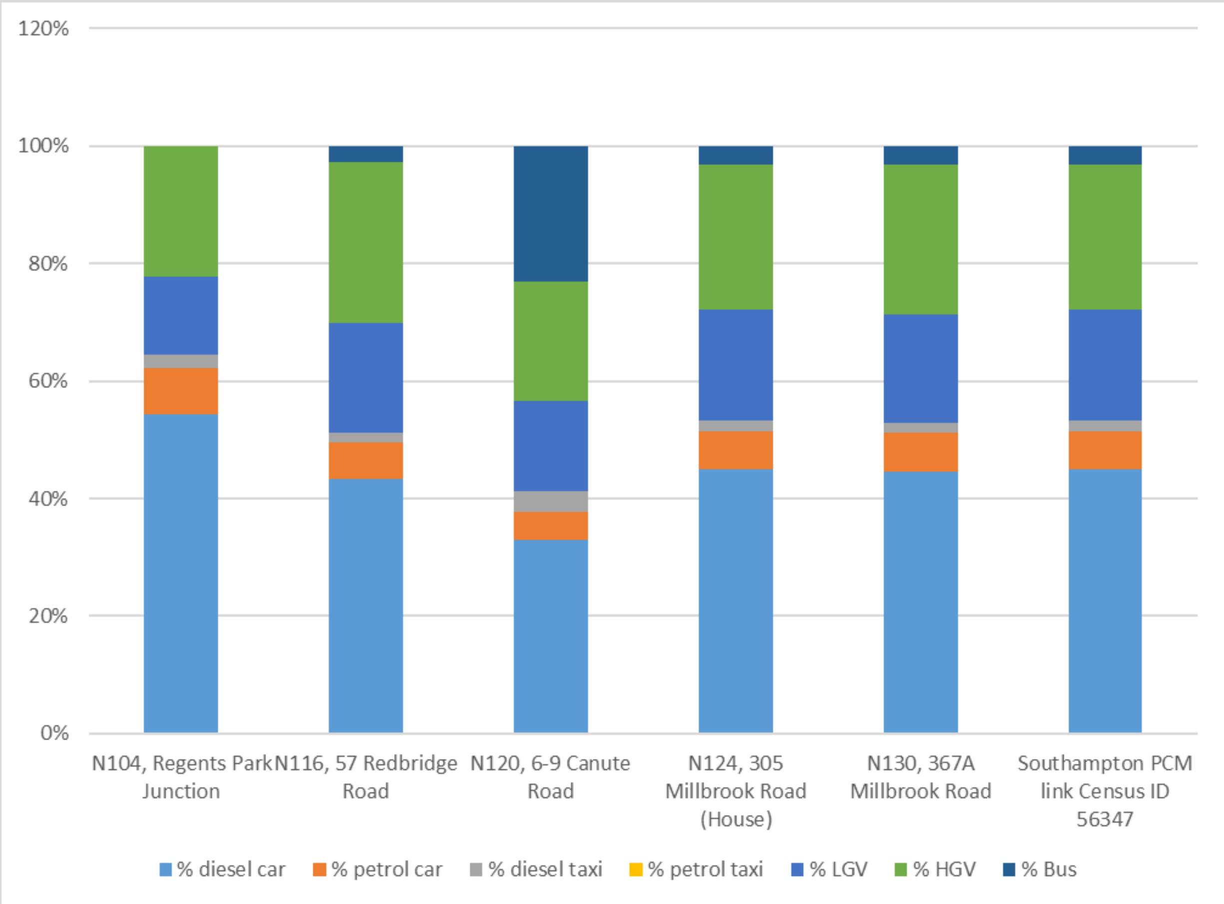
Location	Main background	Marcham industrial sources	Rail	Port Rail	Port machinery	Shipping	Roads	Total
N104, Regents Park Junction	23.9	0.2	0.0	0.0	0.2	1.5	36.8	62.6
N116, 57 Redbridge Road	17.4	0.1	0.0	0.0	0.1	0.7	31.6	49.9
N120, 6-9 Canute Road	31.4	0.3	0.0	0.2	0.1	4.4	42.0	78.3
N124, 305 Millbrook Road (House)	24.3	0.4	0.2	0.1	0.2	1.4	45.9	72.6
N130, 367A Millbrook Road	23.8	0.2	0.0	0.0	0.2	1.4	44.9	70.6
Southampton PCM link Census ID 56347	24.8	0.4	0.2	0.4	0.2	1.5	60.3	87.9

Figure 6 Breakdown of NOx concentrations by source type – 2015 baseline (μg.m^{-3})



The road contribution can be broken down further to show the contribution for each main vehicle type as illustrated in Figure 7. The break does vary across locations as would be expected. However, overall diesel cars are the main contributor followed by HGV and vans. Buses are only a small proportion along the Western Approaches, but at Canute Road near the city centre are much more significant. Taxis account for between 2% and 4% of the emissions, with the higher contribution again being at the city centre location.

Figure 7 Breakdown of road NOx contribution by vehicle type



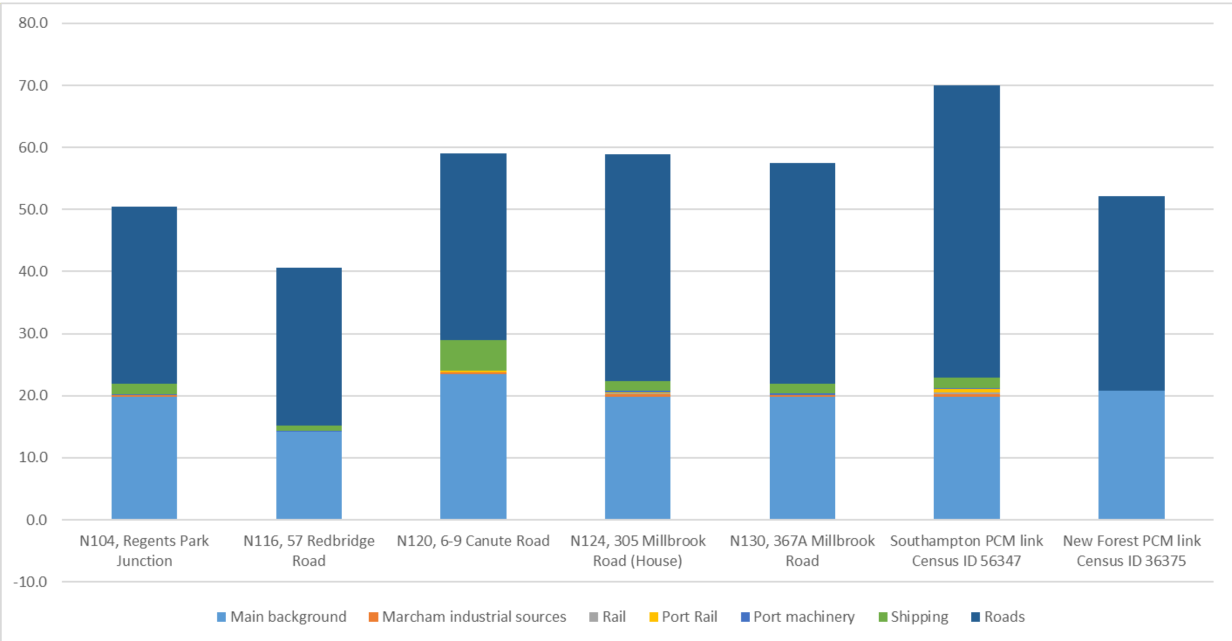
3.3.2 2020 baseline source apportionment

The 2020 source apportionment results are presented in Table 6 and Figure 8. These results are shown in terms of NOx concentrations. These show that the main source of air pollution in 2020 is still expected to be road traffic (60-70%). The majority of the remaining contribution will be general background (25-30%), comprising commercial and residential emissions. The activity on the port in terms of machinery and rail movements increases slightly when compared with 2015. The contribution from ships at dock and accessing the port also increases slightly when compared with 2015; this is attributable to projected increases in shipping activity.

Table 6 NOx concentrations in 2020 for each source modelled (µg/m^3)

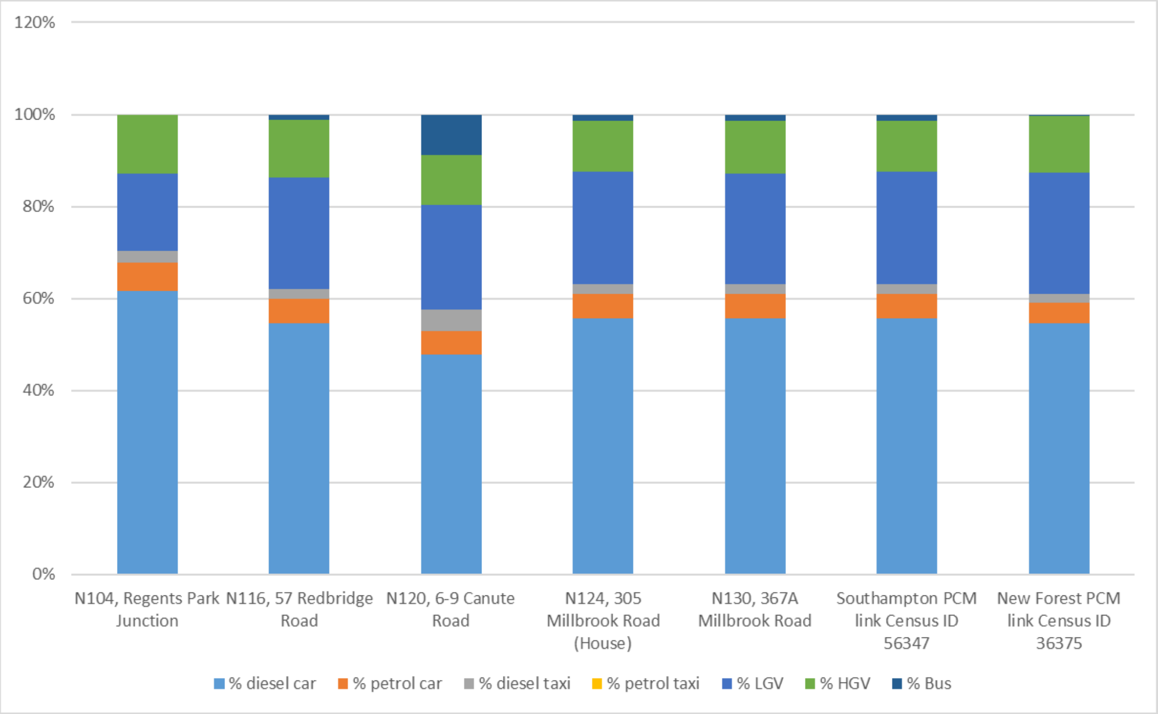
Location	Main background	Marcham industrial sources	Rail	Port Rail	Port machinery	Shipping	Roads	Total
N104, Regents Park Junction	19.8	0.2	0.0	0.0	0.2	1.7	28.5	50.5
N116, 57 Redbridge Road	14.2	0.1	0.0	0.0	0.1	0.8	25.4	40.6
N120, 6-9 Canute Road	23.5	0.3	0.0	0.2	0.1	4.9	30.1	59.1
N124, 305 Millbrook Road (House)	19.8	0.4	0.2	0.2	0.2	1.6	36.5	58.9
N130, 367A Millbrook Road	19.8	0.2	0.0	0.0	0.2	1.6	35.6	57.4
Southampton PCM link Census ID 56347	19.8	0.4	0.2	0.6	0.2	1.7	47.0	70.0
New Forest PCM link Census ID 36375	20.8						31.3	52.1

Figure 8: Breakdown of NOx concentrations by source type – 2020 baseline (µg.m^{-3})



The breakdown of projected NOx emissions from various vehicle categories in 2020 is presented in Figure 9. The 2020 source apportionment analysis shows similar results to 2015; whereby diesel cars are the main contributor followed by LGV. When compared with 2015, HGVs contribute a lower proportion of NOx emissions, LGV emissions now contribute a greater proportion. Buses still contribute only a small proportion along the Western Approach, but are much more significant in the city centre. The highest proportion of emissions form taxis is also in the city centre.

Figure 9 Breakdown of road NOx contribution by vehicle type



4 Options results

The four CAZ scheme options have been modelled for both the Southampton and New Forest model areas. The results have been extracted for both the PCM links and the local monitoring locations in the same way as for the baseline results in Section 3 above.

4.1 Comparison with PCM

A summary of the modelled annual mean NO_2 results for each of the options is shown in Table 7 with details provided in Table 8 below. The detailed results are broken down in the same way as the baseline results with three sections showing results for the PCM links in Southampton, PCM links in the wider Southampton modelled area and the PCM links in New Forest. The mapped results are shown in Figures 7 to 10.

Table 7 Summary of NO_2 results for the PCM links for options in 2020

Option	With SCC Boundary		Beyond SCC Boundary		Average Change in NO_2 (%) in SCC	Average Change in NO_2 (%) in NFDC
	PCM links > 40µ/m^3	PCM links > 35µ/m^3	PCM links > 40µ/m^3	PCM links > 35µ/m^3		
Baseline	3	11	6	7	N/a	N/a
Option 1	2	5	6	6	-6.5%	-1.8%
Option 1a	2	5	6	6	-6.5%	-2.0%
Option 2	3	7	6	7	-3.8%	-2.5%
Option 3	3	7	6	7	-3.6%	-2.0%

The impact of each option on the Southampton model area can be summarised as follows:

- Option 1 – City-wide CAZ B: on average this reduces concentrations of NO_2 by 6.5%, but this varies from link to link ranging from a 2% reduction up to 18% reduction. This is enough remove the exceedance on the Western Approach at Millbrook Road West, reducing the number of exceedances from 9 to 8. In addition, it reduces the number of PCM at risk of exceedance which were above 35µ/m^3 from 18 to 11. This reduces the risk of these links potentially exceeding in the future.

- Option 1a – City-wide HGV charging: this option is very similar to Option 1 but using different mechanisms to affect buses and taxis. Its impact is also very similar to option 1 reducing average NO_2 concentrations by 6.5%, which again reduces the number of exceedance from 8 to 9 and reduces the number of links over 35µ/m^3 from 18 to 11.

- Option 2 – city-centre CAZ A: this option has a similar impact on buses and taxis to option 1a, but has a lower impact on HGVs. Overall this measure reduces NO_2 concentration on average by 3.8%, about half that of Options 1 and 1a. However, this is not enough to reduce the number of exceedance but it does reduce the number of links over 35µ/m^3 from 18 to 14, a little less than options 1 and 1a.

- Option 3 – non-charging CAZ package: this option has a very similar impact to Option 2 with an average 3.6% reduction in NO_2 concentrations and the number of links over 35µ/m^3 from 18 to 14, a little less than options 1 and 1a.

The impact of all the schemes in New Forest is similar with an average reduction in NO_2 concentrations of about 2%. There are no exceedances in the baseline model for New Forest so there is no impact on reducing the number of exceedances from implementing the options.

Table 8 Annual mean NO2 for each PCM link in 2020 by option

CensusID	LA Name	Length (m)	Annual Mean NO2 in 2020 Baseline	Option 1	Option 1a	Option 2	Option 3
Southampton Links							
16340	Southampton Council	1082.4	24.3	22.1	22.1	23.2	23.2
16891	Southampton Council	2346.2	31.6	29.4	29.2	30.3	30.4
16892	Southampton Council	454.3	27.8	27.0	27.1	27.4	27.4
17531	Southampton Council	1700.7	20.9	18.8	18.8	19.7	19.7
17532	Southampton Council	530.8	28.8	27.4	27.4	28.0	28.0
17974	Southampton Council	403.3	31.1	27.2	27.1	29.2	29.2
18113	Southampton Council	1374.0	20.8	19.5	19.5	20.2	20.2
26062	Southampton Council	584.8	43.5	40.2	40.3	41.6	41.7
26296	Southampton Council	3194.8	31.2	28.5	28.5	29.8	29.9
26351	Southampton Council	804.7	32.9	29.7	29.7	31.3	31.3
26371	Southampton Council	1552.0	26.0	23.6	23.6	24.9	24.9
27635	Southampton Council	1340.1	22.8	21.3	21.3	22.0	22.0
36987	Southampton Council	1656.8	21.8	21.5	21.6	21.7	21.7
37658	Southampton Council	2303.4	30.2	28.4	28.0	28.4	28.6
38212	Southampton Council	734.2	36.6	34.8	34.9	35.2	35.4
46375	Southampton Council	1393.8	27.7	25.4	25.4	26.6	26.6
46963	Southampton Council	1662.6	33.4	30.9	30.7	32.0	32.0
46964	Southampton Council	1150.7	27.8	27.0	27.1	27.4	27.4
48317	Southampton Council	497.7	23.7	22.9	22.9	23.2	23.3
48456	Southampton Council	195.4	24.4	23.6	23.7	23.9	24.0
48513	Southampton Council	285.2	28.0	26.9	26.9	27.2	27.3
56347	Southampton Council	3251.6	41.1	37.6	37.7	40.2	40.2
56374	Southampton Council	711.3	24.1	22.6	22.6	23.4	23.4
57434	Southampton Council	152.7	31.4	27.6	27.5	29.5	29.5
57672	Southampton Council	161.7	29.9	27.7	27.7	28.8	28.9
6292	Southampton Council	1061.9	24.4	23.4	23.4	23.8	23.8
6349	Southampton Council	1506.1	31.0	28.4	28.3	29.6	29.7
6367	Southampton Council	1742.9	25.2	23.5	23.5	24.4	24.4
6368	Southampton Council	1678.0	38.1	35.1	35.1	36.9	37.0
6933	Southampton Council	2249.1	39.9	36.6	36.6	38.1	38.3
70064	Southampton Council	238.9	22.9	22.3	22.2	22.5	22.5
70066	Southampton Council	218.6	30.6	28.6	28.5	29.1	29.2
70108	Southampton Council	421.0	15.6	15.3	15.3	15.4	15.5
70109	Southampton Council	771.9	19.9	18.7	18.6	19.2	19.2
73605	Southampton Council	750.2	20.6	19.6	19.5	20.0	20.0
73613	Southampton Council	166.0	19.5	18.8	18.8	19.1	19.1
73615	Southampton Council	288.6	38.4	33.9	33.9	36.2	36.3
75250	Southampton Council	292.7	33.1	31.2	31.3	32.4	32.4
75251	Southampton Council	274.6	35.4	33.5	33.6	34.6	34.7
75252	Southampton Council	987.1	35.8	34.2	34.3	34.6	34.9
75253	Southampton Council	1009.8	24.4	23.4	23.4	23.9	24.0

75258	Southampton Council	568.7	48.7	42.6	42.7	46.6	46.7
7569	Southampton Council	2010.9	25.8	24.3	24.2	25.0	25.1
7580	Southampton Council	3056.8	29.2	26.4	26.4	26.6	26.6
86003	Southampton Council	275.9	35.4	32.8	32.3	33.1	33.3
99871	Southampton Council	1401.4	39.0	32.1	32.0	34.5	34.7
99872	Southampton Council	2089.2	31.6	29.4	29.4	30.6	30.6
37658	Southampton Council	446.8	30.2	28.4	28.0	28.4	28.6
46963	Southampton Council	238.9	33.4	30.9	30.7	32.0	32.0
46964	Southampton Council	245.5	27.8	27.0	27.1	27.4	27.4
6292	Southampton Council	891.9	24.4	23.4	23.4	23.8	23.8
73613	Southampton Council	678.0	19.5	18.8	18.8	19.1	19.1
7569	Southampton Council	119.3	25.8	24.3	24.2	25.0	25.1
Other links in Southampton Study area							
7988	Eastleigh Borough Council	263.7	20.4	19.0	19.0	19.5	19.5
7992	Eastleigh Borough Council	120.8	22.4	22.1	22.1	22.2	22.3
8129	Eastleigh Borough Council	57.5	17.9	17.2	17.2	17.5	17.5
8559	Eastleigh Borough Council	642.0	37.5	35.0	35.0	35.8	35.8
16269	Eastleigh Borough Council	126.2	21.1	20.0	20.1	20.5	20.5
16321	Eastleigh Borough Council	1211.5	41.9	41.6	41.7	41.5	41.6
17793	Test Valley Borough Council	875.8	61.1	55.4	55.6	56.6	56.7
28018	Test Valley Borough Council	387.2	32.5	30.3	30.4	30.5	30.5
29041	Test Valley Borough Council	578.5	33.6	33.2	33.3	32.8	32.8
36039	Eastleigh Borough Council	552.4	30.8	26.9	27.0	28.3	28.4
36293	Eastleigh Borough Council	646.7	21.0	20.2	20.3	20.5	20.5
38107	Test Valley Borough Council	140.0	51.4	44.4	44.5	48.7	48.8
47635	Test Valley Borough Council	61.7	20.1	19.0	19.0	19.5	19.5
48064	Eastleigh Borough Council	1211.8	75.6	68.4	68.6	72.2	72.4
56058	Test Valley Borough Council	327.1	33.5	31.9	32.0	32.3	32.4
56931	Eastleigh Borough Council	470.3	30.7	28.9	29.0	29.4	29.4
73606	Eastleigh Borough Council	284.7	23.0	21.3	21.3	22.1	22.1
73607	Eastleigh Borough Council	12.2	21.4	20.6	20.6	20.9	20.9
73609	Eastleigh Borough Council	342.6	57.2	52.2	52.3	54.7	54.8
73614	Test Valley Borough Council	476.2	21.8	20.7	20.8	21.1	21.1
75259	Test Valley Borough Council	704.1	58.0	56.4	56.5	53.8	53.9
New Forest links							
36375	New Forest District Council	30.6	33.7	32.7	32.7	32.7	32.8
56960	New Forest District Council	24.8	35.1	35.2	34.3	33.7	34.7
48475	New Forest District Council	224.5	23.1	22.6	22.6	22.6	22.6
16341	New Forest District Council	211.5	31.0	30.0	30.1	30.0	30.1
78316	New Forest District Council	993.3	16.0	15.9	15.9	15.8	15.8
28356	New Forest District Council	590.9	19.0	18.8	18.8	18.7	18.7
38492	New Forest District Council	163.6	24.2	23.8	23.8	23.7	23.7
74832	New Forest District Council	370.5	23.8	23.2	23.2	23.2	23.2

Figure 10 Annual mean NO_2 concentrations for Option 1 in 2020

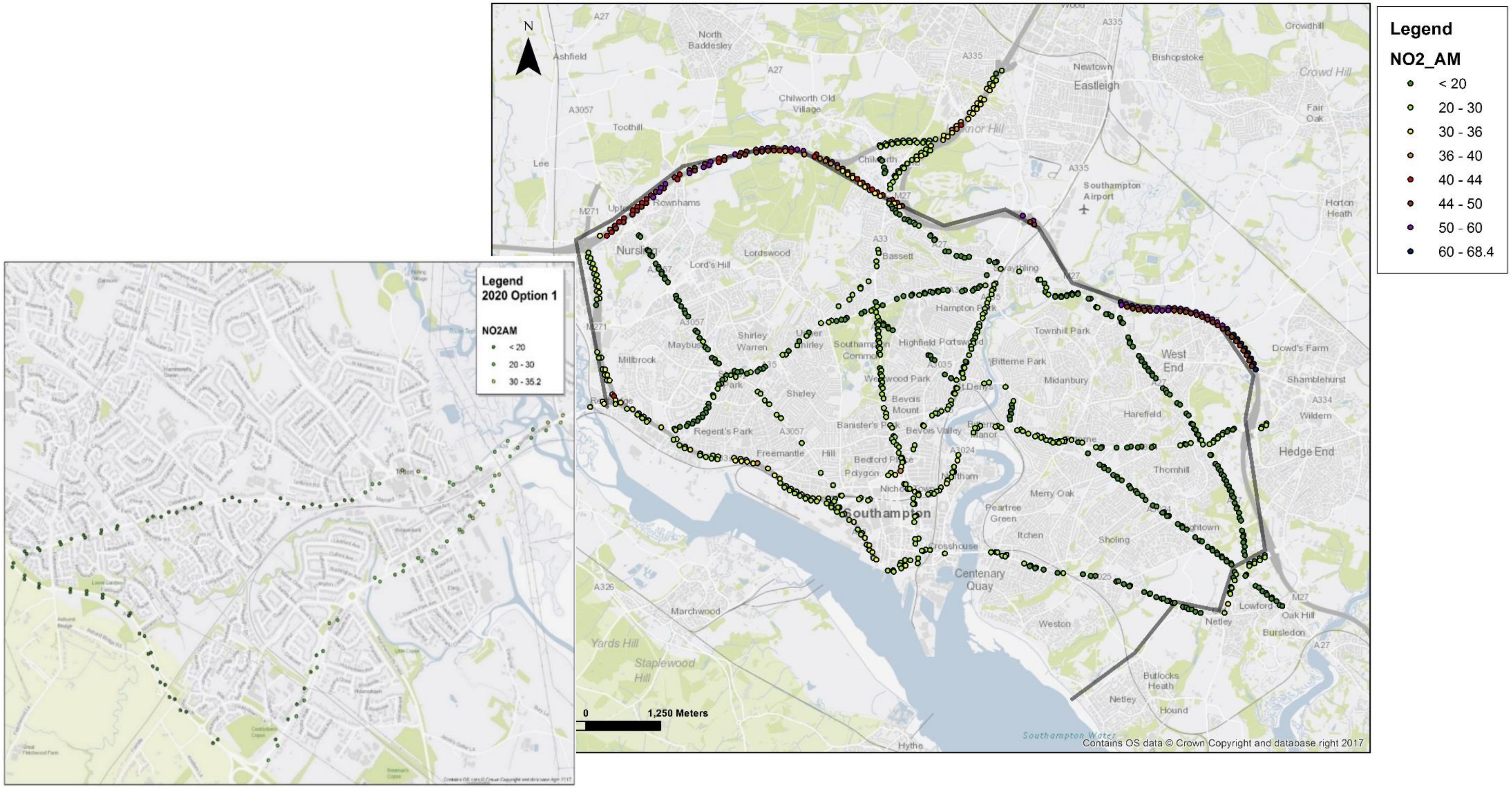


Figure 11 Annual mean NO_2 concentrations for Option 1a in 2020

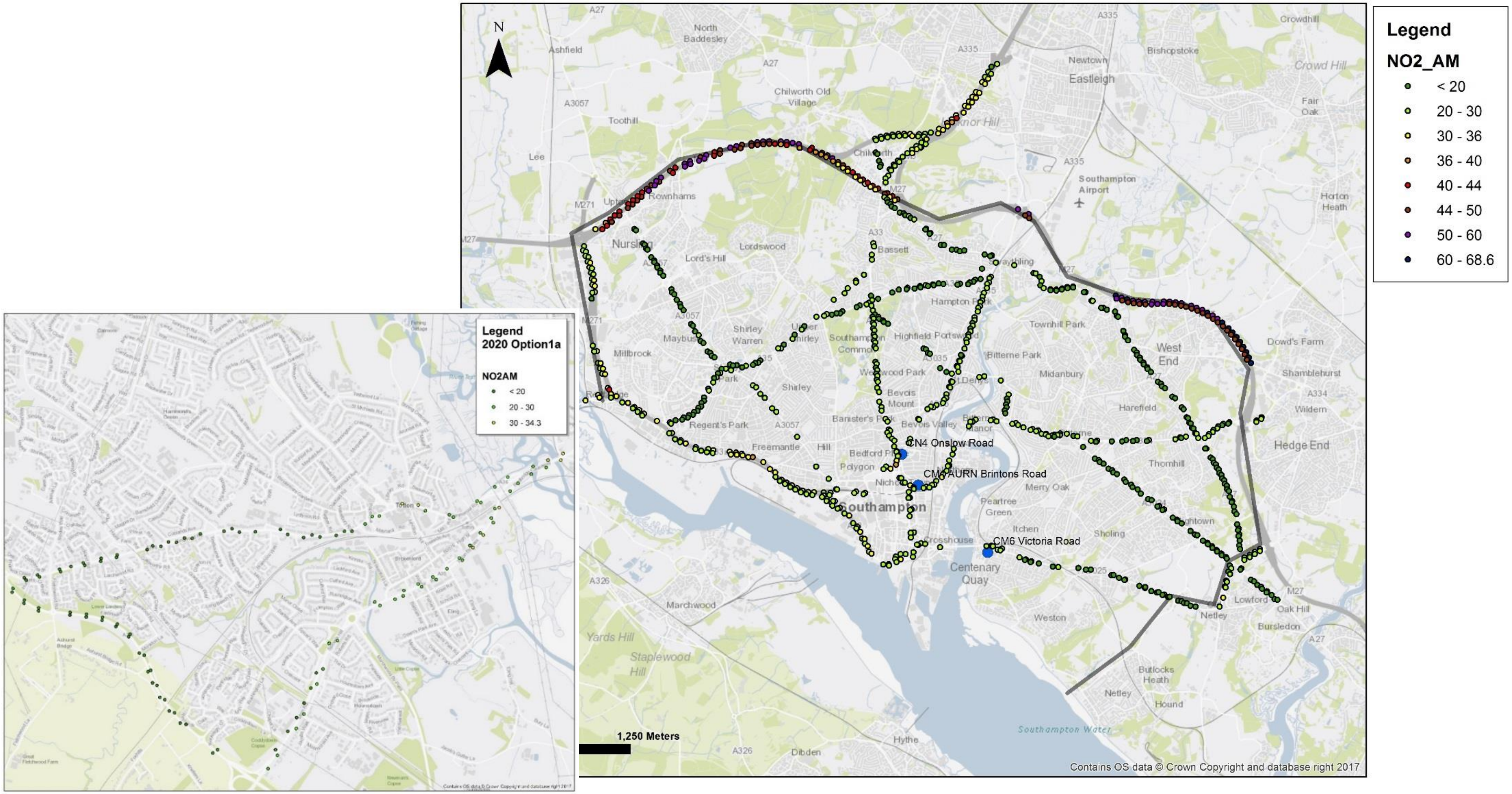
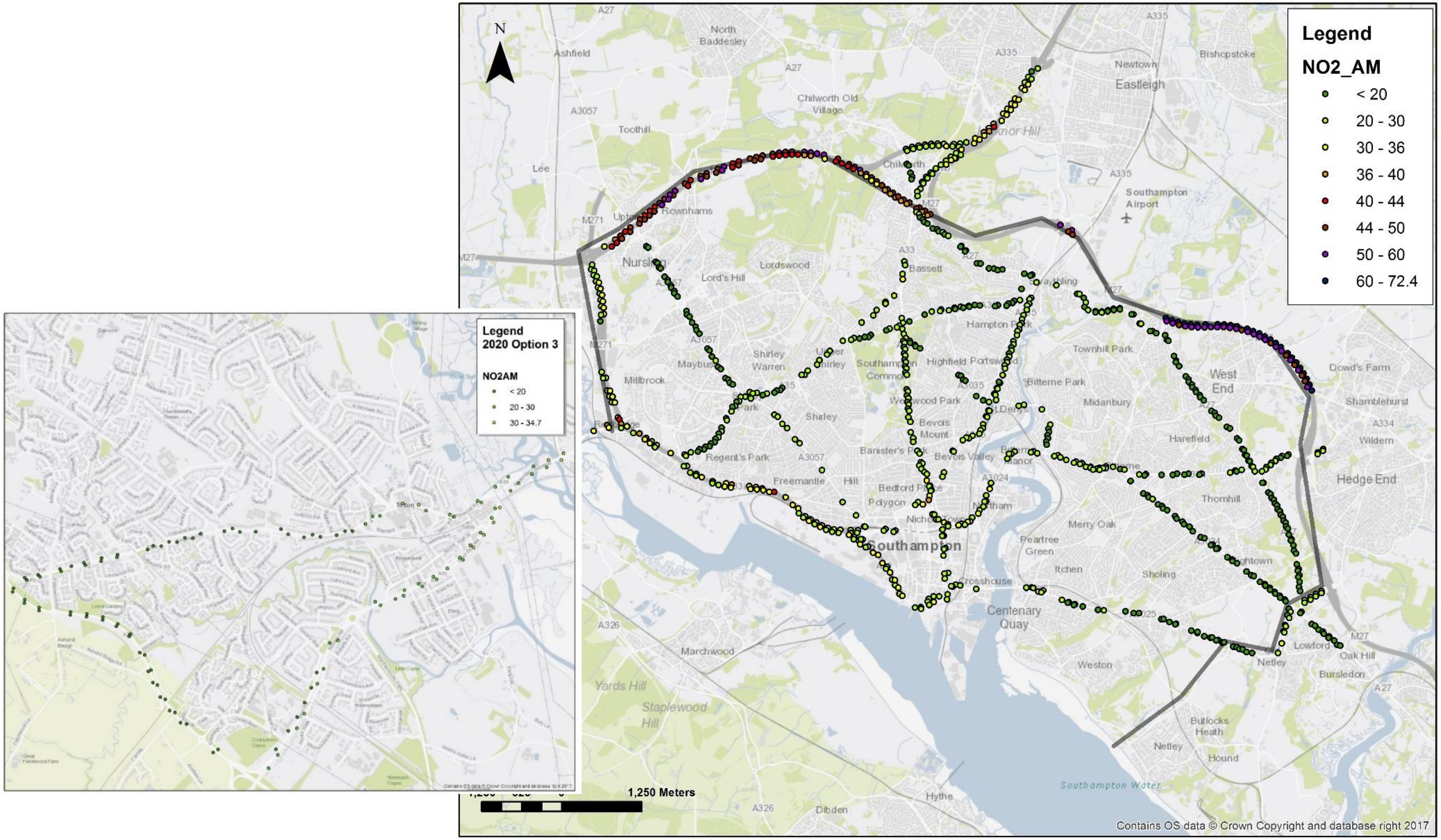


Figure 12 Annual mean NO_2 concentrations for Option 2 in 2020

Figure 13 Annual mean NO_2 concentrations for Option 3 in 2020



4.2 Results at local monitoring points

Modelled NO_2 results have also been extracted from the model for each of the monitoring locations in Southampton and New Forest. These results provide an indication of the impact of the options in relation to areas of concern in relation to local air quality management.

In both Southampton and New Forest all of the monitoring locations were below the 40 µg/m^3 limit value in the baseline and remain so for all the options modelled.

Table 9: Predicted NO_2 annual mean concentrations at monitoring site locations in 2020

Monitoring site name	Site ID	Site type	NO_2 annual mean (µg.m^{-3})			
			Option 1	Option 1a	Option 2	Option 3
Southampton Monitoring Locations						
CM1 AURN Brintons Road	CM1	Urban Centre	27.0	26.8	27.9	28.0
CM4 Onslow Road	CM4	Roadside	32.2	32.0	33.3	33.4
CM6 Victoria Road	CM6	Roadside	18.6	18.5	18.8	18.8
Redbridge School Fence	N101	Roadside	29.0	29.0	30.6	30.7
64 Burgess Road	N102	Roadside	18.3	18.3	18.7	18.7
485 Millbrook Road	N103	Roadside	28.9	28.9	30.4	30.4
Regents Park Junction	N104	Roadside	28.7	28.7	30.8	30.8
2 Romsey Road	N106	Roadside	19.7	19.2	20.3	20.3
Cranbury Place	N107	Roadside	31.8	31.2	30.5	31.9
72 Bevois Valley Road	N109	Roadside	24.8	24.7	25.5	25.5
206 Bitterne Road	N113	Roadside	22.4	22.3	23.1	23.2
Library, Bitterne Road	N114	Roadside	23.6	23.5	24.7	24.8
54 Redbridge Road	N115	Roadside	28.6	28.6	31.1	31.2
57 Redbridge Road	N116	Roadside	23.6	23.7	25.5	25.5
3 Rockstone Place	N118	Roadside	23.4	22.9	22.7	23.6
6-9 Canute Road	N120	Roadside	32.8	32.3	33.1	33.3
151 Paynes Road	N122	Roadside	31.7	31.7	33.1	33.1
102 St Andrews Road	N123	Roadside	26.2	26.3	26.7	26.8
305 Millbrook Road	N124	Roadside	32.9	32.9	35.0	35.1
Princes Court	N125	Roadside	27.4	27.2	28.6	28.6
107 St. Andrews Road	N126	Roadside	27.1	27.1	27.6	27.7
Canute Road	N129	Roadside	34.7	34.4	35.0	35.2
367A Millbrook Road	N130	Roadside	31.8	31.8	34.2	34.3
142 Romsey Road 1	N131	Roadside	25.7	23.7	24.6	26.0
539 Millbrook Road	N133	Roadside	22.8	22.8	23.7	23.7
433-435 Millbrook Road	N134	Roadside	28.1	28.1	30.3	30.3
24 Victoria Road	N135	Roadside	20.6	20.2	20.2	20.6
23 Victoria Road	N136	Roadside	20.5	20.2	20.1	20.6
66 Burgess Road 1	N138	Roadside	25.1	24.5	23.6	25.2
5 Commercial Road	N140	Roadside	32.0	31.0	30.5	32.3

Town Quay	N141	Kerbside	35.9	36.0	36.3	36.6
102 Romsey Road	N143	Roadside	21.3	20.3	20.5	21.5
208 Northam Road	N144	Roadside	29.4	29.3	30.6	30.6
222 Northam Road	N146	Roadside	26.6	26.5	27.5	27.5
44B Burgess Road	N149	Roadside	19.8	19.9	20.3	20.3
134 Romsey Road	N151	Roadside	25.5	23.5	24.3	25.8
M271	N152	Roadside	31.2	31.3	32.5	32.5
Coniston Road	N153	Roadside	26.1	26.2	27.1	27.1
Oceana Boulevard,	N154	Roadside	24.6	24.3	25.0	25.0
4 Platform Road	N157	Roadside	26.6	26.4	27.4	27.5
24 Portsmouth Road	N158	Roadside	19.6	19.4	19.9	19.9
35 Portsmouth Road	N159	Roadside	17.9	17.8	18.0	18.0
2 Dorset Street	N160	Roadside	27.1	27.1	27.9	28.0
30 Addis Square	N161	Roadside	18.8	17.9	18.6	19.1
263A Portswood Road	N162	Roadside	21.0	20.4	20.5	21.2
285 Portswood Road	N163	Roadside	19.4	18.7	18.8	19.4
168-174 Portswood Road	N164	Roadside	20.5	19.3	20.1	20.7
8 The Broadway	N165	Roadside	20.5	19.3	20.1	20.7
14 New Road	N166	Roadside	27.7	27.2	28.4	28.5
13 Romsey Road	N167	Roadside	20.0	19.4	20.8	20.9
23 Romsey Road	N168	Roadside	20.1	19.5	21.0	21.0
150 Romsey Road	N169	Roadside	25.7	23.7	24.6	26.0
4 New Road	N172	Roadside	28.7	28.2	29.7	29.7
19A Burgess Road	N173	Roadside	25.3	25.3	26.1	26.2
166A Bitterne Road	N174	Roadside	26.2	26.0	26.9	27.0
38 Shirley High Street	N175	Roadside	26.4	24.9	25.2	26.5
126 Shirley High Street	N176	Roadside	23.5	23.0	23.0	23.8
95 Shirley High Street	N177	Roadside	23.1	21.5	22.6	23.4
2 Gover Road	N178	Roadside	20.5	20.5	21.3	21.3
New Forest monitoring locations						
Junction Rd (analyser)	20	Roadside	19.06	19.06	18.96	18.98
30, Junction Rd	21	Kerbside	20.04	20.05	19.93	19.95
25, Junction Rd	22	Roadside	17.45	17.45	17.37	17.39
26, Rumbridge St.	23	Roadside	19.86	19.6	19.41	19.61
2, Eling Lane	24	Roadside	17.72	17.72	17.64	17.66
Elingfield Court, High St.	25	Roadside	19.61	19.47	19.45	19.5
55, High St.	26	Roadside	14.7	14.71	14.73	14.74
114, Commercial Rd	27	Kerbside	22.02	22	22.06	22.1
Commercial Rd	28	Roadside	21.44	21.42	21.48	21.51
Ringwood Rd / Maynard Rd rbt	29	Roadside	21.65	21.65	21.58	21.61
Asda rbt	30	Roadside	18.67	18.68	18.59	18.61
1, Rose Rd	31	Roadside	13.22	13.23	13.23	13.23

5 Conclusions

This report has provided an overview of the air quality results, in terms of NO_2 concentrations, for the Southampton and New Forest CAZ study areas covering the 2015 base year, 2020 baseline and 4 CAZ options in 2020. The results have been provided for the national air quality model (PCM) links and locl monitoring locations.

The baseline results for 2020 indicate the following:

- There are 3 exceedances of the 40µ/m^3 limit with in the Southampton City Council area, one is on the Western Approach at Millbrook Road West, but the other two relate to Highways England roads on the motorway network;

- There are a further 6 exceedances on the motorway network around Southampton falling into other districts (Eastleigh and Test Valley);

- No exceedances were identified in the New Forest modelled area in the 2020 baseline;

- All of the monitoring locations in both Southampton and New Forest were estimated to be under the 40µ/m^3 limit by 2020.

The impact of the options can be summaries as follows:

- Options 1 (Citywide CAZ B) and Option 1a (Citywide HGV charging scheme) show very similar impacts in Southampton with an average reduction in NO_2 concentrations of 6.5%. This is enough remove the exceedance on the Western Approach at Millbrook Road West, reducing the number of exceedances from 9 to 8. In addition, it reduces the number of PCM at risk of exceedance which were above 35µ/m^3 from 18 to 11.

- Options 2 (City centre CAZ A) and 3 (non-charging measures) both have a similar impact in Southampton which is about half that of options 1 and 1a with an average reduction in NO_2 concentrations of 3.6%. However, this is not enough to reduce the number of exceedance but it does reduce the number of links over 35µ/m^3 from 18 to 14, a little less than options 1 and 1a.

- All options have a similar impact on New Forest with an average reduction in NO_2 concentrations of around 2%.

Overall this suggests that from an air quality point of view either option 1 or 1a would provide the most benefits.

Appendices

Appendix 1: Southampton updated air quality model verification and adjustment

Appendix 2: New Forest air quality model verification and adjustment

Appendix 3: Transport model results for the city-wide CAZ B option

Appendix 1: Southampton updated air quality model verification and adjustment

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations; this helps to identify how the model is performing and if any adjustments should be applied. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. The LAQM.TG(16) guidance recommends making the adjustment to the road contribution of the pollutant only and not the background concentration these are combined with.

The approach outlined in LAQM.TG(16) section 7.508 – 7.534 (also in Box 7.14 and 7.15) has been used in this case. All roadside automatic and diffusion tube NO_2 measurement sites in Southampton have been used for model verification. A single road NOx adjustment factor was derived and used to calculate:

- Citywide modelling results at receptor points adjacent to relevant PCM road links
- Citywide 1m resolution NO_2 annual mean concentration rasters providing a continuous representation of the spatial variation in modelled concentrations.

The use of a zonal model verification approach was also considered during our analysis of modelled vs measured Road NOx; we concluded:

- There was no clear pattern in the value of road NOx adjustment factors across different zones of the city; allocating zones would therefore have been a subjective process.
- There could be various factors contributing to variable model agreement at individual measurement sites across the domain, these include uncertainties or omissions in the modelled traffic activity data, uncertainties in estimates of background concentrations, and omission of other nearby sources that have not been explicitly modelled e.g. bus stops, car parks etc. When modelling at the local scale, we typically model with a consistent background concentration across the model domain; and the impact of other sources such as car parks and bus stops can be modelled. Including this amount of detail is not however practical when modelling at city scale.
- Using a zonal approach could be considered relevant when the intention of the modelling is to focus on evidence relevant to specific areas or hotspots within the wider model domain e.g. small AQMA's. Whereby applying a zone specific road NOx adjustment factor may reduce the overall average error between measured and modelled concentrations at that location and hence increase confidence in the model results and associated conclusions. However, when generating evidence relevant to citywide impacts, applying different road NOx adjustment factors across the domain may create sudden step changes in modelled concentrations at the edge of each zone. For the Southampton CAZ assessment this would mean we were unable to produce a continuous NO_2 annual mean concentration raster for use in the distributional analysis aspect of the economics modelling. It may also have led to inconsistencies in the modelled concentrations at receptor points adjacent to relevant PCM road links where these were at the edge of a (subjectively allocated) verification zone.
- We have also presented results for future year scenarios using road NOx adjustment factors specific to each monitoring site, which could be considered as a zonal verification approach. This aims to provide an indication of when it is likely that compliance will be achieved at each measurement site even if the required Road NOx adjustment factor is higher than the slope of the best fit line across all sites.

It is appropriate to verify the performance of the RapidAir model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). To verify the model, the predicted annual mean Road NOx concentrations were compared with concentrations measured at the various monitoring sites during 2015. The model output of Road NOx (the total NOx originating from road traffic) was compared with measured Road NOx, where the measured Road NOx contribution is calculated as the difference between the total NOx and the background NOx value. Total measured NOx for each diffusion tube was calculated from the measured NO_2 concentration using the latest version of the Defra NOx/NO_2 calculator issued for use in the CAZ cities (v5.3).

The initial comparison of the modelled vs measured Road NOx identified that the model was under-predicting the Road NOx contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road NOx contribution vs. measured Road NOx contribution was then determined using linear regression and used as a global/domain wide Road NOx adjustment factor. This factor was then applied to the modelled Road NOx concentration at each discretely modelled receptor point to provide adjusted modelled Road NOx concentrations. A linear regression plot comparing modelled and monitored Road NOx concentrations before and after adjustment is presented in Figure A3.1.

The total annual mean NO_2 concentrations were then determined using the NOx/NO_2 calculator to combine background and adjusted road contribution concentrations.

Some clear outliers were apparent during the model verification process, whereby we unable to refine the model inputs sufficiently to achieve acceptable model performance at these locations. There are a number of reasons why this could be the case e.g.

- A site located next to a large car park, bus stop, petrol station, or taxi rank that has not been explicitly modelled due to unknown activity data.
- Sites located underneath trees or vegetation i.e. unsuitable locations for diffusion tubes to measure NO_2 concentrations effectively
- No traffic model road link included where the NO_2 sampler is located, or not all road links included e.g. at a junction.
- Uncertainties in the traffic model outputs.
- Uncertainties in the background maps, and the uncertainties introduced by modelling background concentrations over such a wide area at 1km resolution i.e. the mapped background concentrations change very suddenly at the edges of each 1km background map square. In reality annual average background concentrations would change gradually over an urban area. A possible solution to this issue wold be to interpolate the 1km background maps to a finer resolution e.g. 200m; this would have the effect of smoothing out the sudden changes in background concentrations at the 1km square edges of the background maps

However, in this case, excluding all of these outliers from the verification process would lead to a lower road NOx adjustment factor than that calculated using all sites. Therefore, to present a conservative approach to adjusting future year predictions of road NOx concentrations, a primary NOx adjustment factor (PAdj) of **2.1593** based on model verification using all of the 2015 NO_2 measurements was applied to all modelled Road NOx data prior to calculating an NO_2 annual mean.

A plot comparing modelled and monitored NO_2 concentrations before and after adjustment during 2015 is presented in Figure A3.2.

Figure A3.1 Comparison of modelled Road NOx Vs Measured Road NOx before and after adjustment (all sites)

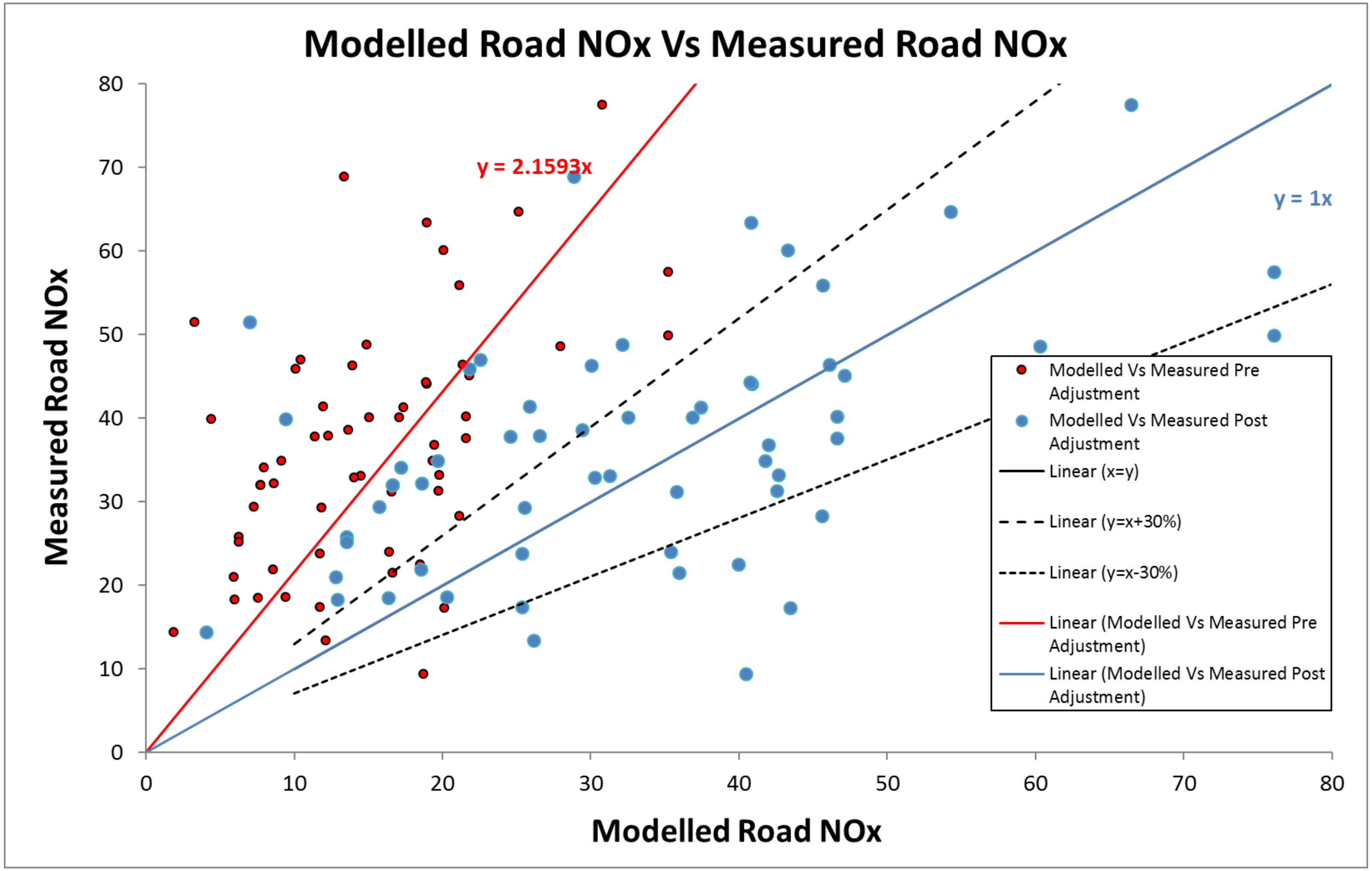
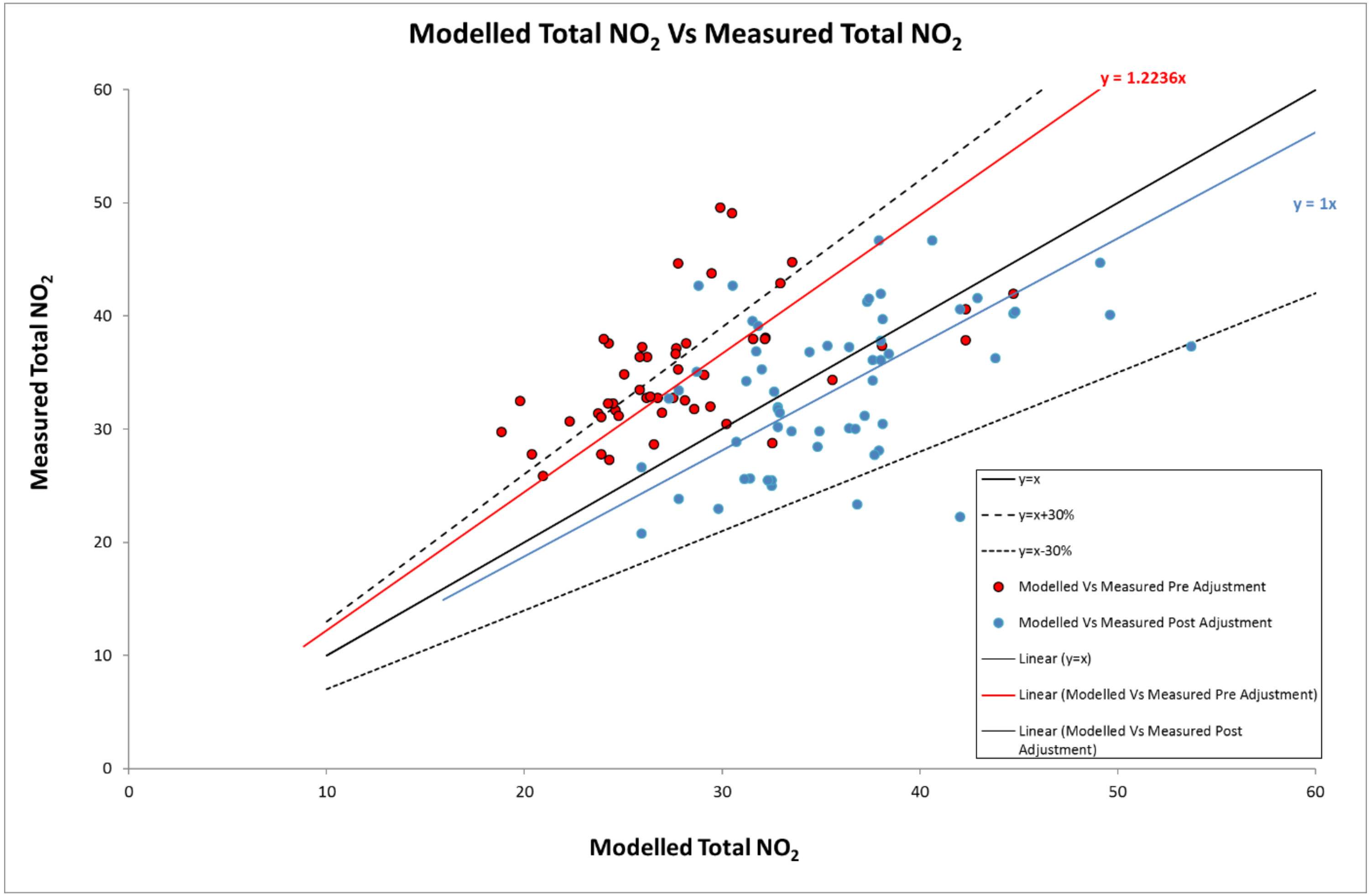


Figure A3.2: Modelled vs. measured NO_2 annual mean 2015



Model performance

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A3.1.

In this case the RMSE was calculated at 6.7 µg.m^{-3}. An RMSE was also calculated when clear outliers were excluded which reduced the average model error to 5.3 µg.m^{-3}.

Table A3.1: Root mean square error

NO_2 monitoring site	Measured NO_2 annual mean concentration 2015 (µg.m^{-3})	Modelled NO_2 annual mean concentration 2015 (µg.m^{-3})
CM1	32.0	35.3
CM4	42.0	40.6
CM6	42.0	22.3
N101	44.7	40.3
N102	29.8	23.0
N103	31.7	36.9
N104	38.4	36.7
N106	37.9	28.2
N107	53.7	37.3
N109	37.2	31.2
N113	34.9	29.9
N114	32.8	32.0
N115	36.4	37.3
N116	38.1	30.5
N118	34.8	28.5
N120	38.0	42.0
N122	31.5	39.6
N123	32.8	30.2
N124	37.3	41.3
N125	35.3	37.4
N126	32.8	31.8
N129	28.8	42.7
N130	44.8	40.4
N131	37.9	46.7
N133	30.7	28.9
N134	37.6	36.1
N135	31.4	25.7
N136	31.1	25.6
N138	43.8	36.3
N140	49.6	40.1
N141	30.5	42.7
N143	34.4	36.9
N144	31.8	39.2

NO_2 monitoring site	Measured NO_2 annual mean concentration 2015 ($\mu g.m^{-3}$)	Modelled NO_2 annual mean concentration 2015 ($\mu g.m^{-3}$)
N146	28.7	35.1
N149	32.5	25.0
N151	37.4	41.5
N152	49.1	44.7
N153	31.2	34.3
N154	32.9	31.5
N157	27.8	33.4
N158	36.8	23.4
N159	25.9	20.8
N160	32.6	33.4
N161	32.5	25.5
N162	37.7	27.8
N163	27.8	23.8
N164	32.3	25.5
N165	32.3	25.5
N166	38.1	39.7
N167	33.5	29.8
N168	36.4	30.1
N169	40.6	46.7
N172	42.9	41.6
N173	27.3	32.7
N174	37.6	34.3
N175	38.0	37.8
N176	38.0	36.1
N177	36.7	30.1
N178	25.9	26.6
	RMSE (all sites)	**6.7**
	RMSE (excluding clear outliers)	**5.1**

Appendix 2 – New Forest air quality model verification and adjustment

Verification of the model involves comparison of the modelled results with any local monitoring data at relevant locations; this helps to identify how the model is performing and if any adjustments should be applied. The verification process involves checking and refining the model input data to try and reduce uncertainties and produce model outputs that are in better agreement with the monitoring results. This can be followed by adjustment of the modelled results if required. The LAQM.TG(16) guidance recommends making the adjustment to the road contribution of the pollutant only and not the background concentration these are combined with.

The approach outlined in LAQM.TG(16) section 7.508 – 7.534 (also in Box 7.14 and 7.15) has been used in this case. All roadside diffusion tube NO_2 measurement sites in New Forest study area have been used for model verification.

It is appropriate to verify the performance of the RapidAir model in terms of primary pollutant emissions of nitrogen oxides (NOx = NO + NO_2). To verify the model, the predicted annual mean Road NOx concentrations were compared with concentrations measured at the various monitoring sites during 2015.

The model output of Road NOx (the total NOx originating from road traffic) was compared with measured Road NOx, where the measured Road NOx contribution is calculated as the difference between the total NOx and the background NOx value. Total measured NOx for each diffusion tube was calculated from the measured NO_2 concentration using the latest version of the Defra NOx/NO_2 calculator issued for use in the CAZ cities (v5.3).

The initial comparison of the modelled vs measured Road NOx identified that the model was under-predicting the Road NOx contribution at most locations. Refinements were subsequently made to the model inputs to improve model performance where possible.

The gradient of the best fit line for the modelled Road NOx contribution vs. measured Road NOx contribution was then determined using linear regression and used as a global/domain wide Road NOx adjustment factor. This factor was then applied to the modelled Road NOx concentration at each discretely modelled receptor point to provide adjusted modelled Road NOx concentrations. A linear regression plot comparing modelled and monitored Road NOx concentrations before and after adjustment is presented in Figure A1.1.

The total annual mean NO_2 concentrations were then determined using the NOx/NO_2 calculator to combine background and adjusted road contribution concentrations.

Some clear outliers were apparent during the model verification process, whereby we unable to refine the model inputs sufficiently to achieve acceptable model performance at these locations. There are a number of reasons why this could be the case e.g.

- A site located next to a large car park, bus stop, petrol station, or taxi rank that has not been explicitly modelled due to unknown activity data.
- Sites located underneath trees or vegetation i.e. unsuitable locations for diffusion tubes to measure NO_2 concentrations effectively
- No traffic model road link included where the NO_2 sampler is located, or not all road links included e.g. at a junction.
- Uncertainties in the traffic model outputs.

- Uncertainties in the background maps, and the uncertainties introduced by modelling background concentrations over such a wide area at 1km resolution i.e. the mapped background concentrations change very suddenly at the edges of each 1km background map square. In reality annual average background concentrations would change gradually over an urban area. A possible solution to this issue wold be to interpolate the 1km background maps to a finer resolution e.g. 200m; this would have the effect of smoothing out the sudden changes in background concentrations at the 1km square edges of the background maps

However, in this case, excluding all of these outliers from the verification process would lead to a lower road NOx adjustment factor than that calculated using all sites. Therefore, to present a conservative approach to adjusting future year predictions of road NOx concentrations, a primary NOx adjustment factor (PAdj) of **1.7456** based on model verification using all of the 2015 NO_2 measurements was applied to all modelled Road NOx data prior to calculating an NO_2 annual mean.

A plot comparing modelled and monitored NO_2 concentrations before and after adjustment during 2015 is presented in Figure A1.2.

Figure A1.1 Comparison of modelled Road NO_x Vs Measured Road NO_x before and after adjustment (all sites)

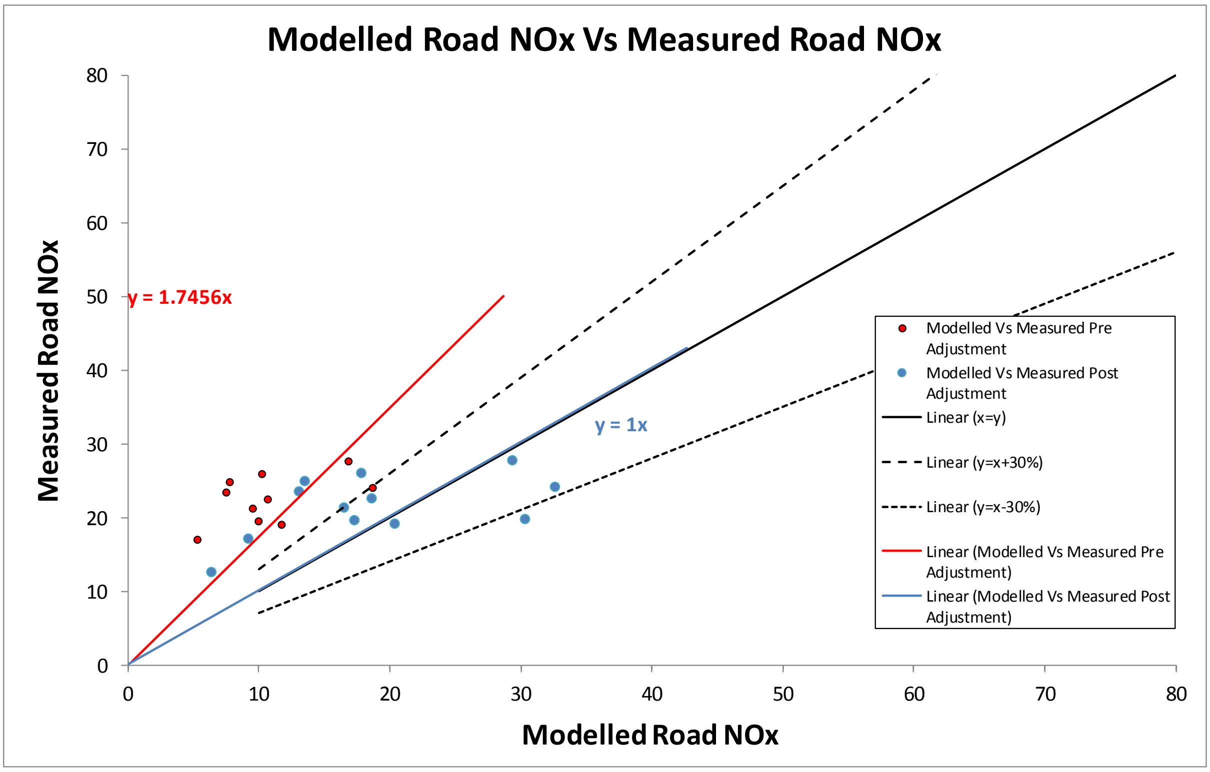
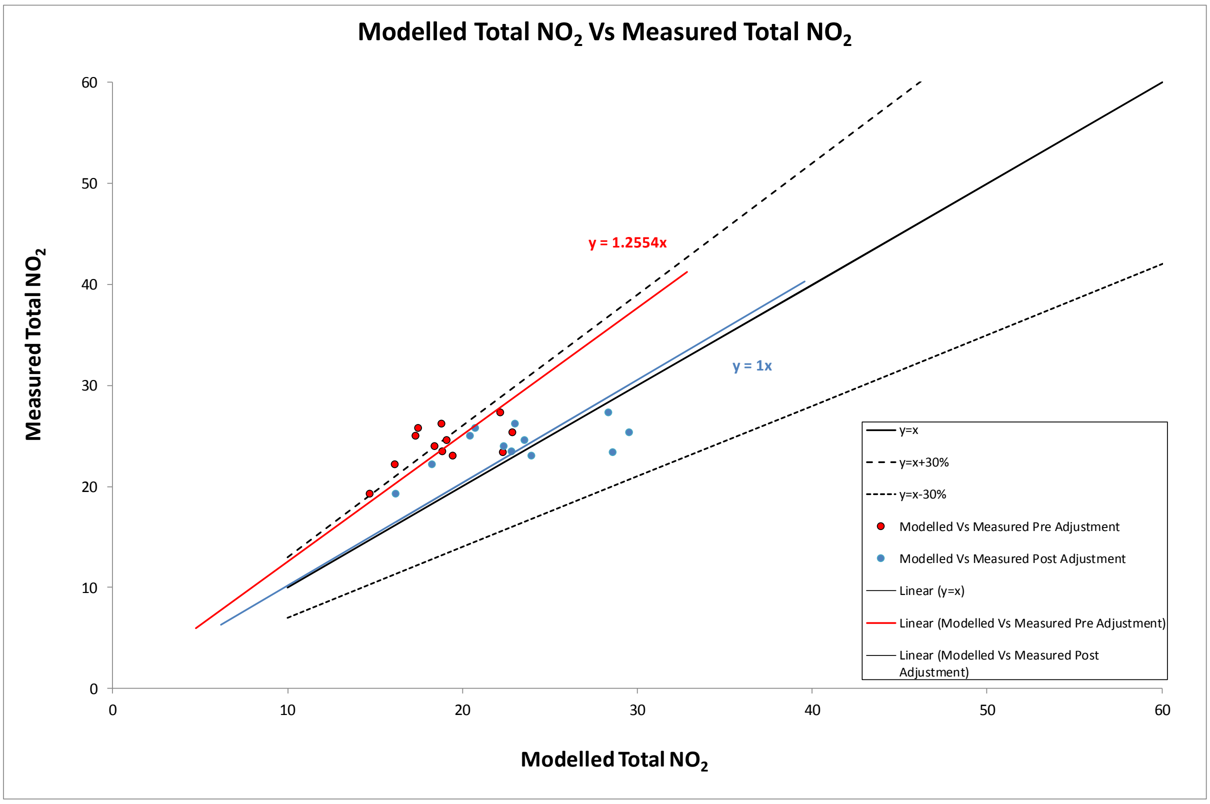


Figure A1.2: Modelled vs. measured NO_2 annual mean 2015



Model performance

To evaluate the model performance and uncertainty, the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations was calculated, as detailed in Technical Guidance LAQM.TG(16). The calculated RMSE is presented in Table A1.1.

In this case the RMSE was calculated at 3.3 $\mu g.m^{-3}$. An RMSE was also calculated when clear outliers were excluded, however the RMSE remained at 3.3 $\mu g.m^{-3}$.

Table A1.1: Root mean square error

NO_2 monitoring site	Measured NO_2 annual mean concentration 2015 ($\mu g.m^{-3}$)	Modelled NO_2 annual mean concentration 2015 ($\mu g.m^{-3}$)
20 - Junction Rd (analyser)	23.9	22.4
21 - 30 Junction Rd	24.5	23.6
22 - 25 Junction Rd	25.0	20.5
23 - 26 Rumbridge St.	26.1	23.0
24 - 2 Eling Lane	25.7	20.8
25 - Elingfield Court, High St.	23.0	24.0
26 - 55 High St.	22.1	18.3
27 - 114 Commercial Rd	25.3	29.6
28 - Commercial Rd	23.3	28.6
29 - Ringwood Rd / Maynard Rd roundabout	27.2	28.4
30 - Asda roundabout	23.4	22.9
31 - 1 Rose Rd	19.2	16.2
	RMSE (all sites)	**3.3**
	RMSE (excluding clear outliers)	**3.3**

Appendix 3 – Transport model results for the city-wide CAZ B option

This is attached as a separate PDF report.

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APPENDIX 4

Appendix 4 is the local modelled air quality data for the New Forest district modelling domain. The data file is too large to attach however a summary of the data is detailed within the draft Final Plan. Should you wish to view all the local modelled air quality data please contact Rachel Higgins (rachel.higgins@nfdc.gov.uk).

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Analytical assurance statement

Analytical Assurance Statement for transport and air quality modelling.

1. Limitations of the Analysis
- Has the Analysis been constrained by time or cost, meaning further proportionate analysis has not been undertaken?
- Could the further analysis that could be done lead to different conclusions?
- Does the analysis rely on appropriate sources of evidence?
- How reliable are the underpinning assumptions?

2. Risk of Error / Robustness of the Analysis
- Has there been sufficient time and space for proportionate levels of quality assurance to be undertaken?
- Have sufficient checks been made on the analysis to ensure absence of errors in calculations?
- Have sufficiently skilled staff been responsible for producing the analysis?

3. Uncertainty
- What is the level of residual uncertainty (the level of uncertainty remaining at the end of the analysis)?

4. Use of analysis

- Does the evidence provided support the business case?
- Is there evidence the agreed target will be achieved?

1. Limitations of the Analysis

- *Has the Analysis been constrained by time or cost, meaning further proportionate analysis has not been undertaken?*

  The analysis has been constrained by time and cost to some degree. The transport and air quality modelling of a range of options is complex and time consuming, and the project is working to a time and cost budget. However, we do not believe this has constrained proportionate analysis from being undertaken for assessment of baseline NO_2 concentrations in New Forest.

- *Could the further analysis that could be done lead to different conclusions?*

  A further update of the related Southampton modelling has been carried out. This has resulted in reductions in NO_2 concentrations in 2020. Carrying out a similar update for New Forest would not be expected to lead to different conclusions than those identified in the existing modelling: this already shows compliance with the NO_2 limit value and so lower concentrations would only support this position.

- *Does the analysis rely on appropriate sources of evidence?*

  The work has aimed to use the best available data sources that could be collected within the time and budget available. The key data sources comprise:

- Traffic flows have been provided by the existing Sub-Regional Transport Model (SRTM) that covers the areas of Southampton, Portsmouth and South Hampshire which has been validated to 2015. SYSTRA have prepared a transport model review note for SRTM, the 'Transport modelling methodology report (T3)'. This note has been assessed by JAQU/DfT and SRTM has been approved as being 'Fit for Purpose' to assess the highway impacts of Clean Air Zone and other air quality proposals.
- The data used to build, calibrate and validate the SRTM includes roadside interview surveys (RSIs), screenline, manual classified and automatic traffic counts, automatic number plate recognition (ANPR) and TrafficMaster data for journey times. More detailed information is included in T2 (already provided).
- Local fleet composition data was derived from analysis of a comprehensive ANPR survey covering 18 sites in Southampton one week from the 5th to 11th December 2016. This has been used to provide both the compliant/non-compliant split in the traffic model and the detailed fleet split in terms of Euro standards in the air quality emissions model. This was deemed to be representative of traffic in the New Forest assessment area so no additional ANPR data specific to the New Forest was collected.
- Speed data has been taken from the national traffic master data set for the road links in Southampton and New Forest. This is considered to be the most robust speed data set available.
- Vehicle emission data is based on COPERT V as specified by the JAQU guidance and again is considered the best available data for this scale of modelling.
- Ratified diffusion tube data for 2015 has been used to validate the air quality model and was available at 12 sites across the New Forest assessment area. No automatic sites were available in this location, so the diffusion data was deemed the best available with which to verify the model.

- *How reliable are the underpinning assumptions?*

  There are a wide range of assumptions used in the transport and air quality modelling. In general, the study has used the assumptions as provided by JAQU guidance for carrying out the CAZ feasibility studies. However, there are a number of areas where local assumptions have needed to be made and the evidence for these assumptions varies.

  The key assumptions that are likely to have the most impact on the baseline analysis are summarised as follows:

  - Within the SRTM, each model component has assumptions and parameters. Generically, the Values of Time are consistent with WebTAG Databook March 2017. Chapter 4 of the Model Forecasting report provides further details about these assumptions, but these are summarised below for each model component, alongside the appropriate reference:
    - MDM – car occupancies were calculated for each purpose based on observed survey data (Table 6)
    - MDM – car availability is expected to change over time (Table 7)
    - MDM – goods vehicle changes over time are derived from the National Transport (Freight) model (Table 8)
    - GDM – Southampton Airport growth assumed to follow the DfT's 2013 Aviation Forecasts (Table 9)
    - GDM – Portsmouth Port growth has used a combination of Portsmouth Port Masterplan 2011 and freight growth (Table 10)
    - GDM – Southampton Port growth used draft consultation of 2016 Masterplan (Table 11)
    - RTM – vehicle operation costs parameters as defined in WebTAG Databook March 2017 (Table 12)
    - PTM – bus and heavy rail public transport fares have been assumed to rise at 1% per annum above the growth in RPI
    - PTM – ferry services public transport fares have been assumed to increase in line with values of time (Table 13)

- Fleet projection – it has been necessary to project the 2015 ANPR fleet data forward to the target year. This has been done with a fleet projection tool developed by Ricardo. This takes as its basis that the local trends in fleet turn over will be the same as the national data in the NAEI, but from a different starting point. This is clearly a simplification and there are likely to be some differences locally. However, given no local projections exist, this was viewed to be the best approach and in line with JAQU guidance.

As well as the baseline modelling a set of mitigation measures were tested in parallel for Southampton, but given that the baseline results already showed compliance the impacts of these measures on compliance on New Forest DC links was not tested. As such the assumptions for modelling these measures are of less importance than the assumptions for the baseline, but for completeness they are set out below:

- Behavioural assumptions – in terms of how vehicle owners respond to the different options will be important and varies from each of the options assessed:
  - The charging schemes (city wide CAZ B and city centre CAZ A) – the key assumption used here is in relation to the upgrade behaviour of drivers in relation to the charge. The standard behavioural responses provided by JAQU, based on TfL data, have been used. It is recognised that in practice this response may be different in Southampton, but adopting the JAQU assumptions was felt to be a proportionate approach without the time and resource to undertake new data collection at this stage. Also, no consideration has been given at this stage to locally specific charge rates. Where further work has been done around the charge-response relationship (e.g. for Leeds), insufficient evidence was available with which to depict a local charge-response relationship and no evidence found suggested that the relationship could be confidently assumed to be different in the local context.
  - Non-charging measures – the behaviour/activity assumptions used are based on literature review and previous LES studies carried out by Ricardo. As such they are not locally specific but based on experience of schemes elsewhere. It should also be noted that the non-charging measures have only been defined in outline terms and so the behavioural responses and activity changes are generic for the measures included.
- Impact extrapolation – to provide the economic assessment over a 10-year period an estimate of the benefits and costs over 10 years needs to be made. Generic guidance has been provided by JAQU on this topic and we have taken this into account in developing the approach for this study. The key impact that needs to be extrapolated is the emission benefit and how this will reduce in future years. Without modelling further future years at this stage it was felt to be proportionate to model the reduction in emission benefit of the scheme using the PCM trends from 2020 to 2030 for the Southampton baseline PCM results. We recognise that this does not account for a number of local factors, not least future development and highways schemes. However, as explained further in E1, this approach was deemed appropriate and most proportionate given:
  - Further resource would be needed to develop an adequate model to depict changes in emissions over the future period, akin to an emissions model extrapolated to 2030 (which wasn't appropriate purely to apply to the economics case)
  - Even then, it is questionable how different the results between such a local model and national trends would be. Given lack of local-specific projection parameters, such a model would instead use national parameters anyway
  - Also it is questionable whether one could have confidence in any difference produced from a local relative to national modelling. There is always inherent uncertainty associated with projecting parameters forward. Hence the results attained from such a local fleet projection model, and those represented by the extrapolation factors derived from the national plans (in particular given the overlap in inputs used), are deemed likely to fall within the range of uncertainty around this exercise.

In summary there are limitations and uncertainties in the assumptions made, with the greatest limitations being around the modelling of the mitigation measures. However, given that the key outcome has been compliance in the baseline, it is the assumptions used for baseline modelling that are most important and these are the most robust.

2. Risk of Error / Robustness of the Analysis

- *Has there been sufficient time and space for proportionate levels of quality assurance to be undertaken?*

  Quality management for all Ricardo projects (and all deliverables produced) is delivered in accordance with the requirements of the International Standard ISO 9001:2008. Principles of quality assurance (QA) are integrated in all our activities and at all levels through established and implemented procedures according to the international standard. The formally appointed Project Manager and Project Director lead in ensuring the project is undertaken in accordance with the current Ricardo Quality Assurance processes and that the system is effective.

  As noted above the citywide modelling of the CAZ options is both complex and time consuming, whilst being carried under tight delivery times scales. However, all analysis for the New Forest has been developed in accordance with these over-arching Ricardo QA policies and procedures to ensure high quality and accuracy of deliverables. Specifically, this includes:

    - Use of the core principles from our modelling QA group in the design of analysis spreadsheets;
    - Technical oversight of methodological modelling issues from our modelling knowledge leader;
    - Day-to-day oversight of the modelling work by the lead modeller;
    - Checks of assumptions, input data, calculation sheets and output results
    - Overall review and sign off by the project director.

  All models have been developed in accordance with Ricardo's 'best practice' modelling guidance for the construction of workbooks and tools. This includes having separate sheets for data import, manipulation and results. In addition, the model has been developed with strict version control procedures (to avoid version error) and with assigned governance and responsibilities (i.e. the PM holds overall responsibility for the quality of the model, with analysts holding joint responsibility for the elements they developed).

  In some cases, some data transformations have been carried out in MS Excel prior to import to the economic model. Each of those transformation workbooks has been identified and also subject to scrutiny.

  All data sources used in the model are appropriately referenced and clearly marked where data is inputted into the model. All assumptions and data sources have been logged, in particular as part of the Air Quality Reports.

  In accordance with Ricardo's QA processes, all deliverables and outputs have been signed off by both the Project Manager and/or Project Director before release. Also, we issued draft results to New Forest for review and scrutiny prior to finalising.

- *Have sufficient checks been made on the analysis to ensure absence of errors in calculations?*

  Checks on modelling work are carried out as part of our quality assurance process. Again, with complex models across several thousand road-links there is a large amount of data and calculations to check. With this amount of data it is not possible to check everything. Our approach has been as follows:

    - Review and check all methods being used in the model set up and calculations;
    - Review model input data for consistency, this has focused on samples of data and key locations;

- Check calculations in all spreadsheets, again using a sampling approach to check calculation steps;
- Sense check results using the experience of the lead modeller, knowledge leader and project director to ensure that they seem reasonable.

Where any anomalies in results have been identified in the checking process these have then been explored for errors in data or calculations.

Finally as part of the model validation process for the base year air quality model the results are compared with monitoring data. Where there is a significant difference with the modelling data (i.e. +/– 30%), checks are carried out to explore why these differences occur.

We believe this level of check is proportionate for the time and resources we have available, and has identified a number of issues that have had to be corrected. However, it is not an absolute guarantee that there are no errors, but it is sufficient to ensure that all results are reasonable and consistent.

- *Have sufficiently skilled staff been responsible for producing the analysis?*

The air quality modelling team at Ricardo have significant experience of developing, assessing and recommending measures to reduce emissions and improve air quality at the city scale, including extensive expertise in air pollution modelling from the development of inventories and baselines, to modelling the future impacts of abatement scenarios.

The team is led by a Project Director who holds over 20 years of experience of working on transport and emissions reduction projects. His key areas of expertise include vehicle emissions modelling, low emission vehicle technologies, sustainable transport measures and local air quality management and policy. He has worked on a number of LES, LEZ and CAZ projects in the UK including in Southampton, Derby, Nottingham, Oxford, London, Leicester and South Oxfordshire.

The day-to-day modelling work is led by an experienced atmospheric scientist with a strong focus on modelling transport and industrial emissions and characterising their effects on ambient air quality. He is an advanced user of ADMS, ADMS-Roads, ADMS-Urban, AERMOD, CALPUFF, Envi-Met CFD, ArcGIS, QGIS and other air dispersion modelling tools as well as meteorological modelling software such as WRF. He has also developed Ricardo's in-house dispersion modelling suite (RapidAir).

The modelling lead is supported by our modelling knowledge leader to explore and resolve any methodological issues. In addition a team of experienced consultants specialising in air quality impact assessment and atmospheric dispersion modelling are carrying out aspects of the modelling work, guided by the modelling lead.

All staff have had specific training on all the modelling tools being used for this work.

The transport modelling team at SYSTRA have significant experience of model development and appraisal work to support funding bids. SYSTRA have developed the Solent Transport Sub-Regional Transport Model (SRTM), a land-use and transport interaction (LUTI) model. They have used the modelling suite as an evidence base for the development of the Transport Delivery Plan for the Solent area. This work has helped to prioritise transport interventions, support Local Plans and the development of a Spatial Strategy for the Solent area, and inform development control, highway authorities and the Local Enterprise Partnership. Using this model SYSTRA have also tested a number of large proposed developments and transport schemes in the area including: the Southampton City Centre Action Plan, Eastleigh Transport Assessment/Transport Strategy, the Smart Motorway Programme (for Highways England), support for the preparation of the Station Quarter Business Case and testing of improvement options in Southampton's Eastern Corridor. In addition, they have explored the provision of Park and Ride sites and various motorway junction improvement schemes, as part of initiatives aimed to improve access to the city.

The team is led by a project Director with 30 years' experience in transport modelling. He was responsible for the development of the WebTAG compliant SRTM, and has had significant experience on applications of the model to support DfT Pinch Point bids, Regional Growth Fund and Cycle City bids. He was also heavily involved in developing strategies which provided vital evidence and forecasts in support of Local Sustainable Transport Fund (LSTF) and also Better Bus Area Fund (BBAF) bid submissions to DfT, both of which were successful in receiving full funding.

The modelling team at SYSTRA is led by an experienced user of the SRTM, who has advanced knowledge of SQL, C# and CUBE scripting. He is supported by a number of other team members who are experienced transport modellers and users of the SRTM, who are guided by both the project director and the lead modeller.

SYSTRA have also been able to draw on support, and share best practices from other teams that have been working on CAZ projects elsewhere in the country, such as Nottingham and Derby.

3. Uncertainty

- *What is the level of residual uncertainty (the level of uncertainty remaining at the end of the analysis)?*

A direct assessment of uncertainty in the air quality results is only carried out for the baseline model as part of the validation process against monitored air quality data. In this process, model performance and uncertainty is assessed using the Root Mean Square Error (RMSE) for the observed vs predicted NO_2 annual mean concentrations, as detailed in Technical Guidance LAQM.TG(16). In this case the RMSE was calculated at 3.3 $\mu g.m^{-3}$. This can then be used as a measure of error or uncertainty on forecast results for future years.

This error metric has been used when considering the results by considering locations over 36 $\mu g.m^{-3}$ as being at risk of exceedance. Therefore, the reduction in the number of links with concentrations greater than 36 $\mu g.m^{-3}$ has also been used to compare options.

When assessing the mitigation options in future years, there will also be uncertainty related to the assumptions we have made in modelling these future scenarios. The reliability of the assumptions used in the modelling has been discussed above with the key areas of uncertainty relating to the behavioural response generated by given measures and how the vehicle fleet evolves in the future.

The level of uncertainty included within the transport modelling is also only assessed in the base year model, as part of the validation process comparing the modelled and observed data. The differences between modelled and observed data are quantified and then assessed. The acceptability of the proportion of instances where the criteria are met is then assessed.

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
- Modelled and observed journey times along routes, as a check on the quality of the network

The SRTM's standard 'Reference Case' scenarios representing forecast year conditions include both new transport infrastructure schemes and land use development assumptions to represent expected changes in conditions compared to the Base year.

Reference case transport infrastructure only includes those schemes that have received the necessary planning approvals and are fully funded. This provides a high degree of certainty that the schemes will be constructed.

In the standard Reference Case, land use inputs (sqm floorspace) are derived from the Local Plans for each of the planning authorities and the records of granted planning permissions. The Local Plan information currently input to the SRTM dates from April 2016 and only includes Adopted Plans at that time (it is anticipated that periodic updates of the land use inputs will be undertaken to account for newly adopted Plans and planning permissions etc). In later model years, and particularly those beyond current Plan periods, the model includes a process referred to as 'intensification'. This enables continued growth to be represented within existing developed areas to allow TEMPRO forecasts to be met. Intensification is limited to those areas where development already exists because it is not considered appropriate for the model to arbitrarily allocate development to undeveloped areas. It follows that there is less certainty in the actual location of this growth.

4. Use of analysis

- *Does the evidence provided support the business case?*

  Evidence has been provided from the analysis in terms of NO_2 concentration results for each of the national PCM road links in the New Forest assessment area for the baseline.

  The outcome of the modelling indicated that the PCM links in New Forest would comfortably meet the NO_2 limit value by 2020 with the highest modelled NO_2 concentration being 35 μgm^{-3}.

  The level of uncertainty estimated in the air quality model of 3.3 μgm^{-3} indicates that with a maximum modelling result of 35 μgm^{-3}, it could be expected for compliance to be achieved by 2020 even within the bounds of uncertainty of the modelling. Therefore no further mitigation measures are needed to achieve compliance.

- *Is there evidence the agreed target will be achieved?*

  Yes, the modelling suggests New Forest will be compliant by 2020 under the baseline conditions even accounting for modelling uncertainty.

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APPENDIX 6

Joint Air Quality Unit of Defra and DfT (JAQU)

Local Plan Transport Modelling Tracking Table (T1) v1 - 7 Feb 18

Ref	Requirement	LA	JAQU Review
	Transport model specification : Model Selection		
	Present year validation if the model is more than 5 years old (e.g. ANPR, journey times etc.).		2015 Base year, with 2015 counts and journey time data.
	The coverage of the transport model should be robust enough to capture if any route choice will be impacted due to the proposed measures		Good coverage. Covers the City in detail and includes M27 and skeleton network beyond for any strategic rerouting,
	Validation should be based on comparison between observed (i.e. from ANPR data) and modelled vehicle composition, flows (on links and across screenlines/cordons), traffic pattern and journey time within the key study area (WebTAG Unit M3.11).		Good screenline and journey time validation. Matrices built from observed OD data as well as synthetic data (although old 2010/2011, but uplifted. The screenline calibration indicates strategic movements are well validated. Individual count calibration is much weaker.
	For light and heavy goods vehicles, validation will need to be reported for short screenlines using grouped counts to ensure a larger sample size.	This has been reported in an updated SRTM Validation Report and included	LGV and HGV results not reported

[1] https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/427124/webtag-tag-unit-m3-1-highway-assignment-modelling.pdf

		within Appendix A of this document	
	The assignment convergence meets WebTAG convergence criteria (WebTAG unit M3.1, section 3.3, Convergence Measures and Acceptable Values)		Yes – converges (future year not reported, but reasonable to assume that it will)
	Vehicle disaggregation: the transport model must split modes (e.g. HGV, LGV) to provide capability to distinguish between compliant and non-compliant vehicles under projection scenarios which include a Clean Air Zone.		Demand split into • Car employer's business • Car other • HGV • LGV Broken into compliant/ non-compliant for forecasting Taxis a fixed proportion based on ANPR surveys (applied by area i.e. higher proportions in the City Centre. Buses also modelled.
	If modelling does not fully meet above requirements in the key study area, please provide mitigation measures/implications.	Screenlines shown in T3, and expanded link validation in Southampton and New Forest is reported in Appendix A in the	Need to provide additional information for a CAZ focused validation report for example reporting on (mentioned by Jiao): • LGV/ HGV calibration • does weak link validation affect the AQ modelling • Focus on key areas relevant to CAZ testing • Any caveats etc.

		updated SRTM Validation Report	
	Overall model assessment		
	Base model fit		
	Model calibration/ validation		Looks good, just need to add missing reporting
	Present year validation (if relevant)		
	Transport model forecasting methodology		
	Baseline forecast (demand growth assumption as per WebTAG guidance) including the review of committed schemes and local development plan.		Need a forecasting report with assumptions listed, but would expect it to be reasonable: "Known developments and committed (funded) highway schemes are included within the models' Reference Case scenarios (2019, 2026, 2031 and 2036) to provide a representation of future year transport supply and demand."
	An uncertainty log providing a clear description of the planning status of local developments.	The SRTM Forecasting Report is still being reviewed and will be provided when ready. An additional chapter has been added to T3 (Section 4.2) for Forecast	Need a forecasting report with assumptions.

		Year Uncertainty	
	Description of the future year transport supply assumptions (i.e. planned road networks examined for the baseline, core scenario and variant scenarios)		Yes is described Included in Table 5 in report, no discussion of certainty
	Description of the travel cost assumptions as per WebTAG guidance (e.g. fuel costs, PT fares, parking).		No forecasting report – but would be confident is has reasonable assumptions
	Description on the proposed CAZ charging options, if relevant, and how the options are modelled in transport models (e.g. timeframes, eligibility etc.)		“The CAZ scheme is assumed to be a ‘within cordon charge’ the same as the London ULEZ as opposed to a charge for crossing the zone boundary.” **Figure 3 Illustrative CAZ boundaries**  JAQU’s assumptions for the behavioural responses of vehicle owners to the CAZ charges will be applied. When modelling the CAZ in Southampton the ULEZ charge will be used so that consistency is maintained with the JAQU behavioural response

<table>
<tr>
<td></td>
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<td>
data. This is currently £12.50 for cars and vans, and £100 for HGVs and buses and coaches.
No mention of mode shift below
Table 6 JAQU assumptions on behavioural response to the CAZ
<table>
<tr><th colspan="9">Proportions of non-compliant vehicle kilometres which react to the zone</th></tr>
<tr><th></th><th>Petrol Cars</th><th>Diesel Cars</th><th>Petrol LGVs</th><th>Diesel LGVs</th><th>RHGVs</th><th>AHGVs</th><th>Buses</th><th>Coaches</th></tr>
<tr><td>Pay charge – Continue into zone</td><td>7.1%</td><td>7.1%</td><td>20.3%</td><td>20.3%</td><td>8.7%</td><td>8.7%</td><td>0.0%</td><td>15.6%</td></tr>
<tr><td>Avoid Zone – Vkms removed, modelled elsewhere</td><td>21.4%</td><td>21.4%</td><td>10.0%</td><td>10.0%</td><td>0.0%</td><td>0.0%</td><td>0.0%</td><td>0.0%</td></tr>
<tr><td>Cancel journey – vkms removed completely</td><td>7.1%</td><td>7.1%</td><td>6.0%</td><td>6.0%</td><td>8.7%</td><td>8.7%</td><td>6.4%</td><td>12.5%</td></tr>
<tr><td>Replace Vehicle – vkms replaced with compliant vkms</td><td>64.3%</td><td>64.3%</td><td>63.8%</td><td>63.8%</td><td>82.6%</td><td>82.6%</td><td>93.6%</td><td>71.9%</td></tr>
</table>
Source: JAQU, CAZ Technical working group minutes – 15/2/17
</td>
</tr>
<tr>
<td></td>
<td>Description of forecasted vehicle composition assumptions, if deviating from EFT assumptions</td>
<td></td>
<td>In line with JAQu guidance:
“a local fuel type and Euro class distribution has been projected forward from the local ANPR results to provide Euro class distributions for each of the future modelling years. This project has been carried out in line with the draft methodology provided by JAQU. This has been done by deriving future scaling</td>
</tr>
</table>

			factors from the national NAEI data, applying these to the local ANPR results and then normalising to 100%. This gives an evolution of the local fleet that is slightly behind the national fleet. "
	What and how to interpret and implement CAZ non-compliant user behaviour change, if relevant: replacing vehicle for compliance, avoiding zone, cancelling journeys, mode shift and other		See above
	Outline of methodology for non-compliant user behaviour research, if undertaken.		Using JAQU assumption – should comment on to what extent this is applicable/ acceptable for Southampton. Also how would you test different levels.
	Describe how the transport modelling implications are fed into the air quality modelling (e.g. speed, congestion etc.)		Sensible methodology : • AADT flows for future baseline years will be provided from the SYSTRA sub-regional traffic model. • Projected fleet split (vehicle type): All future year scenarios will have the 4 core vehicle category fleet splits provided from the traffic model • Car, • LGV, • HGV ○ Rigid ○ Arctic • Bus/ Coach • Projected fuel type and Euro class distribution descreibed above • Future year scenarios average vehicle speed data: Average link speeds for all future year scenarios will be calculated by adjusting the observed baseline speed data (Traffic Master) by the ratio of the 2015 baseline vs future baseline journey times calculated by the traffic model

			• Projected vehicle NOx emission rates will be calculated using the latest COPERT v5 NOx emission functions applied to the projected average flows, fleet and vehicle age composition for each future baseline year being modelled.
	Overall forecasting methodology assessment		
	Forecasting assumptions		Needs more details, but seems to be sensible in line with WebTAG, JAQU guidance.
	Policy options and the implementation in the model.		All responses modelled, should comment on use of JAQU assumptions for behaviour change and its applicability to Southampton conditions. What happens if charges are different than ULEZ. Only options modelled are focused on upgrading the fleet, modelled in the AQ model.
	Modelling Non-compliant vehicles behaviour change.		See above
	<u>Final Transport Modelling</u>		
	The detailed vehicle fleet composition for each policy scenario and the baseline (broken down by vehicle type and Euro standard) so that changes to the fleet are clear.		
	Details of modelling methodology		
	Forecast assumptions: demand growth, network changes and transport costs growth		
	Baseline forecast		
	Scenario testing (policy options)		
	What and how to implement transport modelling forecast to air quality modelling		
	Impact analysis and key findings		
	Overall forecasting assessment		
	Forecast assumptions		

	Policy option modelling		
	Impact analysis and further application to AQ modelling		

<u>JAQU review</u>

Green – Accepted – Information meets requirement

Grey – Accepted - Information meets requirement and JAQU to provide assistance in meeting requirement

Yellow – Requires further information or a response to a question to be provided either in the table or in the report

Red – Information provided does not meet the requirement

Solent Transport Model

20/06/2017

Reference number 102891

ROAD TRAFFIC MODEL

MODEL DEVELOPMENT AND VALIDATION REPORT

Solent Transport

SYSTRA

SOLENT TRANSPORT MODEL

ROAD TRAFFIC MODEL

IDENTIFICATION TABLE	
Client/Project owner	Solent Transport
Project	Solent Transport Model
Study	Road Traffic Model
Type of document	Model Development and Validation Report
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APPROVAL

Version	Name		Date	Modifications
1	Main Authors	Stefanos Taskaris, Ian Wilkinson	20/06/2017	
	Checked by	Ian Burden	20/06/2017	
	Approved by	Chris Whitehead	20/06/2017	

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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.

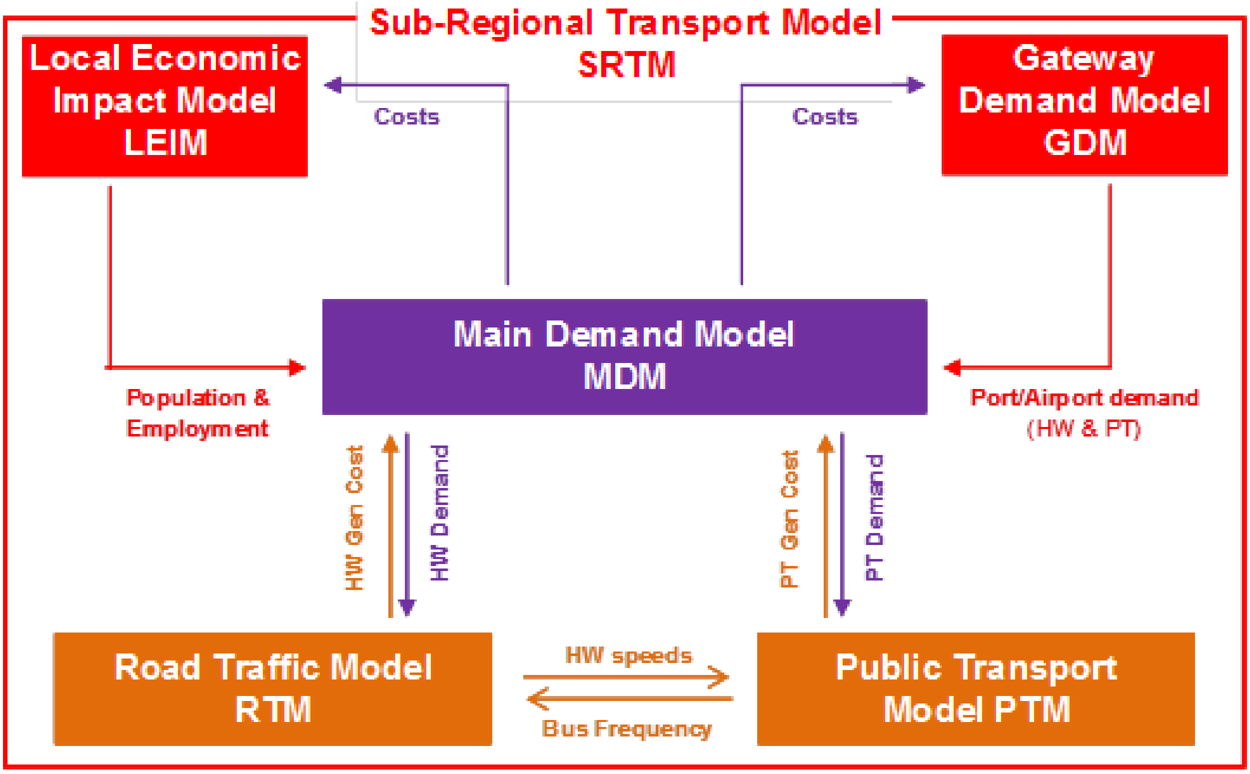
2.1.2 As the lead contractor SYSTRA takes overall responsibility for the RTM documented in this Working Paper, the models listed in the Foreword, and the associated project deliverables.

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

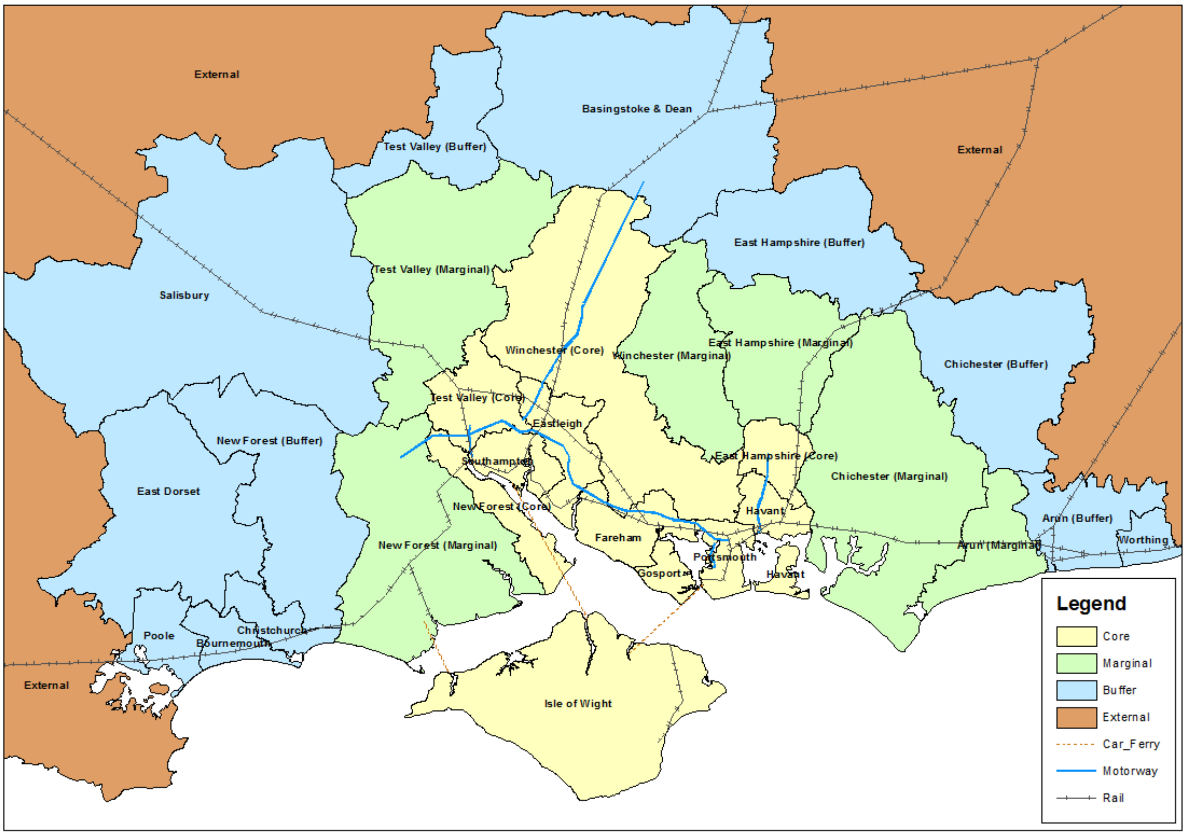
4.2.1 The modelled area of the RTM is sub-divided into four regions which differ by zone aggregation and modelling detail, as follows:

- 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

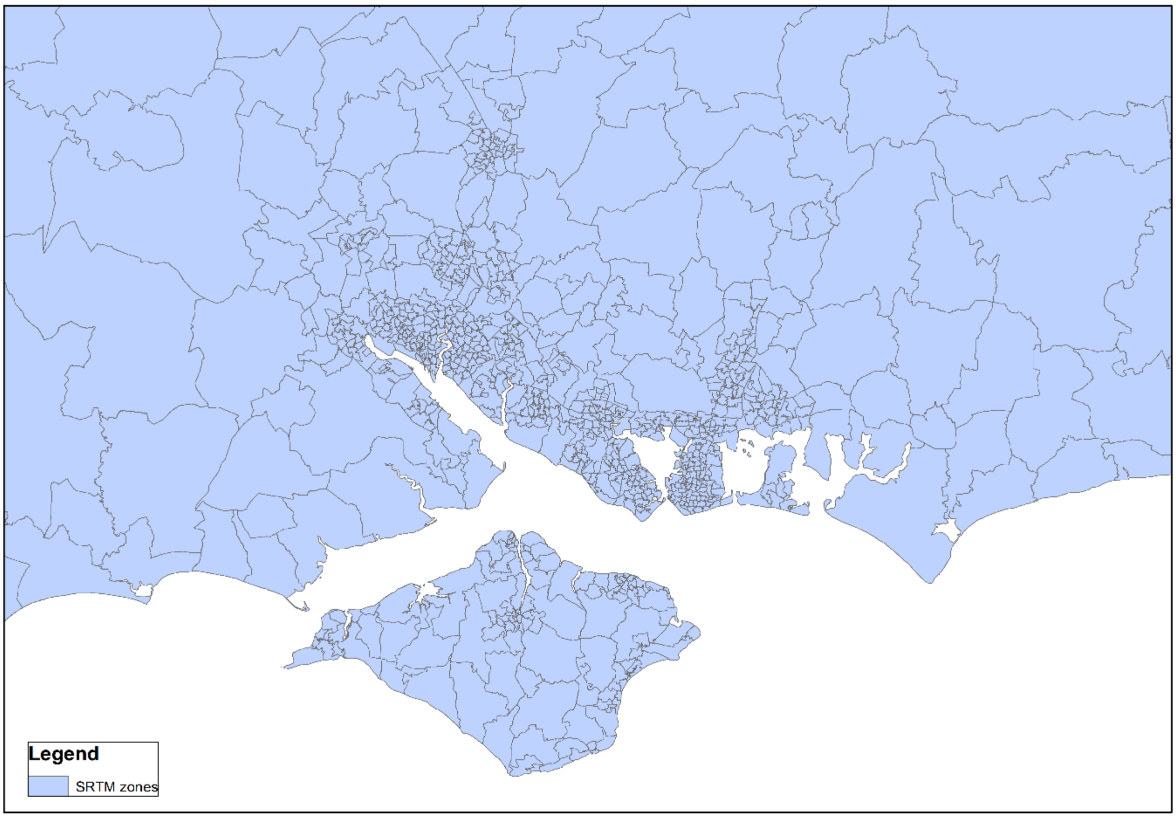
MODEL	REQUIREMENT
MDM & LEIM	Land use characteristics for ensuring zones contain similar land use
	Known future development sites are not given their own exclusive zones. Instead zone numbers have been reserved for that purpose in future year modelling
RTM	Highway access can be realistically modelled
	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

MODEL	REQUIREMENT
	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	7:00-10:00	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.

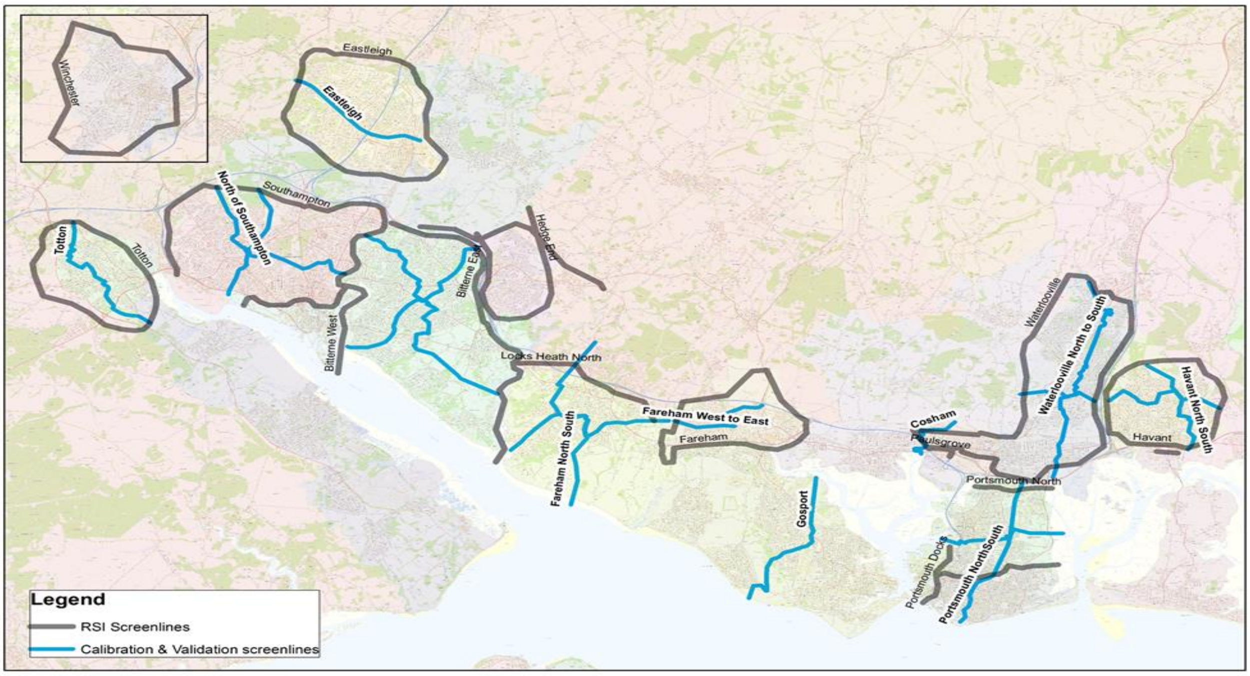
5.2 Roadside Interview (RSI) Surveys

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.

Figure 4. Location of RSI Sites and Screenlines



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

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 dataset. These are listed in Table 9.

