Tritax Symmetry (Hinckley) Limited

HINCKLEY NATIONAL RAIL FREIGHT INTERCHANGE

The Hinckley National Rail Freight Interchange Development Consent Order

Project reference TR050007

Environmental Statement
Volume 2: Appendices

Appendix 8.1: Transport Assessment [part 6 of 20] Pan-regional Transport Highway Assignment Local Model Validation Report (May 2021)

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Planning Act 2008

The Infrastructure Planning (Applications: Prescribed Forms and Procedure) Regulations 2009 Regulation 5(2)(a)

The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017 Regulation 14

This document forms a part of the Environmental Statement for the Hinckley National Rail Freight Interchange project.

Tritax Symmetry (Hinckley) Limited (TSH) has applied to the Secretary of State for Transport for a Development Consent Order (DCO) for the Hinckley National Rail Freight Interchange (HNRFI).

To help inform the determination of the DCO application, TSH has undertaken an environmental impact assessment (EIA) of its proposals. EIA is a process that aims to improve the environmental design of a development proposal, and to provide the decision maker with sufficient information about the environmental effects of the project to make a decision.

The findings of an EIA are described in a written report known as an Environmental Statement (ES). An ES provides environmental information about the scheme, including a description of the development, its predicted environmental effects and the measures proposed to ameliorate any adverse effects.

Further details about the proposed Hinckley National Rail Freight Interchange are available on the project website:

[redacted]

The DCO application and documents relating to the examination of the proposed development can be viewed on the Planning Inspectorate's National Infrastructure Planning website:

https://infrastructure.planninginspectorate.gov.uk/projects/east-midlands/hinckley-national-rail-freight-interchange/

AECOM

Pan-Regional Transport Model

Highway Assignment Local Model Validation Report

May 2021

Quality information

Prepared by	Checked by	Approved by
Clare Norris Consultant	Aled Davies Associate Director	Mark Dazeley Regional Director

Revision History

Revision	Revision date	Details	Authorised	Name	Position
v1	2021-01-29	Draft for issue	Yes	Mark Dazeley	Regional Director
v2	2021-05-17	Updated following client comments	Yes	Mark Dazeley	Regional Director
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Prepared for:

Leicestershire County Council

Prepared by:

AECOM Limited
AECOM House
63-77 Victoria Street
St Albans
Hertfordshire
AL1 3ER
UK

[redacted]

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1. Overview

1.1 Introduction

1.1.1 The Leicester and Leicestershire Integrated Transport Model (LLITM) was commissioned by Leicestershire County Council (LCC) and was a suite of models containing highway and public transport assignment models; a demand model (which included a parking model of Leicester City and Loughborough town centre), and a land-use model. The assignment models contained within this suite, including the highway model, were developed to represent a typical weekday with a base year of 2014, with a neutral month of April/May/June (excluding weeks with bank holidays).

1.1.2 The Pan-Regional Transport Model (PRTM) was initially developed as a variant of LLITM for a strategic road scheme appraisal which included sections outside Leicestershire in the LLITM fixed-speed buffer network. Since then, a large area of the Midlands surrounding Leicestershire has been updated with more detailed network and zoning with congestion represented by speed-flow curves. This is referred to in this document as the ‘PRTM area’. New calibration data were also added to the PRTM area to calibrate the external areas of the matrix. This calibrated model has subsequently been used for several applications.

1.1.3 In 2019, AECOM was commissioned to undertake an update of the PRTM, with special attention given to the area around the proposed M1 J20a and Whetstone Pastures development which was intended as the first major application of the updated model. Further details of the update are given in section 2.2.2.

1.1.4 This report details the development of the PRTM highway model including its key features, calibration and validation data, network and trip matrix development and calibration, and validation methods and results. This work was all undertaken in-line with TAG Unit M3.1 guidance on developing a highway assignment model.

1.2 Report Structure

1.2.1 The structure of the report is based on the structure detailed in Appendix F of TAG Unit M3.1 for a highway model LMVR.

- **Section 2 - Proposed Uses of the Model and Key Model Design Considerations**: this section outlines the known and expected uses of the model, and how PRTM has been developed in response to these objectives.
- **Section 3 - Model Standards**: this section details the measures used to assess the model in terms of modelled flows and journey times, and also discusses the convergence criteria and standards adopted.
- **Section 4 - Key Features of the Model**: this section considers the main characteristics of the model, including the zone system, the network detail, the time periods modelled, the user classes within the assignment and the relationship of the highway model with the wider PRTM suite.
- **Section 5 - Calibration and Validation Data**: this section details the source and processing of the observed data used for calibration and validation of the highway model in terms of both counts and journey times.
- **Section 6 - Network Development:** this section details the methods and processes adopted in the development of the highway network including junction modelling and the speed-flow relationships applied within the network.
- **Section 7 - Trip Matrix Development**: this section details the development of the prior matrices using observed roadside interview data, mobile network data and the synthesis of unobserved movements using a gravity model approach.

- **Section 8 - Network Calibration and Validation**: this section details the checks on the network coding against the observed count and journey time data to identify any potential errors in the network coding or observed data.
- **Section 9 - Route Choice Calibration and Validation**: this section considers the calibration of route choice in the model, and in particular the representation of HGV routeing, and reviews the routeing within the highway assignment between key urban centres.
- **Section 10 - Trip Matrix Calibration and Validation**: this section details the updates to the prior matrices applied before the application of matrix estimation, and also discusses the impact on the updated prior matrices of the matrix estimation process.
- **Section 11 - Assignment Calibration and Validation**: this section details the performance of the model against the standards defined in Section 3.
- **Section 12 - Summary of Model Development, Standards Achieved and Suitability for Use**: this section summaries the results of the model calibration and validation, and assesses the outcome of this process against the known applications of the model.

1.2.2 This report also contains the following appendices and associated files:

- **Appendix A– Detailed Screenline Performance**: this appendix provides the results of the screenline performance by vehicle type.
- **Appendix B– Detailed Journey Time Performance**: this appendix contains detailed results of the journey time validation.
- **Appendix C– Summary of Network Statistics**: this appendix contains high-level statistics from the PRTM highway model. These include information on the network, matrix totals and network statistics (such as vehicle kilometres and average speeds) from the base year.
- **Appendix D– Assignment Calibration and Validation - Independent Validation Model**: This appendix considers the aggregate performance of the independent validation version of the highway model against screenline and individual counts.
- **Appendix E**– Model Performance by Area: This appendix considers the model performance for each individual district within Leicestershire as well as separately for the Strategic Road Network, Leicestershire Cordon and External and PRTM Area

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

2.1 Proposed Uses of the Model

2.1.1 The focus of the PRTM highway model is to ensure flexibility in assessing each of the following broad types of study:

- transport assessment of development(s) and masterplans;
- transport evidence to support Core Strategies / Local Plans;
- TAG transport scheme appraisal;
- future transport scheme prioritisation and Local Transport Board (LTB), Local Enterprise Partnership (LEP) and Department for Transport (DfT) submissions;
- Local Transport Plan (LTP) strategy evidence;
- local studies within Leicestershire that involve significant strategic traffic from outside the county;
- regional SRN studies where the extent of the scheme extends beyond Leicestershire;
- land-use assessments / forecasts; and
- to support other modelling, data trends and microsimulation analysis conducted by LCC.

2.1.2 Each of these possible applications of PRTM requires an identification of forecast issues and transport related problems forecast in the future and, in particular, their underlying cause or causes. The wider PRTM suite has been designed to forecast from a base year of 2014 up to a forecast horizon of 