Table 9. List of Journey Time Routes

NO.	SET	MAP ID	DESCRIPTION
1	Part 1 – 2010 routes	1	A336 RINGWOOD ROAD - A35 BURGESS ROAD
2	Part 1 – 2010 routes	2	A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE
3	Part 1 – 2010 routes	3	A33 DORSET STREET - A335 TWYFORD ROAD
4	Part 1 – 2010 routes	4	A33 DORSET STREET - A33
5	Part 1 – 2010 routes	5	A3024 BURSLEDON ROAD - A33 THE AVENUE
6	Part 1 – 2010 routes	6	A27 WEST END ROAD - A27 BASSETT GREEN ROAD
7	Part 1 – 2010 routes	7	A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD
8	Part 1 – 2010 routes	8	A27 WESTERN WAY - A27 BRIDGE ROAD
9	Part 1 – 2010 routes	9	A32 MUMBY ROAD - B3334 TITCHFIELD ROAD
10	Part 1 – 2010 routes	10	A32 FAREHAM ROAD - A27 WESTERN ROAD
11	Part 1 – 2010 routes	11	A397 NORTHERN ROAD - A3 LONDON ROAD
12	Part 1 – 2010 routes	12	B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD
13	Part 1 - Portsmouth	1	A2030 VELDER AVENUE - A2030 EASTERN ROAD
14	Part 1 - Portsmouth	2	A288 MILTON ROAD - A288 COPNOR ROAD
15	Part 1 - Portsmouth	3	M275 - - A27
16	Part 1 - Portsmouth	4	A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD
17	Part 1 - Portsmouth	5	A3 MARKETWAY - A27 WESTERN ROAD
18	Part 2 – 2015 new	1	M3 Junction 11 - A32
19	Part 2 – 2015 new	2	M27 Junction 2 - A303
20	Part 2 – 2015 new	3	M27 Junction 2 - A34
21	Part 2 – 2015 new	Sec 1	Six Dials Junction un to Windhover Rbt
22	Part 2 – 2015 new	Sec 2	M27 Junction 7 to M3 Junction 11
23	Part 2 – 2015 new	Sec 3	M27 Junction 10 - M3 Junction 11
24	Motorway		M27 Junction 3 – Junction 11
25	Motorway		M3 Junction 8 – Junction 14

5.5.2 Figure 5 to Figure 12 show the locations of the routes.

Figure 5. Map of Journey Time Assessment Routes

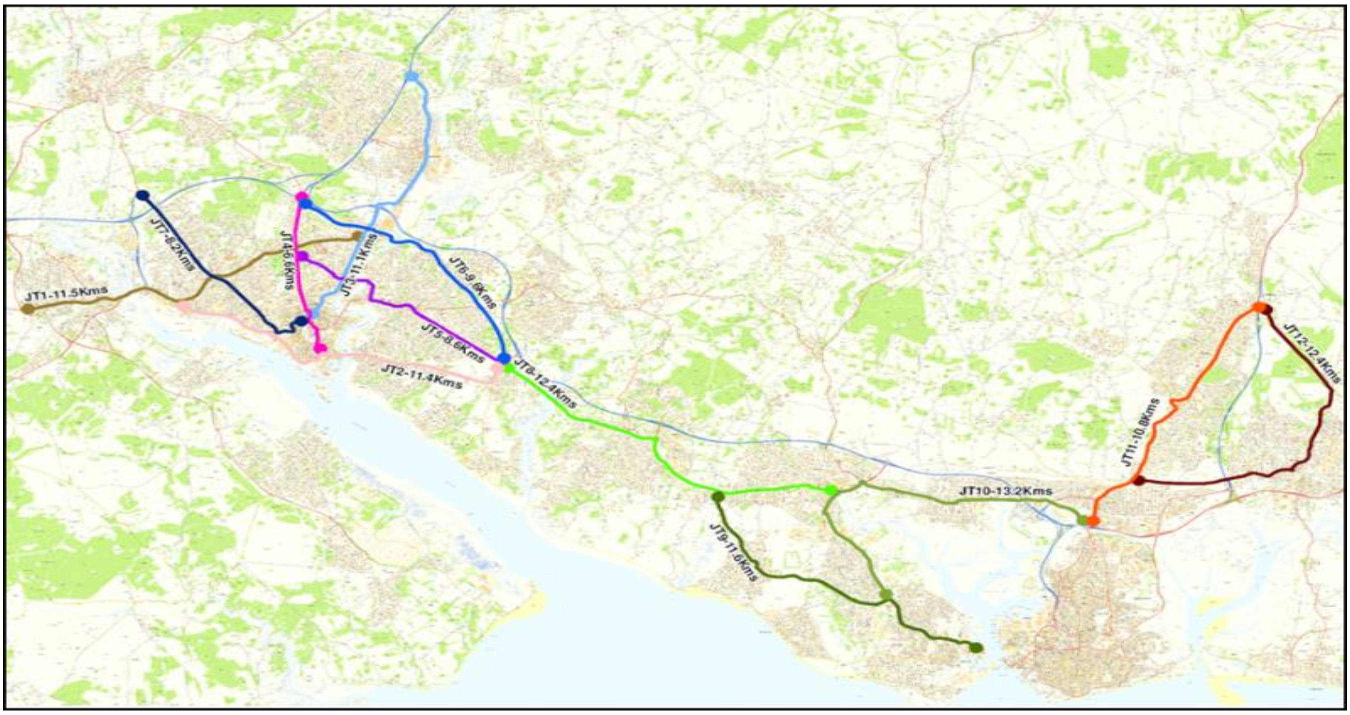


Figure 6. Map of Journey Time Assessment Routes

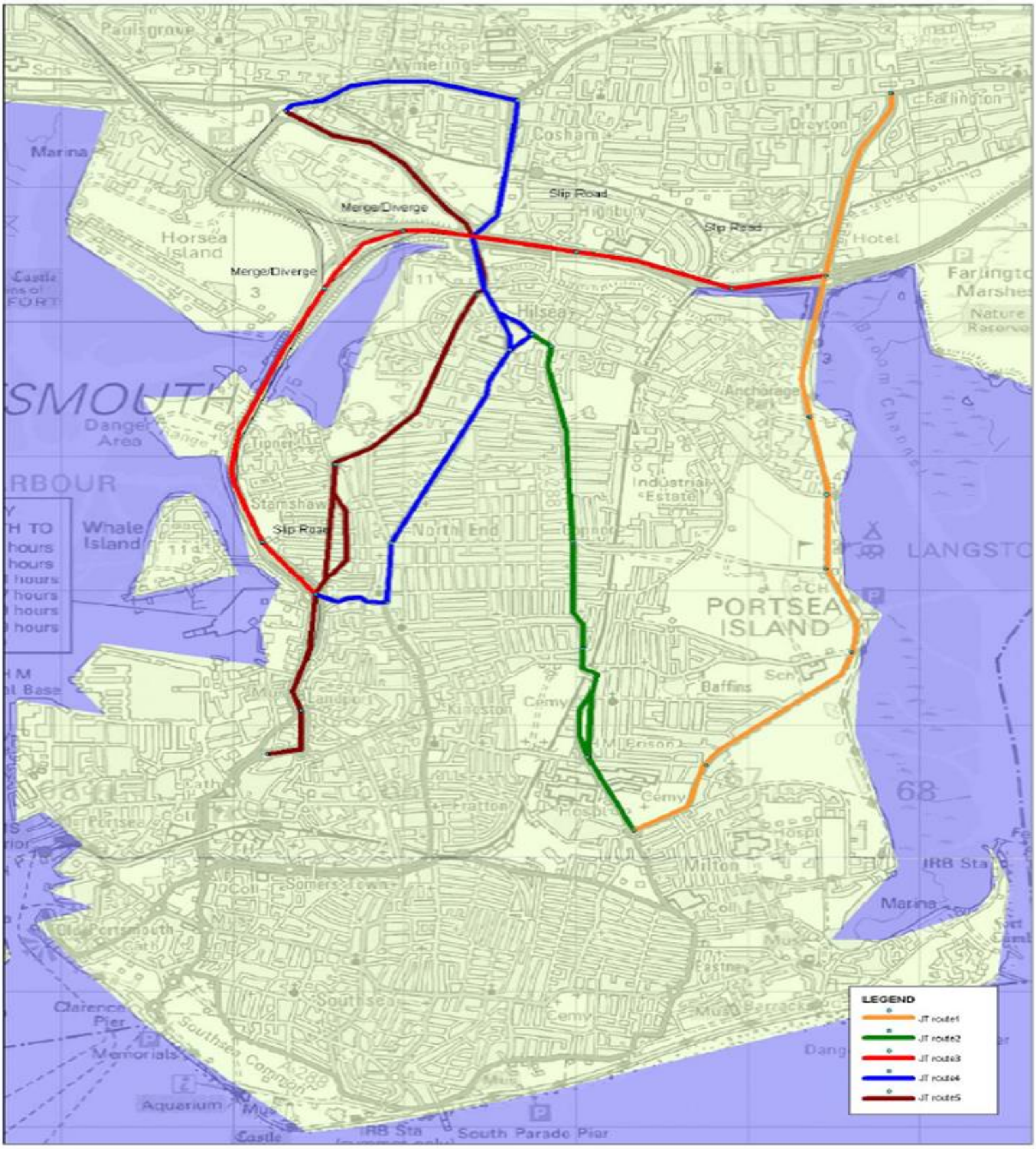


Figure 7. Route 1 M3 Junction 11 to A32 via A3090

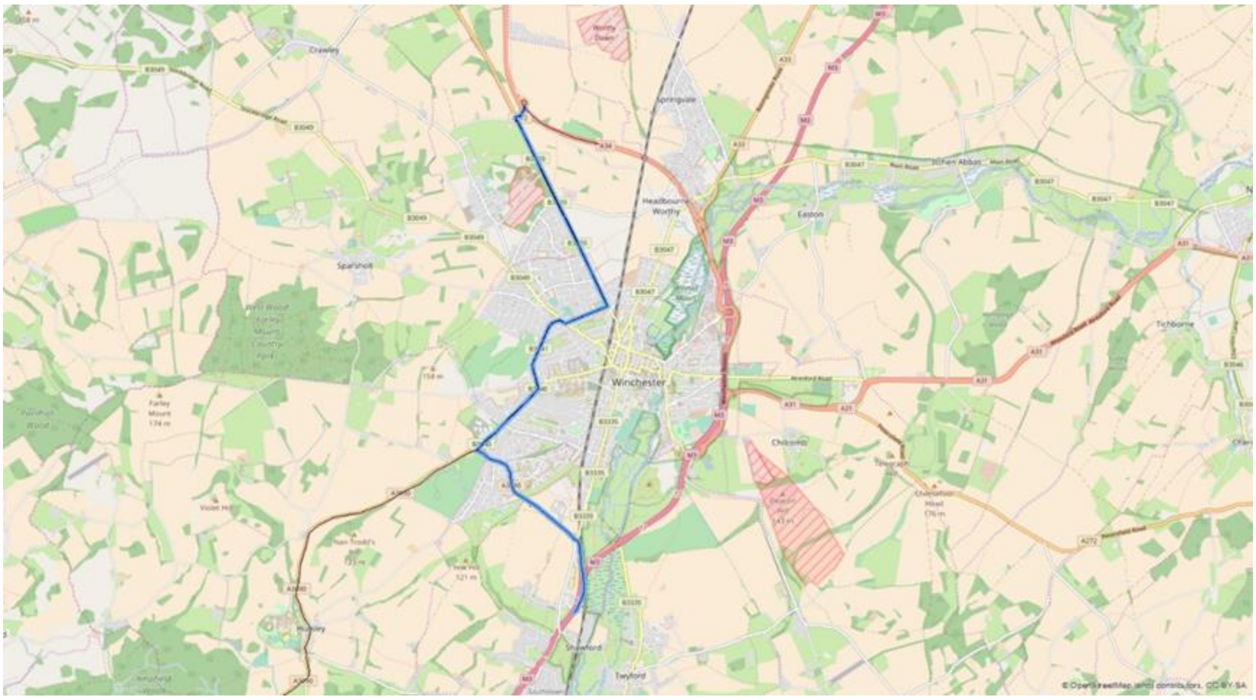


Figure 8. Route 2 M27 Junction 2 to A303 Salisbury Road via A36 and B3084

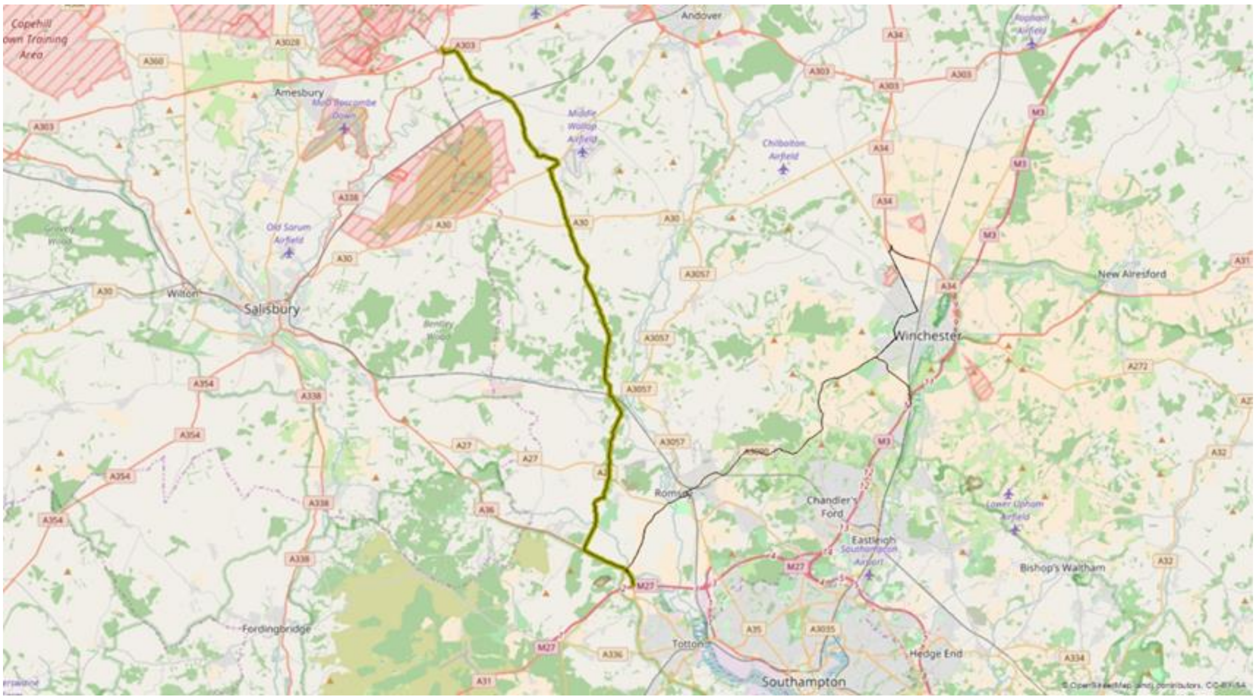


Figure 9. Route 3 M27 Junction 2 to A34 via Romsey Road and B3420

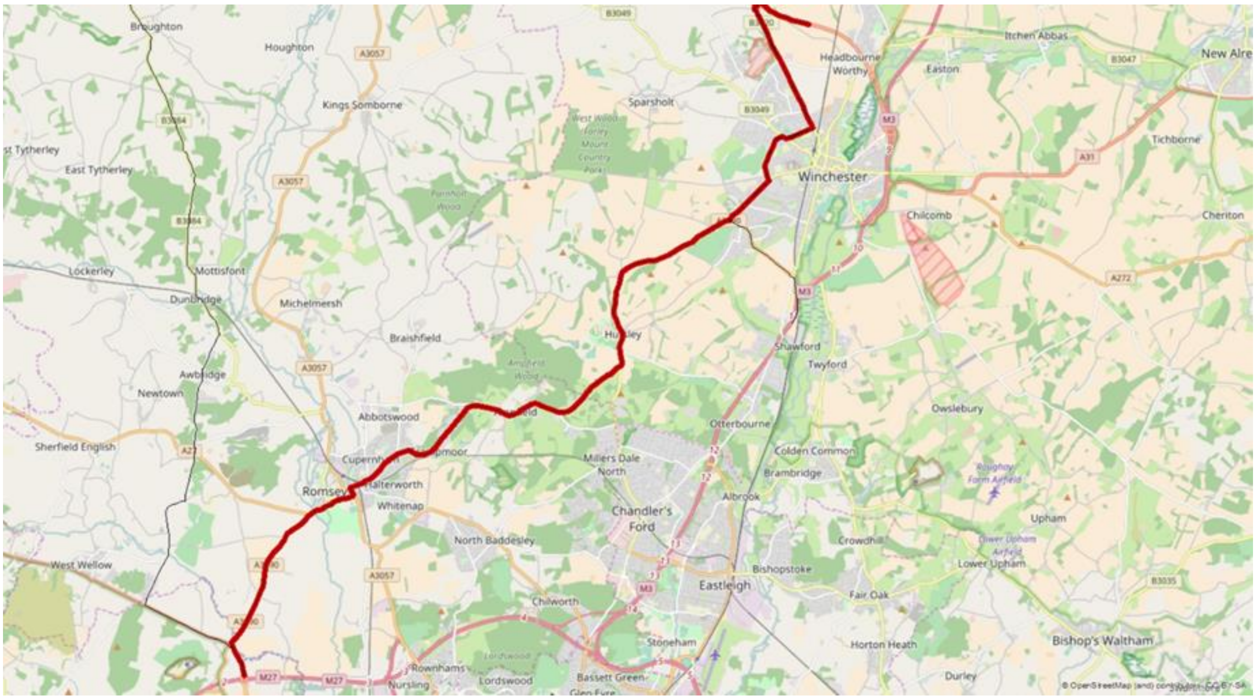


Figure 10. SEC1 Windhover Roundabout to Six Dials Junction via A3024

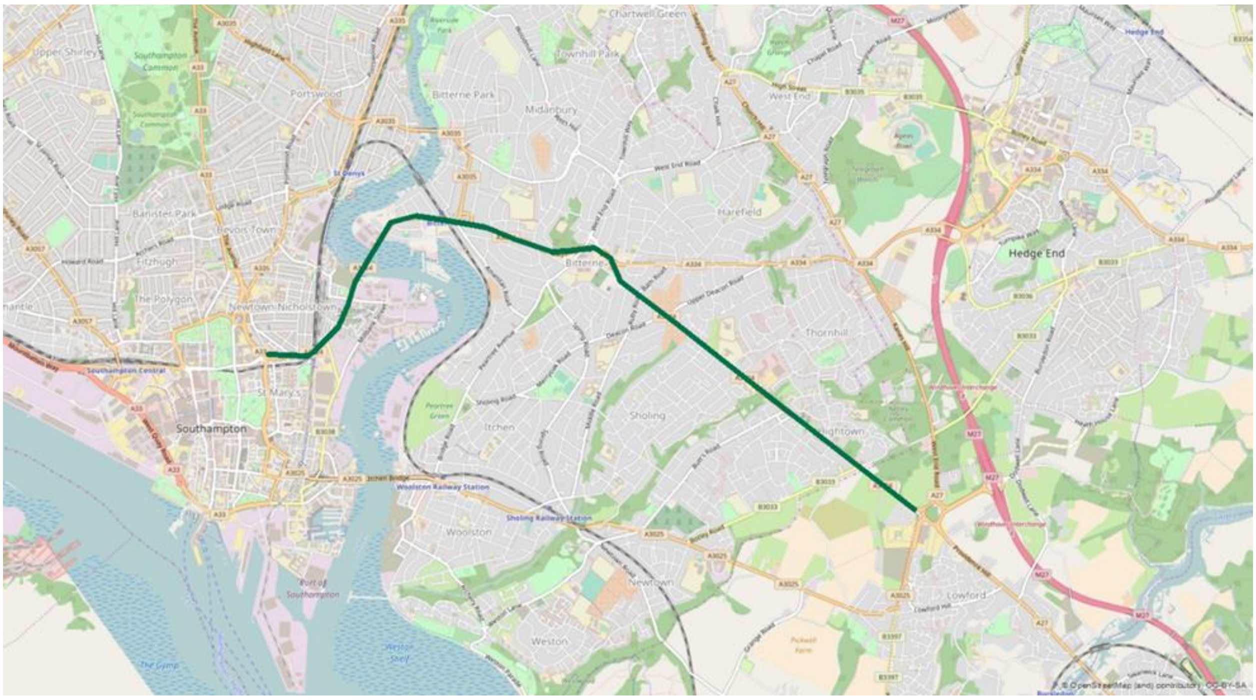


Figure 11. SEC2 M27 Junction 7 to M3 Junction 11 via Fair Oak Winchester Road

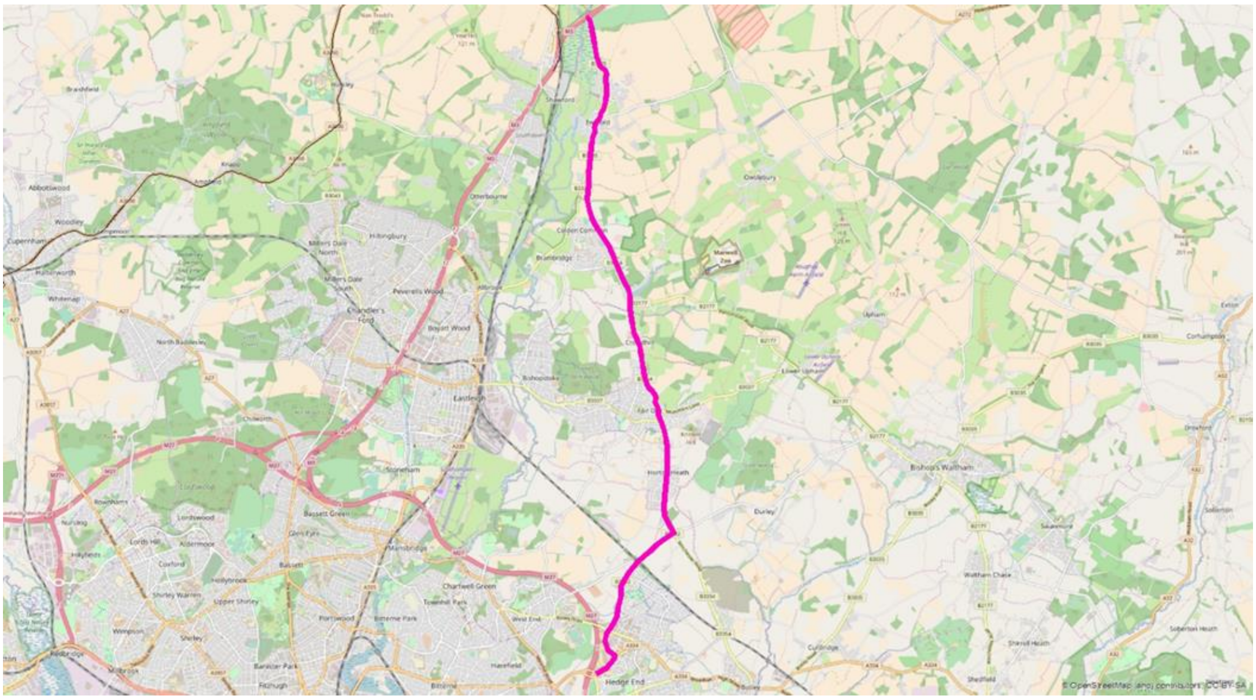
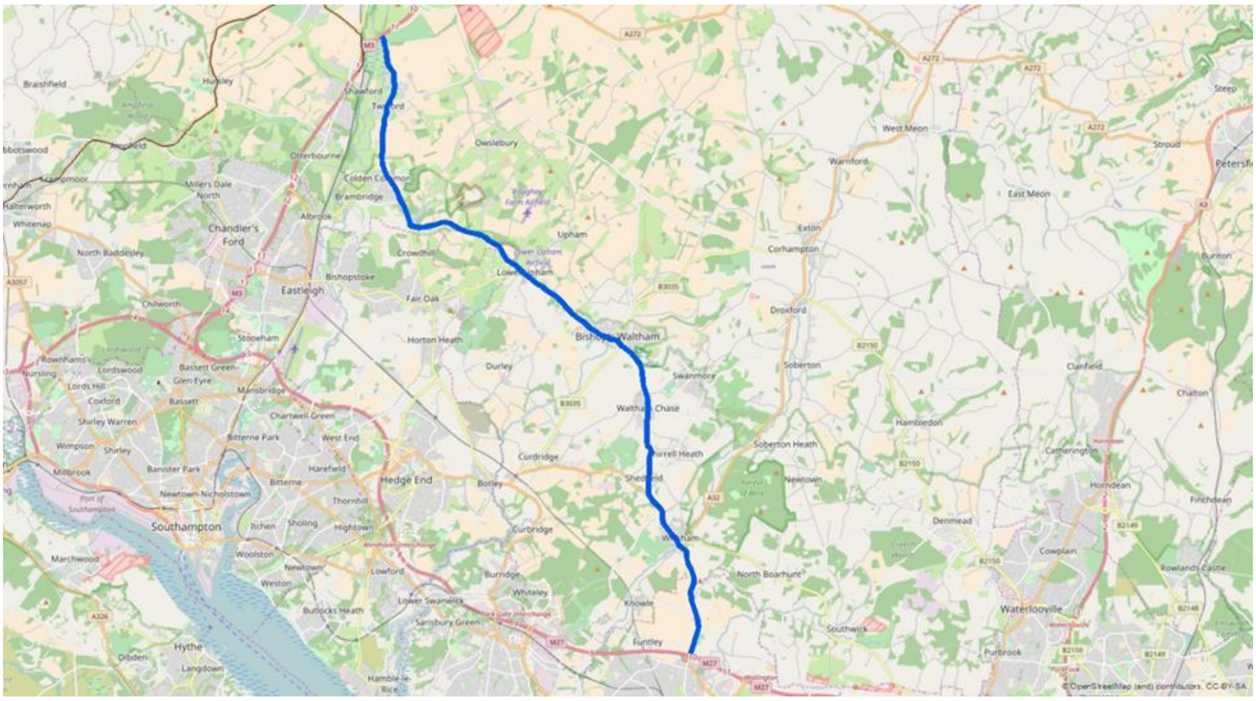


Figure 12. SEC3 M27 Junction10 to M3 Junction11 via Colden Common Main Road



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.

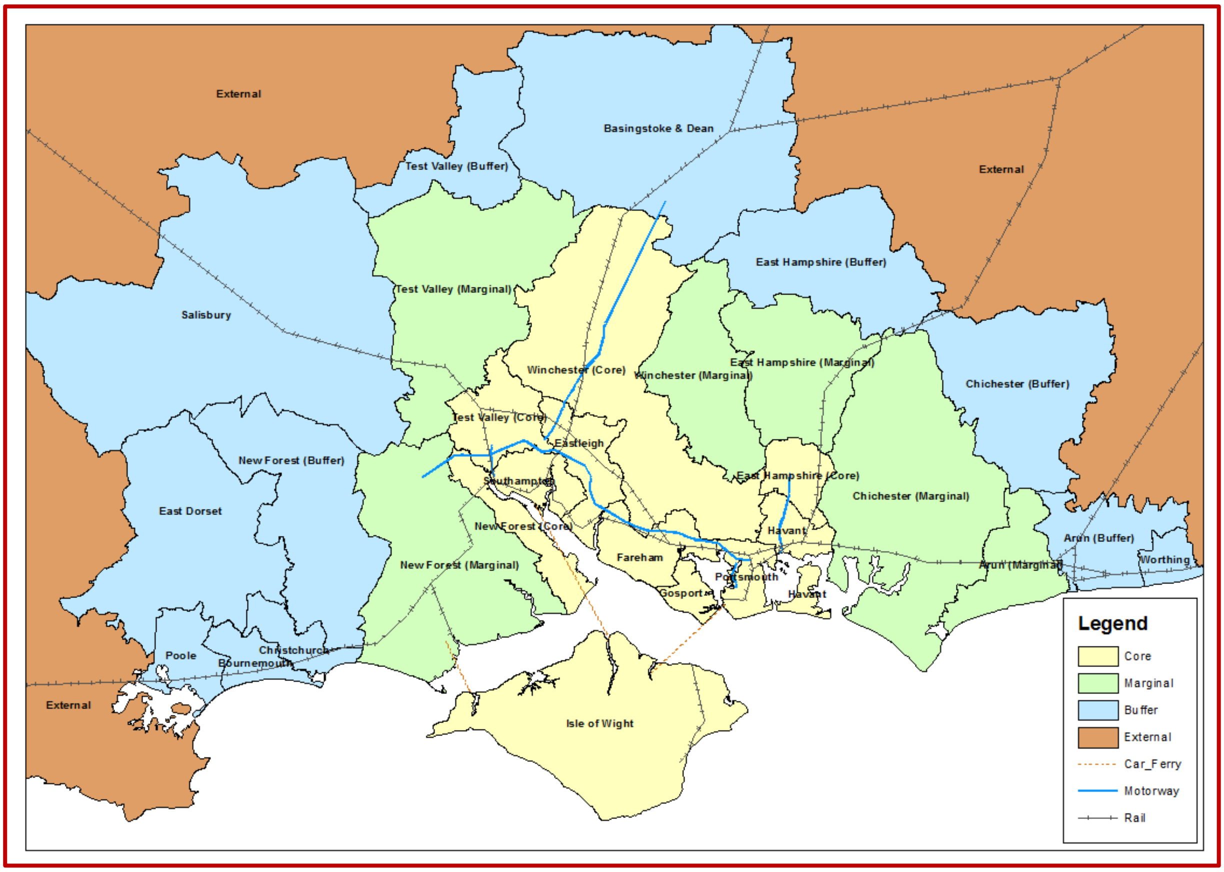
6.2 Network Structure

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 13 shows the four regions of the study area.

Figure 13. 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.

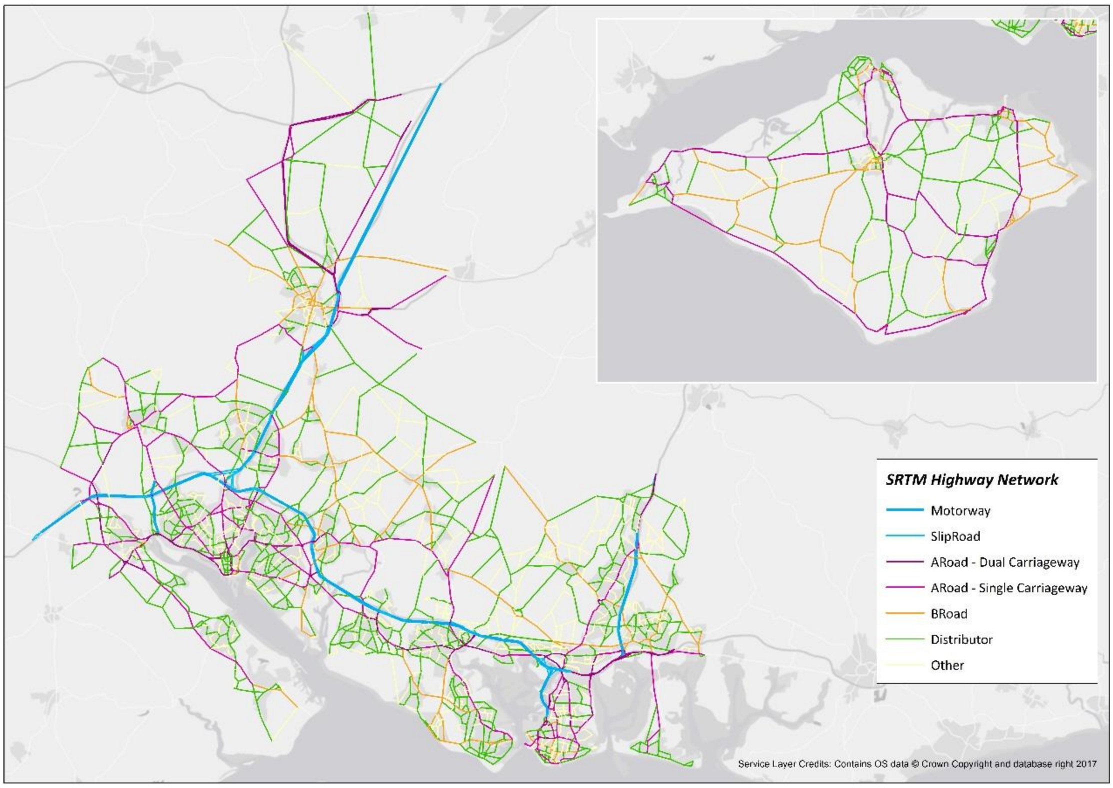
6.3.5 The use of this technique improves both coding speed and accuracy.

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 14 shows the RTM network by aggregated link type.

Figure 14. 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	ABBR.	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 15.

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 15. Aggregation of RSI Origins and Destinations to Solent Trip Purposes

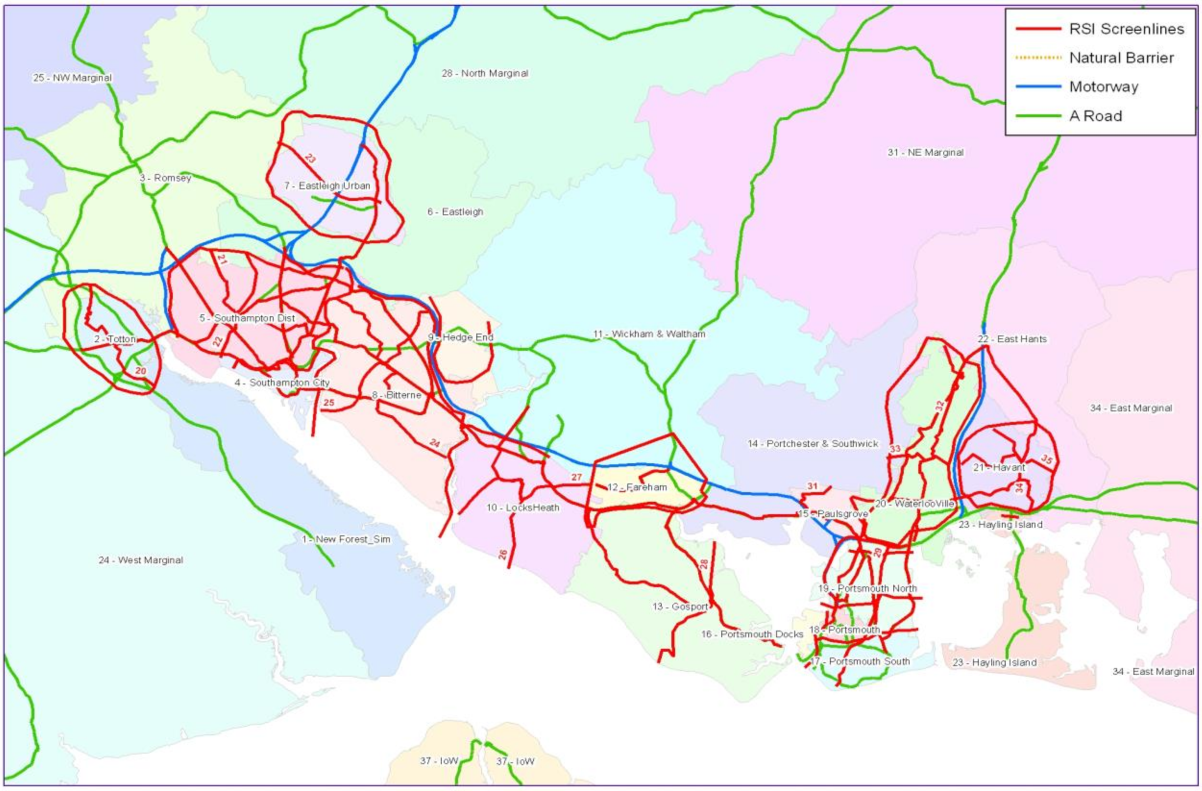
		RSI Destination Purpose								
		Home	Holiday Home/hotel	Normal place of work	Employers business	Education	Shopping	Personal business	Visit friends	Recreation/Leisure
RSI Origin Purpose	Home	HBO	HBO	HBW	HBB	HBE	HBO	HBO	HBO	HBO
	Holiday Home/hotel	HBO	NHO	NHB	NHB	NHO	NHO	NHO	NHO	NHO
	Normal place of 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 16) 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 16. 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.

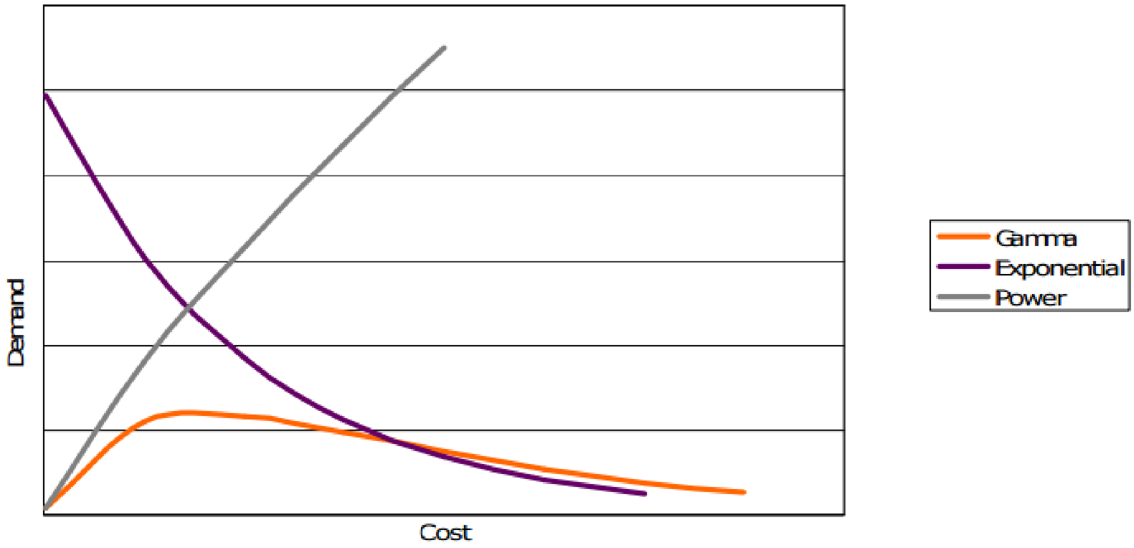
7.5.9 The cost deterrence function (Gamma distribution) requires manual calibration and takes the form:

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

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 17.

Figure 17. 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).

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.

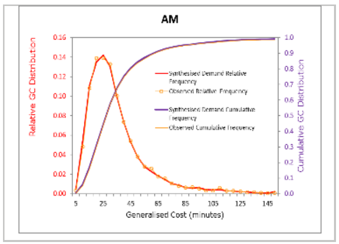
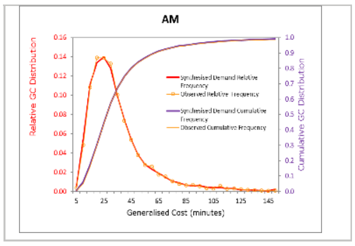
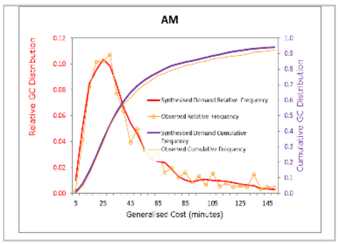
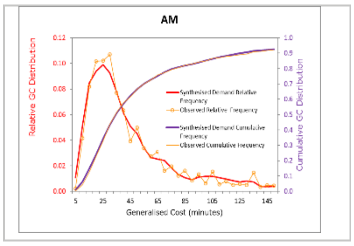
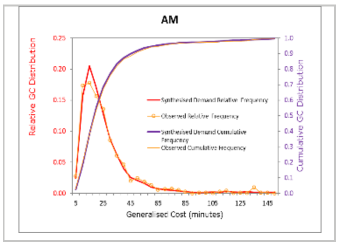
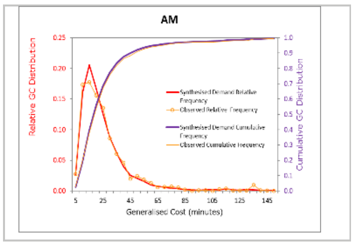
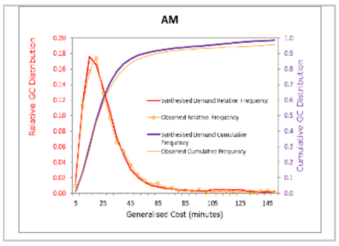
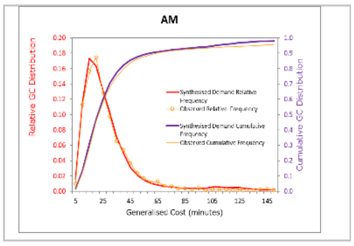
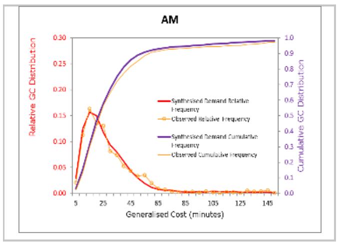
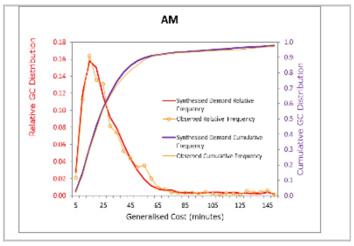
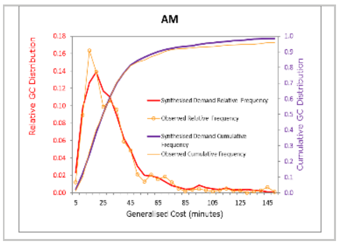
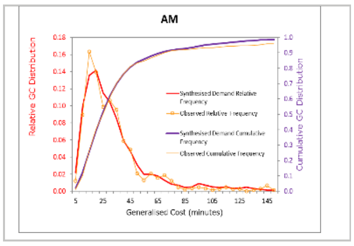
7.5.22 Table 14, Table 15, and Table 16 present a comparison of the relative and cumulative frequency between the observed and the synthesised demand.

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

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

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

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

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

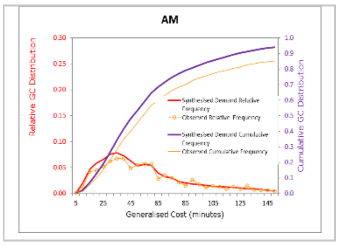
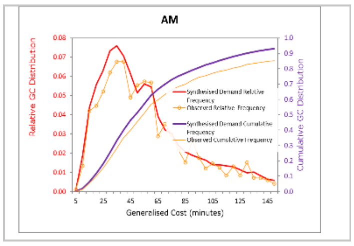
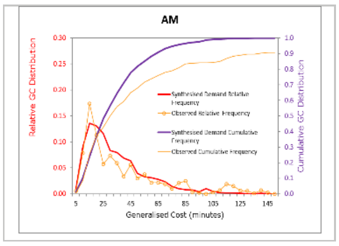
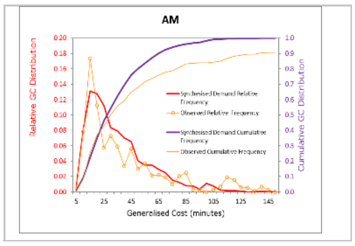
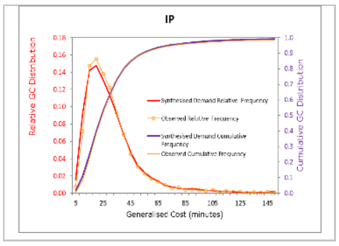
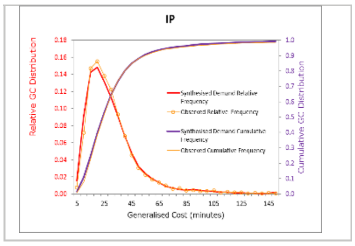
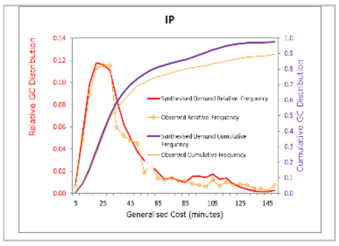
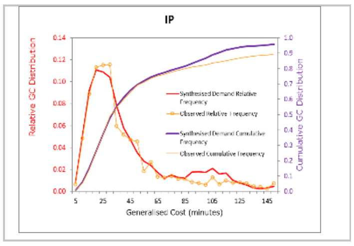
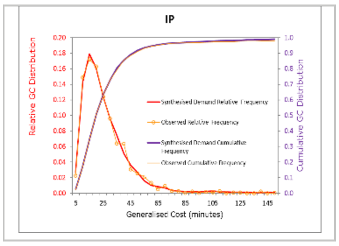
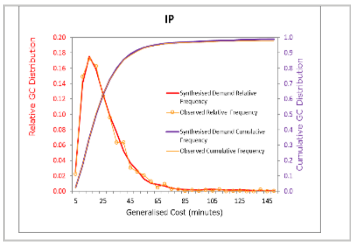
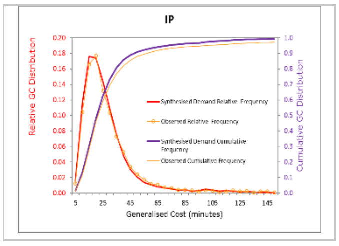
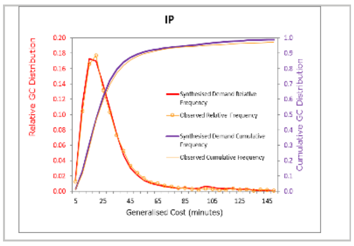
NOP LGV		
NOP HGV		

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

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

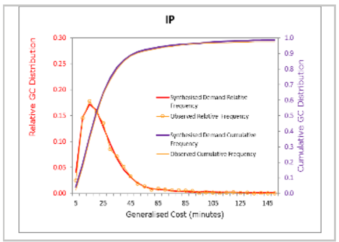
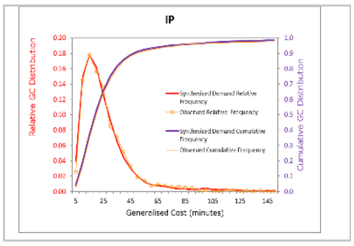
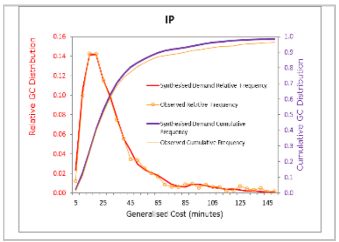
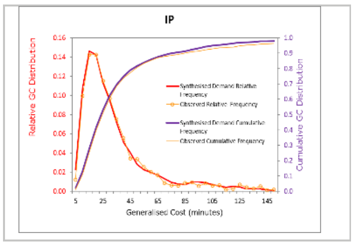
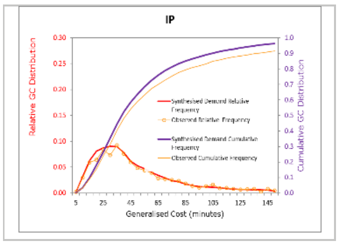
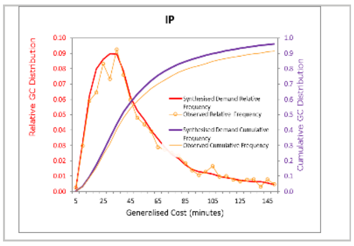
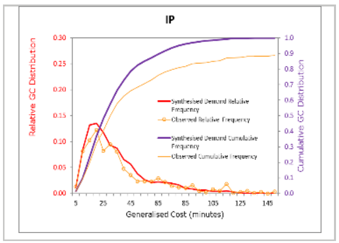
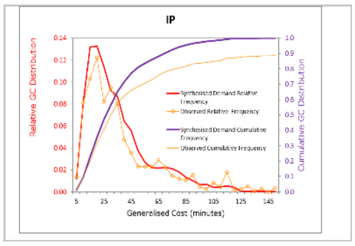
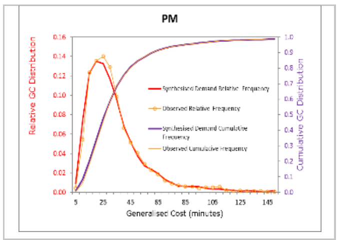
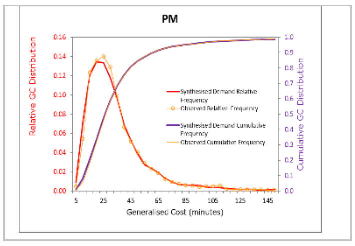
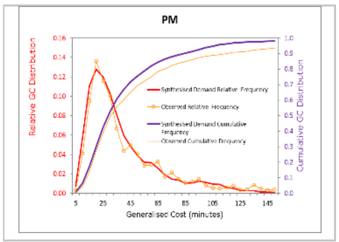
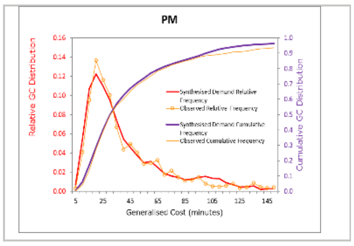
NHO CAR		
NHB CAR		
NOP LGV		
NOP HGV		

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

PURPOSE VEHICLE	SINGLY OR DOUBLY	TRIPLY
HBW CAR		
HBB CAR		

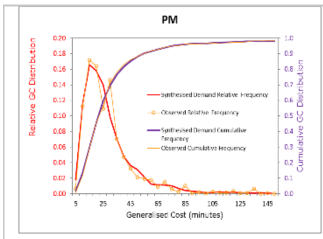
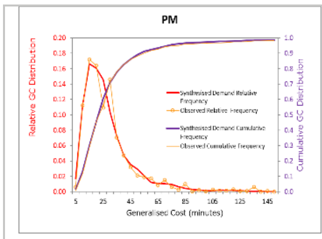
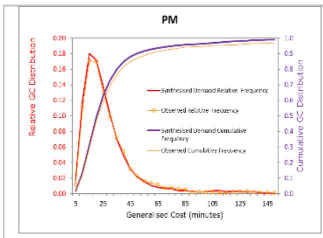
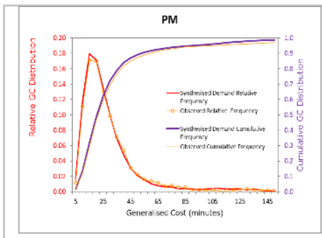
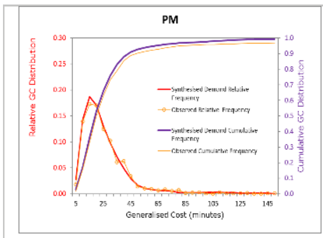
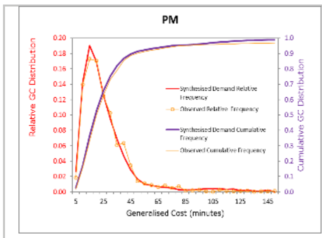
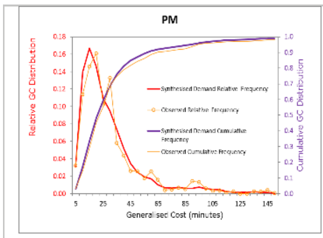
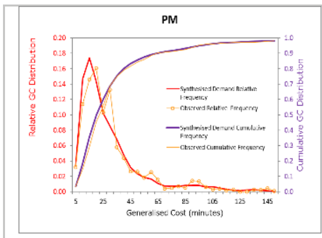
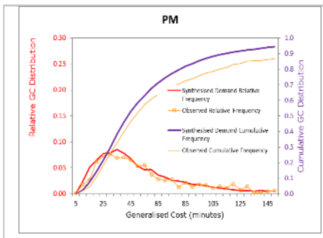
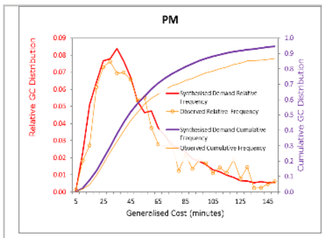
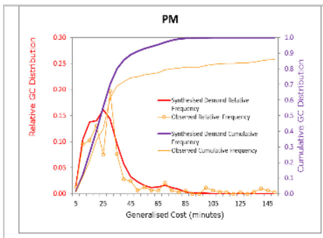
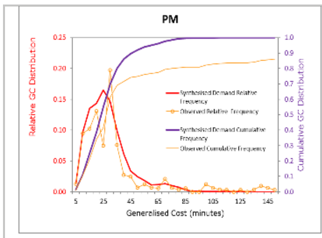
HBE CAR		
HBO CAR		
NHO CAR		
NHB CAR		
NOP LGV		
NOP HGV		

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	HGV IP	HGV 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	CAR IP	CAR 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 16. 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.

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 26 presents matrix sizes by user class before and after matrix estimation.

Table 26. Prior and Estimated Matrix Sizes

USER CLASS	1	2	3	4	TOTAL
	Car Business	Car Non Business	LGV	OGV	All Vehicles
AM peak hour					
Prior	14,319	159,647	18,212	19,050	211,229
Calibrated	13,829	163,080	17,045	18,370	212,324
% Diff	-3%	2%	-6%	-4%	1%
Inter peak ave hour					
Prior	11,513	122,857	13,676	14,712	162,758
Calibrated	11,098	128,055	12,568	14,613	166,335
% Diff	-4%	4%	-8%	-1%	2%
PM peak hour					
Prior	9,746	175,705	16,045	11,978	213,472
Calibrated	9,250	181,542	15,261	11,798	217,850
% Diff	-5%	3%	-5%	-2%	2%

Analysis of Matrix Differences Pre/Post Matrix Estimation

8.3.3 Figure 19-26 show scatter plots of the pre and post ME matrix row and column totals by period. All time periods show a good correlation with R^2 values, and the graph intercept is reasonably close to zero.

Figure 19. Scatter Plot of Pre and Post ME AM Peak Matrix Row Totals

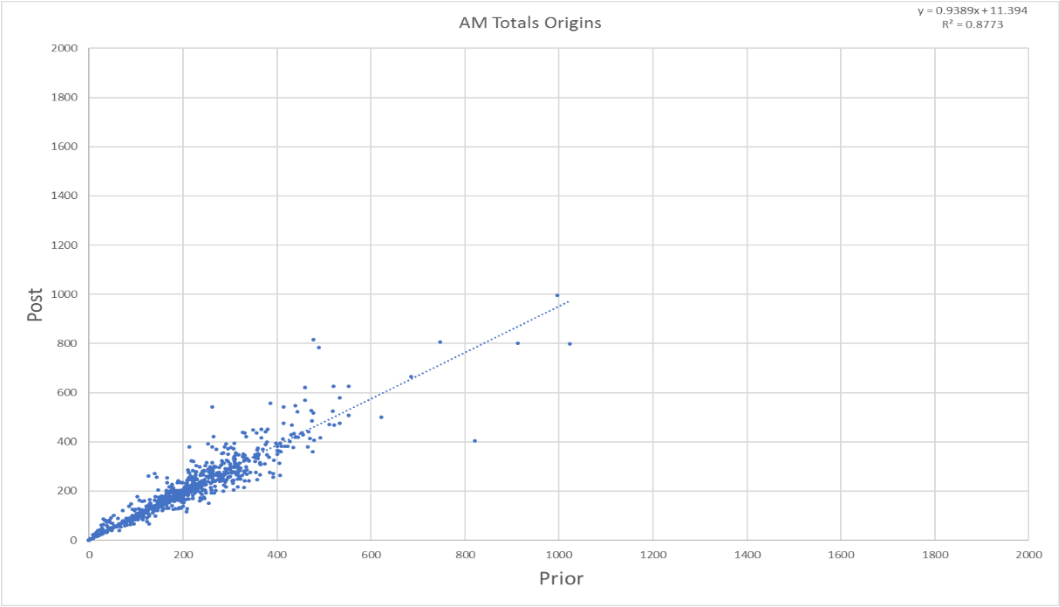


Figure 20. Scatter Plot of Pre and Post ME AM Peak Matrix Column Totals

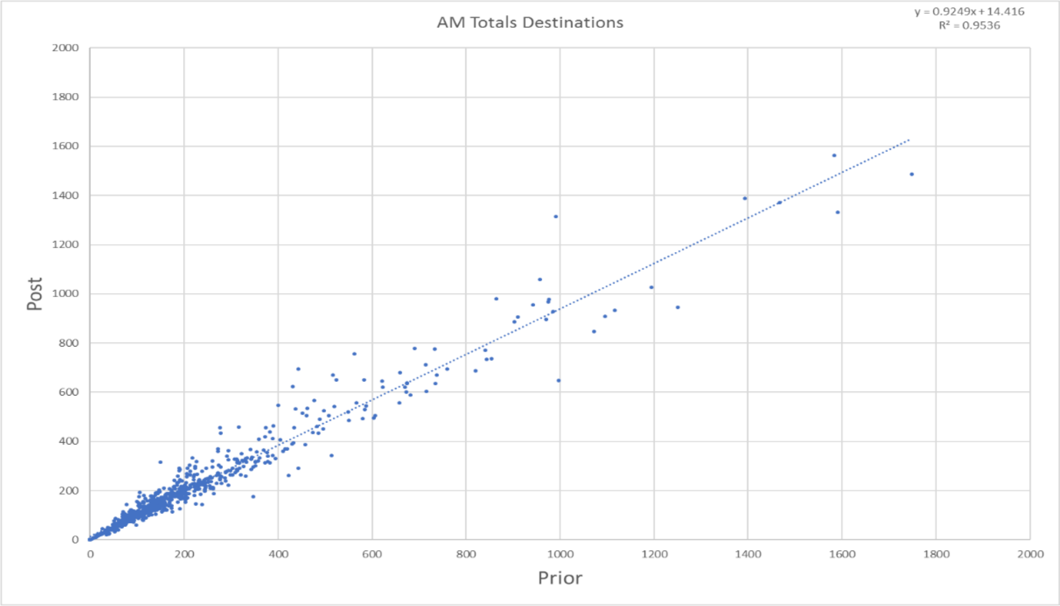


Figure 21. Scatter Plot of Pre and Post ME Inter Peak Matrix Row Totals

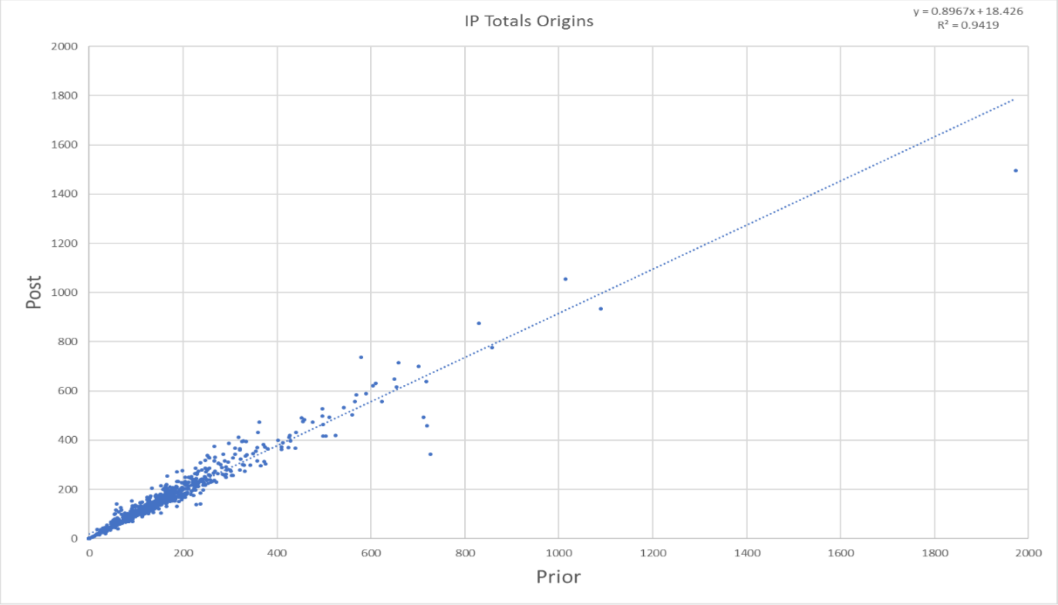


Figure 22. Scatter Plot of Pre and Post ME Inter Peak Matrix Column Totals

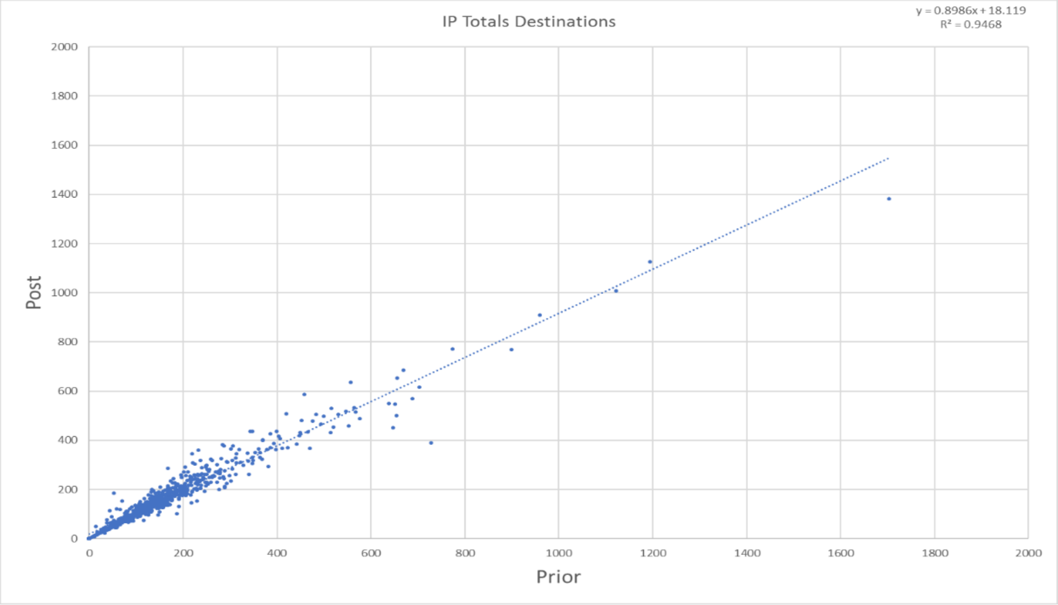


Figure 23. Scatter Plot of Pre and Post ME PM Peak Matrix Row Totals

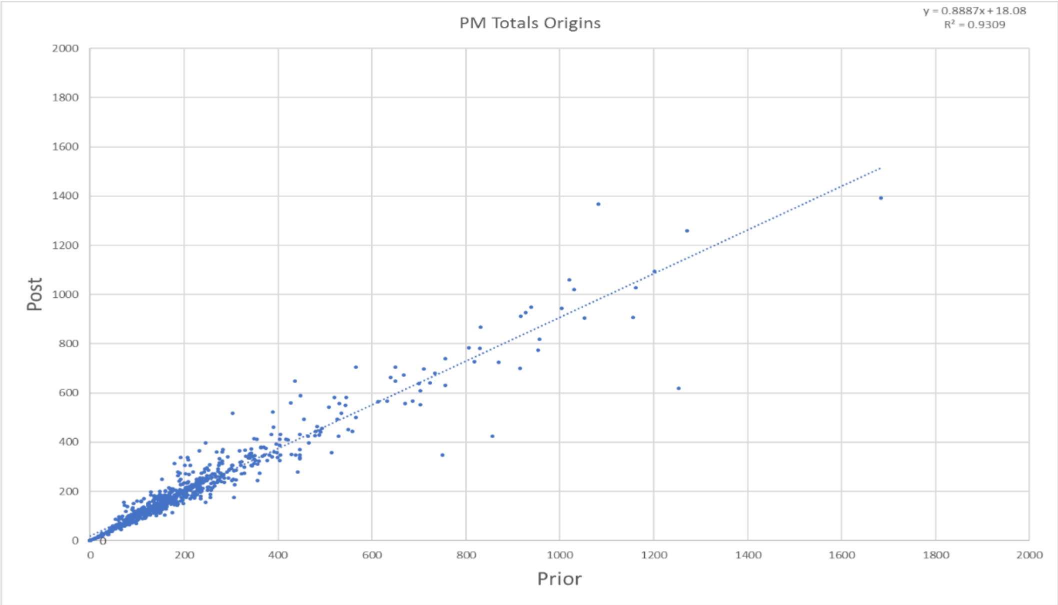
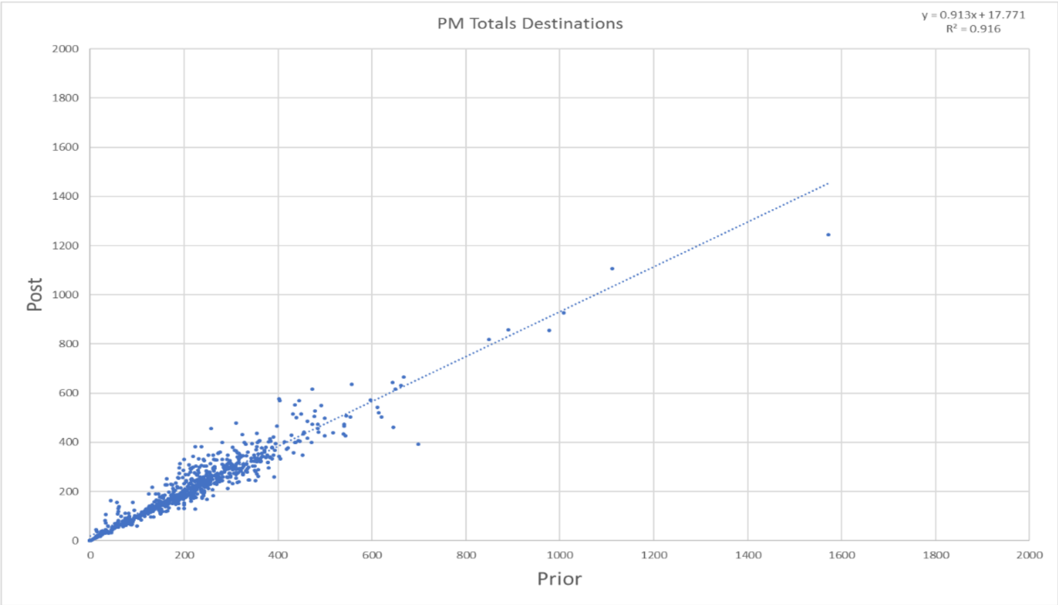


Figure 24. Scatter Plot of Pre and Post ME PM Peak Matrix Column Totals



Trip Length Distributions

8.3.4 Figure 25-29 show trip length frequency distributions, showing the number of trips lying within each distance band pre and post matrix estimation, by period. Table 27 shows the mean trip length for the prior and post estimation matrices.

8.3.5 The shape of the curves in Figure 25, Figure 26, and Figure 26 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 25. Trip Frequency Distribution Pre/Post ME AM Peak Hour – Relative frequency

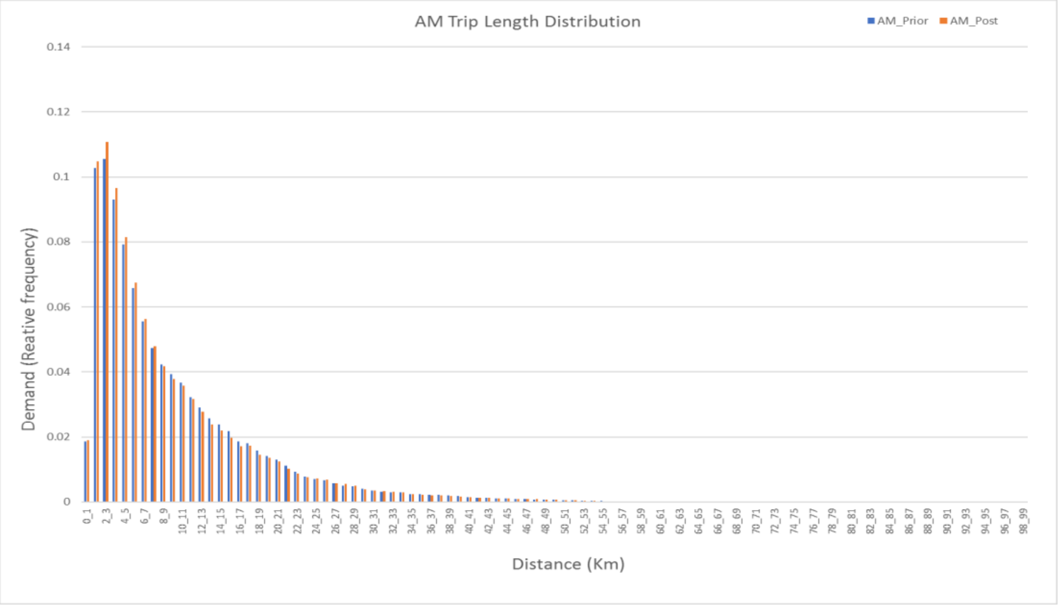


Figure 26. Trip Frequency Distribution Pre/Post ME Inter-Peak Hour – Relative frequency

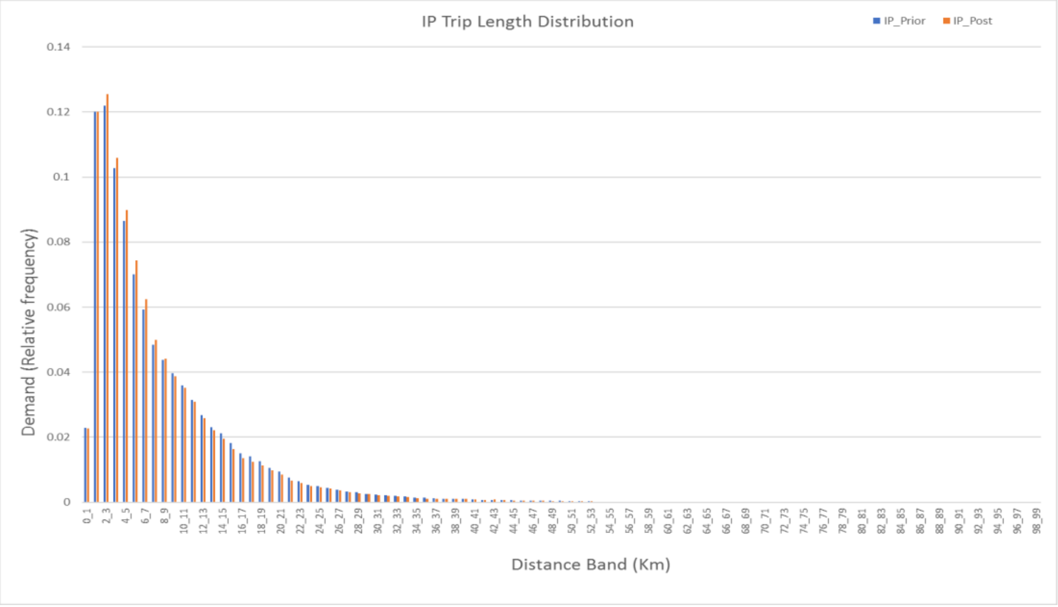
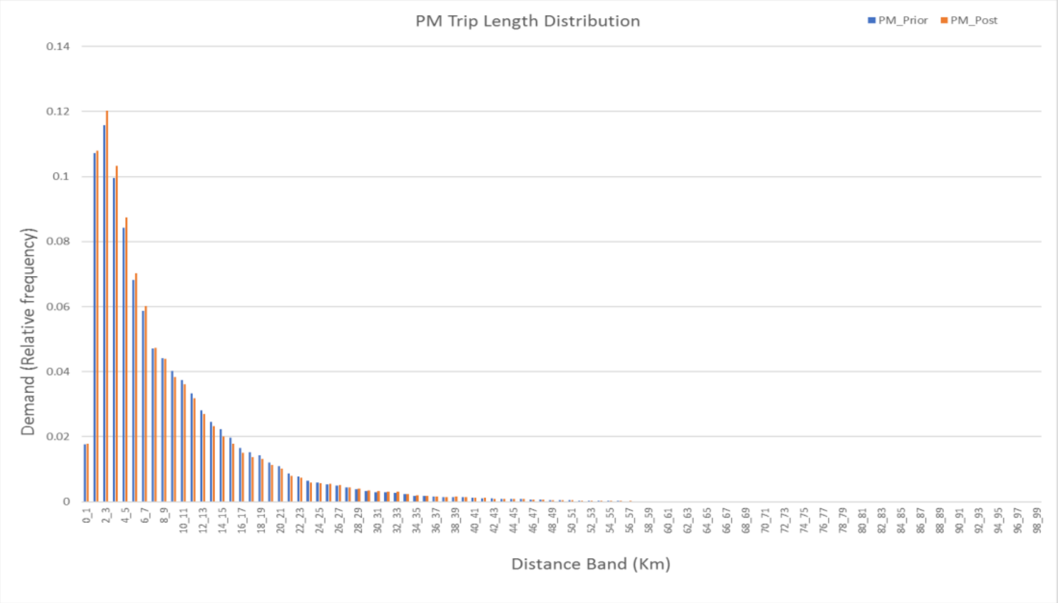


Figure 27. Trip Frequency Distribution Pre/Post ME PM Peak Hour – Relative frequency



8.3.6 The mean trip length (for within the Core area) changes by 2% to 3 %, with average trip length decreasing in all cases.

Table 27. Mean Trip Length (km)

MODEL PERIOD	PRIOR	POST	%
AM Peak Hour	5.05	4.96	-1.8%
IP Hour	4.35	4.21	-3.3%
PM Peak Hour	4.71	4.64	-1.5%

8.4 Trip Matrix Validation

8.4.1 Chapter 3 described the WebTAG validation standards. The screenline flow criteria and acceptability guidelines are reproduced in Table 28.

Table 28. 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 29 and Table 30 show the results of the cordon and screenline validation analysis for each of the modelled periods, for vehicles and cars respectively. **Appendix A** shows the validation performance of each cordon and screenline.

Table 29. 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)**	**91%**	**85%**	**85%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*92%*	*91%*	*82%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*97%*	*95%*	*95%*

Table 30. 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)**	**95%**	**89%**	**86%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*97%*	*94%*	*86%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*98%*	*95%*	*97%*

8.4.3 Appendix A shows the validation performance of each cordon and screenline.

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 31 reproduces the validation criteria and acceptability guidelines for link flows.

Table 31. 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 Table 32 and Table 33 show the results of the network validation analysis for each of the modelled periods, for vehicles and cars respectively. **Appendix A** shows the validation performance of each cordon and screenline.

Table 32. 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)**	**60%**	**71%**	**60%**
	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)**	**54%**	**63%**	**54%**
	*GEH < **10** for individual flows*	*N/A*	*80%*	*86%*	*77%*

Table 33. 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)**	**64%**	**75%**	**62%**
	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%**	**64%**	**57%**
	*GEH < **10** for individual flows*	*N/A*	*80%*	*88%*	*81%*

9.3 Journey Time Validation

9.3.1 The acceptability guideline for journey times are reproduced in Table 34.

Table 34. 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 35 below shows the number of journey time routes meeting the criteria. **Appendix B** shows the validation performance of each route.

Table 35. 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%**	**80%**	**64%**
	*Modelled times along routes should be within **20%** of surveyed times (or 1 minute, if higher)*	*N/A*	*90%*	*94%*	*78%*

9.3.3 **Appendix C** 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 36.

Table 36. 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 37 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 37. Convergence and Stability Model Results

MEASURE OF CONVERGENCE	SATURN PARAM-ETER	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)	0.020 0.039 0.018 0.029	0.018 0.018 0.018 0.019	0.045 0.025 0.049 0.029
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%**	98.5 98.4 98.3 98.7	98.2 98.4 98.6 98.6	98.6 98.3 98.9 98.0
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%**	99.1 99.2 99.1 99.3	99.9 99.9 99.9 99.9	99.3 99.4 99.3 99.1

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 38 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 38. 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)**	**91%**	**85%**	**85%**
	Differences between modelled flows and counts should be within GEH=4 of the counts	*N/A*	*92%*	*91%*	*82%*
	*Differences between modelled flows and counts should be less than **10%** of the counts*	*N/A*	*97%*	*95%*	*95%*
Link Flow Validation	**Individual flows within 15% of counts for flows from 700 to 2700 veh/h** **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**	**>85% of cases (WebTAG)**	**60%**	**71%**	**60%**
	GEH < 5 for individual flows	**> 85% of cases (WebTAG)**	**54%**	**63%**	**54%**
	*GEH < **10** for individual flows*	*N/A*	*80%*	*86%*	*77%*
Journey Times Validation	**Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher)**	**>85% of routes (WebTAG)**	**82%**	**80%**	**64%**
	*Modelled times along routes should be within **20%** of surveyed times (or 1 minute, if higher)*	*N/A*	*90%*	*94%*	*78%*

10.2.2 Table 38 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.

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

AM
Vehicles

Cordon/ Screenline	Dir	Sites	Cordon and Screenlines Validation: Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	7.5%	10.0%	Link Validation: WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	10,689	11,239	550	5.1%	5.3	N	N	Y	Y	69%	63%	69%	75%
1 Fareham Enclosure	Inbound	16	10,880	11,417	537	4.9%	5.1	N	Y	Y	Y	50%	50%	63%	75%
2 Havant Enclosure	Outbound	11	5,540	5,569	29	0.5%	0.4	Y	Y	Y	Y	36%	27%	73%	91%
2 Havant Enclosure	Inbound	11	5,805	5,801	-4	-0.1%	0.0	Y	Y	Y	Y	64%	55%	73%	82%
3 Hayling Island Enclosure	Outbound	1	1,498	1,508	10	0.7%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	870	880	10	1.1%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	5,344	5,807	463	8.7%	6.2	N	N	N	Y	50%	63%	75%	88%
4 Hedge End Enclosure	Inbound	8	5,152	4,937	-215	-4.2%	3.0	Y	Y	Y	Y	50%	50%	75%	75%
5 Waterlooville Enclosure	Outbound	18	11,227	11,261	34	0.3%	0.3	Y	Y	Y	Y	39%	39%	50%	78%
5 Waterlooville Enclosure	Inbound	18	9,447	9,637	190	2.0%	1.9	Y	Y	Y	Y	50%	33%	67%	78%
71 Portsmouth South Enclosure	Outbound	6	4,527	4,509	-18	-0.4%	0.3	Y	Y	Y	Y	83%	83%	83%	100%
71 Portsmouth South Enclosure	Inbound	6	4,616	4,581	-36	-0.8%	0.5	Y	Y	Y	Y	50%	67%	67%	83%
72 Portsmouth North Enclosure	Outbound	8	7,231	7,086	-145	-2.0%	1.7	Y	Y	Y	Y	33%	67%	67%	83%
72 Portsmouth North Enclosure	Inbound	8	8,254	8,287	33	0.4%	0.4	Y	Y	Y	Y	75%	63%	88%	88%
8 Southampton City Enclosure	Outbound	12	4,893	5,039	147	3.0%	2.1	Y	Y	Y	Y	67%	50%	67%	83%
8 Southampton City Enclosure	Inbound	12	7,688	7,454	-234	-3.0%	2.7	Y	Y	Y	Y	25%	25%	42%	50%
91 Bitterne West Screenline	Eastbound	5	2,957	2,883	-74	-2.5%	1.4	Y	Y	Y	Y	80%	100%	100%	100%
91 Bitterne West Screenline	Westbound	5	5,586	5,627	41	0.7%	0.5	Y	Y	Y	Y	40%	40%	60%	100%
92 Bitterne East Screenline	Eastbound	4	3,669	3,581	-88	-2.4%	1.5	Y	Y	Y	Y	50%	50%	100%	100%
92 Bitterne East Screenline	Westbound	4	3,266	3,301	35	1.1%	0.6	Y	Y	Y	Y	50%	50%	50%	75%
10 Locks Heath North Screenline	Outbound	9	6,648	6,837	188	2.8%	2.3	Y	Y	Y	Y	56%	56%	89%	89%
10 Locks Heath North Screenline	Inbound	9	6,791	6,756	-35	-0.5%	0.4	Y	Y	Y	Y	56%	56%	56%	67%
11 Totton Enclosure	Outbound	19	9,671	9,785	114	1.2%	1.2	Y	Y	Y	Y	83%	72%	72%	78%
11 Totton Enclosure	Inbound	19	10,156	10,367	211	2.1%	2.1	Y	Y	Y	Y	61%	56%	61%	67%
12 Eastleigh Enclosure	Outbound	11	5,272	5,246	-26	-0.5%	0.4	Y	Y	Y	Y	64%	73%	73%	91%
12 Eastleigh Enclosure	Inbound	11	5,991	6,406	414	6.9%	5.3	N	N	Y	Y	27%	27%	55%	73%
13 Southampton Enclosure	Outbound	14	11,443	11,636	194	1.7%	1.8	Y	Y	Y	Y	64%	71%	86%	93%
13 Southampton Enclosure	Inbound	14	15,311	15,346	34	0.2%	0.3	Y	Y	Y	Y	29%	36%	64%	93%
36 Solent RSI Cordon	Northbound	3	216	180	-36	-16.8%	2.6	Y	N	N	N	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	198	80	-118	-59.4%	10.0	N	N	N	N	100%	67%	67%	67%
Total	**Total**	290	190,840	193,046	2,206	1.2%		83%	83%	90%	93%	55%	54%	69%	81%
Calibration Screenlines															
20 Totton	Eastbound	8	3,896	3,982	86	2.2%	1.4	Y	Y	Y	Y	88%	88%	88%	88%
20 Totton	Westbound	8	3,346	3,536	190	5.7%	3.2	Y	N	Y	Y	38%	38%	50%	75%
21 North of Southampton	Eastbound	15	11,511	11,287	-224	-1.9%	2.1	Y	Y	Y	Y	40%	27%	47%	67%
21 North of Southampton	Westbound	15	10,993	10,964	-29	-0.3%	0.3	Y	Y	Y	Y	33%	27%	47%	60%
22 South of Southampton	Eastbound	7	5,047	5,117	70	1.4%	1.0	Y	Y	Y	Y	43%	29%	43%	71%
22 South of Southampton	Westbound	7	4,442	4,604	162	3.7%	2.4	Y	Y	Y	Y	57%	57%	57%	57%
23 Eastleigh	Eastbound	6	8,843	8,668	-175	-2.0%	1.9	Y	Y	Y	Y	67%	67%	83%	100%
23 Eastleigh	Westbound	6	7,903	7,753	-150	-1.9%	1.7	Y	Y	Y	Y	33%	33%	33%	67%
24 Bitterne Northwest to Southeast	Eastbound	15	5,066	4,978	-88	-1.7%	1.2	Y	Y	Y	Y	43%	36%	50%	71%
24 Bitterne Northwest to Southeast	Westbound	15	5,686	5,543	-143	-2.5%	1.9	Y	Y	Y	Y	86%	57%	79%	93%
25 Bitterne Southwest to Northeast	Eastbound	10	4,462	4,350	-112	-2.5%	1.7	Y	Y	Y	Y	44%	44%	67%	67%
25 Bitterne Southwest to Northeast	Westbound	10	4,785	4,953	167	3.5%	2.4	Y	Y	Y	Y	67%	67%	100%	100%
26 Fareham North South	Eastbound	9	8,241	8,250	9	0.1%	0.1	Y	Y	Y	Y	67%	56%	67%	78%
26 Fareham North South	Westbound	9	7,979	8,207	228	2.9%	2.5	Y	Y	Y	Y	50%	38%	50%	88%
271 Locks Heath West to East	Northbound	11	5,031	5,124	93	1.8%	1.3	Y	Y	Y	Y	55%	55%	64%	82%
271 Locks Heath West to East	Southbound	11	3,002	2,991	-11	-0.4%	0.2	Y	Y	Y	Y	45%	36%	45%	73%
272 Fareham West to East	Northbound	4	1,885	1,945	59	3.1%	1.4	Y	Y	Y	Y	75%	75%	100%	100%
272 Fareham West to East	Southbound	4	2,042	2,117	76	3.7%	1.7	Y	Y	Y	Y	25%	50%	50%	50%
28 Gosport	Northbound	6	3,445	3,437	-8	-0.2%	0.1	Y	Y	Y	Y	50%	50%	83%	83%
28 Gosport	Southbound	6	2,768	2,721	-47	-1.7%	0.9	Y	Y	Y	Y	83%	67%	83%	83%
29 Portsmouth NorthSouth	Eastbound	16	9,608	9,269	-338	-3.5%	3.5	Y	Y	Y	Y	75%	69%	88%	88%
29 Portsmouth NorthSouth	Westbound	17	10,998	10,664	-334	-3.0%	3.2	Y	Y	Y	Y	41%	24%	47%	59%
30 Portsmouth EastWest	Northbound	9	6,377	6,350	-27	-0.4%	0.3	Y	Y	Y	Y	67%	44%	44%	89%
30 Portsmouth EastWest	Southbound	9	6,932	6,848	-84	-1.2%	1.0	Y	Y	Y	Y	78%	56%	67%	78%
31 Cosham	Eastbound	5	8,740	8,814	74	0.8%	0.8	Y	Y	Y	Y	60%	60%	60%	80%
31 Cosham	Westbound	5	7,872	7,991	118	1.5%	1.3	Y	Y	Y	Y	60%	60%	60%	60%
32 Waterlooville North to South	Eastbound	15	11,471	11,320	-151	-1.3%	1.4	Y	Y	Y	Y	40%	33%	40%	60%
32 Waterlooville North to South	Westbound	15	11,667	11,646	-21	-0.2%	0.2	Y	Y	Y	Y	53%	47%	53%	67%
33 Waterlooville West to East	Northbound	5	3,733	3,733	0	0.0%	0.0	Y	Y	Y	Y	80%	60%	100%	100%
33 Waterlooville West to East	Southbound	5	4,994	5,019	25	0.5%	0.4	Y	Y	Y	Y	80%	60%	100%	100%
34 Havant North South	Eastbound	7	4,770	4,897	127	2.7%	1.8	Y	Y	Y	Y	71%	57%	71%	86%
34 Havant North South	Westbound	7	5,131	5,189	59	1.1%	0.8	Y	Y	Y	Y	100%	100%	100%	100%
35 Havant East West	Northbound	11	4,868	4,894	26	0.5%	0.4	Y	Y	Y	Y	64%	45%	55%	64%
35 Havant East West	Southbound	11	6,360	6,294	-65	-1.0%	0.8	Y	Y	Y	Y	55%	45%	45%	73%
201 Winchester Cordon	Outbound	15	4,514	4,434	-80	-1.8%	1.2	Y	Y	Y	Y	80%	67%	73%	93%
201 Winchester Cordon	Inbound	15	5,914	5,851	-63	-1.1%	0.8	Y	Y	Y	Y	67%	60%	67%	73%
Total		349	224,324	223,741	-582	-0.3%		100%	97%	100%	100%	59%	50%	63%	77%
Motorways															
M27	Eastbound	14										86%	86%	93%	93%
M27	Westbound	14										85%	85%	85%	92%
M3	Eastbound	6										60%	60%	100%	100%
M3	Westbound	6										100%	80%	100%	100%
A3(M)	Northbound	4										100%	75%	100%	100%
A3(M)	Southbound	4										100%	100%	100%	100%
M275	Northbound	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										100%	100%	100%	100%
Total	**Total**	54										88%	84%	94%	96%
Overall								92%	91%	95%	97%	60%	54%	68%	80%

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

AM
Car

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	WebTAG within 7.5%	WebTAG within 10.0%	Link Validation: 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	8,963	9,305	342	3.8%	3.6	Y	Y	Y	Y	69%	63%	69%	75%
1 Fareham Enclosure	Inbound	16	9,150	9,500	351	3.8%	3.6	Y	Y	Y	Y	50%	50%	63%	81%
2 Havant Enclosure	Outbound	11	4,587	4,611	24	0.5%	0.3	Y	Y	Y	Y	55%	45%	64%	91%
2 Havant Enclosure	Inbound	11	4,834	4,853	18	0.4%	0.3	Y	Y	Y	Y	73%	64%	73%	82%
3 Hayling Island Enclosure	Outbound	1	1,193	1,204	11	0.9%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	730	677	-53	-7.3%	2.0	Y	N	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	4,506	4,730	224	5.0%	3.3	Y	Y	Y	Y	63%	75%	75%	88%
4 Hedge End Enclosure	Inbound	8	4,327	4,124	-203	-4.7%	3.1	Y	Y	Y	Y	50%	50%	63%	75%
5 Waterlooville Enclosure	Outbound	18	9,225	9,397	172	1.9%	1.8	Y	Y	Y	Y	50%	56%	72%	78%
5 Waterlooville Enclosure	Inbound	18	7,816	7,901	84	1.1%	0.9	Y	Y	Y	Y	67%	56%	67%	72%
71 Portsmouth South Enclosure	Outbound	6	4,012	3,944	-68	-1.7%	1.1	Y	Y	Y	Y	83%	83%	83%	100%
71 Portsmouth South Enclosure	Inbound	6	3,964	3,895	-68	-1.7%	1.1	Y	Y	Y	Y	67%	67%	67%	67%
72 Portsmouth North Enclosure	Outbound	8	6,093	6,013	-80	-1.3%	1.0	Y	Y	Y	Y	50%	50%	67%	83%
72 Portsmouth North Enclosure	Inbound	8	7,102	7,090	-12	-0.2%	0.1	Y	Y	Y	Y	75%	75%	75%	88%
8 Southampton City Enclosure	Outbound	12	4,098	4,067	-32	-0.8%	0.5	Y	Y	Y	Y	75%	58%	75%	83%
8 Southampton City Enclosure	Inbound	12	6,447	6,234	-214	-3.3%	2.7	Y	Y	Y	Y	42%	33%	42%	42%
91 Bitterne West Screenline	Eastbound	5	2,596	2,531	-65	-2.5%	1.3	Y	Y	Y	Y	100%	100%	100%	100%
91 Bitterne West Screenline	Westbound	5	4,907	4,971	65	1.3%	0.9	Y	Y	Y	Y	60%	60%	100%	100%
92 Bitterne East Screenline	Eastbound	4	3,159	3,036	-123	-3.9%	2.2	Y	Y	Y	Y	25%	25%	75%	100%
92 Bitterne East Screenline	Westbound	4	2,710	2,675	-34	-1.3%	0.7	Y	Y	Y	Y	50%	50%	50%	75%
10 Locks Heath North Screenline	Outbound	9	5,508	5,669	161	2.9%	2.2	Y	Y	Y	Y	78%	78%	78%	89%
10 Locks Heath North Screenline	Inbound	9	5,567	5,593	26	0.5%	0.3	Y	Y	Y	Y	56%	56%	67%	67%
11 Totton Enclosure	Outbound	19	8,095	7,955	-140	-1.7%	1.6	Y	Y	Y	Y	72%	61%	78%	83%
11 Totton Enclosure	Inbound	19	8,485	8,471	-14	-0.2%	0.2	Y	Y	Y	Y	61%	56%	61%	72%
12 Eastleigh Enclosure	Outbound	11	4,282	4,122	-160	-3.7%	2.5	Y	Y	Y	Y	73%	73%	82%	82%
12 Eastleigh Enclosure	Inbound	11	5,170	5,470	299	5.8%	4.1	N	N	Y	Y	18%	27%	55%	82%
13 Southampton Enclosure	Outbound	14	9,931	9,961	30	0.3%	0.3	Y	Y	Y	Y	79%	71%	86%	93%
13 Southampton Enclosure	Inbound	14	13,457	13,415	-41	-0.3%	0.4	Y	Y	Y	Y	43%	43%	86%	93%
36 Solent RSI Cordon	Northbound	3	172	180	8	4.6%	0.6	Y	Y	Y	Y	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	131	80	-51	-38.7%	4.9	N	N	N	N	100%	67%	67%	67%
Total	**Total**	290	161,218	161,674	456	0.3%		93%	90%	97%	97%	62%	58%	71%	81%
Calibration Screenlines															
20 Totton	Eastbound	8	3,246	3,266	20	0.6%	0.3	Y	Y	Y	Y	100%	88%	88%	88%
20 Totton	Westbound	8	2,634	2,722	88	3.4%	1.7	Y	Y	Y	Y	50%	50%	50%	63%
21 North of Southampton	Eastbound	15	9,924	9,738	-186	-1.9%	1.9	Y	Y	Y	Y	47%	33%	47%	67%
21 North of Southampton	Westbound	15	9,345	9,278	-67	-0.7%	0.7	Y	Y	Y	Y	33%	33%	53%	60%
22 South of Southampton	Eastbound	7	4,450	4,426	-23	-0.5%	0.4	Y	Y	Y	Y	43%	29%	43%	71%
22 South of Southampton	Westbound	7	3,927	3,962	35	0.9%	0.6	Y	Y	Y	Y	57%	57%	57%	71%
23 Eastleigh	Eastbound	6	7,521	7,298	-223	-3.0%	2.6	Y	Y	Y	Y	67%	67%	83%	100%
23 Eastleigh	Westbound	6	6,575	6,385	-190	-2.9%	2.4	Y	Y	Y	Y	33%	33%	33%	50%
24 Bitterne Northwest to Southeast	Eastbound	15	4,495	4,379	-116	-2.6%	1.7	Y	Y	Y	Y	57%	50%	57%	71%
24 Bitterne Northwest to Southeast	Westbound	15	4,959	4,796	-163	-3.3%	2.3	Y	Y	Y	Y	79%	43%	79%	86%
25 Bitterne Southwest to Northeast	Eastbound	10	3,942	3,859	-83	-2.1%	1.3	Y	Y	Y	Y	44%	44%	56%	67%
25 Bitterne Southwest to Northeast	Westbound	10	4,263	4,405	142	3.3%	2.2	Y	Y	Y	Y	67%	89%	100%	100%
26 Fareham North South	Eastbound	9	6,984	6,879	-105	-1.5%	1.3	Y	Y	Y	Y	67%	67%	78%	78%
26 Fareham North South	Westbound	9	6,731	6,887	156	2.3%	1.9	Y	Y	Y	Y	63%	50%	75%	88%
271 Locks Heath West to East	Northbound	11	4,325	4,419	94	2.2%	1.4	Y	Y	Y	Y	64%	64%	64%	82%
271 Locks Heath West to East	Southbound	11	2,528	2,544	16	0.6%	0.3	Y	Y	Y	Y	45%	36%	55%	73%
272 Fareham West to East	Northbound	4	1,618	1,690	72	4.4%	1.8	Y	Y	Y	Y	75%	75%	100%	100%
272 Fareham West to East	Southbound	4	1,728	1,814	86	5.0%	2.0	Y	Y	Y	Y	50%	50%	50%	50%
28 Gosport	Northbound	6	2,957	2,958	1	0.0%	0.0	Y	Y	Y	Y	50%	67%	67%	83%
28 Gosport	Southbound	6	2,393	2,364	-28	-1.2%	0.6	Y	Y	Y	Y	83%	67%	67%	83%
29 Portsmouth NorthSouth	Eastbound	16	7,980	7,629	-351	-4.4%	4.0	Y	Y	Y	Y	73%	69%	81%	81%
29 Portsmouth NorthSouth	Westbound	17	9,469	9,199	-270	-2.8%	2.8	Y	Y	Y	Y	47%	29%	53%	59%
30 Portsmouth EastWest	Northbound	9	5,413	5,386	-27	-0.5%	0.4	Y	Y	Y	Y	56%	44%	56%	89%
30 Portsmouth EastWest	Southbound	9	6,025	5,953	-72	-1.2%	0.9	Y	Y	Y	Y	67%	67%	67%	89%
31 Cosham	Eastbound	5	7,460	7,350	-109	-1.5%	1.3	Y	Y	Y	Y	60%	60%	60%	80%
31 Cosham	Westbound	5	6,822	6,798	-24	-0.4%	0.3	Y	Y	Y	Y	60%	60%	60%	60%
32 Waterlooville North to South	Eastbound	15	9,673	9,390	-283	-2.9%	2.9	Y	Y	Y	Y	53%	53%	53%	60%
32 Waterlooville North to South	Westbound	15	9,838	9,723	-115	-1.2%	1.2	Y	Y	Y	Y	47%	40%	60%	73%
33 Waterlooville West to East	Northbound	5	3,216	3,142	-74	-2.3%	1.3	Y	Y	Y	Y	80%	80%	100%	100%
33 Waterlooville West to East	Southbound	5	4,208	4,120	-88	-2.1%	1.4	Y	Y	Y	Y	100%	80%	100%	100%
34 Havant North South	Eastbound	7	4,035	3,978	-57	-1.4%	0.9	Y	Y	Y	Y	71%	71%	71%	86%
34 Havant North South	Westbound	7	4,398	4,389	-10	-0.2%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
35 Havant East West	Northbound	11	4,116	3,986	-130	-3.2%	2.0	Y	Y	Y	Y	64%	45%	55%	73%
35 Havant East West	Southbound	11	5,424	5,480	56	1.0%	0.8	Y	Y	Y	Y	64%	45%	55%	64%
201 Winchester Cordon	Outbound	15	3,735	3,683	-52	-1.4%	0.8	Y	Y	Y	Y	92%	69%	92%	100%
201 Winchester Cordon	Inbound	15	4,996	4,923	-73	-1.5%	1.0	Y	Y	Y	Y	69%	69%	69%	69%
Total		349	191,353	189,201	-2,152	-1.1%		100%	100%	100%	100%	62%	55%	66%	77%
Motorways															
M27	Eastbound	14										93%	93%	93%	93%
M27	Westbound	14										85%	85%	92%	100%
M3	Eastbound	6										60%	60%	100%	100%
M3	Westbound	6										100%	100%	100%	100%
A3(M)	Northbound	4										100%	75%	100%	100%
A3(M)	Southbound	4										100%	100%	100%	100%
M275	Northbound	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										100%	100%	100%	100%
Total	**Total**	54										90%	88%	96%	98%
Overall								97%	95%	98%	98%	64%	59%	71%	80%

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

Site Description	*Dir*	AM VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	AM CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure																																					
Outbound																																					
A33 Mountbatten Way	*W*	1,396	1,531	135	10%	3.5	Y	Y	Y	Y	1,186	1,244	58	5%	1.7	Y	Y	Y	Y	146	166	19	13%	1.6	Y	Y	Y	Y	64	120	56	88%	5.9	Y	N	Y	Y
Central Station Bridge	*N*	587	612	24	4%	1.0	Y	Y	Y	Y	506	531	25	5%	1.1	Y	Y	Y	Y	59	79	20	34%	2.4	Y	Y	Y	Y	21	-	-21	-100%	6.4	Y	N	Y	Y
Blechynden Terrace	*W*	133	206	73	55%	5.6	Y	N	Y	Y	105	134	28	27%	2.6	Y	Y	Y	Y	7	18	11	159%	3.1	Y	Y	Y	Y	11	10	-1	-5%	0.2	Y	Y	Y	Y
Cumberland Place	*N*	559	289	-270	-48%	13.1	N	N	N	N	476	224	-252	-53%	13.5	N	N	N	N	37	24	-13	-35%	2.3	Y	Y	Y	Y	38	41	2	7%	0.4	Y	Y	Y	Y
Above Bar Street - (one way this direction)	*N*	83	159	76	92%	6.9	Y	N	Y	Y	52	110	58	110%	6.4	Y	N	Y	Y	8	14	6	77%	1.8	Y	Y	Y	Y	15	7	-8	-54%	2.4	Y	Y	Y	Y
East Park Terrace	*N*	249	255	6	3%	0.4	Y	Y	Y	Y	205	215	10	5%	0.7	Y	Y	Y	Y	24	8	-16	-66%	3.9	Y	Y	Y	Y	18	29	12	67%	2.4	Y	Y	Y	Y
New Road	*E*	427	373	-53	-12%	2.7	Y	Y	Y	Y	363	271	-92	-25%	5.2	Y	N	Y	Y	36	39	3	8%	0.5	Y	Y	Y	Y	26	41	15	57%	2.6	Y	Y	Y	Y
Kingsway	*N*	490	310	-181	-37%	9.0	N	N	N	Y	416	246	-170	-41%	9.4	N	N	N	Y	44	43	-1	-2%	0.1	Y	Y	Y	Y	30	21	-9	-30%	1.8	Y	Y	Y	Y
St Marys Street	*N*	134	605	471	350%	24.5	N	N	N	N	112	475	363	324%	21.2	N	N	N	N	19	92	73	388%	9.8	Y	N	N	Y	3	38	35	1009%	7.6	Y	N	N	Y
Britannia Road	*N*	189	216	27	14%	1.9	Y	Y	Y	Y	137	178	40	29%	3.2	Y	Y	Y	Y	29	22	-7	-25%	1.4	Y	Y	Y	Y	21	16	-5	-23%	1.1	Y	Y	Y	Y
Princes Street	*W*	207	106	-101	-49%	8.1	N	N	N	Y	146	95	-51	-35%	4.6	Y	Y	Y	Y	37	7	-30	-81%	6.3	Y	N	Y	Y	24	4	-20	-82%	5.2	Y	N	Y	Y
Itchen Bridge	*E*	438	377	-61	-14%	3.0	Y	Y	Y	Y	392	344	-48	-12%	2.5	Y	Y	Y	Y	21	6	-15	-73%	4.2	Y	Y	Y	Y	24	-	-24	-100%	7.0	Y	N	Y	Y
		4,893	**5,039**	**147**	**3.0%**	**2.1**	**67%**	**50%**	**67%**	**83%**	**4,098**	**4,067**	**-32**	**-0.8%**	**0.5**	**75%**	**58%**	**75%**	**83%**	**467**	**518**	**51**	**11.0%**	**2.3**	**100%**	**83%**	**92%**	**100%**	**294**	**328**	**34**	**11.4%**	**1.9**	**100%**	**58%**	**92%**	**100%**
Inbound																																					
A33 Mountbatten Way	*E*	2,523	2,587	63	3%	1.3	Y	Y	Y	Y	2,143	2,183	40	2%	0.9	Y	Y	Y	Y	264	295	31	12%	1.9	Y	Y	Y	Y	116	108	-8	-7%	0.8	Y	Y	Y	Y
Central Station Bridge	*S*	499	249	-251	-50%	13.0	N	N	N	N	440	218	-222	-50%	12.2	N	N	N	N	45	30	-15	-34%	2.5	Y	Y	Y	Y	14	-	-14	-100%	5.3	Y	N	Y	Y
Blechynden Terrace	*E*	169	608	440	260%	22.3	N	N	N	N	107	481	374	348%	21.8	N	N	N	N	13	61	47	352%	7.8	Y	N	N	Y	30	21	-9	-31%	1.9	Y	Y	Y	Y
Cumberland Place	*S*	627	400	-227	-36%	10.0	N	N	N	N	516	293	-223	-43%	11.1	N	N	N	N	65	53	-12	-18%	1.5	Y	Y	Y	Y	42	52	10	23%	1.4	Y	Y	Y	Y
Above Bar Street - (one way in other direction)	*N*	83	159	76	92%	6.9	Y	N	Y	Y	52	110	58	110%	6.4	Y	N	Y	Y	8	14	6	77%	1.8	Y	Y	Y	Y	15	7	-8	-54%	2.4	Y	Y	Y	Y
East Park Terrace	*S*	378	186	-192	-51%	11.4	N	N	N	N	316	149	-168	-53%	11.0	N	N	N	N	37	21	-16	-44%	3.0	Y	Y	Y	Y	24	14	-10	-42%	2.4	Y	Y	Y	Y
New Road	*W*	541	310	-231	-43%	11.2	N	N	N	N	467	141	-325	-70%	18.7	N	N	N	N	51	61	9	18%	1.3	Y	Y	Y	Y	22	86	64	286%	8.7	Y	N	N	Y
Kingsway	*S*	704	586	-119	-17%	4.7	N	Y	Y	Y	574	491	-83	-15%	3.6	Y	Y	Y	Y	71	51	-19	-27%	2.5	Y	Y	Y	Y	54	43	-11	-20%	1.6	Y	Y	Y	Y
St Marys Street	*S*	158	345	187	118%	11.8	N	N	N	N	141	292	151	106%	10.2	N	N	N	N	13	35	22	162%	4.4	Y	Y	Y	Y	3	18	15	429%	4.5	Y	Y	Y	Y
Britannia Road	*S*	161	308	147	91%	9.6	N	N	N	Y	126	275	150	119%	10.6	N	N	N	N	22	18	-4	-16%	0.8	Y	Y	Y	Y	13	15	2	14%	0.5	Y	Y	Y	Y
Princes Street	*E*	637	495	-142	-22%	6.0	N	N	Y	Y	505	454	-51	-10%	2.3	Y	Y	Y	Y	91	30	-61	-67%	7.8	Y	N	N	Y	39	11	-29	-73%	5.7	Y	N	Y	Y
Itchen Bridge	*W*	1,207	1,221	14	1%	0.4	Y	Y	Y	Y	1,060	1,147	88	8%	2.6	Y	Y	Y	Y	89	46	-42	-48%	5.1	Y	N	Y	Y	48	-	-48	-100%	9.8	Y	N	N	Y
		7,688	**7,454**	**-234**	**-3.0%**	**2.7**	**25%**	**25%**	**42%**	**50%**	**6,447**	**6,234**	**-214**	**-3.3%**	**2.7**	**42%**	**33%**	**42%**	**42%**	**769**	**716**	**-54**	**-7.0%**	**2.0**	**100%**	**75%**	**83%**	**100%**	**422**	**375**	**-47**	**-11.2%**	**2.4**	**100%**	**67%**	**83%**	**100%**
91 Bitterne West Screenline																																					
Eastbound																																					
Itchen Bridge	*E*	438	377	-61	-14%	3.0	Y	Y	Y	Y	392	344	-48	-12%	2.5	Y	Y	Y	Y	21	6	-15	-73%	4.2	Y	Y	Y	Y	24	-	-24	-100%	7.0	Y	N	Y	Y
Northam Bridge	*E*	859	748	-111	-13%	3.9	Y	Y	Y	Y	729	645	-85	-12%	3.2	Y	Y	Y	Y	90	40	-50	-56%	6.2	Y	N	Y	Y	39	40	0	1%	0.0	Y	Y	Y	Y
Cobden Bridge	*E*	626	686	60	10%	2.4	Y	Y	Y	Y	570	626	56	10%	2.3	Y	Y	Y	Y	34	33	-1	-3%	0.2	Y	Y	Y	Y	20	19	-1	-7%	0.3	Y	Y	Y	Y
Woodmill Lane	*S*	538	460	-78	-14%	3.5	Y	Y	Y	Y	483	426	-57	-12%	2.7	Y	Y	Y	Y	44	23	-21	-47%	3.6	Y	Y	Y	Y	11	12	0	4%	0.1	Y	Y	Y	Y
Mansbridge Road	*E*	497	611	115	23%	4.9	N	Y	Y	Y	422	490	68	16%	3.2	Y	Y	Y	Y	55	89	34	62%	4.0	Y	Y	Y	Y	17	31	13	77%	2.7	Y	Y	Y	Y
		2,957	**2,883**	**-74**	**-2.5%**	**1.4**	**80%**	**100%**	**100%**	**100%**	**2,596**	**2,531**	**-65**	**-2.5%**	**1.3**	**100%**	**100%**	**100%**	**100%**	**244**	**192**	**-53**	**-21.6%**	**3.6**	**100%**	**80%**	**100%**	**100%**	**112**	**101**	**-12**	**-10.3%**	**1.1**	**100%**	**80%**	**100%**	**100%**
Westbound																																					
Itchen Bridge	*W*	1,207	1,221	14	1%	0.4	Y	Y	Y	Y	1,060	1,147	88	8%	2.6	Y	Y	Y	Y	89	46	-42	-48%	5.1	Y	N	Y	Y	48	-	-48	-100%	9.8	Y	N	N	Y
Northam Bridge	*W*	2,012	1,660	-352	-17%	8.2	N	N	N	Y	1,709	1,431	-278	-16%	7.0	N	N	Y	Y	211	98	-112	-53%	9.0	N	N	N	Y	92	106	14	15%	1.4	Y	Y	Y	Y
Cobden Bridge	*W*	1,176	1,390	214	18%	6.0	N	N	Y	Y	1,077	1,224	146	14%	4.3	Y	Y	Y	Y	59	117	57	97%	6.1	Y	N	Y	Y	38	42	4	10%	0.6	Y	Y	Y	Y
Woodmill Lane	*N*	295	442	146	50%	7.6	N	N	N	Y	260	377	117	45%	6.6	N	N	Y	Y	27	40	13	50%	2.3	Y	Y	Y	Y	8	24	16	190%	3.9	Y	Y	Y	Y
Mansbridge Road	*W*	895	913	18	2%	0.6	Y	Y	Y	Y	801	792	-9	-1%	0.3	Y	Y	Y	Y	67	70	3	4%	0.3	Y	Y	Y	Y	25	50	26	103%	4.2	Y	Y	Y	Y
		5,586	**5,627**	**41**	**0.7%**	**0.5**	**40%**	**40%**	**60%**	**100%**	**4,907**	**4,971**	**65**	**1.3%**	**0.9**	**60%**	**60%**	**100%**	**100%**	**453**	**372**	**-81**	**-17.9%**	**4.0**	**80%**	**40%**	**80%**	**100%**	**212**	**223**	**11**	**5.3%**	**0.8**	**100%**	**80%**	**80%**	**100%**
92 Bitterne East Screenline																																					
Eastbound																																					
Botley Road	*E*	807	637	-170	-21%	6.3	N	N	Y	Y	706	502	-204	-29%	8.3	N	N	N	Y	74	79	5	7%	0.6	Y	Y	Y	Y	24	53	29	117%	4.6	Y	Y	Y	Y
A334 Charles Watts Way	*E*	882	989	106	12%	3.5	Y	Y	Y	Y	757	883	126	17%	4.4	N	Y	Y	Y	85	83	-3	-3%	0.3	Y	Y	Y	Y	38	22	-16	-42%	2.9	Y	Y	Y	Y
St. John's Road	*N*	384	544	160	42%	7.4	N	N	Y	Y	344	489	145	42%	7.1	N	N	Y	Y	34	55	21	61%	3.1	Y	Y	Y	Y	6	-	-6	-100%	3.6	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	*E*	1,596	1,412	-184	-12%	4.7	Y	Y	Y	Y	1,353	1,162	-190	-14%	5.4	Y	N	Y	Y	148	124	-24	-16%	2.1	Y	Y	Y	Y	90	125	34	38%	3.3	Y	Y	Y	Y
		3,669	**3,581**	**-88**	**-2.4%**	**1.5**	**50%**	**50%**	**100%**	**100%**	**3,159**	**3,036**	**-123**	**-3.9%**	**2.2**	**25%**	**25%**	**75%**	**100%**	**341**	**340**	**-1**	**-0.3%**	**0.0**	**100%**	**100%**	**100%**	**100%**	**159**	**200**	**40**	**25.4%**	**3.0**	**100%**	**100%**	**100%**	**100%**
Westbound																																					
Botley Road	*W*	655	684	29	4%	1.1	Y	Y	Y	Y	592	565	-27	-5%	1.1	Y	Y	Y	Y	48	72	24	50%	3.1	Y	Y	Y	Y	14	44	29	207%	5.5	Y	N	Y	Y
A334 Charles Watts Way	*W*	1,028	794	-234	-23%	7.8	N	N	N	Y	895	683	-212	-24%	7.5	N	N	N	Y	91	72	-19	-21%	2.2	Y	Y	Y	Y	38	37	-0	0%	0.0	Y	Y	Y	Y
St. John's Road	*S*	252	544	293	116%	14.7	N	N	N	N	226	484	258	114%	13.7	N	N	N	N	21	60	39	185%	6.1	Y	N	Y	Y	5	-	-5	-100%	3.1	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	*W*	1,332	1,279	-53	-4%	1.5	Y	Y	Y	Y	996	942	-54	-5%	1.7	Y	Y	Y	Y	222	182	-39	-18%	2.8	Y	Y	Y	Y	105	154	49	46%	4.3	Y	Y	Y	Y
		3,266	**3,301**	**35**	**1.1%**	**0.6**	**50%**	**50%**	**50%**	**75%**	**2,710**	**2,675**	**-34**	**-1.3%**	**0.7**	**50%**	**50%**	**50%**	**75%**	**382**	**387**	**4**	**1.2%**	**0.2**	**100%**	**75%**	**100%**	**100%**	**162**	**235**	**73**	**45.2%**	**5.2**	**100%**	**75%**	**100%**	**100%**
11 Totton Enclosure																																					
Outbound																																					
Redbridge roundabout approach from west on Totton	*N*	2,129	2,231	102	5%	2.2	Y	Y	Y	Y	1,755	1,761	6	0%	0.1	Y	Y	Y	Y	237	311	74	31%	4.5	Y	Y	Y	Y	132	156	24	18%	2.0	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	*E*	1,061	1,062	2	0%	0.1	Y	Y	Y	Y	989	952	-37	-4%	1.2	Y	Y	Y	Y	47	50	2	5%	0.3	Y	Y	Y	Y	24	53	30	125%	4.8	Y	Y	Y	Y
Hill Street	*N*	4	0	-4	-98%	2.8	Y	Y	Y	Y	3	0	-3	-98%	2.4	Y	Y	Y	Y	1	-	-1	-100%	1.1	Y	Y	Y	Y	0	-	-0	-100%	0.9	Y	Y	Y	Y
A36 east of A326	*W*	738	734	-5	-1%	0.2	Y	Y	Y	Y	561	495	-66	-12%	2.9	Y	Y	Y	Y	100	145	46	46%	4.2	Y	Y	Y	Y	74	92	18	25%	2.0	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	*N*	1,402	1,325	-77	-5%	2.1	Y	Y	Y	Y	1,186	1,165	-21	-2%	0.6	Y	Y	Y	Y	146	110	-36	-25%	3.2	Y	Y	Y	Y	64	50	-14	-22%	1.9	Y	Y	Y	Y
Loperwood Lane	*N*	25	179	154	621%	15.3	N	N	N	N	20	141	120	596%	13.4	N	N	N	N	3	24	20	591%	5.5	Y	N	Y	Y	1	14	13	1167%	4.8	Y	Y	Y	Y
Loperwood	*W*	82	59	-23	-28%	2.8	Y	Y	Y	Y	72	40	-32	-45%	4.3	Y	Y	Y	Y	8	12	3	39%	1.0	Y	Y	Y	Y	2	7	5	241%	2.3	Y	Y	Y	Y
Tatchbury Lane		5	5	-							5	5	-							0	0	-							-	-	-						
A336 westbound at junction to Bartley	*W*	530	244	-286	-54%	14.6	N	N	N	N	444	186	-258	-58%	14.5	N	N	N	N	56	29	-27	-49%	4.2	Y	Y	Y	Y	28	29	1	2%	0.1	Y	Y	Y	Y
Woodlands Road	*W*	78	164	87	111%	7.9	Y	N	N	Y	65	140	75	116%	7.4	Y	N	Y	Y	8	18	10	125%	2.8	Y	Y	Y	Y	5	6	1	18%	0.4	Y	Y	Y	Y
Foxhills	*W*	103	259	156	151%	11.6	N	N	N	N	93	202	110	118%	9.0	N	N	N	Y	8	39	31	398%	6.5	Y	N	Y	Y	2	17	15	632%	4.7	Y	Y	Y	Y
A35 on dual close to Western Bypass	*W*	741	769	28	4%	1.0	Y	Y	Y	Y	588	602	13	2%	0.5	Y	Y	Y	Y	96	119	23	24%	2.2	Y	Y	Y	Y	50	48	-2	-5%	0.4	Y	Y	Y	Y
Deerleap Lane	*S*	83	-	-83	-100%	12.9	Y	N	N	N	72	-	-72	-100%	12.0	Y	N	N	N	7	-	-7	-100%	3.8	Y	Y	Y	Y	3	-	-3	-100%	2.6	Y	Y	Y	Y
Staplewood Lane	*S*	2	-	-2	-100%	1.8	Y	Y	Y	Y	1	-	-1	-100%	1.4	Y	Y	Y	Y	1	-	-1	-100%	1.1	Y	Y	Y	Y	-	-	-						
Twiggs Lane	*S*	99	129	29	29%	2.7	Y	Y	Y	Y	81	101	20	25%	2.1	Y	Y	Y	Y	15	27	12	86%	2.7	Y	Y	Y	Y	3	-	-3	-100%	2.5	Y	Y	Y	Y
A326 Marchwood Bypass	*S*	1,105	1,104	-1	0%	0.0	Y	Y	Y	Y	968	930	-38	-4%	1.2	Y	Y	Y	Y	76	88	12	16%	1.3	Y	Y	Y	Y	58	85	27	47%	3.2	Y	Y	Y	Y
Hythe Road	*S*	190	200	11	6%	0.8	Y	Y	Y	Y	155	190	35	23%	2.7	Y	Y	Y	Y	16	9	-7	-45%	2.0	Y	Y	Y	Y	18	0	-18	-98%	5.9	Y	N	Y	Y
Marchwood Bypass	*E*	625	712	87	14%	3.4	Y	Y	Y	Y	453	622	169	37%	7.3	N	N	Y	Y	114	61	-53	-46%	5.6	Y	N	Y	Y	55	29	-26	-47%	4.0	Y	Y	Y	Y
Marchwood Road	*E*	669	608	-61	-9%	2.4	Y	Y	Y	Y	585	424	-161	-27%	7.2	N	N	Y	Y	38	102	63	165%	7.6	Y	N	N	Y	45	83	38	84%	4.7	Y	Y	Y	Y
		9,671	**9,785**	**114**	**1.2%**	**1.2**	**83%**	**72%**	**72%**	**78%**	**8,095**	**7,955**	**-140**	**-1.7%**	**1.6**	**72%**	**61%**	**78%**	**83%**	**977**	**1,143**	**166**	**17.0%**	**5.1**	**100%**	**78%**	**94%**	**100%**	**565**	**668**	**104**	**18.3%**	**4.2**	**100%**	**94%**	**100%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST
SRTM 2015
CORDONS AND SCREENLINES

Site Description	Dir	AM VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	AM CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Inbound																																					
Redbridge roundabout approach from west on Totton	S	1,455	1,613	158	11%	4.0	Y	Y	Y	Y	1,077	1,145	68	6%	2.0	Y	Y	Y	Y	211	268	57	27%	3.7	Y	Y	Y	Y	158	198	39	25%	3.0	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	W	1,053	992	-61	-6%	1.9	Y	Y	Y	Y	941	884	-57	-6%	1.9	Y	Y	Y	Y	70	63	-7	-10%	0.8	Y	Y	Y	Y	40	38	-2	-5%	0.3	Y	Y	Y	Y
Hill Street	S	4	-	-4	-100%	3.0	Y	Y	Y	Y	4	-	-4	-100%	2.7	Y	Y	Y	Y	1	-	-1	-100%	1.1	Y	Y	Y	Y	0	-	-0	-100%	0.5	Y	Y	Y	Y
A36 east of A326	E	643	709	66	10%	2.5	Y	Y	Y	Y	512	536	24	5%	1.1	Y	Y	Y	Y	82	114	31	38%	3.2	Y	Y	Y	Y	45	59	13	29%	1.8	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	S	881	592	-290	-33%	10.7	N	N	N	N	745	519	-227	-30%	9.0	N	N	N	Y	92	51	-41	-45%	4.9	Y	Y	Y	Y	40	22	-18	-46%	3.3	Y	Y	Y	Y
Loperwood Lane	S	64	254	190	296%	15.1	N	N	N	N	61	229	168	275%	13.9	N	N	N	N	2	16	14	551%	4.5	Y	Y	Y	Y	1	9	8	1599%	3.9	Y	Y	Y	Y
Loperwood	E	94	165	71	76%	6.3	Y	N	Y	Y	82	154	73	89%	6.7	Y	N	Y	Y	10	6	-3	-35%	1.2	Y	Y	Y	Y	3	4	1	50%	0.7	Y	Y	Y	Y
Tatchbury Lane		2	2	-							2	2	-							0	0	-							-	-	-						
A336 westbound at junction to Bartley	E	480	276	-203	-42%	10.5	N	N	N	N	402	224	-178	-44%	10.1	N	N	N	N	51	40	-10	-20%	1.5	Y	Y	Y	Y	25	12	-13	-51%	3.0	Y	Y	Y	Y
Woodlands Road	E	116	131	14	12%	1.3	Y	Y	Y	Y	105	121	16	15%	1.5	Y	Y	Y	Y	7	8	1	13%	0.3	Y	Y	Y	Y	4	1	-3	-75%	2.0	Y	Y	Y	Y
Foxhills	E	55	216	161	291%	13.8	N	N	N	N	50	202	153	306%	13.6	N	N	N	N	3	10	7	240%	2.8	Y	Y	Y	Y	2	2	-0	-13%	0.2	Y	Y	Y	Y
A35 on dual close to Western Bypass	E	787	787	-1	0%	0.0	Y	Y	Y	Y	678	615	-63	-9%	2.5	Y	Y	Y	Y	86	124	38	45%	3.8	Y	Y	Y	Y	21	48	27	129%	4.6	Y	Y	Y	Y
Deerleap Lane	N	205	54	-152	-74%	13.4	N	N	N	N	184	48	-136	-74%	12.6	N	N	N	N	17	5	-12	-70%	3.6	Y	Y	Y	Y	4	-	-4	-100%	2.8	Y	Y	Y	Y
Staplewood Lane	N	4	0	-4	-100%	2.7	Y	Y	Y	Y	3	0	-3	-100%	2.5	Y	Y	Y	Y	0	-	-0	-100%	1.0	Y	Y	Y	Y	-	-	-						
Twiggs Lane	N	122	247	125	102%	9.2	N	N	N	Y	104	243	139	134%	10.6	N	N	N	N	15	4	-11	-74%	3.6	Y	Y	Y	Y	4	-	-4	-100%	2.7	Y	Y	Y	Y
A326 Marchwood Bypass	N	1,576	1,384	-192	-12%	5.0	Y	Y	Y	Y	1,246	1,081	-165	-13%	4.8	Y	Y	Y	Y	237	207	-30	-13%	2.0	Y	Y	Y	Y	87	92	5	6%	0.5	Y	Y	Y	Y
Hythe Road	N	325	533	208	64%	10.0	N	N	N	N	278	443	165	60%	8.7	N	N	N	Y	26	86	60	234%	8.0	Y	N	N	Y	20	3	-17	-85%	5.0	Y	Y	Y	Y
Marchwood Bypass	W	1,637	1,689	52	3%	1.3	Y	Y	Y	Y	1,391	1,389	-1	0%	0.0	Y	Y	Y	Y	165	202	36	22%	2.7	Y	Y	Y	Y	77	94	17	22%	1.8	Y	Y	Y	Y
Marchwood Road	W	652	725	73	11%	2.8	Y	Y	Y	Y	622	636	14	2%	0.6	Y	Y	Y	Y	15	81	67	448%	9.6	Y	N	N	Y	15	7	-8	-55%	2.5	Y	Y	Y	Y
		10,156	**10,367**	**211**	**2.1%**	**2.1**	**61%**	**56%**	**61%**	**67%**	**8,485**	**8,471**	**-14**	**-0.2%**	**0.2**	**61%**	**56%**	**61%**	**72%**	**1,089**	**1,286**	**196**	**18.0%**	**5.7**	**100%**	**89%**	**89%**	**100%**	**547**	**589**	**42**	**7.6%**	**1.8**	**100%**	**100%**	**100%**	**100%**

13 Southampton Enclosure

Site Description	Dir	VEH Obs	Model	Diff	% Diff	GEH	Abs %	GEH5	GEH7.5	GEH10	CAR Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10	LGV Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10	HGV Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10
Outbound																																					
A35 Redbridge Road	W	2,110	2,216	106	5%	2.3	Y	Y	Y	Y	1,794	1,809	15	1%	0.4	Y	Y	Y	Y	211	236	25	12%	1.7	Y	Y	Y	Y	106	163	58	55%	5.0	Y	Y	Y	Y
Brownhill Way	W	1,022	1,120	98	10%	3.0	Y	Y	Y	Y	878	951	73	8%	2.4	Y	Y	Y	Y	107	139	32	30%	2.9	Y	Y	Y	Y	36	30	-6	-17%	1.1	Y	Y	Y	Y
Romsey Road	N	609	722	112	18%	4.3	N	Y	Y	Y	531	589	57	11%	2.4	Y	Y	Y	Y	56	88	32	58%	3.8	Y	Y	Y	Y	21	45	24	116%	4.2	Y	Y	Y	Y
Rownhams Lane	N	523	382	-141	-27%	6.6	N	N	Y	Y	436	345	-92	-21%	4.6	Y	Y	Y	Y	64	31	-33	-51%	4.8	Y	Y	Y	Y	22	5	-17	-79%	4.8	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba:	N	1,495	1,818	323	22%	7.9	N	N	N	Y	1,400	1,563	163	12%	4.2	Y	Y	Y	Y	58	136	78	136%	8.0	Y	N	N	Y	36	114	79	221%	9.1	Y	Y	N	Y
A27 Bassett Green Road close to Lobelia Road	N	699	345	-354	-51%	15.5	N	N	N	N	622	279	-343	-55%	16.2	N	N	N	N	55	39	-17	-30%	2.4	Y	Y	Y	Y	19	28	9	48%	1.9	Y	Y	Y	Y
Stoneham Lane	N	115	207	92	80%	7.2	Y	N	Y	Y	101	187	86	85%	7.2	Y	N	Y	Y	9	15	6	69%	1.8	Y	Y	Y	Y	5	1	-3	-72%	2.0	Y	Y	Y	Y
A335 Stoneham Way	N	1,084	1,227	143	13%	4.2	Y	Y	Y	Y	846	1,125	279	33%	8.9	N	N	N	Y	142	70	-73	-51%	7.1	Y	N	Y	Y	86	32	-54	-63%	7.0	Y	N	Y	Y
Wide Lane	N	827	716	-111	-13%	4.0	Y	Y	Y	Y	726	583	-143	-20%	5.6	N	N	Y	Y	71	88	17	24%	1.9	Y	Y	Y	Y	27	36	9	34%	1.7	Y	Y	Y	Y
Mansbridge Road	E	497	611	115	23%	4.9	N	Y	Y	Y	422	490	68	16%	3.2	Y	Y	Y	Y	55	89	34	62%	4.0	Y	Y	Y	Y	17	31	13	77%	2.7	Y	Y	Y	Y
Woodmill Lane	S	538	460	-78	-14%	3.5	Y	Y	Y	Y	483	426	-57	-12%	2.7	Y	Y	Y	Y	44	23	-21	-47%	3.6	Y	Y	Y	Y	11	12	0	4%	0.1	Y	Y	Y	Y
Cobden Bridge	E	626	686	60	10%	2.4	Y	Y	Y	Y	570	626	56	10%	2.3	Y	Y	Y	Y	34	33	-1	-3%	0.2	Y	Y	Y	Y	20	19	-1	-7%	0.3	Y	Y	Y	Y
Northam Bridge	E	859	748	-111	-13%	3.9	Y	Y	Y	Y	729	645	-85	-12%	3.2	Y	Y	Y	Y	90	40	-50	-56%	6.2	Y	N	Y	Y	39	40	0	1%	0.0	Y	Y	Y	Y
Itchen Bridge	E	438	377	-61	-14%	3.0	Y	Y	Y	Y	392	344	-48	-12%	2.5	Y	Y	Y	Y	21	6	-15	-73%	4.2	Y	Y	Y	Y	24	-	-24	-100%	7.0	Y	N	Y	Y
		11,443	**11,636**	**194**	**1.7%**	**1.8**	**64%**	**71%**	**86%**	**93%**	**9,931**	**9,961**	**30**	**0.3%**	**0.3**	**79%**	**71%**	**86%**	**93%**	**1,018**	**1,034**	**16**	**1.6%**	**0.5**	**100%**	**79%**	**93%**	**100%**	**469**	**555**	**86**	**18.3%**	**3.8**	**100%**	**79%**	**93%**	**100%**
Inbound																																					
A35 Redbridge Road	E	3,225	3,304	79	2%	1.4	Y	Y	Y	Y	2,742	2,718	-24	-1%	0.5	Y	Y	Y	Y	323	384	61	19%	3.3	Y	Y	Y	Y	161	191	30	19%	2.3	Y	Y	Y	Y
Brownhill Way	E	1,008	775	-233	-23%	7.8	N	N	Y	Y	909	652	-257	-28%	9.2	N	N	N	Y	69	94	25	36%	2.7	Y	Y	Y	Y	28	28	0	0%	0.0	Y	Y	Y	Y
Romsey Road	S	494	616	122	25%	5.2	N	N	Y	Y	434	536	102	23%	4.6	N	Y	Y	Y	43	55	13	30%	1.8	Y	Y	Y	Y	17	25	8	48%	1.8	Y	Y	Y	Y
Rownhams Lane	S	606	716	110	18%	4.3	N	Y	Y	Y	524	678	154	29%	6.3	N	N	Y	Y	61	28	-32	-53%	4.8	Y	Y	Y	Y	18	8	-11	-58%	2.9	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba:	S	1,693	2,004	312	18%	7.2	N	N	Y	Y	1,601	1,821	220	14%	5.3	Y	N	Y	Y	45	50	6	13%	0.8	Y	Y	Y	Y	45	122	77	169%	8.4	Y	N	N	Y
A27 Bassett Green Road close to Lobelia Road	S	542	546	4	1%	0.2	Y	Y	Y	Y	477	511	33	7%	1.5	Y	Y	Y	Y	46	19	-27	-60%	4.8	Y	Y	Y	Y	17	16	-1	-5%	0.2	Y	Y	Y	Y
Stoneham Lane	S	237	7	-229	-97%	20.8	N	N	N	N	220	5	-215	-98%	20.3	N	N	N	N	9	0	-8	-98%	4.0	Y	Y	Y	Y	8	0	-8	-99%	3.9	Y	Y	Y	Y
A335 Stoneham Way	S	1,497	1,171	-326	-22%	8.9	N	N	N	Y	1,291	1,053	-238	-18%	7.0	N	N	Y	Y	119	100	-19	-16%	1.9	Y	Y	Y	Y	81	19	-62	-77%	8.7	Y	N	N	Y
Wide Lane	S	424	580	157	37%	7.0	N	N	Y	Y	351	470	119	34%	5.9	N	N	Y	Y	46	87	41	89%	5.0	Y	N	Y	Y	24	17	-7	-29%	1.5	Y	Y	Y	Y
Mansbridge Road	W	895	913	18	2%	0.6	Y	Y	Y	Y	801	792	-9	-1%	0.3	Y	Y	Y	Y	67	70	3	4%	0.3	Y	Y	Y	Y	25	50	26	103%	4.2	Y	Y	Y	Y
Woodmill Lane	N	295	442	146	50%	7.6	N	N	N	Y	260	377	117	45%	6.6	N	N	Y	Y	27	40	13	50%	2.3	Y	Y	Y	Y	8	24	16	190%	3.9	Y	Y	Y	Y
Cobden Bridge	W	1,176	1,390	214	18%	6.0	N	N	Y	Y	1,077	1,224	146	14%	4.3	Y	Y	Y	Y	59	117	57	97%	6.1	Y	N	Y	Y	38	42	4	10%	0.6	Y	Y	Y	Y
Northam Bridge	W	2,012	1,660	-352	-17%	8.2	N	N	N	Y	1,709	1,431	-278	-16%	7.0	N	N	Y	Y	211	98	-112	-53%	9.0	N	N	N	Y	92	106	14	15%	1.4	Y	Y	Y	Y
Itchen Bridge	W	1,207	1,221	14	1%	0.4	Y	Y	Y	Y	1,060	1,147	88	8%	2.6	Y	Y	Y	Y	89	46	-42	-48%	5.1	Y	N	Y	Y	48	-	-48	-100%	9.8	Y	N	N	Y
		15,311	**15,346**	**34**	**0.2%**	**0.3**	**29%**	**36%**	**64%**	**93%**	**13,457**	**13,415**	**-41**	**-0.3%**	**0.4**	**43%**	**43%**	**86%**	**93%**	**1,212**	**1,188**	**-24**	**-2.0%**	**0.7**	**93%**	**71%**	**93%**	**100%**	**612**	**651**	**39**	**6.3%**	**1.5**	**100%**	**79%**	**79%**	**100%**

20 Totton

Site Description	Dir	VEH Obs	Model	Diff	% Diff	GEH	Abs %	GEH5	GEH7.5	GEH10	CAR Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10	LGV Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10	HGV Obs	Model	Diff	% Diff	GEH	Abs or %	GEH=5	GEH=7.5	GEH=10
Eastbound																																					
Marchwood Bypass south of Jacobs Gutter Lane	N	73	4	-69	-94%	11.1	Y	N	N	N	59	0	-59	-100%	10.9	Y	N	N	N	6	0	-6	-100%	3.5	Y	Y	Y	Y	7	4	-3	-40%	1.2	Y	Y	Y	Y
Spicers Hill south of Spicers Way	N	2,032	2,013	-18	-1%	0.4	Y	Y	Y	Y	1,655	1,586	-68	-4%	1.7	Y	Y	Y	Y	260	297	37	14%	2.2	Y	Y	Y	Y	111	127	16	14%	1.4	Y	Y	Y	Y
Rushington Lane	E	3	1	-2	-69%	1.5	Y	Y	Y	Y	1	-	-1	-100%	1.6	Y	Y	Y	Y	0	-	-0	-100%	0.7	Y	Y	Y	Y	1	-	-1	-100%	1.6	Y	Y	Y	Y
Ringwood Road east of Calmore Road	E	695	679	-16	-2%	0.6	Y	Y	Y	Y	637	630	-6	-1%	0.2	Y	Y	Y	Y	46	27	-18	-40%	3.0	Y	Y	Y	Y	12	19	7	56%	1.7	Y	Y	Y	Y
Water Lane near Totton College	E	174	196	22	13%	1.6	Y	Y	Y	Y	152	180	28	18%	2.2	Y	Y	Y	Y	14	9	-5	-34%	1.4	Y	Y	Y	Y	8	4	-3	-40%	1.2	Y	Y	Y	Y
Calmore Drive	E	205	204	-1	0%	0.1	Y	Y	Y	Y	179	183	4	2%	0.3	Y	Y	Y	Y	19	18	-0	-2%	0.1	Y	Y	Y	Y	8	3	-5	-63%	2.1	Y	Y	Y	Y
Cooks Lane east of Calmore Road	E	129	179	49	38%	4.0	Y	Y	Y	Y	105	151	46	43%	4.0	Y	Y	Y	Y	19	17	-3	-13%	0.6	Y	Y	Y	Y	5	11	6	128%	2.2	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	E	585	706	121	21%	4.8	N	Y	Y	Y	459	536	77	17%	3.5	Y	Y	Y	Y	75	114	39	52%	4.0	Y	Y	Y	Y	46	55	9	19%	1.2	Y	Y	Y	Y
		3,896	**3,982**	**86**	**2.2%**	**1.4**	**88%**	**88%**	**88%**	**88%**	**3,246**	**3,266**	**20**	**0.6%**	**0.3**	**100%**	**88%**	**88%**	**88%**	**439**	**482**	**43**	**9.9%**	**2.0**	**100%**	**100%**	**100%**	**100%**	**198**	**224**	**26**	**13.0%**	**1.8**	**100%**	**100%**	**100%**	**100%**
Westbound																																					
Marchwood Bypass south of Jacobs Gutter Lane	S	676	898	222	33%	7.9	N	N	N	Y	514	736	222	43%	8.9	N	N	N	Y	92	104	12	13%	1.2	Y	Y	Y	Y	65	56	-10	-15%	1.3	Y	Y	Y	Y
Spicers Hill south of Spicers Way	S	892	547	-345	-39%	12.9	N	N	N	N	645	352	-292	-45%	13.1	N	N	N	N	151	126	-25	-17%	2.2	Y	Y	Y	Y	88	69	-19	-22%	2.2	Y	Y	Y	Y
Rushington Lane	W	79	72	-7	-9%	0.9	Y	Y	Y	Y	67	66	-2	-2%	0.2	Y	Y	Y	Y	9	3	-6	-65%	2.4	Y	Y	Y	Y	2	1	-1	-34%	0.6	Y	Y	Y	Y
Ringwood Road east of Calmore Road	W	466	287	-178	-38%	9.2	N	N	N	Y	404	200	-204	-51%	11.7	N	N	N	N	42	47	5	11%	0.7	Y	Y	Y	Y	18	39	20	109%	3.8	Y	Y	Y	Y
Water Lane near Totton College	W	280	525	245	88%	12.2	N	N	N	N	241	459	219	91%	11.7	N	N	N	N	27	44	17	62%	2.8	Y	Y	Y	Y	11	19	8	72%	2.1	Y	Y	Y	Y
Calmore Drive	W	149	208	59	39%	4.4	Y	Y	Y	Y	136	193	57	42%	4.4	Y	Y	Y	Y	8	5	-3	-38%	1.2	Y	Y	Y	Y	5	10	5	104%	1.8	Y	Y	Y	Y
Cooks Lane east of Calmore Road	W	177	266	89	50%	6.0	Y	N	Y	Y	157	221	64	41%	4.7	Y	Y	Y	Y	15	27	12	78%	2.6	Y	Y	Y	Y	5	18	13	278%	3.9	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	W	627	734	107	17%	4.1	N	Y	Y	Y	470	495	25	5%	1.2	Y	Y	Y	Y	90	145	56	62%	5.1	Y	N	Y	Y	64	92	28	44%	3.2	Y	Y	Y	Y
		3,346	**3,536**	**190**	**5.7%**	**3.2**	**38%**	**38%**	**50%**	**75%**	**2,634**	**2,722**	**88**	**3.4%**	**1.7**	**50%**	**50%**	**50%**	**63%**	**435**	**501**	**66**	**15.2%**	**3.1**	**100%**	**88%**	**100%**	**100%**	**259**	**303**	**45**	**17.3%**	**2.7**	**100%**	**100%**	**100%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST
SRTM 2015
CORDONS AND SCREENLINES

		AM VEHICLES									AM CAR									AM LGV									AM HGV								
Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
21 North of Southampton																																					
Eastbound																																					
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	718	589	-129	-18%	5.0	N	N	Y	Y	620	537	-84	-13%	3.5	Y	Y	Y	Y	52	38	-14	-27%	2.1	Y	Y	Y	Y	42	14	-27	-65%	5.1	Y	N	Y	Y
Lawn Road East off Horse Shoe Bridge	E	56	115	59	105%	6.4	Y	N	Y	Y	48	104	56	118%	6.5	Y	N	Y	Y	6	8	2	31%	0.7	Y	Y	Y	Y	2	3	1	26%	0.3	Y	Y	Y	Y
Tennyson Road	N	19	163	144	761%	15.1	N	N	N	N	17	154	137	816%	14.8	N	N	N	N	2	7	5	270%	2.3	Y	Y	Y	Y	0	3	3	621%	2.0	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	N	287	94	-193	-67%	14.0	N	N	N	N	231	78	-153	-66%	12.3	N	N	N	N	33	2	-32	-95%	7.6	Y	N	N	Y	18	1	-18	-95%	5.7	Y	N	Y	Y
A33 The Avenue South of Westwood Road	N	859	1,157	298	35%	9.4	N	N	N	Y	775	1,003	227	29%	7.6	N	N	N	Y	47	75	28	59%	3.6	Y	Y	Y	Y	31	63	32	105%	4.7	Y	Y	Y	Y
Hill Lane	N	411	125	-285	-69%	17.4	N	N	N	N	359	120	-239	-66%	15.4	N	N	N	N	39	4	-36	-91%	7.7	Y	N	N	Y	12	1	-10	-89%	4.1	Y	Y	Y	Y
Ivanhoe Road	N	72	185	113	157%	9.9	N	N	N	Y	64	170	106	165%	9.8	N	N	N	Y	7	12	4	62%	1.5	Y	Y	Y	Y	1	2	1	167%	1.0	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	N	88	-	-88	-100%	13.3	Y	N	N	N	78	-	-78	-100%	12.5	Y	N	N	N	6	-	-6	-100%	3.5	Y	Y	Y	Y	3	-	-3	-100%	2.6	Y	Y	Y	Y
St James Road	N	452	329	-124	-27%	6.3	N	N	Y	Y	416	290	-126	-30%	6.7	N	N	Y	Y	27	34	7	27%	1.3	Y	Y	Y	Y	9	4	-5	-52%	1.8	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	683	496	-187	-27%	7.7	N	N	N	Y	619	436	-184	-30%	8.0	N	N	N	Y	47	25	-21	-46%	3.6	Y	Y	Y	Y	17	35	18	109%	3.6	Y	Y	Y	Y
Tremona Road	E	286	290	4	1%	0.2	Y	Y	Y	Y	269	267	-2	-1%	0.1	Y	Y	Y	Y	13	20	7	53%	1.7	Y	Y	Y	Y	3	2	-1	-43%	0.9	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	499	812	313	63%	12.2	N	N	N	N	432	685	254	59%	10.7	N	N	N	N	37	90	53	142%	6.6	Y	N	Y	Y	20	21	1	5%	0.2	Y	Y	Y	Y
Aldermoor Road	E	126	135	9	7%	0.8	Y	Y	Y	Y	110	123	13	12%	1.2	Y	Y	Y	Y	9	4	-5	-52%	1.8	Y	Y	Y	Y	6	0	-6	-93%	3.2	Y	Y	Y	Y
Lords Hill Way	E	683	613	-71	-10%	2.8	Y	Y	Y	Y	569	572	3	0%	0.1	Y	Y	Y	Y	83	21	-62	-75%	8.5	Y	N	N	Y	24	11	-13	-54%	3.1	Y	Y	Y	Y
M0027_J0003_J0004	E	6,271	6,185	-86	-1%	1.1	Y	Y	Y	Y	5,315	5,199	-116	-2%	1.6	Y	Y	Y	Y	396	387	-9	-2%	0.5	Y	Y	Y	Y	560	599	40	7%	1.6	Y	Y	Y	Y
		11,511	**11,287**	**-224**	**-1.9%**	**2.1**	**40%**	**27%**	**47%**	**67%**	**9,924**	**9,738**	**-186**	**-1.9%**	**1.9**	**47%**	**33%**	**47%**	**67%**	**805**	**726**	**-79**	**-9.8%**	**2.8**	**100%**	**73%**	**80%**	**100%**	**748**	**760**	**12**	**1.6%**	**0.4**	**100%**	**87%**	**100%**	**100%**
21 North of Southampton																																					
Westbound																																					
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	1,222	1,408	186	15%	5.1	N	N	Y	Y	1,036	1,218	182	18%	5.4	N	N	Y	Y	114	157	42	37%	3.6	Y	Y	Y	Y	63	34	-30	-47%	4.3	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	W	95	23	-71	-75%	9.3	Y	N	N	Y	85	19	-66	-77%	9.1	Y	N	N	Y	7	2	-5	-71%	2.4	Y	Y	Y	Y	2	2	-0	-18%	0.3	Y	Y	Y	Y
Tennyson Road	S	17	167	150	904%	15.7	N	N	N	N	14	156	142	1012%	15.4	N	N	N	N	2	8	6	319%	2.8	Y	Y	Y	Y	1	3	2	340%	1.6	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	S	335	101	-235	-70%	15.9	N	N	N	N	271	68	-203	-75%	15.6	N	N	N	N	38	14	-25	-64%	4.8	Y	Y	Y	Y	22	6	-16	-72%	4.2	Y	Y	Y	Y
A33 The Avenue South of Westwood Road	S	1,101	1,320	219	20%	6.3	N	N	Y	Y	967	1,122	154	16%	4.8	N	Y	Y	Y	86	101	15	18%	1.6	Y	Y	Y	Y	40	83	43	107%	5.5	Y	N	Y	Y
Hill Lane	S	527	356	-171	-33%	8.2	N	N	N	Y	472	327	-145	-31%	7.3	N	N	Y	Y	41	24	-17	-41%	2.9	Y	Y	Y	Y	12	4	-8	-67%	2.8	Y	Y	Y	Y
Ivanhoe Road	S	58	302	244	422%	18.2	N	N	N	N	44	295	251	573%	19.3	N	N	N	N	13	4	-9	-71%	3.2	Y	Y	Y	Y	1	2	1	106%	0.9	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	S	115	-	-115	-100%	15.2	N	N	N	N	108	-	-108	-100%	14.7	N	N	N	N	5	-	-5	-100%	3.2	Y	Y	Y	Y	2	-	-2	-100%	2.1	Y	Y	Y	Y
St James Road	S	320	289	-31	-10%	1.8	Y	Y	Y	Y	296	268	-29	-10%	1.7	Y	Y	Y	Y	18	18	0	0%	0.0	Y	Y	Y	Y	5	3	-2	-46%	1.2	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	708	394	-315	-44%	13.4	N	N	N	N	633	356	-276	-44%	12.4	N	N	N	N	53	15	-39	-72%	6.6	Y	N	Y	Y	21	22	1	7%	0.3	Y	Y	Y	Y
Tremona Road	W	200	201	1	0%	0.1	Y	Y	Y	Y	174	169	-5	-3%	0.4	Y	Y	Y	Y	21	26	4	20%	0.9	Y	Y	Y	Y	5	6	2	36%	0.7	Y	Y	Y	Y
Coxford Road east of Warren Ave	W	240	522	283	118%	14.5	N	N	N	N	197	416	220	112%	12.5	N	N	N	N	18	75	57	312%	8.3	Y	N	N	Y	16	15	-1	-9%	0.4	Y	Y	Y	Y
Aldermoor Road	W	74	95	21	29%	2.3	Y	Y	Y	Y	64	83	19	30%	2.2	Y	Y	Y	Y	6	3	-3	-46%	1.3	Y	Y	Y	Y	3	1	-2	-78%	1.6	Y	Y	Y	Y
Lords Hill Way	W	594	436	-159	-27%	7.0	N	N	Y	Y	535	400	-135	-25%	6.3	N	N	Y	Y	37	17	-20	-53%	3.7	Y	Y	Y	Y	21	10	-11	-54%	2.9	Y	Y	Y	Y
M0027_J0004_J0003	W	5,386	5,350	-36	-1%	0.5	Y	Y	Y	Y	4,449	4,381	-68	-2%	1.0	Y	Y	Y	Y	430	444	15	3%	0.7	Y	Y	Y	Y	508	525	18	4%	0.8	Y	Y	Y	Y
		10,993	**10,964**	**-29**	**-0.3%**	**0.3**	**33%**	**27%**	**47%**	**60%**	**9,345**	**9,278**	**-67**	**-0.7%**	**0.7**	**33%**	**33%**	**53%**	**60%**	**891**	**909**	**18**	**2.0%**	**0.6**	**100%**	**87%**	**93%**	**100%**	**722**	**716**	**-7**	**-0.9%**	**0.2**	**100%**	**93%**	**100%**	**100%**
22 South of Southampton																																					
Eastbound																																					
Milbrook Road East West of Waterhouse Lane		2,123	2,928	805	38%	16.0	N	N	N	N	1,804	2,452	647	36%	14.0	N	N	N	N	212	321	109	51%	6.7	N	N	Y	Y	106	143	37	35%	3.3	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	E	261	231	-30	-11%	1.9	Y	Y	Y	Y	227	224	-3	-1%	0.2	Y	Y	Y	Y	28	5	-23	-84%	5.8	Y	N	Y	Y	6	2	-4	-73%	2.2	Y	Y	Y	Y
Shirley High Street East of Park St	S	550	360	-190	-35%	8.9	N	N	N	Y	488	300	-189	-39%	9.5	N	N	N	Y	34	17	-18	-52%	3.5	Y	Y	Y	Y	24	6	-18	-76%	4.7	Y	Y	Y	Y
Victor Street east of Crown Street	N	157	78	-79	-50%	7.3	Y	N	Y	Y	144	72	-72	-50%	6.9	Y	N	Y	Y	11	5	-6	-58%	2.3	Y	Y	Y	Y	3	1	-1	-44%	0.8	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	683	496	-187	-27%	7.7	N	N	N	Y	619	436	-184	-30%	8.0	N	N	N	Y	47	25	-21	-46%	3.6	Y	Y	Y	Y	17	35	18	109%	3.6	Y	Y	Y	Y
Dale Road north of Norham Avenue	N	470	260	-209	-45%	11.0	N	N	N	N	412	212	-199	-48%	11.3	N	N	N	N	41	36	-5	-13%	0.9	Y	Y	Y	Y	17	9	-8	-46%	2.1	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	E	804	765	-39	-5%	1.4	Y	Y	Y	Y	756	731	-24	-3%	0.9	Y	Y	Y	Y	37	20	-17	-45%	3.1	Y	Y	Y	Y	11	12	1	9%	0.3	Y	Y	Y	Y
		5,047	**5,117**	**70**	**1.4%**	**1.0**	**43%**	**29%**	**43%**	**71%**	**4,450**	**4,426**	**-23**	**-0.5%**	**0.4**	**43%**	**29%**	**43%**	**71%**	**410**	**429**	**18**	**4.5%**	**0.9**	**86%**	**71%**	**100%**	**100%**	**183**	**208**	**25**	**13.7%**	**1.8**	**100%**	**100%**	**100%**	**100%**
Westbound																																					
Milbrook Road East West of Waterhouse Lane		1,662	2,182	519	31%	11.8	N	N	N	N	1,413	1,786	373	26%	9.3	N	N	N	Y	166	247	80	48%	5.6	Y	N	Y	Y	83	140	57	69%	5.4	Y	N	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	W	234	247	13	5%	0.8	Y	Y	Y	Y	206	235	29	14%	2.0	Y	Y	Y	Y	23	9	-14	-62%	3.6	Y	Y	Y	Y	6	3	-3	-54%	1.5	Y	Y	Y	Y
Shirley High Street East of Park St	N	449	497	48	11%	2.2	Y	Y	Y	Y	407	412	5	1%	0.3	Y	Y	Y	Y	22	36	14	63%	2.6	Y	Y	Y	Y	17	12	-5	-29%	1.3	Y	Y	Y	Y
Victor Street east of Crown Street	N	157	-	-157	-100%	17.7	N	N	N	N	144	-	-144	-100%	16.9	N	N	N	N	11	-	-11	-100%	4.7	Y	Y	Y	Y	3	-	-3	-100%	2.3	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	708	394	-315	-44%	13.4	N	N	N	N	633	356	-276	-44%	12.4	N	N	N	N	53	15	-39	-72%	6.6	Y	N	Y	Y	21	22	1	7%	0.3	Y	Y	Y	Y
Dale Road north of Norham Avenue	S	323	361	38	12%	2.0	Y	Y	Y	Y	292	319	27	9%	1.5	Y	Y	Y	Y	22	34	12	56%	2.3	Y	Y	Y	Y	9	5	-4	-47%	1.6	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	907	924	17	2%	0.5	Y	Y	Y	Y	833	853	21	2%	0.7	Y	Y	Y	Y	56	47	-8	-15%	1.2	Y	Y	Y	Y	18	22	4	24%	1.0	Y	Y	Y	Y
		4,442	**4,604**	**162**	**3.7%**	**2.4**	**57%**	**57%**	**57%**	**57%**	**3,927**	**3,962**	**35**	**0.9%**	**0.6**	**57%**	**57%**	**57%**	**71%**	**353**	**388**	**34**	**9.7%**	**1.8**	**100%**	**71%**	**100%**	**100%**	**156**	**204**	**48**	**31.0%**	**3.6**	**100%**	**86%**	**100%**	**100%**
24 Bitterne Northwest to Southeast																																					
Eastbound																																					
Hamble Lane		608	822	214	35%	8.0	N	N	N	Y	517	609	92	18%	3.9	Y	Y	Y	Y	61	124	63	103%	6.5	Y	N	Y	Y	30	88	58	191%	7.5	Y	N	N	Y
Grange Road South of A3025	N	257	172	-85	-33%	5.8	Y	N	Y	Y	216	160	-56	-26%	4.1	Y	Y	Y	Y	31	12	-19	-62%	4.2	Y	Y	Y	Y	10	1	-9	-93%	4.0	Y	Y	Y	Y
Coxs Drive	E	2	128	126	6640%	15.7	N	N	N	N	2	125	123	7237%	15.5	N	N	N	N	0	3	2	1203%	2.0	Y	Y	Y	Y	-	1	1		1.3	Y	Y	Y	Y
Portsmouth Road	E	859	512	-347	-40%	13.3	N	N	N	N	769	468	-301	-39%	12.1	N	N	N	N	61	25	-37	-60%	5.6	Y	N	Y	Y	28	14	-14	-50%	3.0	Y	Y	Y	Y
Butts Road	E	291	241	-50	-17%	3.1	Y	Y	Y	Y	251	216	-36	-14%	2.3	Y	Y	Y	Y	27	13	-15	-53%	3.2	Y	Y	Y	Y	11	10	-1	-10%	0.4	Y	Y	Y	Y
Kathleen Road	E	155	555	400	258%	21.2	N	N	N	N	128	530	401	313%	22.1	N	N	N	N	15	11	-4	-27%	1.1	Y	Y	Y	Y	9	5	-4	-42%	1.4	Y	Y	Y	Y
Burlesdon Road	S	708	293	-416	-59%	18.6	N	N	N	N	655	230	-424	-65%	20.2	N	N	N	N	37	11	-26	-71%	5.3	Y	N	Y	Y	16	34	17	107%	3.5	Y	Y	Y	Y
Upper Deacon Road	N	194	235	41	21%	2.8	Y	Y	Y	Y	185	216	31	17%	2.2	Y	Y	Y	Y	6	18	11	179%	3.3	Y	Y	Y	Y	3	-	-3	-100%	2.5	Y	Y	Y	Y
Bitterne Road	E	473	602	128	27%	5.5	N	N	Y	Y	418	544	126	30%	5.7	N	N	Y	Y	34	57	23	68%	3.4	Y	Y	Y	Y	21	-	-21	-100%	6.5	Y	N	Y	Y
Shales Road south of Taunton Drive	N	91	136	45	50%	4.3	Y	Y	Y	Y	80	125	45	56%	4.4	Y	Y	Y	Y	9	8	-1	-14%	0.4	Y	Y	Y	Y	2	4	2	89%	1.1	Y	Y	Y	Y
West End Road	E	724	858	134	18%	4.8	N	Y	Y	Y	676	773	97	14%	3.6	Y	Y	Y	Y	34	53	19	55%	2.8	Y	Y	Y	Y	14	29	16	115%	3.4	Y	Y	Y	Y
Townhill Way	N	467	279	-188	-40%	9.7	N	N	N	Y	397	254	-143	-36%	7.9	N	N	N	Y	48	17	-31	-65%	5.4	Y	N	Y	Y	16	2	-15	-90%	4.9	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	124	43	-81	-65%	8.9	Y	N	N	Y	110	42	-69	-62%	7.9	Y	N	N	Y	7	1	-6	-84%	2.9	Y	Y	Y	Y	5	0	-5	-98%	3.0	Y	Y	Y	Y
Northfield Road		20	20	-							19	19	-							0	0	-							0	0	-						
Foresthill Drive north of Woodmill Lane	E	92	82	-10	-11%	1.1	Y	Y	Y	Y	71	68	-3	-4%	0.4	Y	Y	Y	Y	6	2	-4	-74%	2.3	Y	Y	Y	Y	15	1	-14	-94%	5.0	Y	Y	Y	Y
		5,066	**4,978**	**-88**	**-1.7%**	**1.2**	**43%**	**36%**	**50%**	**71%**	**4,495**	**4,379**	**-116**	**-2.6%**	**1.7**	**57%**	**50%**	**57%**	**71%**	**377**	**352**	**-25**	**-6.5%**	**1.3**	**100%**	**71%**	**100%**	**100%**	**180**	**189**	**9**	**4.9%**	**0.6**	**100%**	**86%**	**93%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

Site Description	Dir	AM VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	AM CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	AM HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound																																					
Hamble Lane		963	894	-69	-7%	2.2	Y	Y	Y	Y	818	679	-140	-17%	5.1	N	N	Y	Y	96	153	57	59%	5.1	Y	N	Y	Y	48	62	13	28%	1.8	Y	Y	Y	Y
Grange Road South of A3025	S	268	184	-84	-31%	5.6	Y	N	Y	Y	227	159	-67	-30%	4.8	Y	Y	Y	Y	32	24	-8	-25%	1.5	Y	Y	Y	Y	9	1	-8	-93%	3.8	Y	Y	Y	Y
Coxs Drive	W	8	83	75	984%	11.2	Y	N	N	N	7	77	69	925%	10.7	Y	N	N	N	0	4	4		2.9	Y	Y	Y	Y	0	2	2	1412%	1.8	Y	Y	Y	Y
Portsmouth Road	W	801	836	36	4%	1.3	Y	Y	Y	Y	704	740	36	5%	1.4	Y	Y	Y	Y	62	68	7	11%	0.8	Y	Y	Y	Y	32	18	-14	-44%	2.9	Y	Y	Y	Y
Butts Road	W	281	206	-75	-27%	4.8	Y	Y	Y	Y	247	174	-73	-30%	5.1	Y	N	Y	Y	26	16	-10	-39%	2.2	Y	Y	Y	Y	8	16	8	99%	2.3	Y	Y	Y	Y
Kathleen Road	W	145	57	-88	-60%	8.7	Y	N	N	Y	118	41	-76	-65%	8.6	Y	N	N	Y	14	3	-11	-79%	3.9	Y	Y	Y	Y	10	5	-5	-48%	1.7	Y	Y	Y	Y
Burlesdon Road	N	671	566	-105	-16%	4.2	N	Y	Y	Y	562	429	-133	-24%	6.0	N	N	Y	Y	53	22	-31	-58%	5.0	Y	N	Y	Y	53	96	43	81%	5.0	Y	Y	Y	Y
Upper Deacon Road	S	153	76	-77	-50%	7.2	Y	N	Y	Y	145	75	-70	-48%	6.7	Y	N	Y	Y	3	1	-2	-61%	1.4	Y	Y	Y	Y	5	-	-5	-100%	3.1	Y	Y	Y	Y
Bitterne Road	W	710	973	262	37%	9.0	N	N	N	Y	628	919	291	46%	10.5	N	N	N	N	53	50	-2	-4%	0.3	Y	Y	Y	Y	28	-	-28	-100%	7.5	Y	N	N	Y
Shales Road south of Taunton Drive	S	64	125	61	96%	6.3	Y	N	Y	Y	59	118	59	99%	6.2	Y	N	Y	Y	3	4	1	34%	0.5	Y	Y	Y	Y	2	2	1	45%	0.5	Y	Y	Y	Y
West End Road	W	874	940	66	8%	2.2	Y	Y	Y	Y	781	832	51	7%	1.8	Y	Y	Y	Y	70	69	-1	-1%	0.1	Y	Y	Y	Y	20	37	17	83%	3.1	Y	Y	Y	Y
Townhill Way	S	448	383	-65	-15%	3.2	Y	Y	Y	Y	386	346	-40	-10%	2.1	Y	Y	Y	Y	34	21	-13	-38%	2.5	Y	Y	Y	Y	27	3	-25	-91%	6.4	Y	N	Y	Y
Wakefield Road north of Cornwall Road	S	124	92	-31	-25%	3.0	Y	Y	Y	Y	114	87	-27	-24%	2.7	Y	Y	Y	Y	6	1	-5	-79%	2.6	Y	Y	Y	Y	3	0	-3	-95%	2.4	Y	Y	Y	Y
Northfield Road		22	22	-							22	22	-							0	0	-							0	0	-						
Foresthill Drive north of Woodmill Lane	W	154	104	-50	-32%	4.4	Y	Y	Y	Y	140	98	-42	-30%	3.9	Y	Y	Y	Y	11	5	-6	-58%	2.3	Y	Y	Y	Y	4	2	-1	-37%	0.8	Y	Y	Y	Y
		5,686	**5,543**	**-143**	**-2.5%**	**1.9**	**86%**	**57%**	**79%**	**93%**	**4,959**	**4,796**	**-163**	**-3.3%**	**2.3**	**79%**	**43%**	**79%**	**86%**	**464**	**443**	**-21**	**-4.6%**	**1.0**	**100%**	**86%**	**100%**	**100%**	**250**	**244**	**-6**	**-2.3%**	**0.4**	**100%**	**86%**	**93%**	**100%**
25 Bitterne Southwest to Northeast																																					
Eastbound																																					
Victoria Road		8	8	-							-	-	-							-	-	-							-	-	-						
Archery Road	N	446	211	-235	-53%	13.0	N	N	N	N	391	190	-201	-51%	11.8	N	N	N	N	32	16	-16	-51%	3.3	Y	Y	Y	Y	22	5	-17	-79%	4.7	Y	Y	Y	Y
Portsmouth Road	E	871	971	100	11%	3.3	Y	Y	Y	Y	814	922	108	13%	3.7	Y	Y	Y	Y	39	36	-3	-7%	0.4	Y	Y	Y	Y	16	4	-12	-73%	3.7	Y	Y	Y	Y
STATION ROAD	E	126	176	50	40%	4.1	Y	Y	Y	Y	107	163	56	52%	4.8	Y	Y	Y	Y	9	4	-6	-61%	2.3	Y	Y	Y	Y	8	0	-8	-100%	4.1	Y	Y	Y	Y
South East Road	E	227	460	233	102%	12.6	N	N	N	N	208	443	234	112%	13.0	N	N	N	N	15	14	-1	-10%	0.4	Y	Y	Y	Y	4	4	0	10%	0.2	Y	Y	Y	Y
Bursledon Road West of NE Road	S	659	393	-267	-40%	11.6	N	N	N	N	586	328	-258	-44%	12.1	N	N	N	N	49	13	-36	-73%	6.5	Y	N	Y	Y	24	34	10	40%	1.8	Y	Y	Y	Y
A334 Thornhill Park Road	E	590	721	131	22%	5.1	N	N	Y	Y	509	650	140	28%	5.8	N	N	Y	Y	58	70	13	22%	1.6	Y	Y	Y	Y	22	-	-22	-100%	6.6	Y	N	Y	Y
Pine Drive	S	48	36	-12	-25%	1.8	Y	Y	Y	Y	42	34	-8	-19%	1.3	Y	Y	Y	Y	5	2	-3	-54%	1.4	Y	Y	Y	Y	1	-	-1	-100%	1.6	Y	Y	Y	Y
A27 Moorhill Road		679	736	57	8%	2.2	Y	Y	Y	Y	577	627	50	9%	2.0	Y	Y	Y	Y	68	63	-5	-7%	0.6	Y	Y	Y	Y	34	47	13	38%	2.0	Y	Y	Y	Y
Botley Road	E	807	637	-170	-21%	6.3	N	N	Y	Y	706	502	-204	-29%	8.3	N	N	N	Y	74	79	5	7%	0.6	Y	Y	Y	Y	24	53	29	117%	4.6	Y	Y	Y	Y
		4,462	**4,350**	**-112**	**-2.5%**	**1.7**	**44%**	**44%**	**67%**	**67%**	**3,942**	**3,859**	**-83**	**-2.1%**	**1.3**	**44%**	**44%**	**56%**	**67%**	**349**	**297**	**-52**	**-14.8%**	**2.9**	**100%**	**89%**	**100%**	**100%**	**156**	**147**	**-9**	**-6.0%**	**0.8**	**100%**	**89%**	**100%**	**100%**
Westbound																																					
Victoria Road		8	8	-							-	-	-							-	-	-							-	-	-						
Archery Road	S	238	229	-9	-4%	0.6	Y	Y	Y	Y	206	201	-5	-3%	0.4	Y	Y	Y	Y	19	25	7	37%	1.5	Y	Y	Y	Y	13	2	-10	-82%	3.8	Y	Y	Y	Y
Portsmouth Road	W	1,075	1,214	139	13%	4.1	Y	Y	Y	Y	977	1,127	150	15%	4.6	N	Y	Y	Y	72	77	5	7%	0.6	Y	Y	Y	Y	25	2	-23	-92%	6.2	Y	N	Y	Y
STATION ROAD	W	225	142	-83	-37%	6.1	Y	N	Y	Y	193	132	-61	-32%	4.8	Y	Y	Y	Y	18	2	-16	-88%	4.9	Y	Y	Y	Y	10	-	-10	-100%	4.4	Y	Y	Y	Y
South East Road	W	356	475	119	33%	5.8	N	N	Y	Y	327	439	113	34%	5.8	N	N	Y	Y	22	22	0	0%	0.0	Y	Y	Y	Y	8	14	6	82%	1.9	Y	Y	Y	Y
Bursledon Road West of NE Road	N	664	594	-70	-11%	2.8	Y	Y	Y	Y	552	456	-96	-17%	4.3	Y	Y	Y	Y	64	23	-41	-64%	6.2	Y	N	Y	Y	46	96	51	112%	6.0	Y	N	Y	Y
A334 Thornhill Park Road	W	822	688	-134	-16%	4.9	N	Y	Y	Y	738	657	-81	-11%	3.1	Y	Y	Y	Y	56	30	-26	-47%	4.0	Y	Y	Y	Y	27	-	-27	-100%	7.3	Y	N	Y	Y
Pine Drive	N	53	86	33	63%	4.0	Y	Y	Y	Y	48	83	35	73%	4.3	Y	Y	Y	Y	4	3	-1	-18%	0.4	Y	Y	Y	Y	1	-	-1	-100%	1.5	Y	Y	Y	Y
A27 Moorhill Road	S	690	833	143	21%	5.2	N	N	Y	Y	629	745	115	18%	4.4	N	Y	Y	Y	44	45	1	2%	0.1	Y	Y	Y	Y	16	43	28	176%	5.1	Y	N	Y	Y
Botley Road	W	655	684	29	4%	1.1	Y	Y	Y	Y	592	565	-27	-5%	1.1	Y	Y	Y	Y	48	72	24	50%	3.1	Y	Y	Y	Y	14	44	29	207%	5.5	Y	N	Y	Y
		4,785	**4,953**	**167**	**3.5%**	**2.4**	**67%**	**67%**	**100%**	**100%**	**4,263**	**4,405**	**142**	**3.3%**	**2.2**	**67%**	**89%**	**100%**	**100%**	**346**	**299**	**-47**	**-13.5%**	**2.6**	**100%**	**89%**	**100%**	**100%**	**158**	**202**	**44**	**27.6%**	**3.3**	**100%**	**44%**	**100%**	**100%**
116 Motorway - M27																																					
Eastbound																																					
J2 to J3	E	4,023	5,169	1,145	28%	16.9	N	N	N	N	3,410	4,376	965	28%	15.5	N	N	N	N	254	328	74	29%	4.4	Y	Y	Y	Y	359	465	106	29%	5.2	N	N	Y	Y
J3 to J4	E	6,271	6,185	-86	-1%	1.1	Y	Y	Y	Y	5,315	5,199	-116	-2%	1.6	Y	Y	Y	Y	396	387	-9	-2%	0.5	Y	Y	Y	Y	560	599	40	7%	1.6	Y	Y	Y	Y
J4 to J5	E	5,072	4,653	-419	-8%	6.0	N	N	Y	Y	4,299	4,070	-228	-5%	3.5	Y	Y	Y	Y	349	335	-14	-4%	0.8	Y	Y	Y	Y	424	248	-177	-42%	9.6	N	N	N	Y
J5 to J7	E	5,507	5,299	-208	-4%	2.8	Y	Y	Y	Y	4,667	4,414	-253	-5%	3.8	Y	Y	Y	Y	379	402	22	6%	1.1	Y	Y	Y	Y	461	484	23	5%	1.1	Y	Y	Y	Y
J7 to J8	E	5,272	5,076	-196	-4%	2.7	Y	Y	Y	Y	4,468	4,201	-267	-6%	4.1	Y	Y	Y	Y	363	376	12	3%	0.6	Y	Y	Y	Y	441	499	58	13%	2.7	Y	Y	Y	Y
Westbound																																					
J8 to J7	W	6,106	5,925	-181	-3%	2.3	Y	Y	Y	Y	5,297	5,078	-220	-4%	3.1	Y	Y	Y	Y	409	426	18	4%	0.9	Y	Y	Y	Y	400	421	21	5%	1.0	Y	Y	Y	Y
J7 to J5	W	7,138	6,297	-841	-12%	10.3	N	N	N	N	6,192	5,555	-638	-10%	8.3	N	N	N	Y	478	439	-39	-8%	1.8	Y	Y	Y	Y	468	303	-165	-35%	8.4	N	N	N	Y
J5 to J4	W	5,692	5,113	-579	-10%	7.9	N	N	N	Y	4,938	4,514	-424	-9%	6.2	N	N	Y	Y	381	359	-22	-6%	1.1	Y	Y	Y	Y	373	240	-133	-36%	7.6	N	N	N	Y
J4 to J3	W	5,386	5,350	-36	-1%	0.5	Y	Y	Y	Y	4,449	4,381	-68	-2%	1.0	Y	Y	Y	Y	430	444	15	3%	0.7	Y	Y	Y	Y	508	525	18	4%	0.8	Y	Y	Y	Y
J3 to J2	W	4,000	4,114	114	3%	1.8	Y	Y	Y	Y	3,304	3,351	47	1%	0.8	Y	Y	Y	Y	319	330	11	4%	0.6	Y	Y	Y	Y	377	433	56	15%	2.8	Y	Y	Y	Y
118 Motorway - M3																																					
Eastbound																																					
J14 to J13	E	6,419	6,419	-							5,535	5,535	-							371	371	-							514	514	-						
Westbound																																					
J13 to J14	W	2,550	2,884	334	13%	6.4	Y	N	Y	Y	2,119	2,224	105	5%	2.3	Y	Y	Y	Y	149	209	60	40%	4.5	Y	Y	Y	Y	283	452	169	60%	8.8	N	N	N	Y

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

IP
Vehicles

Cordon/ Screenline	Dir	Sites	Cordon and Screenlines Validation: Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	7.5%	10.0%	Link Validation: WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	7,571	7,668	97	1.3%	1.1	Y	Y	Y	Y	75%	56%	75%	81%
1 Fareham Enclosure	Inbound	16	7,844	7,950	106	1.4%	1.2	Y	Y	Y	Y	63%	56%	81%	88%
2 Havant Enclosure	Outbound	11	4,489	4,325	-164	-3.7%	2.5	Y	Y	Y	Y	73%	73%	73%	91%
2 Havant Enclosure	Inbound	11	4,579	4,460	-118	-2.6%	1.8	Y	Y	Y	Y	73%	73%	82%	82%
3 Hayling Island Enclosure	Outbound	1	912	926	14	1.6%	0.5	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	945	958	13	1.3%	0.4	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	3,815	3,995	180	4.7%	2.9	Y	Y	Y	Y	75%	75%	75%	75%
4 Hedge End Enclosure	Inbound	8	4,328	4,394	66	1.5%	1.0	Y	Y	Y	Y	50%	63%	75%	88%
5 Waterlooville Enclosure	Outbound	18	7,469	7,240	-229	-3.1%	2.7	Y	Y	Y	Y	50%	50%	67%	83%
5 Waterlooville Enclosure	Inbound	18	7,630	7,400	-230	-3.0%	2.6	Y	Y	Y	Y	56%	56%	67%	83%
71 Portsmouth South Enclosure	Outbound	6	3,571	3,538	-33	-0.9%	0.6	Y	Y	Y	Y	67%	67%	100%	100%
71 Portsmouth South Enclosure	Inbound	6	3,833	3,760	-73	-1.9%	1.2	Y	Y	Y	Y	83%	83%	83%	83%
72 Portsmouth North Enclosure	Outbound	8	5,711	5,563	-148	-2.6%	2.0	Y	Y	Y	Y	67%	67%	83%	100%
72 Portsmouth North Enclosure	Inbound	8	5,628	5,583	-45	-0.8%	0.6	Y	Y	Y	Y	100%	88%	100%	100%
8 Southampton City Enclosure	Outbound	12	4,983	4,984	1	0.0%	0.0	Y	Y	Y	Y	50%	50%	58%	67%
8 Southampton City Enclosure	Inbound	12	4,883	4,642	-241	-4.9%	3.5	Y	Y	Y	Y	42%	42%	50%	58%
91 Bitterne West Screenline	Eastbound	5	3,207	2,984	-223	-6.9%	4.0	Y	N	Y	Y	100%	100%	100%	100%
91 Bitterne West Screenline	Westbound	5	2,912	2,664	-248	-8.5%	4.7	N	N	N	Y	80%	80%	100%	100%
92 Bitterne East Screenline	Eastbound	4	2,720	2,788	68	2.5%	1.3	Y	Y	Y	Y	50%	50%	75%	100%
92 Bitterne East Screenline	Westbound	4	2,561	2,629	68	2.7%	1.3	Y	Y	Y	Y	75%	75%	100%	100%
10 Locks Heath North Screenline	Outbound	9	4,635	4,871	236	5.1%	3.4	Y	N	Y	Y	78%	78%	78%	89%
10 Locks Heath North Screenline	Inbound	9	4,698	4,910	212	4.5%	3.1	Y	Y	Y	Y	78%	56%	89%	100%
11 Totton Enclosure	Outbound	19	6,430	6,557	127	2.0%	1.6	Y	Y	Y	Y	50%	44%	61%	78%
11 Totton Enclosure	Inbound	19	6,825	6,802	-24	-0.3%	0.3	Y	Y	Y	Y	72%	56%	67%	72%
12 Eastleigh Enclosure	Outbound	11	3,776	3,654	-122	-3.2%	2.0	Y	Y	Y	Y	82%	73%	91%	100%
12 Eastleigh Enclosure	Inbound	11	3,636	3,366	-270	-7.4%	4.6	N	N	Y	Y	82%	82%	91%	100%
13 Southampton Enclosure	Outbound	14	9,677	9,578	-99	-1.0%	1.0	Y	Y	Y	Y	71%	64%	79%	86%
13 Southampton Enclosure	Inbound	14	9,305	9,108	-197	-2.1%	2.1	Y	Y	Y	Y	64%	57%	71%	93%
36 Solent RSI Cordon	Northbound	3	161	59	-102	-63.4%	9.7	N	N	N	N	100%	67%	67%	67%
36 Solent RSI Cordon	Southbound	3	159	78	-82	-51.3%	7.5	N	N	N	N	100%	67%	67%	67%
Total	**Total**	290	138,894	137,436	-1,459	-1.1%		87%	80%	90%	93%	68%	63%	76%	85%
Calibration Screenlines															
20 Totton	Eastbound	8	2,469	2,535	66	2.7%	1.3	Y	Y	Y	Y	63%	38%	63%	75%
20 Totton	Westbound	8	2,699	2,832	134	5.0%	2.5	Y	Y	Y	Y	38%	50%	63%	88%
21 North of Southampton	Eastbound	15	8,273	8,377	104	1.3%	1.1	Y	Y	Y	Y	40%	27%	40%	53%
21 North of Southampton	Westbound	15	8,405	8,469	64	0.8%	0.7	Y	Y	Y	Y	60%	33%	33%	53%
22 South of Southampton	Eastbound	7	3,812	3,698	-114	-3.0%	1.9	Y	Y	Y	Y	29%	29%	29%	71%
22 South of Southampton	Westbound	7	4,038	4,005	-34	-0.8%	0.5	Y	Y	Y	Y	43%	43%	57%	71%
23 Eastleigh	Eastbound	6	6,152	6,342	191	3.1%	2.4	Y	Y	Y	Y	67%	83%	100%	100%
23 Eastleigh	Westbound	6	6,236	6,426	189	3.0%	2.4	Y	Y	Y	Y	67%	67%	67%	100%
24 Bitterne Northwest to Southeast	Eastbound	15	4,162	4,199	37	0.9%	0.6	Y	Y	Y	Y	64%	50%	71%	71%
24 Bitterne Northwest to Southeast	Westbound	15	4,319	3,866	-453	-10.5%	7.1	N	N	N	N	79%	50%	79%	86%
25 Bitterne Southwest to Northeast	Eastbound	10	3,647	3,534	-112	-3.1%	1.9	Y	Y	Y	Y	67%	67%	89%	100%
25 Bitterne Southwest to Northeast	Westbound	10	3,548	3,428	-119	-3.4%	2.0	Y	Y	Y	Y	78%	56%	78%	100%
26 Fareham North South	Eastbound	9	5,261	5,529	268	5.1%	3.6	Y	N	Y	Y	78%	67%	78%	89%
26 Fareham North South	Westbound	9	5,706	5,774	68	1.2%	0.9	Y	Y	Y	Y	63%	38%	50%	100%
271 Locks Heath West to East	Northbound	11	3,000	3,076	76	2.5%	1.4	Y	Y	Y	Y	82%	73%	82%	82%
271 Locks Heath West to East	Southbound	11	3,042	3,067	25	0.8%	0.5	Y	Y	Y	Y	82%	64%	82%	91%
272 Fareham West to East	Northbound	4	1,435	1,420	-15	-1.0%	0.4	Y	Y	Y	Y	75%	75%	75%	100%
272 Fareham West to East	Southbound	4	1,377	1,365	-12	-0.9%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
28 Gosport	Northbound	6	2,524	2,473	-50	-2.0%	1.0	Y	Y	Y	Y	50%	67%	83%	83%
28 Gosport	Southbound	6	2,472	2,419	-53	-2.1%	1.1	Y	Y	Y	Y	83%	67%	67%	83%
29 Portsmouth NorthSouth	Eastbound	16	7,769	7,816	47	0.6%	0.5	Y	Y	Y	Y	56%	38%	56%	75%
29 Portsmouth NorthSouth	Westbound	17	8,075	8,012	-63	-0.8%	0.7	Y	Y	Y	Y	65%	47%	71%	94%
30 Portsmouth EastWest	Northbound	9	4,984	4,930	-54	-1.1%	0.8	Y	Y	Y	Y	67%	67%	67%	89%
30 Portsmouth EastWest	Southbound	9	5,010	4,866	-144	-2.9%	2.0	Y	Y	Y	Y	67%	33%	67%	89%
31 Cosham	Eastbound	5	5,241	5,516	275	5.2%	3.7	Y	N	Y	Y	60%	60%	60%	60%
31 Cosham	Westbound	5	5,131	5,379	248	4.8%	3.4	Y	Y	Y	Y	60%	60%	60%	60%
32 Waterlooville North to South	Eastbound	15	8,268	7,986	-282	-3.4%	3.1	Y	Y	Y	Y	80%	73%	87%	93%
32 Waterlooville North to South	Westbound	15	8,210	8,023	-187	-2.3%	2.1	Y	Y	Y	Y	87%	87%	87%	93%
33 Waterlooville West to East	Northbound	5	2,977	3,049	71	2.4%	1.3	Y	Y	Y	Y	60%	60%	80%	100%
33 Waterlooville West to East	Southbound	5	3,312	3,389	77	2.3%	1.3	Y	Y	Y	Y	60%	60%	80%	80%
34 Havant North South	Eastbound	7	3,795	3,846	51	1.4%	0.8	Y	Y	Y	Y	71%	43%	71%	100%
34 Havant North South	Westbound	7	3,808	3,817	9	0.2%	0.1	Y	Y	Y	Y	100%	86%	100%	100%
35 Havant East West	Northbound	11	4,098	4,218	120	2.9%	1.9	Y	Y	Y	Y	73%	55%	64%	73%
35 Havant East West	Southbound	11	4,165	4,433	268	6.4%	4.1	N	N	Y	Y	82%	73%	73%	82%
201 Winchester Cordon	Outbound	15	3,678	3,536	-142	-3.9%	2.4	Y	Y	Y	Y	100%	87%	100%	100%
201 Winchester Cordon	Inbound	15	3,616	3,509	-107	-2.9%	1.8	Y	Y	Y	Y	93%	80%	100%	100%
Total		349	164,709	165,157	447	0.3%		94%	89%	97%	97%	70%	58%	72%	85%
Motorways															
M27	Eastbound	14										100%	93%	100%	100%
M27	Westbound	14										100%	100%	100%	100%
M3	Eastbound	6										100%	100%	100%	100%
M3	Westbound	6										80%	80%	80%	80%
A3(M)	Northbound	4										100%	100%	100%	100%
A3(M)	Southbound	4										100%	100%	100%	100%
M275	Northbound	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										100%	100%	100%	100%
Total	**Total**	54										98%	96%	98%	98%
Overall								91%	85%	94%	95%	71%	63%	76%	86%

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

IP
Car

Cordon and Screenlines Validation / **Link Validation**

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	WebTAG within 7.5%	WebTAG within 10.0%	WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	6,353	6,406	53	0.8%	0.7	Y	Y	Y	Y	88%	56%	75%	88%
1 Fareham Enclosure	Inbound	16	6,558	6,618	60	0.9%	0.7	Y	Y	Y	Y	75%	63%	81%	88%
2 Havant Enclosure	Outbound	11	3,847	3,744	-103	-2.7%	1.7	Y	Y	Y	Y	73%	73%	73%	100%
2 Havant Enclosure	Inbound	11	3,846	3,750	-96	-2.5%	1.6	Y	Y	Y	Y	73%	64%	91%	91%
3 Hayling Island Enclosure	Outbound	1	715	713	-3	-0.4%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	812	819	6	0.8%	0.2	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	3,216	3,231	14	0.4%	0.3	Y	Y	Y	Y	63%	63%	75%	75%
4 Hedge End Enclosure	Inbound	8	3,662	3,694	32	0.9%	0.5	Y	Y	Y	Y	75%	63%	75%	88%
5 Waterlooville Enclosure	Outbound	18	6,121	6,029	-93	-1.5%	1.2	Y	Y	Y	Y	61%	44%	67%	83%
5 Waterlooville Enclosure	Inbound	18	6,394	6,298	-96	-1.5%	1.2	Y	Y	Y	Y	61%	56%	67%	89%
71 Portsmouth South Enclosure	Outbound	6	3,127	3,062	-65	-2.1%	1.2	Y	Y	Y	Y	67%	67%	100%	100%
71 Portsmouth South Enclosure	Inbound	6	3,338	3,256	-83	-2.5%	1.4	Y	Y	Y	Y	83%	83%	83%	100%
72 Portsmouth North Enclosure	Outbound	8	4,819	4,734	-85	-1.8%	1.2	Y	Y	Y	Y	83%	83%	83%	100%
72 Portsmouth North Enclosure	Inbound	8	4,767	4,728	-39	-0.8%	0.6	Y	Y	Y	Y	100%	100%	100%	100%
8 Southampton City Enclosure	Outbound	12	4,172	4,089	-83	-2.0%	1.3	Y	Y	Y	Y	42%	42%	58%	67%
8 Southampton City Enclosure	Inbound	12	3,999	3,785	-214	-5.4%	3.4	Y	N	Y	Y	42%	33%	67%	67%
91 Bitterne West Screenline	Eastbound	5	2,793	2,675	-118	-4.2%	2.3	Y	Y	Y	Y	100%	100%	100%	100%
91 Bitterne West Screenline	Westbound	5	2,547	2,432	-115	-4.5%	2.3	Y	Y	Y	Y	100%	100%	100%	100%
92 Bitterne East Screenline	Eastbound	4	2,297	2,309	11	0.5%	0.2	Y	Y	Y	Y	50%	50%	100%	100%
92 Bitterne East Screenline	Westbound	4	2,123	2,141	18	0.9%	0.4	Y	Y	Y	Y	50%	50%	100%	100%
10 Locks Heath North Screenline	Outbound	9	3,761	3,917	155	4.1%	2.5	Y	Y	Y	Y	78%	78%	89%	89%
10 Locks Heath North Screenline	Inbound	9	3,715	3,832	116	3.1%	1.9	Y	Y	Y	Y	78%	56%	89%	89%
11 Totton Enclosure	Outbound	19	5,304	5,300	-4	-0.1%	0.1	Y	Y	Y	Y	72%	50%	56%	67%
11 Totton Enclosure	Inbound	19	5,407	5,398	-9	-0.2%	0.1	Y	Y	Y	Y	78%	50%	72%	72%
12 Eastleigh Enclosure	Outbound	11	2,981	2,823	-158	-5.3%	2.9	Y	N	Y	Y	73%	55%	82%	100%
12 Eastleigh Enclosure	Inbound	11	3,057	2,796	-261	-8.5%	4.8	N	N	N	Y	82%	82%	82%	91%
13 Southampton Enclosure	Outbound	14	8,282	8,218	-65	-0.8%	0.7	Y	Y	Y	Y	79%	71%	86%	93%
13 Southampton Enclosure	Inbound	14	8,044	7,947	-97	-1.2%	1.1	Y	Y	Y	Y	79%	71%	71%	93%
36 Solent RSI Cordon	Northbound	3	123	59	-64	-52.4%	6.8	N	N	N	N	100%	67%	67%	67%
36 Solent RSI Cordon	Southbound	3	136	78	-58	-42.9%	5.6	N	N	N	N	100%	67%	67%	100%
Total	**Total**	290	116,318	114,878	-1,440	-1.2%		90%	83%	90%	93%	73%	62%	77%	87%
Calibration Screenlines															
20 Totton	Eastbound	8	1,966	1,990	25	1.3%	0.6	Y	Y	Y	Y	75%	38%	63%	75%
20 Totton	Westbound	8	2,194	2,277	82	3.7%	1.7	Y	Y	Y	Y	50%	50%	75%	88%
21 North of Southampton	Eastbound	15	6,953	6,917	-36	-0.5%	0.4	Y	Y	Y	Y	53%	33%	40%	53%
21 North of Southampton	Westbound	15	6,992	6,981	-11	-0.2%	0.1	Y	Y	Y	Y	60%	33%	40%	53%
22 South of Southampton	Eastbound	7	3,365	3,252	-113	-3.4%	2.0	Y	Y	Y	Y	29%	29%	29%	57%
22 South of Southampton	Westbound	7	3,556	3,478	-78	-2.2%	1.3	Y	Y	Y	Y	57%	57%	71%	71%
23 Eastleigh	Eastbound	6	5,096	5,214	118	2.3%	1.6	Y	Y	Y	Y	67%	67%	100%	100%
23 Eastleigh	Westbound	6	5,101	5,207	106	2.1%	1.5	Y	Y	Y	Y	67%	67%	67%	100%
24 Bitterne Northwest to Southeast	Eastbound	15	3,682	3,714	32	0.9%	0.5	Y	Y	Y	Y	79%	57%	71%	79%
24 Bitterne Northwest to Southeast	Westbound	15	3,766	3,360	-406	-10.8%	6.8	N	N	N	N	71%	57%	71%	93%
25 Bitterne Southwest to Northeast	Eastbound	10	3,228	3,177	-52	-1.6%	0.9	Y	Y	Y	Y	67%	67%	89%	100%
25 Bitterne Southwest to Northeast	Westbound	10	3,157	3,105	-51	-1.6%	0.9	Y	Y	Y	Y	67%	44%	78%	100%
26 Fareham North South	Eastbound	9	4,354	4,480	126	2.9%	1.9	Y	Y	Y	Y	89%	67%	78%	89%
26 Fareham North South	Westbound	9	4,648	4,697	48	1.0%	0.7	Y	Y	Y	Y	88%	38%	88%	100%
271 Locks Heath West to East	Northbound	11	2,570	2,618	48	1.9%	0.9	Y	Y	Y	Y	82%	73%	82%	82%
271 Locks Heath West to East	Southbound	11	2,597	2,628	31	1.2%	0.6	Y	Y	Y	Y	91%	64%	91%	91%
272 Fareham West to East	Northbound	4	1,238	1,233	-5	-0.4%	0.1	Y	Y	Y	Y	75%	75%	75%	100%
272 Fareham West to East	Southbound	4	1,162	1,157	-5	-0.4%	0.2	Y	Y	Y	Y	100%	100%	100%	100%
28 Gosport	Northbound	6	2,191	2,170	-22	-1.0%	0.5	Y	Y	Y	Y	33%	67%	83%	83%
28 Gosport	Southbound	6	2,165	2,142	-23	-1.0%	0.5	Y	Y	Y	Y	67%	67%	67%	83%
29 Portsmouth NorthSouth	Eastbound	16	6,511	6,532	22	0.3%	0.3	Y	Y	Y	Y	63%	44%	56%	81%
29 Portsmouth NorthSouth	Westbound	17	6,931	6,905	-26	-0.4%	0.3	Y	Y	Y	Y	65%	47%	71%	94%
30 Portsmouth EastWest	Northbound	9	4,224	4,178	-47	-1.1%	0.7	Y	Y	Y	Y	78%	56%	78%	100%
30 Portsmouth EastWest	Southbound	9	4,317	4,260	-57	-1.3%	0.9	Y	Y	Y	Y	67%	44%	67%	100%
31 Cosham	Eastbound	5	4,364	4,494	130	3.0%	2.0	Y	Y	Y	Y	60%	60%	60%	60%
31 Cosham	Westbound	5	4,280	4,396	116	2.7%	1.8	Y	Y	Y	Y	60%	60%	60%	80%
32 Waterlooville North to South	Eastbound	15	6,989	6,736	-252	-3.6%	3.0	Y	Y	Y	Y	87%	80%	87%	87%
32 Waterlooville North to South	Westbound	15	6,956	6,743	-213	-3.1%	2.6	Y	Y	Y	Y	87%	87%	87%	93%
33 Waterlooville West to East	Northbound	5	2,574	2,607	33	1.3%	0.7	Y	Y	Y	Y	80%	80%	80%	100%
33 Waterlooville West to East	Southbound	5	2,784	2,841	57	2.1%	1.1	Y	Y	Y	Y	60%	60%	80%	80%
34 Havant North South	Eastbound	7	3,243	3,197	-45	-1.4%	0.8	Y	Y	Y	Y	86%	57%	86%	100%
34 Havant North South	Westbound	7	3,252	3,277	25	0.8%	0.4	Y	Y	Y	Y	100%	86%	100%	100%
35 Havant East West	Northbound	11	3,501	3,532	32	0.9%	0.5	Y	Y	Y	Y	73%	55%	64%	82%
35 Havant East West	Southbound	11	3,542	3,728	186	5.2%	3.1	Y	N	Y	Y	82%	64%	82%	91%
201 Winchester Cordon	Outbound	15	3,056	2,965	-91	-3.0%	1.7	Y	Y	Y	Y	100%	92%	100%	100%
201 Winchester Cordon	Inbound	15	3,054	2,962	-92	-3.0%	1.7	Y	Y	Y	Y	100%	85%	100%	100%
Total		349	139,560	139,150	-410	-0.3%		97%	94%	97%	97%	74%	60%	75%	87%
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										80%	80%	80%	80%
A3(M)	Northbound	4										100%	100%	100%	100%
A3(M)	Southbound	4										100%	100%	100%	100%
M275	Northbound	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										100%	100%	100%	100%
Total	**Total**	54										98%	98%	98%	98%
Overall								94%	89%	94%	95%	75%	64%	78%	88%

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST
SRTM 2015
CORDONS AND SCREENLINES

IP VEHICLES

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	1,451	1,524	73	5%	1.9	Y	Y	Y	Y
Central Station Bridge	N	525	491	-35	-7%	1.5	Y	Y	Y	Y
Blechynden Terrace	W	104	330	225	216%	15.3	N	N	N	N
Cumberland Place	N	573	271	-302	-53%	14.7	N	N	N	N
Above Bar Street - (one way this direction)	N	93	269	176	190%	13.1	N	N	N	N
East Park Terrace	N	287	141	-145	-51%	9.9	N	N	N	Y
New Road	E	349	270	-79	-23%	4.5	Y	Y	Y	Y
Kingsway	N	427	313	-114	-27%	5.9	N	N	Y	Y
St Marys Street	N	134	449	314	234%	18.4	N	N	N	N
Britannia Road	N	231	274	43	19%	2.7	Y	Y	Y	Y
Princes Street	W	266	207	-60	-22%	3.9	Y	Y	Y	Y
Itchen Bridge	E	542	446	-96	-18%	4.3	Y	Y	Y	Y
		4,983	**4,984**	**1**	**0.0%**	**0.0**	**50%**	**50%**	**58%**	**67%**
Inbound										
A33 Mountbatten Way	E	1,470	1,489	18	1%	0.5	Y	Y	Y	Y
Central Station Bridge	S	431	277	-153	-36%	8.2	N	N	N	Y
Blechynden Terrace	E	121	428	307	254%	18.5	N	N	N	N
Cumberland Place	S	568	180	-388	-68%	20.1	N	N	N	N
Above Bar Street - (one way in other direction)	N	93	269	176	190%	13.1	N	N	N	N
East Park Terrace	S	288	258	-30	-10%	1.8	Y	Y	Y	Y
New Road	W	359	289	-70	-20%	3.9	Y	Y	Y	Y
Kingsway	S	524	281	-243	-46%	12.1	N	N	N	N
St Marys Street	S	135	279	144	107%	10.0	N	N	N	N
Britannia Road	S	119	156	37	31%	3.1	Y	Y	Y	Y
Princes Street	E	295	368	73	25%	4.0	Y	Y	Y	Y
Itchen Bridge	W	481	368	-113	-23%	5.5	N	N	Y	Y
		4,883	**4,642**	**-241**	**-4.9%**	**3.5**	**42%**	**42%**	**50%**	**58%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	542	446	-96	-18%	4.3	Y	Y	Y	Y
Northam Bridge	E	1,078	936	-142	-13%	4.5	Y	Y	Y	Y
Cobden Bridge	E	686	602	-84	-12%	3.3	Y	Y	Y	Y
Woodmill Lane	S	286	352	66	23%	3.7	Y	Y	Y	Y
Mansbridge Road	E	615	648	33	5%	1.3	Y	Y	Y	Y
		3,207	**2,984**	**-223**	**-6.9%**	**4.0**	**100%**	**100%**	**100%**	**100%**
Westbound										
Itchen Bridge	W	481	368	-113	-23%	5.5	N	N	Y	Y
Northam Bridge	W	953	814	-139	-15%	4.7	Y	Y	Y	Y
Cobden Bridge	W	675	617	-58	-9%	2.3	Y	Y	Y	Y
Woodmill Lane	N	270	304	35	13%	2.1	Y	Y	Y	Y
Mansbridge Road	W	533	560	26	5%	1.1	Y	Y	Y	Y
		2,912	**2,664**	**-248**	**-8.5%**	**4.7**	**80%**	**80%**	**100%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	574	571	-4	-1%	0.2	Y	Y	Y	Y
A334 Charles Watts Way	E	834	597	-238	-28%	8.9	N	N	N	Y
St. John's Road	N	213	268	54	26%	3.5	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	1,099	1,353	255	23%	7.3	N	N	Y	Y
		2,720	**2,788**	**68**	**2.5%**	**1.3**	**50%**	**50%**	**75%**	**100%**
Westbound										
Botley Road	W	568	477	-92	-16%	4.0	Y	Y	Y	Y
A334 Charles Watts Way	W	782	775	-7	-1%	0.2	Y	Y	Y	Y
St. John's Road	S	183	122	-62	-34%	5.0	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	W	1,027	1,256	229	22%	6.8	N	N	Y	Y
		2,561	**2,629**	**68**	**2.7%**	**1.3**	**75%**	**75%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	1,151	1,204	53	5%	1.5	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	724	706	-17	-2%	0.7	Y	Y	Y	Y
Hill Street	N	4	-	-4	-100%	2.9	Y	Y	Y	Y
A36 east of A326	W	397	516	118	30%	5.5	N	N	Y	Y
A326 Totton Western Bypass south of A36	N	643	440	-203	-32%	8.7	N	N	N	Y
Loperwood Lane	N	26	204	178	681%	16.6	N	N	N	N
Loperwood	W	69	42	-27	-39%	3.6	Y	Y	Y	Y
Tatchbury Lane		2	2	-						
A336 westbound at junction to Bartley	W	363	251	-112	-31%	6.4	N	N	Y	Y
Woodlands Road	W	73	181	108	148%	9.6	N	N	N	Y
Foxhills	W	54	248	195	364%	15.9	N	N	N	N
A35 on dual close to Western Bypass	W	576	481	-95	-17%	4.1	Y	Y	Y	Y
Deerleap Lane	S	103	-	-103	-100%	14.4	N	N	N	N
Staplewood Lane	S	3	-	-3	-100%	2.4	Y	Y	Y	Y
Twiggs Lane	S	67	1	-66	-99%	11.4	Y	N	N	N
A326 Marchwood Bypass	S	953	1,026	74	8%	2.3	Y	Y	Y	Y
Hythe Road	S	205	172	-33	-16%	2.4	Y	Y	Y	Y
Marchwood Bypass	E	471	695	224	48%	9.3	N	N	N	Y
Marchwood Road	E	548	389	-159	-29%	7.4	N	N	Y	Y
		6,430	**6,557**	**127**	**2.0%**	**1.6**	**50%**	**44%**	**61%**	**78%**

IP CAR

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	1,249	1,293	44	4%	1.2	Y	Y	Y	Y
Central Station Bridge	N	451	422	-29	-6%	1.4	Y	Y	Y	Y
Blechynden Terrace	W	74	233	160	217%	12.9	N	N	N	N
Cumberland Place	N	492	226	-267	-54%	14.1	N	N	N	N
Above Bar Street - (one way this direction)	N	59	205	147	251%	12.8	N	N	N	N
East Park Terrace	N	239	120	-119	-50%	8.9	N	N	N	Y
New Road	E	297	197	-100	-34%	6.4	N	N	Y	Y
Kingsway	N	356	250	-107	-30%	6.1	N	N	Y	Y
St Marys Street	N	105	303	198	189%	13.9	N	N	N	N
Britannia Road	N	177	233	56	32%	3.9	Y	Y	Y	Y
Princes Street	W	195	191	-4	-2%	0.3	Y	Y	Y	Y
Itchen Bridge	E	479	416	-63	-13%	3.0	Y	Y	Y	Y
		4,172	**4,089**	**-83**	**-2.0%**	**1.3**	**42%**	**42%**	**58%**	**67%**
Inbound										
A33 Mountbatten Way	E	1,265	1,253	-12	-1%	0.3	Y	Y	Y	Y
Central Station Bridge	S	372	257	-115	-31%	6.5	N	N	Y	Y
Blechynden Terrace	E	59	319	260	441%	18.9	N	N	N	N
Cumberland Place	S	464	135	-329	-71%	19.0	N	N	N	N
Above Bar Street - (one way in other direction)	N	59	205	147	251%	12.8	N	N	N	N
East Park Terrace	S	247	203	-43	-18%	2.9	Y	Y	Y	Y
New Road	W	308	194	-114	-37%	7.2	N	N	Y	Y
Kingsway	S	417	212	-205	-49%	11.6	N	N	N	N
St Marys Street	S	117	210	93	80%	7.3	Y	N	Y	Y
Britannia Road	S	89	141	52	58%	4.8	Y	Y	Y	Y
Princes Street	E	207	318	111	54%	6.9	N	N	Y	Y
Itchen Bridge	W	396	338	-58	-15%	3.0	Y	Y	Y	Y
		3,999	**3,785**	**-214**	**-5.4%**	**3.4**	**42%**	**33%**	**67%**	**67%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	479	416	-63	-13%	3.0	Y	Y	Y	Y
Northam Bridge	E	928	856	-72	-8%	2.4	Y	Y	Y	Y
Cobden Bridge	E	601	545	-56	-9%	2.3	Y	Y	Y	Y
Woodmill Lane	S	258	312	54	21%	3.2	Y	Y	Y	Y
Mansbridge Road	E	527	546	19	4%	0.8	Y	Y	Y	Y
		2,793	**2,675**	**-118**	**-4.2%**	**2.3**	**100%**	**100%**	**100%**	**100%**
Westbound										
Itchen Bridge	W	396	338	-58	-15%	3.0	Y	Y	Y	Y
Northam Bridge	W	820	752	-68	-8%	2.4	Y	Y	Y	Y
Cobden Bridge	W	614	570	-43	-7%	1.8	Y	Y	Y	Y
Woodmill Lane	N	238	273	34	14%	2.2	Y	Y	Y	Y
Mansbridge Road	W	479	500	21	4%	0.9	Y	Y	Y	Y
		2,547	**2,432**	**-115**	**-4.5%**	**2.3**	**100%**	**100%**	**100%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	512	465	-47	-9%	2.1	Y	Y	Y	Y
A334 Charles Watts Way	E	712	539	-173	-24%	6.9	N	N	Y	Y
St. John's Road	N	194	243	49	26%	3.3	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	880	1,062	182	21%	5.8	N	N	Y	Y
		2,297	**2,309**	**11**	**0.5%**	**0.2**	**50%**	**50%**	**100%**	**100%**
Westbound										
Botley Road	W	513	390	-123	-24%	5.8	N	N	Y	Y
A334 Charles Watts Way	W	674	689	16	2%	0.6	Y	Y	Y	Y
St. John's Road	S	164	112	-52	-32%	4.4	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	W	772	950	177	23%	6.0	N	N	Y	Y
		2,123	**2,141**	**18**	**0.9%**	**0.4**	**50%**	**50%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	888	907	19	2%	0.6	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	681	660	-21	-3%	0.8	Y	Y	Y	Y
Hill Street	N	3	-	-3	-100%	2.5	Y	Y	Y	Y
A36 east of A326	W	302	375	74	24%	4.0	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	N	551	383	-168	-30%	7.8	N	N	N	Y
Loperwood Lane	N	23	172	149	663%	15.1	N	N	N	N
Loperwood	W	61	35	-26	-43%	3.8	Y	Y	Y	Y
Tatchbury Lane		2	2	-						
A336 westbound at junction to Bartley	W	304	211	-93	-31%	5.8	Y	N	Y	Y
Woodlands Road	W	65	157	92	143%	8.8	Y	N	N	Y
Foxhills	W	46	206	159	342%	14.2	N	N	N	N
A35 on dual close to Western Bypass	W	463	376	-86	-19%	4.2	Y	Y	Y	Y
Deerleap Lane	S	92	-	-92	-100%	13.5	Y	N	N	N
Staplewood Lane	S	2	-	-2	-100%	1.9	Y	Y	Y	Y
Twiggs Lane	S	57	0	-57	-100%	10.7	Y	N	N	N
A326 Marchwood Bypass	S	792	821	30	4%	1.0	Y	Y	Y	Y
Hythe Road	S	171	162	-10	-6%	0.8	Y	Y	Y	Y
Marchwood Bypass	E	357	581	224	63%	10.3	N	N	N	N
Marchwood Road	E	446	254	-192	-43%	10.3	N	N	N	N
		5,304	**5,300**	**-4**	**-0.1%**	**0.1**	**72%**	**50%**	**56%**	**67%**

IP LGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	140	157	17	12%	1.4	Y	Y	Y	Y
Central Station Bridge	N	54	68	13	25%	1.7	Y	Y	Y	Y
Blechynden Terrace	W	6	25	19	344%	4.9	Y	Y	Y	Y
Cumberland Place	N	45	21	-24	-53%	4.2	Y	Y	Y	Y
Above Bar Street - (one way this direction)	N	10	23	13	128%	3.2	Y	Y	Y	Y
East Park Terrace	N	29	9	-20	-69%	4.5	Y	Y	Y	Y
New Road	E	27	28	1	3%	0.2	Y	Y	Y	Y
Kingsway	N	42	39	-3	-8%	0.5	Y	Y	Y	Y
St Marys Street	N	24	102	79	334%	9.9	Y	N	N	Y
Britannia Road	N	33	21	-12	-35%	2.3	Y	Y	Y	Y
Princes Street	W	43	11	-33	-76%	6.3	Y	N	Y	Y
Itchen Bridge	E	26	2	-24	-91%	6.3	Y	N	Y	Y
		480	**507**	**26**	**5.5%**	**1.2**	**100%**	**75%**	**92%**	**100%**
Inbound										
A33 Mountbatten Way	E	142	167	25	18%	2.0	Y	Y	Y	Y
Central Station Bridge	S	46	19	-27	-58%	4.7	Y	Y	Y	Y
Blechynden Terrace	E	11	51	41	381%	7.3	Y	N	Y	Y
Cumberland Place	S	60	19	-41	-68%	6.5	Y	N	Y	Y
Above Bar Street - (one way in other direction)	N	10	23	13	128%	3.2	Y	Y	Y	Y
East Park Terrace	S	27	30	3	11%	0.5	Y	Y	Y	Y
New Road	W	31	44	12	40%	2.0	Y	Y	Y	Y
Kingsway	S	57	43	-14	-24%	2.0	Y	Y	Y	Y
St Marys Street	S	15	39	24	157%	4.6	Y	Y	Y	Y
Britannia Road	S	18	5	-13	-72%	3.8	Y	Y	Y	Y
Princes Street	E	52	34	-18	-34%	2.7	Y	Y	Y	Y
Itchen Bridge	W	49	2	-46	-95%	9.2	Y	N	N	Y
		517	**477**	**-40**	**-7.8%**	**1.8**	**100%**	**75%**	**92%**	**100%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	26	2	-24	-91%	6.3	Y	N	Y	Y
Northam Bridge	E	104	37	-67	-64%	7.9	Y	N	N	Y
Cobden Bridge	E	55	39	-16	-29%	2.3	Y	Y	Y	Y
Woodmill Lane	S	22	28	6	26%	1.2	Y	Y	Y	Y
Mansbridge Road	E	68	73	6	9%	0.7	Y	Y	Y	Y
		275	**180**	**-95**	**-34.6%**	**6.3**	**100%**	**60%**	**80%**	**100%**
Westbound										
Itchen Bridge	W	49	2	-46	-95%	9.2	Y	N	N	Y
Northam Bridge	W	92	21	-71	-77%	9.4	Y	N	N	Y
Cobden Bridge	W	34	26	-8	-23%	1.4	Y	Y	Y	Y
Woodmill Lane	N	24	18	-7	-27%	1.4	Y	Y	Y	Y
Mansbridge Road	W	39	42	3	8%	0.5	Y	Y	Y	Y
		238	**110**	**-128**	**-53.8%**	**9.7**	**100%**	**60%**	**60%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	43	60	17	39%	2.4	Y	Y	Y	Y
A334 Charles Watts Way	E	86	52	-34	-40%	4.1	Y	Y	Y	Y
St. John's Road	N	16	25	9	55%	1.9	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	129	165	35	27%	2.9	Y	Y	Y	Y
		274	**301**	**27**	**10.0%**	**1.6**	**100%**	**100%**	**100%**	**100%**
Westbound										
Botley Road	W	40	50	10	26%	1.5	Y	Y	Y	Y
A334 Charles Watts Way	W	73	66	-7	-10%	0.8	Y	Y	Y	Y
St. John's Road	S	16	10	-6	-37%	1.6	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	W	165	202	37	22%	2.7	Y	Y	Y	Y
		292	**327**	**34**	**11.8%**	**2.0**	**100%**	**100%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	151	171	20	13%	1.6	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	26	6	-20	-77%	5.0	Y	N	Y	Y
Hill Street	N	1	-	-1	-100%	1.2	Y	Y	Y	Y
A36 east of A326	W	53	90	38	72%	4.5	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	N	62	41	-21	-34%	2.9	Y	Y	Y	Y
Loperwood Lane	N	3	19	16	570%	4.8	Y	Y	Y	Y
Loperwood	W	6	5	-1	-20%	0.5	Y	Y	Y	Y
Tatchbury Lane		0	0	-						
A336 westbound at junction to Bartley	W	38	25	-13	-33%	2.3	Y	Y	Y	Y
Woodlands Road	W	5	19	14	252%	3.9	Y	Y	Y	Y
Foxhills	W	5	30	26	558%	6.2	Y	N	Y	Y
A35 on dual close to Western Bypass	W	76	67	-9	-12%	1.1	Y	Y	Y	Y
Deerleap Lane	S	8	-	-8	-100%	4.0	Y	Y	Y	Y
Staplewood Lane	S	1	-	-1	-100%	1.2	Y	Y	Y	Y
Twiggs Lane	S	7	1	-6	-88%	3.2	Y	Y	Y	Y
A326 Marchwood Bypass	S	92	111	19	21%	1.9	Y	Y	Y	Y
Hythe Road	S	17	9	-8	-47%	2.2	Y	Y	Y	Y
Marchwood Bypass	E	74	73	-0	0%	0.0	Y	Y	Y	Y
Marchwood Road	E	36	58	22	60%	3.2	Y	Y	Y	Y
		660	**726**	**66**	**10.0%**	**2.5**	**100%**	**89%**	**100%**	**100%**

IP HGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	63	73	10	16%	1.2	Y	Y	Y	Y
Central Station Bridge	N	19	-	-19	-100%	6.2	Y	N	Y	Y
Blechynden Terrace	W	15	28	13	85%	2.7	Y	Y	Y	Y
Cumberland Place	N	30	24	-6	-19%	1.1	Y	Y	Y	Y
Above Bar Street - (one way this direction)	N	16	13	-3	-18%	0.7	Y	Y	Y	Y
East Park Terrace	N	18	9	-8	-47%	2.3	Y	Y	Y	Y
New Road	E	23	22	-2	-7%	0.4	Y	Y	Y	Y
Kingsway	N	27	24	-2	-8%	0.4	Y	Y	Y	Y
St Marys Street	N	6	43	37	638%	7.6	Y	N	N	Y
Britannia Road	N	20	19	-1	-3%	0.1	Y	Y	Y	Y
Princes Street	W	27	5	-21	-80%	5.4	Y	N	Y	Y
Itchen Bridge	E	36	-	-36	-100%	8.5	Y	N	N	Y
		298	**260**	**-38**	**-12.7%**	**2.3**	**100%**	**67%**	**83%**	**100%**
Inbound										
A33 Mountbatten Way	E	63	68	5	7%	0.6	Y	Y	Y	Y
Central Station Bridge	S	13	-	-13	-100%	5.1	Y	N	Y	Y
Blechynden Terrace	E	32	10	-21	-68%	4.7	Y	Y	Y	Y
Cumberland Place	S	38	24	-15	-39%	2.7	Y	Y	Y	Y
Above Bar Street - (one way in other direction)	N	16	13	-3	-18%	0.7	Y	Y	Y	Y
East Park Terrace	S	13	22	9	65%	2.1	Y	Y	Y	Y
New Road	W	19	28	9	46%	1.8	Y	Y	Y	Y
Kingsway	S	47	26	-20	-43%	3.4	Y	Y	Y	Y
St Marys Street	S	3	30	27	862%	6.6	Y	N	Y	Y
Britannia Road	S	11	9	-2	-18%	0.6	Y	Y	Y	Y
Princes Street	E	34	16	-18	-53%	3.6	Y	Y	Y	Y
Itchen Bridge	W	26	-	-26	-100%	7.2	Y	N	Y	Y
		316	**247**	**-69**	**-21.9%**	**4.1**	**100%**	**75%**	**100%**	**100%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	36	-	-36	-100%	8.5	Y	N	N	Y
Northam Bridge	E	47	19	-27	-58%	4.7	Y	Y	Y	Y
Cobden Bridge	E	28	9	-18	-67%	4.3	Y	Y	Y	Y
Woodmill Lane	S	6	12	6	104%	2.0	Y	Y	Y	Y
Mansbridge Road	E	19	28	9	49%	1.9	Y	Y	Y	Y
		135	**68**	**-66**	**-49.2%**	**6.6**	**100%**	**80%**	**80%**	**100%**
Westbound										
Itchen Bridge	W	26	-	-26	-100%	7.2	Y	N	Y	Y
Northam Bridge	W	41	17	-24	-58%	4.4	Y	Y	Y	Y
Cobden Bridge	W	26	13	-14	-52%	3.1	Y	Y	Y	Y
Woodmill Lane	N	7	14	7	103%	2.2	Y	Y	Y	Y
Mansbridge Road	W	15	17	2	12%	0.5	Y	Y	Y	Y
		115	**60**	**-55**	**-47.6%**	**5.8**	**100%**	**80%**	**100%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	17	43	25	146%	4.6	Y	Y	Y	Y
A334 Charles Watts Way	E	35	5	-30	-86%	6.7	Y	N	Y	Y
St. John's Road	N	4	-	-4	-100%	2.7	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	84	126	41	49%	4.0	Y	Y	Y	Y
		141	**173**	**33**	**23.3%**	**2.6**	**100%**	**75%**	**100%**	**100%**
Westbound										
Botley Road	W	16	34	18	117%	3.7	Y	Y	Y	Y
A334 Charles Watts Way	W	33	19	-14	-43%	2.8	Y	Y	Y	Y
St. John's Road	S	4	-	-4	-100%	2.8	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	W	85	104	19	22%	1.9	Y	Y	Y	Y
		138	**156**	**19**	**13.6%**	**1.5**	**100%**	**100%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	107	122	15	14%	1.4	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	17	32	16	96%	3.2	Y	Y	Y	Y
Hill Street	N	0	-	-0	-100%	0.7	Y	Y	Y	Y
A36 east of A326	W	40	49	9	22%	1.3	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	N	28	16	-11	-41%	2.4	Y	Y	Y	Y
Loperwood Lane	N	1	13	13	1552%	4.7	Y	Y	Y	Y
Loperwood	W	2	2	-0	-22%	0.3	Y	Y	Y	Y
Tatchbury Lane		-	-	-						
A336 westbound at junction to Bartley	W	20	14	-6	-28%	1.3	Y	Y	Y	Y
Woodlands Road	W	3	3	1	25%	0.4	Y	Y	Y	Y
Foxhills	W	2	11	9	439%	3.6	Y	Y	Y	Y
A35 on dual close to Western Bypass	W	34	38	4	11%	0.6	Y	Y	Y	Y
Deerleap Lane	S	3	-	-3	-100%	2.6	Y	Y	Y	Y
Staplewood Lane	S	0	-	-0	-100%	0.9	Y	Y	Y	Y
Twiggs Lane	S	2	-	-2	-100%	2.2	Y	Y	Y	Y
A326 Marchwood Bypass	S	65	92	27	41%	3.0	Y	Y	Y	Y
Hythe Road	S	16	1	-15	-97%	5.3	Y	N	Y	Y
Marchwood Bypass	E	37	41	4	10%	0.6	Y	Y	Y	Y
Marchwood Road	E	64	77	13	20%	1.5	Y	Y	Y	Y
		442	**511**	**70**	**15.8%**	**3.2**	**100%**	**94%**	**100%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

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Inbound

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Redbridge roundabout approach from west on Totton	S	1,150	1,259	109	10%	3.1	Y	Y	Y	Y	867	938	71	8%	2.4	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	W	926	916	-10	-1%	0.3	Y	Y	Y	Y	834	824	-10	-1%	0.3	Y	Y	Y	Y
Hill Street	S	5	-	-5	-100%	3.2	Y	Y	Y	Y	4	-	-4	-100%	2.9	Y	Y	Y	Y
A36 east of A326	E	402	490	89	22%	4.2	Y	Y	Y	Y	288	338	50	17%	2.8	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	S	682	495	-187	-27%	7.7	N	N	N	Y	584	427	-157	-27%	7.0	N	N	Y	Y
Loperwood Lane	S	21	178	157	733%	15.7	N	N	N	N	19	156	137	710%	14.6	N	N	N	N
Loperwood	E	66	71	5	8%	0.6	Y	Y	Y	Y	55	57	2	3%	0.2	Y	Y	Y	Y
Tatchbury Lane		4	4	-							4	4	-						
A336 westbound at junction to Bartley	E	366	264	-103	-28%	5.8	N	N	Y	Y	308	218	-90	-29%	5.5	Y	N	Y	Y
Woodlands Road	E	68	134	65	96%	6.5	Y	N	Y	Y	60	122	61	101%	6.4	Y	N	Y	Y
Foxhills	E	33	135	102	309%	11.1	N	N	N	N	29	123	95	333%	10.9	Y	N	N	N
A35 on dual close to Western Bypass	E	502	481	-21	-4%	1.0	Y	Y	Y	Y	420	376	-43	-10%	2.2	Y	Y	Y	Y
Deerleap Lane	N	90	-	-90	-100%	13.4	Y	N	N	N	80	-	-80	-100%	12.7	Y	N	N	N
Staplewood Lane	N	2	-	-2	-100%	2.2	Y	Y	Y	Y	2	-	-2	-100%	1.9	Y	Y	Y	Y
Twiggs Lane	N	69	0	-69	-100%	11.7	Y	N	N	N	56	-	-56	-100%	10.5	Y	N	N	N
A326 Marchwood Bypass	N	949	919	-30	-3%	1.0	Y	Y	Y	Y	524	659	135	26%	5.6	N	N	Y	Y
Hythe Road	N	186	45	-141	-76%	13.1	N	N	N	N	155	25	-130	-84%	13.7	N	N	N	N
Marchwood Bypass	W	930	995	65	7%	2.1	Y	Y	Y	Y	764	737	-27	-4%	1.0	Y	Y	Y	Y
Marchwood Road	W	373	416	43	11%	2.1	Y	Y	Y	Y	356	396	40	11%	2.1	Y	Y	Y	Y
		6,825	**6,802**	**-24**	**-0.3%**	**0.3**	**72%**	**56%**	**67%**	**72%**	**5,407**	**5,398**	**-9**	**-0.2%**	**0.1**	**78%**	**50%**	**72%**	**72%**

Site Description	Dir	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Redbridge roundabout approach from west on Totton	S	138	158	20	14%	1.6	Y	Y	Y	Y	134	161	27	20%	2.3	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	W	62	54	-8	-12%	1.0	Y	Y	Y	Y	30	31	1	4%	0.2	Y	Y	Y	Y
Hill Street	S	1	-	-1	-100%	1.2	Y	Y	Y	Y	0	-	-0	-100%	0.7	Y	Y	Y	Y
A36 east of A326	E	60	91	32	53%	3.6	Y	Y	Y	Y	51	60	9	18%	1.3	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	S	65	49	-17	-26%	2.2	Y	Y	Y	Y	29	19	-10	-34%	2.0	Y	Y	Y	Y
Loperwood Lane	S	2	13	12	684%	4.3	Y	Y	Y	Y	0	9	8	2106%	3.9	Y	Y	Y	Y
Loperwood	E	8	10	2	24%	0.6	Y	Y	Y	Y	2	3	1	21%	0.3	Y	Y	Y	Y
Tatchbury Lane		0	0	-							-	-	-						
A336 westbound at junction to Bartley	E	36	33	-3	-7%	0.5	Y	Y	Y	Y	21	12	-9	-42%	2.2	Y	Y	Y	Y
Woodlands Road	E	5	9	4	80%	1.5	Y	Y	Y	Y	3	2	-1	-22%	0.4	Y	Y	Y	Y
Foxhills	E	2	8	6	288%	2.6	Y	Y	Y	Y	3	3	1	25%	0.4	Y	Y	Y	Y
A35 on dual close to Western Bypass	E	59	67	8	14%	1.0	Y	Y	Y	Y	23	38	15	67%	2.8	Y	Y	Y	Y
Deerleap Lane	N	6	-	-6	-100%	3.6	Y	Y	Y	Y	3	-	-3	-100%	2.5	Y	Y	Y	Y
Staplewood Lane	N	0	-	-0	-100%	1.0	Y	Y	Y	Y	0	-	-0	-100%	0.7	Y	Y	Y	Y
Twiggs Lane	N	10	0	-10	-100%	4.5	Y	Y	Y	Y	3	-	-3	-100%	2.3	Y	Y	Y	Y
A326 Marchwood Bypass	N	342	175	-167	-49%	10.4	N	N	N	N	76	81	5	7%	0.6	Y	Y	Y	Y
Hythe Road	N	13	16	3	26%	0.9	Y	Y	Y	Y	18	3	-15	-81%	4.5	Y	Y	Y	Y
Marchwood Bypass	W	92	174	82	89%	7.1	Y	N	Y	Y	71	81	10	14%	1.1	Y	Y	Y	Y
Marchwood Road	W	9	14	5	49%	1.3	Y	Y	Y	Y	8	5	-3	-36%	1.1	Y	Y	Y	Y
		911	**871**	**-39**	**-4.3%**	**1.3**	**94%**	**89%**	**94%**	**94%**	**475**	**509**	**34**	**7.2%**	**1.5**	**100%**	**100%**	**100%**	**100%**

13 Southampton Enclosure

Outbound

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
A35 Redbridge Road	W	2,175	2,212	37	2%	0.8	Y	Y	Y	Y	1,849	1,860	11	1%	0.3	Y	Y	Y	Y
Brownhill Way	W	621	613	-8	-1%	0.3	Y	Y	Y	Y	537	511	-26	-5%	1.1	Y	Y	Y	Y
Romsey Road	N	321	455	135	42%	6.8	N	N	Y	Y	278	381	103	37%	5.7	N	N	Y	Y
Rownhams Lane	N	293	222	-72	-24%	4.5	Y	Y	Y	Y	248	202	-47	-19%	3.1	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba	N	1,186	1,149	-36	-3%	1.1	Y	Y	Y	Y	1,052	969	-83	-8%	2.6	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	N	363	619	256	71%	11.6	N	N	N	N	318	493	175	55%	8.7	N	N	N	Y
Stoneham Lane	N	92	8	-84	-91%	11.8	Y	N	N	N	83	5	-78	-94%	11.8	Y	N	N	N
A335 Stoneham Way	N	1,032	772	-260	-25%	8.7	N	N	N	Y	792	689	-103	-13%	3.8	Y	Y	Y	Y
Wide Lane	N	388	543	156	40%	7.2	N	N	Y	Y	333	433	100	30%	5.1	N	N	Y	Y
Mansbridge Road	E	615	648	33	5%	1.3	Y	Y	Y	Y	527	546	19	4%	0.8	Y	Y	Y	Y
Woodmill Lane	S	286	352	66	23%	3.7	Y	Y	Y	Y	258	312	54	21%	3.2	Y	Y	Y	Y
Cobden Bridge	E	686	602	-84	-12%	3.3	Y	Y	Y	Y	601	545	-56	-9%	2.3	Y	Y	Y	Y
Northam Bridge	E	1,078	936	-142	-13%	4.5	Y	Y	Y	Y	928	856	-72	-8%	2.4	Y	Y	Y	Y
Itchen Bridge	E	542	446	-96	-18%	4.3	Y	Y	Y	Y	479	416	-63	-13%	3.0	Y	Y	Y	Y
		9,677	**9,578**	**-99**	**-1.0%**	**1.0**	**71%**	**64%**	**79%**	**86%**	**8,282**	**8,218**	**-65**	**-0.8%**	**0.7**	**79%**	**71%**	**86%**	**93%**

Site Description	Dir	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
A35 Redbridge Road	W	218	228	11	5%	0.7	Y	Y	Y	Y	109	115	6	5%	0.6	Y	Y	Y	Y
Brownhill Way	W	59	73	14	24%	1.8	Y	Y	Y	Y	24	28	4	17%	0.8	Y	Y	Y	Y
Romsey Road	N	30	51	21	70%	3.3	Y	Y	Y	Y	12	23	11	88%	2.6	Y	Y	Y	Y
Rownhams Lane	N	34	16	-18	-53%	3.6	Y	Y	Y	Y	11	2	-9	-80%	3.4	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba	N	82	127	46	56%	4.5	Y	Y	Y	Y	49	48	-1	-3%	0.2	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	N	31	78	47	154%	6.4	Y	N	Y	Y	12	49	37	307%	6.7	Y	N	Y	Y
Stoneham Lane	N	5	0	-5	-92%	2.9	Y	Y	Y	Y	4	0	-4	-98%	2.9	Y	Y	Y	Y
A335 Stoneham Way	N	143	54	-90	-63%	9.0	Y	N	N	Y	90	29	-61	-68%	7.9	Y	N	N	Y
Wide Lane	N	35	59	24	69%	3.5	Y	Y	Y	Y	18	43	25	138%	4.5	Y	Y	Y	Y
Mansbridge Road	E	68	73	6	9%	0.7	Y	Y	Y	Y	19	28	9	49%	1.9	Y	Y	Y	Y
Woodmill Lane	S	22	28	6	26%	1.2	Y	Y	Y	Y	6	12	6	104%	2.0	Y	Y	Y	Y
Cobden Bridge	E	55	39	-16	-29%	2.3	Y	Y	Y	Y	28	9	-18	-67%	4.3	Y	Y	Y	Y
Northam Bridge	E	104	37	-67	-64%	7.9	Y	N	N	Y	47	19	-27	-58%	4.7	Y	Y	Y	Y
Itchen Bridge	E	26	2	-24	-91%	6.3	Y	N	Y	Y	36	-	-36	-100%	8.5	Y	N	N	Y
		911	**867**	**-44**	**-4.8%**	**1.5**	**100%**	**71%**	**86%**	**100%**	**464**	**405**	**-59**	**-12.7%**	**2.8**	**100%**	**79%**	**86%**	**100%**

Inbound

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
A35 Redbridge Road	E	2,121	2,082	-40	-2%	0.9	Y	Y	Y	Y	1,803	1,755	-48	-3%	1.1	Y	Y	Y	Y
Brownhill Way	E	540	547	6	1%	0.3	Y	Y	Y	Y	474	450	-24	-5%	1.1	Y	Y	Y	Y
Romsey Road	S	320	491	171	53%	8.5	N	N	N	Y	278	434	156	56%	8.3	N	N	N	Y
Rownhams Lane	S	286	146	-140	-49%	9.5	N	N	N	Y	243	132	-111	-46%	8.1	N	N	N	Y
A33 Bassett Avenue between Winchester Road and Ba	S	1,229	1,392	162	13%	4.5	Y	Y	Y	Y	1,120	1,246	126	11%	3.7	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	S	429	263	-166	-39%	8.9	N	N	N	Y	367	234	-133	-36%	7.7	N	N	N	Y
Stoneham Lane	S	78	8	-71	-90%	10.8	Y	N	N	N	72	5	-67	-93%	10.7	Y	N	N	N
A335 Stoneham Way	S	863	865	2	0%	0.1	Y	Y	Y	Y	695	724	29	4%	1.1	Y	Y	Y	Y
Wide Lane	S	526	652	126	24%	5.2	N	N	Y	Y	445	535	89	20%	4.0	Y	Y	Y	Y
Mansbridge Road	W	533	560	26	5%	1.1	Y	Y	Y	Y	479	500	21	4%	0.9	Y	Y	Y	Y
Woodmill Lane	N	270	304	35	13%	2.1	Y	Y	Y	Y	238	273	34	14%	2.2	Y	Y	Y	Y
Cobden Bridge	W	675	617	-58	-9%	2.3	Y	Y	Y	Y	614	570	-43	-7%	1.8	Y	Y	Y	Y
Northam Bridge	W	953	814	-139	-15%	4.7	Y	Y	Y	Y	820	752	-68	-8%	2.4	Y	Y	Y	Y
Itchen Bridge	W	481	368	-113	-23%	5.5	N	N	Y	Y	396	338	-58	-15%	3.0	Y	Y	Y	Y
		9,305	**9,108**	**-197**	**-2.1%**	**2.1**	**64%**	**57%**	**71%**	**93%**	**8,044**	**7,947**	**-97**	**-1.2%**	**1.1**	**79%**	**71%**	**71%**	**93%**

Site Description	Dir	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
A35 Redbridge Road	E	212	214	2	1%	0.1	Y	Y	Y	Y	106	101	-5	-5%	0.5	Y	Y	Y	Y
Brownhill Way	E	45	79	34	74%	4.3	Y	Y	Y	Y	20	18	-2	-11%	0.5	Y	Y	Y	Y
Romsey Road	S	31	31	-0	0%	0.0	Y	Y	Y	Y	11	26	15	135%	3.5	Y	Y	Y	Y
Rownhams Lane	S	31	10	-21	-69%	4.8	Y	Y	Y	Y	11	3	-8	-77%	3.2	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba	S	59	66	7	12%	0.9	Y	Y	Y	Y	48	68	20	42%	2.6	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	S	45	13	-31	-70%	5.8	Y	N	Y	Y	17	15	-2	-9%	0.4	Y	Y	Y	Y
Stoneham Lane	S	3	0	-2	-87%	1.9	Y	Y	Y	Y	4	0	-4	-100%	2.7	Y	Y	Y	Y
A335 Stoneham Way	S	97	93	-3	-4%	0.4	Y	Y	Y	Y	67	48	-19	-29%	2.5	Y	Y	Y	Y
Wide Lane	S	57	88	31	53%	3.6	Y	Y	Y	Y	22	23	1	6%	0.3	Y	Y	Y	Y
Mansbridge Road	W	39	42	3	8%	0.5	Y	Y	Y	Y	15	17	2	12%	0.5	Y	Y	Y	Y
Woodmill Lane	N	24	18	-7	-27%	1.4	Y	Y	Y	Y	7	14	7	103%	2.2	Y	Y	Y	Y
Cobden Bridge	W	34	26	-8	-23%	1.4	Y	Y	Y	Y	26	13	-14	-52%	3.1	Y	Y	Y	Y
Northam Bridge	W	92	21	-71	-77%	9.4	Y	N	N	Y	41	17	-24	-58%	4.4	Y	Y	Y	Y
Itchen Bridge	W	49	2	-46	-95%	9.2	Y	N	N	Y	26	-	-26	-100%	7.2	Y	N	Y	Y
		818	**704**	**-114**	**-14.0%**	**4.1**	**100%**	**79%**	**86%**	**100%**	**421**	**363**	**-58**	**-13.9%**	**3.0**	**100%**	**93%**	**100%**	**100%**

20 Totton

Eastbound

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Marchwood Bypass south of Jacobs Gutter Lane	N	63	-	-63	-100%	11.3	Y	N	N	N	51	-	-51	-100%	10.1	Y	N	N	N
Spicers Hill south of Spicers Way	N	1,213	1,286	74	6%	2.1	Y	Y	Y	Y	923	963	40	4%	1.3	Y	Y	Y	Y
Rushington Lane	E	1	1	-0	-30%	0.4	Y	Y	Y	Y	1	-	-1	-100%	1.1	Y	Y	Y	Y
Ringwood Road east of Calmore Road	E	449	195	-254	-57%	14.2	N	N	N	N	411	171	-240	-58%	14.1	N	N	N	N
Water Lane near Totton College	E	146	270	123	84%	8.5	N	N	N	Y	128	255	127	99%	9.1	N	N	N	Y
Calmore Drive	E	133	114	-19	-14%	1.7	Y	Y	Y	Y	119	103	-16	-13%	1.5	Y	Y	Y	Y
Cooks Lane east of Calmore Road	E	106	184	79	74%	6.5	Y	N	Y	Y	86	160	74	86%	6.7	Y	N	Y	Y
Salisbury Road east of Pauletts Lane	E	356	483	127	36%	6.2	N	N	Y	Y	246	338	91	37%	5.4	Y	N	Y	Y
		2,469	**2,535**	**66**	**2.7%**	**1.3**	**63%**	**38%**	**63%**	**75%**	**1,966**	**1,990**	**25**	**1.3%**	**0.6**	**75%**	**38%**	**63%**	**75%**

Site Description	Dir	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Marchwood Bypass south of Jacobs Gutter Lane	N	6	-	-6	-100%	3.5	Y	Y	Y	Y	6	-	-6	-100%	3.5	Y	Y	Y	Y
Spicers Hill south of Spicers Way	N	181	209	28	15%	2.0	Y	Y	Y	Y	102	110	8	8%	0.8	Y	Y	Y	Y
Rushington Lane	E	0	-	-0	-100%	0.4	Y	Y	Y	Y	1	-	-1	-100%	1.2	Y	Y	Y	Y
Ringwood Road east of Calmore Road	E	28	8	-21	-73%	4.9	Y	Y	Y	Y	10	15	5	53%	1.5	Y	Y	Y	Y
Water Lane near Totton College	E	12	7	-5	-43%	1.7	Y	Y	Y	Y	6	6	-0	-4%	0.1	Y	Y	Y	Y
Calmore Drive	E	10	7	-3	-28%	1.0	Y	Y	Y	Y	4	4	-0	0%	0.0	Y	Y	Y	Y
Cooks Lane east of Calmore Road	E	15	11	-4	-26%	1.1	Y	Y	Y	Y	4	13	9	223%	3.0	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	E	53	91	38	70%	4.4	Y	Y	Y	Y	53	53	0	1%	0.0	Y	Y	Y	Y
		306	**333**	**27**	**8.8%**	**1.5**	**100%**	**100%**	**100%**	**100%**	**186**	**201**	**15**	**8.2%**	**1.1**	**100%**	**100%**	**100%**	**100%**

Westbound

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Marchwood Bypass south of Jacobs Gutter Lane	S	608	786	178	29%	6.7	N	N	Y	Y	474	648	175	37%	7.4	N	N	Y	Y
Spicers Hill south of Spicers Way	S	713	604	-108	-15%	4.2	N	Y	Y	Y	536	470	-66	-12%	2.9	Y	Y	Y	Y
Rushington Lane	W	38	39	1	2%	0.2	Y	Y	Y	Y	32	35	3	9%	0.5	Y	Y	Y	Y
Ringwood Road east of Calmore Road	W	538	220	-318	-59%	16.3	N	N	N	N	484	167	-316	-65%	17.5	N	N	N	N
Water Lane near Totton College	W	211	273	62	29%	4.0	Y	Y	Y	Y	184	239	55	30%	3.8	Y	Y	Y	Y
Calmore Drive	W	133	166	32	24%	2.6	Y	Y	Y	Y	124	144	20	16%	1.8	Y	Y	Y	Y
Cooks Lane east of Calmore Road	W	104	229	125	120%	9.7	N	N	N	Y	90	197	108	120%	9.0	N	N	N	Y
Salisbury Road east of Pauletts Lane	W	353	516	162	46%	7.8	N	N	N	Y	271	375	104	38%	5.8	N	N	Y	Y
		2,699	**2,832**	**134**	**5.0%**	**2.5**	**38%**	**50%**	**63%**	**88%**	**2,194**	**2,277**	**82**	**3.7%**	**1.7**	**50%**	**50%**	**75%**	**88%**

Site Description	Dir	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Marchwood Bypass south of Jacobs Gutter Lane	S	75	84	8	11%	0.9	Y	Y	Y	Y	56	51	-5	-9%	0.7	Y	Y	Y	Y
Spicers Hill south of Spicers Way	S	117	100	-17	-15%	1.6	Y	Y	Y	Y	55	34	-21	-38%	3.1	Y	Y	Y	Y
Rushington Lane	W	4	3	-2	-36%	0.8	Y	Y	Y	Y	2	1	-1	-67%	1.1	Y	Y	Y	Y
Ringwood Road east of Calmore Road	W	40	23	-17	-43%	3.1	Y	Y	Y	Y	13	27	14	112%	3.2	Y	Y	Y	Y
Water Lane near Totton College	W	19	22	3	18%	0.8	Y	Y	Y	Y	8	9	1	18%	0.5	Y	Y	Y	Y
Calmore Drive	W	7	12	5	72%	1.6	Y	Y	Y	Y	3	10	7	275%	2.9	Y	Y	Y	Y
Cooks Lane east of Calmore Road	W	11	20	10	90%	2.5	Y	Y	Y	Y	4	11	8	206%	2.8	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	W	45	90	45	99%	5.5	Y	N	Y	Y	34	49	15	45%	2.3	Y	Y	Y	Y
		319	**354**	**35**	**11.0%**	**1.9**	**100%**	**88%**	**100%**	**100%**	**174**	**193**	**19**	**10.9%**	**1.4**	**100%**	**100%**	**100%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

Site Description	Dir	IP VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	IP CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	IP HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
21 North of Southampton																																					
Eastbound																																					
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	767	639	-128	-17%	4.8	N	Y	Y	Y	659	595	-64	-10%	2.6	Y	Y	Y	Y	64	32	-32	-50%	4.7	Y	Y	Y	Y	40	12	-28	-70%	5.5	Y	N	Y	Y
Lawn Road East off Horse Shoe Bridge	E	67	115	47	70%	5.0	Y	Y	Y	Y	59	99	40	67%	4.5	Y	Y	Y	Y	6	9	3	44%	1.0	Y	Y	Y	Y	2	7	5	257%	2.4	Y	Y	Y	Y
Tennyson Road	N	25	189	164	649%	15.8	N	N	N	N	21	178	157	738%	15.7	N	N	N	N	3	9	6	199%	2.5	Y	Y	Y	Y	1	2	1	97%	0.7	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	N	341	76	-265	-78%	18.3	N	N	N	N	291	49	-242	-83%	18.5	N	N	N	N	32	2	-30	-94%	7.3	Y	N	Y	Y	16	11	-4	-27%	1.2	Y	Y	Y	Y
A33 The Avenue South of Westwood Road	N	755	1,025	269	36%	9.0	N	N	N	Y	655	884	229	35%	8.3	N	N	N	Y	59	85	26	45%	3.1	Y	Y	Y	Y	37	40	3	9%	0.5	Y	Y	Y	Y
Hill Lane	N	362	148	-214	-59%	13.4	N	N	N	N	317	137	-180	-57%	11.9	N	N	N	N	35	6	-29	-82%	6.4	Y	N	Y	Y	9	4	-5	-52%	1.9	Y	Y	Y	Y
Ivanhoe Road	N	33	133	100	304%	11.0	N	N	N	N	29	117	87	299%	10.2	Y	N	N	N	3	12	9	339%	3.4	Y	Y	Y	Y	1	3	2	255%	1.6	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	N	49	-	-49	-100%	9.9	Y	N	N	Y	43	-	-43	-100%	9.3	Y	N	N	Y	4	-	-4	-100%	2.8	Y	Y	Y	Y	2	-	-2	-100%	1.9	Y	Y	Y	Y
St James Road	N	366	278	-87	-24%	4.9	Y	Y	Y	Y	335	248	-87	-26%	5.1	Y	N	Y	Y	24	23	-0	-1%	0.1	Y	Y	Y	Y	7	7	-0	-4%	0.1	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	626	286	-340	-54%	15.9	N	N	N	N	567	264	-302	-53%	14.8	N	N	N	N	43	17	-26	-61%	4.8	Y	Y	Y	Y	16	5	-11	-68%	3.4	Y	Y	Y	Y
Tremona Road	E	158	100	-58	-37%	5.1	Y	N	Y	Y	144	93	-51	-35%	4.7	Y	Y	Y	Y	11	6	-5	-46%	1.8	Y	Y	Y	Y	4	1	-2	-64%	1.5	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	208	786	577	277%	25.9	N	N	N	N	165	685	519	314%	25.2	N	N	N	N	21	64	44	209%	6.7	Y	N	Y	Y	13	20	7	53%	1.7	Y	Y	Y	Y
Aldermoor Road	E	107	85	-23	-21%	2.3	Y	Y	Y	Y	93	75	-18	-19%	1.9	Y	Y	Y	Y	8	1	-6	-84%	3.1	Y	Y	Y	Y	6	1	-5	-90%	3.0	Y	Y	Y	Y
Lords Hill Way	E	415	181	-234	-56%	13.5	N	N	N	N	342	165	-176	-52%	11.1	N	N	N	N	50	5	-45	-89%	8.5	Y	N	N	Y	16	1	-15	-94%	5.2	Y	N	Y	Y
M0027_J0003_J0004	E	3,992	4,336	344	9%	5.3	Y	N	Y	Y	3,233	3,328	94	3%	1.6	Y	Y	Y	Y	275	329	55	20%	3.1	Y	Y	Y	Y	484	679	195	40%	8.1	N	N	N	Y
		8,273	**8,377**	**104**	**1.3%**	**1.1**	**40%**	**27%**	**40%**	**53%**	**6,953**	**6,917**	**-36**	**-0.5%**	**0.4**	**53%**	**33%**	**40%**	**53%**	**636**	**601**	**-35**	**-5.5%**	**1.4**	**100%**	**73%**	**93%**	**100%**	**654**	**794**	**140**	**21.5%**	**5.2**	**93%**	**80%**	**93%**	**100%**
21 North of Southampton																																					
Westbound																																					
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	723	706	-17	-2%	0.6	Y	Y	Y	Y	582	618	36	6%	1.5	Y	Y	Y	Y	87	75	-12	-13%	1.3	Y	Y	Y	Y	49	12	-37	-75%	6.7	Y	N	Y	Y
Lawn Road East off Horse Shoe Bridge	W	68	18	-50	-73%	7.6	Y	N	N	Y	59	13	-45	-77%	7.6	Y	N	N	Y	7	2	-5	-73%	2.4	Y	Y	Y	Y	2	3	1	34%	0.5	Y	Y	Y	Y
Tennyson Road	S	27	124	96	350%	11.1	Y	N	N	N	23	115	92	399%	11.1	Y	N	N	N	3	7	4	107%	1.6	Y	Y	Y	Y	1	2	1	47%	0.4	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	S	332	105	-228	-68%	15.4	N	N	N	N	285	74	-210	-74%	15.7	N	N	N	N	29	11	-19	-64%	4.2	Y	Y	Y	Y	15	6	-9	-58%	2.7	Y	Y	Y	Y
A33 The Avenue South of Westwood Road	S	775	1,052	277	36%	9.2	N	N	N	Y	652	881	230	35%	8.3	N	N	N	Y	76	89	12	16%	1.4	Y	Y	Y	Y	39	68	28	72%	3.9	Y	Y	Y	Y
Hill Lane	S	376	242	-134	-36%	7.6	N	N	N	Y	333	227	-106	-32%	6.3	N	N	Y	Y	33	11	-22	-67%	4.7	Y	Y	Y	Y	10	4	-6	-57%	2.1	Y	Y	Y	Y
Ivanhoe Road	S	34	124	91	270%	10.2	Y	N	N	N	26	117	91	357%	10.8	Y	N	N	N	7	5	-2	-26%	0.7	Y	Y	Y	Y	1	1	0	25%	0.3	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	S	90	-	-90	-100%	13.4	Y	N	N	N	82	-	-82	-100%	12.8	Y	N	N	N	5	-	-5	-100%	3.2	Y	Y	Y	Y	3	-	-3	-100%	2.3	Y	Y	Y	Y
St James Road	S	275	279	4	1%	0.2	Y	Y	Y	Y	255	258	3	1%	0.2	Y	Y	Y	Y	15	17	2	13%	0.5	Y	Y	Y	Y	4	4	-0	-11%	0.2	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	606	214	-393	-65%	19.4	N	N	N	N	543	198	-345	-64%	17.9	N	N	N	N	45	10	-35	-77%	6.6	Y	N	Y	Y	17	5	-12	-70%	3.6	Y	Y	Y	Y
Tremona Road	W	194	260	66	34%	4.4	Y	Y	Y	Y	165	225	60	37%	4.3	Y	Y	Y	Y	23	25	2	7%	0.3	Y	Y	Y	Y	6	10	4	72%	1.5	Y	Y	Y	Y
Coxford Road east of Warren Ave	W	215	669	454	211%	21.6	N	N	N	N	175	588	413	237%	21.2	N	N	N	N	20	48	28	142%	4.8	Y	Y	Y	Y	13	17	5	39%	1.3	Y	Y	Y	Y
Aldermoor Road	W	76	84	8	11%	0.9	Y	Y	Y	Y	66	74	8	12%	1.0	Y	Y	Y	Y	6	1	-5	-85%	2.7	Y	Y	Y	Y	3	1	-2	-74%	1.7	Y	Y	Y	Y
Lords Hill Way	W	416	178	-238	-57%	13.8	N	N	N	N	376	159	-217	-58%	13.3	N	N	N	N	22	8	-14	-64%	3.7	Y	Y	Y	Y	16	2	-14	-87%	4.7	Y	Y	Y	Y
M0027_J0004_J0003	W	4,198	4,414	216	5%	3.3	Y	Y	Y	Y	3,372	3,432	61	2%	1.0	Y	Y	Y	Y	308	363	55	18%	3.0	Y	Y	Y	Y	518	619	100	19%	4.2	N	Y	Y	Y
		8,405	**8,469**	**64**	**0.8%**	**0.7**	**60%**	**33%**	**33%**	**53%**	**6,992**	**6,981**	**-11**	**-0.2%**	**0.1**	**60%**	**33%**	**40%**	**53%**	**687**	**671**	**-15**	**-2.2%**	**0.6**	**100%**	**93%**	**100%**	**100%**	**699**	**755**	**56**	**8.0%**	**2.1**	**93%**	**93%**	**100%**	**100%**
22 South of Southampton																																					
Eastbound																																					
Milbrook Road East West of Waterhouse Lane		1,433	1,783	351	24%	8.7	N	N	N	Y	1,218	1,514	296	24%	8.0	N	N	N	Y	143	179	36	25%	2.8	Y	Y	Y	Y	72	79	7	10%	0.8	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	E	179	230	51	29%	3.6	Y	Y	Y	Y	154	222	68	44%	5.0	Y	Y	Y	Y	19	5	-14	-72%	4.0	Y	Y	Y	Y	5	1	-4	-73%	2.1	Y	Y	Y	Y
Shirley High Street East of Park St	S	433	267	-166	-38%	8.9	N	N	N	Y	389	211	-179	-46%	10.3	N	N	N	N	21	13	-8	-37%	1.9	Y	Y	Y	Y	19	5	-14	-74%	4.0	Y	Y	Y	Y
Victor Street east of Crown Street	N	248	106	-142	-57%	10.7	N	N	N	N	233	99	-134	-57%	10.4	N	N	N	N	12	5	-7	-61%	2.5	Y	Y	Y	Y	3	2	-1	-38%	0.7	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	626	286	-340	-54%	15.9	N	N	N	N	567	264	-302	-53%	14.8	N	N	N	N	43	17	-26	-61%	4.8	Y	Y	Y	Y	16	5	-11	-68%	3.4	Y	Y	Y	Y
Dale Road north of Norham Avenue	N	307	487	180	59%	9.0	N	N	N	Y	268	422	154	57%	8.3	N	N	N	Y	29	48	19	67%	3.1	Y	Y	Y	Y	11	15	4	34%	1.1	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	E	586	538	-47	-8%	2.0	Y	Y	Y	Y	536	521	-16	-3%	0.7	Y	Y	Y	Y	37	14	-23	-62%	4.6	Y	Y	Y	Y	12	3	-9	-78%	3.4	Y	Y	Y	Y
		3,812	**3,698**	**-114**	**-3.0%**	**1.9**	**29%**	**29%**	**29%**	**71%**	**3,365**	**3,252**	**-113**	**-3.4%**	**2.0**	**29%**	**29%**	**29%**	**57%**	**305**	**282**	**-24**	**-7.8%**	**1.4**	**100%**	**100%**	**100%**	**100%**	**138**	**109**	**-28**	**-20.6%**	**2.6**	**100%**	**100%**	**100%**	**100%**
Westbound																																					
Milbrook Road East West of Waterhouse Lane		1,691	2,017	325	19%	7.6	N	N	N	Y	1,438	1,702	265	18%	6.7	N	N	Y	Y	169	213	44	26%	3.2	Y	Y	Y	Y	85	92	8	9%	0.8	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	W	209	218	9	4%	0.6	Y	Y	Y	Y	182	205	23	12%	1.6	Y	Y	Y	Y	20	10	-10	-50%	2.6	Y	Y	Y	Y	7	3	-5	-63%	2.1	Y	Y	Y	Y
Shirley High Street East of Park St	N	344	482	138	40%	6.8	N	N	Y	Y	319	394	76	24%	4.0	Y	Y	Y	Y	11	35	24	207%	4.9	Y	Y	Y	Y	12	15	3	23%	0.8	Y	Y	Y	Y
Victor Street east of Crown Street	N	248	-	-248	-100%	22.3	N	N	N	N	233	-	-233	-100%	21.6	N	N	N	N	12	-	-12	-100%	4.9	Y	Y	Y	Y	3	-	-3	-100%	2.4	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	606	214	-393	-65%	19.4	N	N	N	N	543	198	-345	-64%	17.9	N	N	N	N	45	10	-35	-77%	6.6	Y	N	Y	Y	17	5	-12	-70%	3.6	Y	Y	Y	Y
Dale Road north of Norham Avenue	S	283	354	70	25%	3.9	Y	Y	Y	Y	254	317	63	25%	3.7	Y	Y	Y	Y	22	27	5	23%	1.0	Y	Y	Y	Y	7	7	-0	-4%	0.1	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	657	721	64	10%	2.4	Y	Y	Y	Y	588	662	74	13%	2.9	Y	Y	Y	Y	51	40	-11	-22%	1.7	Y	Y	Y	Y	17	18	1	6%	0.3	Y	Y	Y	Y
		4,038	**4,005**	**-34**	**-0.8%**	**0.5**	**43%**	**43%**	**57%**	**71%**	**3,556**	**3,478**	**-78**	**-2.2%**	**1.3**	**57%**	**57%**	**71%**	**71%**	**330**	**335**	**5**	**1.4%**	**0.3**	**100%**	**86%**	**100%**	**100%**	**148**	**140**	**-8**	**-5.6%**	**0.7**	**100%**	**100%**	**100%**	**100%**
24 Bitterne Northwest to Southeast																																					
Eastbound																																					
Hamble Lane		451	746	295	66%	12.1	N	N	N	N	383	552	168	44%	7.8	N	N	N	Y	45	113	68	150%	7.6	Y	N	N	Y	23	81	59	260%	8.1	Y	N	N	Y
Grange Road South of A3025	N	216	140	-76	-35%	5.7	Y	N	Y	Y	185	129	-56	-30%	4.5	Y	Y	Y	Y	22	11	-12	-53%	2.9	Y	Y	Y	Y	8	1	-7	-90%	3.4	Y	Y	Y	Y
Coxs Drive	E	1	78	76	5868%	12.1	Y	N	N	N	1	74	73	7270%	11.9	Y	N	N	N	0	2	2	1067%	1.8	Y	Y	Y	Y	0	2	2	1640%	1.7	Y	Y	Y	Y
Portsmouth Road	E	610	504	-107	-17%	4.5	N	Y	Y	Y	541	453	-88	-16%	4.0	Y	Y	Y	Y	42	25	-17	-40%	2.9	Y	Y	Y	Y	27	20	-6	-24%	1.3	Y	Y	Y	Y
Butts Road	E	229	161	-68	-30%	4.9	Y	Y	Y	Y	200	151	-49	-24%	3.7	Y	Y	Y	Y	19	4	-15	-78%	4.4	Y	Y	Y	Y	9	4	-5	-57%	2.0	Y	Y	Y	Y
Kathleen Road	E	164	360	196	119%	12.1	N	N	N	N	139	331	192	138%	12.5	N	N	N	N	12	13	1	6%	0.2	Y	Y	Y	Y	10	7	-3	-28%	1.0	Y	Y	Y	Y
Burlesdon Road	S	617	253	-364	-59%	17.5	N	N	N	N	548	213	-335	-61%	17.2	N	N	N	N	44	9	-35	-79%	6.7	Y	N	Y	Y	24	13	-11	-44%	2.5	Y	Y	Y	Y
Upper Deacon Road	N	166	260	94	57%	6.4	Y	N	Y	Y	156	244	87	56%	6.2	Y	N	Y	Y	7	15	8	124%	2.5	Y	Y	Y	Y	3	-	-3	-100%	2.4	Y	Y	Y	Y
Bitterne Road	E	549	585	37	7%	1.5	Y	Y	Y	Y	490	548	57	12%	2.5	Y	Y	Y	Y	36	37	1	3%	0.2	Y	Y	Y	Y	22	-	-22	-100%	6.7	Y	N	Y	Y
Shales Road south of Taunton Drive	N	73	74	2	2%	0.2	Y	Y	Y	Y	66	72	6	9%	0.7	Y	Y	Y	Y	5	2	-3	-69%	1.9	Y	Y	Y	Y	2	1	-1	-50%	0.8	Y	Y	Y	Y
West End Road	E	535	635	100	19%	4.2	N	Y	Y	Y	497	575	78	16%	3.4	Y	Y	Y	Y	25	37	12	46%	2.1	Y	Y	Y	Y	12	20	8	68%	2.0	Y	Y	Y	Y
Townhill Way	N	319	266	-53	-17%	3.1	Y	Y	Y	Y	277	254	-23	-8%	1.4	Y	Y	Y	Y	27	6	-22	-79%	5.3	Y	N	Y	Y	10	0	-10	-96%	4.3	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	83	32	-50	-61%	6.6	Y	N	Y	Y	73	32	-41	-56%	5.7	Y	N	Y	Y	5	0	-4	-92%	2.8	Y	Y	Y	Y	3	0	-3	-99%	2.4	Y	Y	Y	Y
Northfield Road		10	10	-							10	10	-							0	0	-							0	0	-						
Foresthill Drive north of Woodmill Lane	E	139	94	-45	-32%	4.2	Y	Y	Y	Y	115	79	-36	-32%	3.7	Y	Y	Y	Y	7	2	-5	-66%	2.1	Y	Y	Y	Y	16	1	-15	-96%	5.3	Y	N	Y	Y
		4,162	**4,199**	**37**	**0.9%**	**0.6**	**64%**	**50%**	**71%**	**71%**	**3,682**	**3,714**	**32**	**0.9%**	**0.5**	**79%**	**57%**	**71%**	**79%**	**296**	**275**	**-21**	**-7.0%**	**1.2**	**100%**	**79%**	**93%**	**100%**	**169**	**151**	**-18**	**-10.8%**	**1.4**	**100%**	**79%**	**93%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST
SRTM 2015
CORDONS AND SCREENLINES

Page 246

IP VEHICLES / IP CAR

Site Description	Dir	VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound																			
Hamble Lane		714	585	-129	-18%	5.1	N	N	Y	Y	607	389	-219	-36%	9.8	N	N	N	Y
Grange Road South of A3025	S	245	106	-139	-57%	10.5	N	N	N	N	214	92	-121	-57%	9.8	N	N	N	Y
Coxs Drive	W	4	89	85	2160%	12.5	Y	N	N	N	3	84	81	2538%	12.3	Y	N	N	N
Portsmouth Road	W	593	564	-28	-5%	1.2	Y	Y	Y	Y	514	489	-25	-5%	1.1	Y	Y	Y	Y
Butts Road	W	218	245	27	12%	1.8	Y	Y	Y	Y	195	225	30	16%	2.1	Y	Y	Y	Y
Kathleen Road	W	155	89	-67	-43%	6.0	Y	N	Y	Y	132	76	-55	-42%	5.4	Y	N	Y	Y
Burlesdon Road	N	561	349	-212	-38%	9.9	N	N	N	Y	480	302	-177	-37%	9.0	N	N	N	Y
Upper Deacon Road	S	120	157	37	31%	3.1	Y	Y	Y	Y	113	149	37	33%	3.2	Y	Y	Y	Y
Bitterne Road	W	509	576	67	13%	2.9	Y	Y	Y	Y	444	547	104	23%	4.7	N	Y	Y	Y
Shales Road south of Taunton Drive	S	46	80	34	73%	4.2	Y	Y	Y	Y	43	75	32	75%	4.2	Y	Y	Y	Y
West End Road	W	578	632	54	9%	2.2	Y	Y	Y	Y	515	568	53	10%	2.3	Y	Y	Y	Y
Townhill Way	S	352	262	-90	-26%	5.1	Y	N	Y	Y	303	237	-66	-22%	4.0	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	S	81	35	-46	-57%	6.1	Y	N	Y	Y	76	30	-45	-60%	6.2	Y	N	Y	Y
Northfield Road		22	22	-							22	22	-						
Foresthill Drive north of Woodmill Lane	W	120	76	-44	-37%	4.5	Y	Y	Y	Y	108	73	-35	-32%	3.7	Y	Y	Y	Y
		4,319	**3,866**	**-453**	**-10.5%**	**7.1**	**79%**	**50%**	**79%**	**86%**	**3,766**	**3,360**	**-406**	**-10.8%**	**6.8**	**71%**	**57%**	**71%**	**93%**
25 Bitterne Southwest to Northeast																			
Eastbound																			
Victoria Road		8	8	-							-	-	-						
Archery Road	N	234	166	-68	-29%	4.8	Y	Y	Y	Y	204	147	-56	-28%	4.2	Y	Y	Y	Y
Portsmouth Road	E	740	686	-54	-7%	2.0	Y	Y	Y	Y	680	652	-28	-4%	1.1	Y	Y	Y	Y
STATION ROAD	E	134	171	38	28%	3.0	Y	Y	Y	Y	116	160	44	38%	3.8	Y	Y	Y	Y
South East Road	E	230	347	117	51%	6.9	N	N	Y	Y	210	333	123	58%	7.4	N	N	Y	Y
Bursledon Road West of NE Road	S	586	382	-204	-35%	9.3	N	N	N	Y	516	339	-177	-34%	8.6	N	N	N	Y
A334 Thornhill Park Road	E	597	728	131	22%	5.1	N	N	Y	Y	529	676	148	28%	6.0	N	N	Y	Y
Pine Drive	S	40	44	4	9%	0.6	Y	Y	Y	Y	35	42	7	21%	1.2	Y	Y	Y	Y
A27 Moorhill Road		504	432	-72	-14%	3.3	Y	Y	Y	Y	428	363	-65	-15%	3.3	Y	Y	Y	Y
Botley Road	E	574	571	-4	-1%	0.2	Y	Y	Y	Y	512	465	-47	-9%	2.1	Y	Y	Y	Y
		3,647	**3,534**	**-112**	**-3.1%**	**1.9**	**67%**	**67%**	**89%**	**100%**	**3,228**	**3,177**	**-52**	**-1.6%**	**0.9**	**67%**	**67%**	**89%**	**100%**
Westbound																			
Victoria Road		8	8	-							-	-	-						
Archery Road	S	246	166	-80	-33%	5.6	Y	N	Y	Y	215	140	-75	-35%	5.6	Y	N	Y	Y
Portsmouth Road	W	735	704	-31	-4%	1.1	Y	Y	Y	Y	659	662	3	0%	0.1	Y	Y	Y	Y
STATION ROAD	W	124	92	-32	-26%	3.1	Y	Y	Y	Y	103	82	-20	-20%	2.1	Y	Y	Y	Y
South East Road	W	195	354	158	81%	9.6	N	N	N	Y	179	337	158	88%	9.8	N	N	N	Y
Bursledon Road West of NE Road	N	558	377	-181	-32%	8.4	N	N	N	Y	481	330	-151	-31%	7.5	N	N	Y	Y
A334 Thornhill Park Road	W	598	646	48	8%	1.9	Y	Y	Y	Y	540	614	73	14%	3.1	Y	Y	Y	Y
Pine Drive	N	23	74	51	228%	7.4	Y	N	Y	Y	20	73	52	256%	7.7	Y	N	N	Y
A27 Moorhill Road	S	492	530	38	8%	1.7	Y	Y	Y	Y	447	478	32	7%	1.5	Y	Y	Y	Y
Botley Road	W	568	477	-92	-16%	4.0	Y	Y	Y	Y	513	390	-123	-24%	5.8	N	N	Y	Y
		3,548	**3,428**	**-119**	**-3.4%**	**2.0**	**78%**	**56%**	**78%**	**100%**	**3,157**	**3,105**	**-51**	**-1.6%**	**0.9**	**67%**	**44%**	**78%**	**100%**
116 Motorway - M27																			
Eastbound																			
J2 to J3	E	3,317	3,514	197	6%	3.4	Y	Y	Y	Y	2,686	2,766	80	3%	1.5	Y	Y	Y	Y
J3 to J4	E	3,992	4,336	344	9%	5.3	Y	N	Y	Y	3,233	3,328	94	3%	1.6	Y	Y	Y	Y
J4 to J5	E	3,298	3,410	112	3%	1.9	Y	Y	Y	Y	2,707	2,783	76	3%	1.5	Y	Y	Y	Y
J5 to J7	E	3,813	4,044	231	6%	3.7	Y	Y	Y	Y	3,129	3,217	87	3%	1.6	Y	Y	Y	Y
J7 to J8	E	3,667	3,888	221	6%	3.6	Y	Y	Y	Y	3,009	3,101	91	3%	1.7	Y	Y	Y	Y
Westbound																			
J8 to J7	W	3,859	4,079	220	6%	3.5	Y	Y	Y	Y	3,171	3,257	87	3%	1.5	Y	Y	Y	Y
J7 to J5	W	3,978	4,149	170	4%	2.7	Y	Y	Y	Y	3,269	3,357	88	3%	1.5	Y	Y	Y	Y
J5 to J4	W	3,497	3,635	138	4%	2.3	Y	Y	Y	Y	2,874	2,953	80	3%	1.5	Y	Y	Y	Y
J4 to J3	W	4,198	4,414	216	5%	3.3	Y	Y	Y	Y	3,372	3,432	61	2%	1.0	Y	Y	Y	Y
J3 to J2	W	3,065	3,216	151	5%	2.7	Y	Y	Y	Y	2,462	2,506	44	2%	0.9	Y	Y	Y	Y
118 Motorway - M3																			
Eastbound																			
J14 to J13	E	4,557	4,557	-							3,722	3,722	-						
Westbound																			
J13 to J14	W	1,842	2,457	615	33%	13.3	N	N	N	N	1,491	1,930	439	29%	10.6	N	N	N	N

IP LGV / IP HGV

Site Description	Dir	LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound																			
Hamble Lane		71	125	54	75%	5.4	Y	N	Y	Y	36	70	35	97%	4.8	Y	Y	Y	Y
Grange Road South of A3025	S	24	13	-11	-45%	2.5	Y	Y	Y	Y	7	1	-7	-93%	3.4	Y	Y	Y	Y
Coxs Drive	W	0	2	2	394%	1.6	Y	Y	Y	Y	0	2	2	730%	1.7	Y	Y	Y	Y
Portsmouth Road	W	49	42	-7	-14%	1.0	Y	Y	Y	Y	28	23	-5	-18%	1.0	Y	Y	Y	Y
Butts Road	W	18	13	-4	-25%	1.1	Y	Y	Y	Y	6	7	1	17%	0.4	Y	Y	Y	Y
Kathleen Road	W	12	3	-9	-77%	3.4	Y	Y	Y	Y	10	2	-9	-82%	3.5	Y	Y	Y	Y
Burlesdon Road	N	42	9	-34	-80%	6.7	Y	N	Y	Y	36	19	-17	-48%	3.3	Y	Y	Y	Y
Upper Deacon Road	S	5	8	2	49%	1.0	Y	Y	Y	Y	2	-	-2	-100%	2.2	Y	Y	Y	Y
Bitterne Road	W	41	26	-15	-37%	2.6	Y	Y	Y	Y	24	-	-24	-100%	6.9	Y	N	Y	Y
Shales Road south of Taunton Drive	S	2	3	1	44%	0.6	Y	Y	Y	Y	1	1	-0	-33%	0.4	Y	Y	Y	Y
West End Road	W	47	42	-5	-10%	0.7	Y	Y	Y	Y	16	21	5	32%	1.2	Y	Y	Y	Y
Townhill Way	S	25	10	-15	-60%	3.5	Y	Y	Y	Y	23	1	-22	-96%	6.4	Y	N	Y	Y
Wakefield Road north of Cornwall Road	S	4	1	-4	-85%	2.3	Y	Y	Y	Y	1	0	-1	-98%	1.5	Y	Y	Y	Y
Northfield Road		0	0	-							0	0	-						
Foresthill Drive north of Woodmill Lane	W	9	2	-7	-81%	3.1	Y	Y	Y	Y	3	1	-2	-74%	1.7	Y	Y	Y	Y
		349	**297**	**-51**	**-14.7%**	**2.9**	**100%**	**86%**	**100%**	**100%**	**195**	**147**	**-47**	**-24.2%**	**3.6**	**100%**	**86%**	**100%**	**100%**
25 Bitterne Southwest to Northeast																			
Eastbound																			
Victoria Road		-	-	-							-	-	-						
Archery Road	N	17	14	-3	-19%	0.8	Y	Y	Y	Y	13	5	-8	-64%	2.8	Y	Y	Y	Y
Portsmouth Road	E	39	20	-19	-48%	3.4	Y	Y	Y	Y	19	6	-14	-70%	3.8	Y	Y	Y	Y
STATION ROAD	E	8	3	-6	-70%	2.5	Y	Y	Y	Y	8	0	-8	-99%	4.0	Y	Y	Y	Y
South East Road	E	15	10	-5	-31%	1.3	Y	Y	Y	Y	5	4	-1	-19%	0.4	Y	Y	Y	Y
Bursledon Road West of NE Road	S	43	11	-31	-73%	6.0	Y	N	Y	Y	25	14	-12	-46%	2.6	Y	Y	Y	Y
A334 Thornhill Park Road	E	46	51	4	10%	0.6	Y	Y	Y	Y	21	-	-21	-100%	6.4	Y	N	Y	Y
Pine Drive	S	4	2	-2	-60%	1.4	Y	Y	Y	Y	1	-	-1	-100%	1.5	Y	Y	Y	Y
A27 Moorhill Road		50	41	-9	-18%	1.4	Y	Y	Y	Y	25	28	3	10%	0.5	Y	Y	Y	Y
Botley Road	E	43	60	17	39%	2.4	Y	Y	Y	Y	17	43	25	146%	4.6	Y	Y	Y	Y
		266	**212**	**-54**	**-20.3%**	**3.5**	**100%**	**89%**	**100%**	**100%**	**135**	**99**	**-36**	**-27.0%**	**3.4**	**100%**	**89%**	**100%**	**100%**
Westbound																			
Victoria Road		-	-	-							-	-	-						
Archery Road	S	19	21	2	12%	0.5	Y	Y	Y	Y	13	5	-7	-58%	2.5	Y	Y	Y	Y
Portsmouth Road	W	52	30	-22	-43%	3.5	Y	Y	Y	Y	23	5	-18	-77%	4.7	Y	Y	Y	Y
STATION ROAD	W	10	1	-9	-87%	3.7	Y	Y	Y	Y	6	0	-6	-99%	3.5	Y	Y	Y	Y
South East Road	W	12	11	-1	-8%	0.3	Y	Y	Y	Y	4	6	2	44%	0.8	Y	Y	Y	Y
Bursledon Road West of NE Road	N	45	9	-35	-79%	6.8	Y	N	Y	Y	31	19	-12	-39%	2.5	Y	Y	Y	Y
A334 Thornhill Park Road	W	38	32	-7	-18%	1.2	Y	Y	Y	Y	19	-	-19	-100%	6.1	Y	N	Y	Y
Pine Drive	N	2	1	-0	-11%	0.1	Y	Y	Y	Y	1	-	-1	-100%	1.1	Y	Y	Y	Y
A27 Moorhill Road	S	31	33	1	5%	0.3	Y	Y	Y	Y	14	19	6	43%	1.4	Y	Y	Y	Y
Botley Road	W	40	50	10	26%	1.5	Y	Y	Y	Y	16	34	18	117%	3.7	Y	Y	Y	Y
		248	**187**	**-60**	**-24.3%**	**4.1**	**100%**	**89%**	**100%**	**100%**	**126**	**89**	**-37**	**-29.7%**	**3.6**	**100%**	**89%**	**100%**	**100%**
116 Motorway - M27																			
Eastbound																			
J2 to J3	E	228	268	40	18%	2.5	Y	Y	Y	Y	402	480	77	19%	3.7	Y	Y	Y	Y
J3 to J4	E	275	329	55	20%	3.1	Y	Y	Y	Y	484	679	195	40%	8.1	N	N	N	Y
J4 to J5	E	249	300	50	20%	3.0	Y	Y	Y	Y	342	327	-15	-4%	0.8	Y	Y	Y	Y
J5 to J7	E	288	350	61	21%	3.4	Y	Y	Y	Y	395	478	82	21%	3.9	Y	Y	Y	Y
J7 to J8	E	277	332	55	20%	3.1	Y	Y	Y	Y	380	455	75	20%	3.7	Y	Y	Y	Y
Westbound																			
J8 to J7	W	270	321	51	19%	2.9	Y	Y	Y	Y	418	501	83	20%	3.9	Y	Y	Y	Y
J7 to J5	W	278	328	50	18%	2.9	Y	Y	Y	Y	431	463	32	7%	1.5	Y	Y	Y	Y
J5 to J4	W	245	284	39	16%	2.4	Y	Y	Y	Y	379	398	19	5%	1.0	Y	Y	Y	Y
J4 to J3	W	308	363	55	18%	3.0	Y	Y	Y	Y	518	619	100	19%	4.2	N	Y	Y	Y
J3 to J2	W	225	264	39	17%	2.5	Y	Y	Y	Y	379	447	68	18%	3.3	Y	Y	Y	Y
118 Motorway - M3																			
Eastbound																			
J14 to J13	E	338	338	-							497	497	-						
Westbound																			
J13 to J14	W	114	162	48	42%	4.1	Y	Y	Y	Y	237	365	128	54%	7.4	N	N	Y	Y

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

PM
Vehicles

Cordon/ Screenline	Dir	Sites	Cordon and Screenlines Validation: Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	WebTAG within 7.5%	WebTAG within 10.0%	Link Validation: WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	10,096	10,517	421	4.2%	4.1	N	Y	Y	Y	75%	63%	75%	75%
1 Fareham Enclosure	Inbound	16	9,848	10,290	442	4.5%	4.4	N	Y	Y	Y	63%	50%	81%	81%
2 Havant Enclosure	Outbound	11	5,721	5,577	-144	-2.5%	1.9	Y	Y	Y	Y	64%	64%	82%	91%
2 Havant Enclosure	Inbound	11	6,052	5,842	-210	-3.5%	2.7	Y	Y	Y	Y	36%	27%	45%	73%
3 Hayling Island Enclosure	Outbound	1	828	837	10	1.2%	0.3	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	1,394	1,427	34	2.4%	0.9	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	4,577	4,661	85	1.9%	1.2	Y	Y	Y	Y	50%	50%	50%	50%
4 Hedge End Enclosure	Inbound	8	5,827	5,857	30	0.5%	0.4	Y	Y	Y	Y	25%	25%	50%	63%
5 Waterlooville Enclosure	Outbound	18	9,803	9,830	28	0.3%	0.3	Y	Y	Y	Y	56%	61%	67%	72%
5 Waterlooville Enclosure	Inbound	18	11,189	11,306	117	1.0%	1.1	Y	Y	Y	Y	39%	44%	61%	83%
71 Portsmouth South Enclosure	Outbound	6	4,182	4,153	-29	-0.7%	0.4	Y	Y	Y	Y	67%	67%	83%	83%
71 Portsmouth South Enclosure	Inbound	6	5,196	5,156	-40	-0.8%	0.6	Y	Y	Y	Y	33%	33%	33%	67%
72 Portsmouth North Enclosure	Outbound	8	7,935	7,962	28	0.4%	0.3	Y	Y	Y	Y	67%	67%	67%	83%
72 Portsmouth North Enclosure	Inbound	8	7,541	7,648	106	1.4%	1.2	Y	Y	Y	Y	63%	50%	88%	88%
8 Southampton City Enclosure	Outbound	12	7,101	7,162	60	0.8%	0.7	Y	Y	Y	Y	42%	50%	50%	58%
8 Southampton City Enclosure	Inbound	12	5,362	5,230	-132	-2.5%	1.8	Y	Y	Y	Y	50%	50%	50%	67%
91 Bitterne West Screenline	Eastbound	5	5,359	5,276	-83	-1.6%	1.1	Y	Y	Y	Y	60%	60%	80%	80%
91 Bitterne West Screenline	Westbound	5	2,811	2,641	-170	-6.0%	3.3	Y	N	Y	Y	60%	60%	80%	100%
92 Bitterne East Screenline	Eastbound	4	3,382	3,461	79	2.3%	1.4	Y	Y	Y	Y	50%	50%	50%	50%
92 Bitterne East Screenline	Westbound	4	2,811	2,813	3	0.1%	0.1	Y	Y	Y	Y	25%	25%	25%	25%
10 Locks Heath North Screenline	Outbound	9	6,578	6,486	-92	-1.4%	1.1	Y	Y	Y	Y	67%	67%	78%	89%
10 Locks Heath North Screenline	Inbound	9	6,668	7,252	585	8.8%	7.0	N	N	N	Y	67%	44%	78%	89%
11 Totton Enclosure	Outbound	19	9,107	9,367	260	2.9%	2.7	Y	Y	Y	Y	50%	44%	61%	67%
11 Totton Enclosure	Inbound	19	9,993	10,102	109	1.1%	1.1	Y	Y	Y	Y	39%	44%	56%	56%
12 Eastleigh Enclosure	Outbound	11	5,497	5,138	-359	-6.5%	4.9	N	N	Y	Y	55%	64%	82%	82%
12 Eastleigh Enclosure	Inbound	11	5,156	4,867	-289	-5.6%	4.1	N	N	Y	Y	45%	45%	64%	82%
13 Southampton Enclosure	Outbound	14	14,164	14,234	69	0.5%	0.6	Y	Y	Y	Y	71%	71%	79%	86%
13 Southampton Enclosure	Inbound	14	11,849	11,891	42	0.4%	0.4	Y	Y	Y	Y	64%	64%	86%	93%
36 Solent RSI Cordon	Northbound	3	194	170	-24	-12.2%	1.8	Y	N	N	N	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	163	74	-88	-54.3%	8.1	N	N	N	N	100%	33%	33%	67%
Total	**Total**	290	186,383	187,229	846	0.5%		80%	80%	90%	93%	55%	53%	67%	75%
Calibration Screenlines															
20 Totton	Eastbound	8	3,297	3,420	123	3.7%	2.1	Y	Y	Y	Y	75%	50%	75%	88%
20 Totton	Westbound	8	4,077	4,448	371	9.1%	5.7	N	N	N	Y	38%	38%	63%	75%
21 North of Southampton	Eastbound	15	11,378	11,259	-119	-1.0%	1.1	Y	Y	Y	Y	40%	27%	33%	53%
21 North of Southampton	Westbound	15	11,550	11,657	107	0.9%	1.0	Y	Y	Y	Y	33%	27%	33%	47%
22 South of Southampton	Eastbound	7	4,464	4,578	114	2.5%	1.7	Y	Y	Y	Y	29%	29%	29%	43%
22 South of Southampton	Westbound	7	4,901	4,990	88	1.8%	1.3	Y	Y	Y	Y	43%	43%	57%	57%
23 Eastleigh	Eastbound	6	8,069	7,981	-88	-1.1%	1.0	Y	Y	Y	Y	67%	50%	100%	100%
23 Eastleigh	Westbound	6	8,779	8,690	-89	-1.0%	0.9	Y	Y	Y	Y	50%	50%	83%	83%
24 Bitterne Northwest to Southeast	Eastbound	15	5,620	6,118	498	8.9%	6.5	N	N	N	Y	43%	36%	50%	57%
24 Bitterne Northwest to Southeast	Westbound	15	5,699	4,900	-799	-14.0%	11.0	N	N	N	N	64%	50%	64%	79%
25 Bitterne Southwest to Northeast	Eastbound	10	4,953	5,121	168	3.4%	2.4	Y	Y	Y	Y	67%	56%	78%	89%
25 Bitterne Southwest to Northeast	Westbound	10	4,533	4,506	-28	-0.6%	0.4	Y	Y	Y	Y	56%	44%	44%	67%
26 Fareham North South	Eastbound	9	7,668	7,869	201	2.6%	2.3	Y	Y	Y	Y	78%	56%	56%	67%
26 Fareham North South	Westbound	9	8,379	8,464	84	1.0%	0.9	Y	Y	Y	Y	50%	25%	63%	75%
271 Locks Heath West to East	Northbound	11	3,392	3,438	46	1.4%	0.8	Y	Y	Y	Y	64%	55%	73%	73%
271 Locks Heath West to East	Southbound	11	5,026	4,911	-116	-2.3%	1.6	Y	Y	Y	Y	36%	27%	64%	73%
272 Fareham West to East	Northbound	4	2,180	2,256	76	3.5%	1.6	Y	Y	Y	Y	100%	75%	100%	100%
272 Fareham West to East	Southbound	4	2,159	2,192	33	1.5%	0.7	Y	Y	Y	Y	75%	50%	75%	100%
28 Gosport	Northbound	6	2,906	2,852	-54	-1.9%	1.0	Y	Y	Y	Y	83%	83%	83%	83%
28 Gosport	Southbound	6	3,382	3,371	-11	-0.3%	0.2	Y	Y	Y	Y	67%	67%	67%	67%
29 Portsmouth NorthSouth	Eastbound	16	10,392	10,472	80	0.8%	0.8	Y	Y	Y	Y	44%	38%	50%	63%
29 Portsmouth NorthSouth	Westbound	17	10,254	10,094	-160	-1.6%	1.6	Y	Y	Y	Y	71%	53%	71%	94%
30 Portsmouth EastWest	Northbound	9	6,512	6,573	62	0.9%	0.8	Y	Y	Y	Y	67%	56%	78%	89%
30 Portsmouth EastWest	Southbound	9	7,312	7,224	-89	-1.2%	1.0	Y	Y	Y	Y	78%	44%	56%	67%
31 Cosham	Eastbound	5	7,791	7,927	136	1.7%	1.5	Y	Y	Y	Y	60%	60%	60%	60%
31 Cosham	Westbound	5	8,015	8,212	197	2.5%	2.2	Y	Y	Y	Y	60%	60%	60%	80%
32 Waterlooville North to South	Eastbound	15	11,513	11,972	459	4.0%	4.2	N	Y	Y	Y	53%	53%	73%	87%
32 Waterlooville North to South	Westbound	15	11,481	10,975	-505	-4.4%	4.8	N	Y	Y	Y	67%	60%	73%	80%
33 Waterlooville West to East	Northbound	5	4,641	4,771	130	2.8%	1.9	Y	Y	Y	Y	40%	40%	40%	100%
33 Waterlooville West to East	Southbound	5	4,587	4,799	212	4.6%	3.1	Y	Y	Y	Y	60%	60%	60%	80%
34 Havant North South	Eastbound	7	5,156	5,398	241	4.7%	3.3	Y	Y	Y	Y	57%	57%	71%	86%
34 Havant North South	Westbound	7	4,766	4,845	78	1.6%	1.1	Y	Y	Y	Y	43%	43%	43%	86%
35 Havant East West	Northbound	11	6,111	5,964	-147	-2.4%	1.9	Y	Y	Y	Y	64%	36%	55%	64%
35 Havant East West	Southbound	11	5,423	5,910	487	9.0%	6.5	N	N	N	Y	45%	36%	36%	45%
201 Winchester Cordon	Outbound	15	5,633	5,753	120	2.1%	1.6	Y	Y	Y	Y	93%	73%	87%	93%
201 Winchester Cordon	Inbound	15	4,881	4,792	-89	-1.8%	1.3	Y	Y	Y	Y	87%	73%	93%	93%
Total		349	226,881	228,701	1,820	0.8%		83%	89%	89%	97%	59%	48%	63%	75%
Motorways															
M27	Eastbound	14										93%	93%	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										100%	100%	100%	100%
M275	Northbound	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										50%	50%	100%	100%
Total	**Total**	54										96%	96%	100%	100%
Overall								82%	85%	89%	95%	60%	54%	67%	77%

APPENDIX A
CORDONS, SCREENLINES and LINK VALIDATION

PM
Car

Cordon/ Screenline	Dir	Sites	Observed	Model	Diff	% Diff	GEH	GEH<= 4	WebTAG within 5.0%	WebTAG within 7.5%	WebTAG within 10.0%	Link Validation WebTAG within Abs or %	GEH=5	GEH=7.5	GEH=10
RSI Cordons and Screenlines															
1 Fareham Enclosure	Outbound	16	8,938	9,239	301	3.4%	3.2	Y	Y	Y	Y	69%	69%	69%	81%
1 Fareham Enclosure	Inbound	16	8,605	8,956	351	4.1%	3.7	Y	Y	Y	Y	69%	63%	81%	88%
2 Havant Enclosure	Outbound	11	5,077	5,004	-73	-1.4%	1.0	Y	Y	Y	Y	64%	64%	82%	91%
2 Havant Enclosure	Inbound	11	5,209	5,142	-66	-1.3%	0.9	Y	Y	Y	Y	45%	36%	64%	91%
3 Hayling Island Enclosure	Outbound	1	689	691	2	0.3%	0.1	Y	Y	Y	Y	100%	100%	100%	100%
3 Hayling Island Enclosure	Inbound	1	1,220	1,235	15	1.3%	0.4	Y	Y	Y	Y	100%	100%	100%	100%
4 Hedge End Enclosure	Outbound	8	4,018	4,053	35	0.9%	0.6	Y	Y	Y	Y	50%	50%	50%	50%
4 Hedge End Enclosure	Inbound	8	5,064	5,083	19	0.4%	0.3	Y	Y	Y	Y	13%	25%	38%	63%
5 Waterlooville Enclosure	Outbound	18	8,366	8,454	88	1.1%	1.0	Y	Y	Y	Y	72%	72%	72%	78%
5 Waterlooville Enclosure	Inbound	18	9,745	9,798	53	0.5%	0.5	Y	Y	Y	Y	50%	44%	67%	89%
71 Portsmouth South Enclosure	Outbound	6	3,811	3,788	-23	-0.6%	0.4	Y	Y	Y	Y	67%	67%	83%	83%
71 Portsmouth South Enclosure	Inbound	6	4,722	4,714	-8	-0.2%	0.1	Y	Y	Y	Y	33%	33%	50%	100%
72 Portsmouth North Enclosure	Outbound	8	6,826	6,939	113	1.7%	1.4	Y	Y	Y	Y	33%	67%	83%	100%
72 Portsmouth North Enclosure	Inbound	8	6,670	6,806	137	2.1%	1.7	Y	Y	Y	Y	63%	63%	88%	88%
8 Southampton City Enclosure	Outbound	12	6,348	6,288	-60	-0.9%	0.8	Y	Y	Y	Y	50%	50%	50%	50%
8 Southampton City Enclosure	Inbound	12	4,682	4,482	-199	-4.3%	2.9	Y	Y	Y	Y	42%	33%	67%	67%
91 Bitterne West Screenline	Eastbound	5	4,808	4,730	-78	-1.6%	1.1	Y	Y	Y	Y	60%	60%	80%	80%
91 Bitterne West Screenline	Westbound	5	2,560	2,479	-81	-3.2%	1.6	Y	Y	Y	Y	60%	80%	80%	100%
92 Bitterne East Screenline	Eastbound	4	3,032	3,043	11	0.4%	0.2	Y	Y	Y	Y	25%	25%	25%	50%
92 Bitterne East Screenline	Westbound	4	2,529	2,509	-20	-0.8%	0.4	Y	Y	Y	Y	25%	25%	25%	25%
10 Locks Heath North Screenline	Outbound	9	5,693	5,632	-61	-1.1%	0.8	Y	Y	Y	Y	89%	78%	89%	89%
10 Locks Heath North Screenline	Inbound	9	5,618	6,039	422	7.5%	5.5	N	N	N	Y	67%	78%	89%	100%
11 Totton Enclosure	Outbound	19	7,963	8,038	75	0.9%	0.8	Y	Y	Y	Y	44%	56%	61%	67%
11 Totton Enclosure	Inbound	19	8,464	8,546	81	1.0%	0.9	Y	Y	Y	Y	56%	44%	56%	61%
12 Eastleigh Enclosure	Outbound	11	4,777	4,381	-397	-8.3%	5.9	N	N	N	Y	55%	55%	82%	82%
12 Eastleigh Enclosure	Inbound	11	4,544	4,278	-266	-5.9%	4.0	N	N	Y	Y	45%	36%	73%	82%
13 Southampton Enclosure	Outbound	14	12,630	12,662	32	0.3%	0.3	Y	Y	Y	Y	71%	71%	86%	86%
13 Southampton Enclosure	Inbound	14	10,630	10,657	27	0.3%	0.3	Y	Y	Y	Y	64%	79%	86%	93%
36 Solent RSI Cordon	Northbound	3	163	170	7	4.2%	0.5	Y	Y	Y	Y	100%	100%	100%	100%
36 Solent RSI Cordon	Southbound	3	141	74	-66	-47.2%	6.4	N	N	N	N	100%	33%	67%	100%
Total	**Total**	290	163,539	163,911	372	0.2%		87%	87%	90%	97%	57%	57%	70%	79%
Calibration Screenlines															
20 Totton	Eastbound	8	2,784	2,838	54	1.9%	1.0	Y	Y	Y	Y	75%	63%	88%	88%
20 Totton	Westbound	8	3,513	3,753	240	6.8%	4.0	Y	N	Y	Y	50%	38%	63%	75%
21 North of Southampton	Eastbound	15	10,120	10,055	-65	-0.6%	0.6	Y	Y	Y	Y	40%	33%	40%	60%
21 North of Southampton	Westbound	15	10,197	10,240	42	0.4%	0.4	Y	Y	Y	Y	33%	27%	33%	47%
22 South of Southampton	Eastbound	7	4,004	4,018	14	0.4%	0.2	Y	Y	Y	Y	14%	29%	29%	43%
22 South of Southampton	Westbound	7	4,371	4,385	14	0.3%	0.2	Y	Y	Y	Y	57%	57%	57%	57%
23 Eastleigh	Eastbound	6	7,069	7,097	28	0.4%	0.3	Y	Y	Y	Y	67%	67%	100%	100%
23 Eastleigh	Westbound	6	7,540	7,416	-124	-1.6%	1.4	Y	Y	Y	Y	33%	50%	83%	83%
24 Bitterne Northwest to Southeast	Eastbound	15	5,095	5,575	480	9.4%	6.6	N	N	N	Y	57%	43%	50%	57%
24 Bitterne Northwest to Southeast	Westbound	15	5,083	4,474	-609	-12.0%	8.8	N	N	N	N	57%	50%	64%	79%
25 Bitterne Southwest to Northeast	Eastbound	10	4,515	4,612	97	2.1%	1.4	Y	Y	Y	Y	56%	44%	56%	89%
25 Bitterne Southwest to Northeast	Westbound	10	4,152	4,154	2	0.0%	0.0	Y	Y	Y	Y	56%	44%	44%	78%
26 Fareham North South	Eastbound	9	6,699	6,699	1	0.0%	0.0	Y	Y	Y	Y	78%	56%	56%	78%
26 Fareham North South	Westbound	9	7,227	7,270	43	0.6%	0.5	Y	Y	Y	Y	63%	50%	63%	88%
271 Locks Heath West to East	Northbound	11	2,998	3,016	18	0.6%	0.3	Y	Y	Y	Y	73%	55%	64%	82%
271 Locks Heath West to East	Southbound	11	4,377	4,361	-16	-0.4%	0.2	Y	Y	Y	Y	55%	36%	64%	73%
272 Fareham West to East	Northbound	4	1,955	2,007	52	2.6%	1.2	Y	Y	Y	Y	100%	75%	100%	100%
272 Fareham West to East	Southbound	4	1,884	1,894	9	0.5%	0.2	Y	Y	Y	Y	75%	75%	100%	100%
28 Gosport	Northbound	6	2,636	2,626	-10	-0.4%	0.2	Y	Y	Y	Y	83%	83%	83%	83%
28 Gosport	Southbound	6	3,063	3,081	18	0.6%	0.3	Y	Y	Y	Y	50%	67%	67%	67%
29 Portsmouth NorthSouth	Eastbound	16	9,039	9,059	20	0.2%	0.2	Y	Y	Y	Y	44%	38%	56%	63%
29 Portsmouth NorthSouth	Westbound	17	8,989	8,891	-98	-1.1%	1.0	Y	Y	Y	Y	71%	47%	71%	94%
30 Portsmouth EastWest	Northbound	9	5,633	5,695	62	1.1%	0.8	Y	Y	Y	Y	67%	44%	78%	100%
30 Portsmouth EastWest	Southbound	9	6,583	6,536	-48	-0.7%	0.6	Y	Y	Y	Y	78%	56%	56%	67%
31 Cosham	Eastbound	5	6,829	6,901	73	1.1%	0.9	Y	Y	Y	Y	60%	60%	60%	80%
31 Cosham	Westbound	5	7,070	7,207	137	1.9%	1.6	Y	Y	Y	Y	60%	60%	80%	80%
32 Waterlooville North to South	Eastbound	15	9,907	10,379	472	4.8%	4.7	N	Y	Y	Y	60%	53%	87%	87%
32 Waterlooville North to South	Westbound	15	9,882	9,333	-548	-5.5%	5.6	N	N	Y	Y	67%	53%	73%	80%
33 Waterlooville West to East	Northbound	5	4,041	4,124	83	2.0%	1.3	Y	Y	Y	Y	40%	40%	60%	100%
33 Waterlooville West to East	Southbound	5	3,969	4,032	63	1.6%	1.0	Y	Y	Y	Y	60%	60%	60%	80%
34 Havant North South	Eastbound	7	4,485	4,693	209	4.7%	3.1	Y	Y	Y	Y	57%	57%	71%	86%
34 Havant North South	Westbound	7	4,123	4,170	48	1.2%	0.7	Y	Y	Y	Y	71%	43%	57%	86%
35 Havant East West	Northbound	11	5,284	5,186	-98	-1.8%	1.4	Y	Y	Y	Y	64%	36%	55%	73%
35 Havant East West	Southbound	11	4,664	5,069	405	8.7%	5.8	N	N	N	Y	55%	36%	45%	73%
201 Winchester Cordon	Outbound	15	4,905	4,876	-29	-0.6%	0.4	Y	Y	Y	Y	100%	92%	100%	100%
201 Winchester Cordon	Inbound	15	4,301	4,121	-181	-4.2%	2.8	Y	Y	Y	Y	85%	85%	92%	100%
Total		349	198,984	199,841	857	0.4%		86%	86%	92%	97%	61%	51%	65%	78%
Motorways															
M27	Eastbound	14										100%	100%	100%	100%
M27	Westbound	14										100%	100%	100%	100%
M3	Eastbound	6										100%	80%	100%	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	1										100%	100%	100%	100%
M275	Southbound	1										100%	100%	100%	100%
M271	Northbound	2										100%	100%	100%	100%
M271	Southbound	2										100%	100%	100%	100%
Total	**Total**	54										100%	98%	100%	100%
Overall								86%	86%	91%	97%	62%	57%	70%	81%

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

PM VEHICLES

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within: Abs %	GEH5	GEH7.5	GEH10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	2,033	2,127	94	5%	2.1	Y	Y	Y	Y
Central Station Bridge	N	737	683	-55	-7%	2.0	Y	Y	Y	Y
Blechynden Terrace	W	130	406	276	213%	16.9	N	N	N	N
Cumberland Place	N	750	346	-403	-54%	17.2	N	N	N	N
Above Bar Street - (one way this direction)	N	94	425	331	353%	20.6	N	N	N	N
East Park Terrace	N	359	173	-186	-52%	11.4	N	N	N	N
New Road	E	459	302	-157	-34%	8.0	N	N	N	Y
Kingsway	N	555	448	-107	-19%	4.8	N	Y	Y	Y
St Marys Street	N	160	540	380	238%	20.3	N	N	N	N
Britannia Road	N	373	377	5	1%	0.2	Y	Y	Y	Y
Princes Street	W	255	249	-7	-3%	0.4	Y	Y	Y	Y
Itchen Bridge	E	1,197	1,086	-112	-9%	3.3	Y	Y	Y	Y
		7,101	**7,162**	**60**	**0.8%**	**0.7**	**42%**	**50%**	**50%**	**58%**
Inbound										
A33 Mountbatten Way	E	1,671	1,794	123	7%	2.9	Y	Y	Y	Y
Central Station Bridge	S	486	258	-228	-47%	11.8	N	N	N	N
Blechynden Terrace	E	153	470	317	207%	18.0	N	N	N	N
Cumberland Place	S	658	173	-485	-74%	23.8	N	N	N	N
Above Bar Street - (one way in other direction)	N	94	425	331	353%	20.6	N	N	N	N
East Park Terrace	S	317	249	-68	-21%	4.0	Y	Y	Y	Y
New Road	W	398	334	-64	-16%	3.3	Y	Y	Y	Y
Kingsway	S	581	410	-171	-29%	7.7	N	N	N	Y
St Marys Street	S	159	278	119	75%	8.1	N	N	N	Y
Britannia Road	S	103	121	18	17%	1.7	Y	Y	Y	Y
Princes Street	E	212	274	62	29%	4.0	Y	Y	Y	Y
Itchen Bridge	W	531	445	-86	-16%	3.9	Y	Y	Y	Y
		5,362	**5,230**	**-132**	**-2.5%**	**1.8**	**50%**	**50%**	**50%**	**67%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	1,197	1,086	-112	-9%	3.3	Y	Y	Y	Y
Northam Bridge	E	1,817	1,705	-112	-6%	2.7	Y	Y	Y	Y
Cobden Bridge	E	1,112	944	-168	-15%	5.2	N	N	Y	Y
Woodmill Lane	S	262	531	269	103%	13.5	N	N	N	N
Mansbridge Road	E	971	1,011	39	4%	1.3	Y	Y	Y	Y
		5,359	**5,276**	**-83**	**-1.6%**	**1.1**	**60%**	**60%**	**80%**	**80%**
Westbound										
Itchen Bridge	W	531	445	-86	-16%	3.9	Y	Y	Y	Y
Northam Bridge	W	901	812	-89	-10%	3.0	Y	Y	Y	Y
Cobden Bridge	W	751	621	-131	-17%	5.0	N	N	Y	Y
Woodmill Lane	N	141	266	125	89%	8.8	N	N	N	Y
Mansbridge Road	W	487	498	10	2%	0.5	Y	Y	Y	Y
		2,811	**2,641**	**-170**	**-6.0%**	**3.3**	**60%**	**60%**	**80%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	654	569	-85	-13%	3.4	Y	Y	Y	Y
A334 Charles Watts Way	E	993	698	-295	-30%	10.2	N	N	N	N
St. John's Road	N	284	832	547	192%	23.2	N	N	N	N
A3024 North-East of Windhover (eastbound approach	E	1,451	1,363	-88	-6%	2.3	Y	Y	Y	Y
		3,382	**3,461**	**79**	**2.3%**	**1.4**	**50%**	**50%**	**50%**	**50%**
Westbound										
Botley Road	W	883	562	-321	-36%	12.0	N	N	N	N
A334 Charles Watts Way	W	887	782	-105	-12%	3.6	Y	Y	Y	Y
St. John's Road	S	376	125	-251	-67%	15.9	N	N	N	N
A3024 North-East of Windhover (westbound from to N	W	665	1,345	680	102%	21.5	N	N	N	N
		2,811	**2,813**	**3**	**0.1%**	**0.1**	**25%**	**25%**	**25%**	**25%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	1,428	1,610	182	13%	4.7	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	883	916	33	4%	1.1	Y	Y	Y	Y
Hill Street	N	5	-	-5	-100%	3.3	Y	Y	Y	Y
A36 east of A326	W	609	756	147	24%	5.6	N	N	Y	Y
A326 Totton Western Bypass south of A36	N	928	493	-436	-47%	16.3	N	N	N	N
Loperwood Lane	N	54	408	354	655%	23.3	N	N	N	N
Loperwood	W	99	83	-16	-16%	1.7	Y	Y	Y	Y
Tatchbury Lane		5	5	-						
A336 westbound at junction to Bartley	W	484	424	-60	-12%	2.8	Y	Y	Y	Y
Woodlands Road	W	110	256	146	133%	10.8	N	N	N	N
Foxhills	W	68	345	277	405%	19.2	N	N	N	N
A35 on dual close to Western Bypass	W	840	653	-187	-22%	6.9	N	N	Y	Y
Deerleap Lane	S	318	-	-318	-100%	25.2	N	N	N	N
Staplewood Lane	S	3	-	-3	-100%	2.3	Y	Y	Y	Y
Twiggs Lane	S	75	126	51	68%	5.1	N	Y	Y	Y
A326 Marchwood Bypass	S	1,416	1,134	-282	-20%	7.9	N	N	N	Y
Hythe Road	S	344	686	343	100%	15.1	N	N	N	N
Marchwood Bypass	E	696	762	66	9%	2.4	Y	Y	Y	Y
Marchwood Road	E	741	711	-30	-4%	1.1	Y	Y	Y	Y
		9,107	**9,367**	**260**	**2.9%**	**2.7**	**50%**	**44%**	**61%**	**67%**

PM CAR

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within: Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	1,800	1,889	89	5%	2.1	Y	Y	Y	Y
Central Station Bridge	N	679	598	-81	-12%	3.2	Y	Y	Y	Y
Blechynden Terrace	W	104	316	213	205%	14.7	N	N	N	N
Cumberland Place	N	678	324	-353	-52%	15.8	N	N	N	N
Above Bar Street - (one way this direction)	N	68	367	299	443%	20.3	N	N	N	N
East Park Terrace	N	319	163	-156	-49%	10.1	N	N	N	N
New Road	E	418	142	-276	-66%	16.5	N	N	N	N
Kingsway	N	499	416	-83	-17%	3.9	Y	Y	Y	Y
St Marys Street	N	133	441	308	231%	18.1	N	N	N	N
Britannia Road	N	327	345	19	6%	1.0	Y	Y	Y	Y
Princes Street	W	220	240	20	9%	1.3	Y	Y	Y	Y
Itchen Bridge	E	1,104	1,046	-59	-5%	1.8	Y	Y	Y	Y
		6,348	**6,288**	**-60**	**-0.9%**	**0.8**	**50%**	**50%**	**50%**	**50%**
Inbound										
A33 Mountbatten Way	E	1,480	1,518	38	3%	1.0	Y	Y	Y	Y
Central Station Bridge	S	446	247	-200	-45%	10.7	N	N	N	N
Blechynden Terrace	E	93	343	251	271%	17.0	N	N	N	N
Cumberland Place	S	568	147	-421	-74%	22.2	N	N	N	N
Above Bar Street - (one way in other direction)	N	68	367	299	443%	20.3	N	N	N	N
East Park Terrace	S	286	223	-63	-22%	3.9	Y	Y	Y	Y
New Road	W	361	244	-117	-32%	6.7	N	N	Y	Y
Kingsway	S	504	359	-145	-29%	7.0	N	N	Y	Y
St Marys Street	S	144	244	100	69%	7.2	N	N	Y	Y
Britannia Road	S	90	118	28	31%	2.7	Y	Y	Y	Y
Princes Street	E	177	257	81	46%	5.5	Y	N	Y	Y
Itchen Bridge	W	466	414	-51	-11%	2.4	Y	Y	Y	Y
		4,682	**4,482**	**-199**	**-4.3%**	**2.9**	**42%**	**33%**	**67%**	**67%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	1,104	1,046	-59	-5%	1.8	Y	Y	Y	Y
Northam Bridge	E	1,609	1,487	-122	-8%	3.1	Y	Y	Y	Y
Cobden Bridge	E	1,000	842	-158	-16%	5.2	N	N	Y	Y
Woodmill Lane	S	247	505	257	104%	13.3	N	N	N	N
Mansbridge Road	E	848	851	3	0%	0.1	Y	Y	Y	Y
		4,808	**4,730**	**-78**	**-1.6%**	**1.1**	**60%**	**60%**	**80%**	**80%**
Westbound										
Itchen Bridge	W	466	414	-51	-11%	2.4	Y	Y	Y	Y
Northam Bridge	W	798	759	-39	-5%	1.4	Y	Y	Y	Y
Cobden Bridge	W	719	591	-127	-18%	5.0	N	Y	Y	Y
Woodmill Lane	N	132	261	129	98%	9.2	N	N	N	Y
Mansbridge Road	W	446	453	7	2%	0.3	Y	Y	Y	Y
		2,560	**2,479**	**-81**	**-3.2%**	**1.6**	**60%**	**80%**	**80%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	606	431	-175	-29%	7.7	N	N	N	Y
A334 Charles Watts Way	E	907	621	-286	-32%	10.3	N	N	N	N
St. John's Road	N	262	788	525	200%	22.9	N	N	N	N
A3024 North-East of Windhover (eastbound approach	E	1,257	1,204	-54	-4%	1.5	Y	Y	Y	Y
		3,032	**3,043**	**11**	**0.4%**	**0.2**	**25%**	**25%**	**25%**	**50%**
Westbound										
Botley Road	W	802	503	-299	-37%	11.7	N	N	N	N
A334 Charles Watts Way	W	832	731	-101	-12%	3.6	Y	Y	Y	Y
St. John's Road	S	334	116	-217	-65%	14.5	N	N	N	N
A3024 North-East of Windhover (westbound from to N	W	561	1,159	598	107%	20.4	N	N	N	N
		2,529	**2,509**	**-20**	**-0.8%**	**0.4**	**25%**	**25%**	**25%**	**25%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	1,199	1,347	149	12%	4.2	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	853	815	-39	-5%	1.3	Y	Y	Y	Y
Hill Street	N	4	-	-4	-100%	3.0	Y	Y	Y	Y
A36 east of A326	W	526	637	112	21%	4.6	N	Y	Y	Y
A326 Totton Western Bypass south of A36	N	820	442	-378	-46%	15.0	N	N	N	N
Loperwood Lane	N	48	387	339	701%	23.0	N	N	N	N
Loperwood	W	90	73	-18	-20%	2.0	Y	Y	Y	Y
Tatchbury Lane		5	5	-						
A336 westbound at junction to Bartley	W	420	377	-43	-10%	2.2	Y	Y	Y	Y
Woodlands Road	W	101	231	129	128%	10.0	N	N	N	N
Foxhills	W	61	295	235	387%	17.6	N	N	N	N
A35 on dual close to Western Bypass	W	726	540	-186	-26%	7.4	N	N	Y	Y
Deerleap Lane	S	290	-	-290	-100%	24.1	N	N	N	N
Staplewood Lane	S	2	-	-2	-100%	2.1	Y	Y	Y	Y
Twiggs Lane	S	68	91	23	34%	2.6	Y	Y	Y	Y
A326 Marchwood Bypass	S	1,230	926	-304	-25%	9.3	N	N	N	Y
Hythe Road	S	305	641	337	111%	15.5	N	N	N	N
Marchwood Bypass	E	559	674	115	21%	4.6	N	Y	Y	Y
Marchwood Road	E	657	558	-99	-15%	4.0	Y	Y	Y	Y
		7,963	**8,038**	**75**	**0.9%**	**0.8**	**44%**	**56%**	**61%**	**67%**

PM LGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within: Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	174	195	20	12%	1.5	Y	Y	Y	Y
Central Station Bridge	N	44	84	41	93%	5.1	Y	N	Y	Y
Blechynden Terrace	W	5	19	14	285%	4.1	Y	Y	Y	Y
Cumberland Place	N	43	11	-32	-75%	6.3	Y	N	Y	Y
Above Bar Street - (one way this direction)	N	8	16	9	116%	2.5	Y	Y	Y	Y
East Park Terrace	N	25	4	-21	-84%	5.6	Y	N	Y	Y
New Road	E	22	34	12	56%	2.3	Y	Y	Y	Y
Kingsway	N	39	24	-15	-38%	2.6	Y	Y	Y	Y
St Marys Street	N	24	75	51	217%	7.3	Y	N	Y	Y
Britannia Road	N	33	25	-9	-26%	1.6	Y	Y	Y	Y
Princes Street	W	27	7	-20	-75%	5.0	Y	Y	Y	Y
Itchen Bridge	E	42	12	-30	-71%	5.8	Y	N	Y	Y
		486	**505**	**19**	**4.0%**	**0.9**	**100%**	**58%**	**100%**	**100%**
Inbound										
A33 Mountbatten Way	E	143	167	23	16%	1.9	Y	Y	Y	Y
Central Station Bridge	S	32	11	-22	-67%	4.7	Y	Y	Y	Y
Blechynden Terrace	E	12	60	48	410%	8.1	Y	N	N	Y
Cumberland Place	S	56	13	-43	-77%	7.4	Y	N	Y	Y
Above Bar Street - (one way in other direction)	N	8	16	9	116%	2.5	Y	Y	Y	Y
East Park Terrace	S	21	14	-6	-31%	1.5	Y	Y	Y	Y
New Road	W	25	33	8	31%	1.5	Y	Y	Y	Y
Kingsway	S	41	39	-2	-4%	0.2	Y	Y	Y	Y
St Marys Street	S	12	22	10	76%	2.3	Y	Y	Y	Y
Britannia Road	S	10	1	-8	-85%	3.5	Y	Y	Y	Y
Princes Street	E	24	11	-13	-56%	3.2	Y	Y	Y	Y
Itchen Bridge	W	41	3	-38	-93%	8.2	Y	N	N	Y
		425	**390**	**-35**	**-8.2%**	**1.7**	**100%**	**75%**	**83%**	**100%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	42	12	-30	-71%	5.8	Y	N	Y	Y
Northam Bridge	E	156	88	-68	-43%	6.1	Y	N	Y	Y
Cobden Bridge	E	47	53	7	14%	0.9	Y	Y	Y	Y
Woodmill Lane	S	12	23	11	93%	2.7	Y	Y	Y	Y
Mansbridge Road	E	99	122	23	23%	2.2	Y	Y	Y	Y
		356	**299**	**-57**	**-16.0%**	**3.1**	**100%**	**60%**	**100%**	**100%**
Westbound										
Itchen Bridge	W	41	3	-38	-93%	8.2	Y	N	N	Y
Northam Bridge	W	77	6	-71	-92%	11.1	Y	N	N	N
Cobden Bridge	W	19	14	-5	-24%	1.1	Y	Y	Y	Y
Woodmill Lane	N	6	5	-1	-19%	0.5	Y	Y	Y	Y
Mansbridge Road	W	31	33	2	6%	0.3	Y	Y	Y	Y
		174	**60**	**-113**	**-65.2%**	**10.5**	**100%**	**60%**	**60%**	**80%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	36	80	44	122%	5.8	Y	N	Y	Y
A334 Charles Watts Way	E	56	74	18	31%	2.2	Y	Y	Y	Y
St. John's Road	N	19	44	25	135%	4.5	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	133	77	-56	-42%	5.5	Y	N	Y	Y
		244	**275**	**31**	**12.7%**	**1.9**	**100%**	**50%**	**100%**	**100%**
Westbound										
Botley Road	W	63	55	-9	-14%	1.1	Y	Y	Y	Y
A334 Charles Watts Way	W	39	37	-2	-6%	0.4	Y	Y	Y	Y
St. John's Road	S	36	8	-28	-77%	5.9	Y	N	Y	Y
A3024 North-East of Windhover (westbound from to N	W	61	114	53	87%	5.7	Y	N	Y	Y
		199	**214**	**14**	**7.2%**	**1.0**	**100%**	**50%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	153	177	24	16%	1.9	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	20	28	8	38%	1.6	Y	Y	Y	Y
Hill Street	N	1	-	-1	-100%	1.4	Y	Y	Y	Y
A36 east of A326	W	61	107	46	76%	5.0	Y	N	Y	Y
A326 Totton Western Bypass south of A36	N	79	31	-49	-61%	6.5	Y	N	Y	Y
Loperwood Lane	N	5	19	13	252%	3.8	Y	Y	Y	Y
Loperwood	W	7	9	2	32%	0.8	Y	Y	Y	Y
Tatchbury Lane		1	1	-						
A336 westbound at junction to Bartley	W	47	43	-4	-9%	0.7	Y	Y	Y	Y
Woodlands Road	W	6	23	18	315%	4.6	Y	Y	Y	Y
Foxhills	W	7	41	34	502%	7.0	Y	N	Y	Y
A35 on dual close to Western Bypass	W	95	84	-11	-12%	1.2	Y	Y	Y	Y
Deerleap Lane	S	23	-	-23	-100%	6.8	Y	N	Y	Y
Staplewood Lane	S	0	-	-0	-100%	0.9	Y	Y	Y	Y
Twiggs Lane	S	6	35	30	538%	6.6	Y	N	Y	Y
A326 Marchwood Bypass	S	140	149	10	7%	0.8	Y	Y	Y	Y
Hythe Road	S	29	42	13	44%	2.1	Y	Y	Y	Y
Marchwood Bypass	E	111	52	-59	-53%	6.5	Y	N	Y	Y
Marchwood Road	E	34	110	76	225%	9.0	Y	N	N	Y
		823	**949**	**126**	**15.3%**	**4.2**	**100%**	**61%**	**94%**	**100%**

PM HGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within: Abs or %	GEH=5	GEH=7.5	GEH=10
8 Southampton City Enclosure										
Outbound										
A33 Mountbatten Way	W	58	42	-16	-28%	2.3	Y	Y	Y	Y
Central Station Bridge	N	15	-	-15	-100%	5.4	Y	N	Y	Y
Blechynden Terrace	W	11	27	16	153%	3.7	Y	Y	Y	Y
Cumberland Place	N	23	11	-12	-52%	2.9	Y	Y	Y	Y
Above Bar Street - (one way this direction)	N	12	14	2	18%	0.6	Y	Y	Y	Y
East Park Terrace	N	14	3	-10	-75%	3.5	Y	Y	Y	Y
New Road	E	19	103	85	452%	10.8	Y	N	N	N
Kingsway	N	16	7	-9	-54%	2.6	Y	Y	Y	Y
St Marys Street	N	3	24	21	718%	5.7	Y	N	Y	Y
Britannia Road	N	12	7	-5	-40%	1.6	Y	Y	Y	Y
Princes Street	W	8	2	-6	-79%	2.8	Y	Y	Y	Y
Itchen Bridge	E	49	-	-49	-100%	9.9	Y	N	N	Y
		238	**240**	**2**	**0.9%**	**0.1**	**100%**	**67%**	**83%**	**92%**
Inbound										
A33 Mountbatten Way	E	48	108	60	127%	6.8	Y	N	Y	Y
Central Station Bridge	S	7	-	-7	-100%	3.9	Y	Y	Y	Y
Blechynden Terrace	E	30	19	-11	-36%	2.2	Y	Y	Y	Y
Cumberland Place	S	30	11	-20	-65%	4.3	Y	Y	Y	Y
Above Bar Street - (one way in other direction)	N	12	14	2	18%	0.6	Y	Y	Y	Y
East Park Terrace	S	9	8	-1	-7%	0.2	Y	Y	Y	Y
New Road	W	11	34	22	199%	4.7	Y	Y	Y	Y
Kingsway	S	34	12	-23	-66%	4.7	Y	Y	Y	Y
St Marys Street	S	2	12	10	552%	3.8	Y	Y	Y	Y
Britannia Road	S	4	2	-2	-47%	1.0	Y	Y	Y	Y
Princes Street	E	10	6	-5	-44%	1.6	Y	Y	Y	Y
Itchen Bridge	W	17	-	-17	-100%	5.9	Y	N	Y	Y
		215	**225**	**10**	**4.7%**	**0.7**	**100%**	**83%**	**100%**	**100%**
91 Bitterne West Screenline										
Eastbound										
Itchen Bridge	E	49	-	-49	-100%	9.9	Y	N	N	Y
Northam Bridge	E	52	105	53	103%	6.0	Y	N	Y	Y
Cobden Bridge	E	53	41	-12	-22%	1.7	Y	Y	Y	Y
Woodmill Lane	S	3	3	1	20%	0.3	Y	Y	Y	Y
Mansbridge Road	E	23	37	14	60%	2.5	Y	Y	Y	Y
		180	**187**	**7**	**3.8%**	**0.5**	**100%**	**60%**	**80%**	**100%**
Westbound										
Itchen Bridge	W	17	-	-17	-100%	5.9	Y	N	Y	Y
Northam Bridge	W	26	23	-2	-9%	0.5	Y	Y	Y	Y
Cobden Bridge	W	13	7	-6	-48%	2.0	Y	Y	Y	Y
Woodmill Lane	N	2	0	-2	-99%	1.8	Y	Y	Y	Y
Mansbridge Road	W	10	11	1	8%	0.2	Y	Y	Y	Y
		68	**42**	**-27**	**-39.3%**	**3.6**	**100%**	**80%**	**100%**	**100%**
92 Bitterne East Screenline										
Eastbound										
Botley Road	E	11	55	44	403%	7.7	Y	N	N	Y
A334 Charles Watts Way	E	27	2	-26	-94%	6.7	Y	N	Y	Y
St. John's Road	N	3	-	-3	-100%	2.6	Y	Y	Y	Y
A3024 North-East of Windhover (eastbound approach	E	57	82	24	42%	2.9	Y	Y	Y	Y
		99	**138**	**39**	**39.6%**	**3.6**	**100%**	**50%**	**75%**	**100%**
Westbound										
Botley Road	W	16	2	-15	-91%	5.0	Y	Y	Y	Y
A334 Charles Watts Way	W	15	14	-2	-11%	0.4	Y	Y	Y	Y
St. John's Road	S	6	-	-6	-100%	3.5	Y	Y	Y	Y
A3024 North-East of Windhover (westbound from to N	W	33	71	37	112%	5.2	Y	N	Y	Y
		71	**86**	**15**	**20.8%**	**1.7**	**100%**	**75%**	**100%**	**100%**
11 Totton Enclosure										
Outbound										
Redbridge roundabout approach from west on Totton .	N	74	81	8	10%	0.9	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	E	10	66	56	554%	9.1	Y	N	N	Y
Hill Street	N	0	-	-0	-100%	0.3	Y	Y	Y	Y
A36 east of A326	W	22	11	-11	-51%	2.7	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	N	26	20	-7	-25%	1.4	Y	Y	Y	Y
Loperwood Lane	N	0	2	1	312%	1.3	Y	Y	Y	Y
Loperwood	W	2	0	-2	-83%	1.6	Y	Y	Y	Y
Tatchbury Lane		-	-	-						
A336 westbound at junction to Bartley	W	16	4	-12	-75%	3.8	Y	Y	Y	Y
Woodlands Road	W	3	1	-2	-53%	1.1	Y	Y	Y	Y
Foxhills	W	1	8	7	812%	3.4	Y	Y	Y	Y
A35 on dual close to Western Bypass	W	18	29	11	65%	2.4	Y	Y	Y	Y
Deerleap Lane	S	4	-	-4	-100%	3.0	Y	Y	Y	Y
Staplewood Lane	S	0	-	-0	-100%	0.5	Y	Y	Y	Y
Twiggs Lane	S	2	-	-2	-100%	1.9	Y	Y	Y	Y
A326 Marchwood Bypass	S	44	57	13	30%	1.8	Y	Y	Y	Y
Hythe Road	S	9	2	-8	-82%	3.3	Y	Y	Y	Y
Marchwood Bypass	E	24	36	13	53%	2.3	Y	Y	Y	Y
Marchwood Road	E	49	43	-6	-12%	0.9	Y	Y	Y	Y
		305	**361**	**56**	**18.5%**	**3.1**	**100%**	**94%**	**94%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

Site Description	Dir	PM VEHICLES Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10	PM CAR Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	PM LGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10	PM HGV Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Inbound																																					
Redbridge roundabout approach from west on Totton	S	2,076	2,396	320	15%	6.8	N	N	Y	Y	1,733	1,943	210	12%	4.9	Y	Y	Y	Y	208	288	80	38%	5.1	Y	N	Y	Y	131	164	32	25%	2.7	Y	Y	Y	Y
Redbridge roundabout approach from west on Comme	W	1,235	1,245	10	1%	0.3	Y	Y	Y	Y	1,147	1,148	1	0%	0.0	Y	Y	Y	Y	59	57	- 2	-4%	0.3	Y	Y	Y	Y	28	33	5	18%	0.9	Y	Y	Y	Y
Hill Street	S	9	-	- 9	-100%	4.3	Y	Y	Y	Y	8	-	- 8	-100%	4.0	Y	Y	Y	Y	1	-	- 1	-100%	1.3	Y	Y	Y	Y	0	-	- 0	-100%	0.5	Y	Y	Y	Y
A36 east of A326	E	662	781	119	18%	4.4	N	Y	Y	Y	535	591	56	10%	2.4	Y	Y	Y	Y	87	125	37	43%	3.6	Y	Y	Y	Y	38	64	26	69%	3.7	Y	Y	Y	Y
A326 Totton Western Bypass south of A36	S	1,312	870	- 441	-34%	13.4	N	N	N	N	1,158	798	- 360	-31%	11.5	N	N	N	N	112	57	- 56	-49%	6.0	Y	N	Y	Y	37	15	- 22	-59%	4.3	Y	Y	Y	Y
Loperwood Lane	S	32	290	257	794%	20.3	N	N	N	N	29	258	229	778%	19.1	N	N	N	N	3	31	28	1047%	6.9	Y	N	Y	Y	0	1	0	90%	0.4	Y	Y	Y	Y
Loperwood	E	87	134	47	55%	4.5	Y	Y	Y	Y	70	117	47	67%	4.9	Y	Y	Y	Y	13	15	2	15%	0.5	Y	Y	Y	Y	3	1	- 2	-74%	1.7	Y	Y	Y	Y
Tatchbury Lane		6	6	-							6	6	-							0	0	-							-	-	-						
A336 westbound at junction to Bartley	E	544	323	- 221	-41%	10.6	N	N	N	N	480	290	- 190	-40%	9.7	N	N	N	Y	46	23	- 23	-49%	3.9	Y	Y	Y	Y	17	10	- 7	-43%	2.0	Y	Y	Y	Y
Woodlands Road	E	84	213	128	152%	10.5	N	N	N	N	75	196	121	161%	10.4	N	N	N	N	7	15	8	109%	2.3	Y	Y	Y	Y	2	1	- 1	-62%	1.1	Y	Y	Y	Y
Foxhills	E	46	166	120	260%	11.6	N	N	N	N	43	151	108	253%	11.0	N	N	N	N	2	12	10	446%	3.7	Y	Y	Y	Y	1	1	0	31%	0.3	Y	Y	Y	Y
A35 on dual close to Western Bypass	E	625	653	27	4%	1.1	Y	Y	Y	Y	546	540	- 6	-1%	0.2	Y	Y	Y	Y	62	84	21	34%	2.5	Y	Y	Y	Y	17	29	12	76%	2.6	Y	Y	Y	Y
Deerleap Lane	N	108	-	- 108	-100%	14.7	N	N	N	N	100	-	- 100	-100%	14.1	Y	N	N	N	6	-	- 6	-100%	3.6	Y	Y	Y	Y	2	-	- 2	-100%	1.8	Y	Y	Y	Y
Staplewood Lane	N	3	-	- 3	-100%	2.3	Y	Y	Y	Y	3	-	- 3	-100%	2.2	Y	Y	Y	Y	0	-	- 0	-100%	0.7	Y	Y	Y	Y	-	-	-						
Twiggs Lane	N	107	2	- 105	-98%	14.3	N	N	N	N	90	2	- 88	-98%	13.0	Y	N	N	N	15	0	- 15	-100%	5.5	Y	N	Y	Y	3	-	- 3	-100%	2.3	Y	Y	Y	Y
A326 Marchwood Bypass	N	1,160	1,175	15	1%	0.4	Y	Y	Y	Y	744	931	187	25%	6.5	N	N	Y	Y	364	182	- 183	-50%	11.0	N	N	N	N	49	59	9	19%	1.3	Y	Y	Y	Y
Hythe Road	N	213	50	- 163	-77%	14.2	N	N	N	N	189	38	- 151	-80%	14.2	N	N	N	N	14	7	- 6	-46%	1.9	Y	Y	Y	Y	10	4	- 6	-60%	2.3	Y	Y	Y	Y
Marchwood Bypass	W	1,264	1,221	- 42	-3%	1.2	Y	Y	Y	Y	1,105	991	- 115	-10%	3.5	Y	Y	Y	Y	99	168	69	69%	6.0	Y	N	Y	Y	57	59	2	3%	0.2	Y	Y	Y	Y
Marchwood Road	W	421	578	158	37%	7.1	N	N	Y	Y	404	547	143	35%	6.5	N	N	Y	Y	10	21	11	108%	2.8	Y	Y	Y	Y	6	9	3	48%	1.1	Y	Y	Y	Y
		9,993	**10,102**	**109**	**1.1%**	**1.1**	**39%**	**44%**	**56%**	**56%**	**8,464**	**8,546**	**81**	**1.0%**	**0.9**	**56%**	**44%**	**56%**	**61%**	**1,110**	**1,084**	**- 26**	**-2.3%**	**0.8**	**94%**	**67%**	**94%**	**94%**	**402**	**449**	**47**	**11.7%**	**2.3**	**100%**	**100%**	**100%**	**100%**
13 Southampton Enclosure																																					
Outbound																																					
A35 Redbridge Road	W	3,013	3,141	127	4%	2.3	Y	Y	Y	Y	2,561	2,640	78	3%	1.5	Y	Y	Y	Y	301	322	21	7%	1.2	Y	Y	Y	Y	151	170	19	13%	1.5	Y	Y	Y	Y
Brownhill Way	W	957	888	- 68	-7%	2.2	Y	Y	Y	Y	880	750	- 130	-15%	4.5	Y	Y	Y	Y	58	118	61	105%	6.5	Y	N	Y	Y	18	20	2	10%	0.4	Y	Y	Y	Y
Romsey Road	N	478	659	181	38%	7.6	N	N	N	Y	429	586	157	37%	7.0	N	N	Y	Y	39	43	5	12%	0.7	Y	Y	Y	Y	10	30	20	195%	4.4	Y	Y	Y	Y
Rownhams Lane	N	604	573	- 31	-5%	1.3	Y	Y	Y	Y	521	549	29	5%	1.2	Y	Y	Y	Y	65	19	- 45	-70%	7.0	Y	N	Y	Y	17	2	- 15	-87%	4.8	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba:	N	1,637	1,722	85	5%	2.1	Y	Y	Y	Y	1,550	1,626	76	5%	1.9	Y	Y	Y	Y	50	56	6	12%	0.8	Y	Y	Y	Y	35	34	- 1	-2%	0.1	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	N	504	531	27	5%	1.2	Y	Y	Y	Y	463	475	11	2%	0.5	Y	Y	Y	Y	30	41	11	36%	1.8	Y	Y	Y	Y	8	15	7	90%	2.1	Y	Y	Y	Y
Stoneham Lane	N	166	12	- 154	-93%	16.4	N	N	N	N	153	9	- 145	-94%	16.1	N	N	N	N	7	0	- 7	-97%	3.6	Y	Y	Y	Y	6	0	- 6	-99%	3.4	Y	Y	Y	Y
A335 Stoneham Way	N	1,103	1,033	- 71	-6%	2.2	Y	Y	Y	Y	964	967	2	0%	0.1	Y	Y	Y	Y	78	38	- 40	-51%	5.2	Y	N	Y	Y	54	28	- 26	-49%	4.1	Y	Y	Y	Y
Wide Lane	N	343	400	57	16%	2.9	Y	Y	Y	Y	300	331	31	10%	1.7	Y	Y	Y	Y	30	39	9	31%	1.5	Y	Y	Y	Y	12	22	10	79%	2.3	Y	Y	Y	Y
Mansbridge Road	E	971	1,011	39	4%	1.3	Y	Y	Y	Y	848	851	3	0%	0.1	Y	Y	Y	Y	99	122	23	23%	2.2	Y	Y	Y	Y	23	37	14	60%	2.5	Y	Y	Y	Y
Woodmill Lane	S	262	531	269	103%	13.5	N	N	N	N	247	505	257	104%	13.3	N	N	N	N	12	23	11	93%	2.7	Y	Y	Y	Y	3	3	1	20%	0.3	Y	Y	Y	Y
Cobden Bridge	E	1,112	944	- 168	-15%	5.2	N	N	Y	Y	1,000	842	- 158	-16%	5.2	N	N	Y	Y	47	53	7	14%	0.9	Y	Y	Y	Y	53	41	- 12	-22%	1.7	Y	Y	Y	Y
Northam Bridge	E	1,817	1,705	- 112	-6%	2.7	Y	Y	Y	Y	1,609	1,487	- 122	-8%	3.1	Y	Y	Y	Y	156	88	- 68	-43%	6.1	Y	N	Y	Y	52	105	53	103%	6.0	Y	N	Y	Y
Itchen Bridge	E	1,197	1,086	- 112	-9%	3.3	Y	Y	Y	Y	1,104	1,046	- 59	-5%	1.8	Y	Y	Y	Y	42	12	- 30	-71%	5.8	Y	N	Y	Y	49	-	- 49	-100%	9.9	Y	N	N	Y
		14,164	**14,234**	**69**	**0.5%**	**0.6**	**71%**	**71%**	**79%**	**86%**	**12,630**	**12,662**	**32**	**0.3%**	**0.3**	**71%**	**71%**	**86%**	**86%**	**1,013**	**976**	**- 37**	**-3.7%**	**1.2**	**100%**	**64%**	**100%**	**100%**	**491**	**507**	**17**	**3.4%**	**0.7**	**100%**	**86%**	**93%**	**100%**
Inbound																																					
A35 Redbridge Road	E	2,317	2,433	116	5%	2.4	Y	Y	Y	Y	1,970	2,003	33	2%	0.7	Y	Y	Y	Y	232	244	13	5%	0.8	Y	Y	Y	Y	116	174	58	50%	4.8	Y	Y	Y	Y
Brownhill Way	E	945	871	- 74	-8%	2.4	Y	Y	Y	Y	863	739	- 124	-14%	4.4	Y	Y	Y	Y	60	109	49	81%	5.3	Y	N	Y	Y	21	23	2	10%	0.5	Y	Y	Y	Y
Romsey Road	S	584	754	169	29%	6.5	N	N	Y	Y	516	688	172	33%	7.0	N	N	Y	Y	56	41	- 15	-27%	2.1	Y	Y	Y	Y	13	25	12	97%	2.8	Y	Y	Y	Y
Rownhams Lane	S	500	468	- 32	-6%	1.5	Y	Y	Y	Y	438	439	0	0%	0.0	Y	Y	Y	Y	48	23	- 25	-52%	4.2	Y	Y	Y	Y	13	4	- 9	-68%	3.0	Y	Y	Y	Y
A33 Bassett Avenue between Winchester Road and Ba:	S	1,682	1,887	205	12%	4.9	Y	Y	Y	Y	1,604	1,716	112	7%	2.7	Y	Y	Y	Y	38	93	54	143%	6.7	Y	N	Y	Y	38	67	29	76%	4.0	Y	Y	Y	Y
A27 Bassett Green Road close to Lobelia Road	S	765	624	- 141	-18%	5.4	N	N	Y	Y	696	577	- 120	-17%	4.8	N	Y	Y	Y	51	30	- 20	-40%	3.2	Y	Y	Y	Y	16	17	1	5%	0.2	Y	Y	Y	Y
Stoneham Lane	S	201	13	- 188	-93%	18.1	N	N	N	N	187	11	- 176	-94%	17.7	N	N	N	N	7	0	- 7	-98%	3.7	Y	Y	Y	Y	7	0	- 7	-98%	3.6	Y	Y	Y	Y
A335 Stoneham Way	S	1,258	1,346	88	7%	2.4	Y	Y	Y	Y	1,109	1,268	159	14%	4.6	Y	Y	Y	Y	97	69	- 29	-29%	3.1	Y	Y	Y	Y	48	9	- 39	-81%	7.3	Y	N	Y	Y
Wide Lane	S	785	854	69	9%	2.4	Y	Y	Y	Y	686	738	52	8%	2.0	Y	Y	Y	Y	77	80	3	4%	0.4	Y	Y	Y	Y	20	29	9	44%	1.8	Y	Y	Y	Y
Mansbridge Road	W	487	498	10	2%	0.5	Y	Y	Y	Y	446	453	7	2%	0.3	Y	Y	Y	Y	31	33	2	6%	0.3	Y	Y	Y	Y	10	11	1	8%	0.2	Y	Y	Y	Y
Woodmill Lane	N	141	266	125	89%	8.8	N	N	N	Y	132	261	129	98%	9.2	N	N	N	Y	6	5	- 1	-19%	0.5	Y	Y	Y	Y	2	0	- 2	-99%	1.8	Y	Y	Y	Y
Cobden Bridge	W	751	621	- 131	-17%	5.0	N	N	Y	Y	719	591	- 127	-18%	5.0	N	Y	Y	Y	19	14	- 5	-24%	1.1	Y	Y	Y	Y	13	7	- 6	-48%	2.0	Y	Y	Y	Y
Northam Bridge	W	901	812	- 89	-10%	3.0	Y	Y	Y	Y	798	759	- 39	-5%	1.4	Y	Y	Y	Y	77	6	- 71	-92%	11.1	Y	N	N	N	26	23	- 2	-9%	0.5	Y	Y	Y	Y
Itchen Bridge	W	531	445	- 86	-16%	3.9	Y	Y	Y	Y	466	414	- 51	-11%	2.4	Y	Y	Y	Y	41	3	- 38	-93%	8.2	Y	N	N	Y	17	-	- 17	-100%	5.9	Y	N	Y	Y
		11,849	**11,891**	**42**	**0.4%**	**0.4**	**64%**	**64%**	**86%**	**93%**	**10,630**	**10,657**	**27**	**0.3%**	**0.3**	**64%**	**79%**	**86%**	**93%**	**840**	**750**	**- 90**	**-10.7%**	**3.2**	**100%**	**71%**	**86%**	**93%**	**361**	**391**	**30**	**8.3%**	**1.6**	**100%**	**86%**	**100%**	**100%**
20 Totton																																					
Eastbound																																					
Marchwood Bypass south of Jacobs Gutter Lane	N	145	-	- 145	-100%	17.1	N	N	N	N	131	-	- 131	-100%	16.2	N	N	N	N	8	-	- 8	-100%	3.9	Y	Y	Y	Y	7	-	- 7	-100%	3.7	Y	Y	Y	Y
Spicers Hill south of Spicers Way	N	1,545	1,580	35	2%	0.9	Y	Y	Y	Y	1,261	1,290	28	2%	0.8	Y	Y	Y	Y	206	219	13	6%	0.9	Y	Y	Y	Y	75	67	- 7	-10%	0.9	Y	Y	Y	Y
Rushington Lane	E	4	1	- 3	-74%	1.8	Y	Y	Y	Y	3	-	- 3	-100%	2.3	Y	Y	Y	Y	0	-	- 0	-100%	0.5	Y	Y	Y	Y	1	-	- 1	-100%	1.2	Y	Y	Y	Y
Ringwood Road east of Calmore Road	E	502	487	- 14	-3%	0.6	Y	Y	Y	Y	468	448	- 21	-4%	1.0	Y	Y	Y	Y	27	18	- 9	-33%	1.9	Y	Y	Y	Y	7	20	13	191%	3.6	Y	Y	Y	Y
Water Lane near Totton College	E	204	138	- 66	-32%	5.1	Y	N	Y	Y	181	126	- 56	-31%	4.5	Y	Y	Y	Y	18	8	- 10	-56%	2.8	Y	Y	Y	Y	5	2	- 3	-51%	1.3	Y	Y	Y	Y
Calmore Drive	E	196	187	- 9	-5%	0.7	Y	Y	Y	Y	176	157	- 19	-11%	1.5	Y	Y	Y	Y	17	25	9	53%	1.9	Y	Y	Y	Y	4	5	1	36%	0.6	Y	Y	Y	Y
Cooks Lane east of Calmore Road	E	162	255	94	58%	6.5	Y	N	Y	Y	137	228	92	67%	6.8	Y	N	Y	Y	20	16	- 4	-20%	0.9	Y	Y	Y	Y	5	11	6	132%	2.3	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	E	539	772	232	43%	9.1	N	N	N	Y	427	591	163	38%	7.2	N	N	Y	Y	74	125	51	68%	5.1	Y	N	Y	Y	37	55	19	51%	2.8	Y	Y	Y	Y
		3,297	**3,420**	**123**	**3.7%**	**2.1**	**75%**	**50%**	**75%**	**88%**	**2,784**	**2,838**	**54**	**1.9%**	**1.0**	**75%**	**63%**	**88%**	**88%**	**369**	**411**	**42**	**11.3%**	**2.1**	**100%**	**88%**	**100%**	**100%**	**140**	**162**	**22**	**15.8%**	**1.8**	**100%**	**100%**	**100%**	**100%**
Westbound																																					
Marchwood Bypass south of Jacobs Gutter Lane	S	793	1,220	427	54%	13.5	N	N	N	N	669	1,051	382	57%	13.0	N	N	N	N	89	146	57	64%	5.3	Y	N	Y	Y	33	20	- 12	-38%	2.4	Y	Y	Y	Y
Spicers Hill south of Spicers Way	S	1,245	1,184	- 61	-5%	1.7	Y	Y	Y	Y	1,022	916	- 106	-10%	3.4	Y	Y	Y	Y	175	172	- 3	-2%	0.2	Y	Y	Y	Y	46	96	50	111%	6.0	Y	N	Y	Y
Rushington Lane	W	60	48	- 12	-19%	1.6	Y	Y	Y	Y	47	43	- 4	-8%	0.5	Y	Y	Y	Y	10	4	- 6	-60%	2.2	Y	Y	Y	Y	3	0	- 3	-95%	2.2	Y	Y	Y	Y
Ringwood Road east of Calmore Road	W	746	361	- 386	-52%	16.4	N	N	N	N	683	316	- 368	-54%	16.4	N	N	N	N	50	30	- 20	-41%	3.2	Y	Y	Y	Y	12	13	1	8%	0.3	Y	Y	Y	Y
Water Lane near Totton College	W	302	446	144	48%	7.4	N	N	Y	Y	265	403	138	52%	7.6	N	N	N	Y	29	39	10	35%	1.7	Y	Y	Y	Y	9	2	- 6	-72%	2.7	Y	Y	Y	Y
Calmore Drive	W	219	182	- 37	-17%	2.6	Y	Y	Y	Y	204	162	- 43	-21%	3.1	Y	Y	Y	Y	11	17	6	56%	1.6	Y	Y	Y	Y	4	3	- 1	-24%	0.5	Y	Y	Y	Y
Cooks Lane east of Calmore Road	W	145	251	106	73%	7.5	N	N	N	Y	130	225	95	73%	7.1	Y	N	Y	Y	11	23	12	110%	2.9	Y	Y	Y	Y	4	3	- 1	-16%	0.3	Y	Y	Y	Y
Salisbury Road east of Pauletts Lane	W	566	756	190	33%	7.4	N	N	Y	Y	493	637	145	29%	6.1	N	N	Y	Y	54	107	53	99%	5.9	Y	N	Y	Y	19	11	- 8	-43%	2.1	Y	Y	Y	Y
		4,077	**4,448**	**371**	**9.1%**	**5.7**	**38%**	**38%**	**63%**	**75%**	**3,513**	**3,753**	**240**	**6.8%**	**4.0**	**50%**	**38%**	**63%**	**75%**	**428**	**537**	**109**	**25.4%**	**5.0**	**100%**	**75%**	**100%**	**100%**	**128**	**149**	**21**	**16.1%**	**1.8**	**100%**	**88%**	**100%**	**100%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST
SRTM 2015
CORDONS AND SCREENLINES

PM VEHICLES

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10
21 North of Southampton – Eastbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	1,101	1,021	-79	-7%	2.4	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	E	96	152	56	59%	5.0	Y	N	Y	Y
Tennyson Road	N	30	233	204	684%	17.7	N	N	N	N
Portswood Road north of Portswood Avenue	N	432	84	-348	-81%	21.6	N	N	N	N
A33 The Avenue South of Westwood Road	N	1,028	1,343	315	31%	9.2	N	N	N	Y
Hill Lane	N	473	269	-204	-43%	10.6	N	N	N	N
Ivanhoe Road	N	36	221	185	512%	16.3	N	N	N	N
Wilton Road north of Colebrook Avenue	N	82	-	-82	-100%	12.8	Y	N	N	N
St James Road	N	453	293	-160	-35%	8.3	N	N	N	Y
Winchester Road north of Wordsworth Road	N	722	409	-312	-43%	13.1	N	N	N	N
Tremona Road	E	165	127	-39	-23%	3.2	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	248	798	550	222%	24.1	N	N	N	N
Aldermoor Road	E	155	136	-19	-12%	1.6	Y	Y	Y	Y
Lords Hill Way	E	623	420	-203	-33%	8.9	N	N	N	Y
M0027_J0003_J0004	E	5,734	5,751	17	0%	0.2	Y	Y	Y	Y
		11,378	**11,259**	**-119**	**-1.0%**	**1.1**	**40%**	**27%**	**33%**	**53%**
21 North of Southampton – Westbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	797	795	-2	0%	0.1	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	W	85	26	-60	-70%	8.0	Y	N	N	Y
Tennyson Road	S	39	184	146	375%	13.8	N	N	N	N
Portswood Road north of Portswood Avenue	S	408	108	-300	-74%	18.7	N	N	N	N
A33 The Avenue South of Westwood Road	S	936	1,355	419	45%	12.4	N	N	N	N
Hill Lane	S	496	221	-275	-55%	14.5	N	N	N	N
Ivanhoe Road	S	47	228	181	382%	15.4	N	N	N	N
Wilton Road north of Colebrook Avenue	S	130	-	-130	-100%	16.1	N	N	N	N
St James Road	S	352	306	-47	-13%	2.6	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	699	244	-455	-65%	21.0	N	N	N	N
Tremona Road	W	301	490	189	63%	9.5	N	N	N	Y
Coxford Road east of Warren Ave	W	388	813	425	110%	17.3	N	N	N	N
Aldermoor Road	W	191	137	-54	-28%	4.2	Y	Y	Y	Y
Lords Hill Way	W	611	442	-169	-28%	7.4	N	N	Y	Y
M0027_J0004_J0003	W	6,070	6,309	238	4%	3.0	Y	Y	Y	Y
		11,550	**11,657**	**107**	**0.9%**	**1.0**	**33%**	**27%**	**33%**	**47%**
22 South of Southampton – Eastbound										
Milbrook Road East West of Waterhouse Lane		1,608	2,152	545	34%	12.6	N	N	N	N
Waterhouse Way near Shirley Park Westbound Hail an	E	278	266	-12	-4%	0.7	Y	Y	Y	Y
Shirley High Street East of Park St	S	540	305	-234	-43%	11.4	N	N	N	N
Victor Street east of Crown Street	N	276	106	-170	-62%	12.3	N	N	N	N
Winchester Road north of Wordsworth Road	N	722	409	-312	-43%	13.1	N	N	N	N
Dale Road north of Norham Avenue	N	297	490	194	65%	9.8	N	N	N	Y
Lordswood Road east of Dale Valley Road	E	745	849	104	14%	3.7	Y	Y	Y	Y
		4,464	**4,578**	**114**	**2.5%**	**1.7**	**29%**	**29%**	**29%**	**43%**
22 South of Southampton – Westbound										
Milbrook Road East West of Waterhouse Lane		2,132	2,770	637	30%	12.9	N	N	N	N
Waterhouse Way near Shirley Park Westbound Hail an	W	282	234	-48	-17%	3.0	Y	Y	Y	Y
Shirley High Street East of Park St	N	450	578	128	28%	5.6	N	N	Y	Y
Victor Street east of Crown Street	N	276	-	-276	-100%	23.5	N	N	N	N
Winchester Road north of Wordsworth Road	S	699	244	-455	-65%	21.0	N	N	N	N
Dale Road north of Norham Avenue	S	251	312	61	25%	3.7	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	812	852	40	5%	1.4	Y	Y	Y	Y
		4,901	**4,990**	**88**	**1.8%**	**1.3**	**43%**	**43%**	**57%**	**57%**
24 Bitterne Northwest to Southeast – Eastbound										
Hamble Lane		606	1,196	590	97%	19.7	N	N	N	N
Grange Road South of A3025	N	251	56	-195	-78%	15.7	N	N	N	N
Coxs Drive	E	1	79	78	7844%	12.3	Y	N	N	N
Portsmouth Road	E	882	716	-166	-19%	5.9	N	N	Y	Y
Butts Road	E	327	208	-119	-36%	7.3	N	N	Y	Y
Kathleen Road	E	215	593	378	175%	18.8	N	N	N	N
Burlesdon Road	S	773	387	-386	-50%	16.0	N	N	N	N
Upper Deacon Road	N	213	196	-17	-8%	1.2	Y	Y	Y	Y
Bitterne Road	E	803	1,190	387	48%	12.3	N	N	N	N
Shales Road south of Taunton Drive	N	101	102	0	0%	0.0	Y	Y	Y	Y
West End Road	E	684	816	132	19%	4.8	N	Y	Y	Y
Townhill Way	N	444	403	-41	-9%	2.0	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	123	38	-85	-69%	9.5	Y	N	N	Y
Northfield Road		7	7	-						
Foresthill Drive north of Woodmill Lane	E	191	131	-59	-31%	4.7	Y	Y	Y	Y
		5,620	**6,118**	**498**	**8.9%**	**6.5**	**43%**	**36%**	**50%**	**57%**

PM CAR

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH<5	GEH<7.5	GEH<10
21 North of Southampton – Eastbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	1,007	955	-53	-5%	1.7	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	E	88	139	51	57%	4.8	Y	Y	Y	Y
Tennyson Road	N	27	221	194	708%	17.4	N	N	N	N
Portswood Road north of Portswood Avenue	N	386	64	-322	-83%	21.5	N	N	N	N
A33 The Avenue South of Westwood Road	N	953	1,247	295	31%	8.9	N	N	N	Y
Hill Lane	N	431	260	-171	-40%	9.2	N	N	N	Y
Ivanhoe Road	N	33	209	177	536%	16.0	N	N	N	N
Wilton Road north of Colebrook Avenue	N	74	-	-74	-100%	12.1	Y	N	N	N
St James Road	N	423	265	-158	-37%	8.5	N	N	N	Y
Winchester Road north of Wordsworth Road	N	672	383	-289	-43%	12.6	N	N	N	N
Tremona Road	E	154	117	-37	-24%	3.2	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	203	691	488	240%	23.1	N	N	N	N
Aldermoor Road	E	140	122	-18	-13%	1.5	Y	Y	Y	Y
Lords Hill Way	E	527	391	-135	-26%	6.3	N	N	Y	Y
M0027_J0003_J0004	E	5,002	4,990	-12	0%	0.2	Y	Y	Y	Y
		10,120	**10,055**	**-65**	**-0.6%**	**0.6**	**40%**	**33%**	**40%**	**60%**
21 North of Southampton – Westbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	695	740	45	6%	1.7	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	W	77	19	-58	-75%	8.3	Y	N	N	Y
Tennyson Road	S	35	178	143	408%	13.8	N	N	N	N
Portswood Road north of Portswood Avenue	S	367	86	-281	-76%	18.6	N	N	N	N
A33 The Avenue South of Westwood Road	S	837	1,223	386	46%	12.0	N	N	N	N
Hill Lane	S	457	207	-249	-55%	13.7	N	N	N	N
Ivanhoe Road	S	37	217	181	495%	16.0	N	N	N	N
Wilton Road north of Colebrook Avenue	S	122	-	-122	-100%	15.6	N	N	N	N
St James Road	S	334	286	-48	-14%	2.7	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	645	215	-429	-67%	20.7	N	N	N	N
Tremona Road	W	264	452	188	71%	9.9	N	N	N	Y
Coxford Road east of Warren Ave	W	336	747	410	122%	17.6	N	N	N	N
Aldermoor Road	W	169	122	-47	-28%	3.9	Y	Y	Y	Y
Lords Hill Way	W	569	414	-156	-27%	7.0	N	N	Y	Y
M0027_J0004_J0003	W	5,252	5,333	80	2%	1.1	Y	Y	Y	Y
		10,197	**10,240**	**42**	**0.4%**	**0.4**	**33%**	**27%**	**33%**	**47%**
22 South of Southampton – Eastbound										
Milbrook Road East West of Waterhouse Lane		1,367	1,808	442	32%	11.1	N	N	N	N
Waterhouse Way near Shirley Park Westbound Hail an	E	248	254	6	3%	0.4	Y	Y	Y	Y
Shirley High Street East of Park St	S	496	238	-257	-52%	13.4	N	N	N	N
Victor Street east of Crown Street	N	255	96	-159	-62%	12.0	N	N	N	N
Winchester Road north of Wordsworth Road	N	672	383	-289	-43%	12.6	N	N	N	N
Dale Road north of Norham Avenue	N	263	424	161	61%	8.7	N	N	N	Y
Lordswood Road east of Dale Valley Road	E	705	815	110	16%	4.0	N	Y	Y	Y
		4,004	**4,018**	**14**	**0.4%**	**0.2**	**14%**	**29%**	**29%**	**43%**
22 South of Southampton – Westbound										
Milbrook Road East West of Waterhouse Lane		1,812	2,407	594	33%	12.9	N	N	N	N
Waterhouse Way near Shirley Park Westbound Hail an	W	250	222	-28	-11%	1.8	Y	Y	Y	Y
Shirley High Street East of Park St	N	424	479	55	13%	2.6	Y	Y	Y	Y
Victor Street east of Crown Street	N	255	-	-255	-100%	22.6	N	N	N	N
Winchester Road north of Wordsworth Road	S	645	215	-429	-67%	20.7	N	N	N	N
Dale Road north of Norham Avenue	S	230	279	49	21%	3.1	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	755	782	28	4%	1.0	Y	Y	Y	Y
		4,371	**4,385**	**14**	**0.3%**	**0.2**	**57%**	**57%**	**57%**	**57%**
24 Bitterne Northwest to Southeast – Eastbound										
Hamble Lane		515	1,085	569	110%	20.1	N	N	N	N
Grange Road South of A3025	N	219	44	-176	-80%	15.3	N	N	N	N
Coxs Drive	E	1	77	76	9862%	12.2	Y	N	N	N
Portsmouth Road	E	810	683	-127	-16%	4.7	N	Y	Y	Y
Butts Road	E	287	199	-87	-31%	5.6	N	N	Y	Y
Kathleen Road	E	191	566	374	196%	19.2	N	N	N	N
Burlesdon Road	S	707	262	-445	-63%	20.2	N	N	N	N
Upper Deacon Road	N	202	184	-18	-9%	1.3	Y	Y	Y	Y
Bitterne Road	E	747	1,124	377	51%	12.3	N	N	N	N
Shales Road south of Taunton Drive	N	93	99	6	7%	0.6	Y	Y	Y	Y
West End Road	E	653	711	58	9%	2.2	Y	Y	Y	Y
Townhill Way	N	393	383	-10	-3%	0.5	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	107	37	-70	-66%	8.3	Y	N	N	Y
Northfield Road		7	7	-						
Foresthill Drive north of Woodmill Lane	E	164	115	-49	-30%	4.1	Y	Y	Y	Y
		5,095	**5,575**	**480**	**9.4%**	**6.6**	**57%**	**43%**	**50%**	**57%**

PM LGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH<5	GEH<7.5	GEH<10
21 North of Southampton – Eastbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	57	49	-8	-15%	1.2	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	E	7	10	4	52%	1.2	Y	Y	Y	Y
Tennyson Road	N	2	10	8	376%	3.2	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	N	31	2	-29	-95%	7.2	Y	N	Y	Y
A33 The Avenue South of Westwood Road	N	49	57	8	16%	1.1	Y	Y	Y	Y
Hill Lane	N	32	7	-25	-78%	5.7	Y	N	Y	Y
Ivanhoe Road	N	3	8	6	195%	2.3	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	N	4	-	-4	-100%	3.0	Y	Y	Y	Y
St James Road	N	22	23	0	2%	0.1	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	37	19	-18	-49%	3.4	Y	Y	Y	Y
Tremona Road	E	10	9	-1	-7%	0.2	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	23	77	54	237%	7.6	Y	N	N	Y
Aldermoor Road	E	9	5	-4	-44%	1.5	Y	Y	Y	Y
Lords Hill Way	E	75	18	-57	-76%	8.4	Y	N	N	Y
M0027_J0003_J0004	E	313	334	21	7%	1.2	Y	Y	Y	Y
		674	**627**	**-47**	**-6.9%**	**1.8**	**100%**	**73%**	**87%**	**100%**
21 North of Southampton – Westbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	67	41	-26	-39%	3.6	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	W	7	2	-4	-63%	2.0	Y	Y	Y	Y
Tennyson Road	S	3	5	2	57%	0.9	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	S	26	6	-20	-79%	5.1	Y	N	Y	Y
A33 The Avenue South of Westwood Road	S	64	92	27	42%	3.1	Y	Y	Y	Y
Hill Lane	S	32	10	-21	-68%	4.7	Y	Y	Y	Y
Ivanhoe Road	S	9	8	-2	-17%	0.6	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	S	7	-	-7	-100%	3.6	Y	Y	Y	Y
St James Road	S	13	17	3	25%	0.9	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	40	13	-27	-67%	5.2	Y	N	Y	Y
Tremona Road	W	32	30	-2	-7%	0.4	Y	Y	Y	Y
Coxford Road east of Warren Ave	W	27	43	16	57%	2.6	Y	Y	Y	Y
Aldermoor Road	W	14	7	-7	-52%	2.3	Y	Y	Y	Y
Lords Hill Way	W	25	16	-10	-38%	2.1	Y	Y	Y	Y
M0027_J0004_J0003	W	398	480	82	21%	3.9	Y	Y	Y	Y
		764	**767**	**4**	**0.5%**	**0.1**	**100%**	**87%**	**100%**	**100%**
22 South of Southampton – Eastbound										
Milbrook Road East West of Waterhouse Lane		161	193	32	20%	2.4	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	E	26	8	-18	-70%	4.4	Y	Y	Y	Y
Shirley High Street East of Park St	S	23	20	-3	-13%	0.7	Y	Y	Y	Y
Victor Street east of Crown Street	N	16	7	-10	-58%	2.8	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	37	19	-18	-49%	3.4	Y	Y	Y	Y
Dale Road north of Norham Avenue	N	26	46	20	79%	3.4	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	E	31	28	-3	-10%	0.6	Y	Y	Y	Y
		320	**320**	**-0**	**0.0%**	**0.0**	**100%**	**100%**	**100%**	**100%**
22 South of Southampton – Westbound										
Milbrook Road East West of Waterhouse Lane		213	255	42	20%	2.8	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	W	27	7	-19	-73%	4.7	Y	Y	Y	Y
Shirley High Street East of Park St	N	12	42	30	255%	5.8	Y	N	Y	Y
Victor Street east of Crown Street	N	16	-	-16	-100%	5.7	Y	N	Y	Y
Winchester Road north of Wordsworth Road	S	40	13	-27	-67%	5.2	Y	N	Y	Y
Dale Road north of Norham Avenue	S	15	24	9	61%	2.1	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	46	53	7	14%	0.9	Y	Y	Y	Y
		370	**395**	**25**	**6.9%**	**1.3**	**100%**	**57%**	**100%**	**100%**
24 Bitterne Northwest to Southeast – Eastbound										
Hamble Lane		61	101	40	66%	4.5	Y	Y	Y	Y
Grange Road South of A3025	N	27	12	-15	-56%	3.5	Y	Y	Y	Y
Coxs Drive	E	0	2	2	4875%	1.9	Y	Y	Y	Y
Portsmouth Road	E	49	23	-25	-52%	4.2	Y	Y	Y	Y
Butts Road	E	30	5	-24	-82%	5.9	Y	N	Y	Y
Kathleen Road	E	13	17	4	29%	1.0	Y	Y	Y	Y
Burlesdon Road	S	46	9	-37	-80%	7.1	Y	N	Y	Y
Upper Deacon Road	N	9	11	3	29%	0.8	Y	Y	Y	Y
Bitterne Road	E	35	65	31	88%	4.3	Y	Y	Y	Y
Shales Road south of Taunton Drive	N	7	2	-5	-69%	2.2	Y	Y	Y	Y
West End Road	E	23	63	39	170%	6.0	Y	N	Y	Y
Townhill Way	N	37	14	-24	-63%	4.7	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	10	1	-10	-92%	4.0	Y	Y	Y	Y
Northfield Road		0	0	-						
Foresthill Drive north of Woodmill Lane	E	10	4	-6	-63%	2.4	Y	Y	Y	Y
		357	**329**	**-28**	**-7.9%**	**1.5**	**100%**	**79%**	**100%**	**100%**

PM HGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH<5	GEH<7.5	GEH<10
21 North of Southampton – Eastbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	N	34	18	-15	-46%	3.0	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	E	1	3	2	191%	1.4	Y	Y	Y	Y
Tennyson Road	N	0	2	2	649%	1.7	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	N	13	5	-8	-65%	2.9	Y	Y	Y	Y
A33 The Avenue South of Westwood Road	N	23	23	0	2%	0.1	Y	Y	Y	Y
Hill Lane	N	10	2	-7	-75%	2.9	Y	Y	Y	Y
Ivanhoe Road	N	0	2	2	532%	1.5	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	N	3	-	-3	-100%	2.5	Y	Y	Y	Y
St James Road	N	7	5	-1	-21%	0.6	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	13	7	-5	-41%	1.7	Y	Y	Y	Y
Tremona Road	E	2	1	-1	-47%	0.7	Y	Y	Y	Y
Coxford Road east of Warren Ave	E	14	15	1	10%	0.4	Y	Y	Y	Y
Aldermoor Road	E	5	1	-5	-87%	2.6	Y	Y	Y	Y
Lords Hill Way	E	15	2	-13	-86%	4.4	Y	Y	Y	Y
M0027_J0003_J0004	E	419	427	8	2%	0.4	Y	Y	Y	Y
		557	**514**	**-44**	**-7.8%**	**1.9**	**100%**	**100%**	**100%**	**100%**
21 North of Southampton – Westbound										
A335 Thomas Lewis Way South of Horse Shoe Bridge	S	30	15	-15	-51%	3.2	Y	Y	Y	Y
Lawn Road East off Horse Shoe Bridge	W	2	4	2	129%	1.3	Y	Y	Y	Y
Tennyson Road	S	1	2	1	136%	0.9	Y	Y	Y	Y
Portswood Road north of Portswood Avenue	S	13	3	-10	-78%	3.6	Y	Y	Y	Y
A33 The Avenue South of Westwood Road	S	26	26	-1	-2%	0.1	Y	Y	Y	Y
Hill Lane	S	7	4	-4	-50%	1.6	Y	Y	Y	Y
Ivanhoe Road	S	1	2	0	36%	0.4	Y	Y	Y	Y
Wilton Road north of Colebrook Avenue	S	1	-	-1	-100%	1.6	Y	Y	Y	Y
St James Road	S	4	3	-2	-34%	0.8	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	14	15	2	13%	0.5	Y	Y	Y	Y
Tremona Road	W	5	8	3	76%	1.4	Y	Y	Y	Y
Coxford Road east of Warren Ave	W	16	8	-8	-53%	2.5	Y	Y	Y	Y
Aldermoor Road	W	6	0	-5	-92%	3.0	Y	Y	Y	Y
Lords Hill Way	W	15	3	-12	-80%	4.0	Y	Y	Y	Y
M0027_J0004_J0003	W	420	497	76	18%	3.6	Y	Y	Y	Y
		562	**589**	**27**	**4.8%**	**1.1**	**100%**	**100%**	**100%**	**100%**
22 South of Southampton – Eastbound										
Milbrook Road East West of Waterhouse Lane		80	140	59	74%	5.7	Y	N	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	E	4	3	-1	-27%	0.6	Y	Y	Y	Y
Shirley High Street East of Park St	S	18	9	-9	-49%	2.4	Y	Y	Y	Y
Victor Street east of Crown Street	N	4	3	-1	-32%	0.7	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	N	13	7	-5	-41%	1.7	Y	Y	Y	Y
Dale Road north of Norham Avenue	N	8	18	10	114%	2.6	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	E	9	5	-4	-46%	1.6	Y	Y	Y	Y
		137	**185**	**48**	**35.3%**	**3.8**	**100%**	**86%**	**100%**	**100%**
22 South of Southampton – Westbound										
Milbrook Road East West of Waterhouse Lane		107	99	-8	-8%	0.8	Y	Y	Y	Y
Waterhouse Way near Shirley Park Westbound Hail an	W	5	4	-2	-31%	0.8	Y	Y	Y	Y
Shirley High Street East of Park St	N	12	19	7	53%	1.7	Y	Y	Y	Y
Victor Street east of Crown Street	N	4	-	-4	-100%	2.8	Y	Y	Y	Y
Winchester Road north of Wordsworth Road	S	14	15	2	13%	0.5	Y	Y	Y	Y
Dale Road north of Norham Avenue	S	4	6	2	36%	0.7	Y	Y	Y	Y
Lordswood Road east of Dale Valley Road	W	11	16	5	43%	1.3	Y	Y	Y	Y
		157	**158**	**1**	**0.7%**	**0.1**	**100%**	**100%**	**100%**	**100%**
24 Bitterne Northwest to Southeast – Eastbound										
Hamble Lane		30	10	-20	-66%	4.5	Y	Y	Y	Y
Grange Road South of A3025	N	4	0	-4	-93%	2.7	Y	Y	Y	Y
Coxs Drive	E	0	0	-0	-37%	0.2	Y	Y	Y	Y
Portsmouth Road	E	22	4	-19	-84%	5.2	Y	N	Y	Y
Butts Road	E	10	1	-8	-85%	3.5	Y	Y	Y	Y
Kathleen Road	E	8	2	-6	-79%	2.8	Y	Y	Y	Y
Burlesdon Road	S	19	97	79	424%	10.4	Y	N	N	N
Upper Deacon Road	N	3	-	-3	-100%	2.3	Y	Y	Y	Y
Bitterne Road	E	21	-	-21	-100%	6.5	Y	N	Y	Y
Shales Road south of Taunton Drive	N	2	0	-1	-83%	1.4	Y	Y	Y	Y
West End Road	E	7	39	32	430%	6.6	Y	N	Y	Y
Townhill Way	N	10	1	-9	-92%	4.0	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	N	3	0	-3	-99%	2.4	Y	Y	Y	Y
Northfield Road		0	0	-						
Foresthill Drive north of Woodmill Lane	E	16	0	-15	-98%	5.4	Y	N	Y	Y
		154	**156**	**1**	**0.8%**	**0.1**	**100%**	**64%**	**93%**	**93%**

APPENDIX A: LINK VALIDATION SOUTHAMPTON AND NEW FOREST

SRTM 2015

CORDONS AND SCREENLINES

PM VEHICLES

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs %	GEH5	GEH7.5	GEH10
Westbound										
Hamble Lane		960	509	-451	-47%	16.6	N	N	N	N
Grange Road South of A3025	S	322	151	-170	-53%	11.1	N	N	N	N
Coxs Drive	W	4	127	123	3239%	15.2	N	N	N	N
Portsmouth Road	W	844	728	-116	-14%	4.1	Y	Y	Y	Y
Butts Road	W	311	339	28	9%	1.6	Y	Y	Y	Y
Kathleen Road	W	241	120	-121	-50%	9.0	N	N	N	Y
Burlesdon Road	N	564	546	-18	-3%	0.8	Y	Y	Y	Y
Upper Deacon Road	S	184	195	11	6%	0.8	Y	Y	Y	Y
Bitterne Road	W	527	611	84	16%	3.5	Y	Y	Y	Y
Shales Road south of Taunton Drive	S	80	130	50	62%	4.8	Y	Y	Y	Y
West End Road	W	818	937	118	14%	4.0	Y	Y	Y	Y
Townhill Way	S	586	374	-212	-36%	9.7	N	N	N	Y
Wakefield Road north of Cornwall Road	S	103	49	-53	-52%	6.1	Y	N	Y	Y
Northfield Road		19	19	-						
Foresthill Drive north of Woodmill Lane	W	137	64	-73	-53%	7.2	Y	N	Y	Y
		5,699	**4,900**	**-799**	**-14.0%**	**11.0**	**64%**	**50%**	**64%**	**79%**
25 Bitterne Southwest to Northeast										
Eastbound										
Victoria Road		8	8	-						
Archery Road	N	288	218	-70	-24%	4.4	Y	Y	Y	Y
Portsmouth Road	E	1,114	1,050	-64	-6%	1.9	Y	Y	Y	Y
STATION ROAD	E	226	415	189	84%	10.6	N	N	N	N
South East Road	E	415	489	75	18%	3.5	Y	Y	Y	Y
Bursledon Road West of NE Road	S	736	575	-161	-22%	6.3	N	N	Y	Y
A334 Thornhill Park Road	E	758	1,045	287	38%	9.6	N	N	N	Y
Pine Drive	S	77	135	57	74%	5.6	Y	N	Y	Y
A27 Moorhill Road		677	617	-60	-9%	2.4	Y	Y	Y	Y
Botley Road	E	654	569	-85	-13%	3.4	Y	Y	Y	Y
		4,953	**5,121**	**168**	**3.4%**	**2.4**	**67%**	**56%**	**78%**	**89%**
Westbound										
Victoria Road		8	8	-						
Archery Road	S	434	214	-220	-51%	12.2	N	N	N	N
Portsmouth Road	W	909	963	54	6%	1.8	Y	Y	Y	Y
STATION ROAD	W	146	99	-48	-33%	4.3	Y	Y	Y	Y
South East Road	W	285	430	145	51%	7.7	N	N	N	Y
Bursledon Road West of NE Road	N	565	535	-30	-5%	1.3	Y	Y	Y	Y
A334 Thornhill Park Road	W	640	676	35	6%	1.4	Y	Y	Y	Y
Pine Drive	N	18	81	63	345%	8.9	Y	N	N	Y
A27 Moorhill Road	S	645	938	293	45%	10.4	N	N	N	N
Botley Road	W	883	562	-321	-36%	12.0	N	N	N	N
		4,533	**4,506**	**-28**	**-0.6%**	**0.4**	**56%**	**44%**	**44%**	**67%**
116 Motorway - M27										
Eastbound										
J2 to J3	E	4,975	4,752	-223	-4%	3.2	Y	Y	Y	Y
J3 to J4	E	5,734	5,751	17	0%	0.2	Y	Y	Y	Y
J4 to J5	E	5,576	5,170	-406	-7%	5.5	N	N	Y	Y
J5 to J7	E	6,425	6,148	-278	-4%	3.5	Y	Y	Y	Y
J7 to J8	E	5,784	5,746	-37	-1%	0.5	Y	Y	Y	Y
Westbound										
J8 to J7	W	5,612	5,678	66	1%	0.9	Y	Y	Y	Y
J7 to J5	W	5,705	5,674	-31	-1%	0.4	Y	Y	Y	Y
J5 to J4	W	5,040	4,954	-85	-2%	1.2	Y	Y	Y	Y
J4 to J3	W	6,070	6,309	238	4%	3.0	Y	Y	Y	Y
J3 to J2	W	5,120	5,201	82	2%	1.1	Y	Y	Y	Y
118 Motorway - M3										
Eastbound										
J14 to J13	E	5,181	5,181	-						
Westbound										
J13 to J14	W	2,995	3,143	148	5%	2.7	Y	Y	Y	Y

PM CAR

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound										
Hamble Lane		816	425	-392	-48%	15.7	N	N	N	N
Grange Road South of A3025	S	282	137	-145	-52%	10.0	N	N	N	N
Coxs Drive	W	3	121	117	3434%	14.9	N	N	N	N
Portsmouth Road	W	762	659	-103	-14%	3.9	Y	Y	Y	Y
Butts Road	W	279	318	39	14%	2.3	Y	Y	Y	Y
Kathleen Road	W	213	106	-107	-50%	8.4	N	N	N	Y
Burlesdon Road	N	504	480	-24	-5%	1.1	Y	Y	Y	Y
Upper Deacon Road	S	169	185	15	9%	1.1	Y	Y	Y	Y
Bitterne Road	W	475	571	96	20%	4.2	Y	Y	Y	Y
Shales Road south of Taunton Drive	S	76	121	45	60%	4.6	Y	Y	Y	Y
West End Road	W	745	882	137	18%	4.8	N	Y	Y	Y
Townhill Way	S	519	343	-176	-34%	8.5	N	N	N	Y
Wakefield Road north of Cornwall Road	S	95	44	-51	-53%	6.1	Y	N	Y	Y
Northfield Road		19	19	-						
Foresthill Drive north of Woodmill Lane	W	125	63	-62	-49%	6.3	Y	N	Y	Y
		5,083	**4,474**	**-609**	**-12.0%**	**8.8**	**57%**	**50%**	**64%**	**79%**
25 Bitterne Southwest to Northeast										
Eastbound										
Victoria Road		-	-	-						
Archery Road	N	260	207	-53	-20%	3.5	Y	Y	Y	Y
Portsmouth Road	E	1,054	1,018	-36	-3%	1.1	Y	Y	Y	Y
STATION ROAD	E	202	403	201	99%	11.5	N	N	N	N
South East Road	E	381	478	97	26%	4.7	Y	Y	Y	Y
Bursledon Road West of NE Road	S	670	448	-222	-33%	9.4	N	N	N	Y
A334 Thornhill Park Road	E	700	976	276	39%	9.5	N	N	N	Y
Pine Drive	S	66	129	62	93%	6.3	Y	N	Y	Y
A27 Moorhill Road		576	522	-54	-9%	2.3	Y	Y	Y	Y
Botley Road	E	606	431	-175	-29%	7.7	N	N	N	Y
		4,515	**4,612**	**97**	**2.1%**	**1.4**	**56%**	**44%**	**56%**	**89%**
Westbound										
Victoria Road		-	-	-						
Archery Road	S	385	189	-196	-51%	11.6	N	N	N	N
Portsmouth Road	W	854	916	62	7%	2.1	Y	Y	Y	Y
STATION ROAD	W	125	89	-35	-28%	3.4	Y	Y	Y	Y
South East Road	W	264	414	151	57%	8.2	N	N	N	Y
Bursledon Road West of NE Road	N	510	469	-41	-8%	1.9	Y	Y	Y	Y
A334 Thornhill Park Road	W	600	633	33	5%	1.3	Y	Y	Y	Y
Pine Drive	N	17	78	61	361%	8.9	Y	N	N	Y
A27 Moorhill Road	S	596	863	267	45%	9.9	N	N	N	Y
Botley Road	W	802	503	-299	-37%	11.7	N	N	N	N
		4,152	**4,154**	**2**	**0.0%**	**0.0**	**56%**	**44%**	**44%**	**78%**
116 Motorway - M27										
Eastbound										
J2 to J3	E	4,340	4,125	-215	-5%	3.3	Y	Y	Y	Y
J3 to J4	E	5,002	4,990	-12	0%	0.2	Y	Y	Y	Y
J4 to J5	E	4,906	4,660	-246	-5%	3.6	Y	Y	Y	Y
J5 to J7	E	5,653	5,432	-221	-4%	3.0	Y	Y	Y	Y
J7 to J8	E	5,089	5,002	-87	-2%	1.2	Y	Y	Y	Y
Westbound										
J8 to J7	W	4,946	4,947	0	0%	0.0	Y	Y	Y	Y
J7 to J5	W	5,029	5,018	-10	0%	0.1	Y	Y	Y	Y
J5 to J4	W	4,442	4,370	-72	-2%	1.1	Y	Y	Y	Y
J4 to J3	W	5,252	5,333	80	2%	1.1	Y	Y	Y	Y
J3 to J2	W	4,430	4,437	7	0%	0.1	Y	Y	Y	Y
118 Motorway - M3										
Eastbound										
J14 to J13	E	4,627	4,627	-						
Westbound										
J13 to J14	W	2,550	2,513	-37	-1%	0.7	Y	Y	Y	Y

PM LGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound										
Hamble Lane		96	73	-23	-24%	2.5	Y	Y	Y	Y
Grange Road South of A3025	S	32	15	-18	-55%	3.7	Y	Y	Y	Y
Coxs Drive	W	0	5	5	1759%	3.0	Y	Y	Y	Y
Portsmouth Road	W	61	47	-13	-22%	1.8	Y	Y	Y	Y
Butts Road	W	25	12	-12	-50%	2.9	Y	Y	Y	Y
Kathleen Road	W	18	3	-15	-83%	4.6	Y	Y	Y	Y
Burlesdon Road	N	37	19	-18	-49%	3.4	Y	Y	Y	Y
Upper Deacon Road	S	10	11	1	8%	0.2	Y	Y	Y	Y
Bitterne Road	W	36	37	1	3%	0.2	Y	Y	Y	Y
Shales Road south of Taunton Drive	S	4	4	1	22%	0.4	Y	Y	Y	Y
West End Road	W	54	39	-16	-29%	2.3	Y	Y	Y	Y
Townhill Way	S	42	17	-25	-60%	4.7	Y	Y	Y	Y
Wakefield Road north of Cornwall Road	S	6	1	-5	-85%	2.8	Y	Y	Y	Y
Northfield Road		0	0	-						
Foresthill Drive north of Woodmill Lane	W	10	1	-9	-91%	3.9	Y	Y	Y	Y
		432	**285**	**-147**	**-34.0%**	**7.8**	**100%**	**100%**	**100%**	**100%**
25 Bitterne Southwest to Northeast										
Eastbound										
Victoria Road		-	-	-						
Archery Road	N	18	10	-8	-45%	2.2	Y	Y	Y	Y
Portsmouth Road	E	41	24	-17	-42%	3.0	Y	Y	Y	Y
STATION ROAD	E	15	3	-12	-80%	4.0	Y	Y	Y	Y
South East Road	E	27	10	-16	-61%	3.8	Y	Y	Y	Y
Bursledon Road West of NE Road	S	45	11	-34	-75%	6.4	Y	N	Y	Y
A334 Thornhill Park Road	E	41	68	28	69%	3.8	Y	Y	Y	Y
Pine Drive	S	9	6	-3	-32%	1.1	Y	Y	Y	Y
A27 Moorhill Road		68	55	-12	-18%	1.6	Y	Y	Y	Y
Botley Road	E	36	80	44	122%	5.8	Y	N	Y	Y
		298	**268**	**-30**	**-10.1%**	**1.8**	**100%**	**78%**	**100%**	**100%**
Westbound										
Victoria Road		-	-	-						
Archery Road	S	36	22	-14	-38%	2.6	Y	Y	Y	Y
Portsmouth Road	W	41	37	-4	-10%	0.7	Y	Y	Y	Y
STATION ROAD	W	12	1	-11	-90%	4.2	Y	Y	Y	Y
South East Road	W	17	13	-4	-22%	1.0	Y	Y	Y	Y
Bursledon Road West of NE Road	N	35	18	-17	-48%	3.2	Y	Y	Y	Y
A334 Thornhill Park Road	W	30	42	12	39%	2.0	Y	Y	Y	Y
Pine Drive	N	1	3	2	154%	1.3	Y	Y	Y	Y
A27 Moorhill Road	S	38	42	4	10%	0.6	Y	Y	Y	Y
Botley Road	W	63	55	-9	-14%	1.1	Y	Y	Y	Y
		274	**234**	**-40**	**-14.8%**	**2.5**	**100%**	**100%**	**100%**	**100%**
116 Motorway - M27										
Eastbound										
J2 to J3	E	271	253	-18	-7%	1.1	Y	Y	Y	Y
J3 to J4	E	313	334	21	7%	1.2	Y	Y	Y	Y
J4 to J5	E	361	297	-65	-18%	3.6	Y	Y	Y	Y
J5 to J7	E	416	414	-2	-1%	0.1	Y	Y	Y	Y
J7 to J8	E	375	439	65	17%	3.2	Y	Y	Y	Y
Westbound										
J8 to J7	W	330	365	35	11%	1.9	Y	Y	Y	Y
J7 to J5	W	335	353	18	5%	1.0	Y	Y	Y	Y
J5 to J4	W	296	316	20	7%	1.1	Y	Y	Y	Y
J4 to J3	W	398	480	82	21%	3.9	Y	Y	Y	Y
J3 to J2	W	335	353	18	5%	0.9	Y	Y	Y	Y
118 Motorway - M3										
Eastbound										
J14 to J13	E	296	296	-						
Westbound										
J13 to J14	W	213	350	137	64%	8.2	N	N	N	Y

PM HGV

Site Description	Dir	Obs	Model	Diff	% Diff	GEH	WebTAG Within Abs or %	GEH=5	GEH=7.5	GEH=10
Westbound										
Hamble Lane		48	10	-38	-79%	7.0	Y	N	Y	Y
Grange Road South of A3025	S	7	0	-7	-96%	3.6	Y	Y	Y	Y
Coxs Drive	W	0	0	0	77%	0.2	Y	Y	Y	Y
Portsmouth Road	W	20	12	-8	-40%	2.0	Y	Y	Y	Y
Butts Road	W	7	8	1	21%	0.5	Y	Y	Y	Y
Kathleen Road	W	8	3	-6	-66%	2.4	Y	Y	Y	Y
Burlesdon Road	N	21	29	7	34%	1.5	Y	Y	Y	Y
Upper Deacon Road	S	4	-	-4	-100%	3.0	Y	Y	Y	Y
Bitterne Road	W	16	-	-16	-100%	5.6	Y	N	Y	Y
Shales Road south of Taunton Drive	S	1	3	2	387%	1.7	Y	Y	Y	Y
West End Road	W	17	15	-3	-16%	0.7	Y	Y	Y	Y
Townhill Way	S	23	1	-22	-97%	6.4	Y	N	Y	Y
Wakefield Road north of Cornwall Road	S	1	0	-1	-86%	1.2	Y	Y	Y	Y
Northfield Road		0	0	-						
Foresthill Drive north of Woodmill Lane	W	2	0	-2	-88%	1.7	Y	Y	Y	Y
		176	**81**	**-95**	**-53.9%**	**8.4**	**100%**	**79%**	**100%**	**100%**
25 Bitterne Southwest to Northeast										
Eastbound										
Victoria Road		-	-	-						
Archery Road	N	9	1	-9	-91%	3.8	Y	Y	Y	Y
Portsmouth Road	E	18	1	-17	-95%	5.6	Y	N	Y	Y
STATION ROAD	E	7	0	-7	-100%	3.6	Y	Y	Y	Y
South East Road	E	7	1	-6	-89%	3.2	Y	Y	Y	Y
Bursledon Road West of NE Road	S	20	98	77	377%	10.0	Y	N	N	N
A334 Thornhill Park Road	E	17	-	-17	-100%	5.8	Y	N	Y	Y
Pine Drive	S	2	-	-2	-100%	2.0	Y	Y	Y	Y
A27 Moorhill Road		34	40	6	18%	1.0	Y	Y	Y	Y
Botley Road	E	11	55	44	403%	7.7	Y	N	N	Y
		125	**195**	**70**	**56.0%**	**5.5**	**100%**	**56%**	**78%**	**89%**
Westbound										
Victoria Road		-	-	-						
Archery Road	S	12	3	-9	-77%	3.4	Y	Y	Y	Y
Portsmouth Road	W	14	3	-11	-80%	3.9	Y	Y	Y	Y
STATION ROAD	W	5	0	-5	-100%	3.2	Y	Y	Y	Y
South East Road	W	4	2	-2	-46%	1.1	Y	Y	Y	Y
Bursledon Road West of NE Road	N	18	29	10	56%	2.1	Y	Y	Y	Y
A334 Thornhill Park Road	W	10	-	-10	-100%	4.5	Y	Y	Y	Y
Pine Drive	N	0	-	-0	-100%	0.4	Y	Y	Y	Y
A27 Moorhill Road	S	10	33	23	226%	4.9	Y	Y	Y	Y
Botley Road	W	16	2	-15	-91%	5.0	Y	Y	Y	Y
		90	**71**	**-19**	**-21.5%**	**2.2**	**100%**	**100%**	**100%**	**100%**
116 Motorway - M27										
Eastbound										
J2 to J3	E	364	374	11	3%	0.5	Y	Y	Y	Y
J3 to J4	E	419	427	8	2%	0.4	Y	Y	Y	Y
J4 to J5	E	309	213	-95	-31%	5.9	Y	N	Y	Y
J5 to J7	E	356	302	-54	-15%	3.0	Y	Y	Y	Y
J7 to J8	E	320	305	-15	-5%	0.9	Y	Y	Y	Y
Westbound										
J8 to J7	W	336	366	31	9%	1.6	Y	Y	Y	Y
J7 to J5	W	341	302	-39	-11%	2.2	Y	Y	Y	Y
J5 to J4	W	301	269	-33	-11%	1.9	Y	Y	Y	Y
J4 to J3	W	420	497	76	18%	3.6	Y	Y	Y	Y
J3 to J2	W	355	412	57	16%	2.9	Y	Y	Y	Y
118 Motorway - M3										
Eastbound										
J14 to J13	E	258	258	-						
Westbound										
J13 to J14	W	232	280	48	21%	3.0	Y	Y	Y	Y

APPENDIX B

JOURNEY TIME VALIDATION

Part 1 (Routes Undertaken for Previous 2010 Base and updated to TrafficMaster 2014) **AM**

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	1,541	32	2%	Y	Y	Y
1	1WB	A35 BURGESS ROAD - A35 WINCHESTER ROAD	1,552	1,470	-82	-5%	Y	Y	Y
2	2EB	A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE	1,473	1,279	-194	-13%	Y	Y	Y
2	2WB	A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST	1,539	1,351	-188	-12%	Y	Y	Y
3	3NB	A33 DORSET STREET - A335 TWYFORD ROAD	1,219	1,177	-43	-4%	Y	Y	Y
3	3SB	A335 TWYFORD ROAD - A33 DORSET STREET	1,123	1,215	92	8%	Y	Y	Y
4	4NB	A33 DORSET STREET - A33	545	526	-19	-3%	Y	Y	Y
4	4SB	A33 - A33 DORSET STREET	731	679	-52	-7%	Y	Y	Y
5	5NB	A3024 BURSLEDON ROAD - A33 THE AVENUE	1,513	1,290	-223	-15%	Y	Y	Y
5	5SB	A33 THE AVENUE - A3024 BURSLEDON ROAD	992	1,193	201	20%	N	N	Y
6	6NB	A27 WEST END ROAD - A27 BASSETT GREEN ROAD	965	1,066	101	10%	Y	Y	Y
6	6SB	A27 BASSETT GREEN ROAD - A27 WEST END ROAD	911	990	79	9%	Y	Y	Y
7	7NB	A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD	1,200	1,132	-68	-6%	Y	Y	Y
7	7SB	A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE	1,173	1,216	43	4%	Y	Y	Y
8	8NB	A27 WESTERN WAY - A27 BRIDGE ROAD	1,083	1,624	541	50%	N	N	N
8	8SB	A27 BRIDGE ROAD - A27 WESTERN WAY	1,277	1,278	1	0%	Y	Y	Y
9	9NB	A32 MUMBY ROAD - B3334 TITCHFIELD ROAD	1,159	1,310	151	13%	Y	Y	Y
9	9SB	B3334 TITCHFIELD ROAD - A32 MUMBY ROAD	1,138	1,176	38	3%	Y	Y	Y
10	10NB	A32 FAREHAM ROAD - A27 WESTERN ROAD	1,534	1,710	176	11%	Y	Y	Y
10	10SB	A27 WESTERN ROAD - A27 WESTERN ROAD	1,427	1,317	-111	-8%	Y	Y	Y
11	11NB	A397 NORTHERN ROAD - A3 LONDON ROAD	1,024	1,248	224	22%	N	N	Y
11	11SB	A3 LONDON ROAD - A397 NORTHERN ROAD	1,073	1,434	360	34%	N	N	N
12	12NB	B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD	908	1,077	169	19%	N	Y	Y
12	12SB	B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD	835	953	118	14%	Y	Y	Y
13	13NB	A2030 VELDER AVENUE - A2030 EASTERN ROAD	743	607	-136	-18%	N	Y	Y
13	13SB	A2030 EASTERN ROAD - A2030 VELDER AVENUE	631	566	-65	-10%	Y	Y	Y
14	14NB	A288 MILTON ROAD - A288 COPNOR ROAD	456	434	-21	-5%	Y	Y	Y
14	14SB	A288 COPNOR ROAD - A288 MILTON ROAD	527	505	-22	-4%	Y	Y	Y
15	15NB	M275 - - A27	224	242	18	8%	Y	Y	Y
15	15SB	A27 - M275	260	250	-11	-4%	Y	Y	Y
16	16NB	A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD	882	816	-65	-7%	Y	Y	Y
16	16SB	A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT	783	749	-34	-4%	Y	Y	Y
17	17NB	A3 MARKETWAY - A27 WESTERN ROAD	757	606	-151	-20%	N	Y	Y
17	17SB	A27 WESTERN ROAD - A3 MARKETWAY	714	768	54	8%	Y	Y	Y
	Total		33,881	34,794	913	3%			

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

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	M3J11 - A32	922	952	29	3%	Y	Y	Y
18	1SB	A32 - M3J11	827	811	-16	-2%	Y	Y	Y
19	2NB	M27J2 - A303	1,930	2,039	109	6%	Y	Y	Y
19	2SB	A303 - M27J2	2,010	2,378	368	18%	N	Y	Y
20	3NB	M27J2 - A34	1,937	2,104	167	9%	Y	Y	Y
20	3SB	A34 - M27J2	1,856	1,981	124	7%	Y	Y	Y
21	SEC1EB	Six Dials Jun to Windhover Rbt	689	860	171	25%	N	N	Y
21	SEC1WB	Windhover Rbt to Six Dials Jun	1,021	1,096	75	7%	Y	Y	Y
22	SEC2NB	M27J7 to M3J11	1,344	1,357	13	1%	Y	Y	Y
22	SEC2SB	M3J11 - M27J7	1,309	1,268	-42	-3%	Y	Y	Y
23	SEC3NB	M27J10 - M3J11	1,898	1,763	-135	-7%	Y	Y	Y
23	SEC3SB	M3J11 - M27J10	1,726	1,612	-114	-7%	Y	Y	Y
	Total		17,470	18,220	750	4%			

M27 and M3 **AM**

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24		M27 Eastbound	1253	1190	-63	-5%	Y	Y	Y
24		M27 Westbound	1344	1441	97	7%	Y	Y	Y
25		M3 Northbound	1146	1153	7	1%	Y	Y	Y
25		M3 Southbound	1415	1523	109	8%	Y	Y	Y

		Percentage within criteria					**82%**	***90%***	***96%***

APPENDIX B

JOURNEY TIME VALIDATION

Part 1 (Routes Undertaken for Previous 2010 Base and updated to TrafficMaster 2014)

IP

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	1,265	-214	-14%	Y	Y	Y
1	1WB	A35 BURGESS ROAD - A35 WINCHESTER ROAD	1,539	1,282	-257	-17%	N	Y	Y
2	2EB	A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE	1,454	1,149	-305	-21%	N	N	Y
2	2WB	A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST	1,437	1,157	-280	-19%	N	Y	Y
3	3NB	A33 DORSET STREET - A335 TWYFORD ROAD	1,093	1,006	-87	-8%	Y	Y	Y
3	3SB	A335 TWYFORD ROAD - A33 DORSET STREET	1,090	1,090	0	0%	Y	Y	Y
4	4NB	A33 DORSET STREET - A33	472	424	-48	-10%	Y	Y	Y
4	4SB	A33 - A33 DORSET STREET	487	468	-18	-4%	Y	Y	Y
5	5NB	A3024 BURSLEDON ROAD - A33 THE AVENUE	1,176	1,141	-34	-3%	Y	Y	Y
5	5SB	A33 THE AVENUE - A3024 BURSLEDON ROAD	1,167	1,151	-16	-1%	Y	Y	Y
6	6NB	A27 WEST END ROAD - A27 BASSETT GREEN ROAD	880	902	21	2%	Y	Y	Y
6	6SB	A27 BASSETT GREEN ROAD - A27 WEST END ROAD	902	942	40	4%	Y	Y	Y
7	7NB	A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD	1,348	1,105	-243	-18%	N	Y	Y
7	7SB	A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE	1,199	1,122	-77	-6%	Y	Y	Y
8	8NB	A27 WESTERN WAY - A27 BRIDGE ROAD	1,104	1,189	85	8%	Y	Y	Y
8	8SB	A27 BRIDGE ROAD - A27 WESTERN WAY	1,148	1,077	-70	-6%	Y	Y	Y
9	9NB	A32 MUMBY ROAD - B3334 TITCHFIELD ROAD	1,056	1,079	23	2%	Y	Y	Y
9	9SB	B3334 TITCHFIELD ROAD - A32 MUMBY ROAD	1,079	1,011	-68	-6%	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	1,207	-152	-11%	Y	Y	Y
11	11NB	A397 NORTHERN ROAD - A3 LONDON ROAD	1,107	1,178	71	6%	Y	Y	Y
11	11SB	A3 LONDON ROAD - A397 NORTHERN ROAD	1,133	1,256	123	11%	Y	Y	Y
12	12NB	B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD	946	948	2	0%	Y	Y	Y
12	12SB	B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD	858	910	52	6%	Y	Y	Y
13	13NB	A2030 VELDER AVENUE - A2030 EASTERN ROAD	647	541	-106	-16%	N	Y	Y
13	13SB	A2030 EASTERN ROAD - A2030 VELDER AVENUE	594	533	-61	-10%	Y	Y	Y
14	14NB	A288 MILTON ROAD - A288 COPNOR ROAD	494	420	-74	-15%	Y	Y	Y
14	14SB	A288 COPNOR ROAD - A288 MILTON ROAD	610	478	-132	-22%	N	N	Y
15	15NB	M275 - - A27	224	229	6	3%	Y	Y	Y
15	15SB	A27 - M275	256	197	-58	-23%	N	N	Y
16	16NB	A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD	778	708	-70	-9%	Y	Y	Y
16	16SB	A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT	759	646	-113	-15%	Y	Y	Y
17	17NB	A3 MARKETWAY - A27 WESTERN ROAD	672	584	-87	-13%	Y	Y	Y
17	17SB	A27 WESTERN ROAD - A3 MARKETWAY	671	539	-132	-20%	N	Y	Y
	Total		32,617	30,251	-2366	-7%			

Part 2 (Routes Newly Analysed for 2015 Base)

IP

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	M3J11 - A32	775	783	8	1%	Y	Y	Y
18	1SB	A32 - M3J11	790	807	17	2%	Y	Y	Y
19	2NB	M27J2 - A303	2,017	1,960	-57	-3%	Y	Y	Y
19	2SB	A303 - M27J2	2,020	2,344	324	16%	N	Y	Y
20	3NB	M27J2 - A34	1,815	1,964	150	8%	Y	Y	Y
20	3SB	A34 - M27J2	1,825	1,963	138	8%	Y	Y	Y
21	SEC1EB	Six Dials Jun to Windhover Rbt	783	825	41	5%	Y	Y	Y
21	SEC1WB	Windhover Rbt to Six Dials Jun	740	886	147	20%	N	Y	Y
22	SEC2NB	M27J7 to M3J11	1,235	1,166	-69	-6%	Y	Y	Y
22	SEC2SB	M3J11 - M27J7	1,272	1,154	-118	-9%	Y	Y	Y
23	SEC3NB	M27J10 - M3J11	1,710	1,611	-100	-6%	Y	Y	Y
23	SEC3SB	M3J11 - M27J10	1,659	1,590	-68	-4%	Y	Y	Y
	Total		16,640	17,054	413	2%			

M27 and M3

IP

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24		M27 Eastbound	945	968	23	2%	Y	Y	Y
24		M27 Westbound	956	1001	45	5%	Y	Y	Y
25		M3 Northbound	1092	1117	25	2%	Y	Y	Y
25		M3 Southbound	1081	1165	85	8%	Y	Y	Y

		Percentage within criteria					**80%**	***94%***	***100%***

APPENDIX B
JOURNEY TIME VALIDATION
Part 1 (Routes Undertaken for Previous 2010 Base and updated to TrafficMaster 2014)

PM

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	1,353	-382	-22%	N	N	Y
1	1WB	A35 BURGESS ROAD - A35 WINCHESTER ROAD	1,771	1,404	-366	-21%	N	N	Y
2	2EB	A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE	1,513	1,272	-241	-16%	N	Y	Y
2	2WB	A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST	1,530	1,274	-256	-17%	N	Y	Y
3	3NB	A33 DORSET STREET - A335 TWYFORD ROAD	1,470	1,065	-406	-28%	N	N	N
3	3SB	A335 TWYFORD ROAD - A33 DORSET STREET	1,469	1,124	-345	-23%	N	N	Y
4	4NB	A33 DORSET STREET - A33	676	529	-147	-22%	N	N	Y
4	4SB	A33 - A33 DORSET STREET	613	581	-32	-5%	Y	Y	Y
5	5NB	A3024 BURSLEDON ROAD - A33 THE AVENUE	1,239	1,283	44	4%	Y	Y	Y
5	5SB	A33 THE AVENUE - A3024 BURSLEDON ROAD	1,589	1,191	-399	-25%	N	N	N
6	6NB	A27 WEST END ROAD - A27 BASSETT GREEN ROAD	915	934	20	2%	Y	Y	Y
6	6SB	A27 BASSETT GREEN ROAD - A27 WEST END ROAD	1,159	962	-196	-17%	N	Y	Y
7	7NB	A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD	1,516	1,181	-334	-22%	N	N	Y
7	7SB	A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE	1,221	1,191	-30	-2%	Y	Y	Y
8	8NB	A27 WESTERN WAY - A27 BRIDGE ROAD	1,505	1,388	-117	-8%	Y	Y	Y
8	8SB	A27 BRIDGE ROAD - A27 WESTERN WAY	1,366	1,270	-96	-7%	Y	Y	Y
9	9NB	A32 MUMBY ROAD - B3334 TITCHFIELD ROAD	1,066	1,080	14	1%	Y	Y	Y
9	9SB	B3334 TITCHFIELD ROAD - A32 MUMBY ROAD	1,277	1,180	-98	-8%	Y	Y	Y
10	10NB	A32 FAREHAM ROAD - A27 WESTERN ROAD	1,534	1,406	-128	-8%	Y	Y	Y
10	10SB	A27 WESTERN ROAD - A27 WESTERN ROAD	1,643	1,479	-164	-10%	Y	Y	Y
11	11NB	A397 NORTHERN ROAD - A3 LONDON ROAD	1,102	1,260	157	14%	Y	Y	Y
11	11SB	A3 LONDON ROAD - A397 NORTHERN ROAD	1,118	1,306	188	17%	N	Y	Y
12	12NB	B2177 PORTSDOWN HILL ROAD - B2149 HAVANT ROAD	955	992	36	4%	Y	Y	Y
12	12SB	B2149 HAVANT ROAD - B2177 PORTSDOWN HILL ROAD	889	1,029	140	16%	N	Y	Y
13	13NB	A2030 VELDER AVENUE - A2030 EASTERN ROAD	792	577	-216	-27%	N	N	N
13	13SB	A2030 EASTERN ROAD - A2030 VELDER AVENUE	768	568	-200	-26%	N	N	N
14	14NB	A288 MILTON ROAD - A288 COPNOR ROAD	535	428	-107	-20%	N	Y	Y
14	14SB	A288 COPNOR ROAD - A288 MILTON ROAD	637	541	-96	-15%	N	Y	Y
15	15NB	M275 - - A27	217	264	47	21%	N	N	Y
15	15SB	A27 - M275	247	217	-30	-12%	Y	Y	Y
16	16NB	A2047 KINGSTON CRESCENT - A3 SOUTHAMPTON ROAD	897	842	-55	-6%	Y	Y	Y
16	16SB	A3 SOUTHAMPTON ROAD - A2047 KINGSTON CRESCENT	832	714	-118	-14%	Y	Y	Y
17	17NB	A3 MARKETWAY - A27 WESTERN ROAD	704	611	-93	-13%	Y	Y	Y
17	17SB	A27 WESTERN ROAD - A3 MARKETWAY	731	706	-25	-3%	Y	Y	Y
	Total		37,229	33,202	-4028	-11%			

Part 2 (Routes Newly Analysed for 2015 Base)

PM

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
18	1NB	M3J11 - A32	889	809	-80	-9%	Y	Y	Y
18	1SB	A32 - M3J11	988	881	-108	-11%	Y	Y	Y
19	2NB	M27J2 - A303	1,995	1,959	-36	-2%	Y	Y	Y
19	2SB	A303 - M27J2	1,986	2,613	626	32%	N	N	N
20	3NB	M27J2 - A34	1,924	2,053	129	7%	Y	Y	Y
20	3SB	A34 - M27J2	2,086	2,134	48	2%	Y	Y	Y
21	SEC1EB	Six Dials Jun to Windhover Rbt	902	874	-29	-3%	Y	Y	Y
21	SEC1WB	Windhover Rbt to Six Dials Jun	827	949	123	15%	Y	Y	Y
22	SEC2NB	M27J7 to M3J11	1,315	1,219	-95	-7%	Y	Y	Y
22	SEC2SB	M3J11 - M27J7	1,400	1,198	-202	-14%	Y	Y	Y
23	SEC3NB	M27J10 - M3J11	1,681	1,621	-61	-4%	Y	Y	Y
23	SEC3SB	M3J11 - M27J10	1,736	1,625	-111	-6%	Y	Y	Y
	Total		17,731	17,935	204	1%			

M27 and M3

PM

No.	Route	Description	TM Tot.Time(s)	Model Tot.Time(s)	Diff.	%Diff.	WebTAG <=15%	*<=20%*	*<=25%*
24		M27 Eastbound	1195	1245	51	4%	Y	Y	Y
24		M27 Westbound	1164	1229	65	6%	Y	Y	Y
25		M3 Northbound	1462	1385	-77	-5%	Y	Y	Y
25		M3 Southbound	1093	1216	124	11%	Y	Y	Y

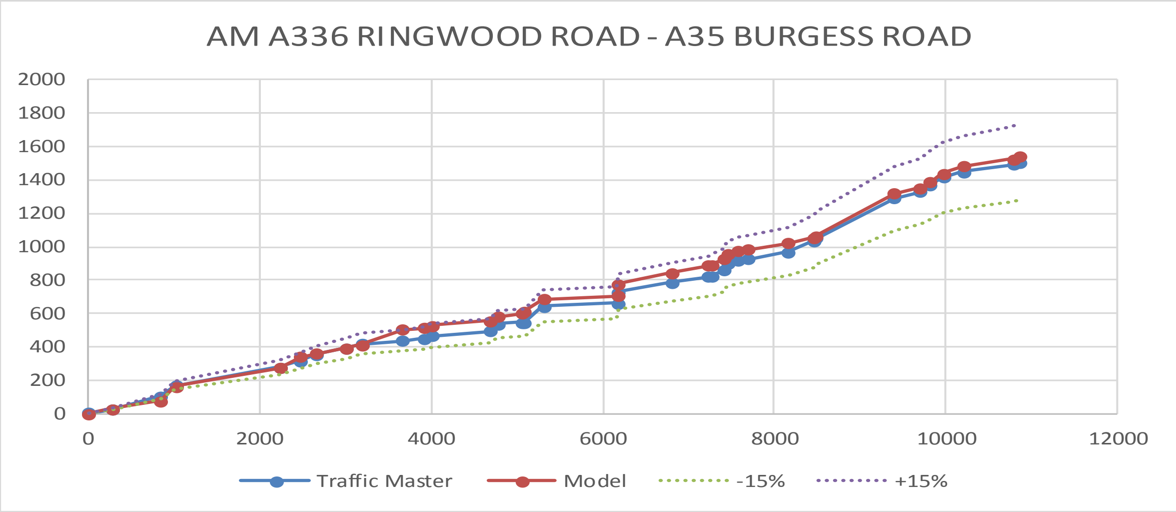
		Percentage within criteria					**64%**	***78%***	***90%***

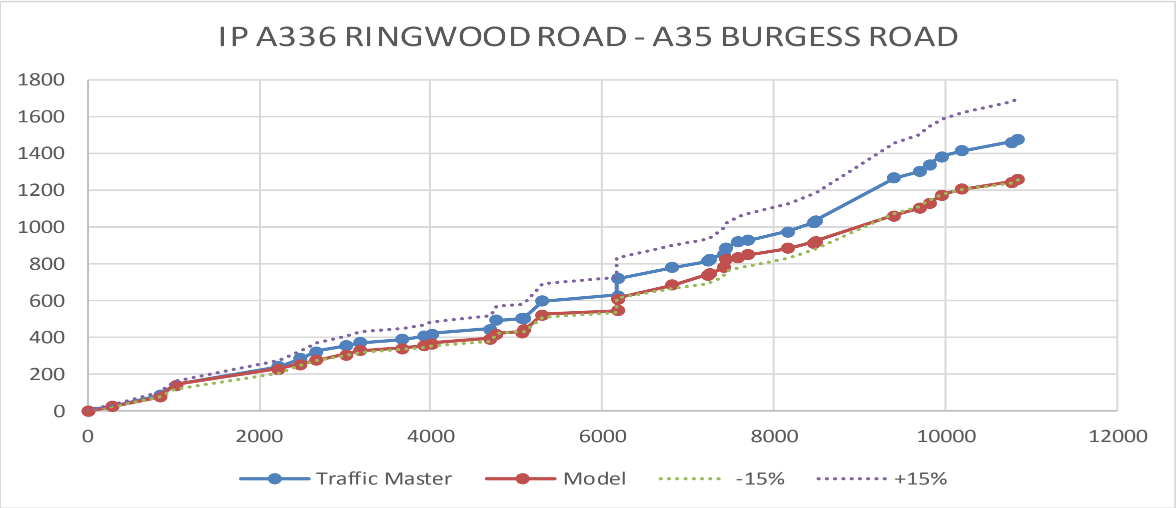
APPENDIX C

TIME-DISTANCE CHARTS

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

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





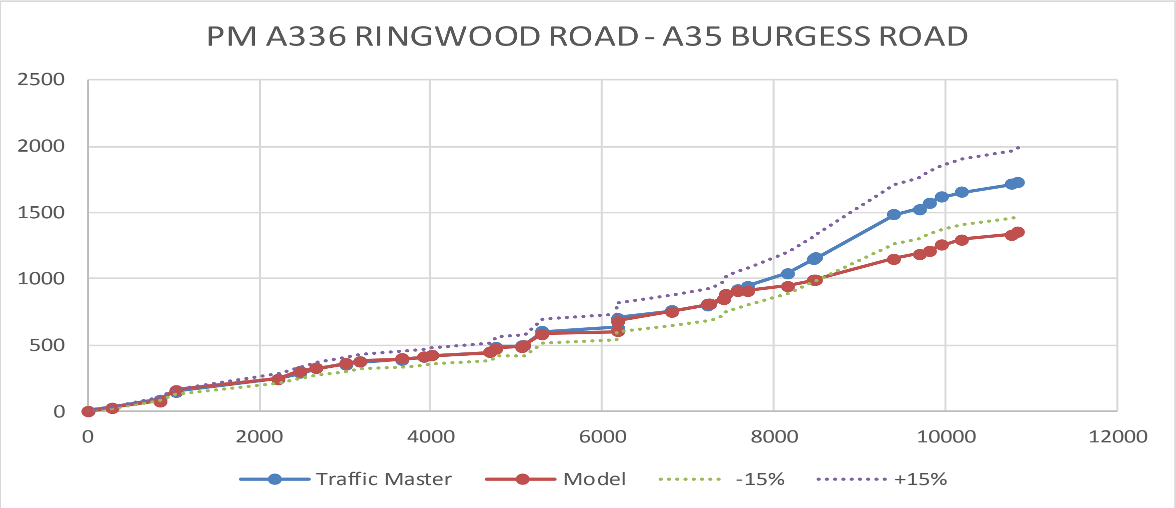
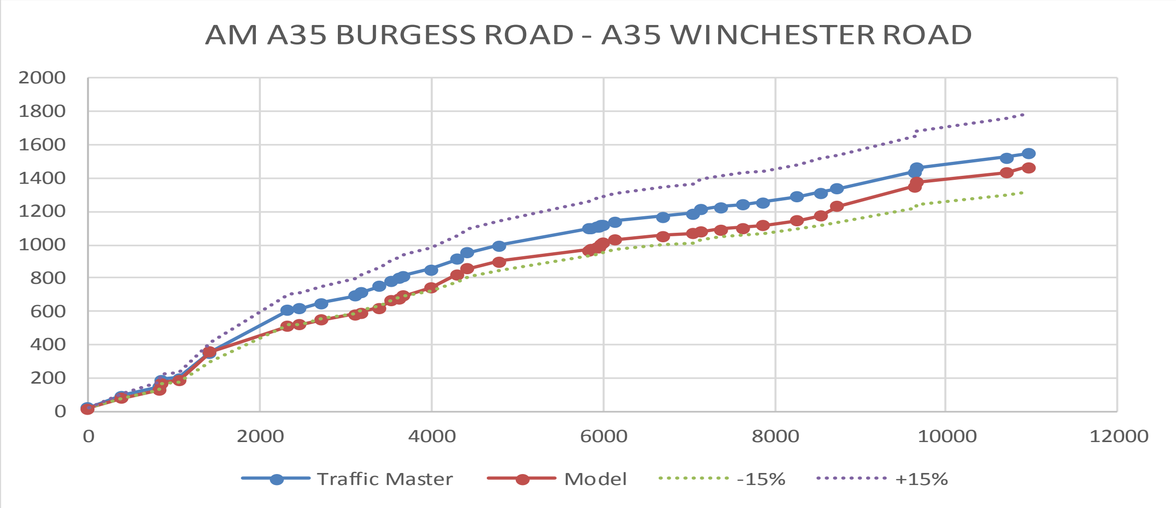
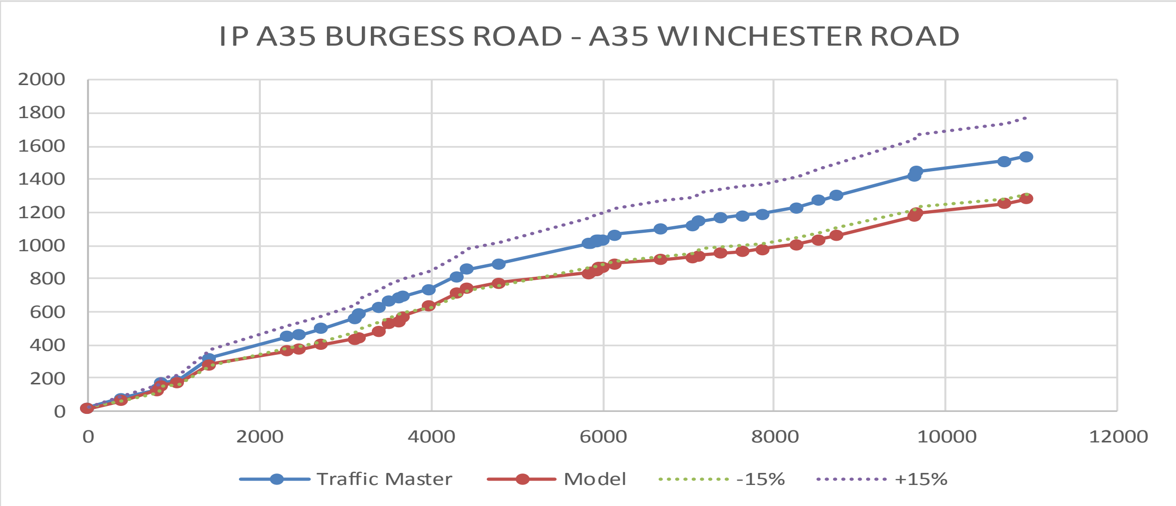


Figure 2. 1WB A35 BURGESS ROAD - A35 WINCHESTER ROAD





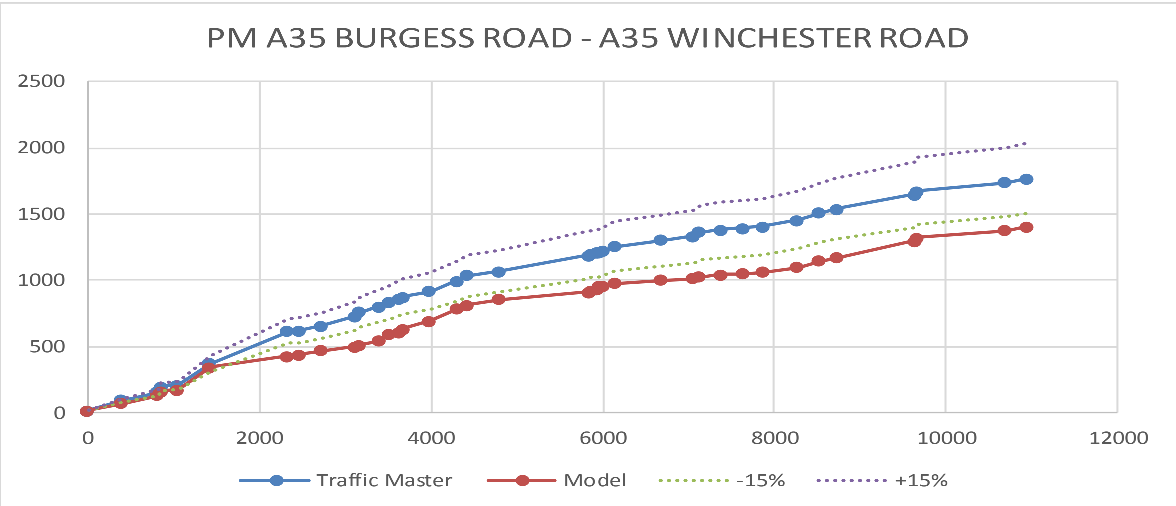
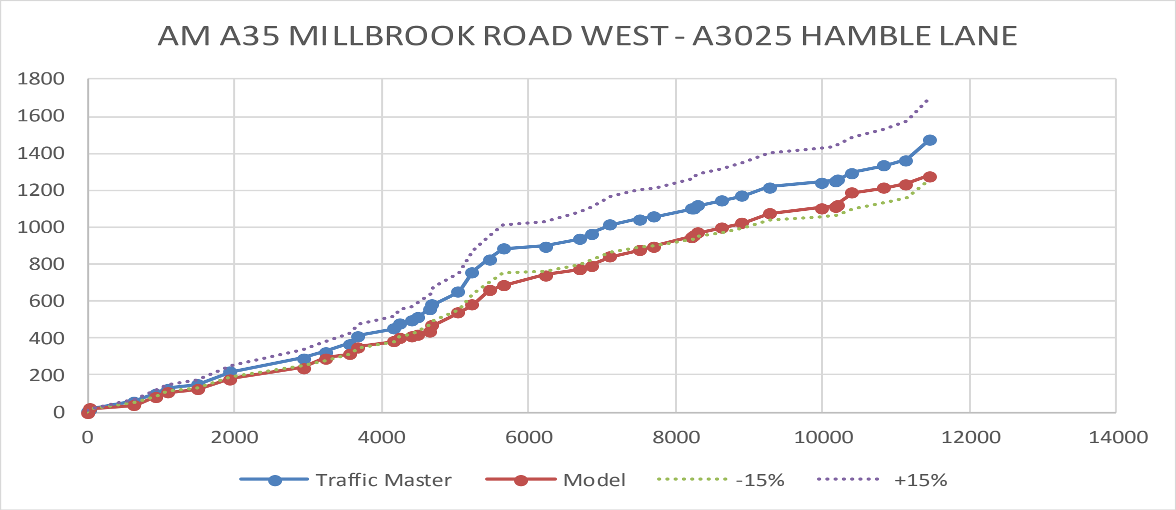
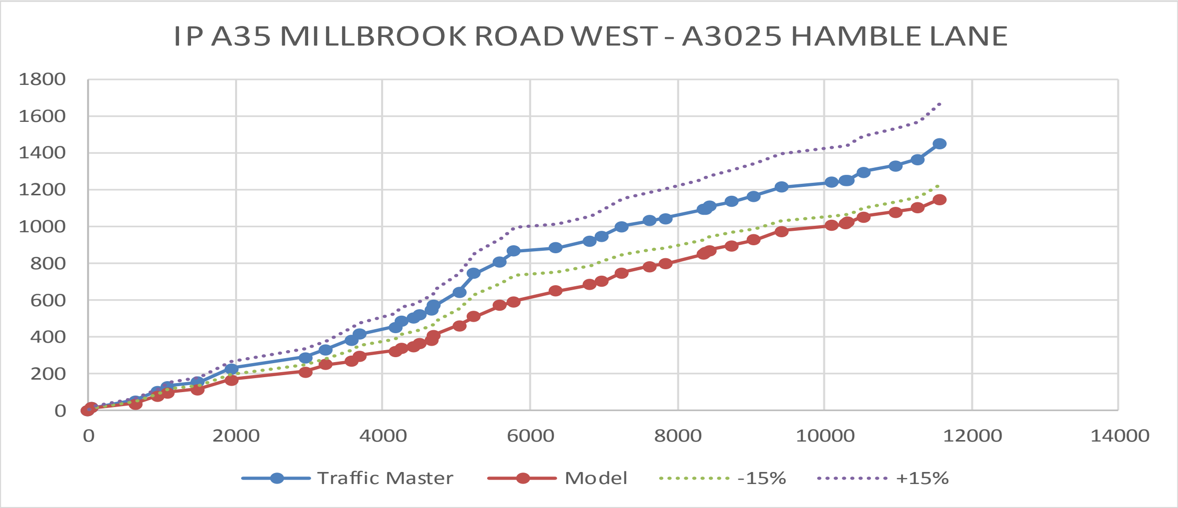


Figure 3. 2EB A35 MILLBROOK ROAD WEST - A3025 HAMBLE LANE





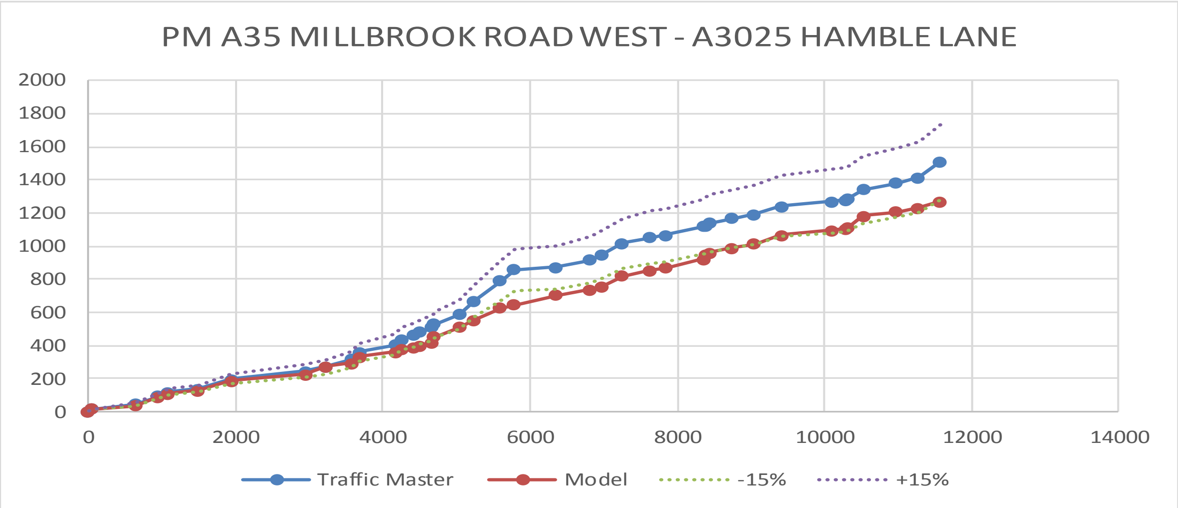
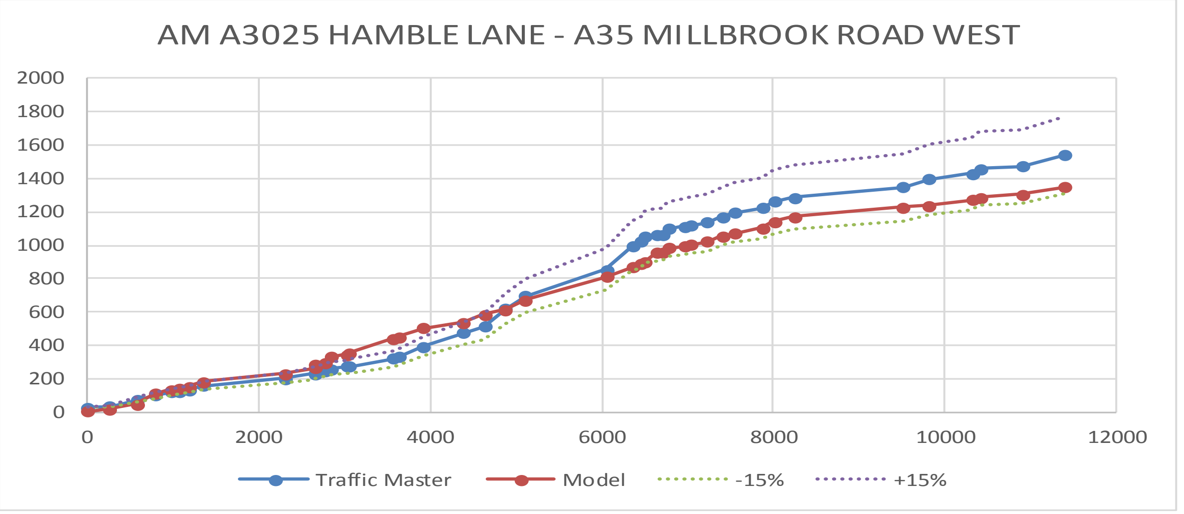
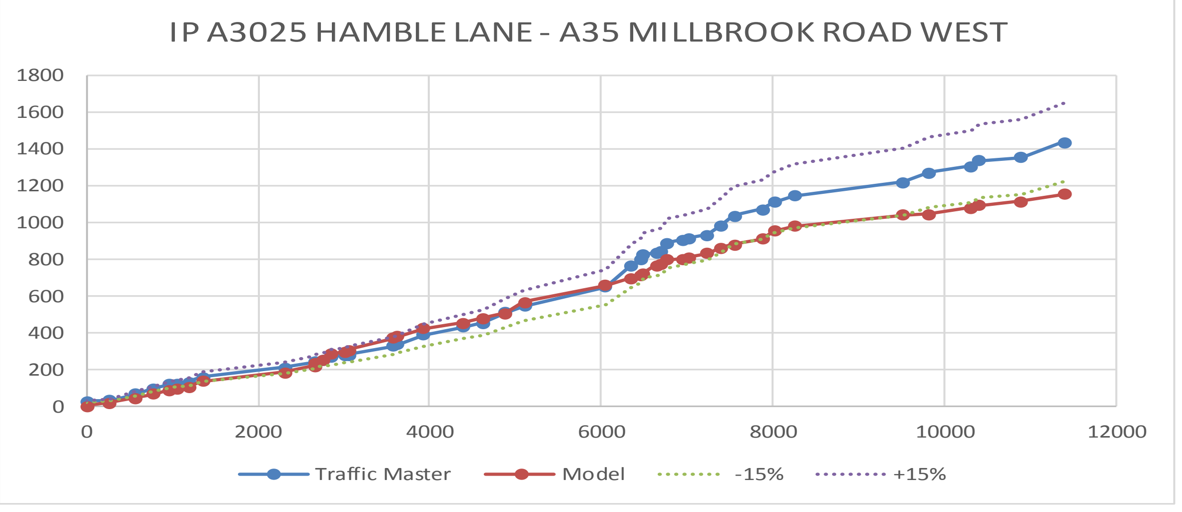


Figure 4. 2WB A3025 HAMBLE LANE - A35 MILLBROOK ROAD WEST





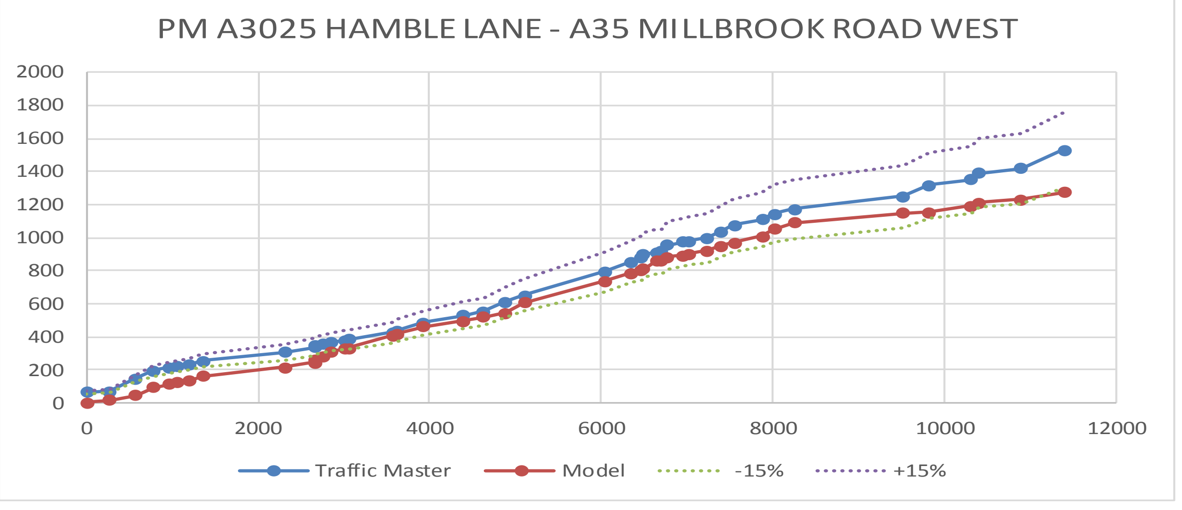
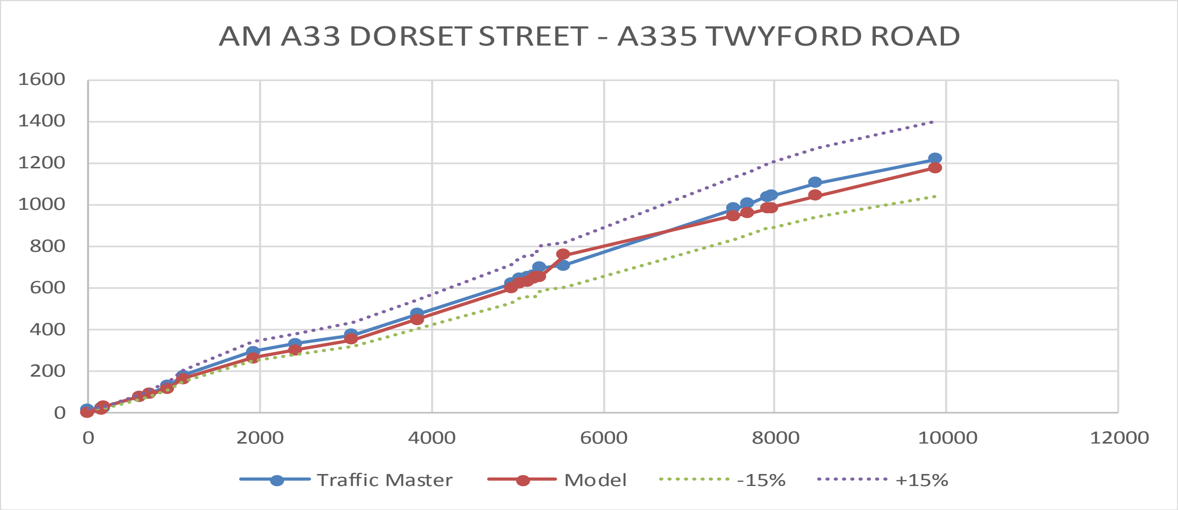
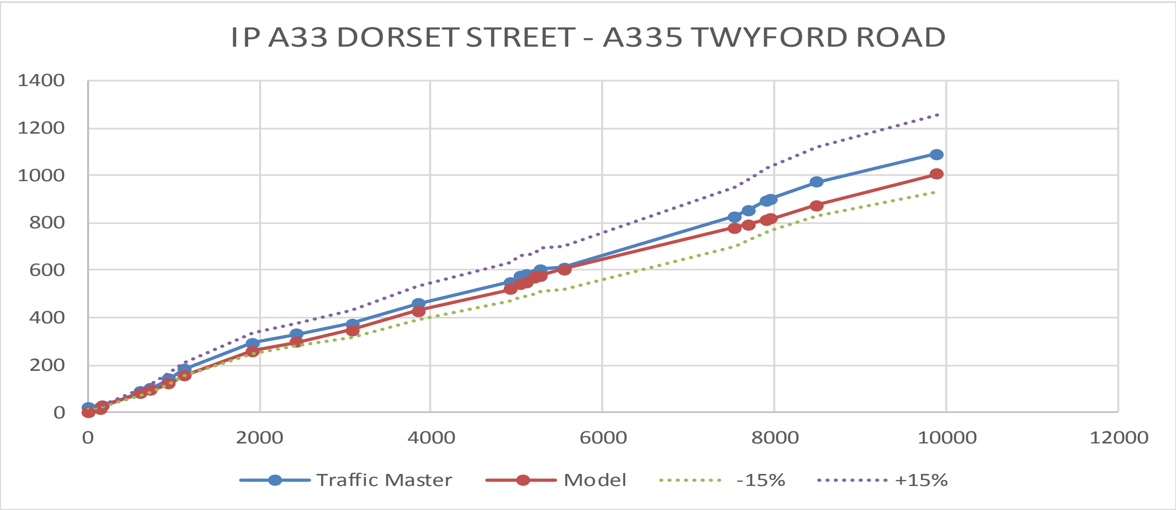


Figure 5. 3NB A33 DORSET STREET - A335 TWYFORD ROAD





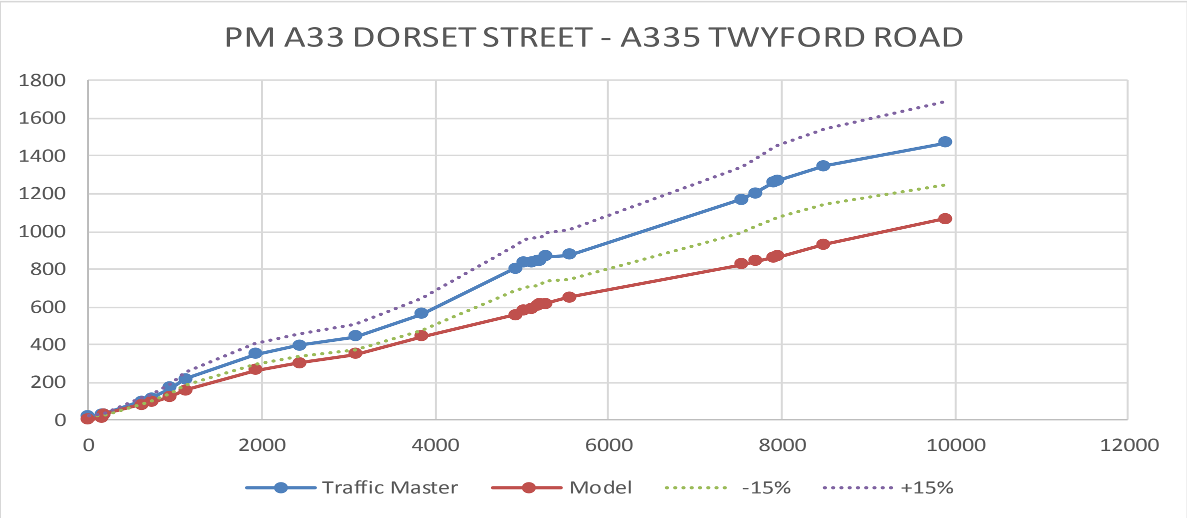
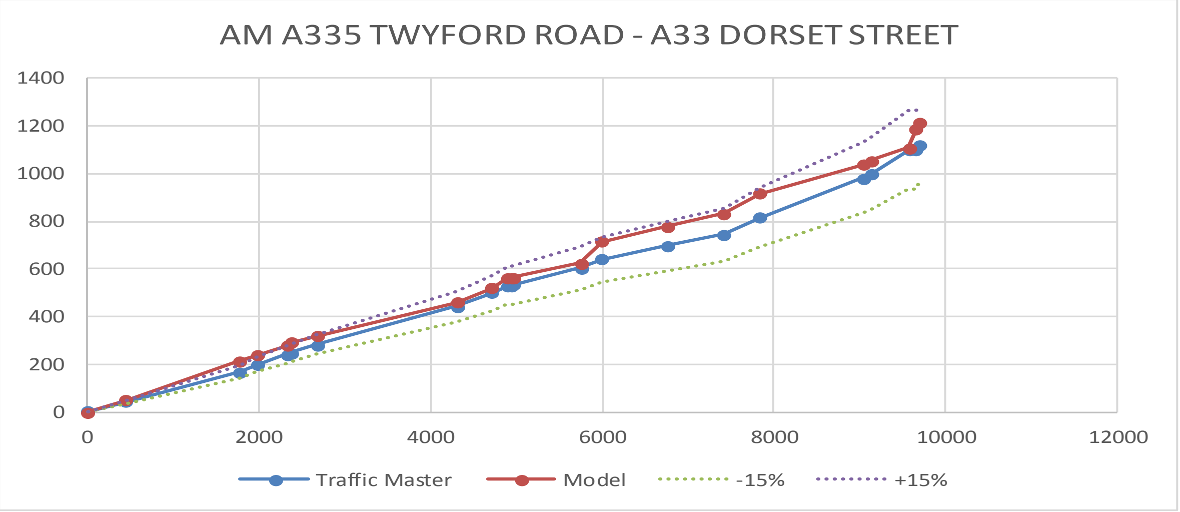
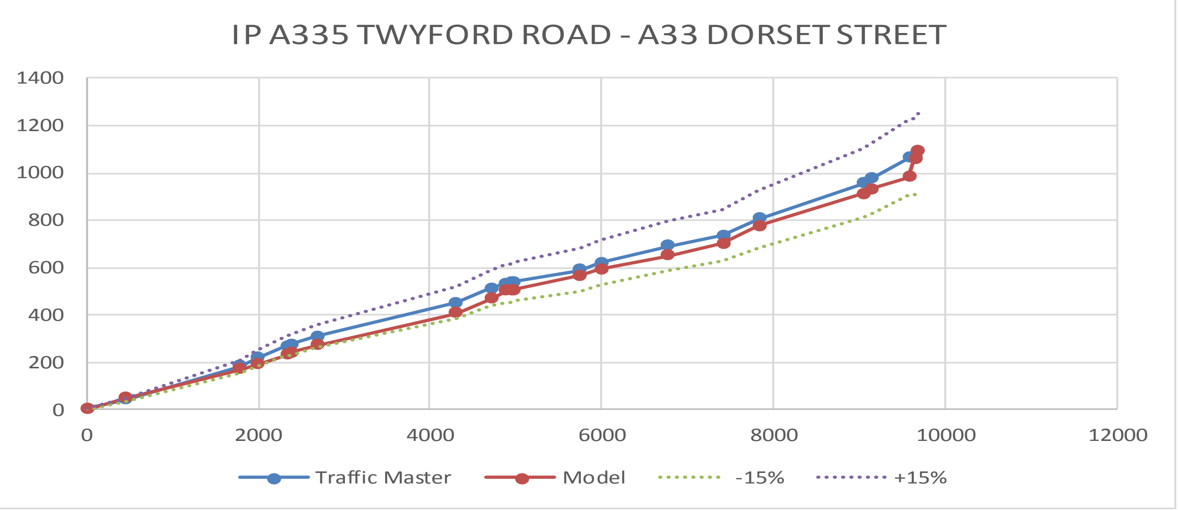


Figure 6. 3SB A335 TWYFORD ROAD - A33 DORSET STREET





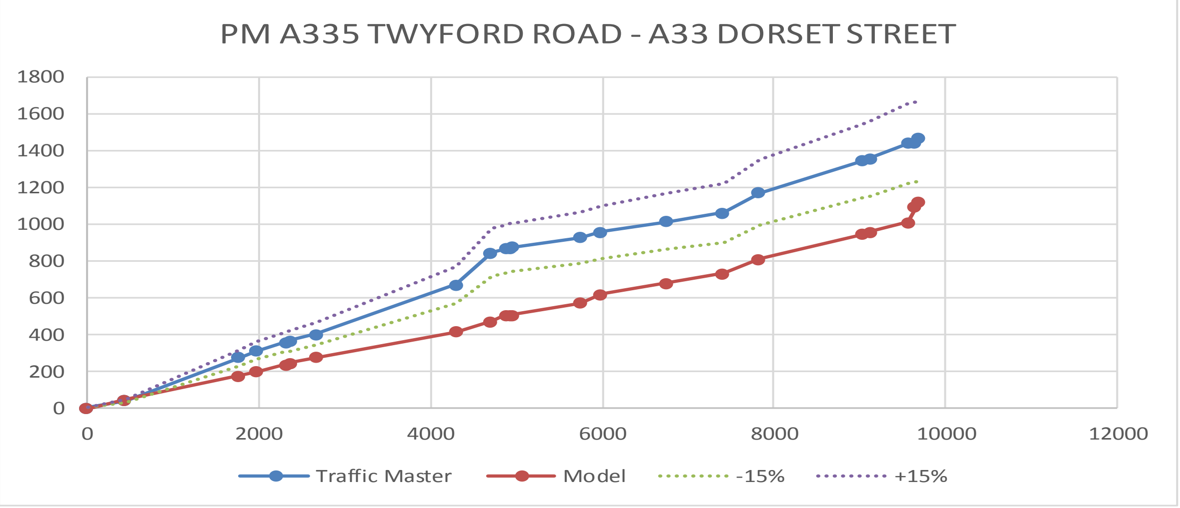
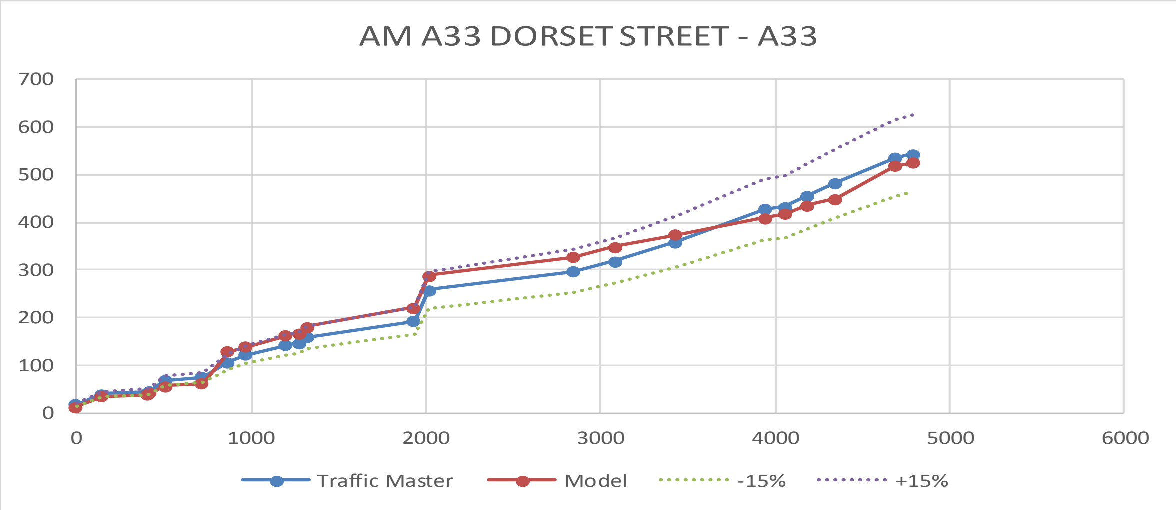
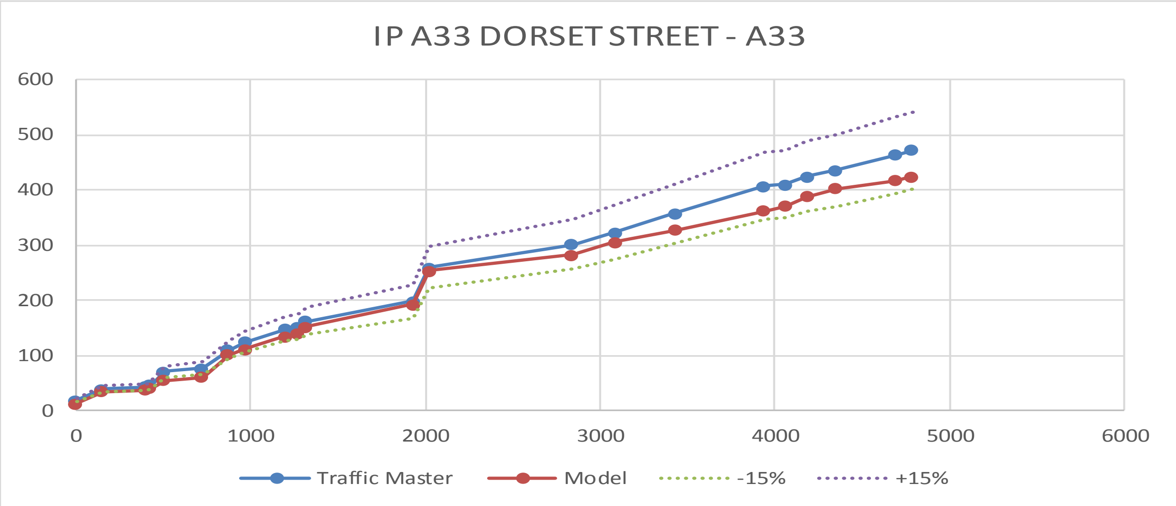


Figure 7. 4NB A33 DORSET STREET - A33





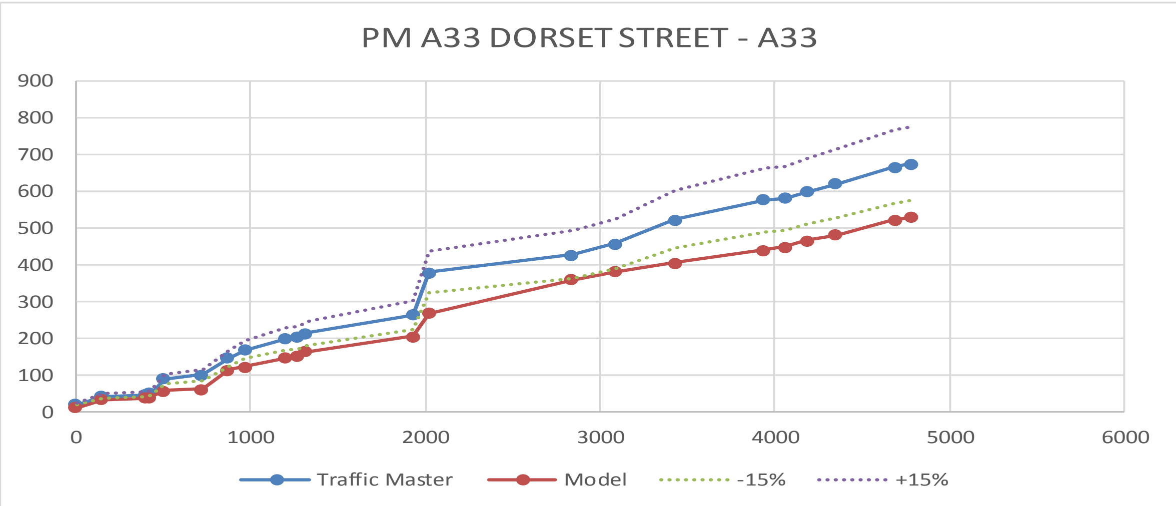
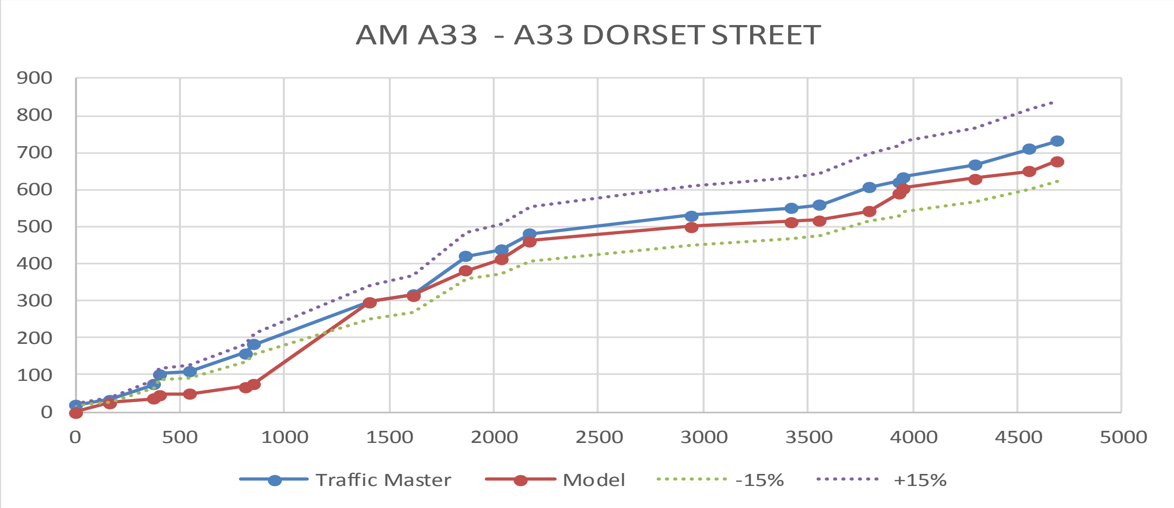
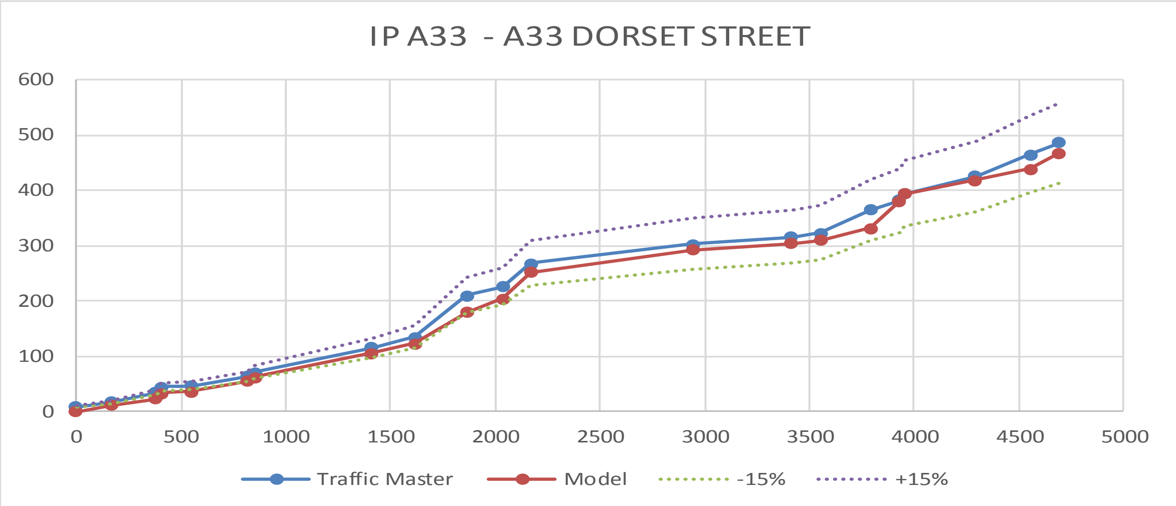


Figure 8. 4SB A33 - A33 DORSET STREET





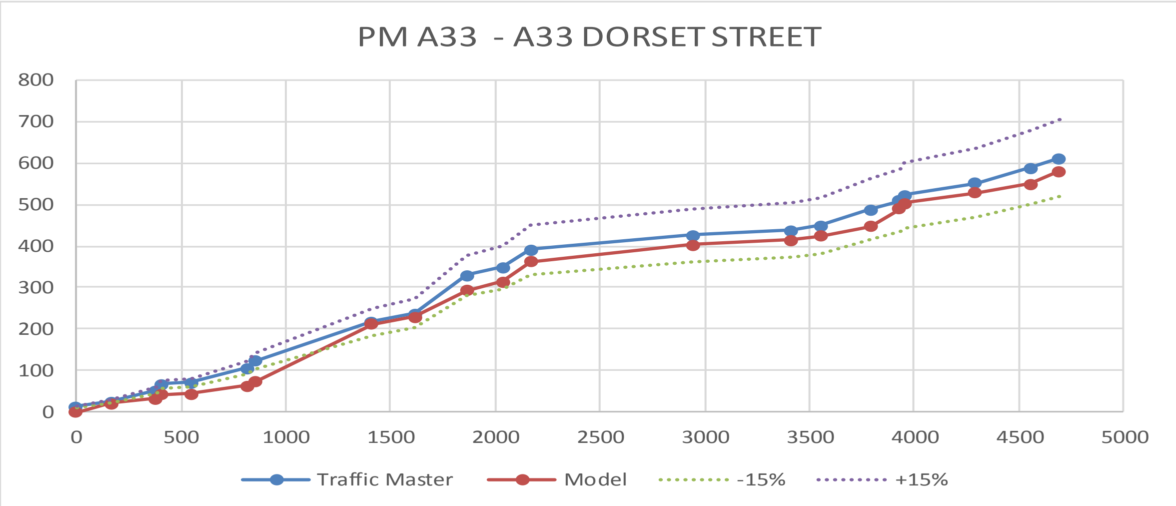
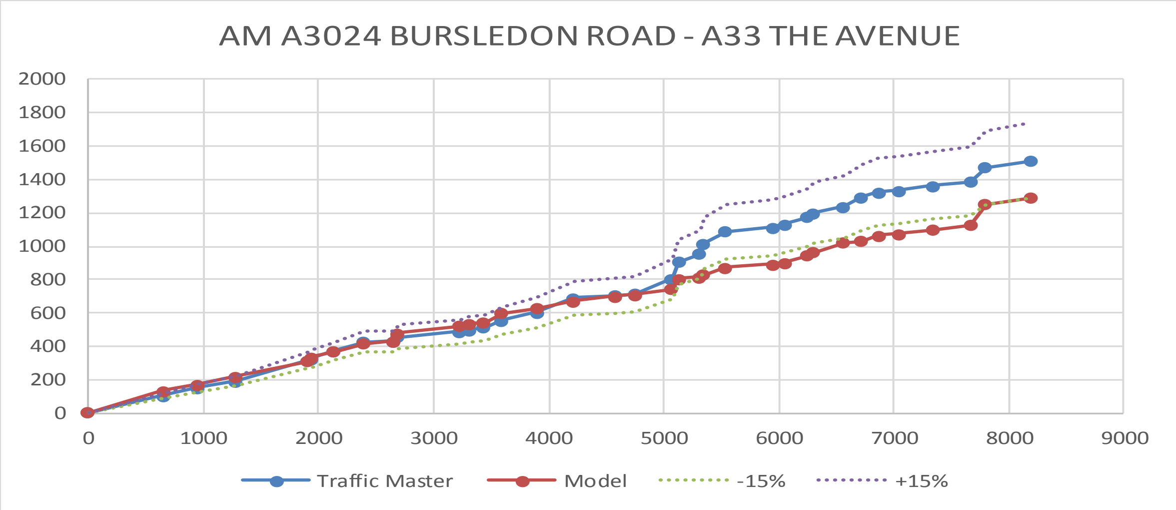
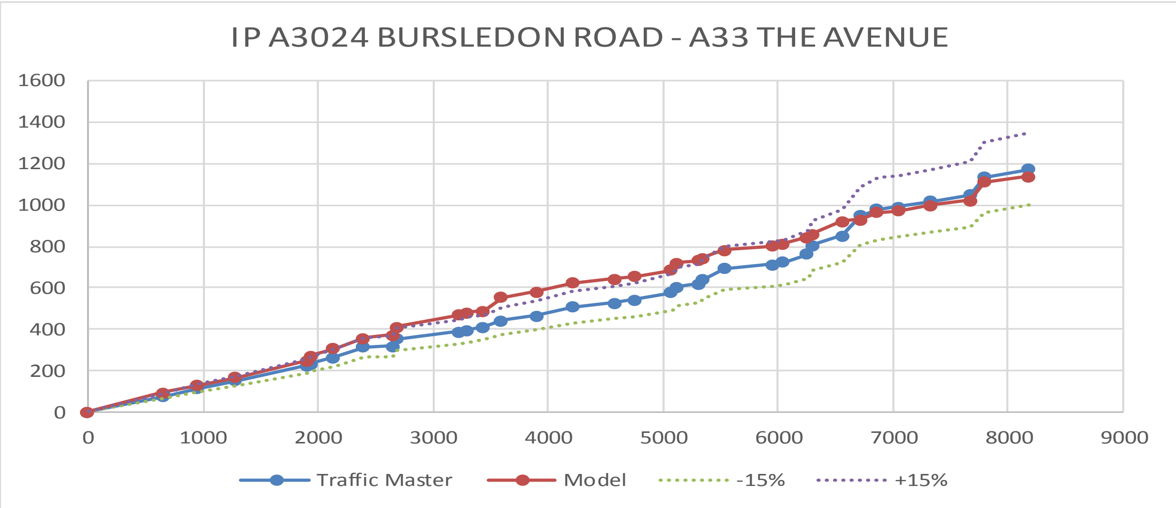


Figure 9. 5NB A3024 BURSLEDON ROAD - A33 THE AVENUE





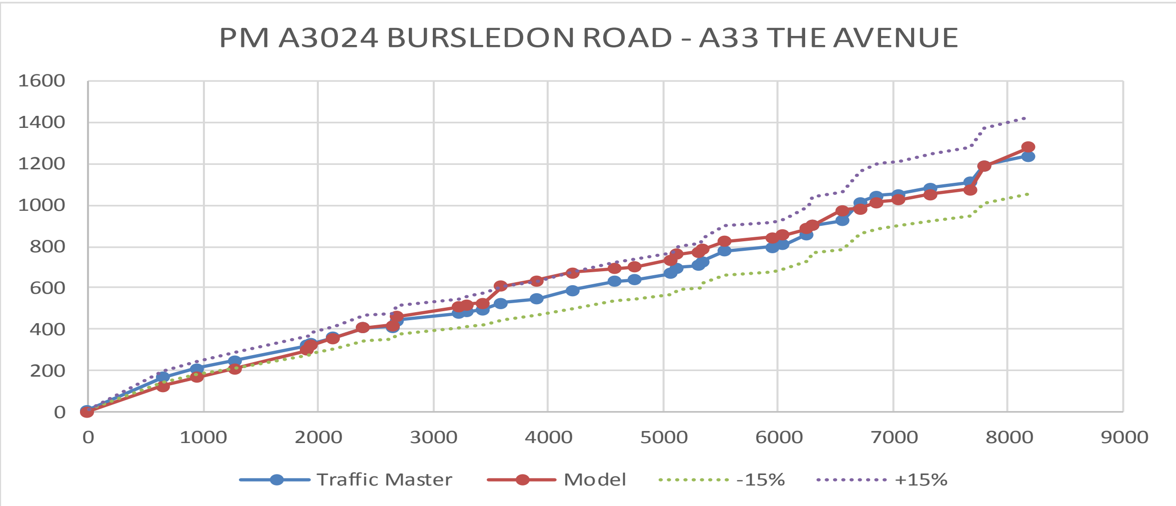
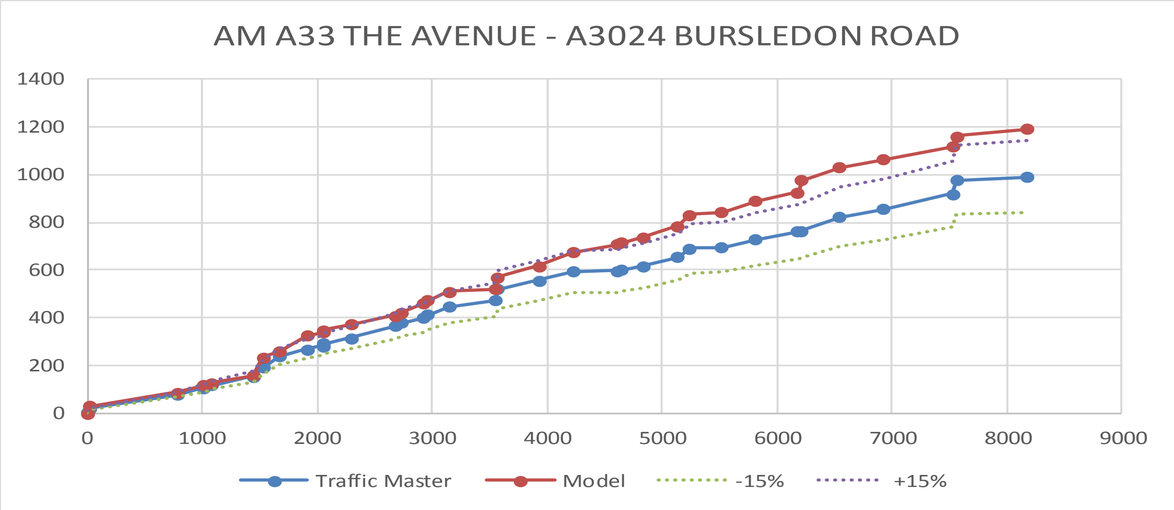
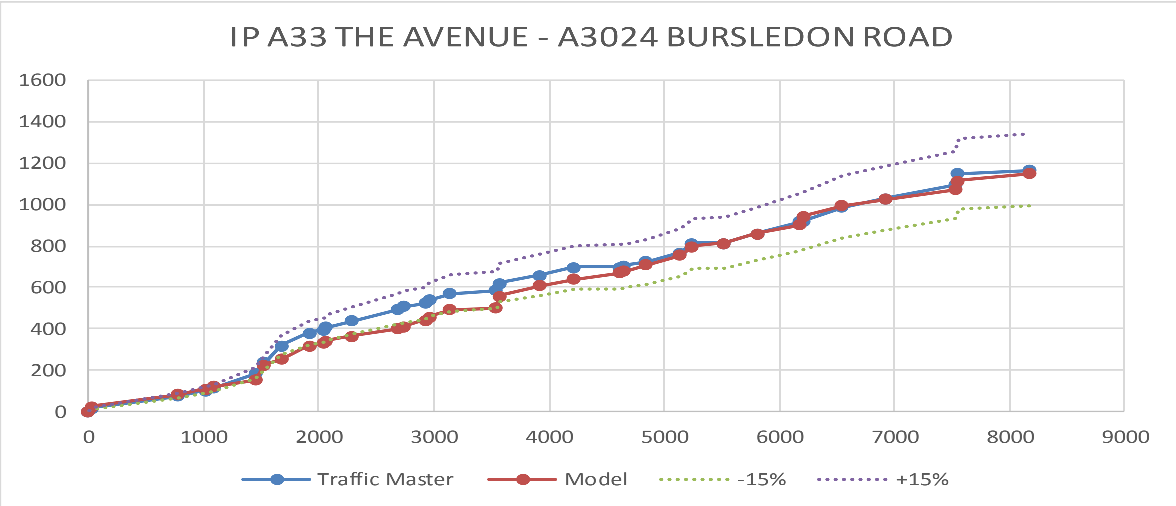


Figure 10. 5SB A33 THE AVENUE - A3024 BURSLEDON ROAD





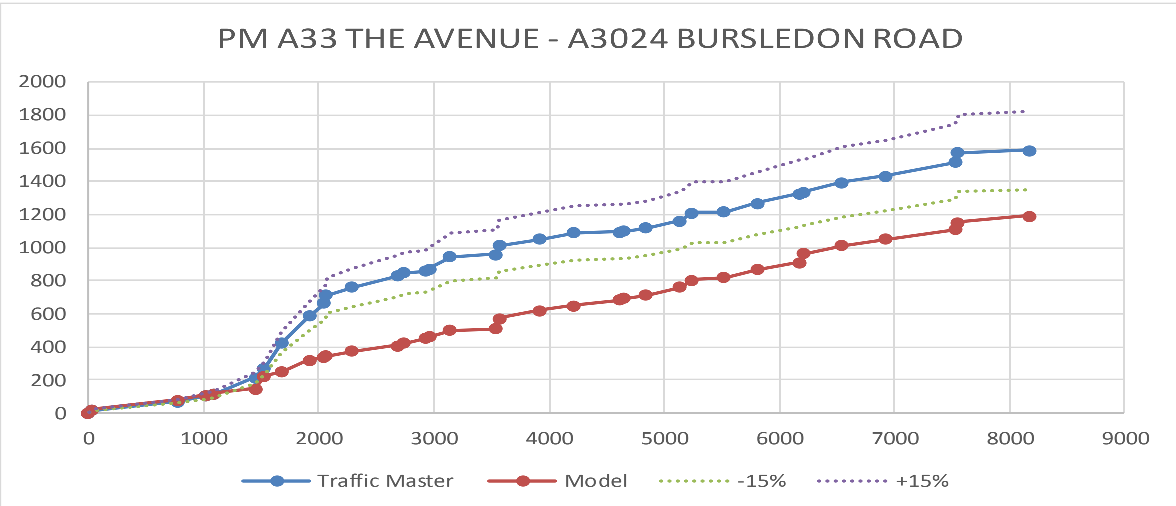
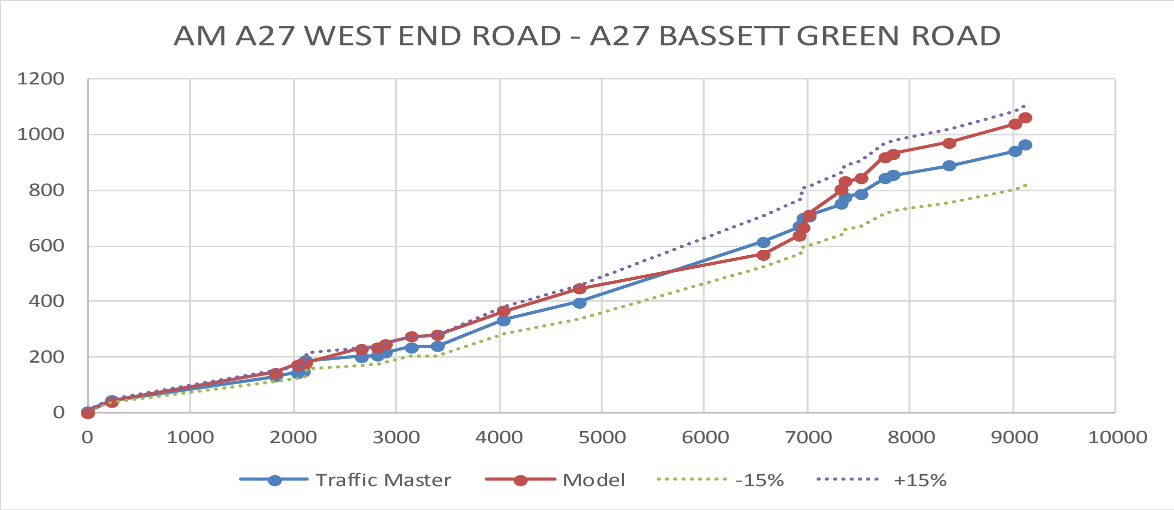
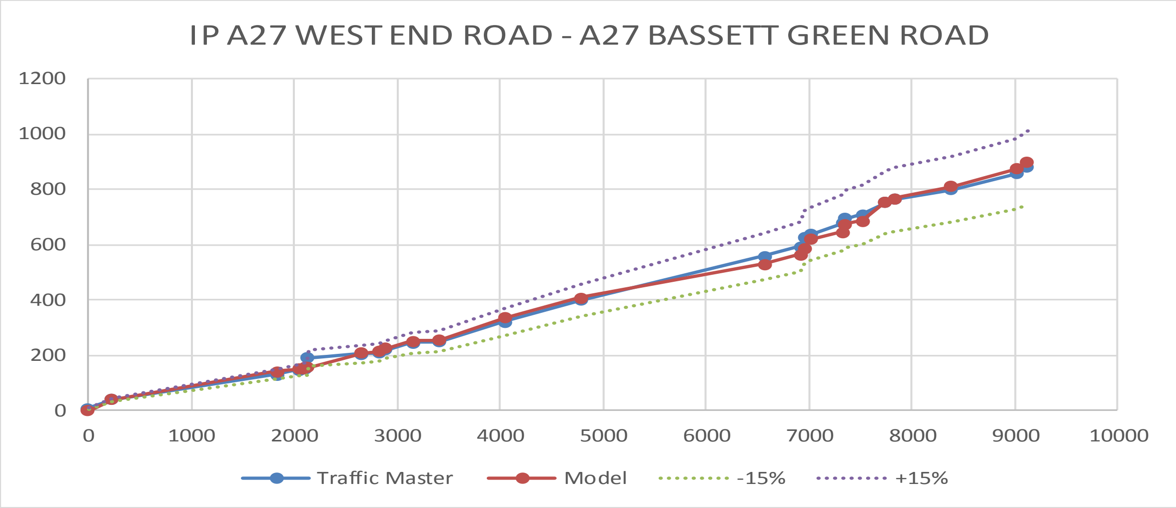


Figure 11. 6NB A27 WEST END ROAD - A27 BASSETT GREEN ROAD





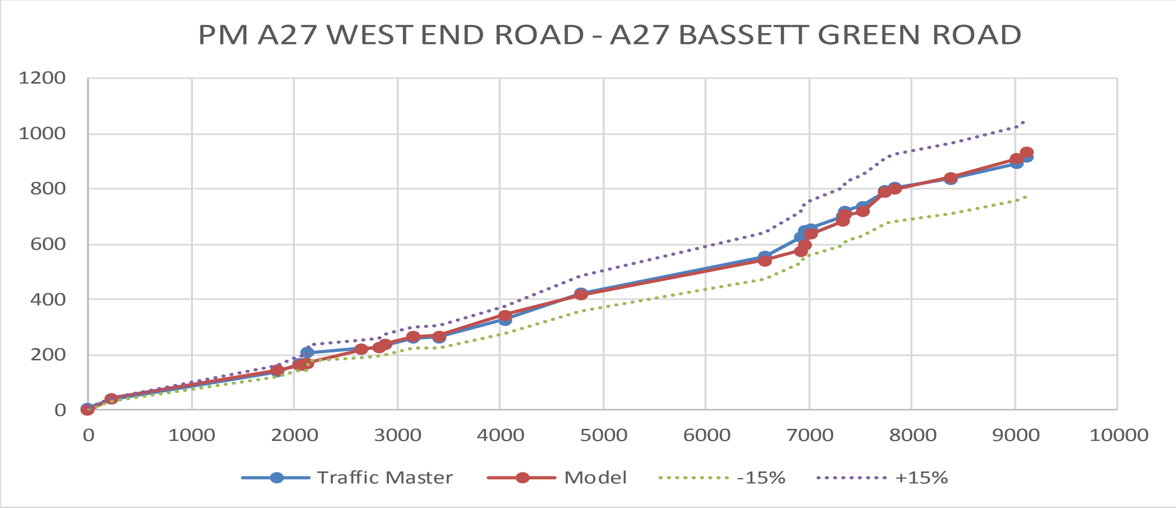
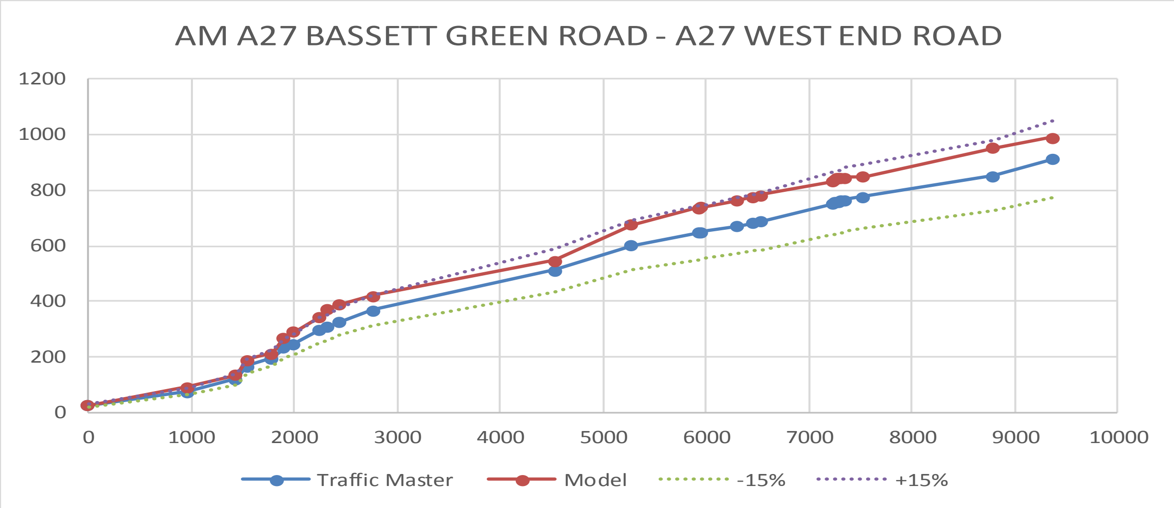


Figure 12. 6SB A27 BASSETT GREEN ROAD - A27 WEST END ROAD



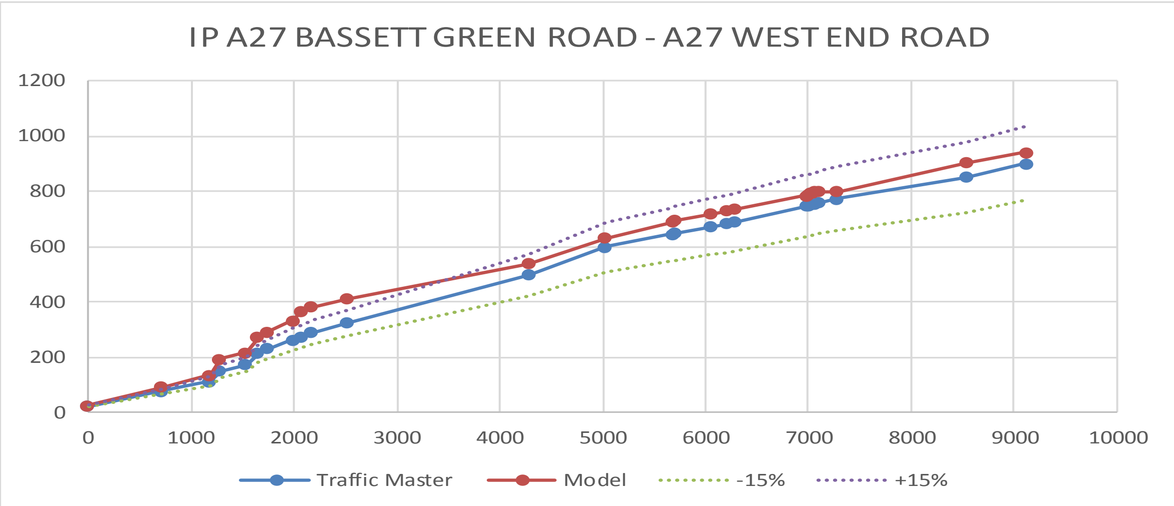
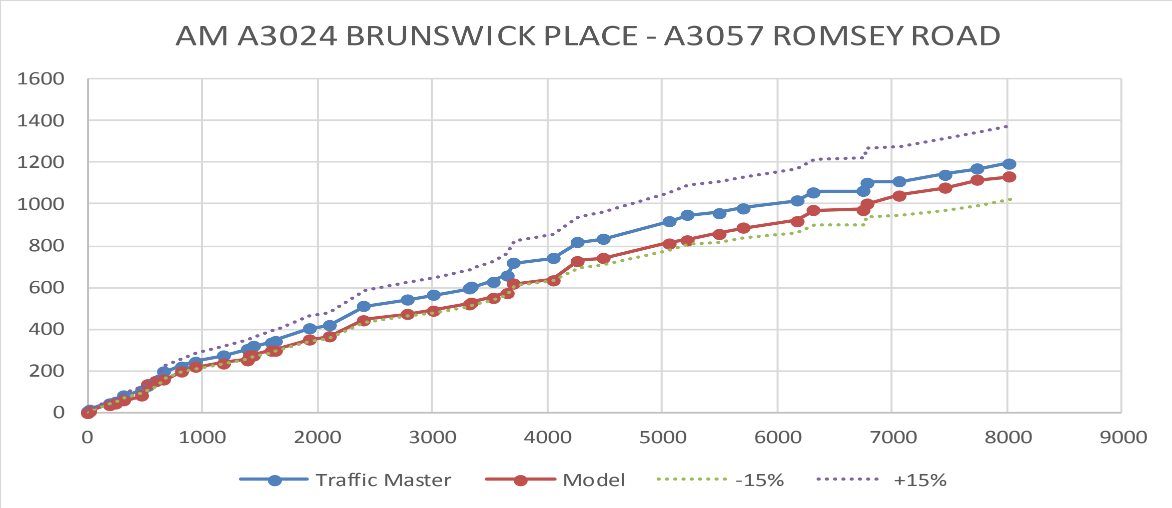
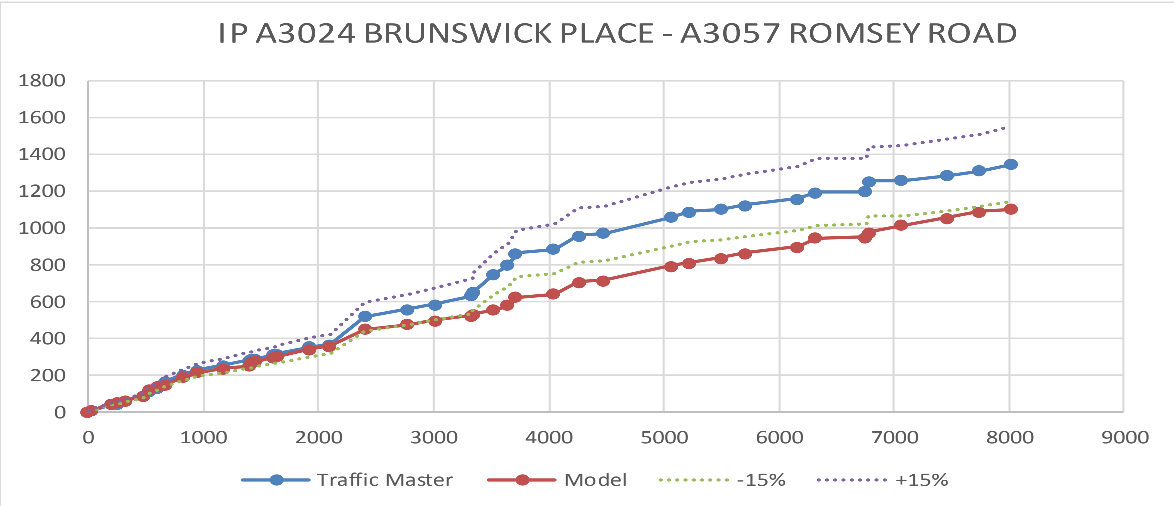


Figure 13. 7NB A3024 BRUNSWICK PLACE - A3057 ROMSEY ROAD





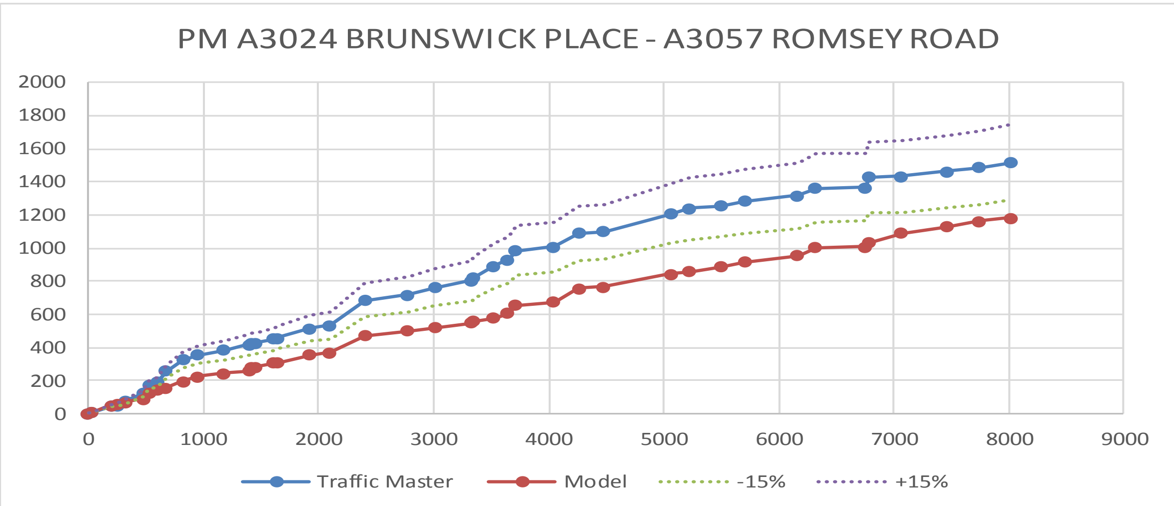
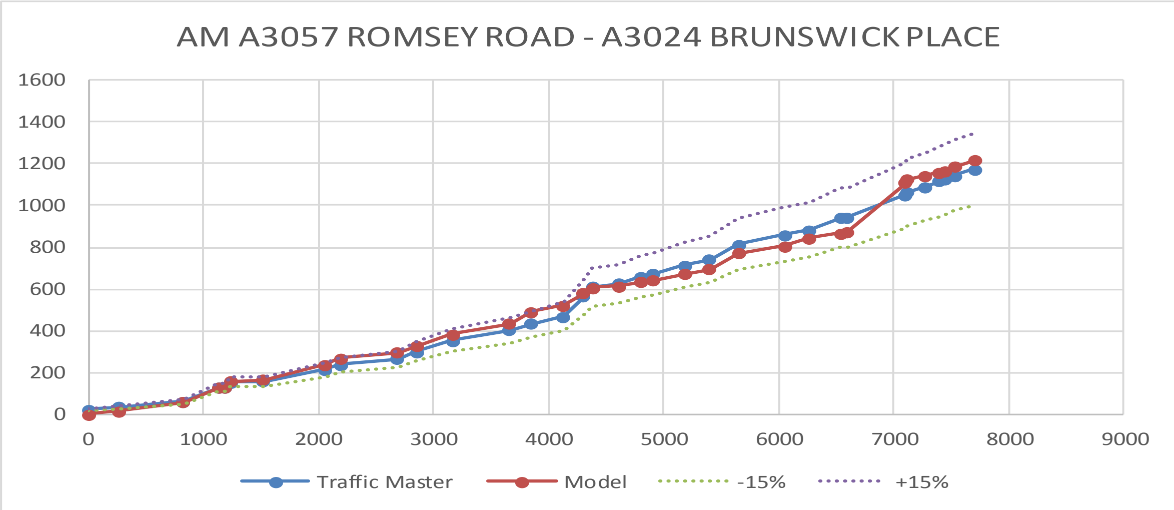
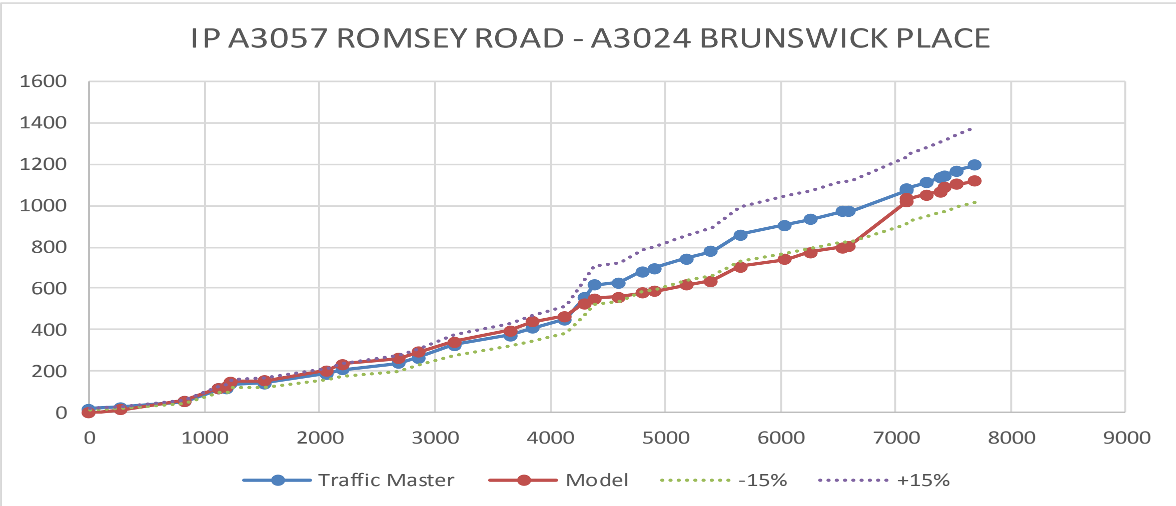


Figure 14. 7SB A3057 ROMSEY ROAD - A3024 BRUNSWICK PLACE





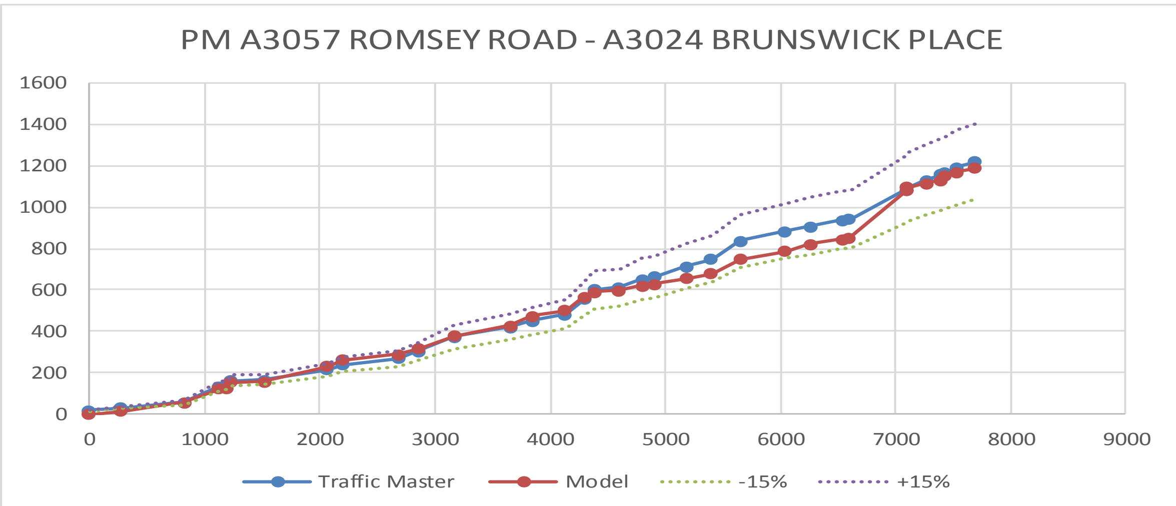
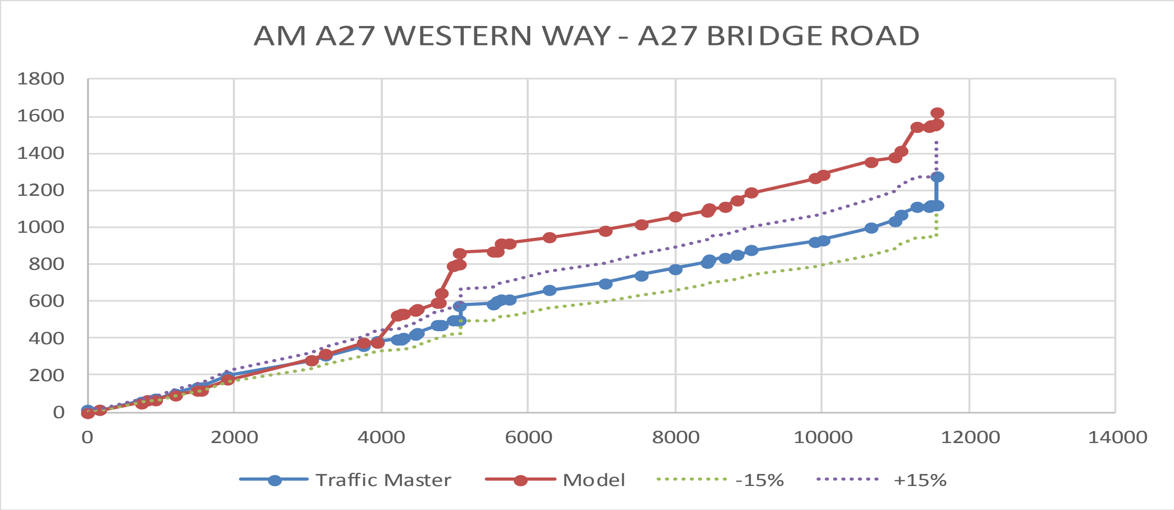
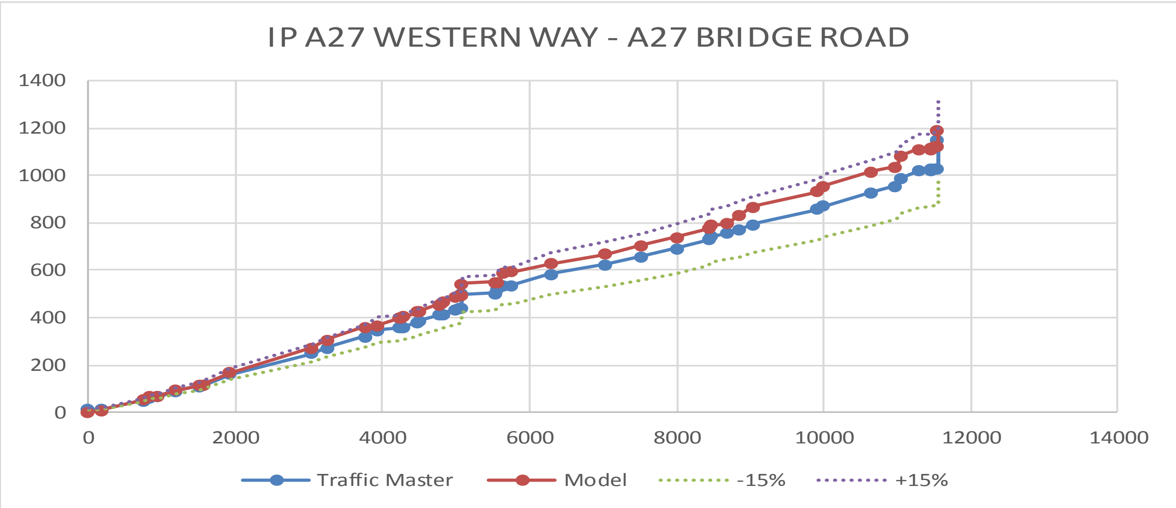


Figure 15. 8NB A27 WESTERN WAY - A27 BRIDGE ROAD





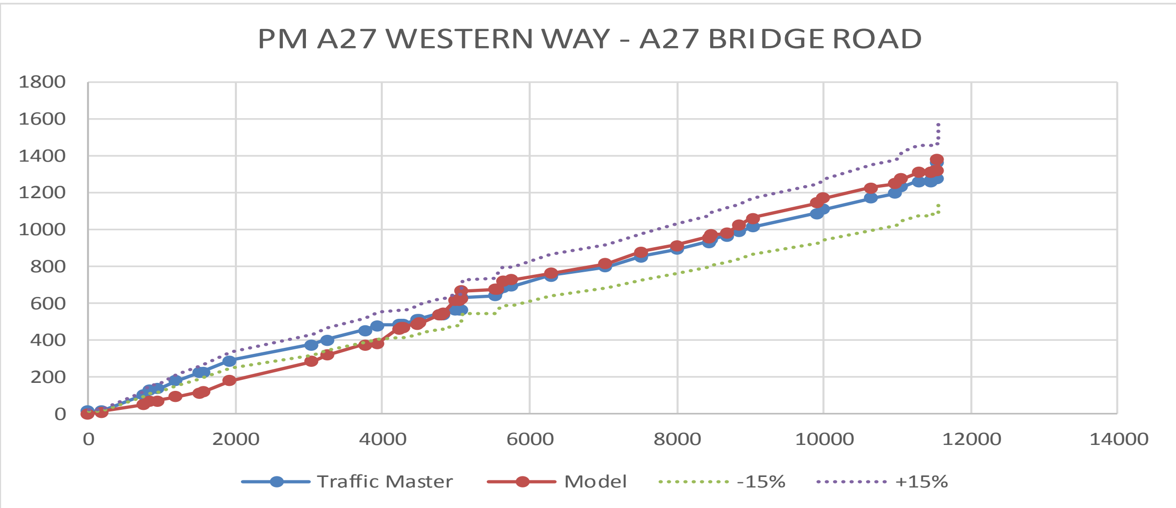
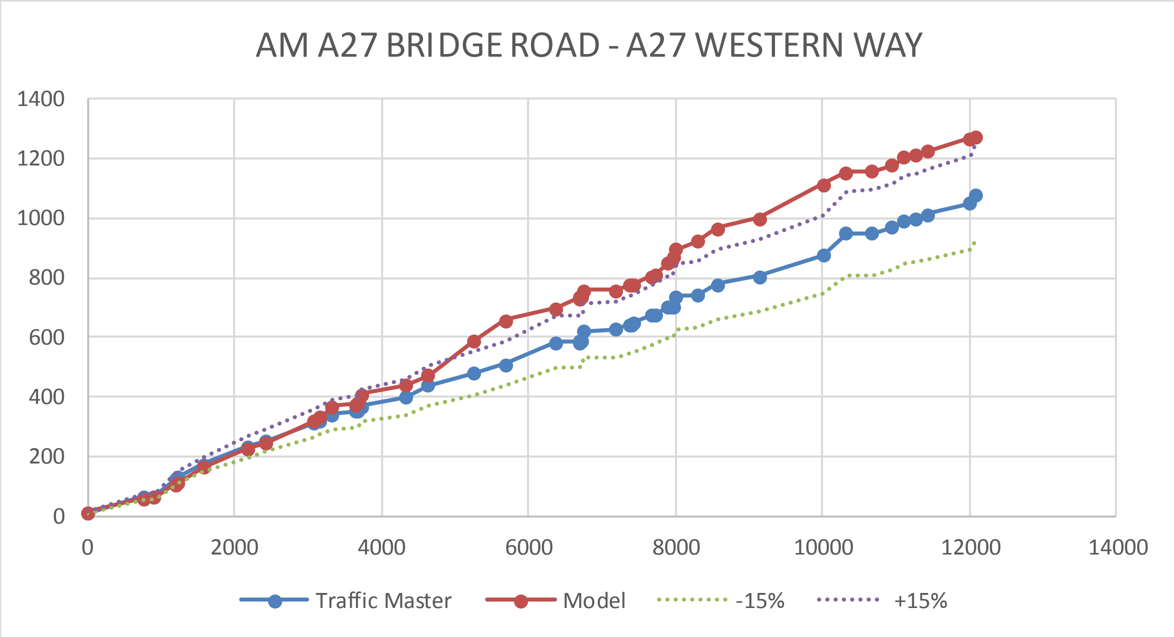
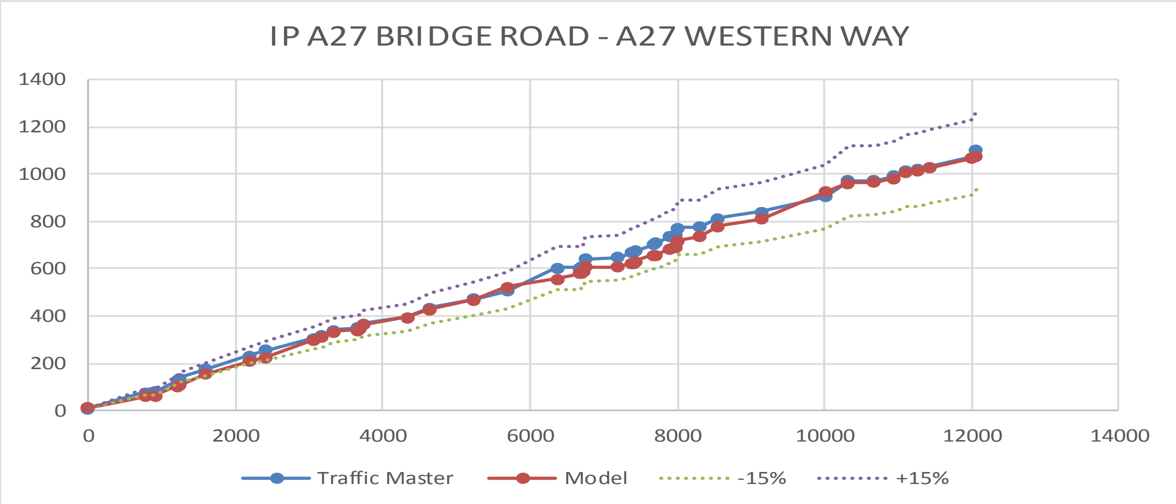


Figure 16. 8SB A27 BRIDGE ROAD - A27 WESTERN WAY





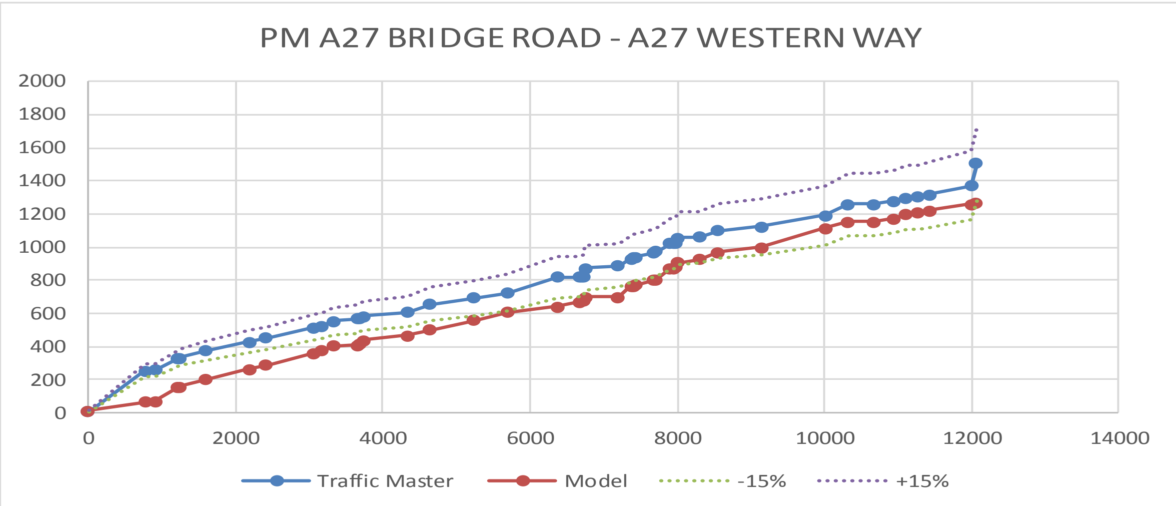
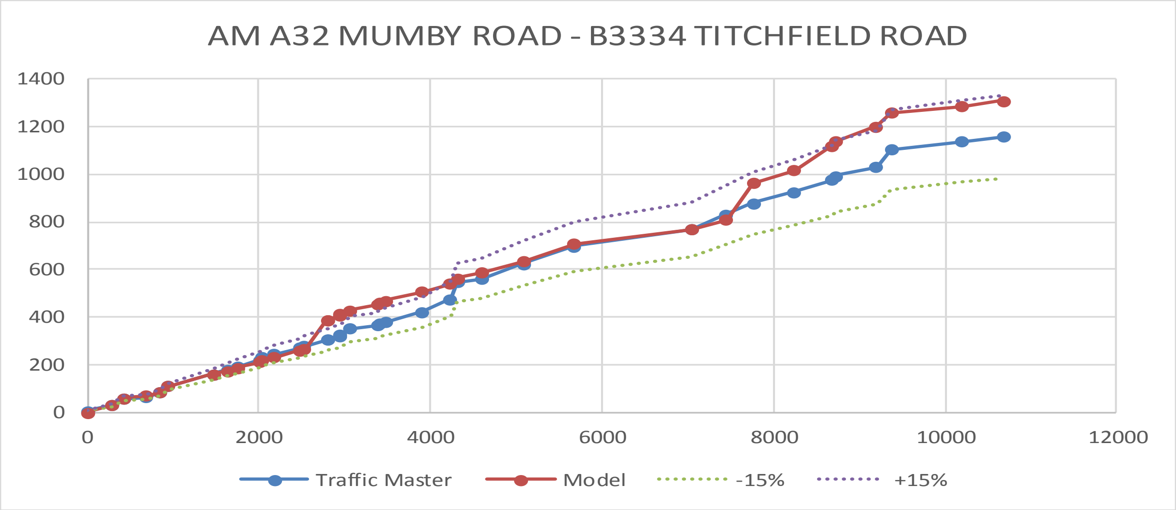
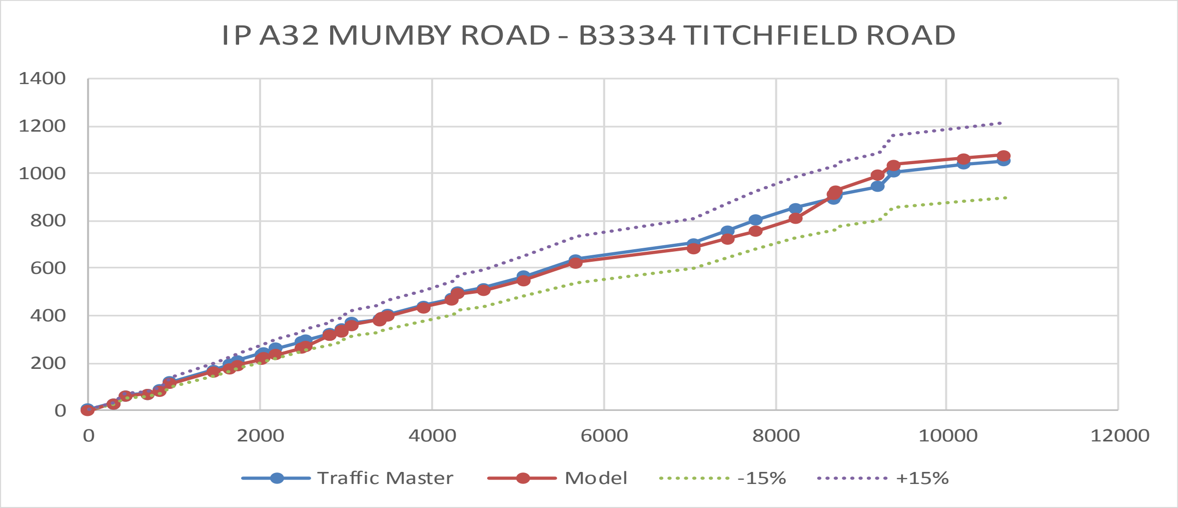


Figure 17. 9NB A32 MUMBY ROAD - B3334 TITCHFIELD ROAD





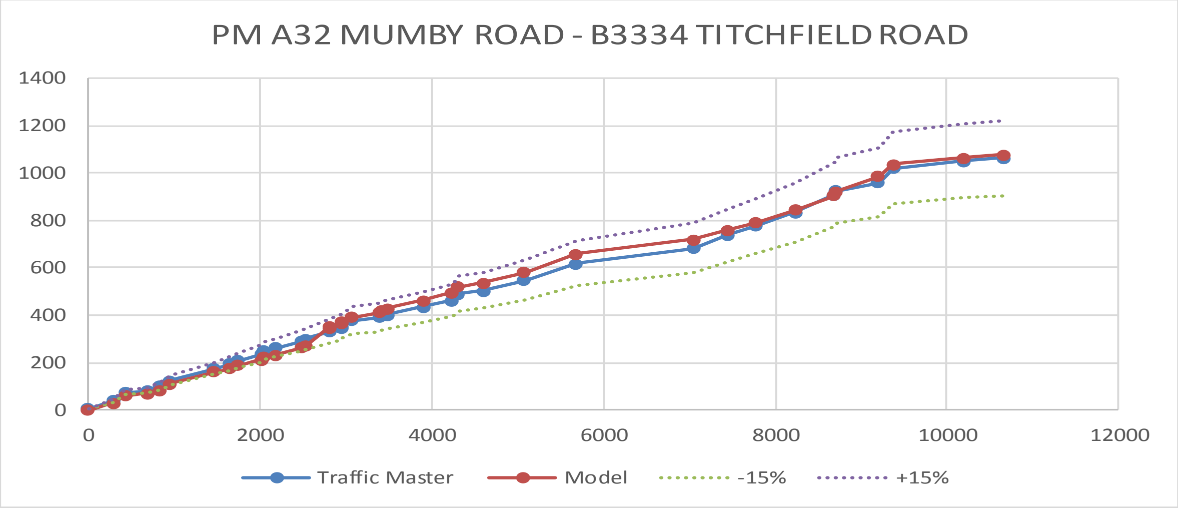
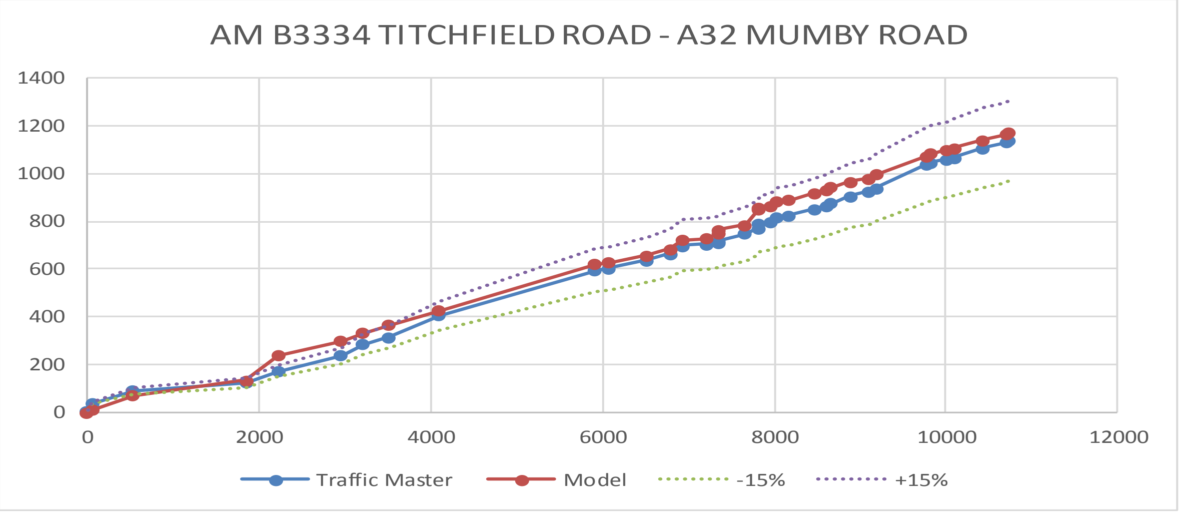
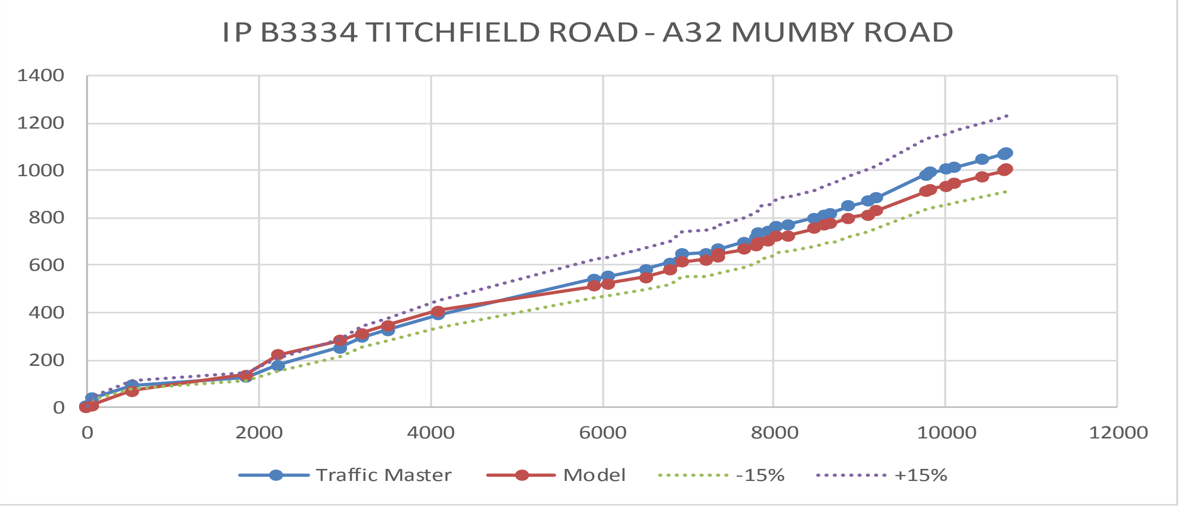


Figure 18. 9SB B3334 TITCHFIELD ROAD - A32 MUMBY ROAD





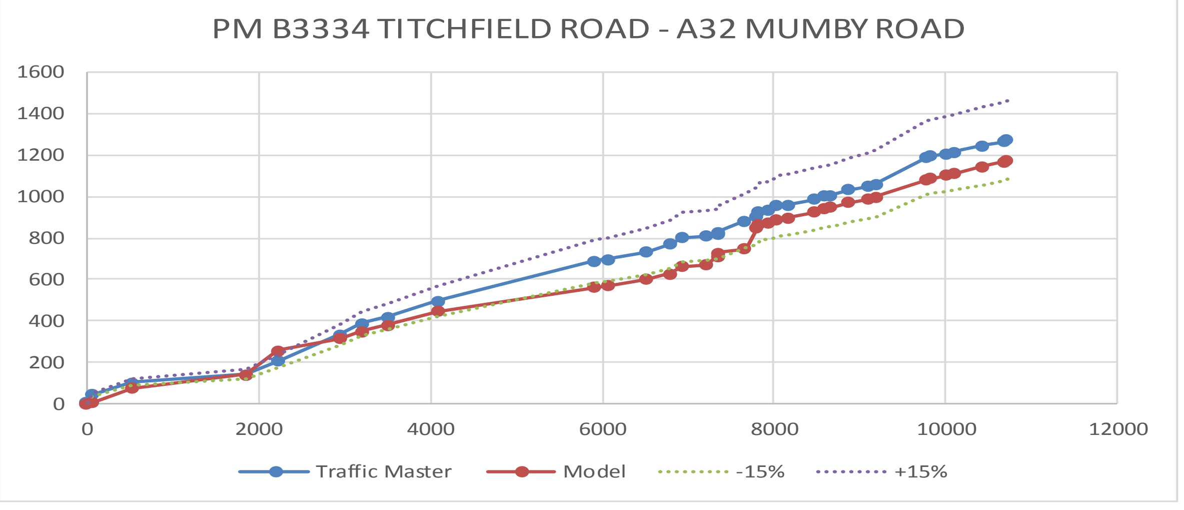
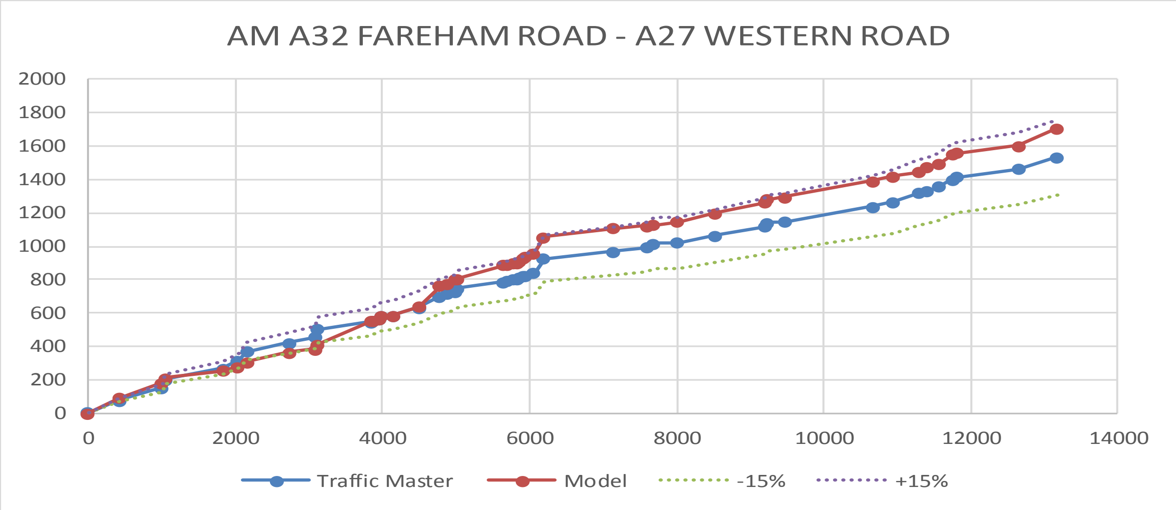
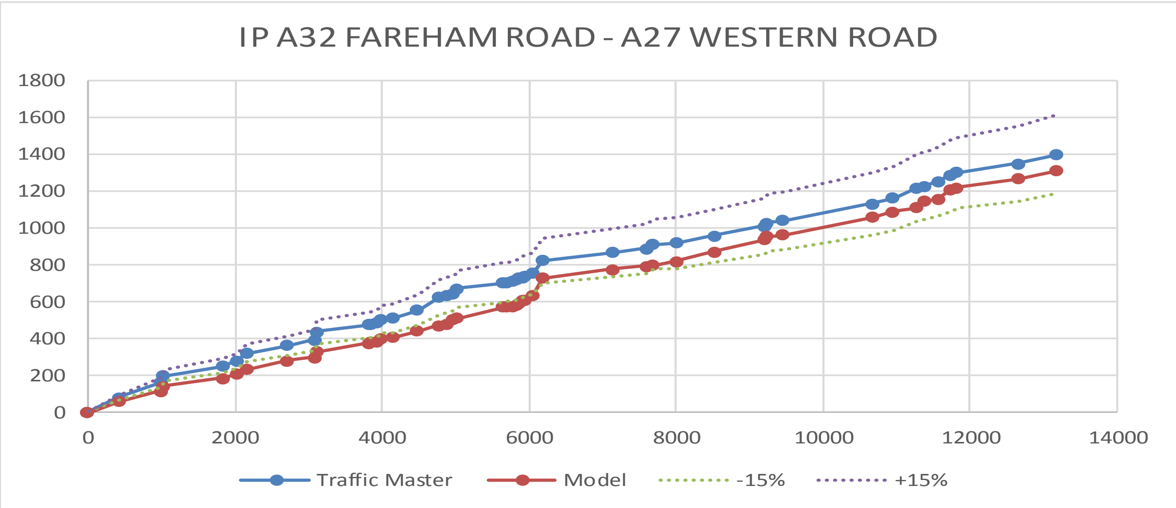


Figure 19. 10NB A32 FAREHAM ROAD - A27 WESTERN ROAD





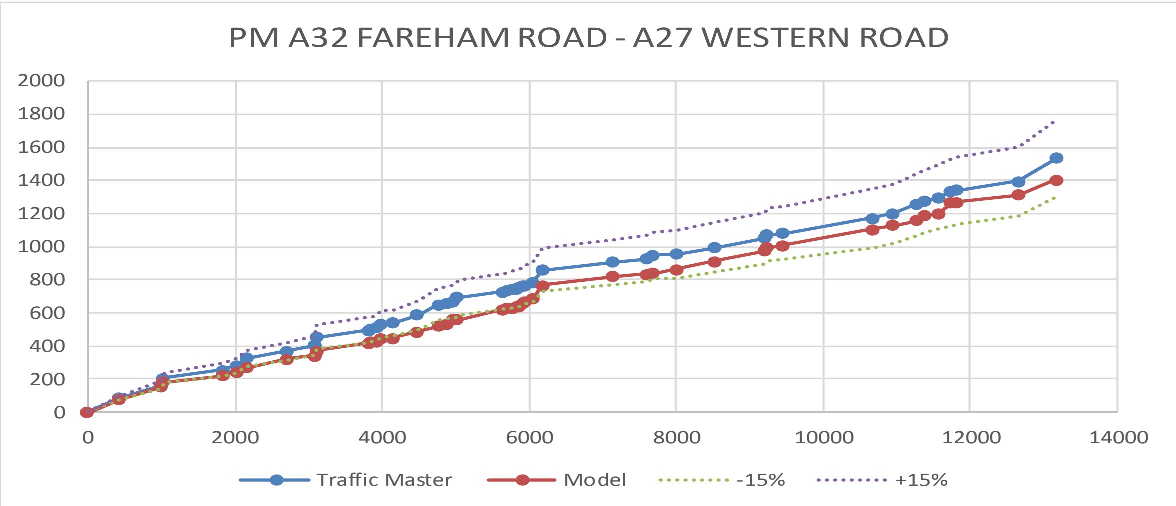
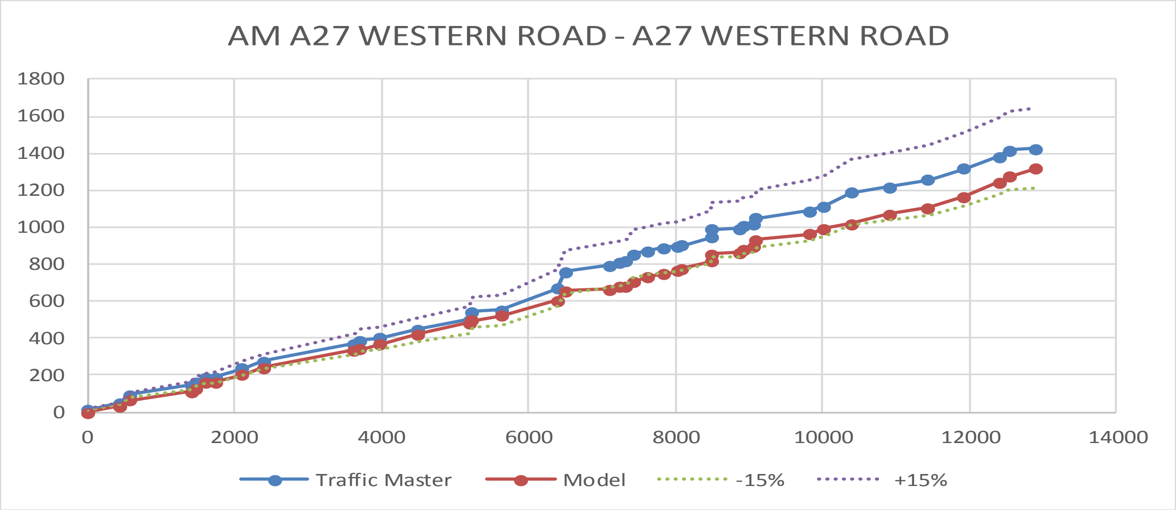
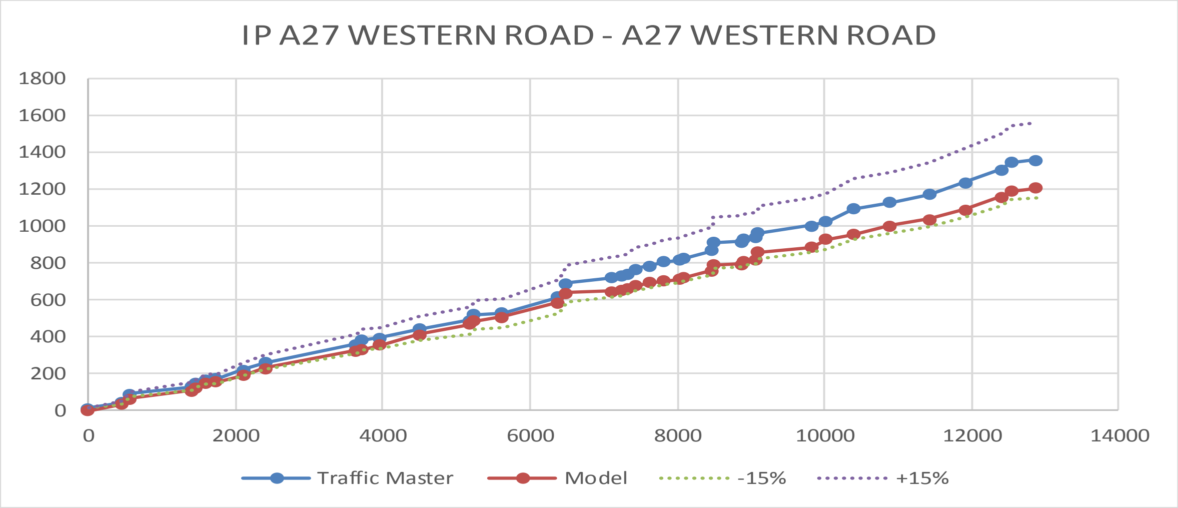


Figure 20. 10SB A27 WESTERN ROAD- A27 WESTERN ROAD





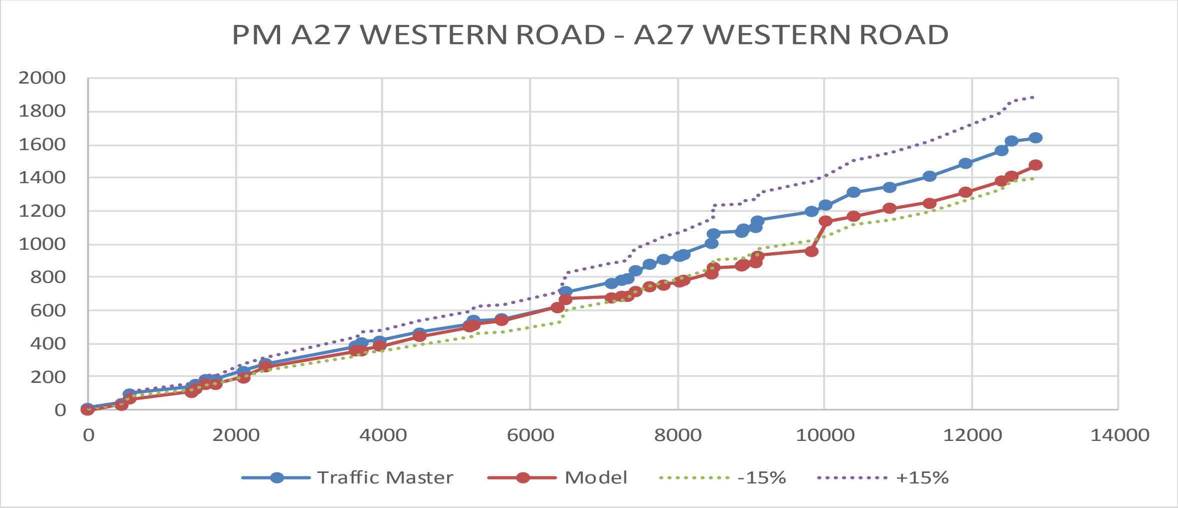
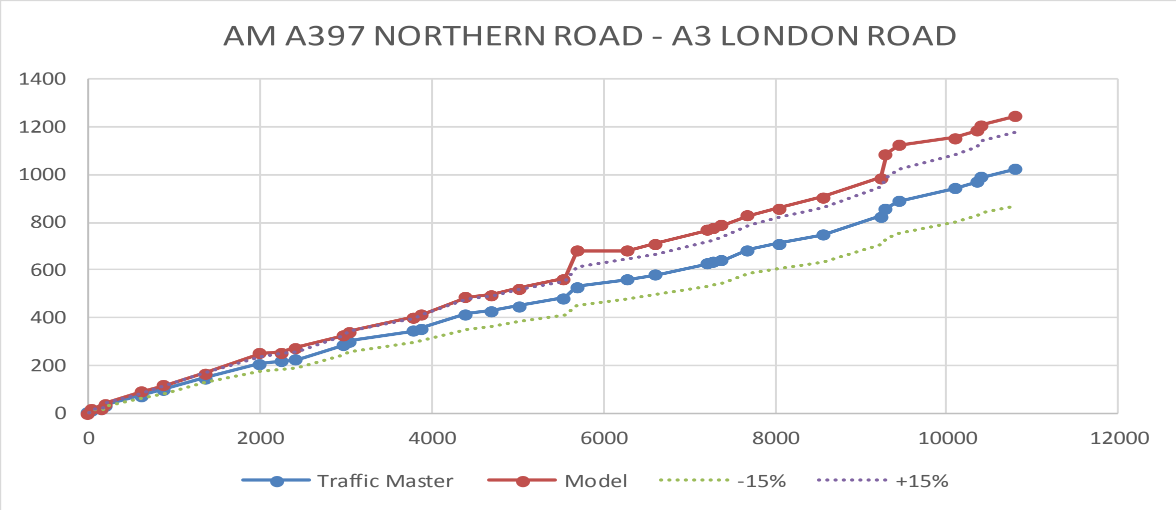
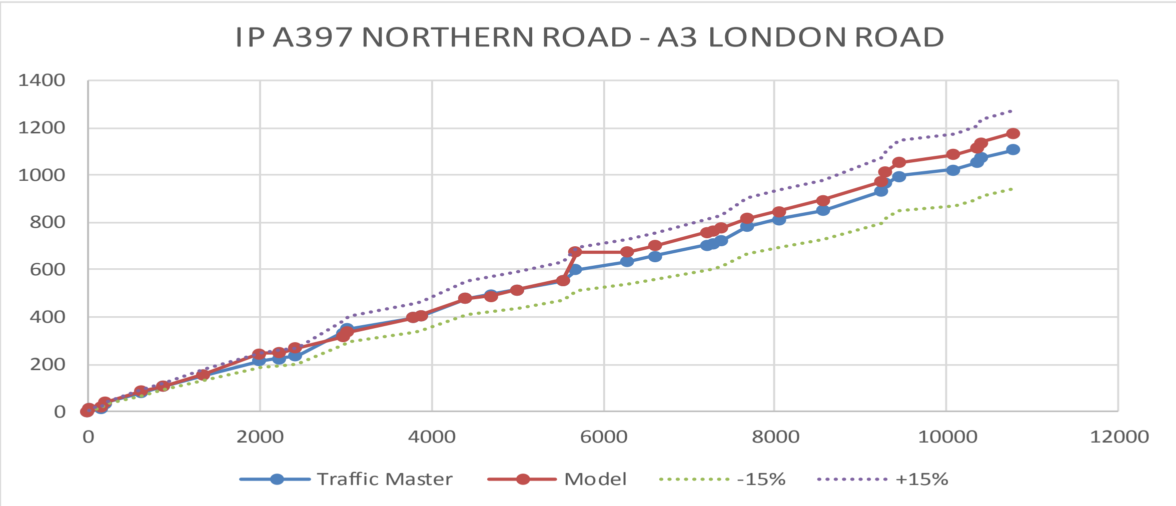


Figure 21. 11NB A397 NORTHERN ROAD- A3 LONDON ROAD





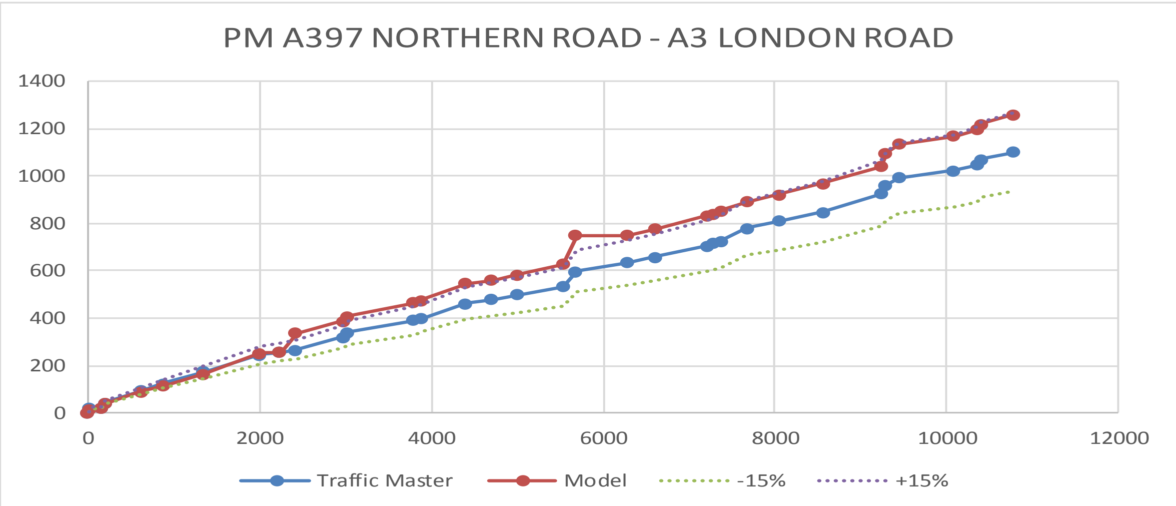
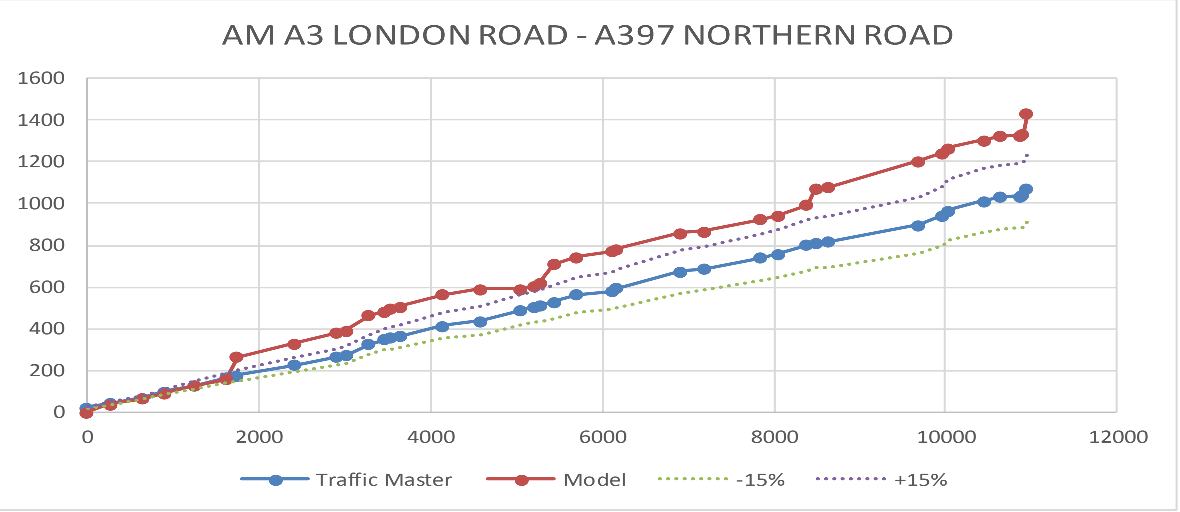
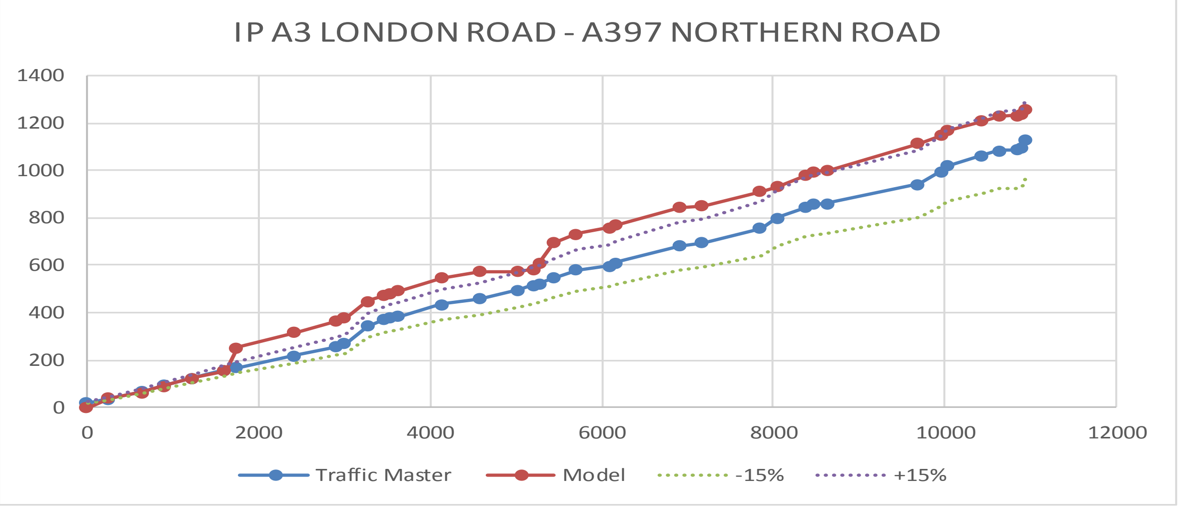


Figure 22. 11SB A3 LONDON ROAD- A397 NORTHERN ROAD





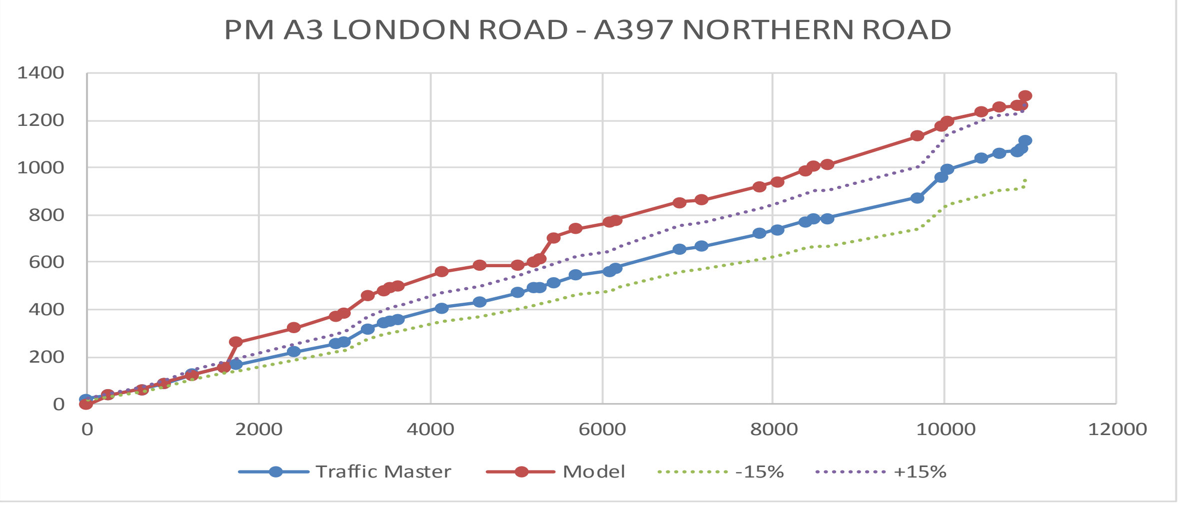
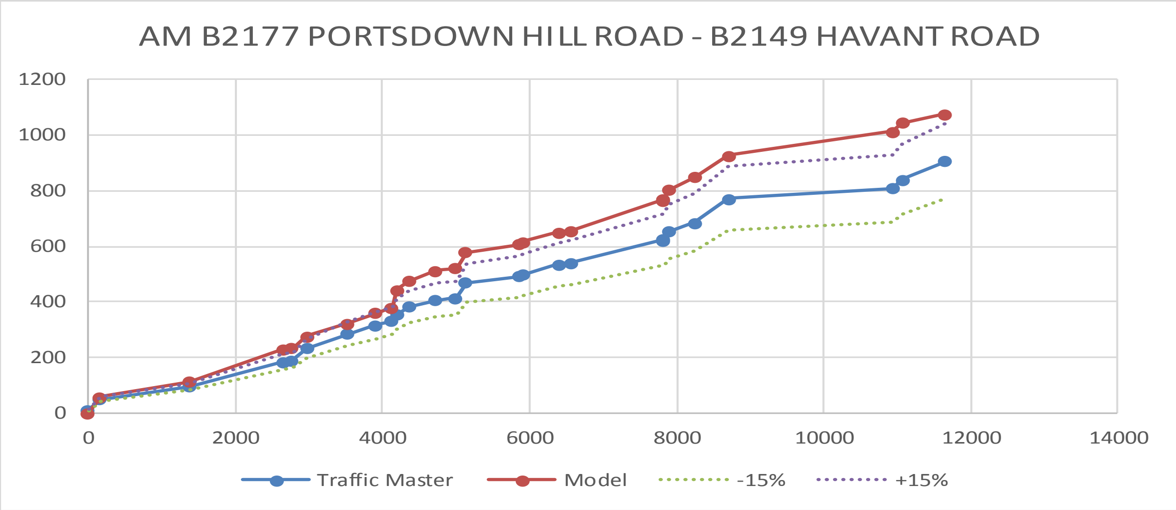
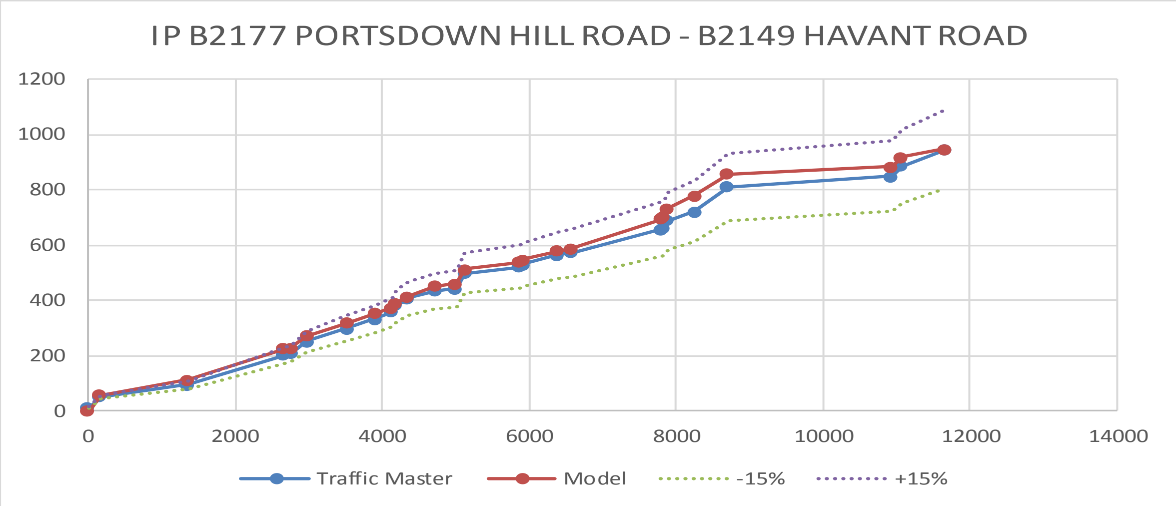


Figure 23. 12NB B2177 PORTSDOWN HILL ROAD – B2149 HAVANT ROAD





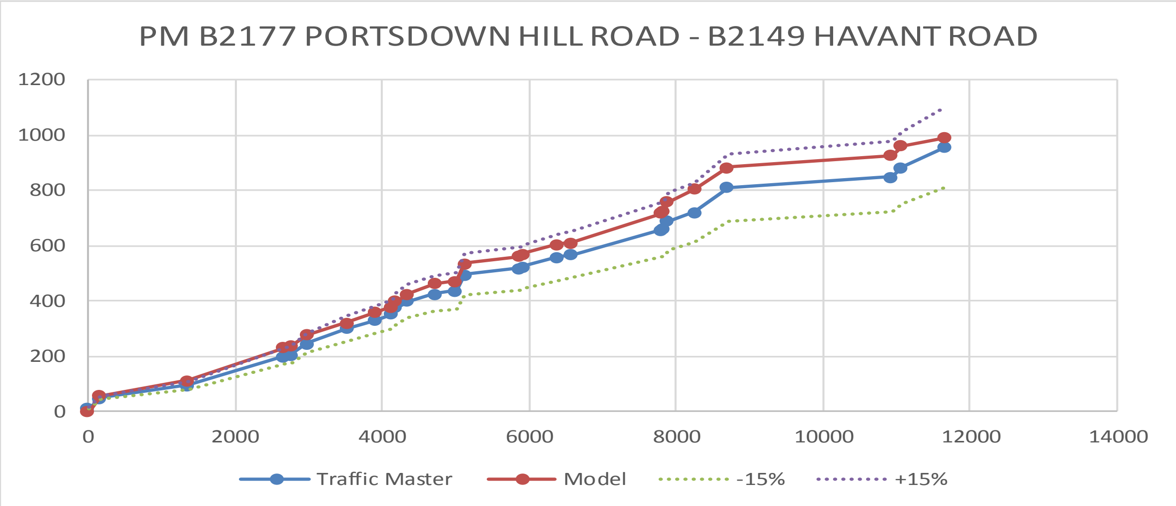
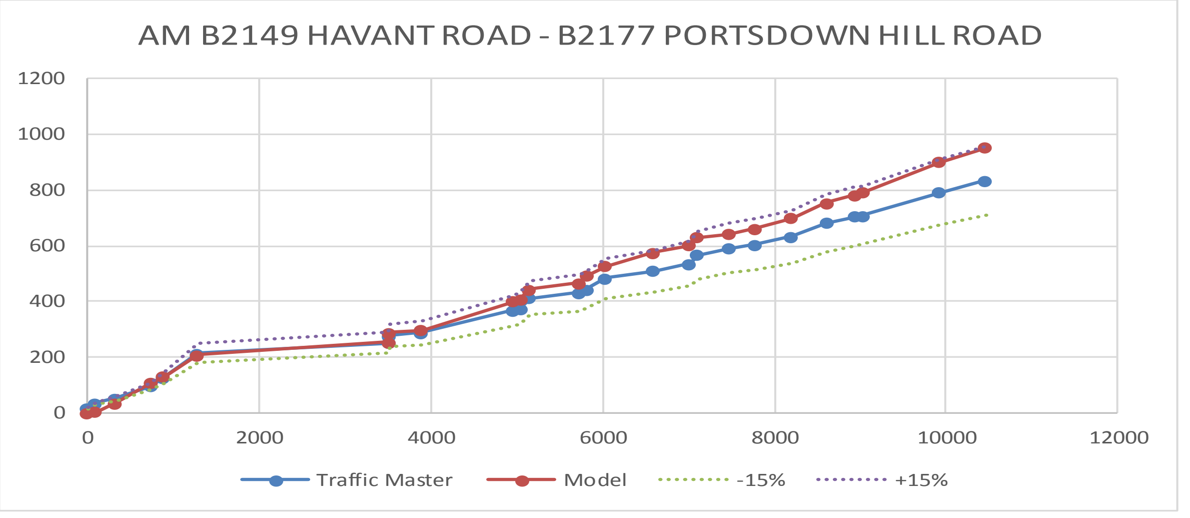
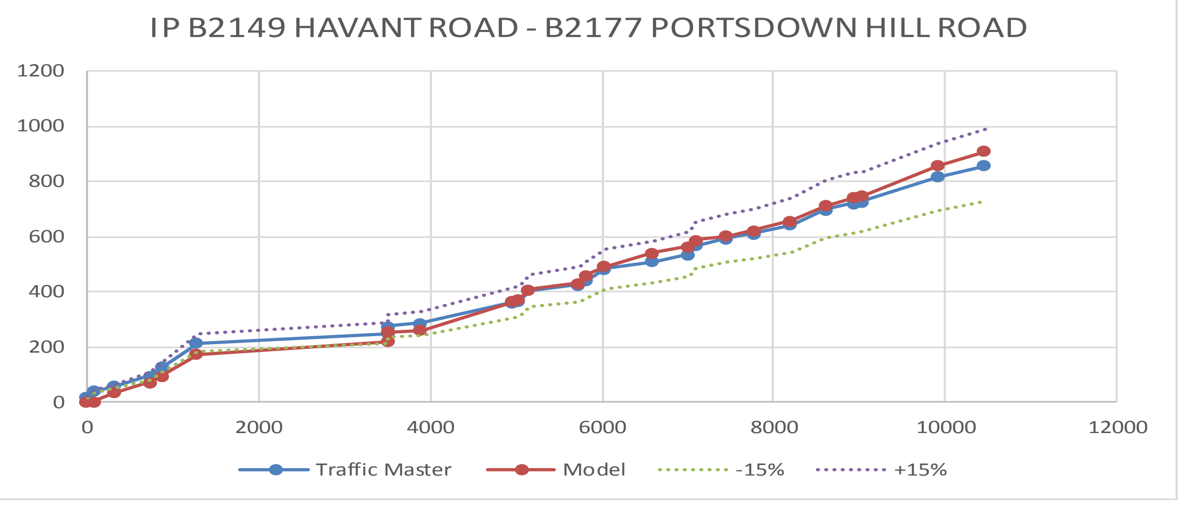


Figure 24. 12SB B2149 HAVANT ROAD – B2177 PORTSDOWN HILL ROAD





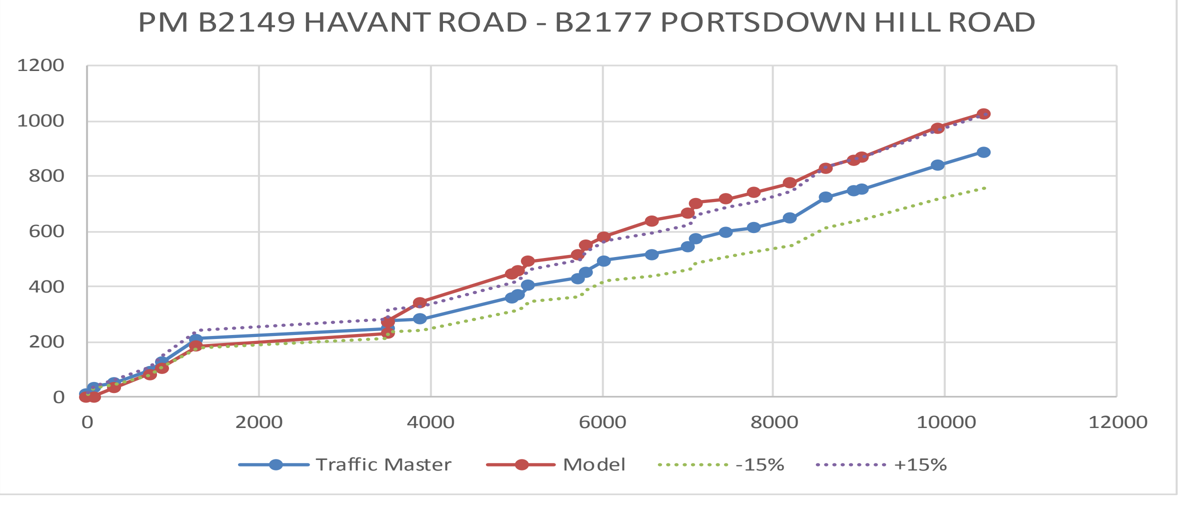
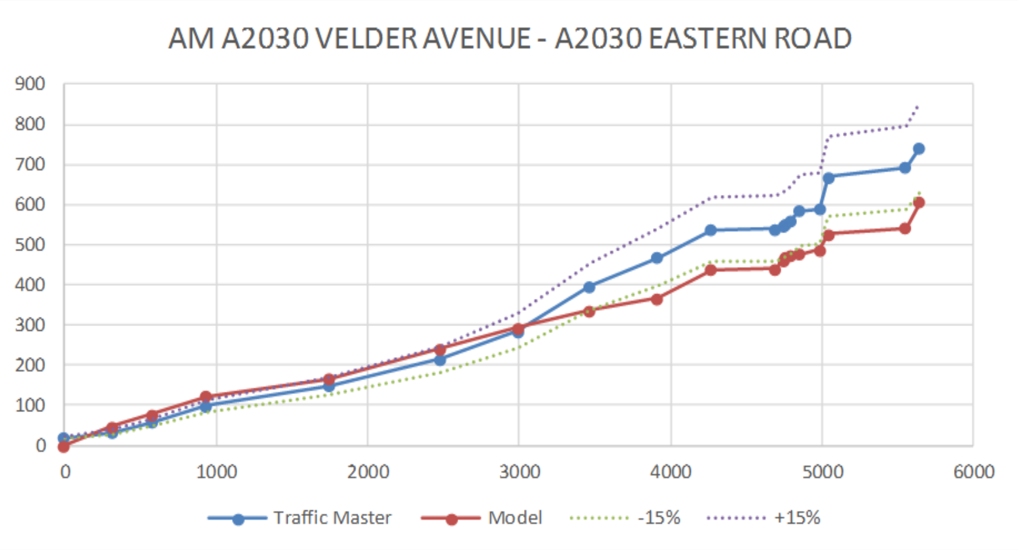
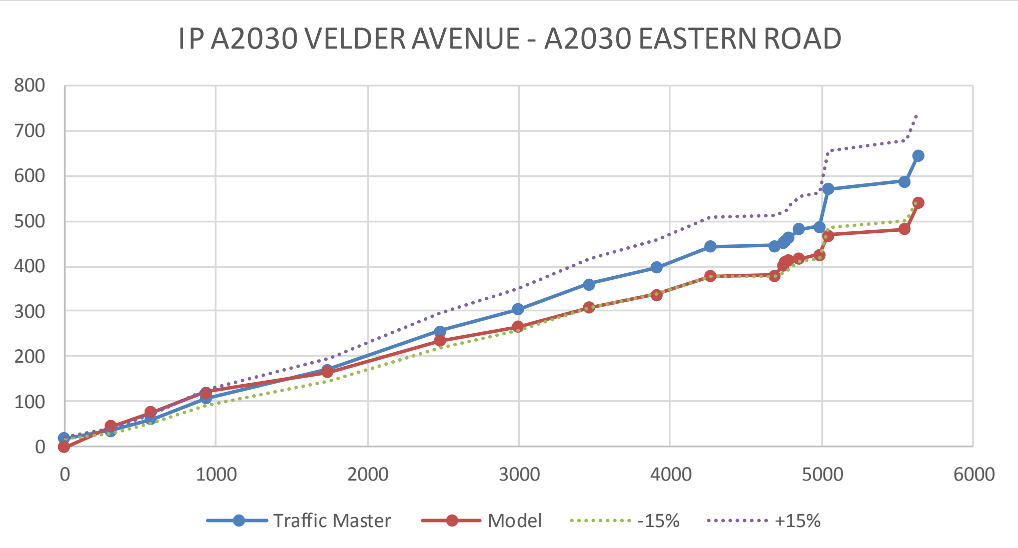


Figure 25. 13NB A2030 VELDER AVENUE- A2030 EASTERN ROAD





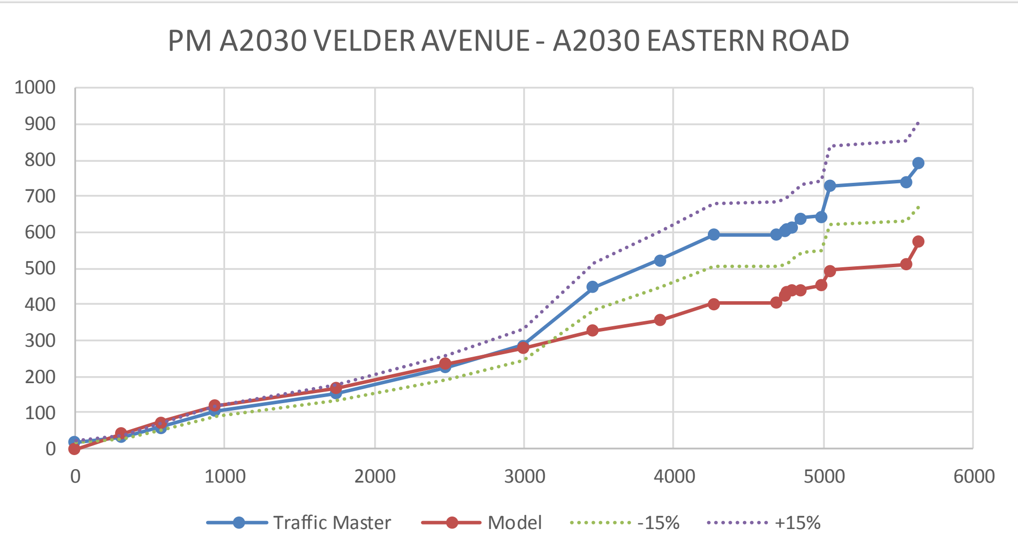
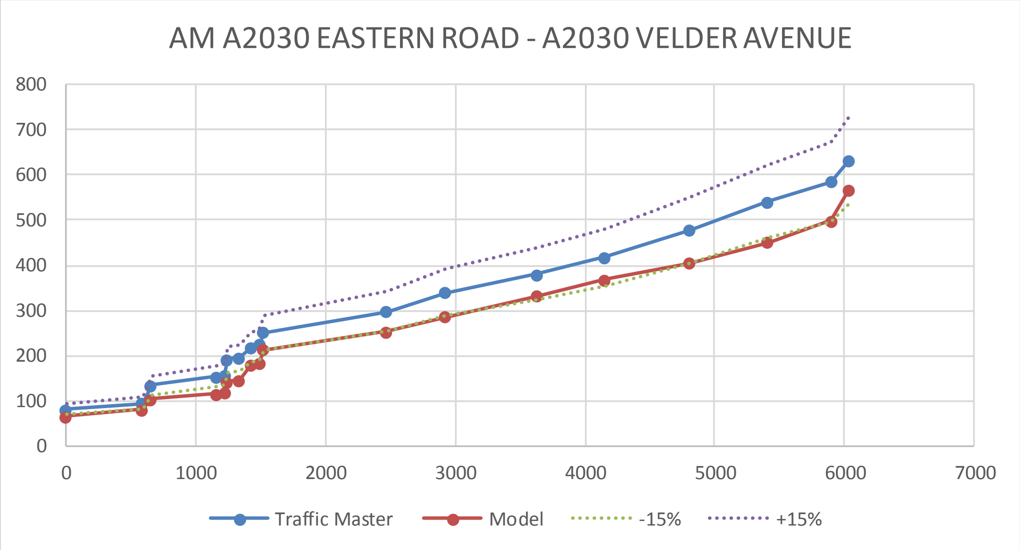
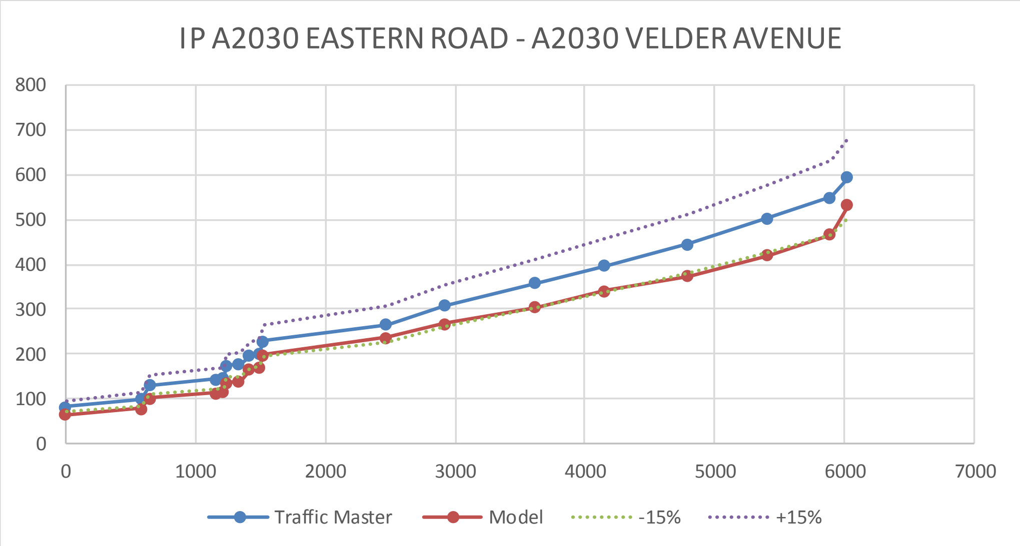


Figure 26. 13SB A2030 EASTERN ROAD – A2030 VELDER AVENUE





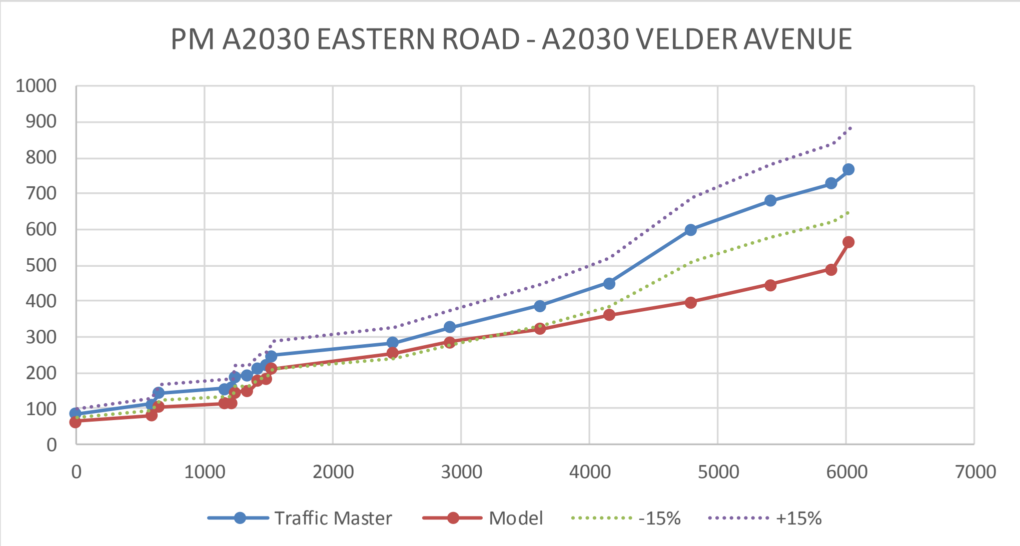
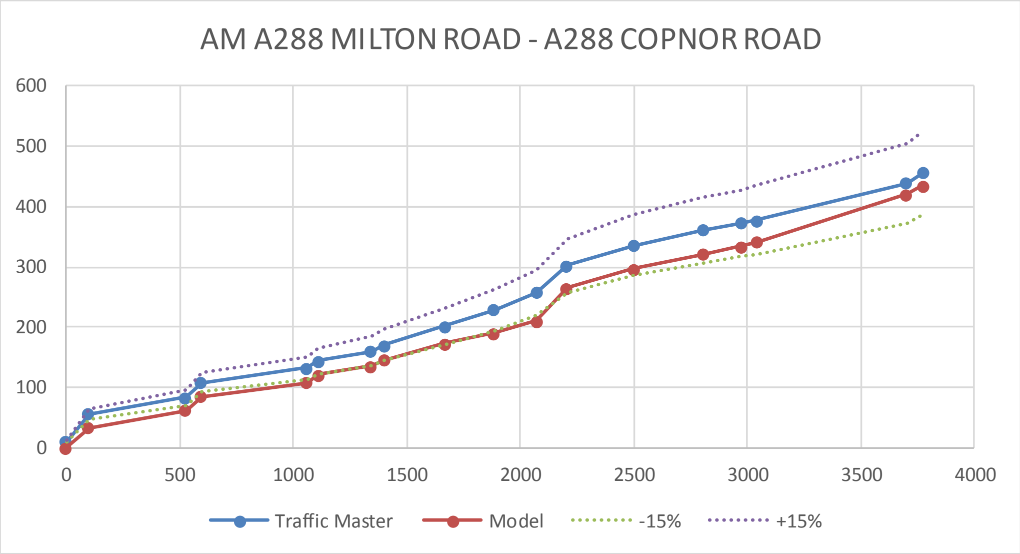
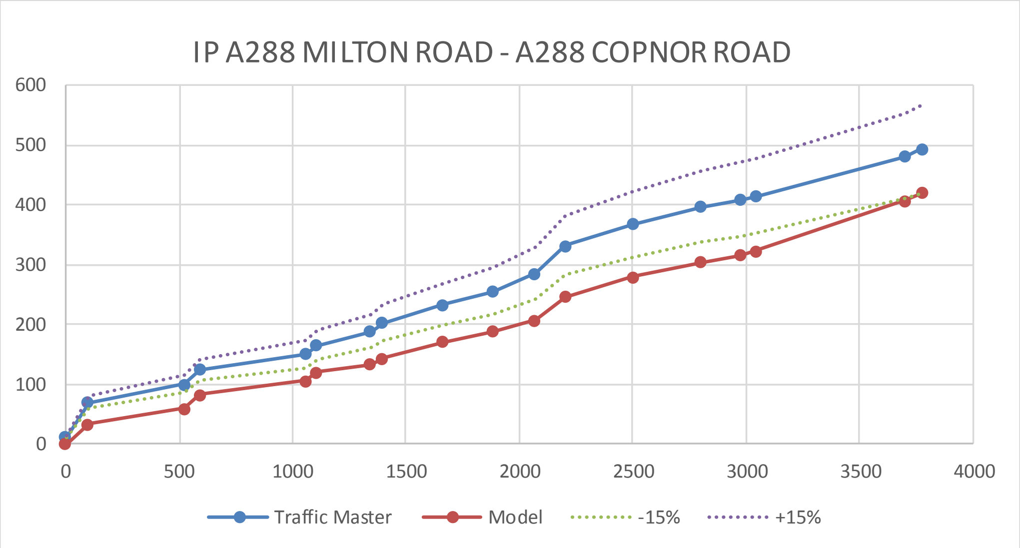


Figure 27. 14NB A288 MILTON ROAD – A288 COPNOR ROAD





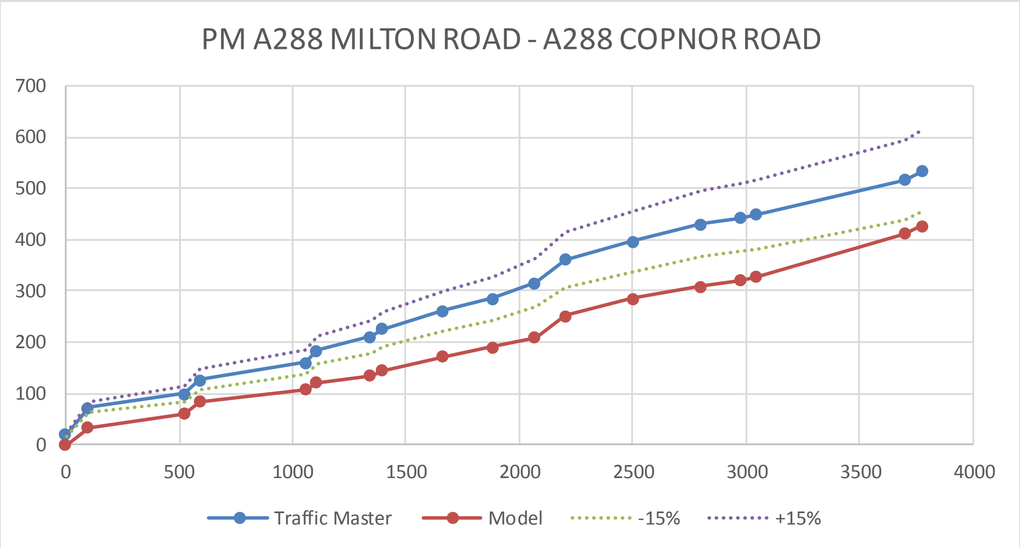
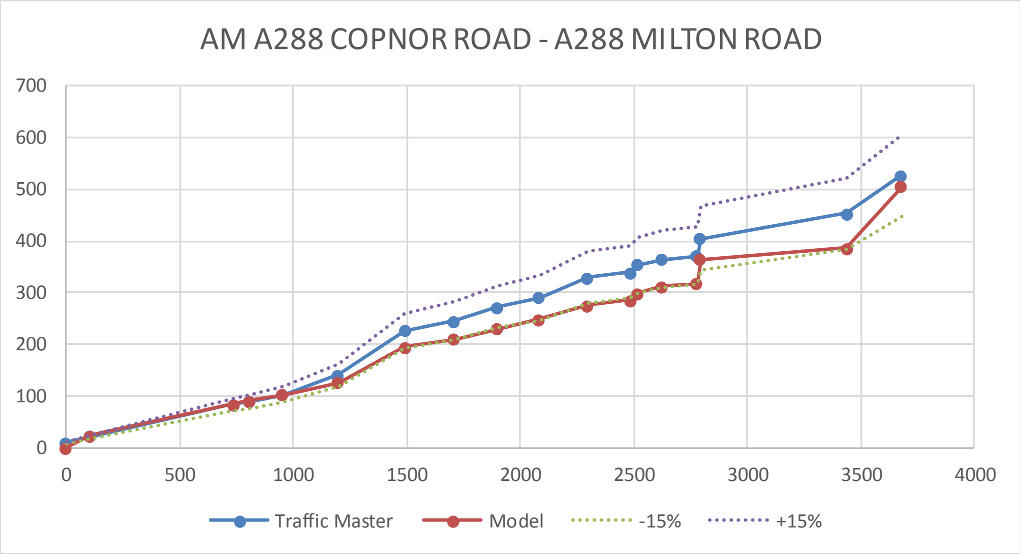
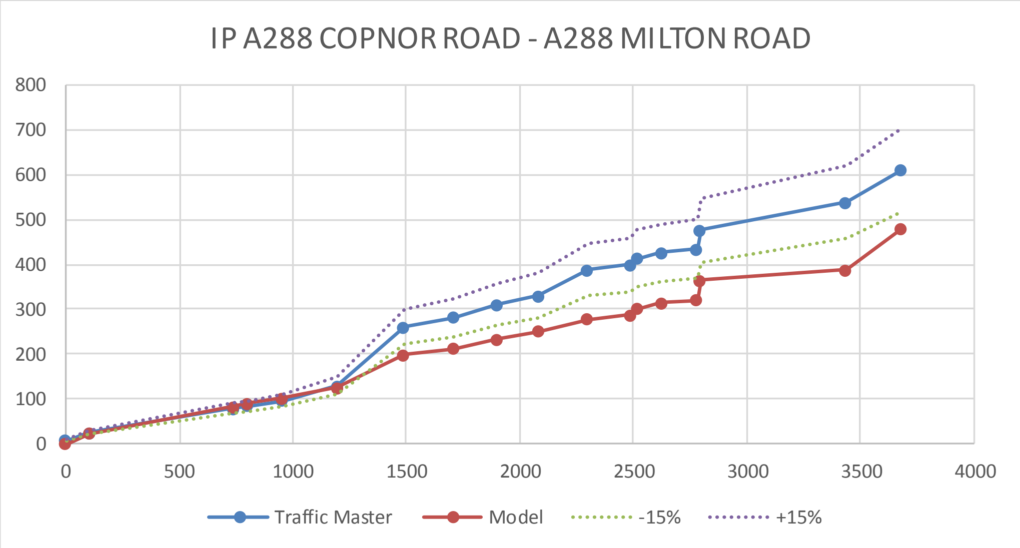


Figure 28. 14SB A288 COPNOR ROAD -A288 MILTON ROAD





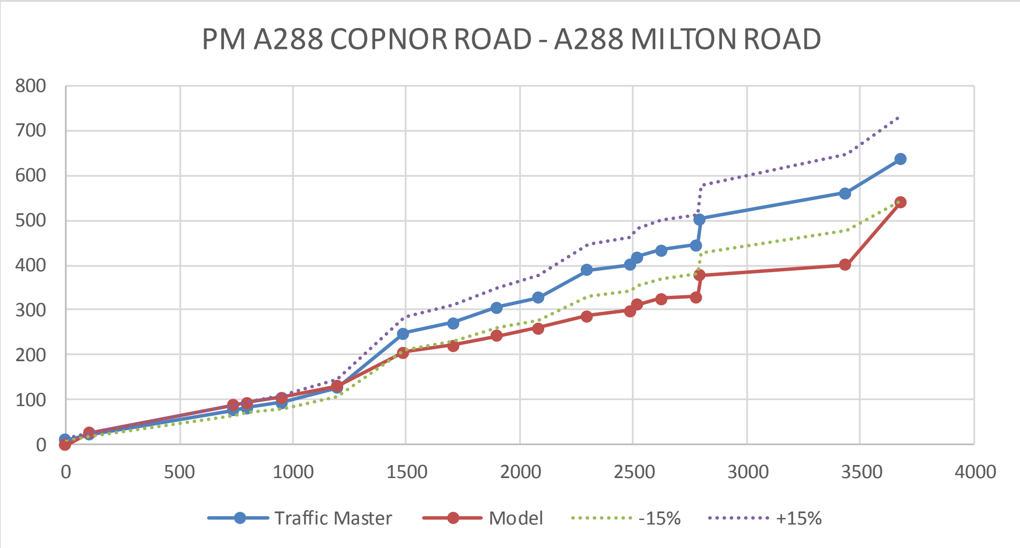
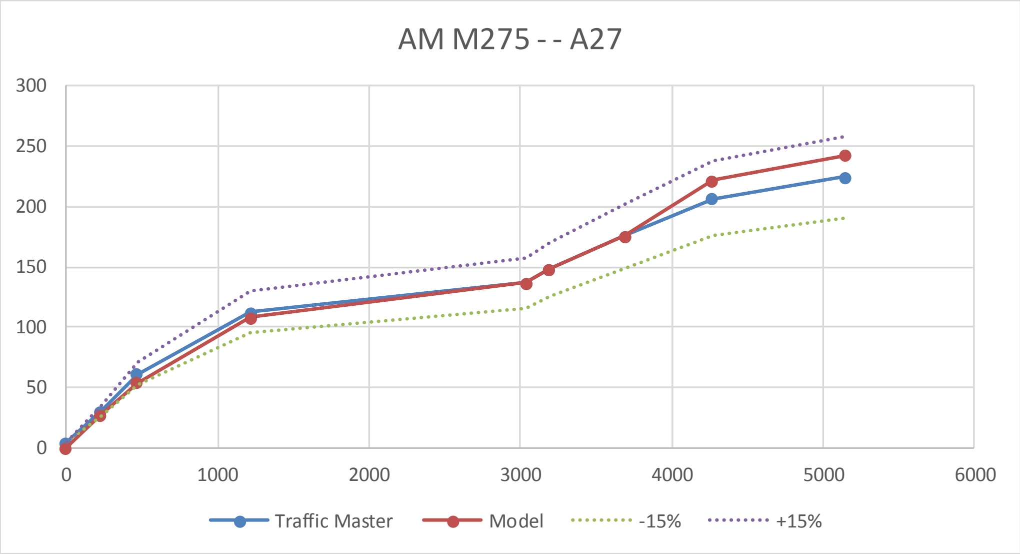
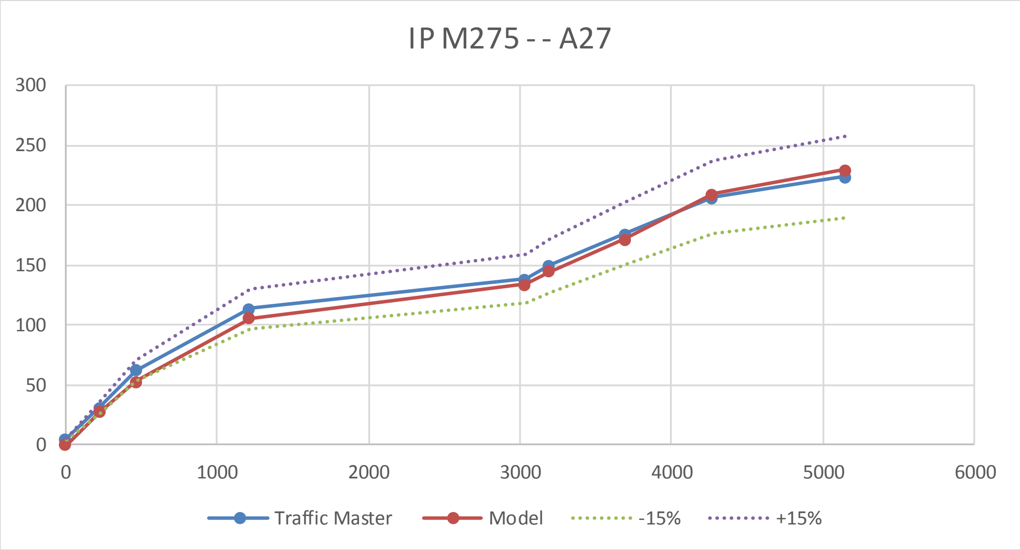


Figure 29. 15NB M275- A27





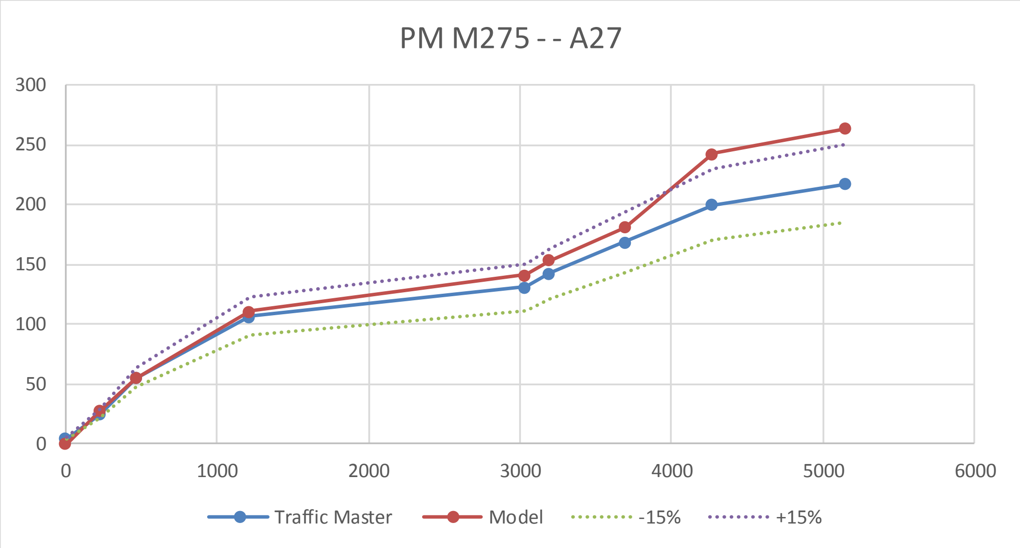
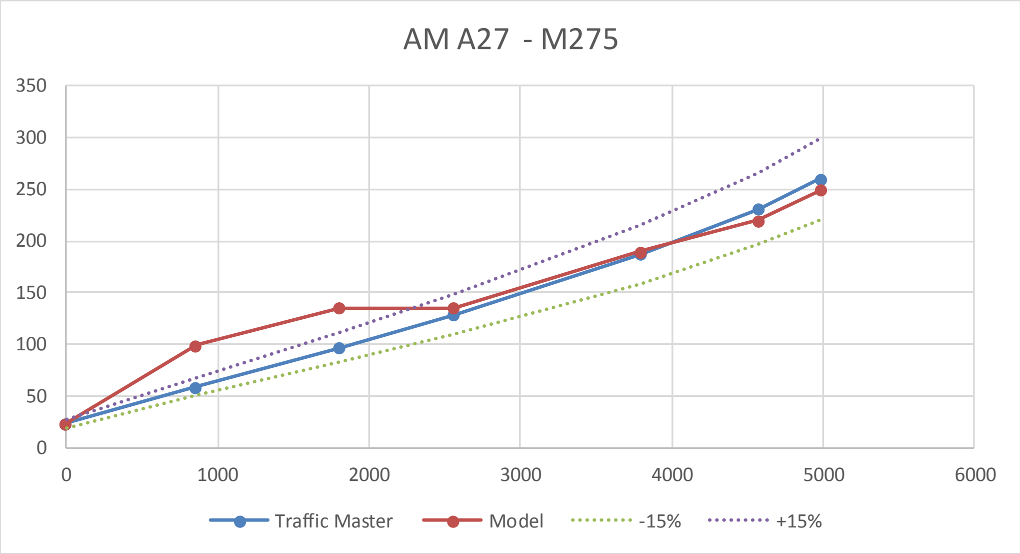
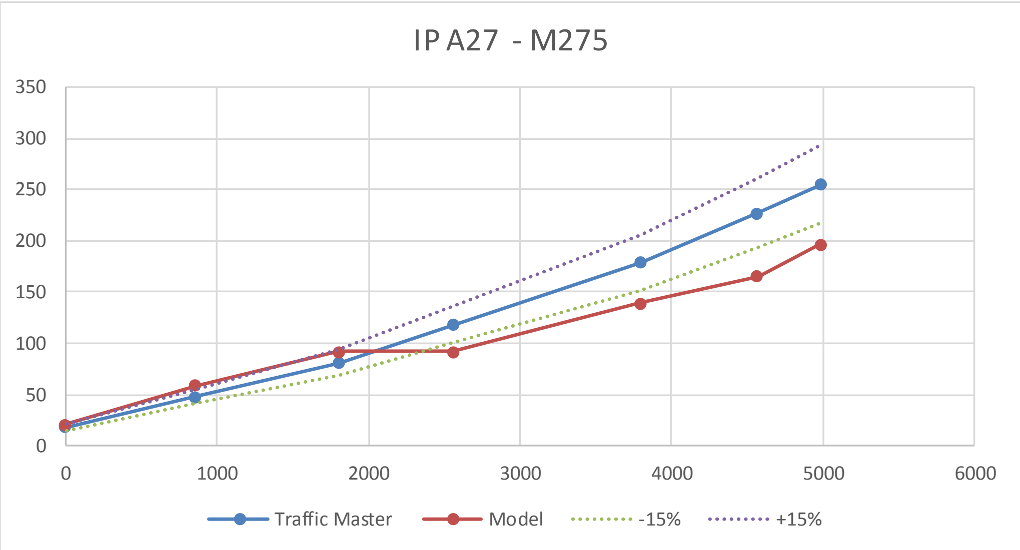


Figure 30. 15SB A27 – M275





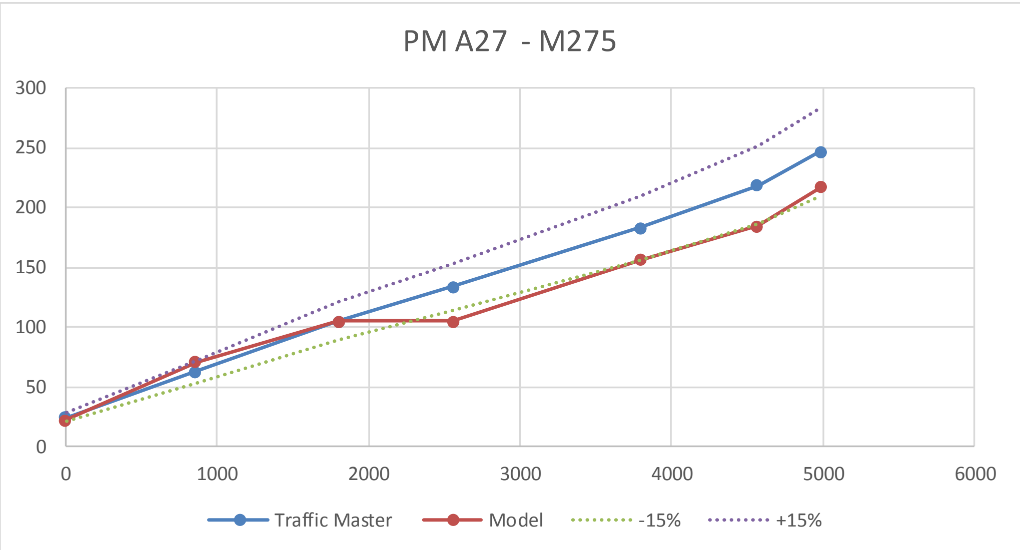
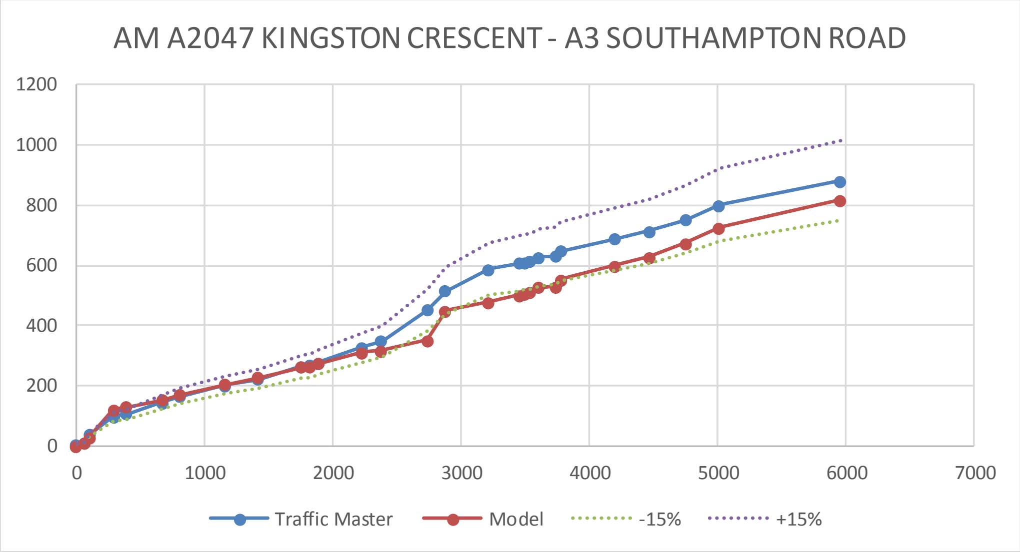
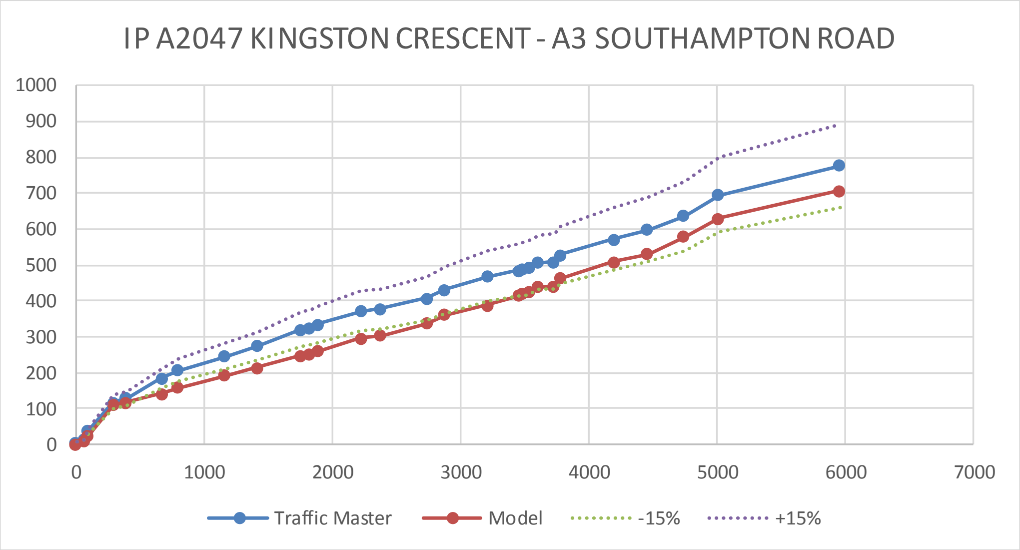


Figure 31. 16NB A2047 KINGSTON CRESCENT – A3 SOUTHAMPTON ROAD





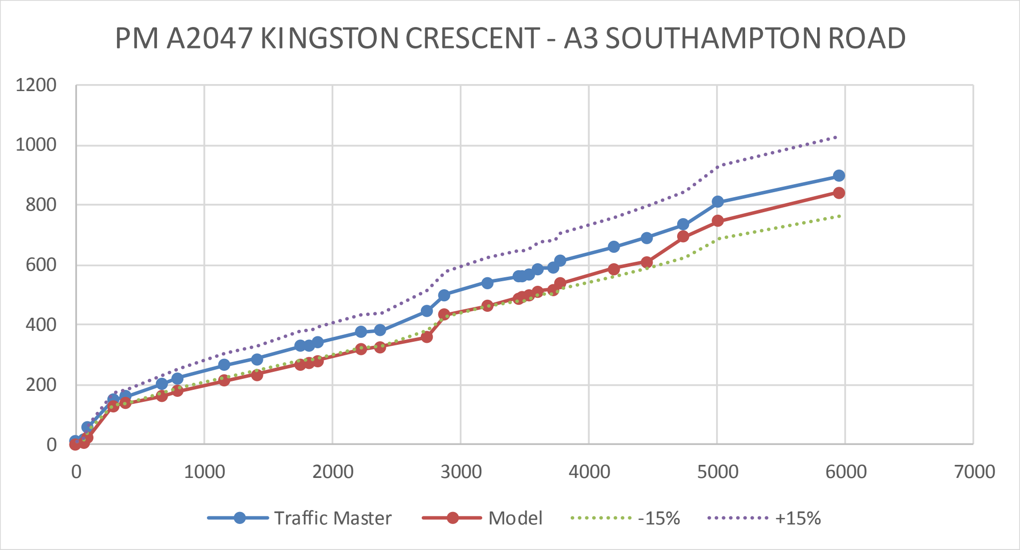
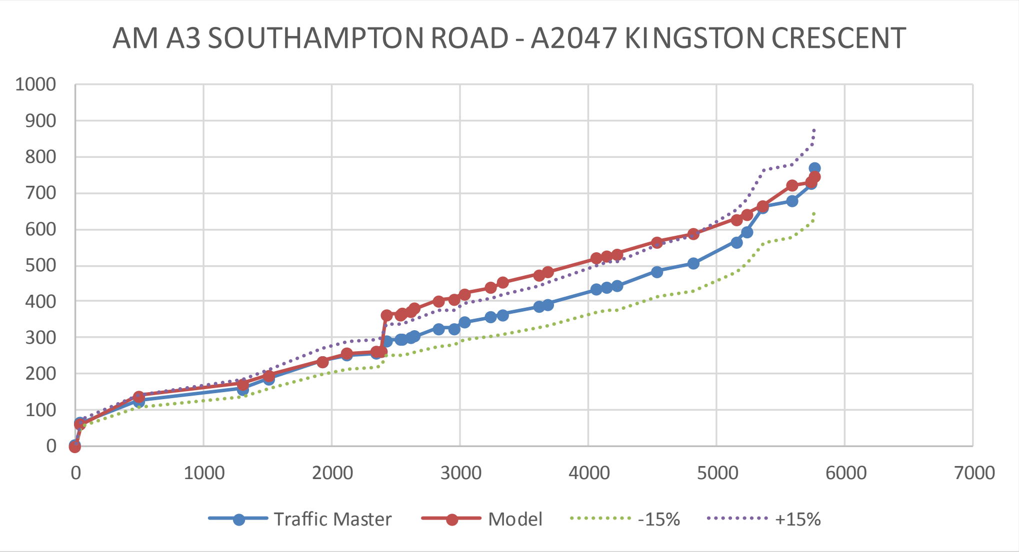
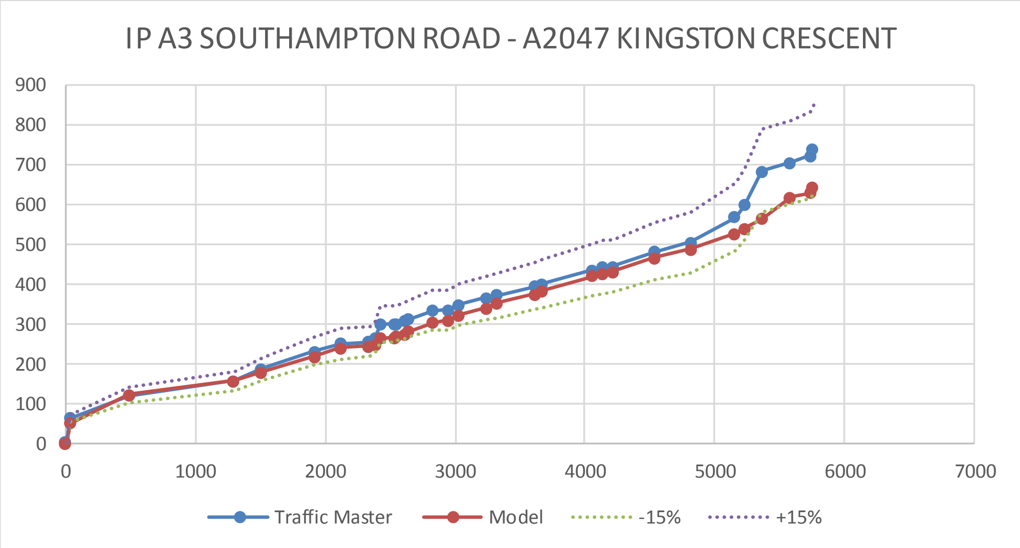


Figure 32. 16SB A3 SOUTHAMPTON ROAD – A2047 KINGSTON CRESCENT





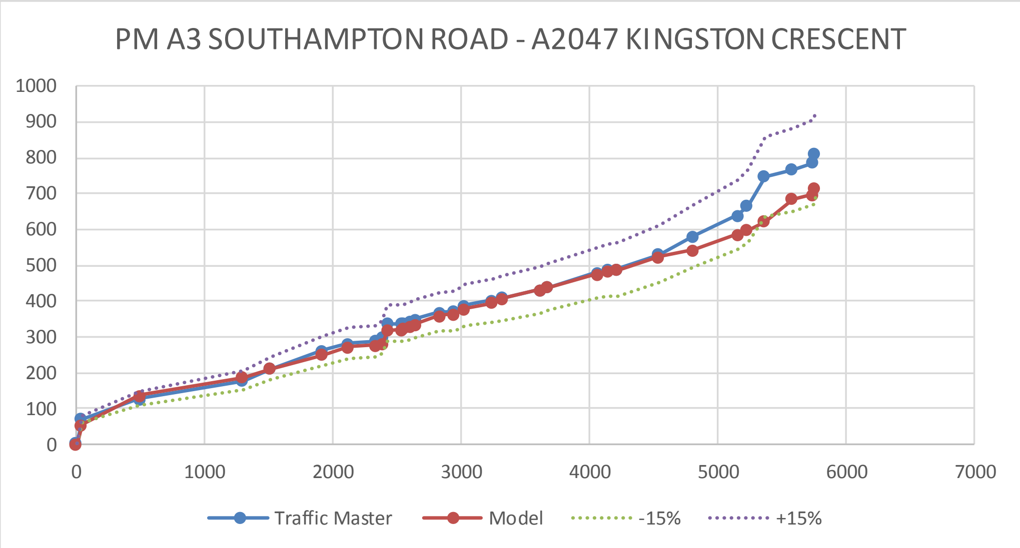
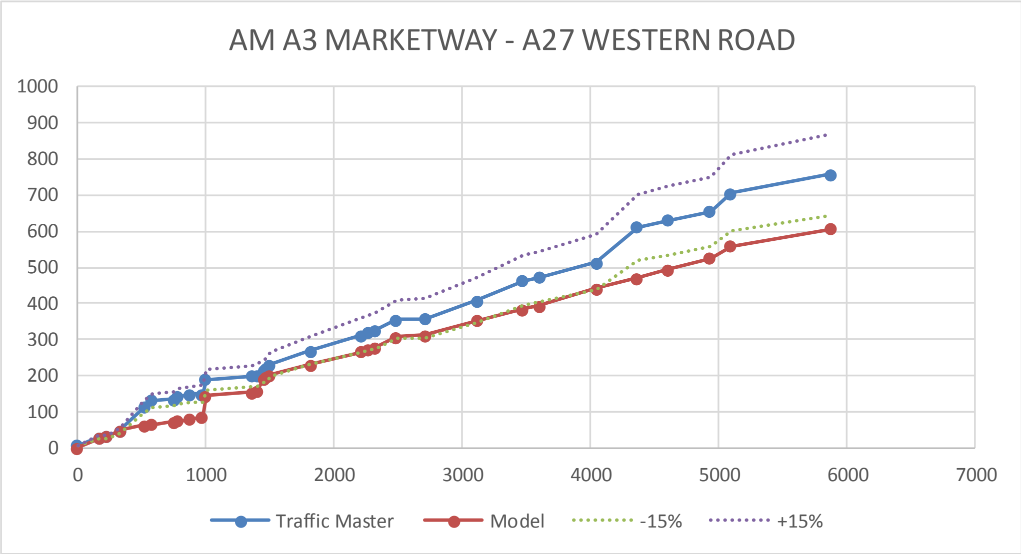
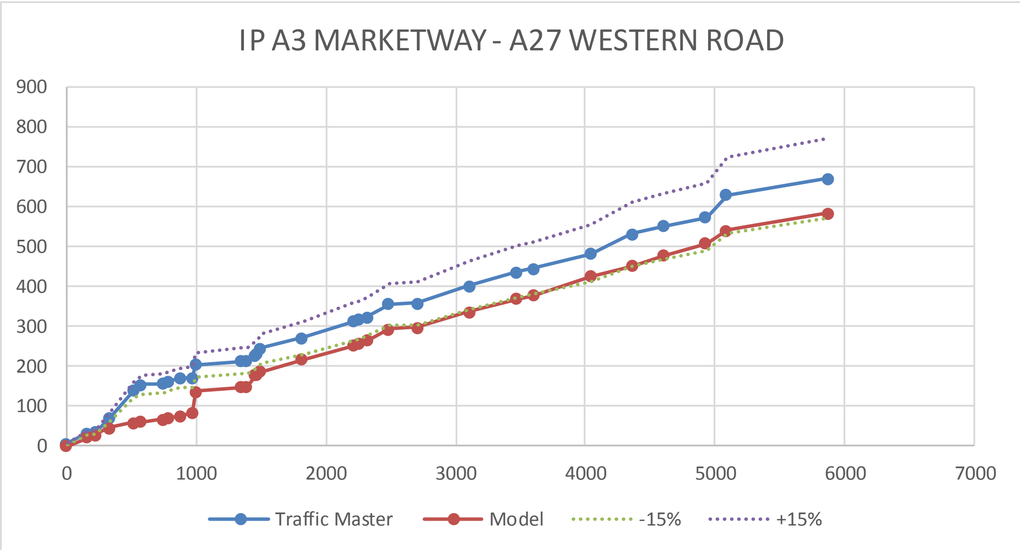


Figure 33. 17 NB A3 MARKETWAY – A27 WESTERN ROAD





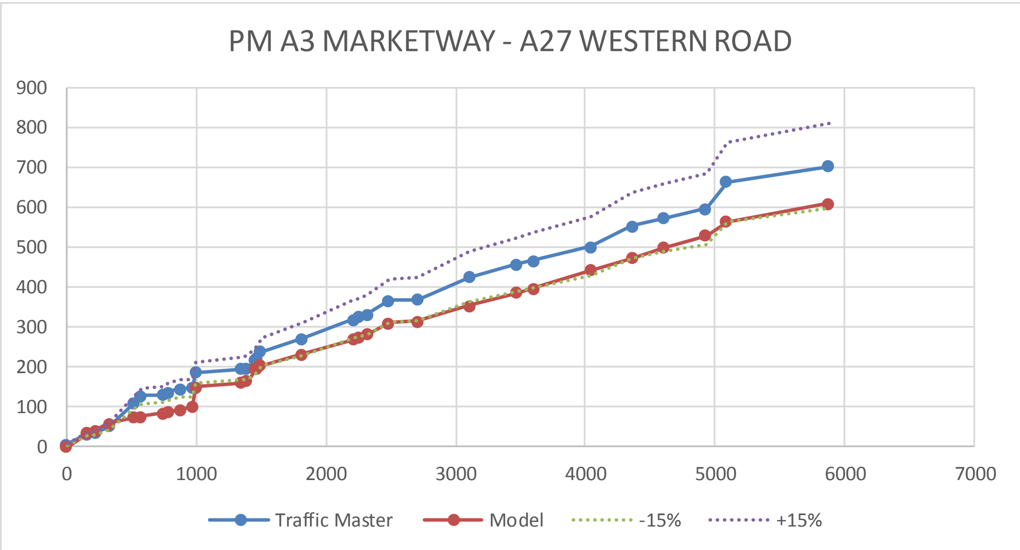
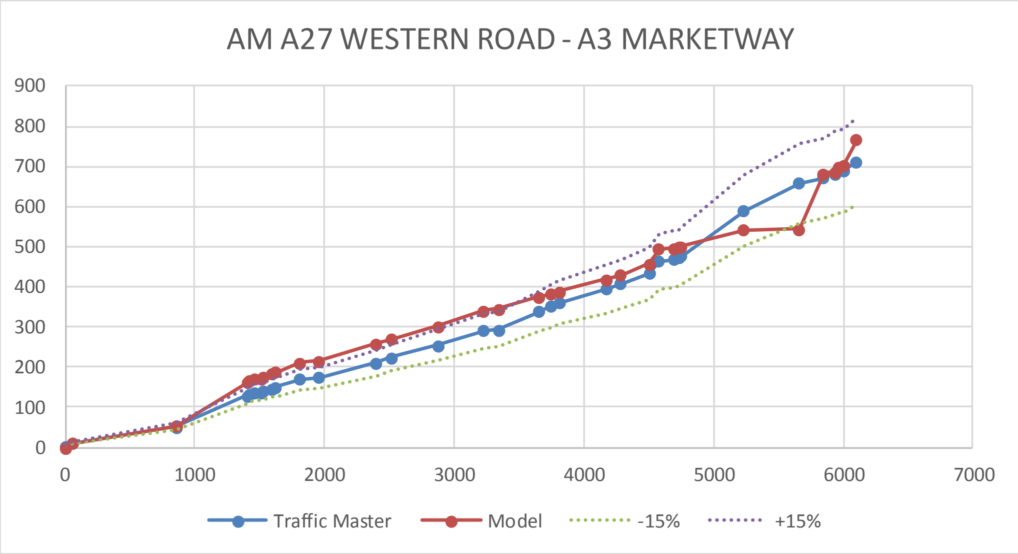
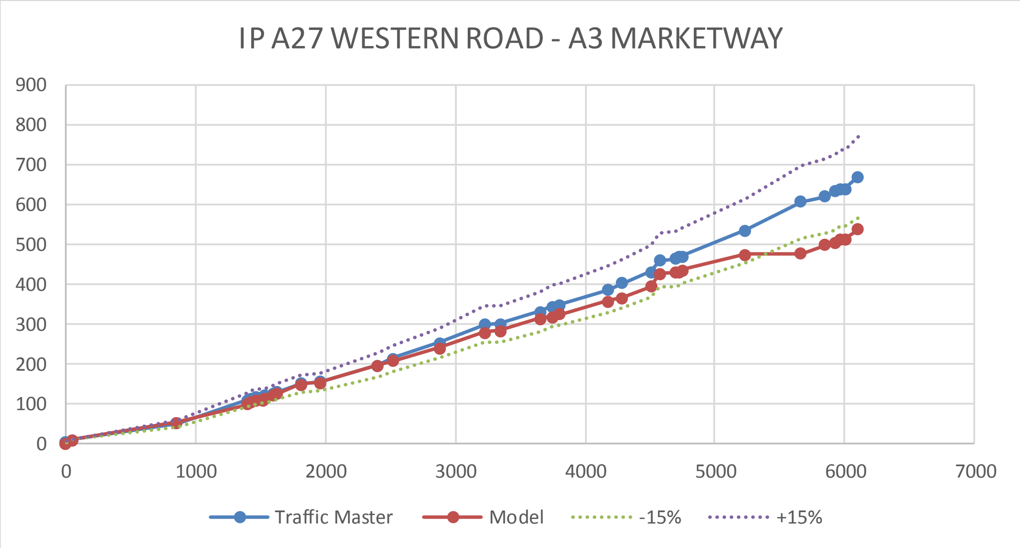


Figure 34. 17SB A27 WESTERN ROAD- A3 MARKETWAY





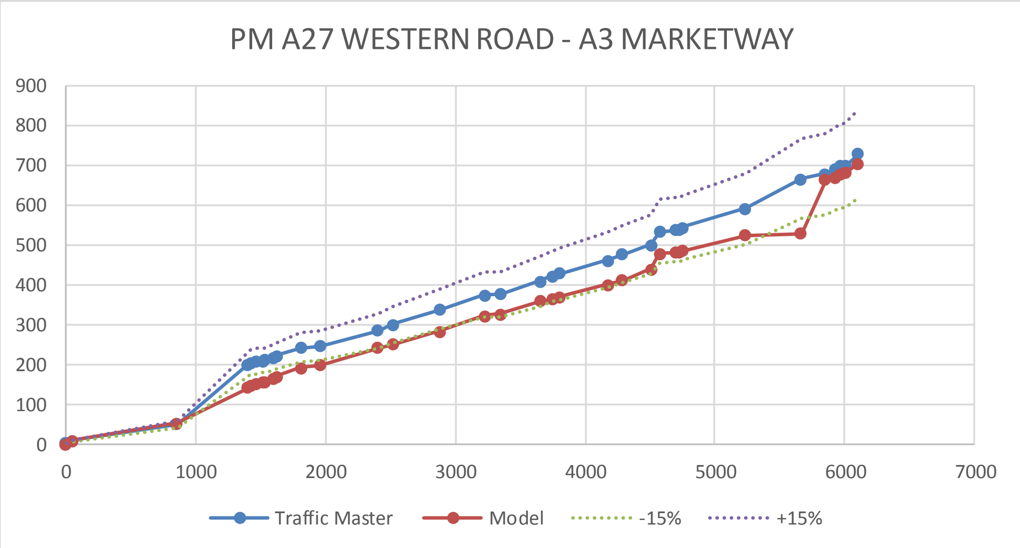
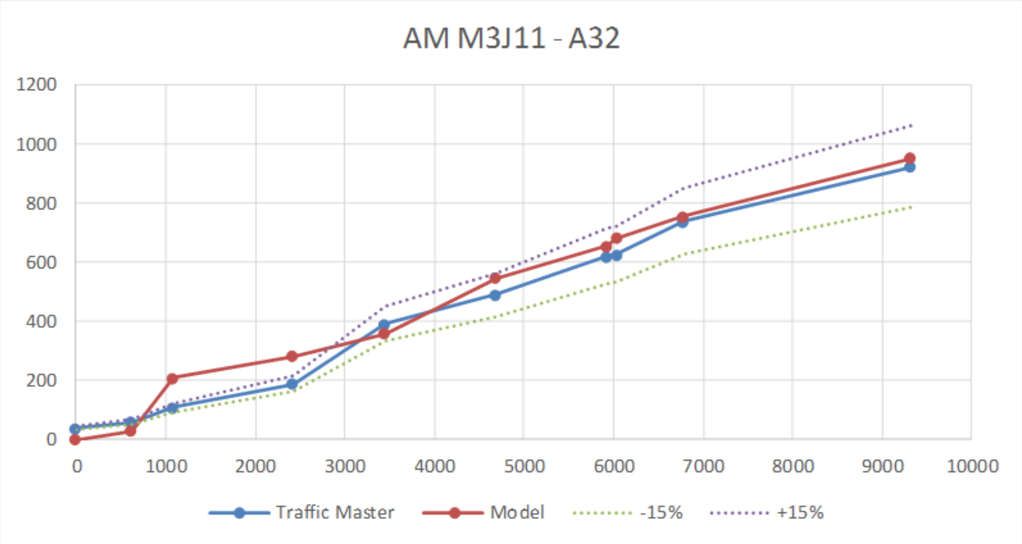
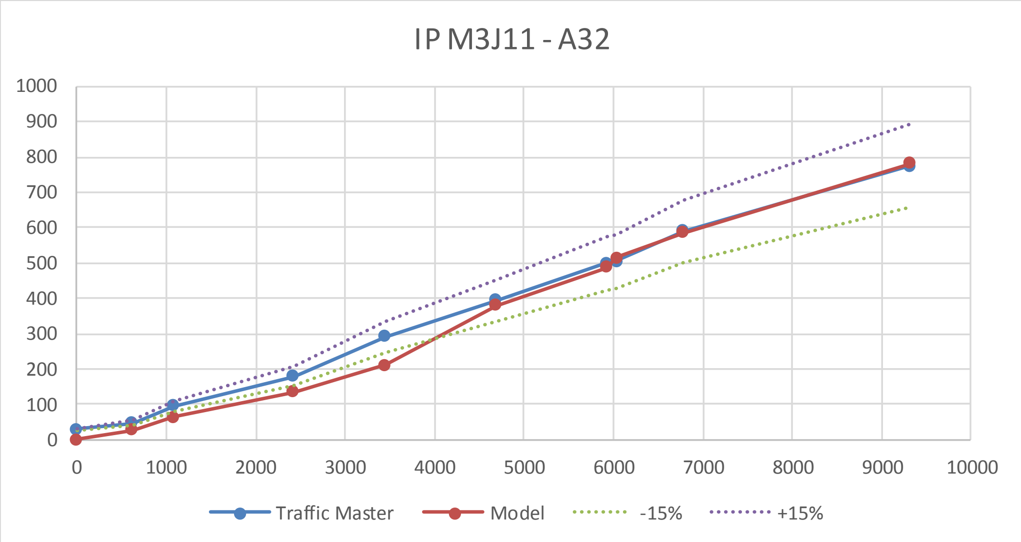


Figure 35. 18NB M3J11- A32





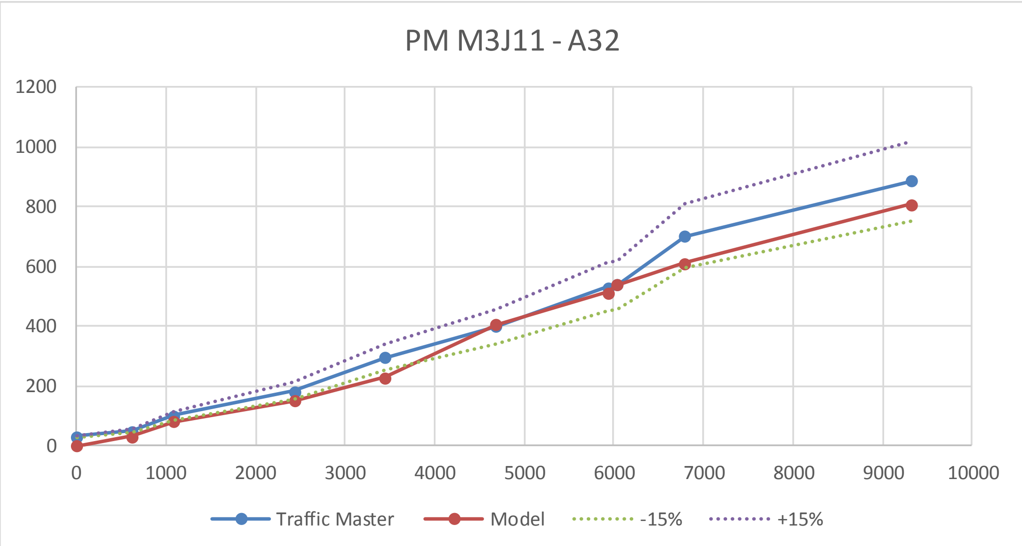
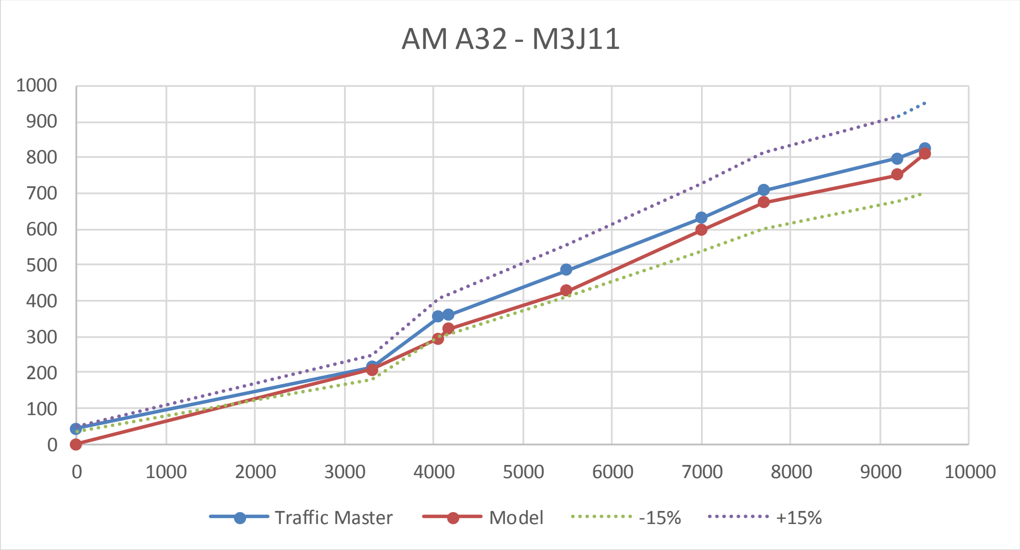
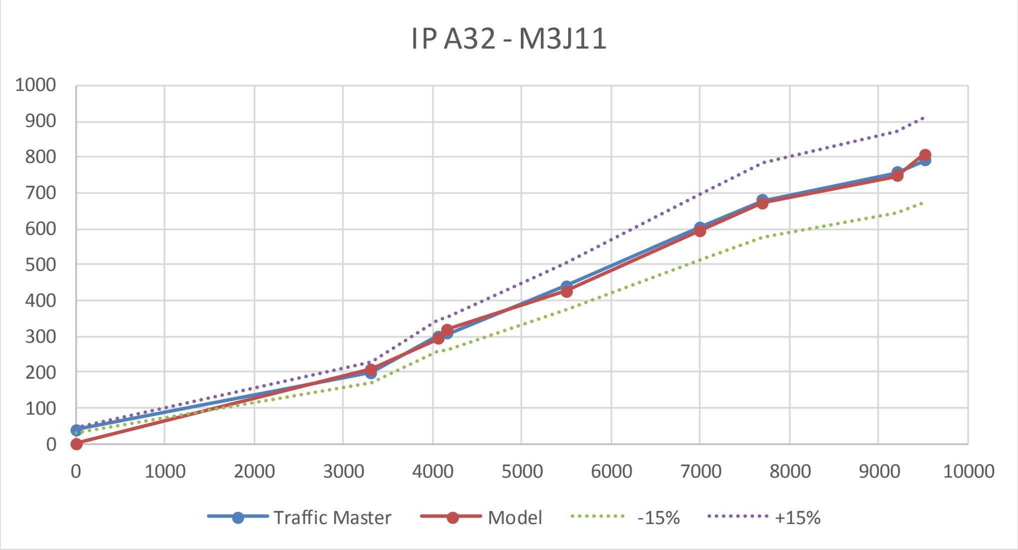


Figure 36. 18SB A32- M3J11





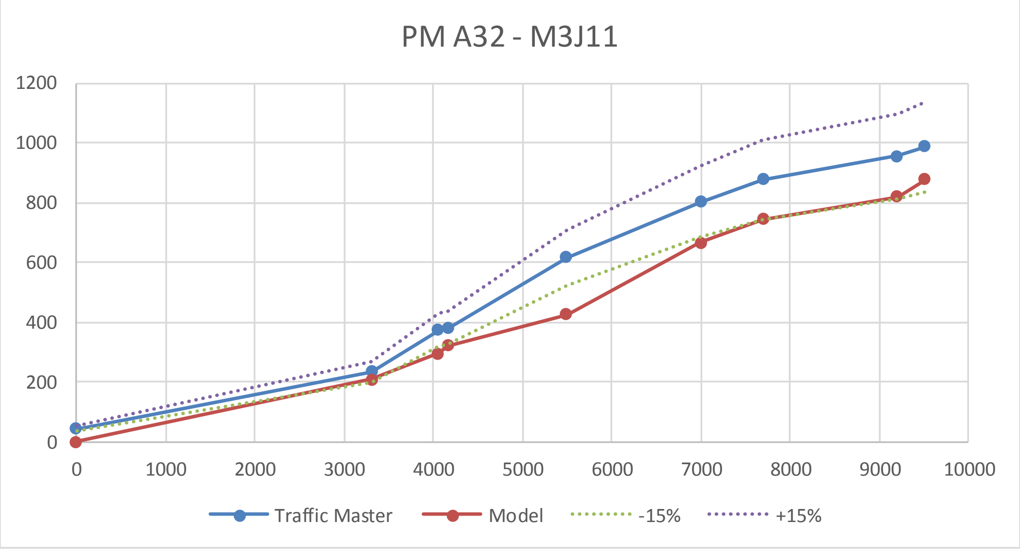
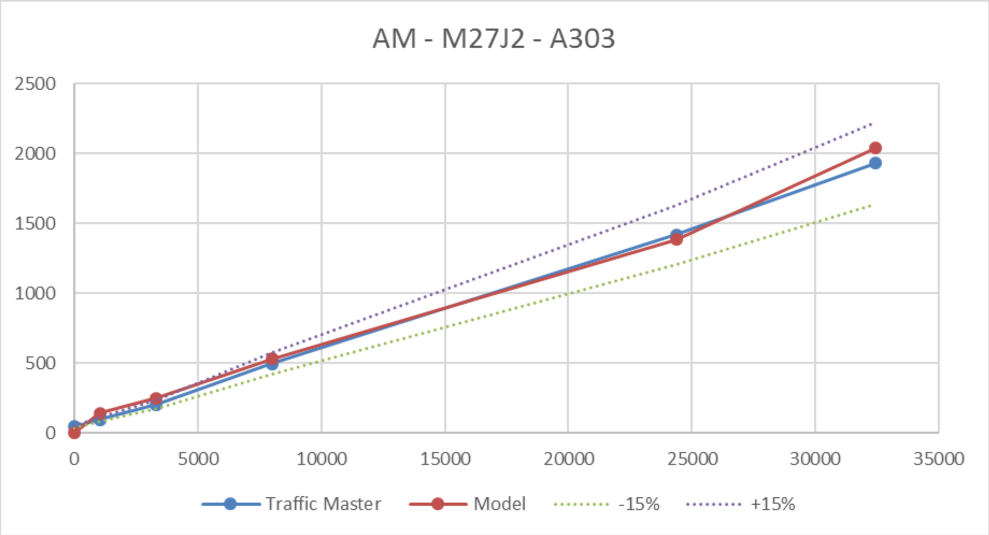
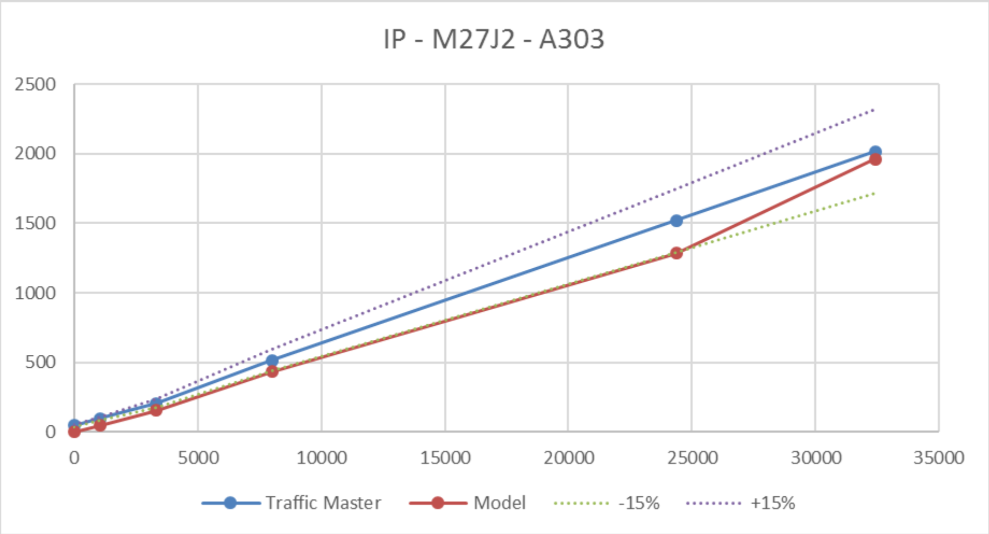


Figure 37. 19NB M27J2 – A303





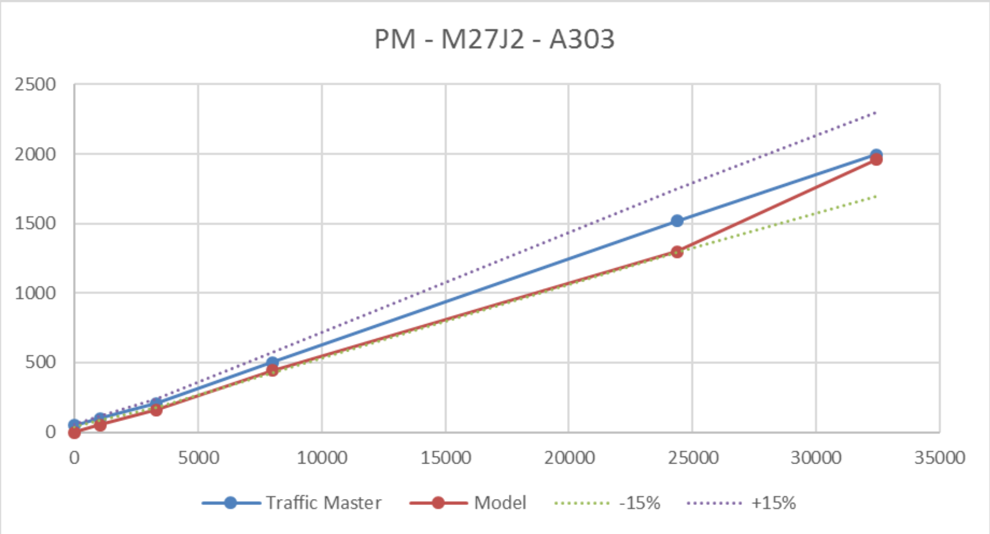
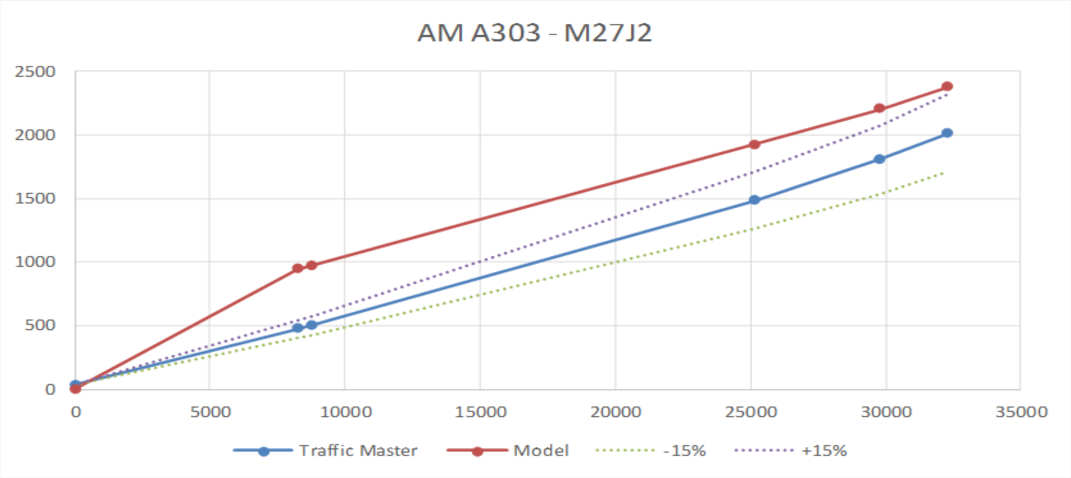
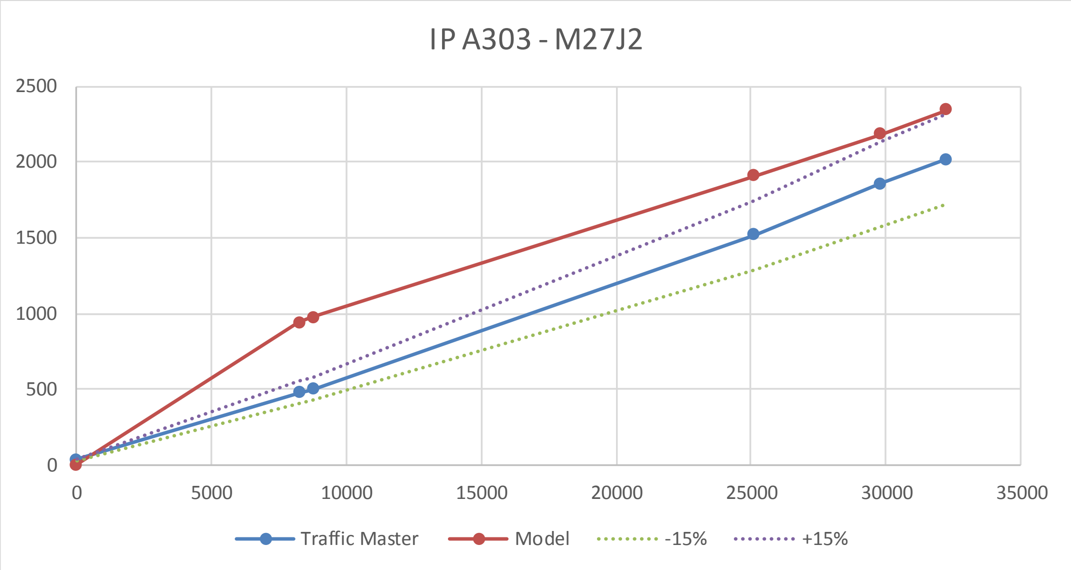


Figure 38. 19SB A303 – M27J2





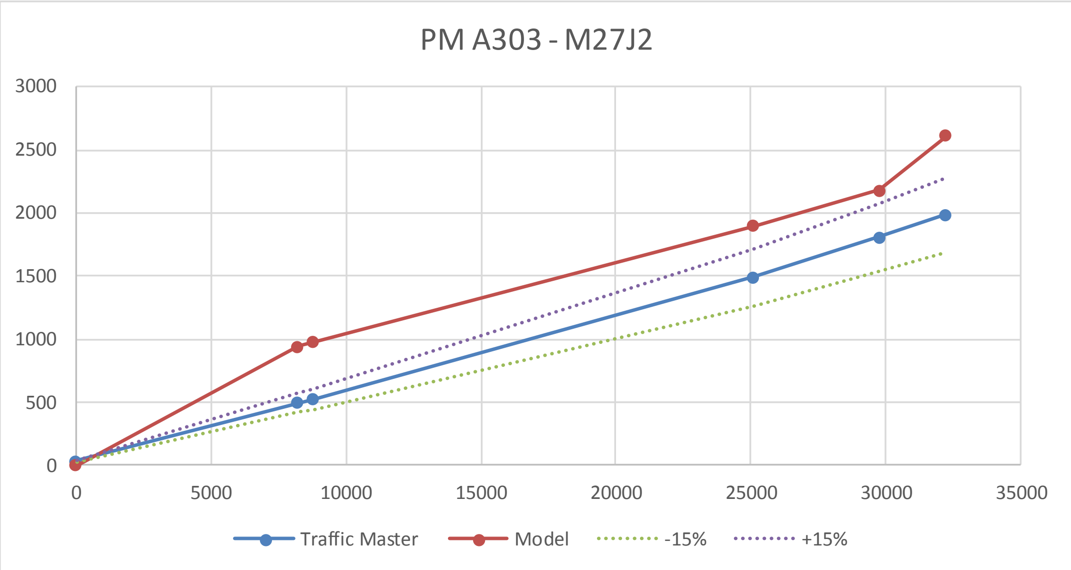
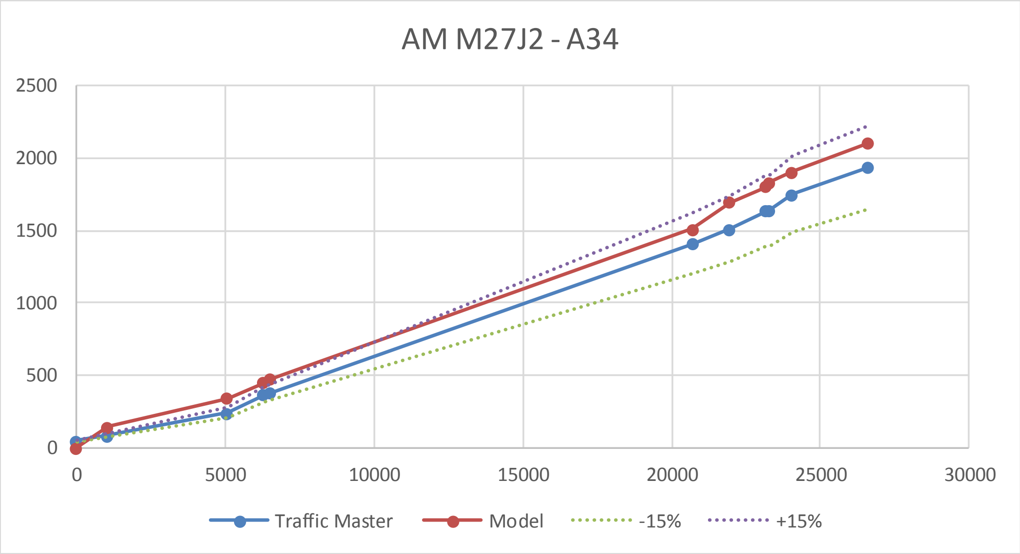
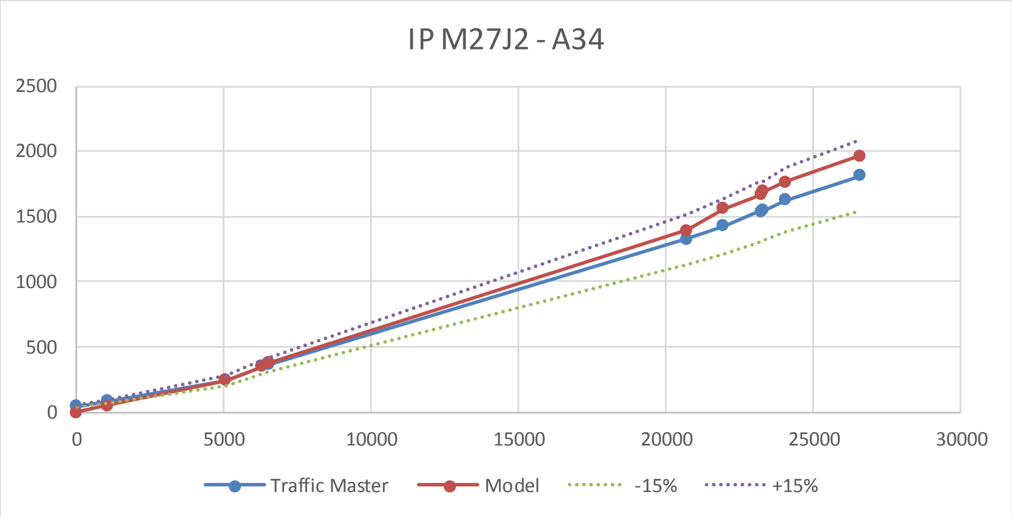


Figure 39. 20NB M27J2 – A34





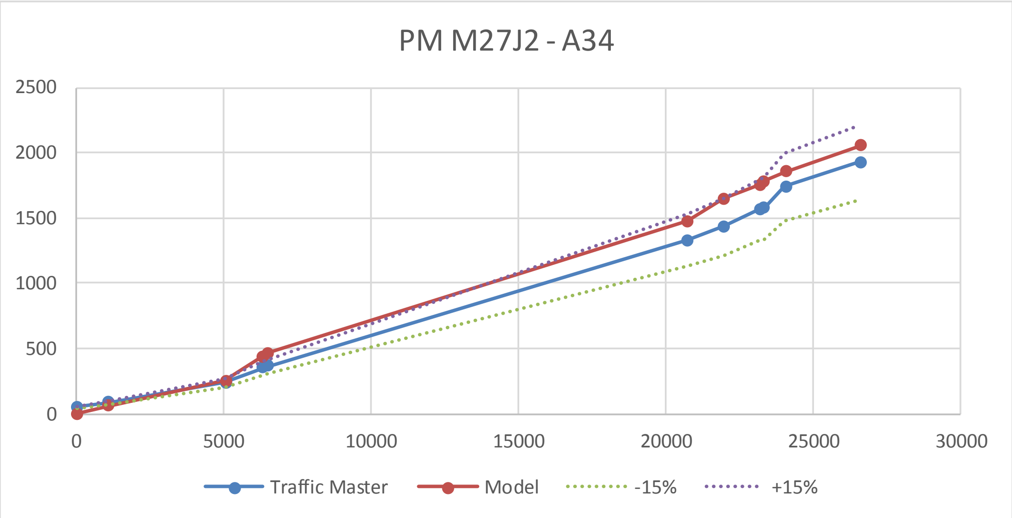
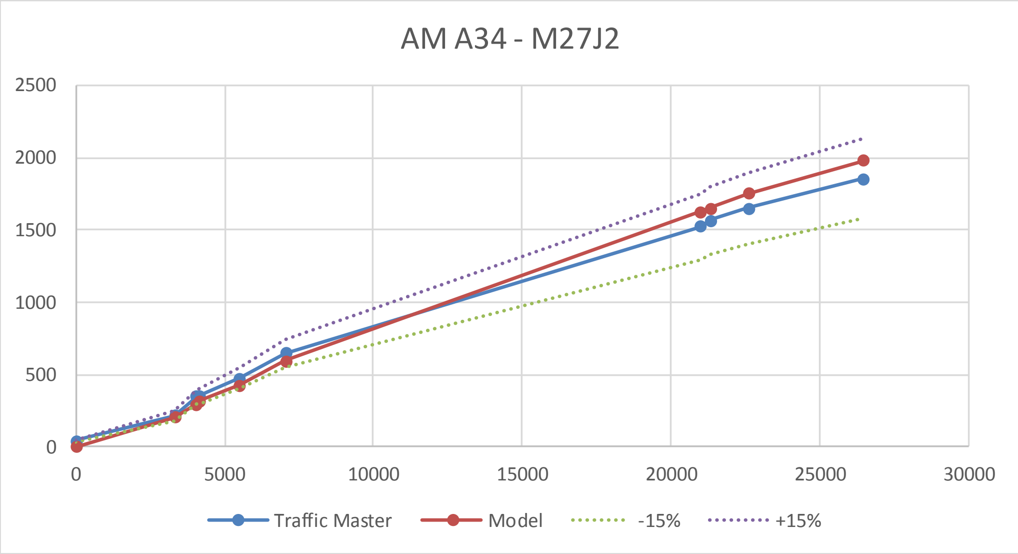
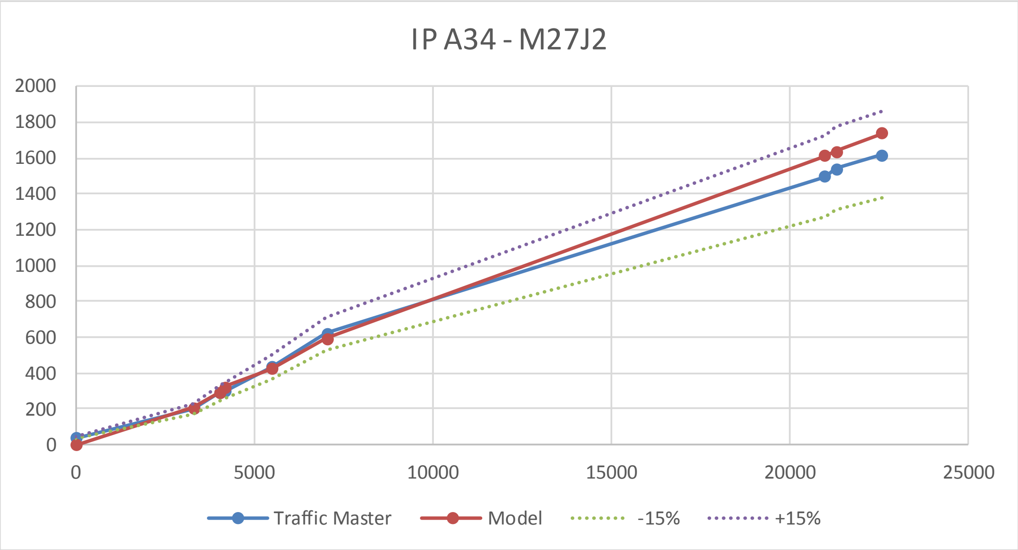


Figure 40. 20SB A34 – M27J2





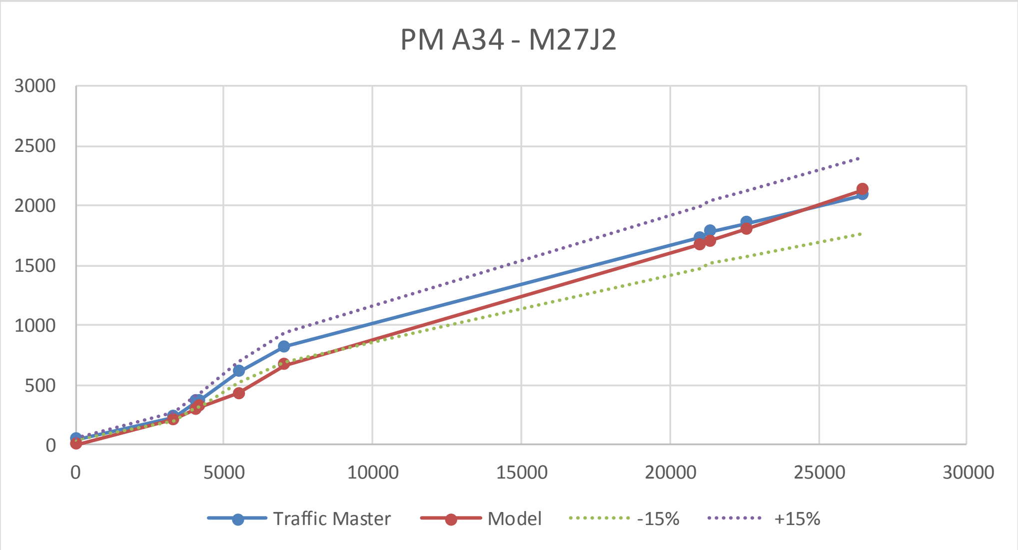
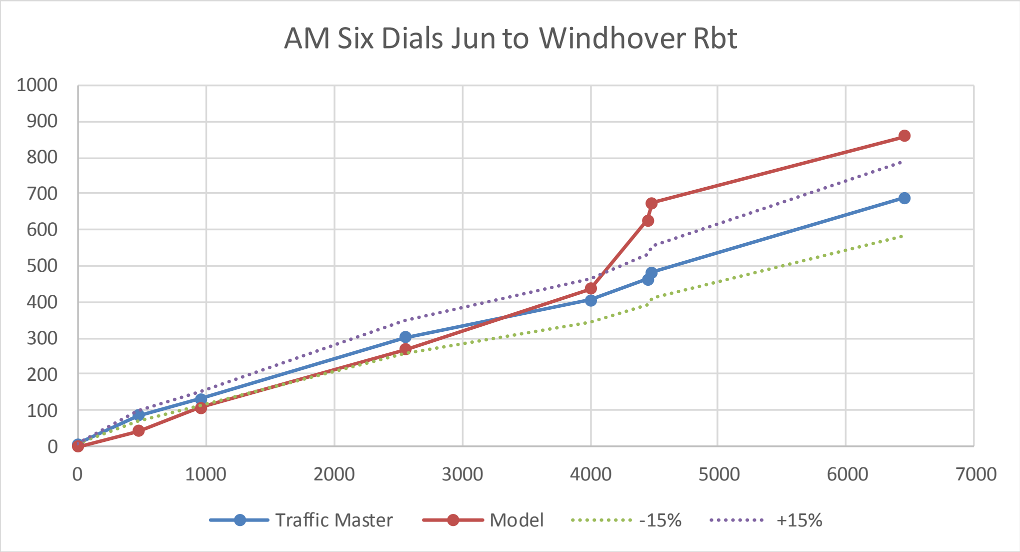
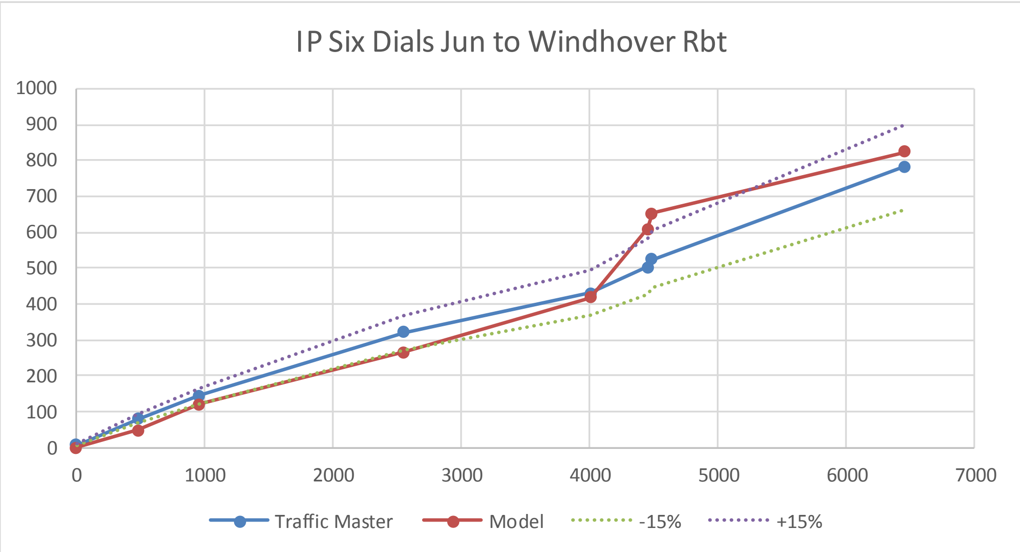


Figure 41. 21NB Six Dials Jum to Windover Rbt





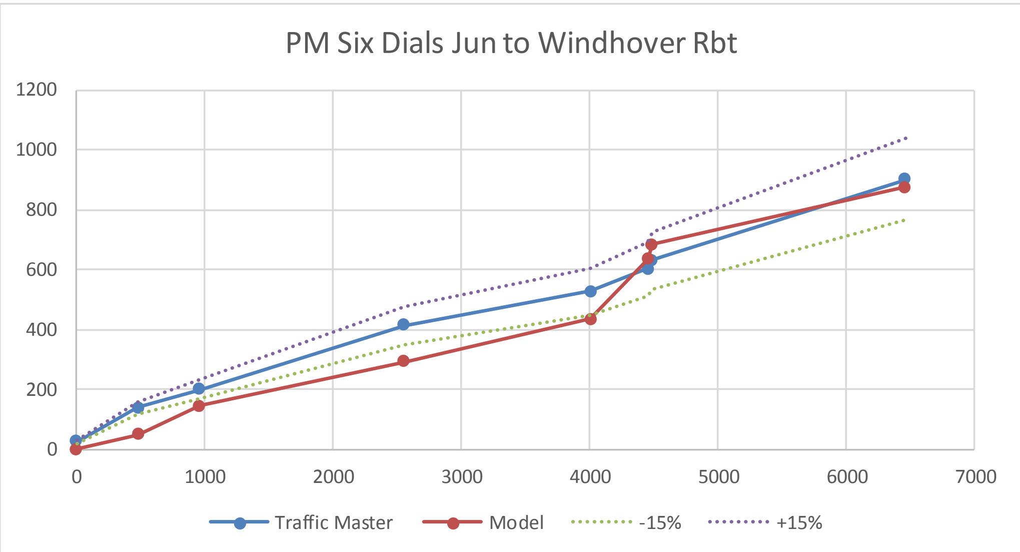


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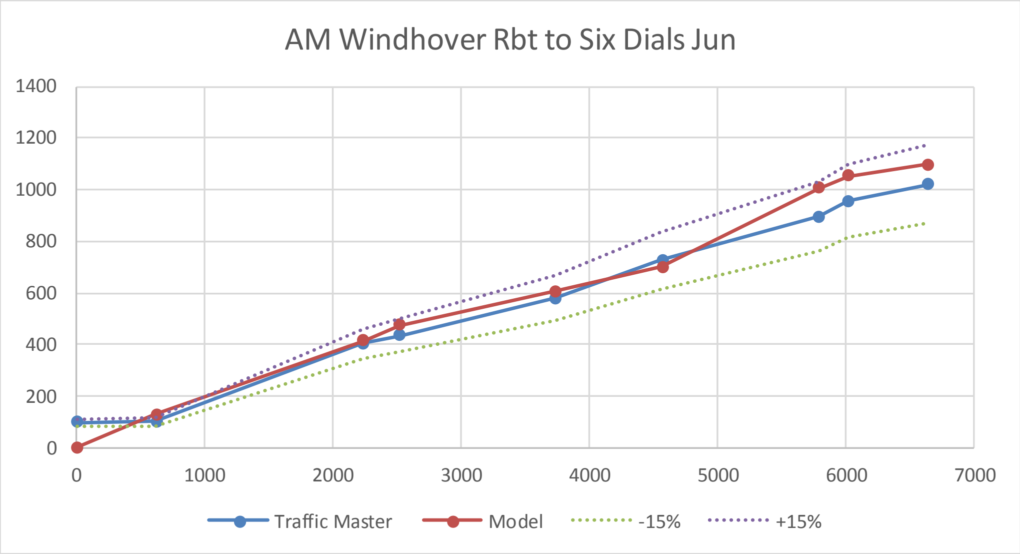
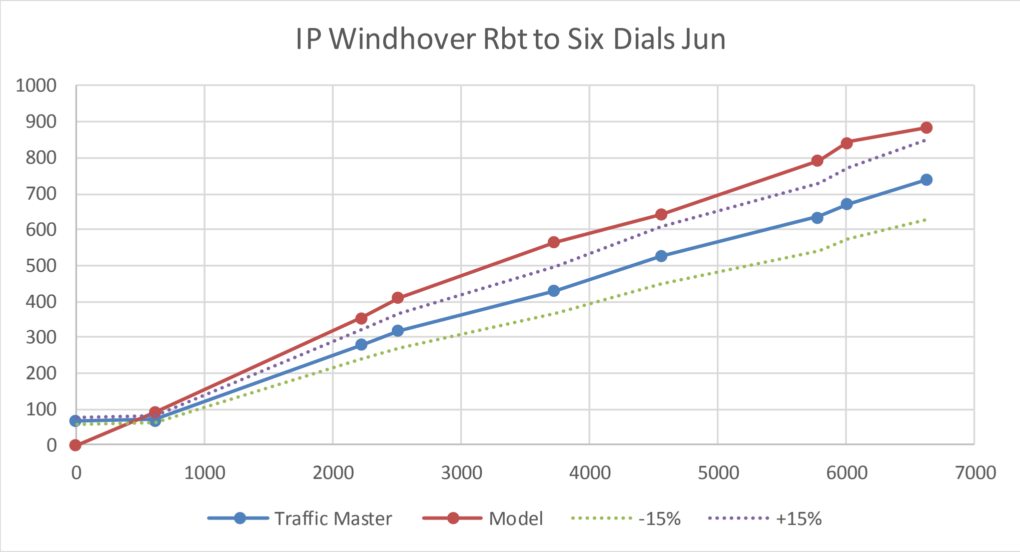
Figure 42. 21SB Windhover Rbt to Six Dials Jun





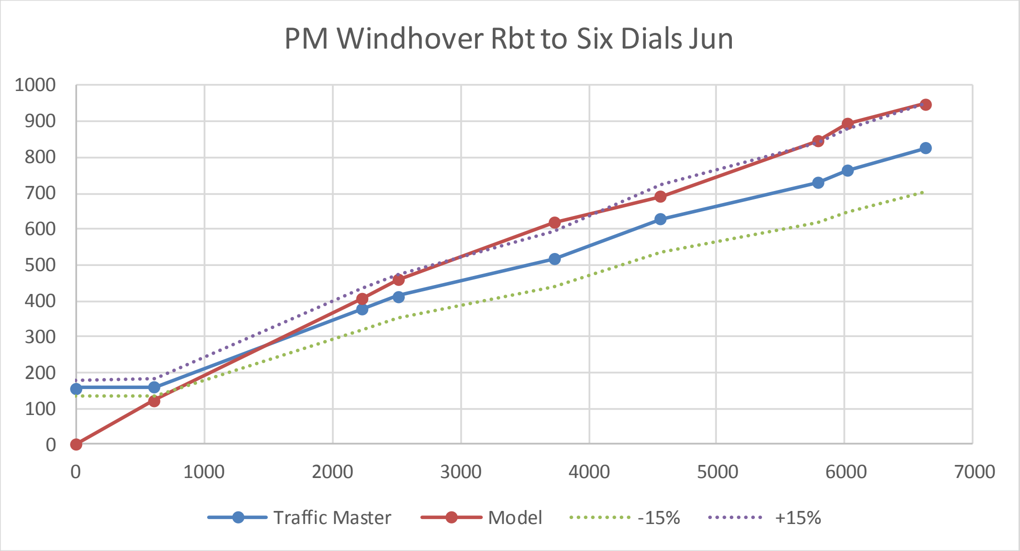
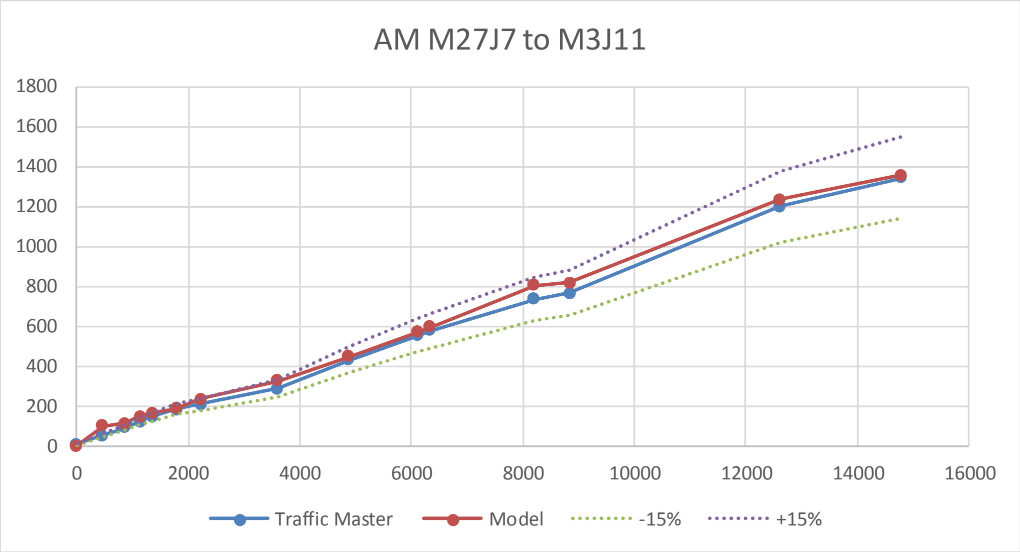
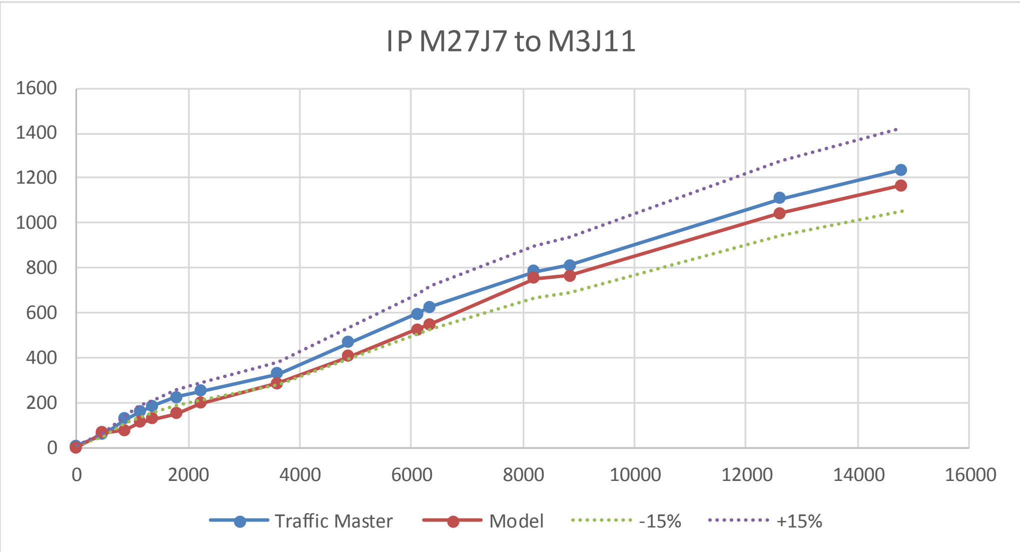


Figure 43. 22NB M27J7 to M3J11





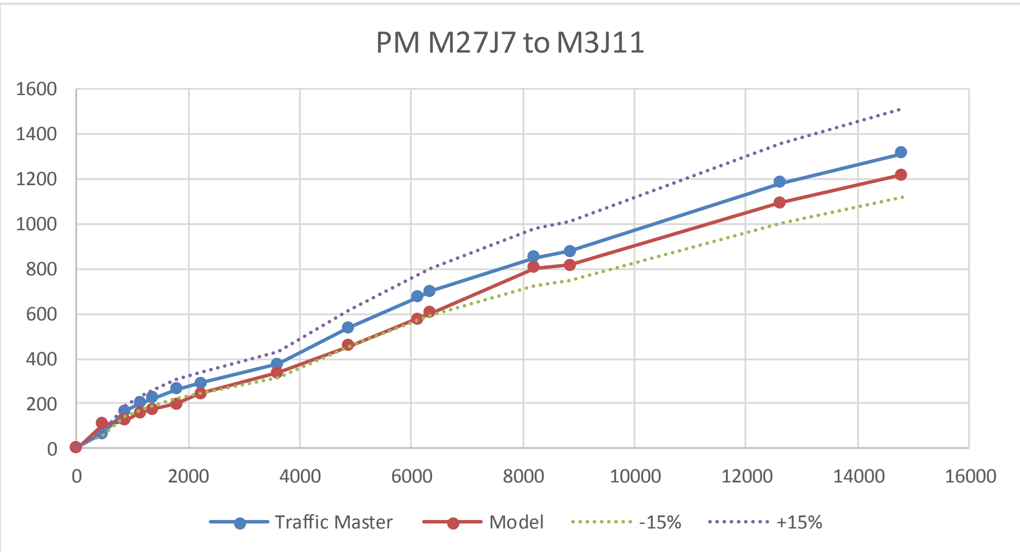
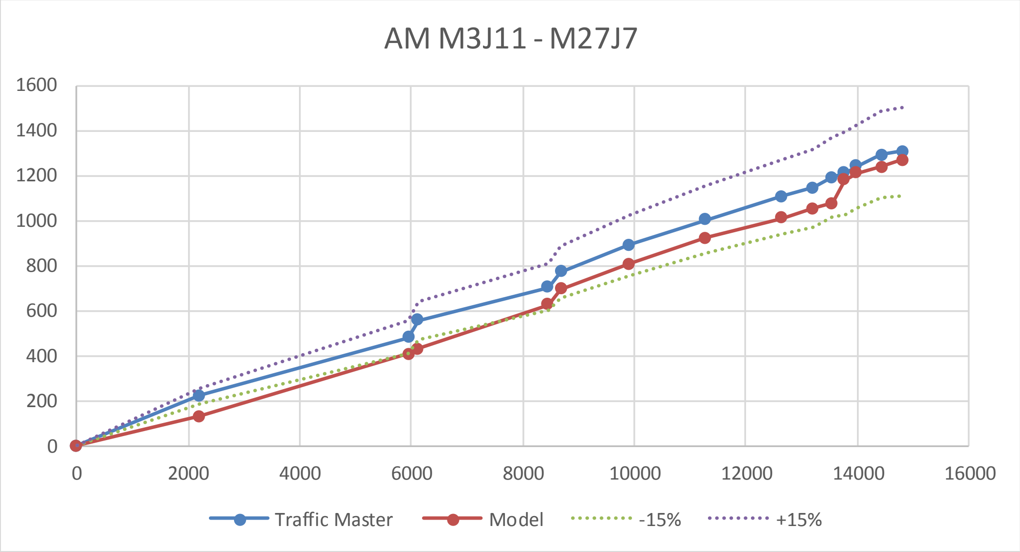
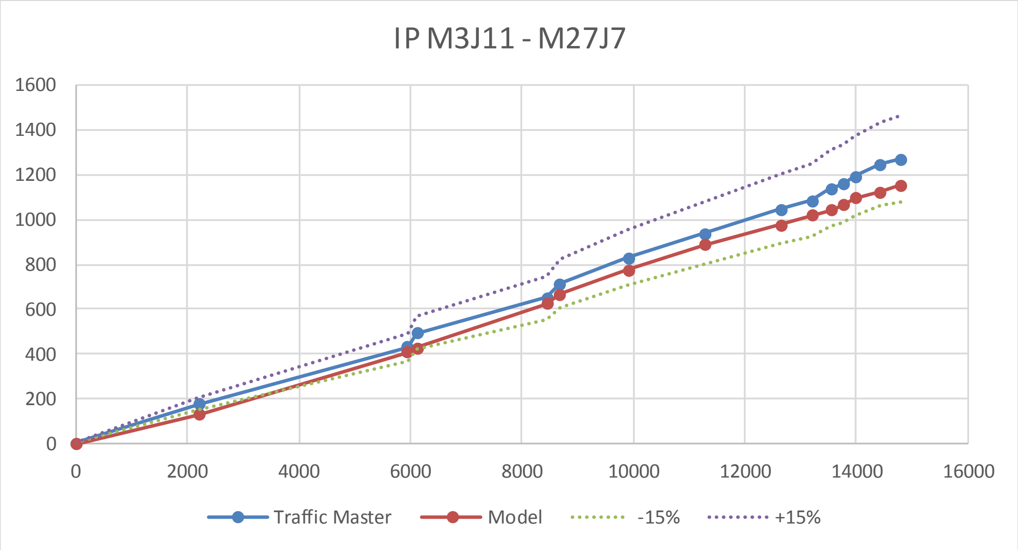


Figure 44. 22SB M3J11 – M27J7





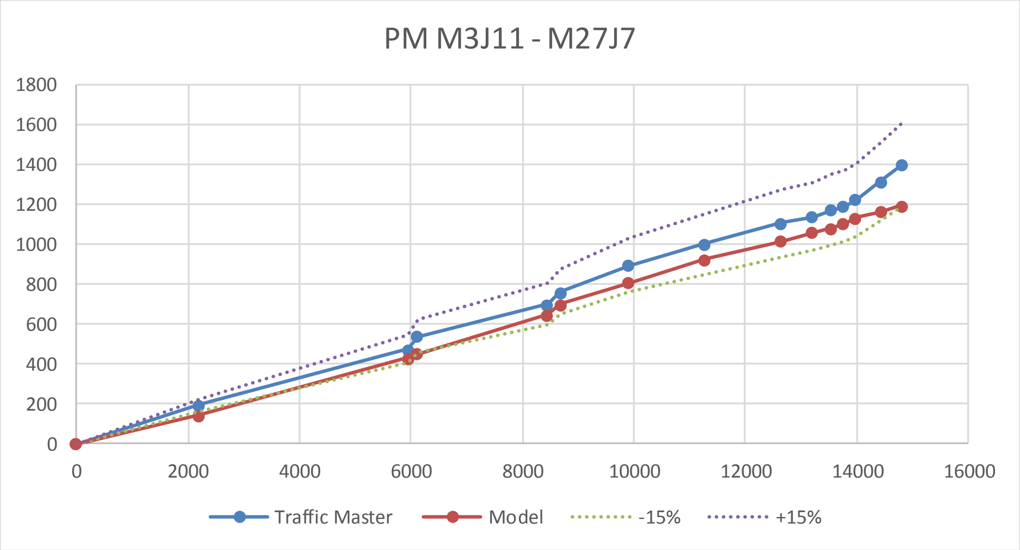
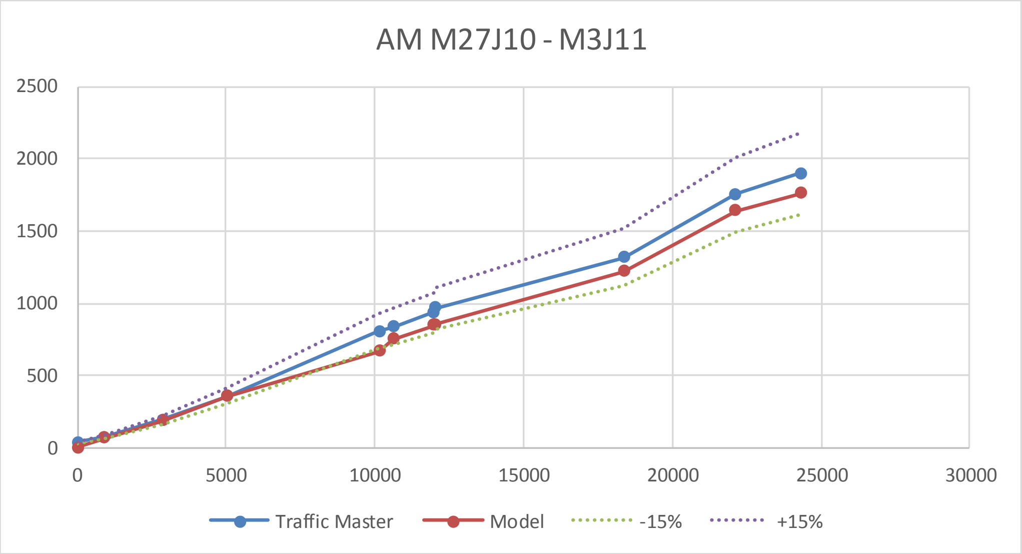
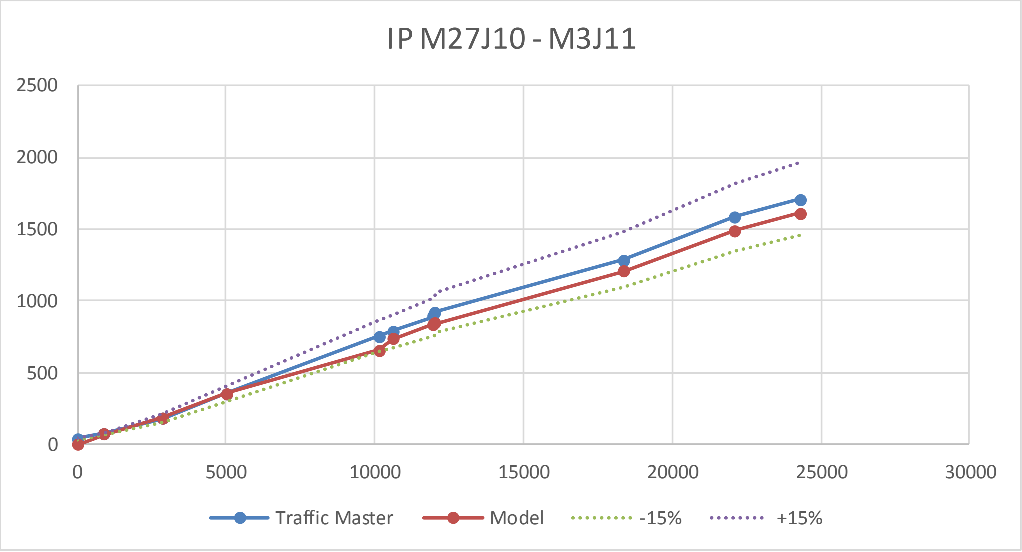


Figure 45. 23NB M27J10 – M3J11





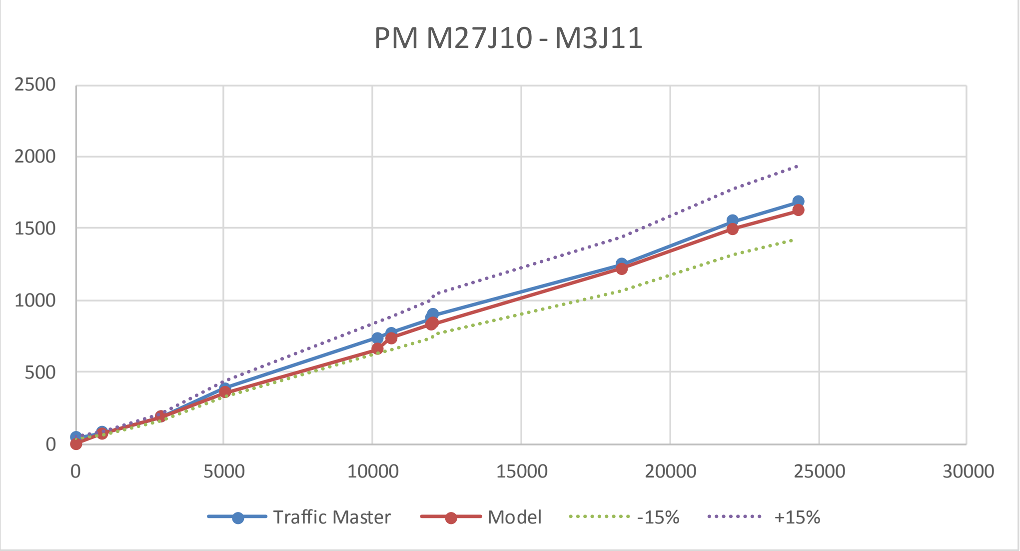
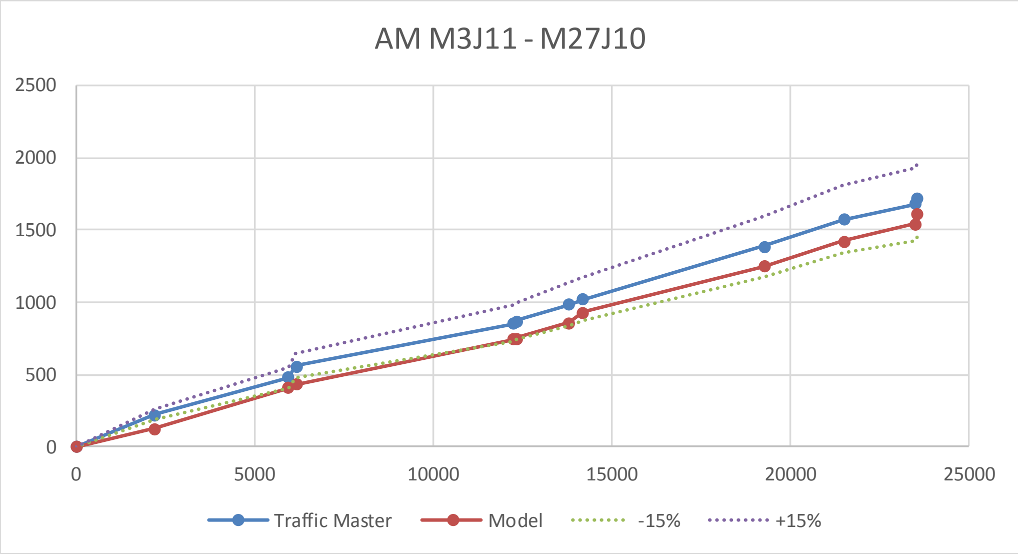
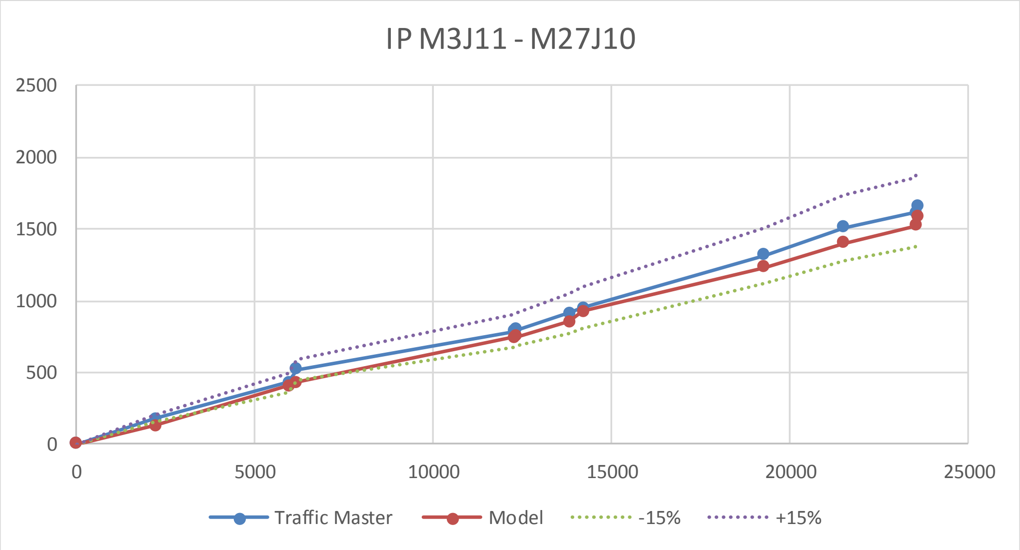


Figure 46. 23SB M3J11 – M27J10





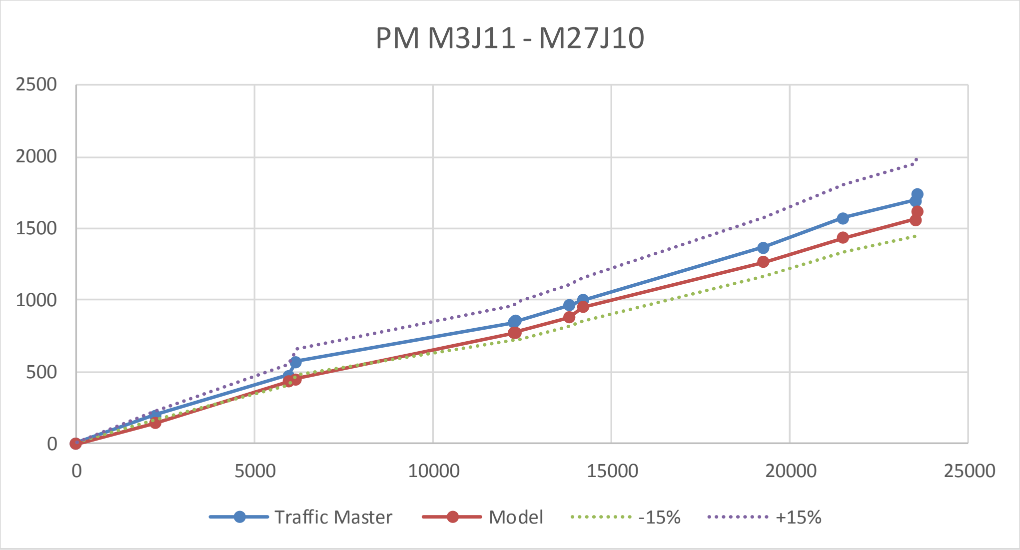


Figure 47. AM M27 Eastbound

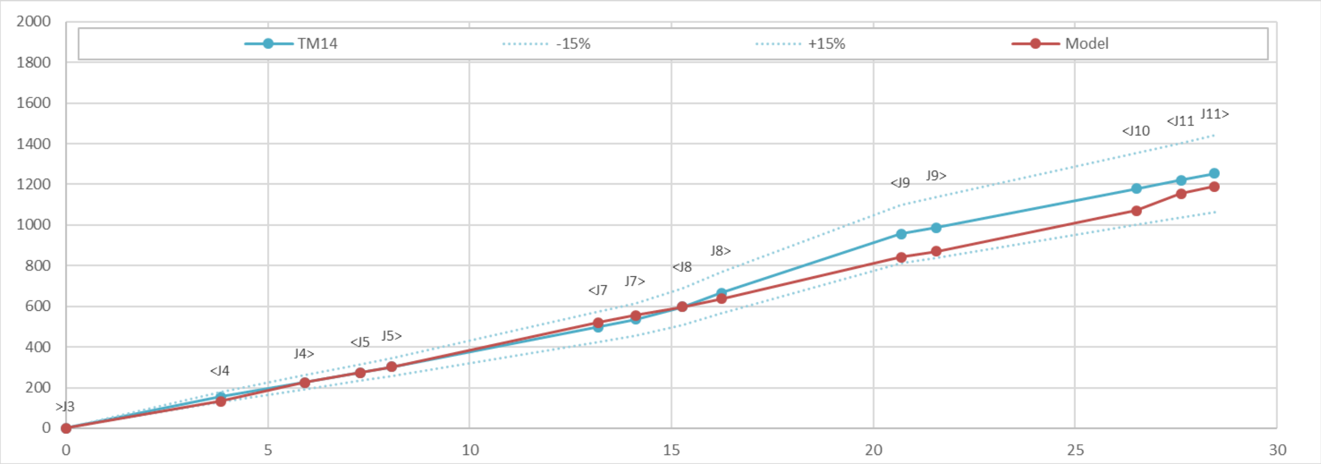


Figure 48. IP M27 Eastbound

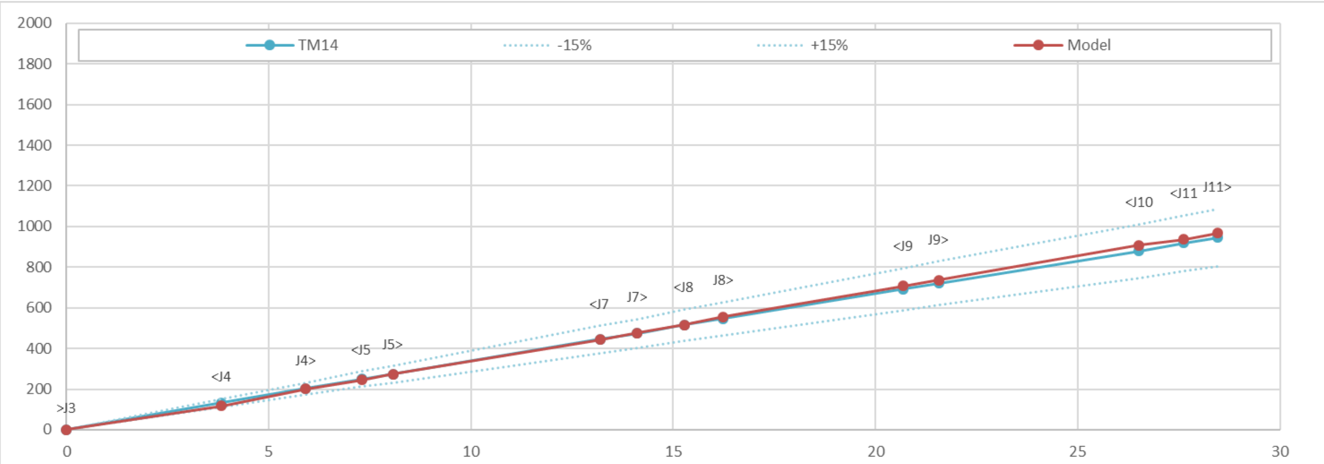


Figure 49. PM M27 Eastbound

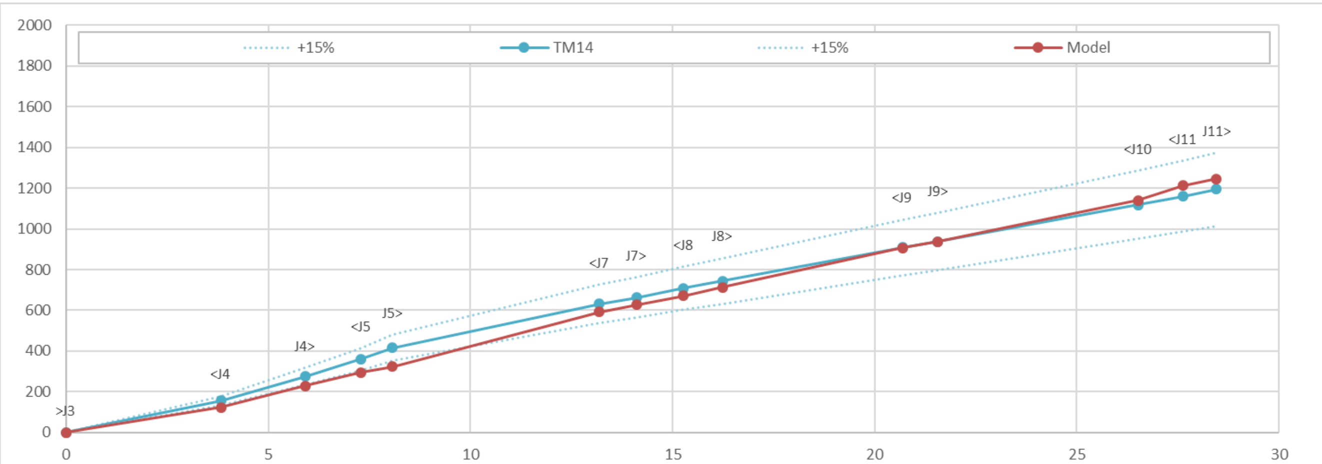


Figure 50. AM M27 Westbound

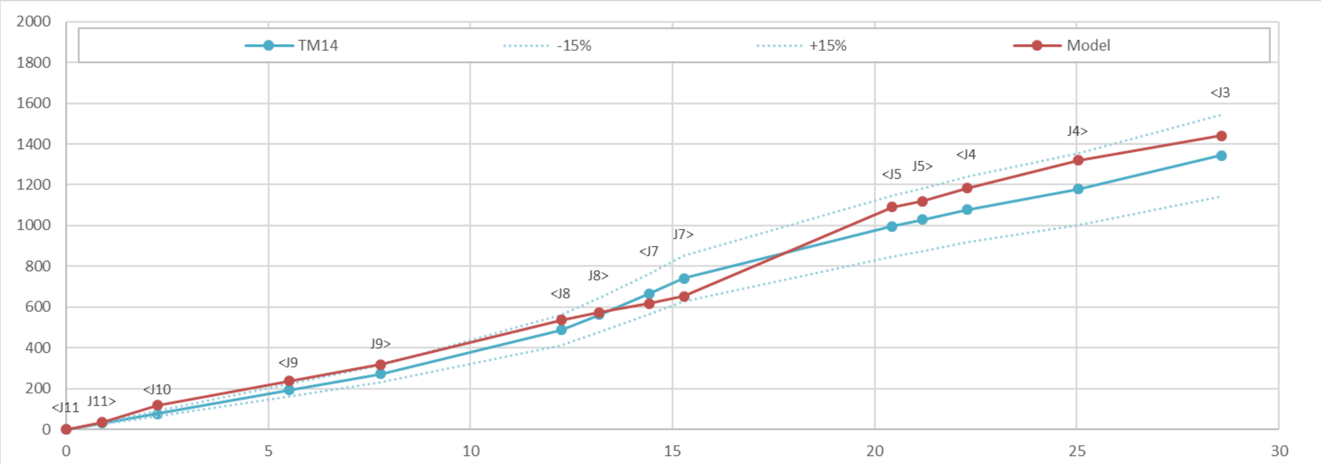


Figure 51. IP M27 Westbound

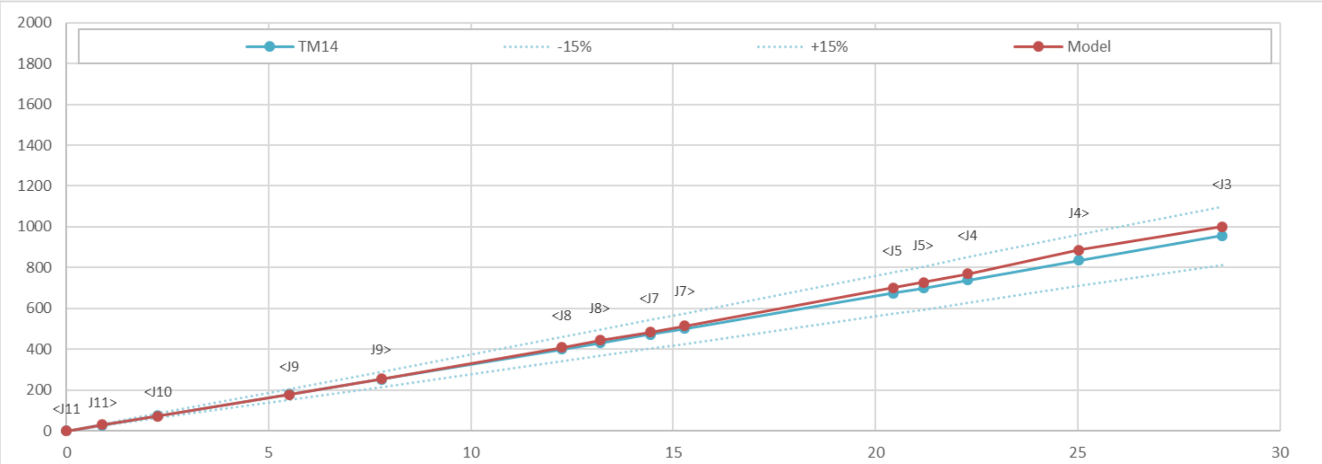


Figure 52. PM M27 Westbound

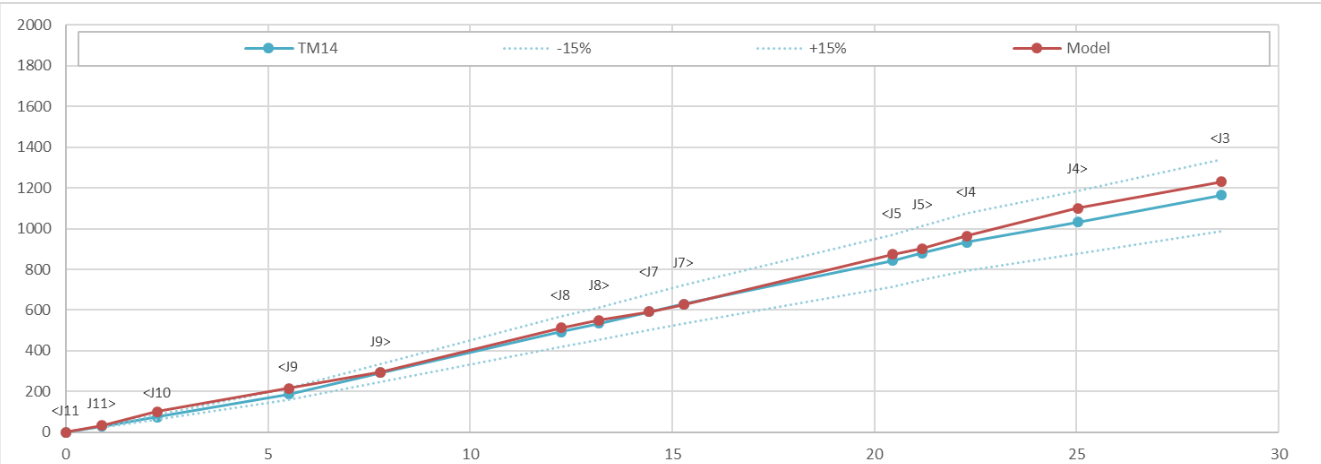


Figure 53. AM M3 Eastbound

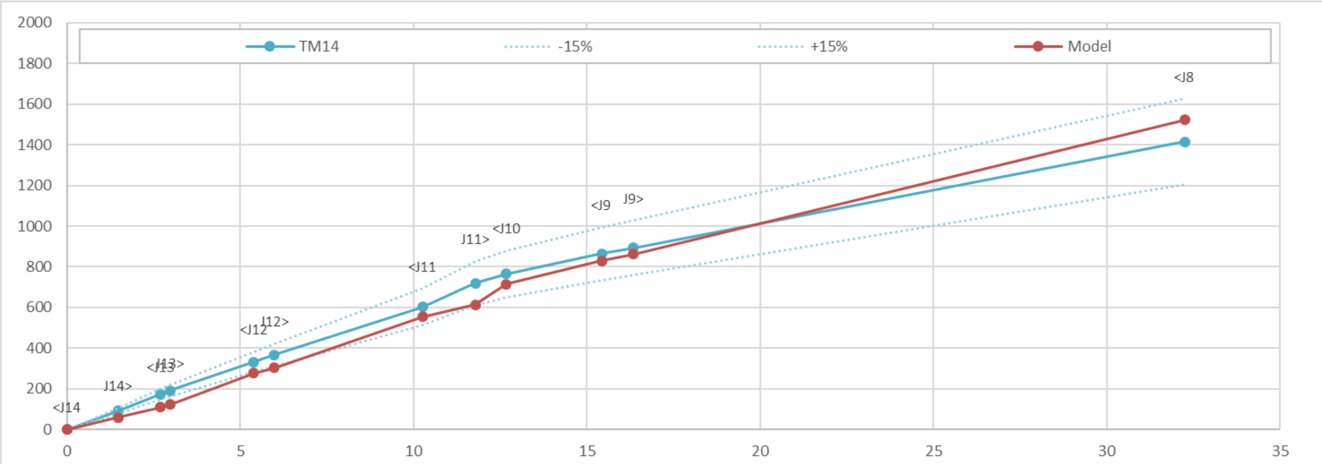


Figure 54. IP M3 Eastbound

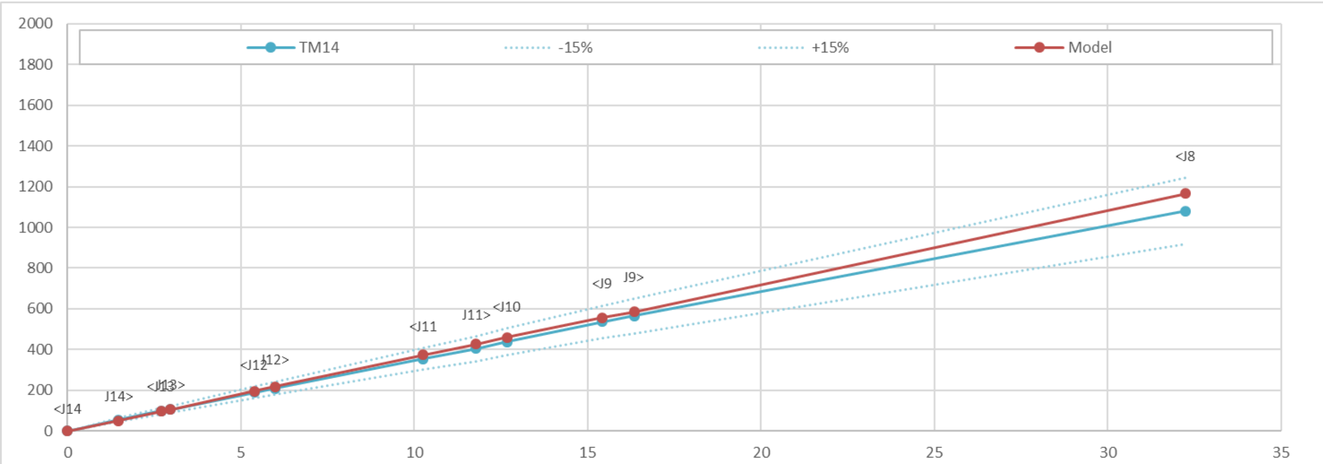


Figure 55. PM M3 Eastbound

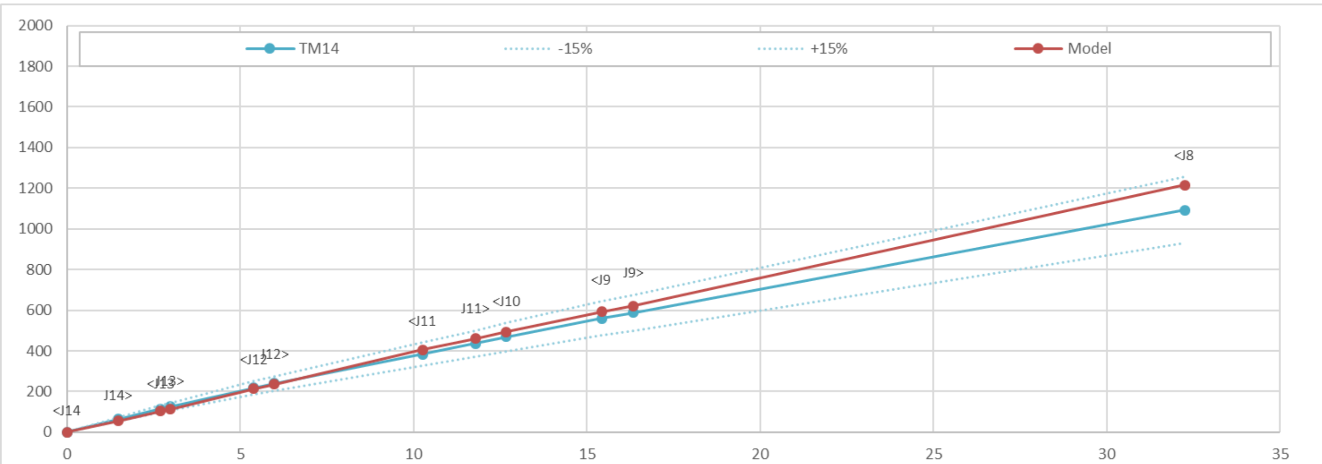


Figure 56. AM M3 Westbound

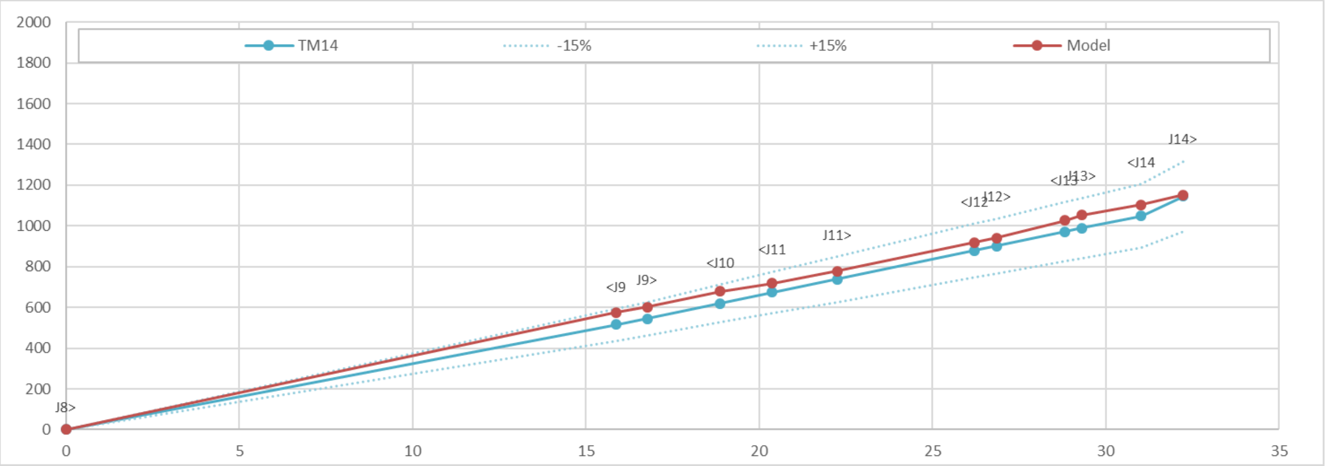


Figure 57. IP M3 Westbound

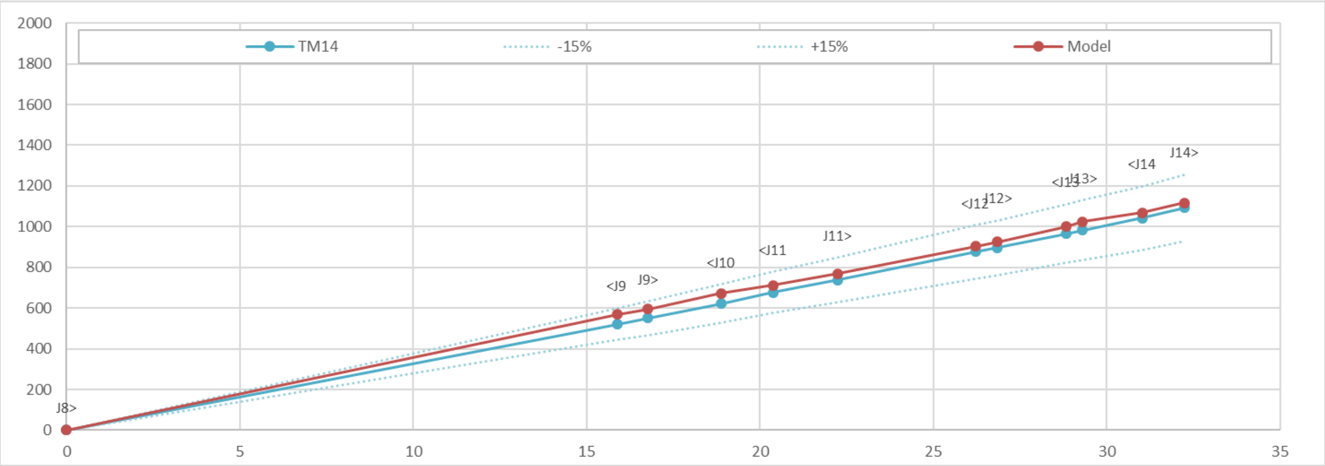
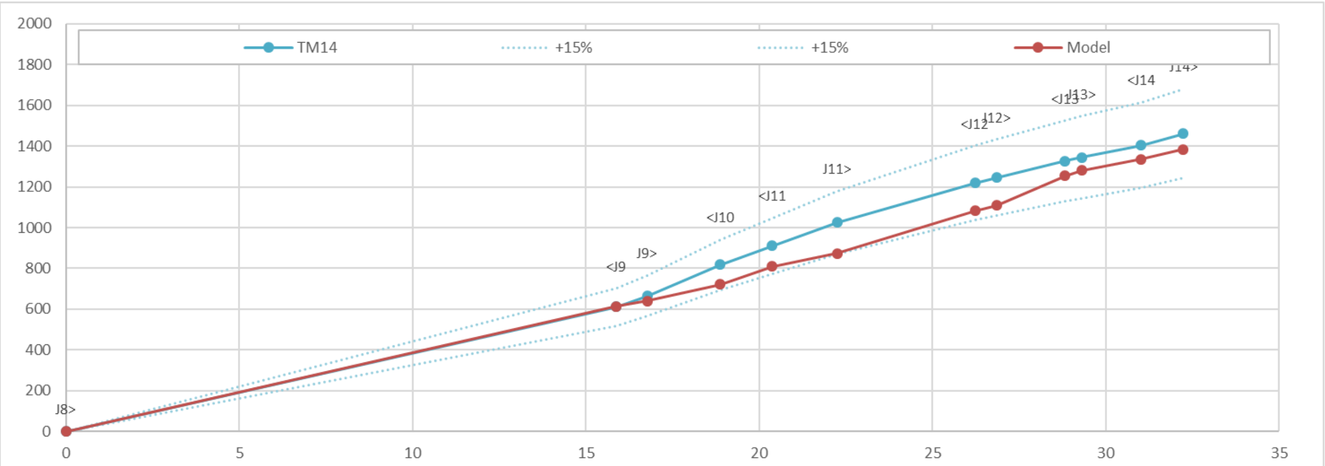


Figure 58. PM M3 Westbound



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SYSTRA

Southampton Clean Air Zone

Reference number 105909

22/05/2018

TRANSPORT MODELLING METHODOLOGY REPORT (T3)

SYSTRA

SOUTHAMPTON CLEAN AIR ZONE

TRANSPORT MODELLING METHODOLOGY REPORT (T3)

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	Checked by	Claire Stephens	Associate	02/05/2018	
	Approved by	Claire Stephens	Associate	02/05/2018	

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1. INTRODUCTION

1.1.1 SYSTRA, working in partnership with Ricardo Energy and Environment Consultants, were commissioned by Southampton City Council for the Southampton Clean Air Zone Feasibility Study, assessing the air quality and transport modelling needs for the feasibility study, delivering the air quality modelling and co-ordinating transport modelling inputs and developing a business case.

1.1.2 This document provides the modelling methodology for the transport inputs, and is structured into the following Chapters:

- Chapter 2: Model review and specification;
- Chapter 3: Base Year Modelling, and;
- Chapter 4: Transport Forecast Modelling.

2. MODEL REVIEW AND SPECIFICATION

2.1.1 Solent Transport commissioned SYSTRA to develop a Sub-Regional Transport Model (SRTM) that covered the areas of Southampton, Portsmouth and South Hampshire. The SRTM has been developed to support a wide-ranging set of interventions across the Solent Transport sub-region, and is specifically required to be capable of:

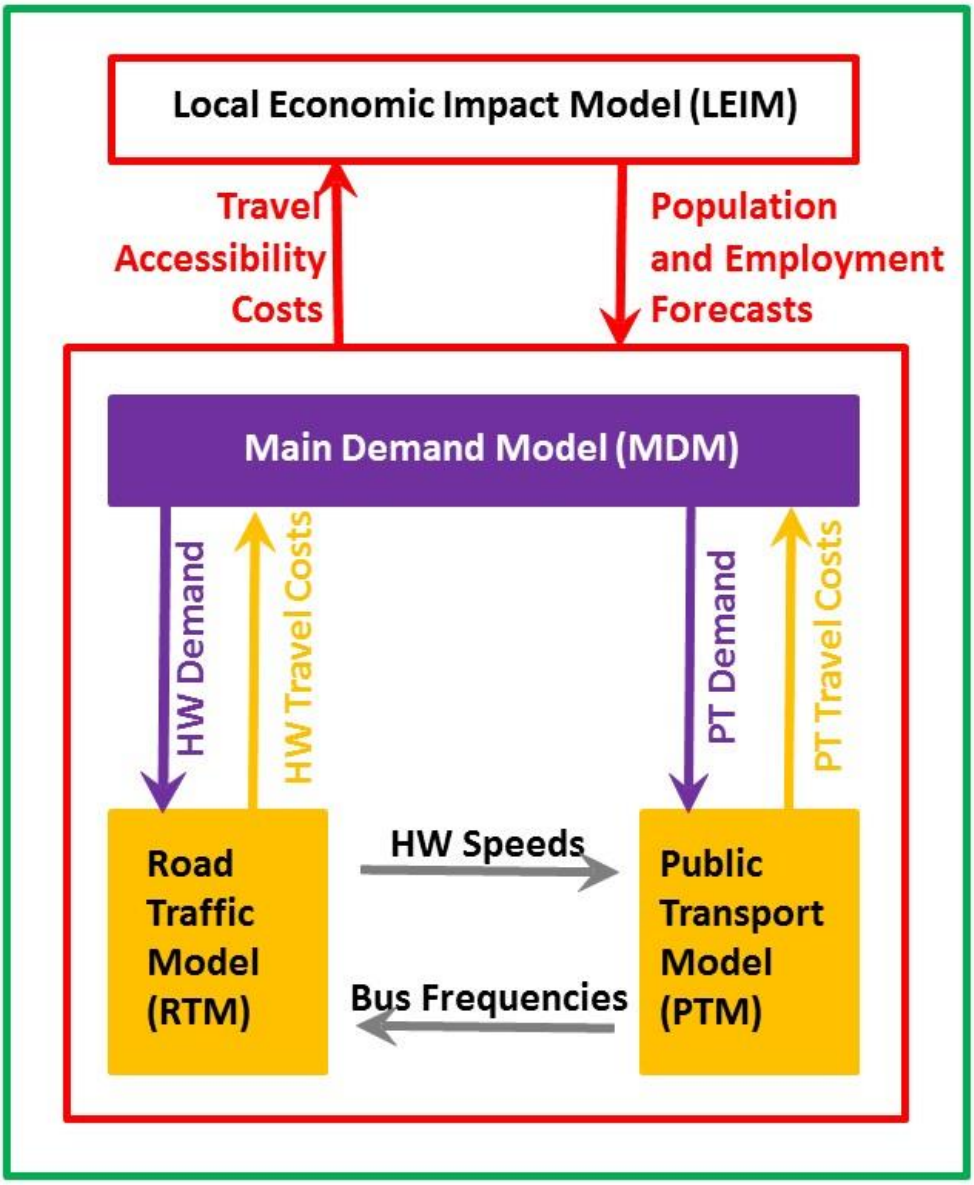
- Forecasting changes in travel demand, road traffic, public transport patronage and active mode use over time as a result of changing economic conditions, land-use policies and development, and transport improvements and interventions;
- Testing the impacts of land-use and transport policies and strategies; and
- Testing the impacts of individual transport interventions in the detail necessary for preparing submissions for inclusions in funding programmes.

2.1.2 The SRTM is a suite of linked models comprising of the following components:

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

2.1.3 The interaction of the sub-models is illustrated in Figure 1 below. The SRTM was originally developed, calibrated and validated against 2010 data and conditions and a Local Model Validation Report (LMVR) is available for this 2010 base-year model.

Figure 1. Interactions of Sub-Models within the SRTM



2.1.4 SYSTRA have recently updated the base year to 2015 survey data. The Validation Report is provided as T2 Model Validation Report.

2.1.5 New survey data has been collected in the Southampton and New Forest area's in 2015. The maps below in Figure 2 and Figure 3 shows the locations of the data that has been used as part of the 2015 re-base validation for Southampton and New Forest respectively.

Figure 2. Location of Validation Data Points for 2015 SRTM Validation - Southampton

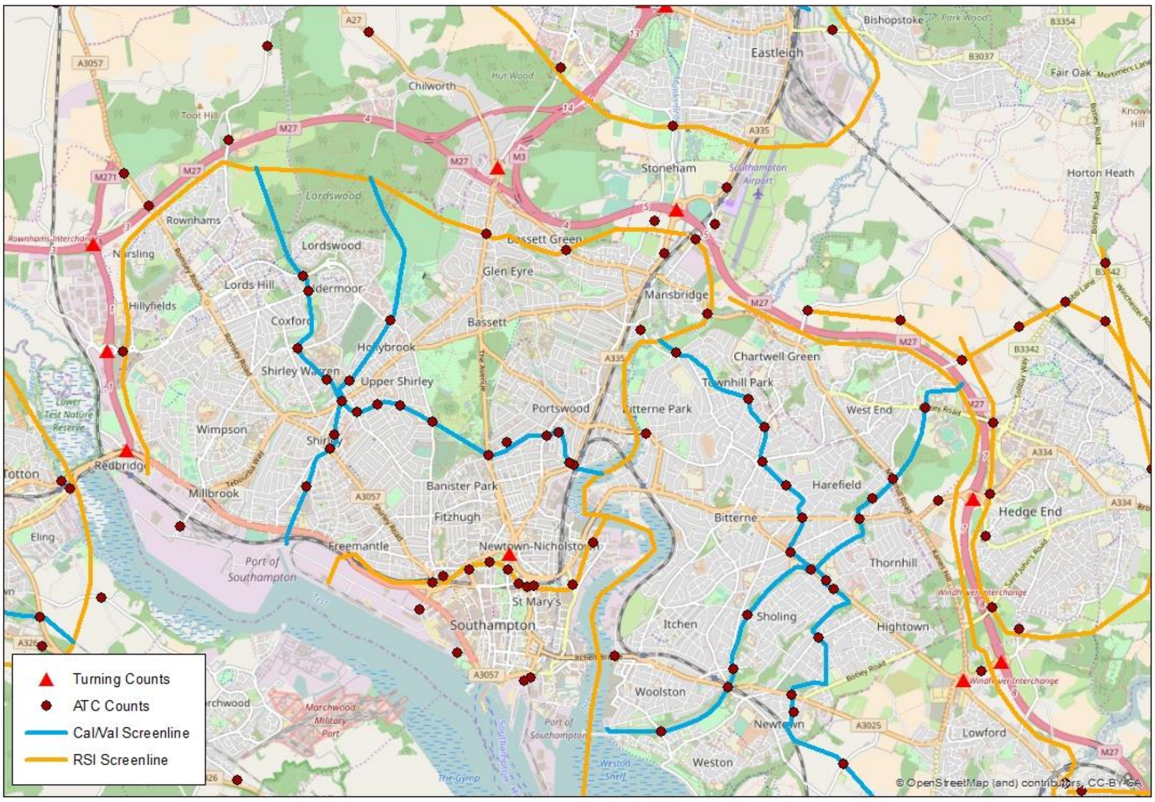
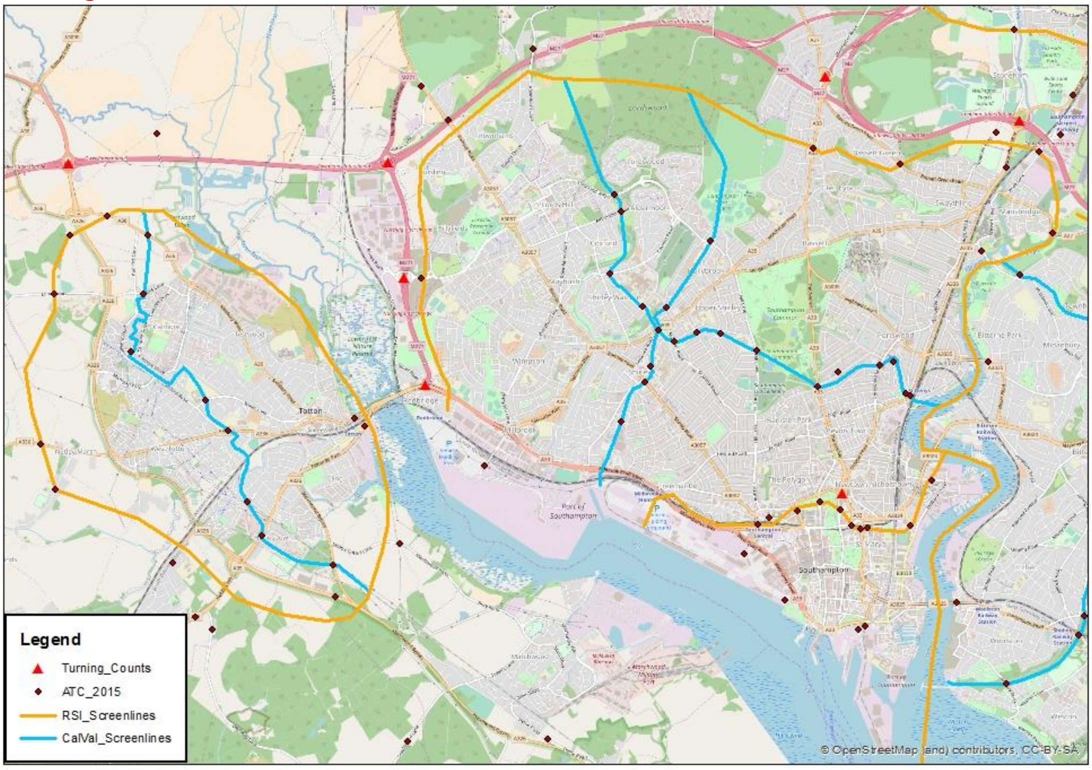


Figure 3. Location of Validation Data Points for 2015 SRTM Validation – New Forest



2.1.6 The 2015 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. The quality of the validation of the model is generally good, with the screenline validation performing particularly well, which is critical for ensuring that the demand in the model is correct for assessing multi-modal schemes and future changes.

2.1.7 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. 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, and the criteria disguises a good model performance that is close to meeting the acceptability guidelines.

2.1.8 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.

2.1.9 Appendix A of the T2 SRTM Validation Report presents the results of the cordon and screenline validation during the AM, IP and PM peak hours for both vehicles and cars. Within Southampton and the New Forest areas, there are 5 RSI cordons / screenlines (Southampton City Enclosure, Bitterne West Screenline, Bitterne East Screenline, Totton Enclosure and Southampton Enclosure) and 5 calibration screenlines (Totton, North of Southampton, South of Southampton, Bitterne Northwest to Southeast and Bitterne Southwest to Northeast). For all of the cordons, screenlines and time periods within Southampton, the overall validation performs well.

2.1.10 The individual link validation results for the validation and calibration cordons and screenlines within Southampton and the New Forest are also presented in Appendix A, expanding the data to report the link validation by user class (cars, LGV and HGVs). The relevant sections of the motorway link validation are also included within this appendix.

2.1.11 The journey time validation is presented in Appendix B, with routes 1 -7 being the routes in Southampton and New Forest.

2.1.12 There is another available transport model of the Southampton City Centre created in AIMSUM by WSPPB. However, the spatial coverage of this AIMSUM model is insufficient to pick up the main traffic diversions likely to be created by the proposed Southampton CAZ and the model does not include many of the changes in travel behaviour (notably mode and destination-choice) which are likely to be generated by the introduction of the CAZ. Any benefits from the modelling of the second-by-second interaction between vehicles available in the AIMSUN model are insufficient to overcome the limitations noted above or the costs associated with using a hybrid 2-traffic-model approach to modelling the traffic within the CAZ Study area.

3. BASE YEAR MODELLING

3.1.1 The base year for the SRTM model is 2015 (as discussed in the section above). This chapter summarises the main features of the SRTM and includes the following sections:

- Geographic scope
- Zoning system
- Timer period
- Traffic input data
- Vehicle disaggregation

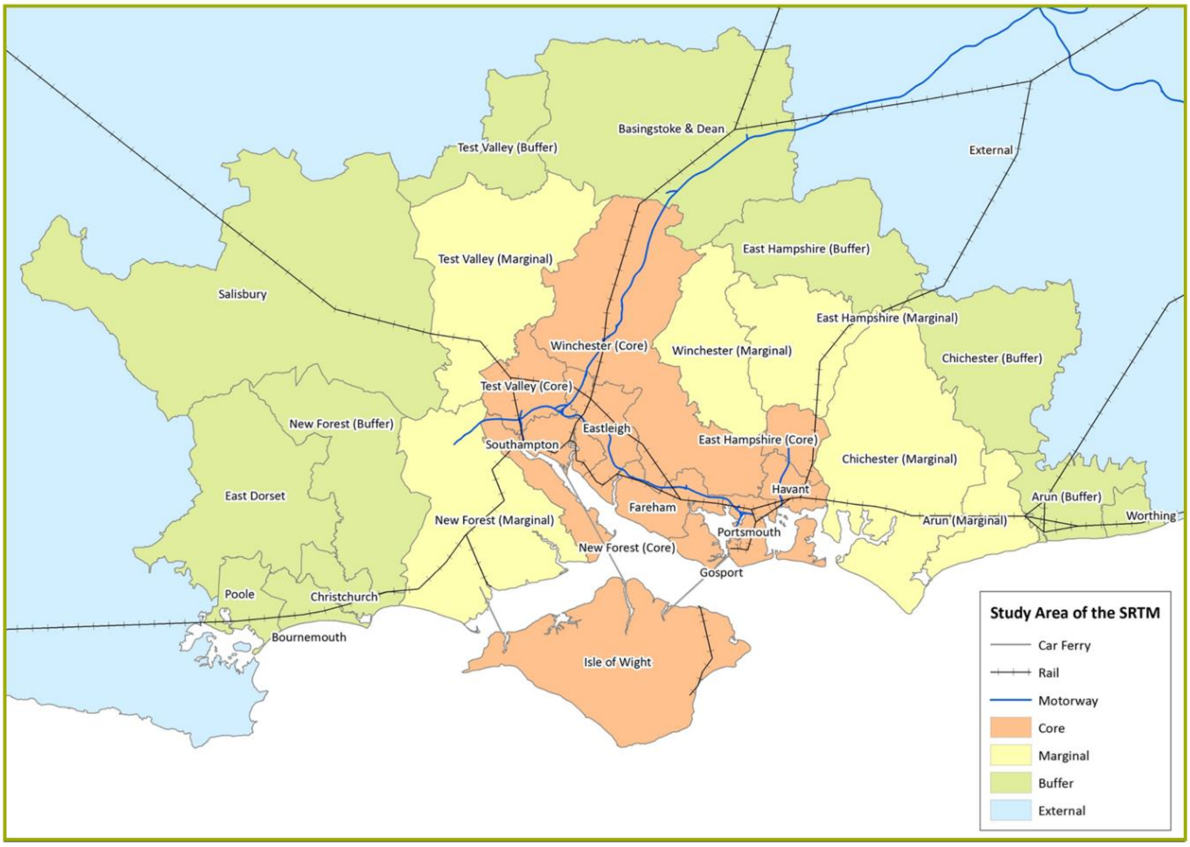
3.2 Geographic Scope

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

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

3.2.2 Figure 4 below shows these four regions within the SRTM. Southampton is within the Core Fully Modelled Area (the most detailed region of the model).

Figure 4. Study Area of the SRTM



3.3 Zoning System

3.3.1 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' (Core Fully Modelled Area) 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.

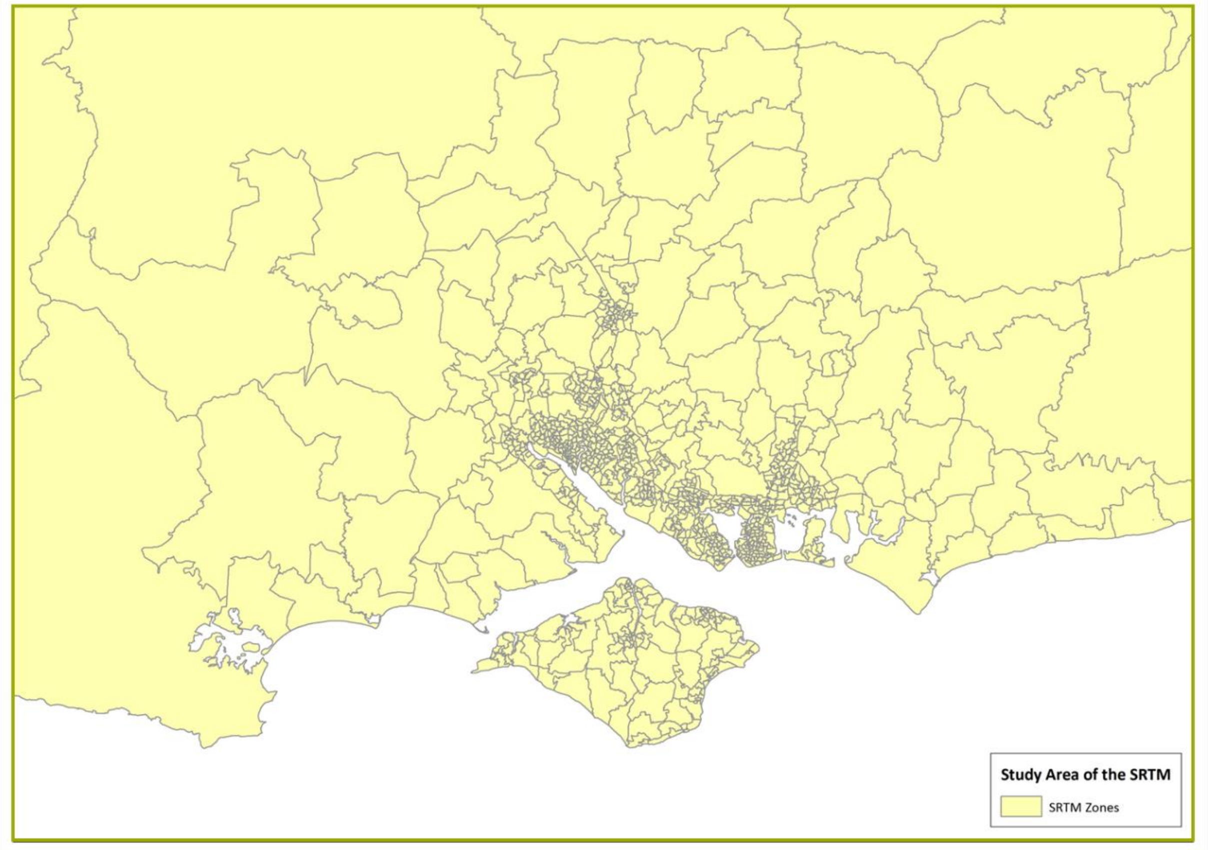
3.3.2 Within this study the zoning must also satisfy the requirements of all of the models within the model suite. Table 1 shows the various zone system requirements for each of the models.

Table 1. SRTM Suite Zone System Requirements

MODEL COMPONENT	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

3.3.3 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. 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. Figure 5 below shows the SRTM zone system around the study area.

Figure 5. SRTM Zone System



3.4 Time Period

3.4.1 Three weekday periods are modelled within the SRTM:

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

3.4.2 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 2.

Table 2. 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)

3.4.3 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.

3.5 Traffic input data

3.5.1 There are 4 main highway user classes modelled in the SRTM:

- Car employer's business
- Car other
- HGV
- LGV

3.5.2 The SRTM also models public transport including buses, trains and ferries.

3.6 Traffic count data

3.6.1 The traffic count data used in model validation was described in the section above.

3.7 Vehicle disaggregation

3.7.1 The SRTM provides 4 core vehicle categories from the air quality modelling work: Cars, HGVs, LGVs and buses. As described in section 4.2.2 of the Air Quality Modelling Methodology Report (AQ2), this was further broken down by splitting HGV's into rigid and articulated vehicles, and an assessment of the proportion of taxis in the vehicle flows. This was done using local count and ANPR data.

4. TRANSPORT FORECAST MODELLING

4.1.1 The SRTM model endeavours to represent transport conditions up to the year 2041. Known developments and committed (funded) highway schemes are included within the models' Reference Case scenarios (2019, 2026, 2031 and 2036) to provide a representation of future year transport supply and demand. Table 3 shows the list of committed highways schemes included within the standard SRTM Reference Case in Southampton and neighbouring districts.

Table 3. Reference Case Schemes

Scheme	Description	2015	2019	2026	2031	2036	2041		District
M27 J3	W/B off-slip and corresponding circulating lane flared to 3 lanes, M271 S/B approach flared to 3 lanes, M271 N/B flare lengthened		✓	✓	✓	✓	✓		Test Valley (Core)
Commercial Rd / Morris Rd / Wyndham Place	Public realm scheme, change to traffic signals		✓	✓	✓	✓	✓		Southampton
M271 Junction 1 / Brownhill Way	Signalisation of M271 Junction 1, additional carriageway on Brownhill Way to Adanac rbt		✓	✓	✓	✓	✓		Test Valley (Core)
A335 Leigh Rd / Passfield Avenue	Junction capacity changes		✓	✓	✓	✓	✓		Eastleigh
SMP M27	Smart motorways M27		✓	✓	✓	✓	✓		Southampton, Test Valley (Core), Eastleigh, Fareham, Winchester (Core), Portsmouth
M271 Redbridge Rbt. (RIS)	Option 2a (completion due 2018 / 2019) - HE will confirm post June 2017 general election		✓	✓	✓	✓	✓		Southampton
A33 Western Approach / Redbridge Rd / Millbrook Rd West	Reduction in speed limit from 50mph to 40mph		✓	✓	✓	✓	✓		Southampton
Woolston - Victoria Rd / Woodley Rd	Changes to Victoria Rd to one way southbound		✓	✓	✓	✓	✓		Southampton
Sundays Hill Bypass	New road alignment with 7.3m carriageway width and 30mph speed limit		✓	✓	✓	✓	✓		Eastleigh
St John's Link Road	6.5m carriageway width and 30mph speed limit		✓	✓	✓	✓	✓		Eastleigh
Chestnut Avenue / Stoneham Lane Roundabout	Roundabout improvements		✓	✓	✓	✓	✓		Eastleigh
Chestnut Avenue / Passfield Avenue Roundabout	Roundabout improvements		✓	✓	✓	✓	✓		Eastleigh
Burnett's Lane Link Road and roundabout	New road alignment between Burnetts Lane and Bubb Lane, extending to access road to Fir Tree Lane. 7.3m carriageway width and 30mph speed limit		✓	✓	✓	✓	✓		Eastleigh
Botley Road / Burnett's Lane	Signals		✓	✓	✓	✓	✓		Eastleigh
Allington Lane / B3037 Fair Oak Road	Signals		✓	✓	✓	✓	✓		Eastleigh
Southampton Road / Chestnut Avenue	Addition of a right turn lane (4 pcus)		✓	✓	✓	✓	✓		Eastleigh

4.1.2 The Smart Motorways measures planned for the M27 (which is assumed would be one of the main diversion routes) is likely to be introduced in 2020, and have been assumed to be in place (with additional capacity changes) from the SRTM model run year of 2019.

4.1.3 The 2019 Reference Case model does not include the disruption created during the construction of these network changes or the resulting changes in network capacity.

4.2 Forecast Year Uncertainty

4.2.1 The SRTM's standard 'Reference Case' scenarios representing forecast year conditions includes both new transport infrastructure schemes and landuse development assumptions to represent expected changes in conditions compared to the Base year.

4.2.2 Reference case transport infrastructure only include those schemes that have received the necessary planning approvals and are fully funded. This provides a high degree of certainty that the schemes will be constructed. Reference Case schemes within Southampton and neighbouring districts are listed above in Table 3.

4.2.3 In the standard Reference Case, landuse inputs (sqm floorspace) are derived from the Local Plans for each of the planning authorities and the records of granted planning permissions. The landuse model (LEIM) represents floorspace either as exogenous or permissible. Exogenous floorspace is always built-out within the model and represents those sites with planning permission or completed sites since the 2015 Base Year - hence exogenous floorspace has a high degree of certainty associated to it. Permissible floorspace refers to those locations identified as suitable for future development but that have not yet been subject to planning approval. The locations and maximum land use quantum of the permissible sites are based on Local Plan allocations. The take up of permissible developments is determined by the LEIM module of SRTM and is based on the local conditions (the relative 'attractiveness' of the development e.g. accessibility). Permissible floorspace has a lower degree of certainty but is still considered the most likely representation of future landuse growth based on available data.

4.2.4 The Local Plan information currently input to the SRTM dates from April 2016 and only includes for Adopted Plans at that time (it is anticipated that periodic updates of the landuse inputs will be undertaken to account for newly adopted Plans and planning permissions etc). In later model years, and particularly those beyond current Plan periods, the model includes a process referred to as 'intensification'. This enables continued growth to be represented within existing developed areas to allow TEMPRO forecasts to be met. Intensification is limited to those areas where development already exists because it is not considered appropriate for the model to arbitrarily allocate development to undeveloped areas. It follows that there is less certainty in the actual location of this growth.

4.3 Baseline Forecast

4.3.1 At the baseline stage the four user classes were split into the 12 user classes, as described below in Section 4.5.12. These different user classes were then run through the SRTM and assigned onto the network, providing the baseline which to compare the CAZ option results.

4.4 Options Forecast

4.4.1 The options forecasts or Do Something (DS) scenarios represent the transport model runs of the CAZ schemes. The proposed CAZ zones were modelled as cordons within the model, where different levels of charging can be applied to different user classes. The CAZ charging scheme applies to all non-compliant vehicles (determined by Euro standards classifications) which travel within a defined enclosed area. The charge is incurred once per day per vehicle.

4.5 Initial Sifting Options

4.5.1 Ten simplified model runs were undertaken for initial sifting of scheme options to explore the impact of various charging area schemes, using a highway only AM peak hour, 2019 fixed demand matrix assignment, with no demand model responses modelled.

4.5.2 Only vehicle ownership and re-routing responses were considered, with the expectation that a number of chargeable non-compliant trips divert to avoid the charge. The results from this sifting options provided an indication of the traffic flow changes, highway impacts and subsequent revenue of each scheme.

4.5.3 Only non-compliant vehicles incur any charges from travelling within the CAZ area. In the highway model tests, non-compliant vehicle demand is split into those beginning or ending their trips **inside** the CAZ area (so are forced to pay the charge), and those who are potentially passing through, so starting and ending their trip **outside** the CAZ area, with the option to re-route to avoid the charge.

4.5.4 Within the tests, non-compliant vehicles which begin or end their trips inside the CAZ (and are forced to pay the charge), do not consider changing their route. This avoids discouraging trips which may pass out of the enclosure then back in. However, these vehicles are included as non-compliant charged types in the outputs.

4.5.5 To establish the compliant and non-compliant vehicle split within the model, JAQU's assumptions for the behavioural responses of vehicle owners to the CAZ charges set out below in Table 4 were utilised. Our understanding is that these assumptions are based on data provided by TfL in relation to expected responses to the London ULEZ. When modelling the CAZ in Southampton, the ULEZ charges were used so that consistency is maintained with the JAQU behavioural response data. The charging structure is modelled as follows:

- **Cars and LGVs:** £12.50
- **HGVs;** £100

4.5.6 Within the highway assignment model, the charge is applied by half on all CAZ entrance and exit network links, ensuring that over a single journey the full charge is incurred.

4.5.7 Table 4 below outlines JAQU assumptions for behavioural responses to the CAZ. The national fleet mix in 2020 is taken as a starting point for compliant/ non-compliant proportions, then the CAZ behavioural response acts on the non-compliant trip makers within the non-compliant group.

4.5.8 Since the demand model captures trips paying the charge, avoiding the zone and cancelling the trip in response to local conditions, just the vehicle upgrade is required to be applied externally according to JAQU guidance. Here trip makers using non-compliant vehicles to make trips which are deemed to be affected by the CAZ respond by upgrading their vehicle to become compliant, using the figures highlighted in bold.

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Table 4. JAQU Assumptions on Behavioural Response to the CAZ

PROPORTION OF NON-COMPLIANT VEHICLE KILOMETRES WHICH REACT TO THE ZONE

	Petrol Cars	Diesel Cars	Petrol LGVs	Diesel LGVs	RHGVs	AHGVs	Buses	Coaches
Pay charge – Continue into zone	7.1%	7.1%	20.3%	20.3%	8.7%	8.7%	0.0%	15.6%
Avoid Zone – Vkms removed, modelled elsewhere	21.4%	21.4%	10.0%	10.0%	0.0%	0.0%	0.0%	0.0%
Cancel journey – vkms removed completely	7.1%	7.1%	6.0%	6.0%	8.7%	8.7%	6.4%	12.5%
Replace Vehicle – vkms replaced with compliant vkms	**64.3%**	**64.3%**	**63.8%**	**63.8%**	**82.6%**	**82.6%**	**93.6%**	**71.9%**

Source: JAQU, CAZ Technical working group minutes – 15/02/2017

4.5.9 The resulting assumed compliance split is provided in Table 5. Across the highway demand the national fleet split is assumed, except where drivers are deemed to respond to the CAZ charging scheme according to the below criteria. For example, for HGVs the national non-compliant level is 14.86% but if affected by the CAZ then 82.6% of those that upgrade vehicles, leaving a non-compliant level of 2.59% (97.41% compliant).

Table 5. Compliance Split Assumptions Used

	% OF COMPLIANT VEHICLES	
VEHICLE TYPE	NATIONAL FLEET MIX IN 2020	REACTING TO CLEAN AIR ZONE
Cars	73.81	90.65
Vans	70.13	89.19
HGVs	85.14	97.41

4.5.10 In the transport model, the higher compliance rate applies to vehicle demand satisfying one of two criteria:

- Where the trip starts or ends within the CAZ area (i.e. an **'inside'** trip)
- Where the trip passes through the CAZ area in the Do Minimum (without charging) scenario (i.e. they travel across the CAZ area but are an '**outside'** trip)

4.5.11 The national fleet split applies to all other demand which is not passing through the CAZ area in the Do Minimum.

4.5.12 To support greater understanding of vehicle behaviour when the CAZ is introduced, the matrices were split into compliant and non-compliant vehicles. As only non-compliant vehicles incur any charges from travelling within the CAZ area, this is further split into those beginning or ending their trips inside the CAZ area and those who pass through the CAZ area (so start and end their trip outside the CAZ area). The compliance split is applied to the existing four Solent highway model user classes, as described below in Table 6, thus ending up with 12 user classes.

Table 6. User Class Compliance Split

VEHICLE TYPE	SOLENT MODEL USER CLASS	NEW USER CLASS – NON COMPLIANT OUTSIDE CAZ AREA	NEW USER CLASS – NON COMPLIANT TO/FROM INSIDE CAZ AREA	NEW USER CLASS - COMPLIANT
Car (in work)	1	1	5	9
Car (not in work)	2	2	6	10
LGV	3	3	7	11
HGV	4	4	8	12

4.5.13 Ten initial sifting runs were undertaken in the SRTM, comparing the lowest demand vehicle class charged (class B&C) against the highest demand vehicle class charged (class D).

4.6 Citywide CAZ – Class B

4.6.1 Based on the ten sifting options, SYSTRA undertook further testing for the preferred scenario, citywide charging of class B (HGVs) within the full demand model. While the sifting analysis only tested the effect of compliance shift (travellers replacing non-compliant vehicles) and re-routing within the AM peak hour, the full demand model run incorporates the inter-peak (1000-1600), PM period (1600-1900) and off peak (1900-0700) time periods as well as the potential for travellers to further alter their behaviour in response to experience of the network. Behavioural responses within the model includes changing modes (to/from public transport or active modes), changing the time of day in which they travel or by changing destination.

4.6.2 Goods vehicle demand is not incorporated within the demand model. When examining HGV charging, the only demand model effect is by travellers in response to the change in HGV behaviour (re-routing to avoid the toll where possible).

4.6.3 For the preferred scenario, only non-compliant goods vehicles incur any charges from travelling within the city-wide CAZ area. As in the sifting option analysis tests, non-compliant heavy goods vehicular demand is split in to those beginning or ending their trips **inside** the CAZ area (so are forced to pay the charge) and those who are potentially passing through, starting and ending their trip **outside** the CAZ area (and may reroute to avoid the charge).

4.6.4 In the preferred scenario, non-compliant heavy goods vehicles which begin or end their trips inside the CAZ area (so are forced to pay the charge) do not consider the charge in their route choice. This avoids discouraging trips which may pass out of the enclosure then back in. However, these vehicles are included as non-compliant charged vehicles in provided network statistics and revenue calculations.

4.6.5 HGVs are assumed to be charged £100 for one day of travel within the CAZ area. This has been implemented as a £50 charge for each trip within the highway assignment model, assuming that HGVs make two trips per day.

4.6.6 The assumed compliance split for all vehicular demand, following JAQU guidance, is provided in Table 5, as per the sifting tests. The national fleet split is generally assumed, except where drivers would respond to the CAZ charging scheme (note that in this test only HGV demand responds). In this case the compliance rate increases to account for drivers replacing their non-compliant vehicle with a compliant vehicle.

4.6.7 HGV demand that is classified as 'reacting to the clean air zone' is identified by analysis of routing in the Do Minimum situation. A 'cordon' is set up within the Saturn assignment software at the proposed CAZ boundaries and trips passing through are identified and flagged where at least 5% of the total OD movement demand passes through.

4.6.8 The demand is split in to classifications which are treated differently:

- **Outside – Outside:** demand does not interact with the CAZ area in the Do Minimum scenario. Remains at national split of compliant/ non-compliant despite the introduction of the CAZ scheme. Non-compliant vehicles would be charged within the highway assignment model if attempting to enter the CAZ area.
- **Through:** Demand passes through the CAZ area in the Do Minimum scenario. In the 'compliance shift' demand matrix, a proportion of the non-compliant demand moves to the new 'compliant shift' compliant userclass which is not charged. The 'compliant shift' userclass is anticipated to have a different vehicle composition than the original 'compliant' userclass, as these are vehicles which have upgraded most recently in response to the CAZ scheme.
- **To/ from CAZ:** These trips are not charged within the assignment model as they would pay the charge with no choice and continue making their trips post-implementation. A portion of the non-compliant demand in this category moves in to the 'compliant shift' compliant userclass.

4.7 Model Outputs

4.7.1 The transport modelling outputs were used for the air quality modelling, with a network review of the SRTM undertaken to check the modelled highway network matches the spatial road layout to ensure successful validation required for the air quality modelling.

4.7.2 The outputs that were provided from the SRTM was in the form of a link based dataset and covered:

- AADT (annual average daily traffic) on each road link in the traffic model;
- AAWT (annual average weekday traffic) on each road link in the traffic model; and
- Journey time on each road link, alongside junction delay, in the traffic model.

4.7.3 For both the AADT and AAWT, the data was reported in the number of vehicles using a link by each user class.

4.7.4 The AADT was calculated from peak hour, inter-peak and off peak model flows, using factors derived from local traffic counts in the Southampton area.

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Solent Transport Evidence Base

11/06/2018

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SRTM MODEL FORECASTING SUMMARY

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SOLENT TRANSPORT EVIDENCE BASE

SRTM MODEL FORECASTING SUMMARY

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1. INTRODUCTION

1.1 Background

1.1.1 SYSTRA Ltd 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.

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

- forecasting changes in travel demand, road traffic, public transport patronage and active mode (walking and cycling) use over time as a result of 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.

1.2 Scope of Report

1.2.1 This Model Forecasting Report covers all components for the Sub Regional Transport Model that are used to forecast travel demand in forecast years. This includes sections covering the operation of the models in forecast mode, input assumptions and future year results for the:

- Main Demand Model (MDM),
- Gateway Demand Mode (GDM);
- Local Economic Impact Model (LEIM);
- Road Traffic Model (RTM); and
- the Public Transport Model (PTM)

1.3 Report Structure

1.3.1 The structure of the chapters following this introduction are as follows:

- Chapter 2 describes how the components of the SRTM fit together and what information is passed between them;
- Chapter 3 details the input assumptions for the Forecast Reference Cases over the years in terms of growth assumptions and committed (and therefore represented) intervention schemes;
- Chapter 4 defines input assumptions for the future years both generic and parameters specific to each of the SRTM model components;
- Chapters 5 & 6 present development and demand results from LEIM and MDM/GDM;
- Chapters 7 & 8 show results pertaining to the Assignment Models (RTM & PTM).

2. SUB-REGIONAL TRANSPORT MODEL OVERVIEW

2.1 Introduction

2.1.1 This chapter provides an overview of the Sub-Regional Transport Model (SRTM), concentrating on how its modules interact to estimate travel costs and demand across the forecast years: 2019, 2026, 2031, 2036 and 2041.

2.1.2 More detailed technical specifications of these modules can be found in R2: Model Development Report, R4: Road Traffic Model Development Report and R5: Public Transport Model Development Report.

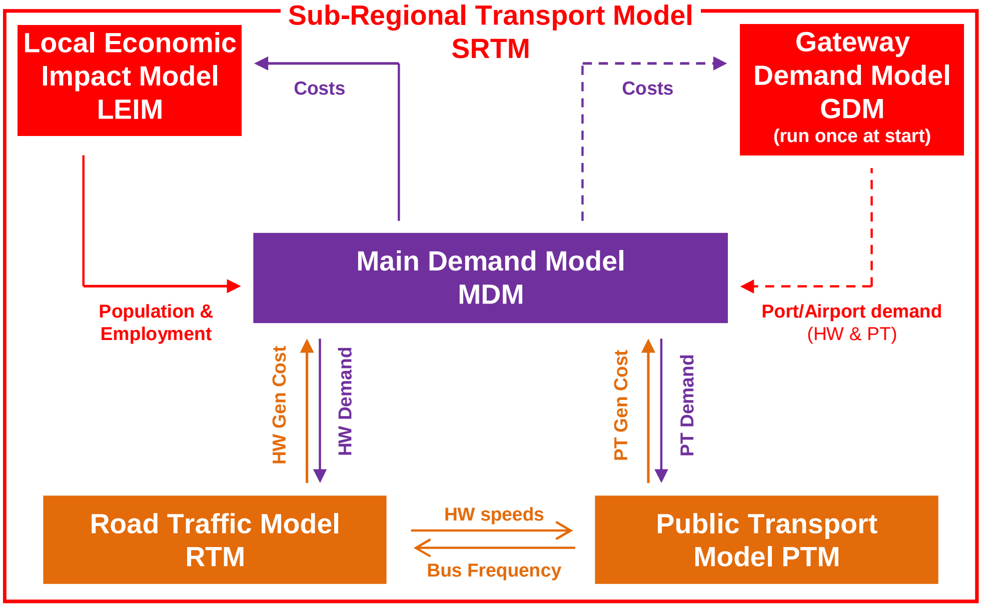
2.2 Model Overview

2.2.1 The Solent Transport 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).

2.2.2 **Error! Reference source not found.** shows the interaction of the various models within the SRTM. The LEIM takes transport costs from a converged run of the MDM and feeds back population and employment data, which is converted into demand matrices. The public transport and road traffic demand are assigned to the public transport and road traffic networks to estimate travel costs, which are then passed back to the MDM to re-estimate demand. The demand and cost calculations are run iteratively, until convergence.

2.2.3 The MDM, which models travel demand responses to changes in costs, including: macro time of day choice, mode choice and destination choice. Each of these choices is modelled as a function of the time and money cost of each alternative, e.g. car, public transport, park-and-ride or walk/cycle. For HW and PT trips, route choice is modelled using the respective assignment models.

Figure 1. The SRTM and the Interaction of the Various Models



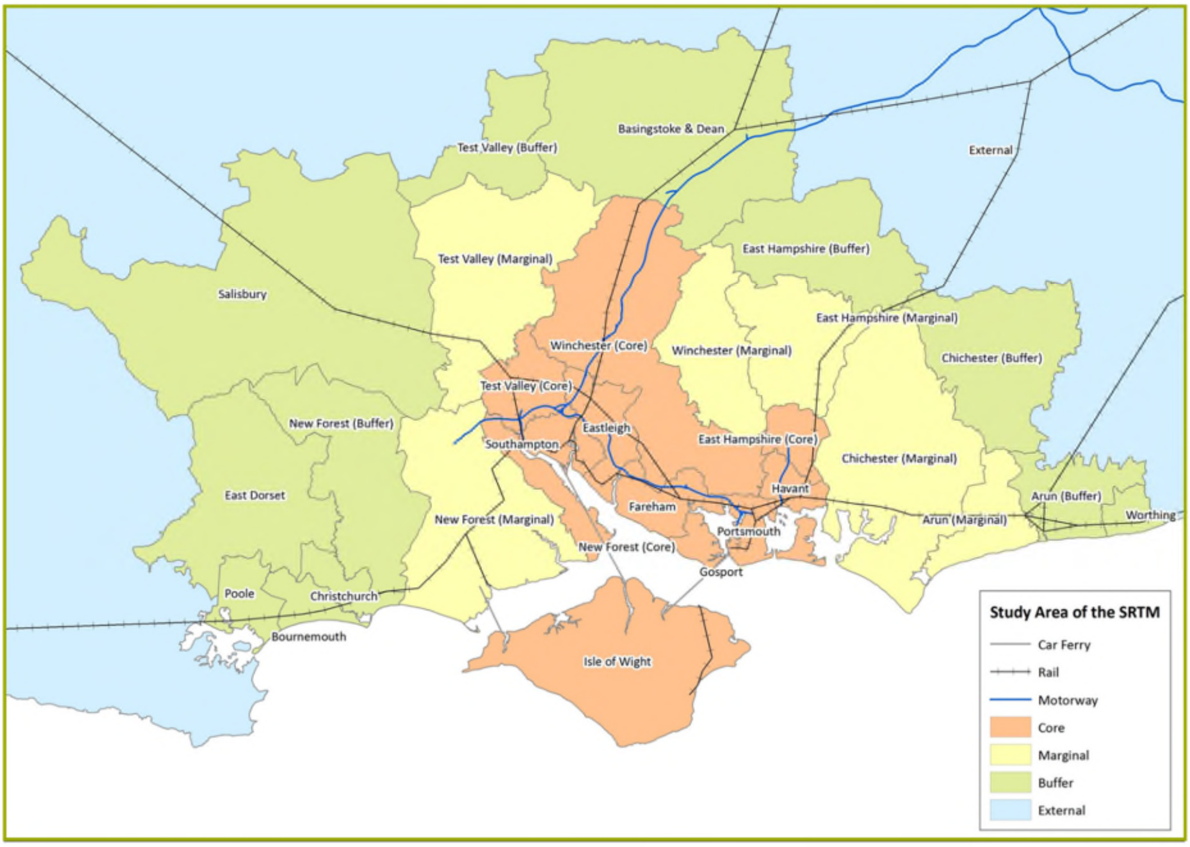
Zoning and Geography

2.2.4 The model has the four model regions shown in Table 1 and Figure 2. In the Core and Marginal Fully Modelled Areas (FMA), the zones are mainly defined as groups of Census Output Areas (COAs) and Census Wards (CWs), respectively. Outside the FMA, the zones are based on Districts and, farther away, on Counties. Largely using COA and CW based zone definitions ensures consistency with the LEIM and the planning data that is used in calculating base year trip ends and future growth.

Table 1. Model Region Definitions

Region	LEIM / MDM Trip Ends Detail	RTM / PTM Detail
Core Fully Modelled Area	Full Land Use Forecast Model (based on building sq metres by zone)	Detailed (Simulation) Network
Marginal Fully Modelled Area		Simpler (Speed Flow) Network
Buffer Area	Coarser (Ward based)	Coarse (Fixed Speed) Network RTM / PTM Detail

Figure 2. Study Area and Regions



Model Segmentation

2.2.5 The SRTM considers all weekday (Monday to Friday) travel over a 24 hour period. Four distinct travel time periods are modelled:

- morning peak (07:00-10:00);
- inter peak (10:00-1600);
- evening peak (1700-1800); and
- off-peak (1900-0700).

2.2.6 For personal trips, six trip purposes are modelled. These are home-based work (HBW), home-based employer's business (HBB), home-based education (HBE), home-based other (HBO), non home-based employer's business (NHB), and non home-based other (NHO).

2.2.7 Three car availability classes and 4 person-types are also defined. The three car availability classes are defined for households: households with no car, households with car competition (fewer cars than adults) and households with no car competition (number of cars is greater or equal to the number of cars). The four person types are: child, working adult, non working adult, retired.

Travel Demand

2.2.8 A significant proportion of the travel people make is associated with a place of residence. These journeys are represented as an array containing the number of 2-way journeys made from the home zone to a workplace, school, shop, or other attractor. The out and return time periods are defined for each return journey. These combinations of out and return time periods are referred to as tours.

2.2.9 There are also journeys made from non-home origins to non-home destinations, in particular those made by employees in the course of their employment, denoted as employers' business trips. The demand for these trips is represented on an origin-destination basis.

2.2.10 The demand for goods vehicles is also represented in terms of origin-destination matrices. Only route choice is represented for goods vehicles; demand responses such as destination and time period choice are not modelled.

Transport Supply

2.2.11 The RTM and PTM are used to prepare a representation of transport supply (travel times and costs) for the computations in the demand model.

2.2.12 The RTM contains a comprehensive representation of the highway network across the Core and Marginal Fully Modelled Areas. In the Core FMA, the interaction of different traffic streams is considered when extracting the costs. In the Marginal FMA, flow/delay relationships are used to represent the impacts of congestion on travel costs. Fixed speed networks are assumed outside the FMA.

2.2.13 For public transport, the PTM model includes details of the routes, fares and frequencies of rail, bus and passenger ferries to, from and within the Core FMA. In-vehicle congestion is not modelled in the PTM. On-road travel times are transferred from the RTM to the PTM, with a factor used to reduce car speeds to reflect the fact that buses typically travel more slowly than cars.

2.2.14 For the active modes (walking and cycling), constant speeds are assumed across the forecast years.

2.2.15 The MDM, RTM and PTM have identical zoning systems, designed based on considerations of highway network access, bus stop catchment size, bus corridors and fare zones.

2.3 SRTM in Forecasting Mode

2.3.1 The calibration of all the components of the SRTM is described in R2 (LEIM, MDM and GDM models calibration and validation), R4 (RTM calibration and validation) and R5 (PTM calibration and validation).

2.3.2 In forecasting mode, the SRTM operates as shown in Figure 3. The SRTM produces demand and cost estimates for 2019, 2026, 2031, 2036 and 2041.

2.3.3 Based on the base year (2015) costs, LEIM produces population and employment forecasts for the next forecast year, 2019. Along with the adjusted trip rates, these forecasts are used to calculate growth factors for the productions and attractions.

2.3.4 The from-home production trip rates derived from NTEM were adjusted to match the observed trip volumes on the validated base year RTM and PTM and 2015 population and employment statistics. The trip rates vary by period and mode of transport, for the 12 person-type/household categories.

2.3.5 Attraction-end growth factors are derived for each zone and purpose using the LEIM outputs and trip attraction weights obtained from NTEM.

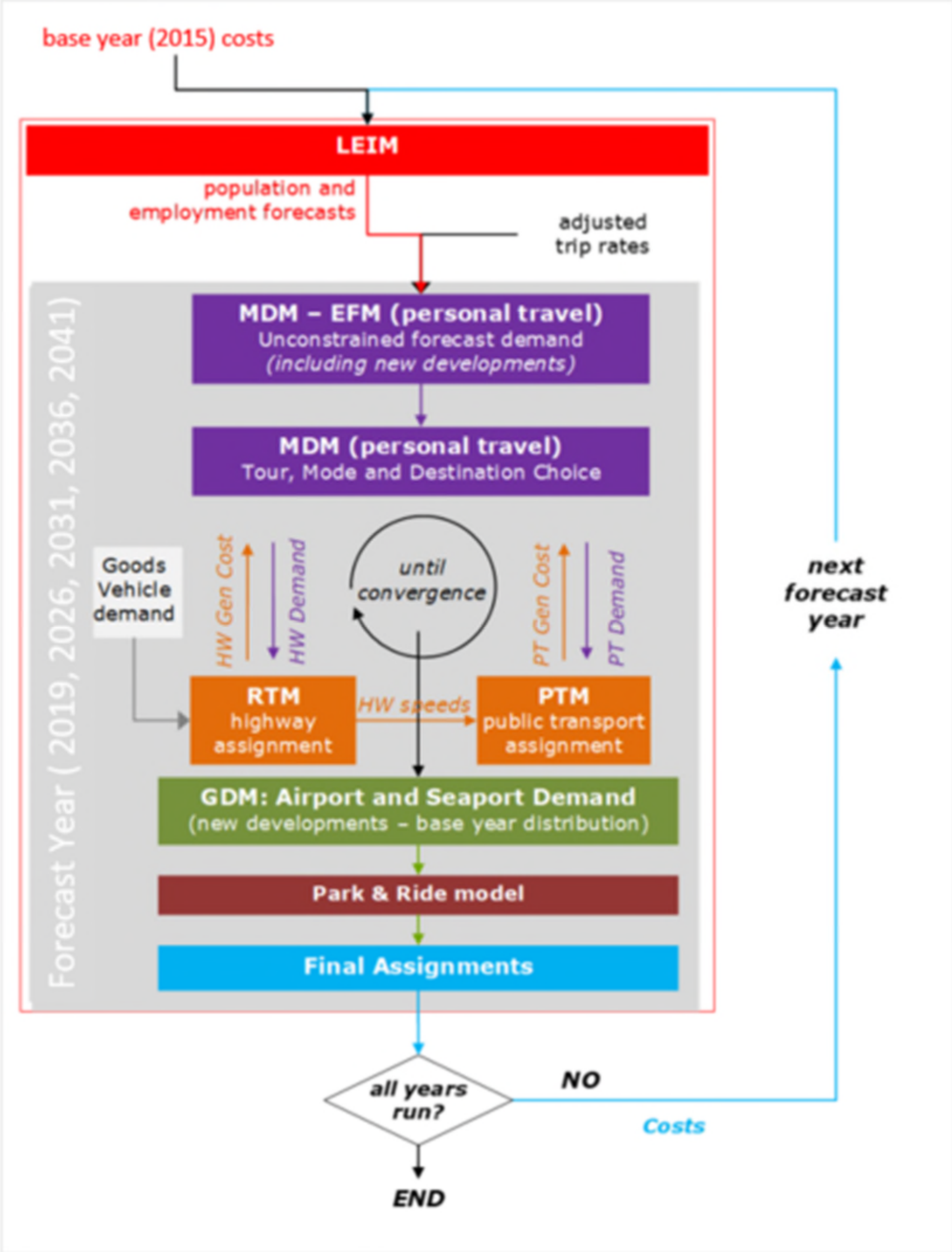
2.3.6 For non home-based trips, which are stored as origin destination matrices, the growth in attractions is applied to both ends of the trips.

2.3.7 The LEIM gives population and employment forecasts for zones in the FMA. For zones outside the FMA, growth factors derived from TEMPRO are applied by mode and purpose/car availability segment.

2.3.8 For new developments, where little or no representative demand exists in the base year matrices, travel patterns are derived in absolute terms. The trip ends are derived by the planning variables associated with the new developments with the production trip rates and the attraction weights.

2.3.9 The MDM then calculates the demand responses to the change in costs. Tour choice, mode choice and destination choice responses are modelled in the MDM. Highway and public transport users' route choices are modelled in the RTM and PTM. Route choice is not modelled for walk and cycle trips. The MDM works iteratively with the RTM and PTM. For each period, mode and purpose the MDM calculates demand using some initial cost assumptions. The RTM and PTM calculate the route costs and feed them back to the MDM, which will recalculate the demand.

Figure 3. SRTM Forecasting – flow chart



2.3.10 Using the converged highway and public transport costs, the GDM calculates the total number of trips to/from the seaports and Southampton Airport and distributes them appropriately. Demand corresponding to the GDM zones are replaced by the demand from the GDM to produce the final demand that is assigned on the road and public transport networks.

2.3.11 The final RTM and PTM assignments are used to assess the operation of the network and provide costs for the next forecast year (2026, after 2019, and so on).

3. REFERENCE CASE DEFINITIONS

3.1 Introduction

3.1.1 Reference Case definitions have been developed for five forecast year scenarios for use with SRTM, and form the basis of the 2019, 2026, 2031, 2036 and 2041 reference cases.

3.1.2 The key assumptions included in these reference case models are described in this chapter. These cover economic, demographic, land-use and transport supply changes in forecast years. The gateway model inputs for the corresponding years are also described.

3.2 Supply Changes

Highway Network Changes

3.2.1 The schemes included in the reference case networks are shown in Table 2. The schemes are included in the reference case networks for all of the modelled years (2019, 2026, 2031, 2036 and 2041).

Table 2. Road Network Changes Summary

District	Scheme	2019	2026	2031	2036	2041
Eastleigh	Botley Road / Burnett's Lane	✓	✓	✓	✓	✓
Eastleigh	Allington Lane / B3037 Fair Oak Road	✓	✓	✓	✓	✓
Eastleigh	Southampton Road / Chestnut Avenue	✓	✓	✓	✓	✓
Fareham	St Margaret's Rbt.	✓	✓	✓	✓	✓
Fareham	Peel Common Rbt.	✓	✓	✓	✓	✓
Fareham	Gudge Heath Lane	✓	✓	✓	✓	✓
Fareham	A27 Southampton Road, Fareham	✓	✓	✓	✓	✓
Fareham	Newgate Lane South, Fareham	✓	✓	✓	✓	✓
Fareham	Station Roundabout (Avenue approach)	✓	✓	✓	✓	✓
Fareham	Stubbington Bypass		✓	✓	✓	✓
Fareham	Peel Common Rbt.		✓	✓	✓	✓
Fareham, Gosport	Stubbington Bypass mitigation measures		✓	✓	✓	✓
Fareham,W'chester	M27 J9 and Parkway South roundabout	✓	✓	✓	✓	✓
Havant	Hulbert Rd/Purbook Way Jn (Dunsbury Hill)	✓	✓	✓	✓	✓
Havant	Dunsbury Hill Farm Business Park	✓	✓	✓	✓	✓
Havant	A3(M) J3	✓	✓	✓	✓	✓
Havant	Purbook Way / College Road	✓	✓	✓	✓	✓
Havant	Interbridges	✓	✓	✓	✓	✓
Havant	Purbrook Way / Stakes Hill Road		✓	✓	✓	✓
Havant	Purbrook Way f. Stakes Hill Rd to College Rd		✓	✓	✓	✓
Havant	Hulbert Rd / Frendstaple Rd / Tempest Ave		✓	✓	✓	✓
Havant/P'mouth	Hayling Island ferry service	✓	✓	✓	✓	✓
Isle of Wight	Mill Street, Newport	✓	✓	✓	✓	✓
Isle of Wight	St. Georges Way, Newport	✓	✓	✓	✓	✓
Isle of Wight	Forest Road / Parkhurst Rd, Newport	✓	✓	✓	✓	✓
Isle of Wight	Coppins Bridge - St Georges Approach	✓	✓	✓	✓	✓
Portsmouth	Havant Road/Eastern Road	✓	✓	✓	✓	✓
Portsmouth	The Hard, Queen St, Wickham St, Clock St	✓	✓	✓	✓	✓
Southampton	Commercial Rd/Morris Rd/Wyndham Place	✓	✓	✓	✓	✓
Southampton	M271 Redbridge Rbt. (RIS)	✓	✓	✓	✓	✓
Southampton	A33 W Approach/Redbridge Rd/Millbrook Rd W	✓	✓	✓	✓	✓
Southampton	Woolston - Victoria Rd / Woodley Rd	✓	✓	✓	✓	✓
Test Valley	M27 J3	✓	✓	✓	✓	✓
Test Valley	M271 Junction 1 / Brownhill Way	✓	✓	✓	✓	✓
Various	Smart Motorways M27	✓	✓	✓	✓	✓

Public Transport Supply

3.2.2 The equivalent list of public transport schemes are shown in Table 3 As with the road network schemes, the public transport schemes are included in the reference case networks for all of the modelled years.

Table 3. Public Transport Network Changes

Scheme	2019	2026	2031	2036	2041
Eclipse Bus Rapid Transit Line Extension (Gosport)	✓	✓	✓	✓	✓

3.3 Demand Changes

Planning Input Data

3.3.1 The residential dwelling planning inputs are shown in Table 4 (Note: These are approximate as actual inputs are based on residential floorspace). The inputs are shown by district for the Core Modelled Area. The number of dwellings is shown for each of the modelled years.

3.3.2 The inputs are based on Local Authority data (provided centrally via HCC) as at April 2016 in accordance with adopted Local Plans at that time (it is anticipated that periodic updates of the landuse inputs will be undertaken to account for newly adopted Plans and planning permissions etc). In later model years beyond current Local Plan periods, the landuse module of the SRTM can replicate additional development floorspace over and above the allocated sites through a process of intensification of existing sites. This enables continued growth to be represented within existing developed areas. Intensification is limited to those areas where development already exists because it is not considered appropriate for the model to arbitrarily allocate development to undeveloped areas. It follows that there is less certainty in the actual location of this growth. The impact of intensification is not accounted for in the tables below.

Table 4. Residential Dwellings LEIM Planning Input (permissible)

	Total Planning Inputs				
District	2015-2019	2015-2026	2015-2031	2015-2036	2015-2041
East Hampshire (Core)	641	1,511	1,599	1,599	1,599
Eastleigh	3,275	5,430	5,680	5,680	5,680
Fareham	1,402	3,996	5,496	6,996	7,796
Gosport	1,070	2,046	2,167	2,167	2,167
Havant	2,162	3,912	4,104	4,104	4,104
New Forest (Core)	257	796	926	1,001	1,062
Test Valley (Core)	1,175	2,824	3,224	3,274	3,282
Winchester (Core)	1,575	5,665	6,389	6,389	6,389
Portsmouth City	1,488	3,356	3,856	3,952	3,952
Southampton City	3,252	5,399	5,486	5,556	5,556
Isle of Wight	2,376	3,960	3,960	3,960	3,960
Core Modelled Area	**18,673**	**34,935**	**38,927**	**40,718**	**41,587**

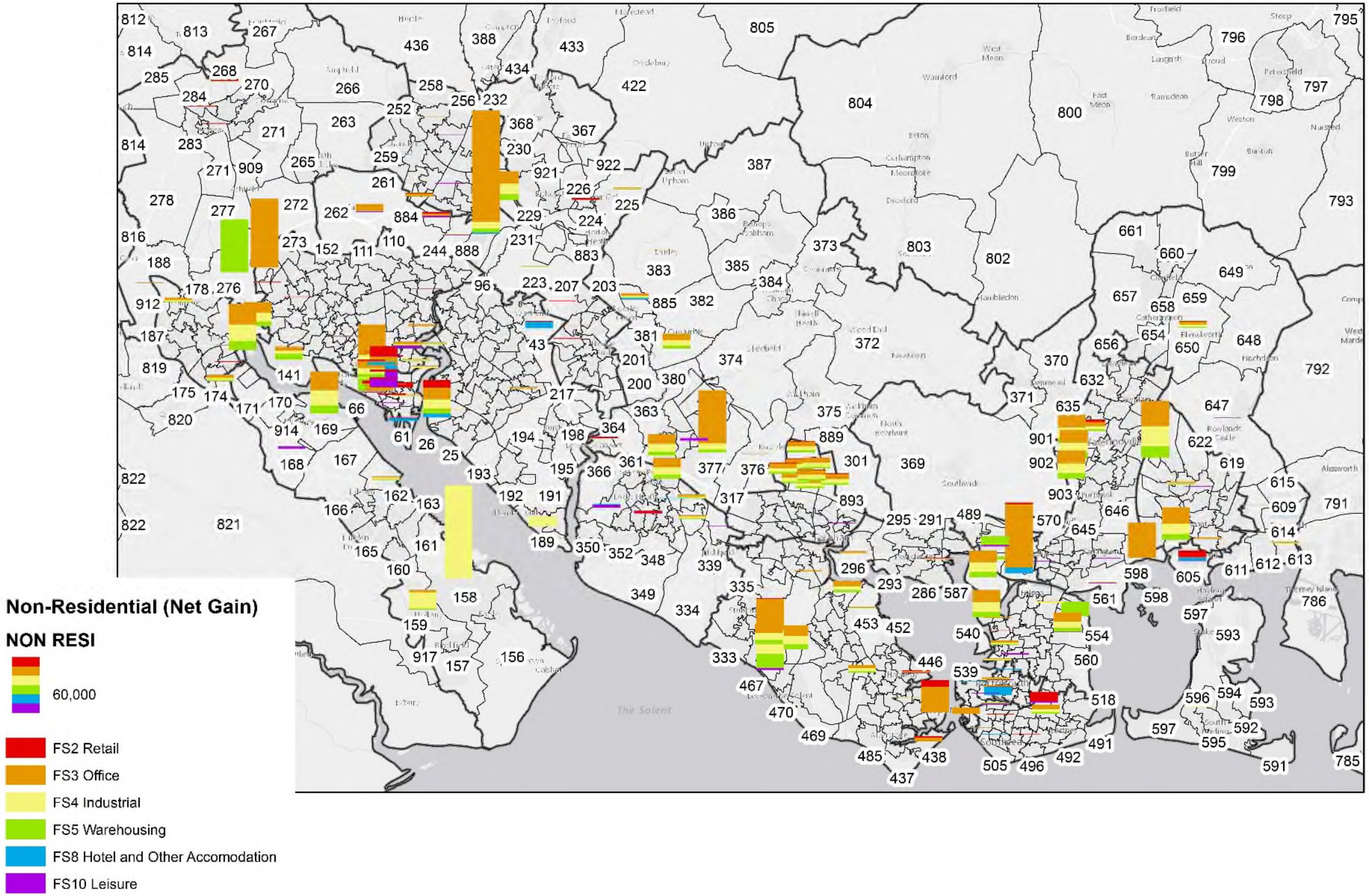
3.3.3 The employment floorspace planning inputs are shown in Table 5. The inputs are shown by district for the Core Modelled Area. The level of floorspace is shown for each of the modelled years.

Table 5. Employment Floorspace (m^2) LEIM Planning Input (permissible) (Office+Industrial+Warehousing)

Total Planning Inputs					
District	**2015-2019**	**2015-2026**	**2015-2031**	**2015-2036**	**2015-2041**
East Hampshire (Core)	6,800	6,800	6,800	6,800	6,800
Eastleigh	25,423	188,283	188,283	188,283	188,283
Fareham	55,212	197,758	197,758	197,758	197,758
Gosport	90,949	131,233	131,233	131,233	131,233
Havant	91,374	150,146	150,146	150,146	150,146
New Forest (Core)	68,624	234,855	234,855	234,855	234,855
Test Valley (Core)	128,062	142,862	142,862	142,862	142,862
Winchester (Core)	94,911	177,395	177,395	177,395	177,395
Portsmouth City	126,001	210,944	210,944	210,944	210,944
Southampton City	-361	175,961	175,961	175,961	175,961
Isle of Wight	89,959	95,195	95,195	95,195	95,195
Core Modelled Area	**776,954**	**1,711,432**	**1,711,432**	**1,711,432**	**1,711,432**

3.3.4 Figure 4 shows the permissible development LEIM input. It is presented by zone and floorspace type.

Figure 4. LEIM Input Permissible Development (sq metre)



4. MODEL INPUT ASSUMPTIONS & PARAMETERS

4.1 Generic Assumptions

Values of Time

4.1.1 Consistent with WebTAG Databook, March 2017, values of working time have been increased in line with GDP per capita, whilst values for other purposes are related to changes in GDP per capita with an elasticity of 0.8.

4.2 MDM Assumptions

Car Occupancy

4.2.1 For the base year model, 2015, car occupancies were calculated for each purpose based on observed survey data for use in the MDM. Recent updates to car occupancy assumptions in WebTAG mean that occupancy is no longer forecast to change in future years, so the model retains the base year occupancy for the future years as shown in Table 6.

Table 6. Car Occupancies

Purpose	2019	2026	2031	2036	2041
HBW	1.113	1.113	1.113	1.113	1.113
HBB	1.128	1.128	1.128	1.128	1.128
HBE	1.697	1.697	1.697	1.697	1.697
HBO	1.512	1.512	1.512	1.512	1.512
NHB	1.181	1.181	1.181	1.181	1.181
NHO	1.467	1.467	1.467	1.467	1.467

Car Availability Splits

4.2.2 The availability of cars for making journeys is expected to change over time. Early increases in car availability level off, or are eroded slightly, by later years (Table 7).

Table 7. Car Availability Splits

Car Availability	2015	2019	2026	2031	2036
No Car	13.8%	12.7%	9.3%	7.7%	6.2%
Part Car	41.0%	39.7%	38.5%	37.7%	36.6%
Full Car	45.2%	47.6%	52.2%	54.6%	57.2%

Goods Vehicle changes over time

4.2.3 For commercial vehicles, growth factors derived from the National Transport (Freight) Model are used to calculate forecast year demand. For each forecast year and goods vehicle type, these factors are shown in Table 8.

Table 8. Goods Vehicle Growth Factors

Forecast Year	Vehicle Type	Growth Factor (rel. to 2015)
2019	LGVs	1.110
	HGVs	1.032
2026	LGVs	1.300
	HGVs	1.087
2031	LGVs	1.424
	HGVs	1.128
2036	LGVs	1.548
	HGVs	1.169
2041	LGVs	1.672
	HGVs	1.211

4.3 Seaport and Airport Input Assumptions

Southampton Airport

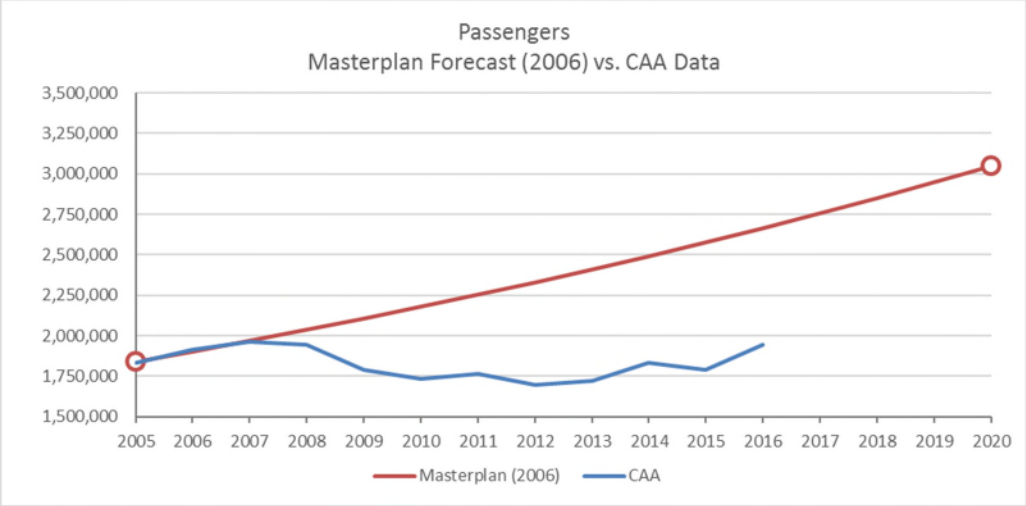
4.3.1 The 2010 modelled growth profile for Southampton Airport was generally based on the 2006 Airport Masterplan[1] but the decision was made in 2010, in consultation with the airport themselves, to delay growth forecasts by 5 years due to the recession.

4.3.2 A recent comparison of projected growth against realised passenger numbers provided by the Civil Aviation Authority[2] against 2006 masterplan forecasts, shown in Figure 5, suggests that passenger growth has been considerably lower than expected.

[1] https://www.southamptonairport.com/media/1051/southampton_masterplan_final.pdf

[2] http://www.caa.co.uk/Data-and-analysis/UK-aviation-market/Airports/Datasets/UK-Airport-data/

Figure 5. Southampton Airport passenger numbers forecasts



4.3.3 Since no new Southampton Airport Masterplan is available for the 2015 update, passenger growth has instead been assumed to follow the Department for Transport's more recent 2013 UK Aviation forecasts[3] which provide passenger growth for individual airports including Southampton.

4.3.4 Employee growth at the airport is assumed to be unchanged, and remain in line with the 2006 Masterplan (including the five year delay in growth) as no more recent employee data is available and no new Masterplan has been produced. Employee growth is not necessarily linked to passenger growth, and this demand is smaller so the assumption has less impact.

4.3.5 It was noted in the development of the 2010 model that only a very small amount of freight is flown from Southampton Airport, resulting in few LGV and HGV movements. No new or conflicting information is available to counter this, so this assumption is held.

4.3.6 The resulting growth profile for Southampton Airport is shown in **Error! Reference source not found.**.

Table 9. Southampton Airport Growth Profiles (from 2015)

Year	Passenger Growth	Employee Growth
2015	0%	0%
2019	2.43%	12.10%
2026	15.57%	41.91%
2031	27.67%	68.66%
2036	43.36%	100.45%
2041	59.33%	138.24%

[3] https://www.gov.uk/government/publications/uk-aviation-forecasts-2013

4.4 Portsmouth Port

4.4.1 The 2010 modelled growth profile for Portsmouth Port was based on discussions with port authorities for the period up to 2015 and government forecasts thereafter.

4.4.2 In 2011 a Portsmouth Port masterplan was produced [4]. This included growth forecasts for passengers, at approximately 1.5% per annum, and freight demand, at approximately 2.5% per annum. Freight growth has also been used to inform employee growth at the port. The resulting growth profile is given in Table 10.

Table 10. Portsmouth Port growth profile (from 2015)

Year	Freight & Employee growth	Passenger growth
2015	0%	0%
2019	10.38%	6.17%
2026	31.21%	17.79%
2031	48.45%	26.90%
2036	67.96%	36.71%
2041	90.03%	47.27%

4.5 Southampton Port

4.5.1 Southampton Port growth was originally informed by the 2009 masterplan[5]. For the rebase exercise a draft consultation version of the 2016 masterplan was available [6] which has been used.

4.5.2 Table 6.2 of the 2016 masterplan provides growth forecasts to 2030 in cruise passengers and freight (split by containers, automotive and, bulk and general cargo). Passenger growth is taken directly from the forecast and freight growth is taken from the sum of all types. Employee growth is assumed to be in line with freight growth.

[4] http://www.portsmouth-port.co.uk/uploads/downloads/PORT_MASTER_PLAN_Final_10_10_11.pdf

[5] http://www.southamptonvts.co.uk/admin/content/files/pdf_downloads/master%20plan/smp.pdf

[6] http://www.southamptonvts.co.uk/port_information/commercial/southampton_master_plan/

Table 11. Southampton Port growth profile (from 2015)

Year	Freight & Employee growth	Passenger growth
2015	0%	0%
2019	29.02%	34.52%
2026	57.84%	63.17%
2031	76.37%	80.17%
2036	96.58%	98.55%
2041	116.79%	116.93%

4.5.3 The 2016 consultation document states that by 2020 it is expected that the existing operational port estate will be operating close to its effective capacity and that expansion is likely to be realised in other areas in order to achieve forecast growth. In particular, the areas of Marchwood Industrial Park and the 'strategic land reserve' (known as Dibden Bay) on are identified as likely areas for expansion.

4.5.4 However, the document does not confirm solid plans or intentions for the new sites. It is anticipated that the existing industrial area of Marchwood will be ready for port use considerably earlier than Didben Bay, which would require construction work, and that the two sites would handle freight traffic rather than cruise ships.

4.5.5 Although the Southampton Port masterplan mentions that expansion to Marchwood and Didben Bay is very likely and included in growth forecasts, no solid plans for these zones and importantly no transport interventions have been included. As such, the growth is assumed to occur within the existing port area.

4.6 RTM Specific Assumptions

Vehicle Operation Costs

4.6.1 For the RTM, the values of time and operating costs are expressed using the SATURN software's pence per minute (ppm) and pence per kilometre (ppk) parameters. These parameters are calculated following WebTAG Databook March 2017 see Table 12.

Table 12. RTM PPM and PPK values (in 2010 prices)

	AM				IP				PM			
	PPM	PPK	K/M	Index	PPM	PPK	M/K	Index	PPM	PPK	M/K	Index
Car - Employer's Business												
2015	**29.82**	**12.31**	0.41	1.00	**30.56**	**11.74**	0.38	1.00	**30.25**	**12.83**	0.42	1.00
2019	**31.92**	**12.00**	0.38	0.98	**32.71**	**11.44**	0.35	0.97	**32.38**	**12.52**	0.39	0.98
2026	**36.23**	**11.93**	0.33	0.97	**37.13**	**11.37**	0.31	0.97	**36.75**	**12.45**	0.34	0.97
2031	**39.99**	**11.59**	0.29	0.94	**40.98**	**11.04**	0.27	0.94	**40.57**	**12.09**	0.30	0.94
2036	**44.32**	**11.47**	0.26	0.93	**45.42**	**10.93**	0.24	0.93	**44.96**	**11.97**	0.27	0.93
2041	**49.02**	**11.36**	0.23	0.92	**50.23**	**10.82**	0.22	0.92	**49.73**	**11.86**	0.24	0.92
Car - Other												
2015	**17.07**	**5.66**	0.33	1.00	**15.49**	**5.49**	0.35	1.00	**17.08**	**5.86**	0.34	1.00
2019	**18.27**	**5.33**	0.29	0.94	**16.58**	**5.16**	0.31	0.94	**18.28**	**5.51**	0.30	0.94
2026	**20.74**	**5.35**	0.26	0.94	**18.82**	**5.18**	0.28	0.94	**20.75**	**5.53**	0.27	0.95
2031	**22.89**	**5.03**	0.22	0.89	**20.78**	**4.87**	0.23	0.89	**22.90**	**5.21**	0.23	0.89
2036	**25.37**	**4.90**	0.19	0.87	**23.03**	**4.74**	0.21	0.86	**25.38**	**5.07**	0.20	0.87
2041	**28.06**	**4.77**	0.17	0.84	**25.47**	**4.61**	0.18	0.84	**28.07**	**4.93**	0.18	0.84
LGVs												
2015	**19.41**	**7.55**	0.39	1.00	**18.37**	**7.34**	0.40	1.00	**18.94**	**7.50**	0.40	1.00
2019	**20.80**	**7.34**	0.35	0.97	**19.72**	**7.14**	0.36	0.97	**20.32**	**7.29**	0.36	0.97
2026	**23.61**	**7.42**	0.31	0.98	**22.38**	**7.22**	0.32	0.98	**23.06**	**7.37**	0.32	0.98
2031	**26.08**	**7.19**	0.28	0.95	**24.73**	**7.00**	0.28	0.95	**25.48**	**7.13**	0.28	0.95
2036	**28.91**	**7.07**	0.24	0.94	**27.41**	**6.89**	0.25	0.94	**28.24**	**7.01**	0.25	0.93
2041	**31.97**	**6.95**	0.22	0.92	**30.32**	**6.77**	0.22	0.92	**31.23**	**6.89**	0.22	0.92
HGVs												
2015	**21.40**	**46.30**	2.16	1.00	**21.40**	**43.70**	2.04	1.00	**21.40**	**48.86**	2.28	1.00
2019	**22.90**	**49.23**	2.15	1.06	**22.90**	**46.46**	2.03	1.06	**22.90**	**51.96**	2.27	1.06
2026	**26.00**	**55.66**	2.14	1.20	**26.00**	**52.58**	2.02	1.20	**26.00**	**58.74**	2.26	1.20
2031	**28.69**	**56.57**	1.97	1.22	**28.69**	**53.43**	1.86	1.22	**28.69**	**59.70**	2.08	1.22
2036	**31.80**	**56.57**	1.78	1.22	**31.80**	**53.43**	1.68	1.22	**31.80**	**59.70**	1.88	1.22
2041	**35.18**	**56.57**	1.61	1.22	**35.18**	**53.43**	1.52	1.22	**35.18**	**59.70**	1.70	1.22

Vehicle Operation Costs

4.6.2 The highway network also incorporates car ferry fares and a toll on Itchen Bridge. These are assumed to increase in line with the value of time in future years.

4.6.3 This assumption is particularly important for car ferry fares to/from the Isle of Wight where this constitutes a significant proportion of the total journey costs. Approximations were required in order to ensure constant generalised travel times were passed to the MDM. This was because the RTM operates using two car user classes (In-work and Not in-work), while the MDM operates using 6 car purposes. The values of time and vehicle occupancies assumed varied by purpose and it was therefore not possible to ensure total travel costs to/from the Isle of Wight remained exactly fixed.

4.7 PTM Specific Assumptions

4.7.1 For bus and heavy rail, public transport fares have been assumed to rise at 1% per annum above the growth in RPI. For PT ferry services, public transport fares have been assumed to increase in line with values of time. Table 13 shows the actual and perceived growth in fares. Figures 6 and 7 show the growth graphically.

Table 13. PTM Specific Assumptions

	2015	2019	2026	2031	2036	2041
VOT	100	107	121	134	149	165
Bus Fares	100	104	112	117	123	130
Rail Fares	100	104	112	117	123	130
Ferry Fares	100	100	110	119	129	140
Perceived Bus Fares	100	97	92	87	83	79
Perceived Rail Fares	100	97	92	87	83	79
Perceived Ferry Fares	100	93	91	89	87	85

Figure 6. Growth in Fares

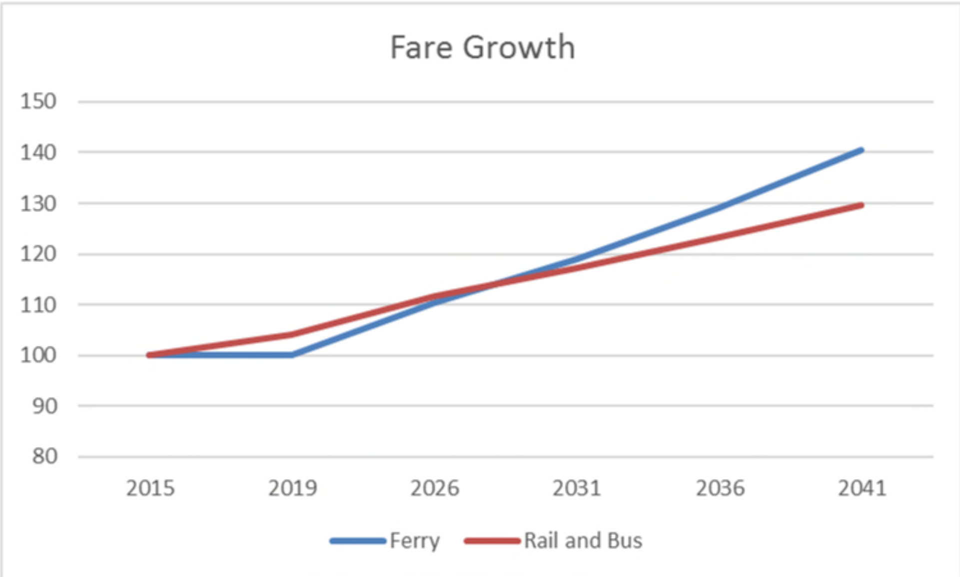
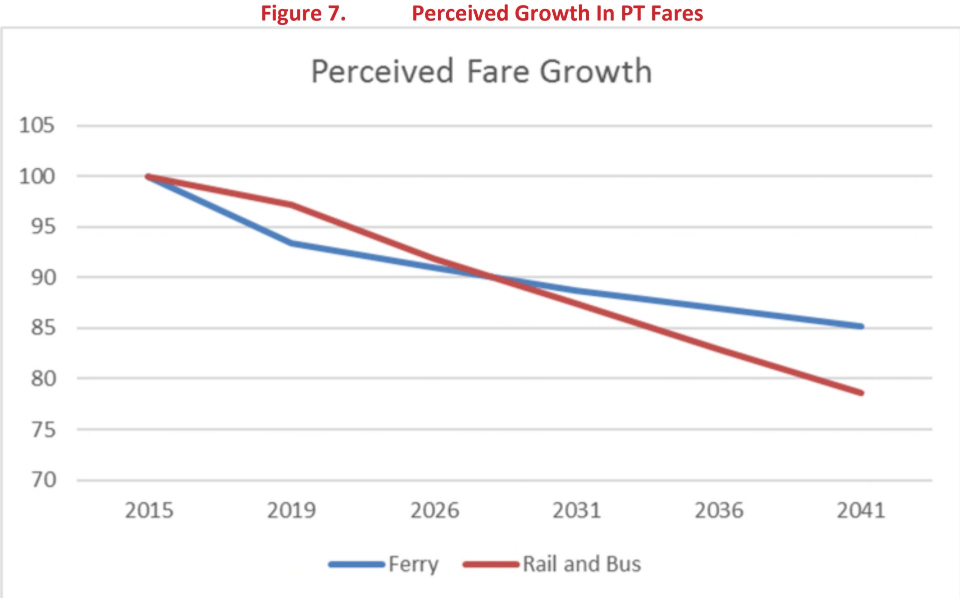


Figure 7. Perceived Growth In PT Fares



5. LEIM FORECASTS

5.1 Summary

5.1.1 This section presents LEIM forecasts including population, households and employment. In forecasting mode, the SRTM responds to the output network conditions and that influence the take-up of permissible floorspace (both residential and non-residential). This can make some locations/ areas more ‘attractive’ than others and can effectively supress employment and population growth in certain areas if the provision of new transport services/ infrastructure do not sufficiently mitigate against increased generalised cost of travel.

5.2 Population

5.2.1 Population forecasts for each modelled year are presented in Table 14. Forecasts are presented at district and area level, with the districts shown in Figure 8 below.

Figure 8. Reported Districts and Areas

Table 14. Population Forecasts by District and Area

District	Total						Difference					Difference from 2015				
	2015	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041
East Hampshire (Core)	20,983	21,813	22,759	22,489	22,327	22,240	829	1,776	1,506	1,343	1,257	4%	8%	7%	6%	6%
Eastleigh	129,029	130,715	132,356	133,761	133,678	132,743	1,686	3,327	4,732	4,649	3,714	1%	3%	4%	4%	3%
Fareham	114,819	114,901	118,291	122,243	126,690	127,407	83	3,473	7,425	11,871	12,589	0%	3%	6%	10%	11%
Gosport	84,627	86,293	91,475	92,952	93,429	94,150	1,666	6,848	8,325	8,803	9,523	2%	8%	10%	10%	11%
Havant	122,892	122,864	121,420	121,502	122,104	122,837	-27	-1,472	-1,390	-788	-54	0%	-1%	-1%	-1%	0%
New Forest (Core)	71,223	68,729	69,399	70,241	70,429	70,371	-2,495	-1,825	-982	-794	-853	-4%	-3%	-1%	-1%	-1%
Test Valley (Core)	41,618	44,198	46,185	47,788	50,847	51,928	2,580	4,567	6,170	9,229	10,310	6%	11%	15%	22%	25%
Winchester (Core)	108,089	109,104	118,556	121,967	123,966	126,797	1,015	10,467	13,878	15,878	18,708	1%	10%	13%	15%	17%
Portsmouth City	211,696	213,893	222,570	226,878	227,786	228,183	2,196	10,874	15,182	16,090	16,486	1%	5%	7%	8%	8%
Southampton City	249,559	249,146	260,577	265,197	265,491	265,889	-413	11,018	15,638	15,932	16,330	0%	4%	6%	6%	7%
Isle of Wight	139,346	146,780	155,747	160,432	164,491	168,755	7,434	16,401	21,087	25,146	29,409	5%	12%	15%	18%	21%
Hampshire County	693,280	698,617	720,441	732,943	743,470	748,474	5,338	27,161	39,663	50,190	55,194	1%	4%	6%	7%	8%
Portsmouth City	211,696	213,893	222,570	226,878	227,786	228,183	2,196	10,874	15,182	16,090	16,486	1%	5%	7%	8%	8%
Southampton City	249,559	249,146	260,577	265,197	265,491	265,889	-413	11,018	15,638	15,932	16,330	0%	4%	6%	6%	7%
Core Modelled Area	**1,293,881**	**1,308,436**	**1,359,334**	**1,385,450**	**1,401,239**	**1,411,300**	**14,555**	**65,454**	**91,569**	**107,358**	**117,419**	**1%**	**5%**	**7%**	**8%**	**9%**
East Hampshire (Marginal)	30,089	30,842	32,570	33,600	34,112	34,363	753	2,481	3,511	4,023	4,275	3%	8%	12%	13%	14%
New Forest (Marginal)	74,831	77,537	81,058	83,507	85,505	86,890	2,706	6,227	8,677	10,674	12,059	4%	8%	12%	14%	16%
Test Valley (Marginal)	26,229	27,464	29,136	30,340	30,876	31,054	1,235	2,906	4,110	4,647	4,824	5%	11%	16%	18%	18%
Winchester (Marginal)	12,655	12,741	13,162	13,329	13,348	13,315	87	507	674	693	660	1%	4%	5%	5%	5%
Arun (Marginal)	86,375	85,128	84,507	85,590	87,090	87,934	-1,247	-1,868	-785	715	1,559	-1%	-2%	-1%	1%	2%
Chichester (Marginal)	94,766	97,733	107,177	111,220	112,329	112,794	2,967	12,411	16,454	17,563	18,028	3%	13%	17%	19%	19%
Marginal Modelled Area	**324,945**	**331,446**	**347,610**	**357,586**	**363,259**	**366,350**	**6,500**	**22,664**	**32,641**	**38,314**	**41,405**	**2%**	**7%**	**10%**	**12%**	**13%**
Arun (Buffer)	69,354	71,860	75,324	77,240	79,409	81,293	2,506	5,970	7,886	10,055	11,939	4%	9%	11%	14%	17%
Chichester (Buffer)	22,233	23,228	24,372	25,195	26,265	27,377	996	2,140	2,962	4,032	5,144	4%	10%	13%	18%	23%
East Hampshire (Buffer)	67,032	74,850	79,537	82,023	84,436	86,938	7,817	12,505	14,990	17,404	19,906	12%	19%	22%	26%	30%
New Forest (Buffer)	32,971	33,650	35,094	35,910	37,074	37,956	679	2,123	2,939	4,103	4,986	2%	6%	9%	12%	15%
Test Valley (Buffer)	52,879	57,056	59,470	62,115	64,525	66,753	4,177	6,591	9,236	11,646	13,874	8%	12%	17%	22%	26%
Bournemouth	194,538	204,337	220,669	231,254	243,516	255,249	9,799	26,131	36,716	48,978	60,711	5%	13%	19%	25%	31%
Poole	150,580	154,947	163,011	168,106	174,675	180,517	4,367	12,431	17,526	24,095	29,937	3%	8%	12%	16%	20%
Christchurch	49,067	49,879	51,721	52,689	54,094	55,006	813	2,654	3,622	5,027	5,939	2%	5%	7%	10%	12%
East Dorset	88,714	90,127	93,389	95,117	97,726	99,398	1,413	4,675	6,403	9,012	10,684	2%	5%	7%	10%	12%
Basingstoke & Dean	173,856	188,277	204,081	214,047	223,664	232,277	14,421	30,225	40,191	49,808	58,421	8%	17%	23%	29%	34%
Worthing	107,718	113,191	120,677	125,085	130,000	135,119	5,473	12,959	17,367	22,282	27,401	5%	12%	16%	21%	25%
Salisbury	122,045	129,937	130,829	134,627	138,103	141,094	7,892	8,785	12,582	16,058	19,049	6%	7%	10%	13%	16%
Buffer Area	**1,130,986**	**1,191,339**	**1,258,174**	**1,303,406**	**1,353,485**	**1,398,975**	**60,353**	**127,188**	**172,420**	**222,499**	**267,990**	**5%**	**11%**	**15%**	**20%**	**24%**
Total	**2,749,812**	**2,831,220**	**2,965,118**	**3,046,442**	**3,117,983**	**3,176,625**	**81,408**	**215,306**	**296,631**	**368,171**	**426,813**	**3%**	**8%**	**11%**	**13%**	**16%**

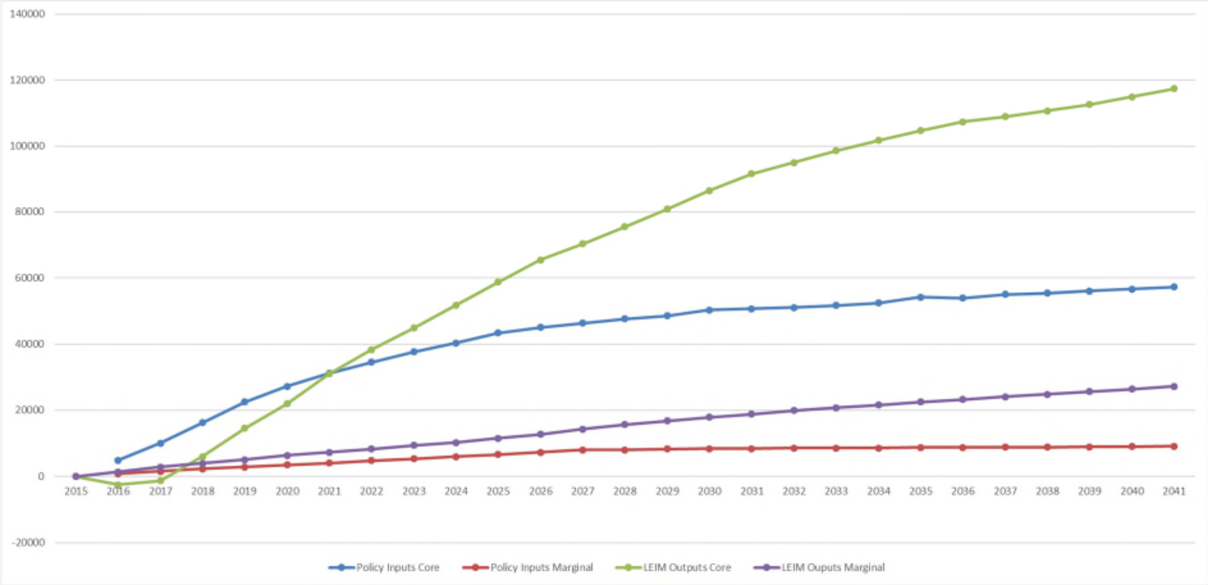
5.3 Households

5.3.1 Table 15 shows the growth in residential floorspace over the forecast years and Figure 9 show the uptake of residential households compared to LEIM inputs for the core and marginal areas.

Table 15. Growth of Residential Floorspace by Year

District	2015	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041
East Hampshire (Core)	8,590	9,131	9,775	9,857	9,907	10,066	542	1,185	1,267	1,317	1,476	6%	14%	15%	15%	17%
Eastleigh	54,153	55,878	56,807	58,415	59,686	60,877	1,725	2,654	4,262	5,533	6,724	3%	5%	8%	10%	12%
Fareham	48,137	49,266	51,858	54,184	57,185	58,478	1,129	3,721	6,047	9,048	10,341	2%	8%	13%	19%	21%
Gosport	36,808	37,662	39,603	40,183	40,657	41,699	853	2,795	3,375	3,848	4,890	2%	8%	9%	10%	13%
Havant	52,493	53,120	52,858	53,487	54,587	55,965	627	365	994	2,094	3,472	1%	1%	2%	4%	7%
New Forest (Core)	30,394	29,704	29,207	29,885	30,573	31,141	-690	-1,187	-510	179	746	-2%	-4%	-2%	1%	2%
Test Valley (Core)	17,910	19,375	20,784	21,389	21,769	22,158	1,465	2,875	3,480	3,859	4,248	8%	16%	19%	22%	24%
Winchester (Core)	43,068	44,921	49,815	51,398	52,091	52,983	1,853	6,747	8,330	9,023	9,915	4%	16%	19%	21%	23%
Portsmouth City	89,501	90,546	95,703	98,736	100,296	101,603	1,045	6,202	9,235	10,796	12,103	1%	7%	10%	12%	14%
Southampton City	104,331	106,907	114,028	116,952	118,838	120,737	2,576	9,697	12,621	14,507	16,406	2%	9%	12%	14%	16%
Isle of Wight	62,652	66,216	71,730	74,987	77,570	80,570	3,565	9,079	12,335	14,918	17,918	6%	14%	20%	24%	29%
Hampshire County	291,553	299,057	310,708	318,799	326,454	333,367	7,504	19,155	27,246	34,901	41,814	3%	7%	9%	12%	14%
Portsmouth City	89,501	90,546	95,703	98,736	100,296	101,603	1,045	6,202	9,235	10,796	12,103	1%	7%	10%	12%	14%
Southampton City	104,331	106,907	114,028	116,952	118,838	120,737	2,576	9,697	12,621	14,507	16,406	2%	9%	12%	14%	16%
Core Modelled Area	**548,036**	**562,726**	**592,169**	**609,473**	**623,158**	**636,277**	**14,690**	**44,133**	**61,437**	**75,122**	**88,241**	**3%**	**8%**	**11%**	**14%**	**16%**
East Hampshire (Marginal)	12,695	12,983	13,802	14,438	14,934	15,333	287	1,107	1,742	2,239	2,638	2%	9%	14%	18%	21%
New Forest (Marginal)	34,153	35,420	36,758	38,224	39,627	40,838	1,266	2,604	4,070	5,474	6,685	4%	8%	12%	16%	20%
Test Valley (Marginal)	10,837	11,303	12,086	12,749	13,280	13,684	466	1,249	1,913	2,443	2,847	4%	12%	18%	23%	26%
Winchester (Marginal)	5,410	5,615	6,071	6,353	6,509	6,660	205	660	942	1,099	1,249	4%	12%	17%	20%	23%
Arun (Marginal)	37,933	38,560	38,489	39,131	39,970	40,900	627	556	1,198	2,037	2,967	2%	1%	3%	5%	8%
Chichester (Marginal)	41,999	44,254	48,575	50,994	51,993	52,849	2,256	6,577	8,995	9,994	10,850	5%	16%	21%	24%	26%
Marginal Modelled Area	**143,027**	**148,134**	**155,780**	**161,888**	**166,314**	**170,264**	**5,107**	**12,753**	**18,860**	**23,286**	**27,237**	**4%**	**9%**	**13%**	**16%**	**19%**

Figure 9. Comparison between input and output Residential Households



5.4 Employment

5.4.1 Table 16 show the growth in LEIM employment forecasts by district and area. Table 17 shows the growth in employment floorspace and Figure 10 show the uptake of employment floorspace (office, industrial & warehousing floorspace) compared to LEIM inputs for the core and marginal areas.

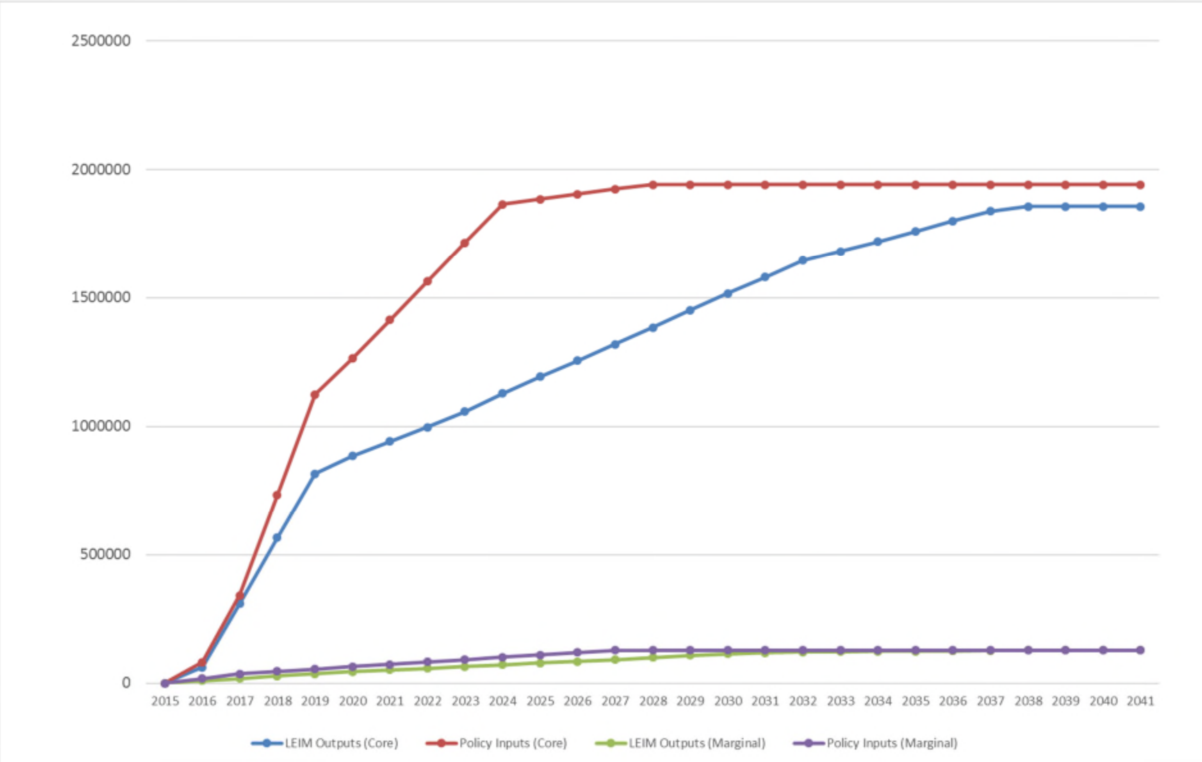
Table 16. Employment Forecasts by District and Area

District	2015	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041	2019	2026	2031	2036	2041
East Hampshire (Core)	4,934	5,479	5,745	5,581	5,472	5,491	544	811	647	537	557	11%	16%	13%	11%	11%
Eastleigh	64,035	65,137	68,502	72,005	75,890	77,852	1,102	4,467	7,970	11,855	13,817	2%	7%	12%	19%	22%
Fareham	52,571	53,488	58,232	62,836	65,702	67,272	917	5,661	10,265	13,131	14,701	2%	11%	20%	25%	28%
Gosport	28,355	33,550	38,659	42,095	46,330	47,559	5,195	10,304	13,740	17,975	19,205	18%	36%	48%	63%	68%
Havant	51,005	53,299	55,902	54,538	53,382	53,900	2,294	4,897	3,533	2,377	2,895	4%	10%	7%	5%	6%
New Forest (Core)	29,521	31,806	36,851	39,554	38,889	38,525	2,285	7,330	10,032	9,367	9,004	8%	25%	34%	32%	30%
Test Valley (Core)	23,032	27,529	29,724	31,771	33,485	35,416	4,498	6,692	8,739	10,454	12,384	20%	29%	38%	45%	54%
Winchester (Core)	74,610	74,092	72,906	74,331	76,868	78,568	-517	-1,704	-279	2,259	3,958	-1%	-2%	0%	3%	5%
Portsmouth City	110,117	112,013	112,342	109,418	106,699	105,805	1,896	2,225	-699	-3,419	-4,313	2%	2%	-1%	-3%	-4%
Southampton City	123,833	128,312	133,282	135,169	137,596	139,351	4,479	9,449	11,336	13,763	15,518	4%	8%	9%	11%	13%
Isle of Wight	56,849	59,032	60,641	61,421	62,814	64,164	2,182	3,791	4,572	5,964	7,315	4%	7%	8%	10%	13%
Hampshire County	328,063	344,381	366,520	382,711	396,018	404,582	16,318	38,456	54,647	67,955	76,519	5%	12%	17%	21%	23%
Portsmouth City	110,117	112,013	112,342	109,418	106,699	105,805	1,896	2,225	-699	-3,419	-4,313	2%	2%	-1%	-3%	-4%
Southampton City	123,833	128,312	133,282	135,169	137,596	139,351	4,479	9,449	11,336	13,763	15,518	4%	8%	9%	11%	13%
Core Modelled Area	**618,863**	**643,738**	**672,784**	**688,719**	**703,126**	**713,902**	**24,875**	**53,921**	**69,856**	**84,263**	**95,039**	**4%**	**9%**	**11%**	**14%**	**15%**
East Hampshire (Marginal)	12,531	12,937	13,372	13,429	13,574	13,624	406	841	898	1,042	1,093	3%	7%	7%	8%	9%
New Forest (Marginal)	33,691	34,447	35,390	35,495	35,822	36,083	756	1,699	1,804	2,131	2,392	2%	5%	5%	6%	7%
Test Valley (Marginal)	11,454	11,537	11,120	10,274	9,821	9,428	83	-334	-1,180	-1,634	-2,026	1%	-3%	-10%	-14%	-18%
Winchester (Marginal)	8,419	8,175	5,831	4,016	3,083	2,450	-244	-2,588	-4,403	-5,336	-5,969	-3%	-31%	-52%	-63%	-71%
Arun (Marginal)	27,380	27,562	26,028	24,553	24,160	24,181	182	-1,352	-2,827	-3,219	-3,199	1%	-5%	-10%	-12%	-12%
Chichester (Marginal)	55,649	57,464	59,721	61,571	62,158	62,397	1,815	4,072	5,922	6,509	6,748	3%	7%	11%	12%	12%
Marginal Modelled Area	**149,124**	**152,122**	**151,462**	**149,339**	**148,618**	**148,164**	**2,998**	**2,337**	**214**	**-507**	**-961**	**2%**	**2%**	**0%**	**0%**	**-1%**
Arun (Buffer)	23,574	24,282	24,980	25,359	25,846	26,342	708	1,406	1,786	2,272	2,768	3%	6%	8%	10%	12%
Chichester (Buffer)	8,472	8,717	8,944	9,027	9,143	9,244	245	472	555	671	771	3%	6%	7%	8%	9%
East Hampshire (Buffer)	25,726	26,269	26,846	27,204	27,653	28,148	542	1,120	1,478	1,927	2,421	2%	4%	6%	7%	9%
New Forest (Buffer)	16,079	17,307	18,403	19,382	20,410	21,553	1,229	2,324	3,304	4,331	5,475	8%	14%	21%	27%	34%
Test Valley (Buffer)	28,357	29,100	29,053	28,638	28,394	28,116	744	696	281	37	-241	3%	2%	1%	0%	-1%
Bournemouth	89,365	91,936	94,773	96,288	98,519	100,834	2,571	5,408	6,923	9,154	11,469	3%	6%	8%	10%	13%
Poole	83,743	85,383	87,125	87,949	89,377	90,909	1,640	3,382	4,206	5,634	7,166	2%	4%	5%	7%	9%
Christchurch	22,500	22,928	23,395	23,634	24,020	24,428	427	894	1,134	1,520	1,928	2%	4%	5%	7%	9%
East Dorset	34,748	35,473	36,223	36,474	36,964	37,505	725	1,475	1,725	2,216	2,757	2%	4%	5%	6%	8%
Basingstoke & Dean	82,255	84,788	87,003	88,184	90,007	91,865	2,534	4,748	5,929	7,752	9,611	3%	6%	7%	9%	12%
Worthing	50,481	52,100	53,662	54,510	55,568	56,646	1,620	3,182	4,029	5,087	6,165	3%	6%	8%	10%	12%
Salisbury	69,863	68,273	68,225	69,648	71,196	72,850	-1,590	-1,638	-215	1,333	2,987	-2%	-2%	0%	2%	4%
Buffer Area	**535,163**	**546,557**	**558,630**	**566,296**	**577,098**	**588,440**	**11,394**	**23,468**	**31,133**	**41,935**	**53,277**	**2%**	**4%**	**6%**	**8%**	**10%**
Total	**1,303,150**	**1,342,417**	**1,382,876**	**1,404,353**	**1,428,842**	**1,450,505**	**39,267**	**79,726**	**101,203**	**125,692**	**147,355**	**3%**	**6%**	**8%**	**10%**	**11%**

Table 17. Growth of Employment Floorspace (Office, Industrial & Warehousing)

District	Total 2015	Total 2019	Total 2026	Total 2031	Total 2036	Total 2041	Difference 2019	Difference 2026	Difference 2031	Difference 2036	Difference 2041	Difference from 2015 2019	Difference from 2015 2026	Difference from 2015 2031	Difference from 2015 2036	Difference from 2015 2041
East Hampshire (Core)	88,987	95,787	95,787	95,787	95,787	95,787	6,800	6,800	6,800	6,800	6,800	8%	8%	8%	8%	8%
Eastleigh	1,859,027	1,885,232	1,989,312	2,072,712	2,117,911	2,122,230	26,205	130,286	213,686	258,885	263,204	1%	7%	11%	14%	14%
Fareham	1,029,171	1,084,442	1,116,389	1,160,830	1,190,739	1,194,450	55,271	87,218	131,659	161,568	165,279	5%	8%	13%	16%	16%
Gosport	435,302	526,251	535,407	546,120	564,299	564,333	90,950	100,105	110,818	128,998	129,032	21%	23%	25%	30%	30%
Havant	920,590	1,026,432	1,040,804	1,050,026	1,069,248	1,082,403	105,842	120,214	129,436	148,658	161,813	11%	13%	14%	16%	18%
New Forest (Core)	565,350	641,680	738,999	803,622	815,298	817,923	76,331	173,650	238,272	249,949	252,574	14%	31%	42%	44%	45%
Test Valley (Core)	631,053	759,116	774,319	774,378	774,438	774,452	128,063	143,266	143,325	143,385	143,399	20%	23%	23%	23%	23%
Winchester (Core)	1,284,876	1,379,801	1,412,585	1,435,105	1,456,176	1,456,176	94,925	127,708	150,229	171,300	171,300	7%	10%	12%	13%	13%
Portsmouth City	1,698,142	1,824,555	1,846,967	1,863,249	1,878,328	1,895,771	126,413	148,825	165,107	180,187	197,630	7%	9%	10%	11%	12%
Southampton City	2,328,373	2,396,154	2,493,702	2,549,185	2,595,739	2,610,305	67,781	165,329	220,812	267,367	281,932	3%	7%	9%	11%	12%
Isle of Wight	713,753	751,907	766,518	784,501	795,679	796,302	38,153	52,765	70,748	81,925	82,549	5%	7%	10%	11%	12%
Hampshire County	6,814,356	7,398,742	7,703,602	7,938,581	8,083,898	8,107,756	584,386	889,246	1,124,226	1,269,542	1,293,400	9%	13%	16%	19%	19%
Portsmouth City	1,698,142	1,824,555	1,846,967	1,863,249	1,878,328	1,895,771	126,413	148,825	165,107	180,187	197,630	7%	9%	10%	11%	12%
Southampton City	2,328,373	2,396,154	2,493,702	2,549,185	2,595,739	2,610,305	67,781	165,329	220,812	267,367	281,932	3%	7%	9%	11%	12%
Core Modelled Area	**11,554,624**	**12,371,358**	**12,810,789**	**13,135,516**	**13,353,645**	**13,410,134**	**816,734**	**1,256,165**	**1,580,892**	**1,799,021**	**1,855,510**	**7%**	**11%**	**14%**	**16%**	**16%**
East Hampshire (Marginal)	197,728	201,232	204,647	207,623	209,797	209,989	3,504	6,919	9,895	12,070	12,261	2%	3%	5%	6%	6%
New Forest (Marginal)	375,242	380,518	389,323	392,479	393,328	393,448	5,276	14,081	17,237	18,086	18,206	1%	4%	5%	5%	5%
Test Valley (Marginal)	312,100	312,100	312,100	312,100	312,100	312,100	0	0	0	0	0	0%	0%	0%	0%	0%
Winchester (Marginal)	154,231	154,231	154,231	154,231	154,231	154,231	1	1	1	1	1	0%	0%	0%	0%	0%
Arun (Marginal)	356,541	356,538	356,538	356,538	356,538	356,538	-3	-3	-3	-3	-3	0%	0%	0%	0%	0%
Chichester (Marginal)	661,015	689,055	724,979	752,455	756,562	759,188	28,041	63,964	91,440	95,547	98,173	4%	10%	14%	14%	15%
Marginal Modelled Area	**2,056,857**	**2,093,675**	**2,141,818**	**2,175,426**	**2,182,557**	**2,185,494**	**36,818**	**84,961**	**118,570**	**125,700**	**128,638**	**2%**	**4%**	**6%**	**6%**	**6%**

Figure 10. Comparison between Input and Output Employment Floorspace



6. MDM & GDM FORECASTS

6.1 Summary

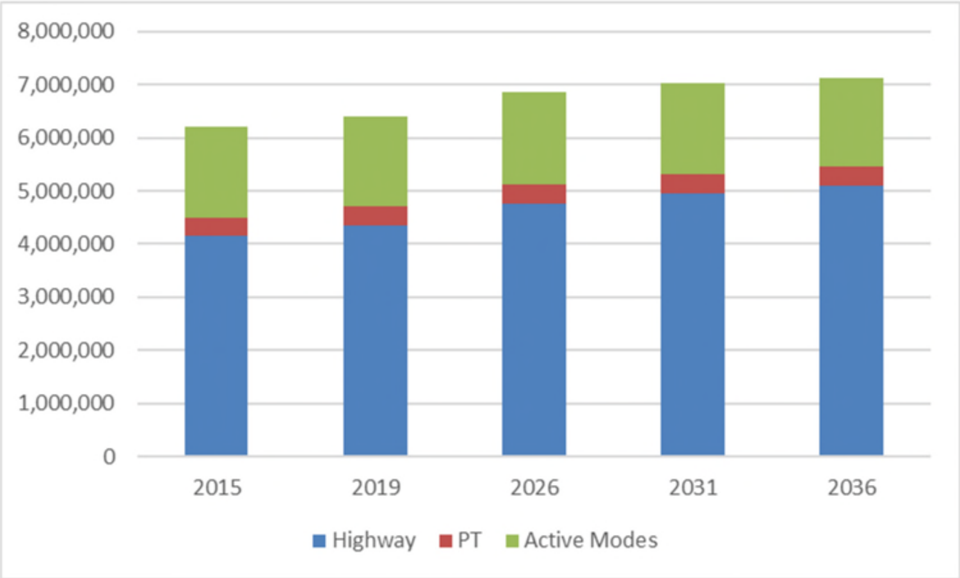
6.1.1 This section presents forecasts from the MDM and the GDM. MDM forecasts include origin and destination trip data and total trips by mode. GDM forecasts include trips to each port by mode, and car and PT mode share.

6.2 MDM Forecasts

6.2.1 Figure 11[7] shows the total number of trips made to / from or within the Core Fully Modelled Area, broken down by main mode, for each modelled year. Figure 12 shows the percentage change in trips from the base year for each mode.

6.2.2 Tables 18 to 20 show the demand by mode for 2015 and 2031. This has been presented by local authority within the South Hampshire Core Area and also aggregated to marginal, buffer and external. The tables show demand by mode, mode share (separately including and excluding Active Modes) and also absolute and percentage changes in demand. Over the 12 hour period car journeys increase by 20%, public transport by 4% and active modes drop by 1%.

Figure 11. Total Trips To/From or Within the Core FMA by Mode and Year



[7] This and all further outputs are based on test DQV.

Figure 12. Change in Total Trips To/From/Within the Core FMA by Mode from 2015

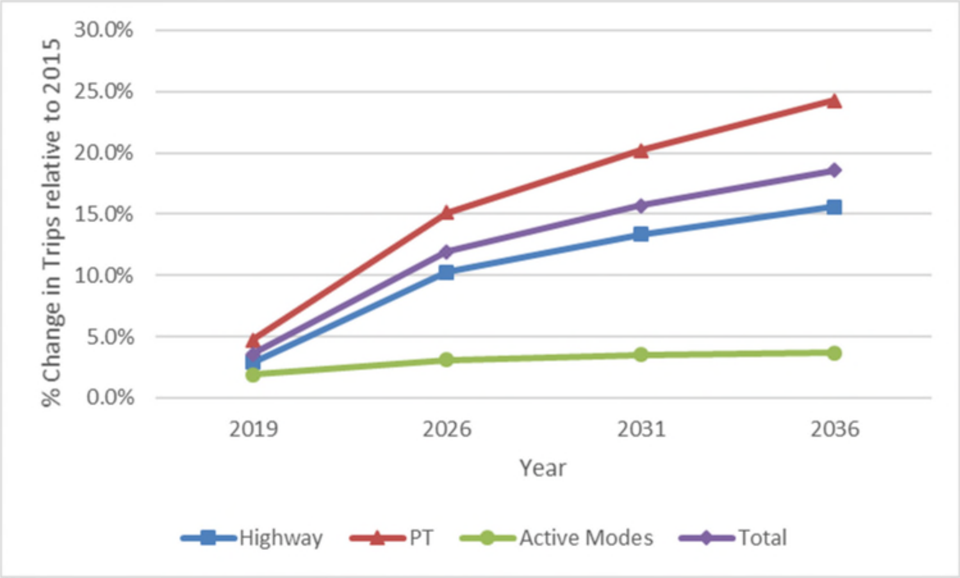


Table 18. Demand by Core Area Authority by Mode (2015 & 2031)

2015 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	61445	4533	15982	5492	3782	1303	123	1171	616	87	15	12704	5948	2448	115649
Test Valley	4709	20124	19529	11785	4545	853	67	416	248	41	20	2817	5034	1243	71432
Southampton	16479	19294	222248	46634	11438	11684	480	4671	2319	394	77	7365	10414	5973	359471
Eastleigh	5634	12331	46882	94114	24736	12319	638	5066	2158	292	22	4213	7348	5716	221468
Winchester	3830	4789	12079	24109	60476	14866	1831	8730	7839	965	48	8260	19749	10954	178526
Fareham	1288	877	11954	11937	14701	102105	21090	23144	7889	796	11	2357	2277	3639	204064
Gosport	124	70	535	631	2028	21238	65273	3819	1245	104	7	397	266	702	96439
Portsmouth	1037	393	4926	4795	8344	22497	3915	211696	35865	6149	332	9082	3691	9030	321752
Havant	547	239	2526	2146	7764	7681	1148	34060	111141	17243	56	19810	3895	7110	215368
East Hampshire	104	49	477	348	1001	858	111	7432	19543	6209	18	3293	1181	2065	42687
Isle of Wight	12	20	55	21	49	11	7	240	57	18	240703	116	63	785	242156
Marginal	12830	2963	6875	3993	8138	2639	420	9723	20192	3290	211	39854	18147	12871	142148
Buffer	5865	5602	10433	7515	19846	2522	311	4196	4546	1209	77	17765	5926	23174	108988
External	2213	1364	6479	6222	11716	3758	716	9712	7827	2130	918	12625	21008	33643	120332
Total	116117	72647	360980	219743	178563	204335	96129	324077	221486	38927	242517	140657	104948	119354	2440480

2031 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	67122	6284	19871	7251	3923	1751	209	1722	804	112	20	14343	7247	2816	133475
Test Valley	6874	24568	26586	14928	5475	1393	167	804	393	55	29	3604	6580	1539	92997
Southampton	22464	27369	264910	56571	13389	14482	1273	6431	2912	499	147	8572	13463	8163	440646
Eastleigh	7490	15867	55284	100117	27747	15815	1644	7153	2951	399	47	5100	9229	7143	255984
Winchester	3956	5888	13397	26721	58765	18993	3207	12882	10175	1527	51	9106	23041	12084	199793
Fareham	1728	1444	14318	15000	18564	110418	27133	29228	10275	1184	14	3027	2854	4127	239313
Gosport	227	190	1310	1580	3416	26643	88939	5853	2096	215	12	677	405	886	132451
Portsmouth	1513	792	6730	6827	12718	29800	6461	240286	40401	7579	589	12410	5311	13409	384827
Havant	688	369	3064	2797	9932	10151	2033	37639	114688	19362	64	25112	4802	7660	238362
East Hampshire	130	66	594	458	1554	1286	247	8644	22341	6792	18	3863	1330	2062	49385
Isle of Wight	17	28	109	42	53	14	12	486	65	17	307418	153	86	1084	309583
Marginal	14308	3702	7703	4723	9009	3360	693	12637	25214	3841	279	46214	21196	15065	167946
Buffer	7025	7289	12736	9068	22885	3168	469	5717	5570	1371	104	20590	7785	28454	132231
External	2420	1662	7992	7333	12503	4181	886	14071	8176	2119	1221	14364	24703	38676	140305
Total	135962	95517	434605	253417	199931	241457	133374	383551	246061	45073	310013	167136	128031	143167	2917296

2015 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	1912	54	1988	74	132	37	26	46	15	2	58	299	169	386	5200
Test Valley	53	769	1000	331	115	25	4	46	13	0	21	112	183	376	3048
Southampton	1931	1006	28958	3856	1187	945	139	638	145	6	651	1061	1477	2893	44893
Eastleigh	69	309	3702	3807	1490	204	64	244	60	12	199	235	254	1152	11799
Winchester	139	112	1241	1476	1317	416	60	288	104	12	300	273	1093	3691	10523
Fareham	36	25	918	210	407	2452	1197	2075	381	15	140	101	126	762	8846
Gosport	27	4	130	61	59	1177	2660	1941	164	1	164	132	78	276	6873
Portsmouth	49	46	646	240	293	2130	1909	19842	4279	404	1395	1345	574	2008	35158
Havant	18	13	157	47	107	388	173	4333	9709	427	200	954	148	904	17578
East Hampshire	2	0	6	12	12	15	1	393	415	154	52	125	1	108	1296
Isle of Wight	50	29	656	211	314	162	169	1396	209	58	22701	323	311	1411	27999
Marginal	281	111	1136	216	274	103	127	1341	1015	123	341	2215	852	1517	9654
Buffer	165	208	1544	292	1088	135	80	556	165	1	312	859	545	422	6374
External	388	393	2746	1194	3543	778	315	1980	961	115	1443	1439	381	580	16257
Total	5122	3078	44827	12026	10338	8968	6923	35119	17635	1331	27976	9474	6192	16486	205496

2031 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	1722	73	2013	98	126	44	37	78	19	2	86	314	198	360	5171
Test Valley	74	762	1460	343	133	30	11	86	24	0	41	133	193	367	3657
Southampton	2099	1546	26598	4175	1267	1115	357	721	154	9	999	1059	1690	3551	45341
Eastleigh	98	324	3856	3675	1423	240	78	347	90	11	282	283	387	1738	12831
Winchester	128	129	1312	1392	3470	477	106	548	270	22	336	283	1119	3645	13235
Fareham	43	29	1060	245	460	2391	1387	2192	428	16	177	130	155	792	9505
Gosport	37	11	285	71	101	1325	3059	2110	246	3	251	149	99	334	8081
Portsmouth	86	89	732	353	554	2292	2134	18180	3843	356	1601	1258	645	2329	34451
Havant	23	24	162	77	266	432	269	3812	8133	389	223	933	163	1092	15999
East Hampshire	2	0	9	12	22	16	3	344	378	146	59	125	1	111	1228
Isle of Wight	74	50	925	285	350	191	258	1544	232	65	23205	400	453	1947	29980
Marginal	296	128	1118	253	284	133	141	1229	984	123	411	2228	936	1572	9835
Buffer	194	219	1693	385	1112	164	105	619	179	1	451	923	494	410	6951
External	358	379	3094	1703	3462	789	363	2156	1120	118	1893	1428	357	668	17888
Total	5234	3763	44317	13067	13030	9640	8309	33966	16100	1262	30013	9646	6891	18917	214154

2015 12hr - Active	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	33100	70	743	0	0	0	0	0	0	0	0	381	0	0	34294
Test Valley	71	16788	1431	496	62	0	0	0	0	0	0	118	0	0	18966
Southampton	727	1329	189137	3692	34	77	0	0	0	0	0	59	0	0	195055
Eastleigh	0	483	3709	53149	845	200	0	0	0	0	0	0	0	0	58387
Winchester	0	65	36	892	51581	854	21	115	366	10	0	144	0	0	54084
Fareham	0	0	81	207	891	51746	1828	876	10	0	0	1	0	0	55639
Gosport	0	0	0	0	20	1843	61881	12	0	0	0	0	0	0	63757
Portsmouth	0	0	0	0	111	856	12	193367	1439	3	0	18	0	0	195806
Havant	0	0	0	0	350	10	0	1487	63194	642	0	819	0	0	66503
East Hampshire	0	0	0	0	10	0	0	3	672	3801	0	52	0	0	4538
Isle of Wight	0	0	0	0	0	0	0	0	0	0	108280	0	0	0	108280
Marginal	400	131	63	0	149	1	0	19	837	53	0	200381	0	0	202035
Buffer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	34298	18866	195199	58437	54054	55588	63742	195878	66519	4509	108280	201974	0	0	1057344

2031 12hr - Active	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	28243	99	883	1	0	0	0	0	0	0	0	305	0	0	29531
Test Valley	99	18378	2006	447	50	0	0	0	0	0	0	116	0	0	21095
Southampton	864	1965	191156	3753	84	74	0	0	0	0	0	48	0	0	197946
Eastleigh	1	439	3745	49562	950	224	0	0	0	0	0	0	0	0	54922
Winchester	0	53	90	1001	50008	1203	38	185	1452	12	0	123	0	0	54165
Fareham	0	0	77	224	1249	49126	2002	825	9	0	0	1	0	0	53514
Gosport	0	0	0	0	37	1996	65195	19	0	0	0	0	0	0	67247
Portsmouth	0	0	0	0	176	815	19	195672	1311	4	0	18	0	0	198014
Havant	0	0	0	0	1399	9	0	1350	55147	565	0	736	0	0	59207
East Hampshire	0	0	0	0	12	0	0	4	585	3837	0	50	0	0	4487
Isle of Wight	0	0	0	0	0	0	0	0	0	0	112653	0	0	0	112653
Marginal	327	126	51	0	127	1	0	18	741	50	0	197114	0	0	198554
Buffer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	29533	21061	198008	54989	54094	53448	67254	198073	59244	4468	112653	198511	0	0	1051335

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Table 19. Mode Share by Core Area Authority (2015 & 2031)

2015 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	64%	97%	85%	99%	97%	97%	82%	96%	98%	98%	21%	95%	97%	86%	75%
Test Valley	97%	53%	89%	93%	96%	97%	95%	90%	95%	100%	49%	92%	96%	77%	76%
Southampton	86%	89%	50%	86%	90%	92%	78%	88%	94%	99%	11%	87%	88%	67%	60%
Eastleigh	99%	94%	86%	62%	91%	97%	91%	95%	97%	96%	10%	95%	97%	83%	76%
Winchester	96%	96%	90%	91%	53%	92%	96%	96%	94%	98%	14%	95%	95%	75%	73%
Fareham	97%	97%	92%	97%	92%	65%	87%	89%	95%	98%	7%	96%	95%	83%	76%
Gosport	82%	95%	80%	91%	96%	88%	50%	66%	88%	99%	4%	75%	77%	72%	58%
Portsmouth	96%	90%	88%	95%	95%	88%	67%	50%	86%	94%	19%	87%	87%	82%	58%
Havant	97%	95%	94%	98%	94%	95%	87%	85%	60%	94%	22%	92%	96%	89%	72%
East Hampshire	98%	100%	99%	97%	98%	98%	99%	95%	95%	61%	26%	95%	100%	95%	88%
Isle of Wight	20%	41%	8%	9%	14%	6%	4%	15%	21%	23%	65%	26%	17%	36%	64%
Marginal	95%	92%	85%	95%	95%	96%	77%	88%	92%	95%	38%	16%	96%	89%	40%
Buffer	97%	96%	87%	96%	95%	95%	79%	88%	96%	100%	20%	95%	92%	98%	94%
External	85%	78%	70%	84%	77%	83%	69%	83%	89%	95%	39%	90%	98%	98%	88%
Total	75%	77%	60%	76%	73%	76%	58%	58%	72%	87%	64%	40%	94%	88%	66%

2031 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	69%	97%	87%	99%	97%	98%	85%	96%	98%	98%	19%	96%	97%	89%	79%
Test Valley	98%	56%	88%	95%	97%	98%	94%	90%	94%	100%	42%	94%	97%	81%	79%
Southampton	88%	89%	55%	88%	91%	92%	78%	90%	95%	98%	13%	89%	89%	70%	64%
Eastleigh	99%	95%	88%	65%	92%	97%	95%	95%	97%	97%	14%	95%	96%	80%	79%
Winchester	97%	97%	91%	92%	52%	92%	96%	95%	86%	98%	13%	96%	95%	77%	75%
Fareham	98%	98%	93%	97%	92%	68%	89%	91%	96%	99%	7%	96%	95%	84%	79%
Gosport	86%	95%	82%	96%	96%	89%	57%	73%	89%	99%	4%	82%	80%	73%	64%
Portsmouth	95%	90%	90%	95%	95%	91%	75%	53%	89%	95%	27%	91%	89%	85%	62%
Havant	97%	94%	95%	97%	86%	96%	88%	88%	64%	95%	22%	94%	97%	88%	76%
East Hampshire	99%	100%	98%	97%	98%	99%	99%	96%	96%	63%	23%	96%	100%	95%	90%
Isle of Wight	18%	36%	11%	13%	13%	7%	4%	24%	22%	21%	69%	28%	16%	36%	68%
Marginal	96%	94%	87%	95%	96%	96%	83%	91%	94%	96%	40%	19%	96%	91%	45%
Buffer	97%	97%	88%	96%	95%	95%	82%	90%	97%	100%	19%	96%	94%	99%	95%
External	87%	81%	72%	81%	78%	84%	71%	87%	88%	95%	39%	91%	99%	98%	89%
Total	80%	79%	64%	79%	75%	79%	64%	62%	77%	89%	68%	45%	95%	88%	70%

2015 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	2%	1%	11%	1%	3%	3%	18%	4%	2%	2%	79%	2%	3%	14%	3%
Test Valley	1%	2%	5%	3%	2%	3%	5%	10%	5%	0%	51%	4%	4%	23%	3%
Southampton	10%	5%	7%	7%	9%	7%	22%	12%	6%	1%	89%	13%	12%	33%	7%
Eastleigh	1%	2%	7%	3%	6%	2%	9%	5%	3%	4%	90%	5%	3%	17%	4%
Winchester	4%	2%	9%	6%	1%	3%	3%	3%	1%	1%	86%	3%	5%	25%	4%
Fareham	3%	3%	7%	2%	3%	2%	5%	8%	5%	2%	93%	4%	5%	17%	3%
Gosport	18%	5%	20%	9%	3%	5%	2%	34%	12%	1%	96%	25%	23%	28%	4%
Portsmouth	4%	10%	12%	5%	3%	8%	33%	5%	10%	6%	81%	13%	13%	18%	6%
Havant	3%	5%	6%	2%	1%	5%	13%	11%	5%	2%	78%	4%	4%	11%	6%
East Hampshire	2%	0%	1%	3%	1%	2%	1%	5%	2%	2%	74%	4%	0%	5%	3%
Isle of Wight	80%	59%	92%	91%	86%	94%	96%	85%	79%	77%	6%	74%	83%	64%	7%
Marginal	2%	3%	14%	5%	3%	4%	23%	12%	5%	4%	62%	1%	4%	11%	3%
Buffer	3%	4%	13%	4%	5%	5%	21%	12%	4%	0%	80%	5%	8%	2%	6%
External	15%	22%	30%	16%	23%	17%	31%	17%	11%	5%	61%	10%	2%	2%	12%
Total	3%	3%	7%	4%	4%	3%	4%	6%	6%	3%	7%	3%	6%	12%	6%

2031 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	2%	1%	9%	1%	3%	2%	15%	4%	2%	2%	81%	2%	3%	11%	3%
Test Valley	1%	2%	5%	2%	2%	2%	6%	10%	6%	0%	58%	3%	3%	19%	3%
Southampton	8%	5%	6%	6%	9%	7%	22%	10%	5%	2%	87%	11%	11%	30%	7%
Eastleigh	1%	2%	6%	2%	5%	1%	5%	5%	3%	3%	86%	5%	4%	20%	4%
Winchester	3%	2%	9%	5%	3%	2%	3%	4%	2%	1%	87%	3%	5%	23%	5%
Fareham	2%	2%	7%	2%	2%	1%	5%	7%	4%	1%	93%	4%	5%	16%	3%
Gosport	14%	5%	18%	4%	3%	4%	2%	26%	11%	1%	96%	18%	20%	27%	4%
Portsmouth	5%	10%	10%	5%	4%	7%	25%	4%	8%	4%	73%	9%	11%	15%	6%
Havant	3%	6%	5%	3%	2%	4%	12%	9%	5%	2%	78%	3%	3%	12%	5%
East Hampshire	1%	0%	2%	3%	1%	1%	1%	4%	2%	1%	77%	3%	0%	5%	2%
Isle of Wight	82%	64%	89%	87%	87%	93%	96%	76%	78%	79%	5%	72%	84%	64%	7%
Marginal	2%	3%	13%	5%	3%	4%	17%	9%	4%	3%	60%	1%	4%	9%	3%
Buffer	3%	3%	12%	4%	5%	5%	18%	10%	3%	0%	81%	4%	6%	1%	5%
External	13%	19%	28%	19%	22%	16%	29%	13%	12%	5%	61%	9%	1%	2%	11%
Total	3%	3%	7%	4%	5%	3%	4%	6%	5%	2%	7%	3%	5%	12%	5%

2015 12hr - Active	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	34%	2%	4%	0%	0%	0%	0%	0%	0%	0%	0%	3%	0%	0%	22%
Test Valley	1%	45%	7%	4%	1%	0%	0%	0%	0%	0%	0%	4%	0%	0%	20%
Southampton	4%	6%	43%	7%	0%	1%	0%	0%	0%	0%	0%	1%	0%	0%	33%
Eastleigh	0%	4%	7%	35%	3%	2%	0%	0%	0%	0%	0%	0%	0%	0%	20%
Winchester	0%	1%	0%	3%	45%	5%	1%	1%	4%	1%	0%	2%	0%	0%	22%
Fareham	0%	0%	1%	2%	6%	33%	8%	3%	0%	0%	0%	0%	0%	0%	21%
Gosport	0%	0%	0%	0%	1%	8%	48%	0%	0%	0%	0%	0%	0%	0%	38%
Portsmouth	0%	0%	0%	0%	1%	3%	0%	46%	3%	0%	0%	0%	0%	0%	35%
Havant	0%	0%	0%	0%	4%	0%	0%	4%	34%	4%	0%	4%	0%	0%	22%
East Hampshire	0%	0%	0%	0%	1%	0%	0%	0%	3%	37%	0%	2%	0%	0%	9%
Isle of Wight	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	29%	0%	0%	0%	29%
Marginal	3%	4%	1%	0%	2%	0%	0%	0%	4%	2%	0%	83%	0%	0%	57%
Buffer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
External	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	22%	20%	32%	20%	22%	21%	38%	35%	22%	10%	29%	57%	0%	0%	29%

2031 12hr - Active	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	29%	2%	4%	0%	0%	0%	0%	0%	0%	0%	0%	2%	0%	0%	18%
Test Valley	1%	42%	7%	3%	1%	0%	0%	0%	0%	0%	0%	3%	0%	0%	18%
Southampton	3%	6%	40%	6%	1%	0%	0%	0%	0%	0%	0%	1%	0%	0%	29%
Eastleigh	0%	3%	6%	32%	3%	1%	0%	0%	0%	0%	0%	0%	0%	0%	17%
Winchester	0%	1%	1%	3%	45%	6%	1%	1%	12%	1%	0%	1%	0%	0%	20%
Fareham	0%	0%	1%	1%	6%	30%	7%	3%	0%	0%	0%	0%	0%	0%	18%
Gosport	0%	0%	0%	0%	1%	7%	41%	0%	0%	0%	0%	0%	0%	0%	32%
Portsmouth	0%	0%	0%	0%	1%	2%	0%	43%	3%	0%	0%	0%	0%	0%	32%
Havant	0%	0%	0%	0%	12%	0%	0%	3%	31%	3%	0%	3%	0%	0%	19%
East Hampshire	0%	0%	0%	0%	1%	0%	0%	0%	3%	36%	0%	1%	0%	0%	8%
Isle of Wight	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	25%	0%	0%	0%	25%
Marginal	2%	3%	1%	0%	1%	0%	0%	0%	3%	1%	0%	80%	0%	0%	53%
Buffer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
External	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	17%	18%	29%	17%	20%	18%	32%	32%	18%	9%	25%	53%	0%	0%	25%

SYSTRA

Table 20. Motorised Mode Share by Core Area Authority (2015 & 2031)

2015 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	97%	99%	89%	99%	97%	97%	82%	96%	98%	98%	21%	98%	97%	86%	96%
Test Valley	99%	96%	95%	97%	98%	97%	95%	90%	95%	100%	49%	96%	96%	77%	96%
Southampton	90%	95%	88%	92%	91%	93%	78%	88%	94%	99%	11%	87%	88%	67%	89%
Eastleigh	99%	98%	93%	96%	94%	98%	91%	95%	97%	96%	10%	95%	97%	83%	95%
Winchester	96%	98%	91%	94%	98%	97%	97%	97%	99%	99%	14%	97%	95%	75%	94%
Fareham	97%	97%	93%	98%	97%	98%	95%	92%	95%	98%	7%	96%	95%	83%	96%
Gosport	82%	95%	80%	91%	97%	95%	96%	66%	88%	99%	4%	75%	77%	72%	93%
Portsmouth	96%	90%	88%	95%	97%	91%	67%	91%	89%	94%	19%	87%	87%	82%	90%
Havant	97%	95%	94%	98%	99%	95%	87%	89%	92%	98%	22%	95%	96%	89%	92%
East Hampshire	98%	100%	99%	97%	99%	98%	99%	95%	98%	98%	26%	96%	100%	95%	97%
Isle of Wight	20%	41%	8%	9%	14%	6%	4%	15%	21%	23%	91%	26%	17%	36%	90%
Marginal	98%	96%	86%	95%	97%	96%	77%	88%	95%	96%	38%	95%	96%	89%	94%
Buffer	97%	96%	87%	96%	95%	95%	79%	88%	96%	100%	20%	95%	92%	98%	94%
External	85%	78%	70%	84%	77%	83%	69%	83%	89%	95%	39%	90%	98%	98%	88%
Total	96%	96%	89%	95%	95%	96%	93%	90%	93%	97%	90%	94%	94%	88%	92%

2031 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	97%	99%	91%	99%	97%	98%	85%	96%	98%	98%	19%	98%	97%	89%	96%
Test Valley	99%	97%	95%	98%	98%	98%	94%	90%	94%	100%	42%	96%	97%	81%	96%
Southampton	91%	95%	91%	93%	91%	93%	78%	90%	95%	98%	13%	89%	89%	70%	91%
Eastleigh	99%	98%	93%	96%	95%	99%	95%	95%	97%	97%	14%	95%	96%	80%	95%
Winchester	97%	98%	91%	95%	94%	98%	97%	96%	97%	99%	13%	97%	95%	77%	94%
Fareham	98%	98%	93%	98%	98%	98%	95%	93%	96%	99%	7%	96%	95%	84%	96%
Gosport	86%	95%	82%	96%	97%	95%	97%	73%	89%	99%	4%	82%	80%	73%	94%
Portsmouth	95%	90%	90%	95%	96%	93%	75%	93%	91%	96%	27%	91%	89%	85%	92%
Havant	97%	94%	95%	97%	97%	96%	88%	91%	93%	98%	22%	96%	97%	88%	94%
East Hampshire	99%	100%	98%	97%	99%	99%	99%	96%	98%	98%	23%	97%	100%	95%	98%
Isle of Wight	18%	36%	11%	13%	13%	7%	4%	24%	22%	21%	93%	28%	16%	36%	91%
Marginal	98%	97%	87%	95%	97%	96%	83%	91%	96%	97%	40%	95%	96%	91%	94%
Buffer	97%	97%	88%	96%	95%	95%	82%	90%	97%	100%	19%	96%	94%	99%	95%
External	87%	81%	72%	81%	78%	84%	71%	87%	88%	95%	39%	91%	99%	98%	89%
Total	96%	96%	91%	95%	94%	96%	94%	92%	94%	97%	91%	95%	95%	88%	93%

2015 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	3%	1%	11%	1%	3%	3%	18%	4%	2%	2%	79%	2%	3%	14%	4%
Test Valley	1%	4%	5%	3%	2%	3%	5%	10%	5%	0%	51%	4%	4%	23%	4%
Southampton	10%	5%	12%	8%	9%	7%	22%	12%	6%	1%	89%	13%	12%	33%	11%
Eastleigh	1%	2%	7%	4%	6%	2%	9%	5%	3%	4%	90%	5%	3%	17%	5%
Winchester	4%	2%	9%	6%	2%	3%	3%	3%	1%	1%	86%	3%	5%	25%	6%
Fareham	3%	3%	7%	2%	3%	2%	5%	8%	5%	2%	93%	4%	5%	17%	4%
Gosport	18%	5%	20%	9%	3%	5%	4%	34%	12%	1%	96%	25%	23%	28%	7%
Portsmouth	4%	10%	12%	5%	3%	9%	33%	9%	11%	6%	81%	13%	13%	18%	10%
Havant	3%	5%	6%	2%	1%	5%	13%	11%	8%	2%	78%	5%	4%	11%	8%
East Hampshire	2%	0%	1%	3%	1%	2%	1%	5%	2%	2%	74%	4%	0%	5%	3%
Isle of Wight	80%	59%	92%	91%	86%	94%	96%	85%	79%	77%	9%	74%	83%	64%	10%
Marginal	2%	4%	14%	5%	3%	4%	23%	12%	5%	4%	62%	5%	4%	11%	6%
Buffer	3%	4%	13%	4%	5%	5%	21%	12%	4%	0%	80%	5%	8%	2%	6%
External	15%	22%	30%	16%	23%	17%	31%	17%	11%	5%	61%	10%	2%	2%	12%
Total	4%	4%	11%	5%	5%	4%	7%	10%	7%	3%	10%	6%	6%	12%	8%

2031 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	3%	1%	9%	1%	3%	2%	15%	4%	2%	2%	81%	2%	3%	11%	4%
Test Valley	1%	3%	5%	2%	2%	2%	6%	10%	6%	0%	58%	4%	3%	19%	4%
Southampton	9%	5%	9%	7%	9%	7%	22%	10%	5%	2%	87%	11%	11%	30%	9%
Eastleigh	1%	2%	7%	4%	5%	1%	5%	5%	3%	3%	86%	5%	4%	20%	5%
Winchester	3%	2%	9%	5%	6%	2%	3%	4%	3%	1%	87%	3%	5%	23%	6%
Fareham	2%	2%	7%	2%	2%	2%	5%	7%	4%	1%	93%	4%	5%	16%	4%
Gosport	14%	5%	18%	4%	3%	5%	3%	27%	11%	1%	96%	18%	20%	27%	6%
Portsmouth	5%	10%	10%	5%	4%	7%	25%	7%	9%	4%	73%	9%	11%	15%	8%
Havant	3%	6%	5%	3%	3%	4%	12%	9%	7%	2%	78%	4%	3%	12%	6%
East Hampshire	1%	0%	2%	3%	1%	1%	1%	4%	2%	2%	77%	3%	0%	5%	2%
Isle of Wight	82%	64%	89%	87%	87%	93%	96%	76%	78%	79%	7%	72%	84%	64%	9%
Marginal	2%	3%	13%	5%	3%	4%	17%	9%	4%	3%	60%	5%	4%	9%	6%
Buffer	3%	3%	12%	4%	5%	5%	18%	10%	3%	0%	81%	4%	6%	1%	5%
External	13%	19%	28%	19%	22%	16%	29%	13%	12%	5%	61%	9%	1%	2%	11%
Total	4%	4%	9%	5%	6%	4%	6%	8%	6%	3%	9%	5%	5%	12%	7%

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Table 21. Change in Demand by Core Area Authority by Mode (2015 & 2031)

2031 - 2015 12hr - Car	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	5677	1751	3889	1759	141	448	86	551	188	25	4	1639	1299	368	17825
Test Valley	2166	4444	7057	3143	930	541	100	388	145	14	9	787	1545	296	21565
Southampton	5985	8075	42662	9937	1951	2798	793	1760	593	105	70	1207	3049	2190	81175
Eastleigh	1856	3535	8402	6003	3011	3496	1005	2087	793	107	25	887	1881	1427	34516
Winchester	125	1099	1317	2612	-1711	4127	1376	4152	2335	561	4	846	3292	1130	21267
Fareham	440	567	2364	3063	3863	8313	6043	6085	2385	388	3	671	576	488	35248
Gosport	104	120	776	948	1388	5405	23666	2034	852	111	4	280	139	184	36012
Portsmouth	477	399	1805	2032	4374	7303	2546	28590	4536	1430	257	3329	1619	4378	63075
Havant	141	130	538	651	2167	2470	886	3579	3546	2119	8	5302	907	550	22994
East Hampshire	26	17	118	110	553	429	136	1212	2799	583	0	570	149	-3	6698
Isle of Wight	4	8	55	20	4	3	4	246	8	0	66715	37	23	299	67426
Marginal	1479	740	828	731	871	720	273	2913	5021	552	67	6359	3049	2194	25798
Buffer	1159	1686	2303	1553	3039	646	159	1521	1024	163	27	2825	1859	5280	23243
External	207	298	1513	1110	787	423	170	4359	349	-12	302	1739	3694	5033	19973
Total	19845	22870	73625	33674	21368	37123	37244	59474	24575	6146	67496	26479	23083	23814	476816

2031 - 2015 12hr - Car %	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	9%	39%	24%	32%	4%	34%	70%	47%	31%	29%	30%	13%	22%	15%	15%
Test Valley	46%	22%	36%	27%	20%	63%	150%	93%	58%	34%	42%	28%	31%	24%	30%
Southampton	36%	42%	19%	21%	17%	24%	165%	38%	26%	27%	90%	16%	29%	37%	23%
Eastleigh	33%	29%	18%	6%	12%	28%	158%	41%	37%	37%	115%	21%	26%	25%	16%
Winchester	3%	23%	11%	11%	-3%	28%	75%	48%	30%	58%	8%	10%	17%	10%	12%
Fareham	34%	65%	20%	26%	26%	8%	29%	26%	30%	49%	26%	28%	25%	13%	17%
Gosport	84%	172%	145%	150%	68%	25%	36%	53%	68%	107%	62%	70%	52%	26%	37%
Portsmouth	46%	102%	37%	42%	52%	32%	65%	14%	13%	23%	77%	37%	44%	48%	20%
Havant	26%	55%	21%	30%	28%	32%	77%	11%	3%	12%	14%	27%	23%	8%	11%
East Hampshire	25%	34%	25%	32%	55%	50%	123%	16%	14%	9%	-1%	17%	13%	0%	16%
Isle of Wight	35%	39%	101%	95%	8%	25%	62%	103%	15%	-2%	28%	32%	36%	38%	28%
Marginal	12%	25%	12%	18%	11%	27%	65%	30%	25%	17%	32%	16%	17%	17%	18%
Buffer	20%	30%	22%	21%	15%	26%	51%	36%	23%	13%	35%	16%	31%	23%	21%
External	9%	22%	23%	18%	7%	11%	24%	45%	4%	-1%	33%	14%	18%	15%	17%
Total	17%	31%	20%	15%	12%	18%	39%	18%	11%	16%	28%	19%	22%	20%	20%

2031 - 2015 12hr - PT	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	-190	19	25	25	-5	7	11	32	3	0	28	15	28	-26	-29
Test Valley	21	-7	459	12	18	5	7	40	11	0	20	21	10	-8	609
Southampton	168	540	-2360	320	80	170	218	84	9	3	348	-2	213	657	448
Eastleigh	29	15	154	-132	-67	37	14	103	29	0	83	48	134	586	1032
Winchester	-11	18	71	-84	2153	61	46	259	165	10	35	10	26	-46	2712
Fareham	6	4	142	35	53	-61	191	116	47	1	36	29	29	30	659
Gosport	11	7	155	9	42	148	399	169	83	2	88	16	21	58	1208
Portsmouth	37	43	86	113	261	163	225	-1662	-436	-48	205	-87	72	321	-707
Havant	5	12	5	30	159	44	96	-521	-1576	-38	23	-21	15	188	-1579
East Hampshire	0	0	3	0	10	1	2	-49	-37	-8	7	0	0	3	-68
Isle of Wight	24	21	269	74	36	29	90	148	24	7	504	77	143	536	1982
Marginal	15	17	-18	37	10	29	14	-112	-31	0	70	13	84	55	181
Buffer	28	11	149	94	24	29	25	63	13	0	139	63	-51	-12	577
External	-31	-15	348	509	-80	11	48	176	159	2	450	-11	-24	88	1631
Total	112	685	-511	1041	2692	671	1386	-1152	-1535	-70	2037	172	699	2431	8658

2031 - 2015 12hr - PT %	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	-10%	34%	1%	33%	-4%	19%	41%	70%	23%	-12%	48%	5%	17%	-7%	-1%
Test Valley	40%	-1%	46%	4%	15%	19%	198%	88%	86%	0%	94%	19%	5%	-2%	20%
Southampton	9%	54%	-8%	8%	7%	18%	157%	13%	6%	57%	54%	0%	14%	23%	1%
Eastleigh	43%	5%	4%	-3%	-4%	18%	23%	42%	48%	-4%	42%	20%	53%	51%	9%
Winchester	-8%	16%	6%	-6%	164%	15%	75%	90%	159%	85%	12%	4%	2%	-1%	26%
Fareham	18%	18%	15%	17%	13%	-2%	16%	6%	12%	6%	26%	28%	23%	4%	7%
Gosport	40%	183%	119%	15%	70%	13%	15%	9%	51%	174%	53%	12%	27%	21%	18%
Portsmouth	75%	94%	13%	47%	89%	8%	12%	-8%	-10%	-12%	15%	-6%	12%	16%	-2%
Havant	26%	93%	3%	63%	148%	11%	56%	-12%	-16%	-9%	11%	-2%	10%	21%	-9%
East Hampshire	-13%	0%	57%	-2%	80%	7%	193%	-12%	-9%	-5%	15%	0%	24%	3%	-5%
Isle of Wight	47%	73%	41%	35%	12%	18%	53%	11%	11%	12%	2%	24%	46%	38%	7%
Marginal	5%	15%	-2%	17%	3%	28%	11%	-8%	-3%	0%	21%	1%	10%	4%	2%
Buffer	17%	5%	10%	32%	2%	21%	31%	11%	8%	25%	45%	7%	-9%	-3%	9%
External	-8%	-4%	13%	43%	-2%	1%	15%	9%	17%	2%	31%	-1%	-6%	15%	10%
Total	2%	22%	-1%	9%	26%	7%	20%	-3%	-9%	-5%	7%	2%	11%	15%	4%

2031 - 2015 12hr - Active	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	-4856	28	140	0	0	0	0	0	0	0	0	-76	0	0	-4763
Test Valley	28	1590	575	-50	-12	0	0	0	0	0	0	-2	0	0	2129
Southampton	137	636	2019	61	51	-3	0	0	0	0	0	-11	0	0	2890
Eastleigh	0	-44	36	-3586	105	24	0	0	0	0	0	0	0	0	-3465
Winchester	0	-12	54	109	-1573	348	17	70	1086	3	0	-21	0	0	81
Fareham	0	0	-3	18	357	-2620	174	-50	-1	0	0	0	0	0	-2125
Gosport	0	0	0	0	17	152	3313	7	0	0	0	0	0	0	3490
Portsmouth	0	0	0	0	65	-41	7	2306	-128	1	0	-1	0	0	2208
Havant	0	0	0	0	1049	-1	0	-137	-8047	-77	0	-83	0	0	-7296
East Hampshire	0	0	0	0	2	0	0	1	-87	36	0	-3	0	0	-51
Isle of Wight	0	0	0	0	0	0	0	0	0	0	4373	0	0	0	4373
Marginal	-73	-5	-12	0	-22	0	0	-1	-97	-3	0	-3266	0	0	-3481
Buffer	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
External	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Total	-4765	2194	2809	-3448	40	-2140	3512	2196	-7275	-41	4373	-3463	0	0	-6009

2031 - 2015 12hr - Active %	New Forest	Test Valley	Southampton	Eastleigh	Winchester	Fareham	Gosport	Portsmouth	Havant	East Hampshire	Isle of Wight	Marginal	Buffer	External	Total
New Forest	-15%	41%	19%	76%	0%	0%	0%	0%	0%	0%	0%	-20%	0%	0%	-14%
Test Valley	40%	9%	40%	-10%	-20%	0%	0%	0%	0%	0%	0%	-2%	0%	0%	11%
Southampton	19%	48%	1%	2%	149%	-3%	0%	0%	0%	0%	0%	-18%	0%	0%	1%
Eastleigh	66%	-9%	1%	-7%	12%	12%	0%	0%	0%	0%	0%	-32%	0%	0%	-6%
Winchester	0%	-18%	149%	12%	-3%	41%	81%	61%	297%	26%	0%	-14%	0%	0%	0%
Fareham	0%	0%	-4%	9%	40%	-5%	10%	-6%	-13%	0%	0%	-31%	0%	0%	-4%
Gosport	0%	0%	0%	0%	86%	8%	5%	61%	-8%	0%	0%	0%	0%	0%	5%
Portsmouth	0%	0%	0%	0%	58%	-5%	58%	1%	-9%	23%	0%	-3%	0%	0%	1%
Havant	0%	0%	0%	0%	300%	-13%	-8%	-9%	-13%	-12%	0%	-10%	0%	0%	-11%
East Hampshire	0%	0%	0%	0%	24%	0%	0%	24%	-13%	1%	0%	-5%	0%	0%	-1%
Isle of Wight	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	4%	0%	0%	0%	4%
Marginal	-18%	-4%	-19%	-33%	-15%	-32%	0%	-4%	-12%	-6%	0%	-2%	0%	0%	-2%
Buffer	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
External	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Total	-14%	12%	1%	-6%	0%	-4%	6%	1%	-11%	-1%	4%	-2%	0%	0%	-1%

6.1 GDM Forecasts

6.1.1 Summaries of the Port and Airport related demand matrices derived in the GDM for the highway and PT assignment models are shown in Table 22 below. The assignment matrices trips are aggregated by purpose, mode and period, and are presented below by port, mode and forecast year. They represent vehicle trips both to and from the ports, between 07:00 and 19:00.

Table 22. GDM Assignment Matrices Summary

	Trips				*% Increase from 2015*			
	Car	***PT***	***LGV***	***OGV***	***Car***	***PT***	***LGV***	***OGV***
Southampton Port – Gate 4								
2015	*2542*	*629*	*484*	*539*				
2019	*3319*	*801*	*630*	*695*	*31%*	*27%*	*30%*	*29%*
2026	*4067*	*955*	*770*	*850*	*60%*	*52%*	*59%*	*58%*
2031	*4540*	*1053*	*858*	*950*	*79%*	*67%*	*77%*	*76%*
2036	*5054*	*1162*	*954*	*1059*	*99%*	*85%*	*97%*	*97%*
Southampton Port – Gate 10								
2015	*2507*	*129*	*380*	*545*				
2019	*3280*	*166*	*494*	*704*	*31%*	*29%*	*30%*	*29%*
2026	*4001*	*204*	*603*	*861*	*60%*	*58%*	*59%*	*58%*
2031	*4453*	*227*	*673*	*962*	*78%*	*76%*	*77%*	*76%*
2036	*4945*	*253*	*749*	*1072*	*97%*	*96%*	*97%*	*97%*
Southampton Port – Gate 20								
2015	*1182*	*21*	*485*	*2235*				
2019	*1527*	*27*	*626*	*2883*	*29%*	*28%*	*29%*	*29%*
2026	*1868*	*33*	*766*	*3528*	*58%*	*56%*	*58%*	*58%*
2031	*2086*	*37*	*855*	*3942*	*76%*	*74%*	*76%*	*76%*
2036	*2325*	*41*	*953*	*4393*	*97%*	*95%*	*97%*	*97%*
Southampton Airport								
2015	*5401*	*346*	*451*	*242*				
2019	*5602*	*346*	*462*	*248*	*4%*	*0%*	*2%*	*2%*
2026	*6416*	*404*	*521*	*280*	*19%*	*17%*	*16%*	*16%*
2031	*7163*	*457*	*576*	*309*	*33%*	*32%*	*28%*	*28%*
2036	*8109*	*528*	*647*	*347*	*50%*	*53%*	*43%*	*43%*
Portsmouth Port								
2015	*3757*	*272*	*471*	*605*				
2019	*5459*	*395*	*684*	*880*	*45%*	*45%*	*45%*	*45%*
2026	*7280*	*527*	*913*	*1173*	*94%*	*94%*	*94%*	*94%*
2031	*8352*	*605*	*1047*	*1346*	*122%*	*122%*	*122%*	*122%*
2036	*9424*	*682*	*1181*	*1519*	*151%*	*151%*	*151%*	*151%*

7. RTM REFERENCE FORECASTS

7.1 Summary

7.1.1 This section presents the results from the RTM reference forecasts. Results include flows, and delays.

7.2 Summary RTM Statistics

7.2.1 Figure 13 to 18 give a graphical representation of the following statistics by period and year:

- Demand by userclass;
- Delays and Cruise times;
- Vehicle Kms;
- Average Speeds;
- Average Trip Length; and
- Average Trip Time.

7.2.2 The modelled time periods are as follows (Note, AM and PM periods represent 3 hours and IP period represents 6 hours):

- AM, 07:00-10:00
- IP, 10:00-16:00
- PM, 16:00-19:00

Figure 13. Demand by Period and Modelled Year

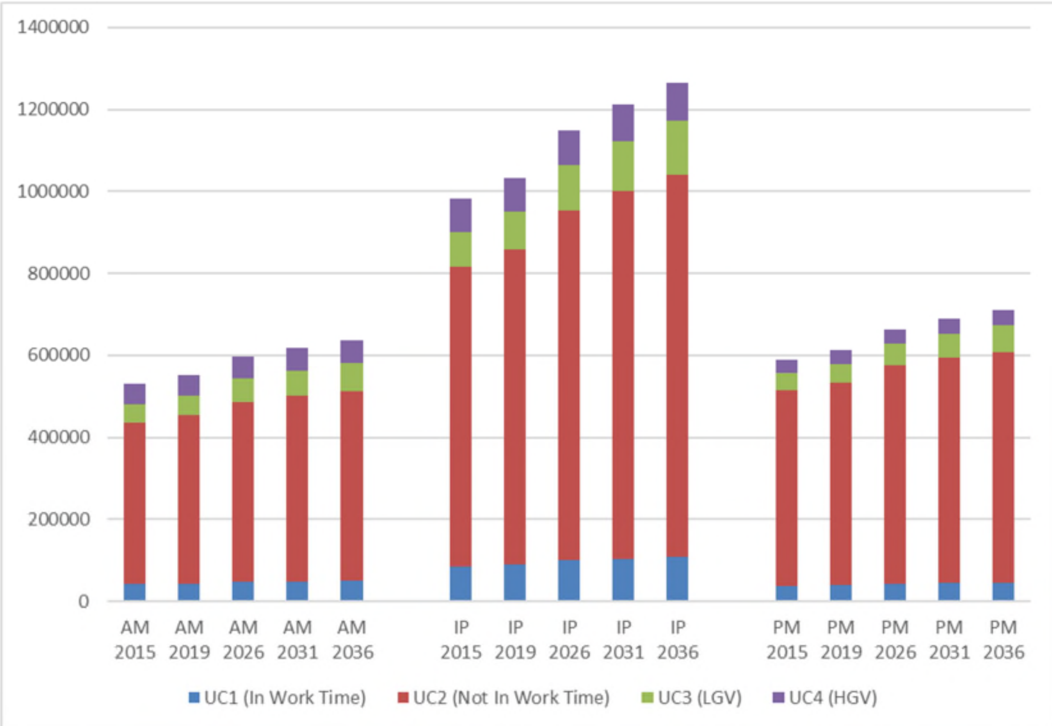


Figure 14. Delays and Cruise Times by Period and Modelled Year

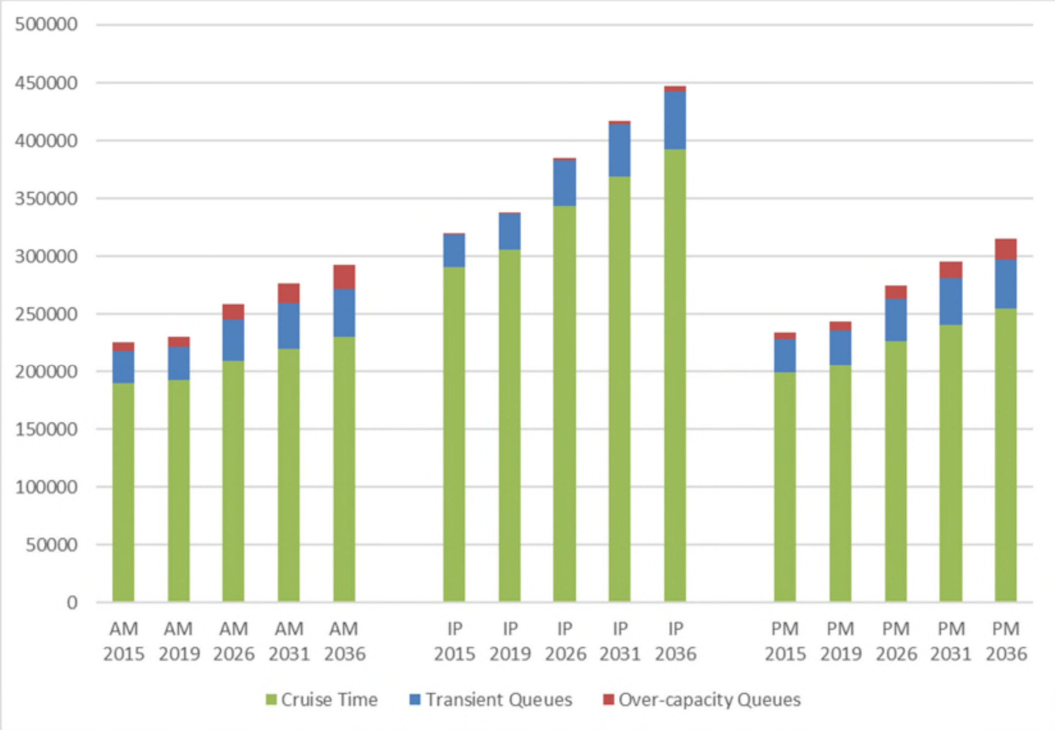


Figure 15. Vehicle Kms by Period and Modelled Year

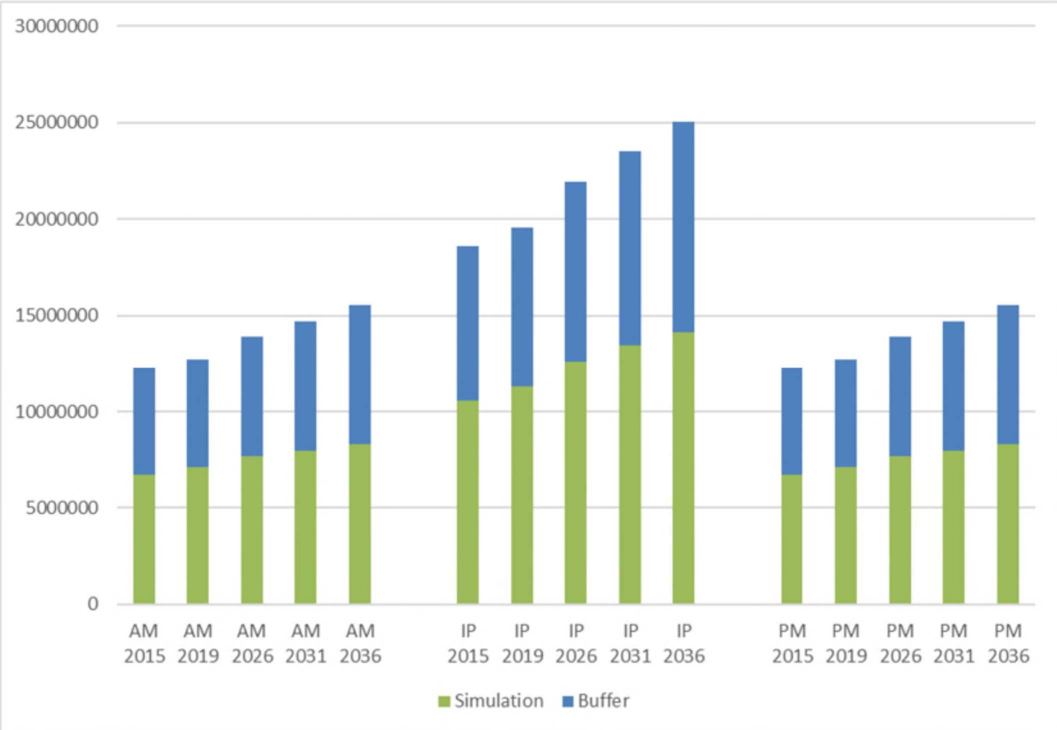


Figure 16. Average Speeds (kph) in the Core Area by Period and Modelled Year

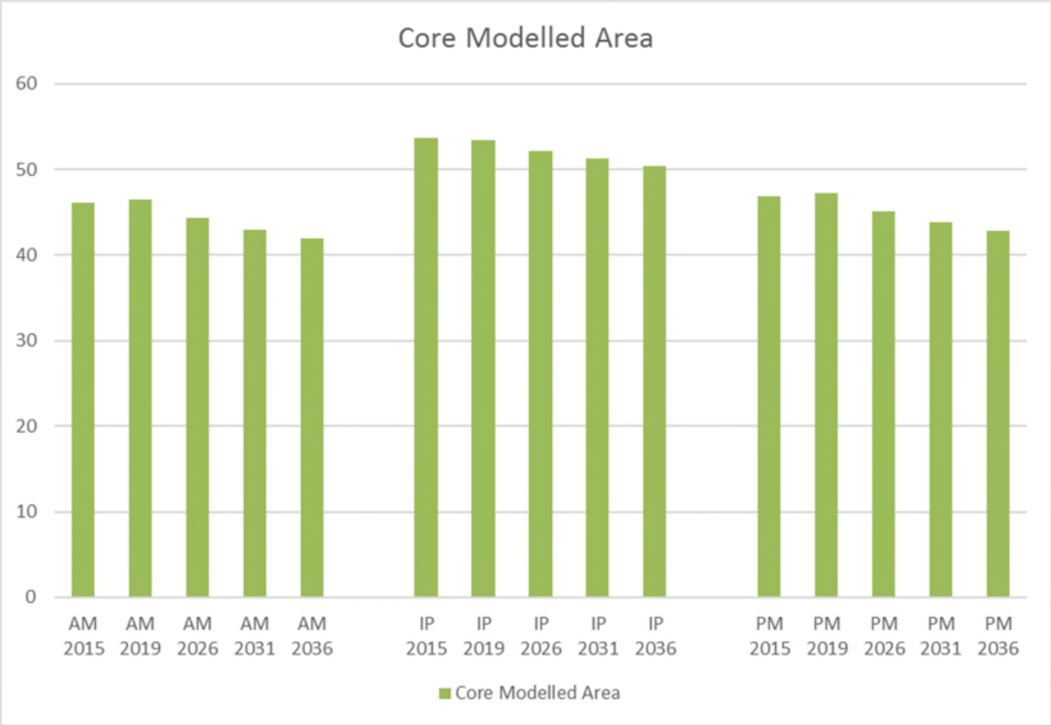


Figure 17. Average Trip Length (km) by Period and Modelled Year

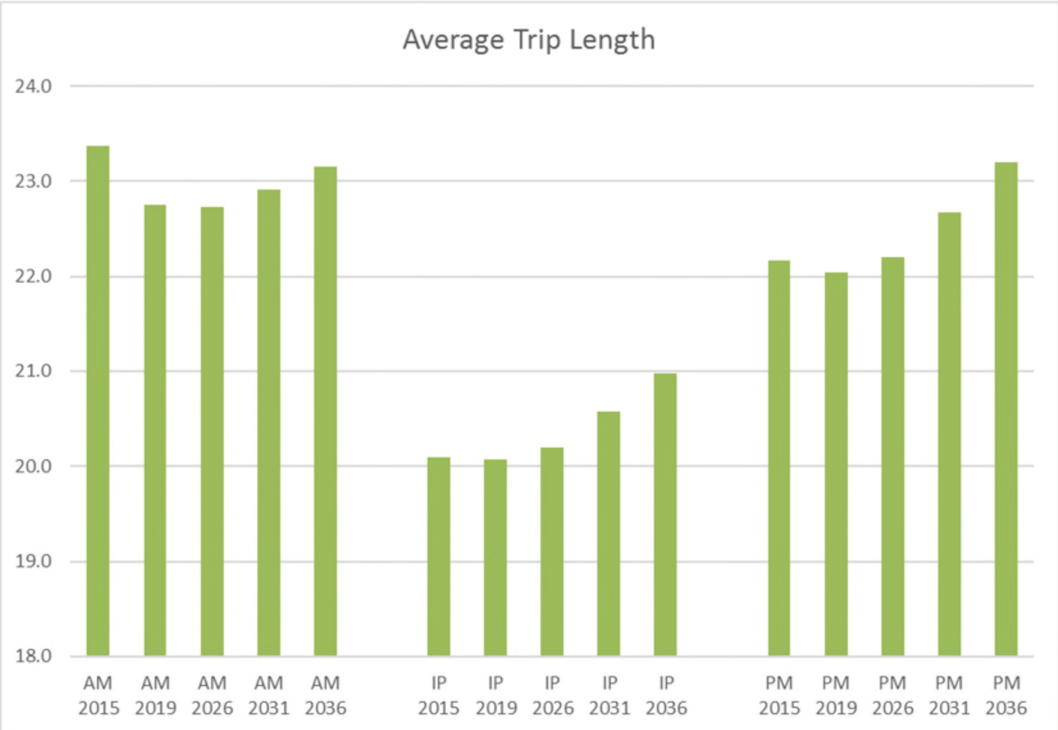
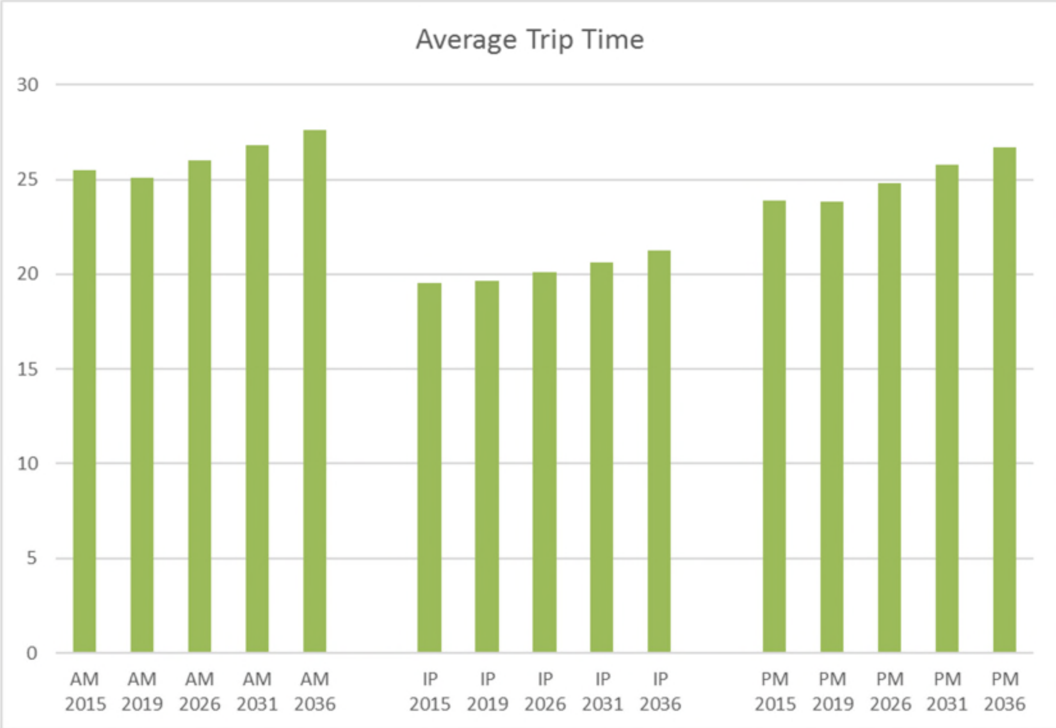


Figure 18. Average Trip Time (Mins) by Period and Modelled Year



7.3 Highway Delays

7.3.1 Figure 19 shows the highway delays for the base case and the reference case for all years to 2036. Delays are shown for the west of the core area, for the PM peak (as the period with the most highway demand). The delay is presented in terms of the average delay per vehicle.

Figure 19. Average Delay per PCU PM Peak

8. PTM REFERENCE FORECASTS

8.1 Summary

8.1.1 This chapter presents the key results from the PTM reference forecasts.

8.1.2 Figure 21 gives a graphical representation of the total public transport demand by period and year. Figure 22 gives PT boardings by mode, period and year.

Figure 20. PT Demand by Period and Modelled Year

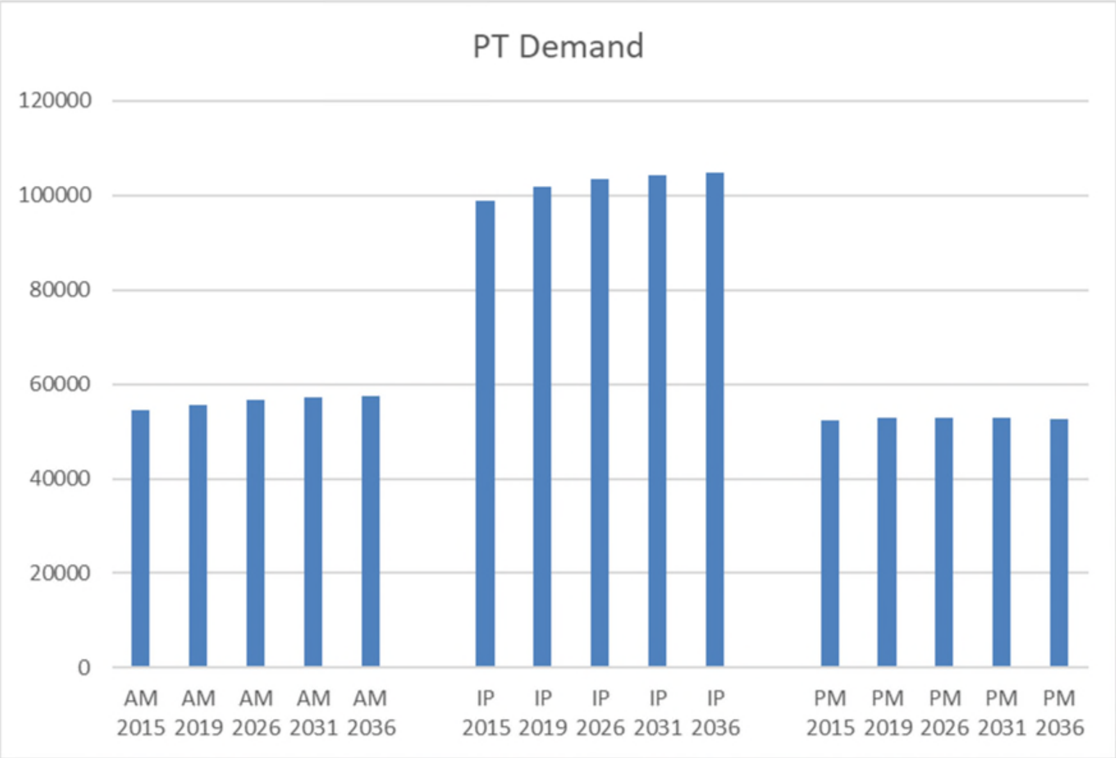
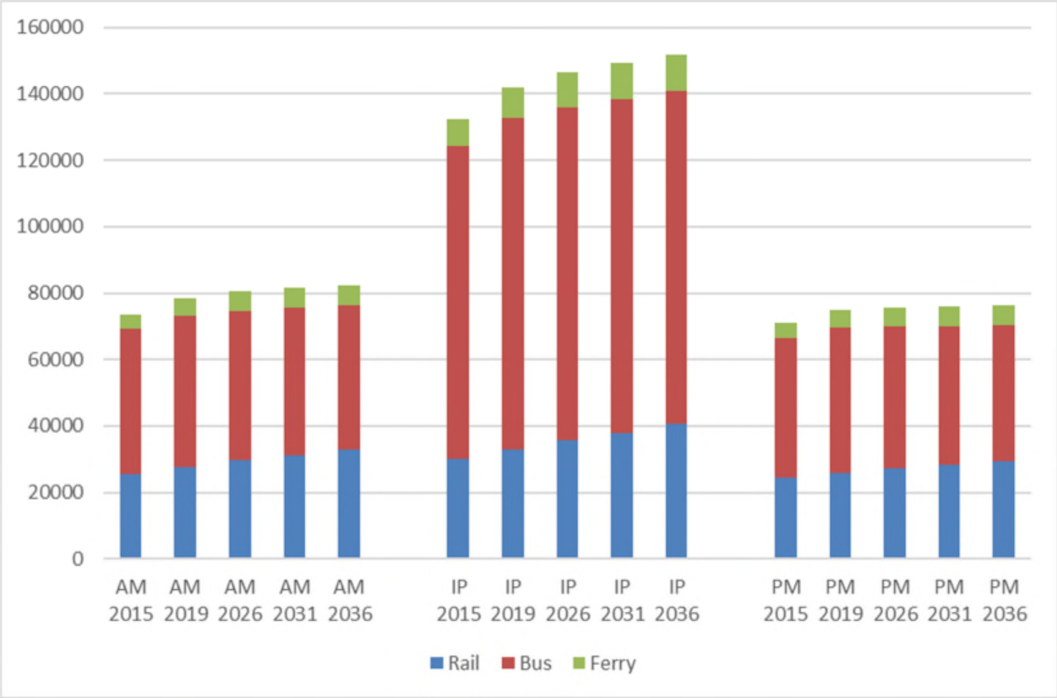


Figure 21. PT Boardings by Mode, Period and Modelled Year



9. CONCLUSIONS

9.1 Summary

9.1.1 The approach and results presented in this note demonstrate that the SRTM components interact as designed and the results produced match the responses that might be expected. Given that these responses are themselves calibrated on both base data and WebTAG sensitivity criteria the model projects for future years represent a compliant projection that reacts to changing inputs assumptions.

9.1.2 Clearly clarity and consensus of these assumptions are required to make use of the model but the reference cases produced thus far provide a working set of future scenarios based on the best available data and assumptions available at the time.

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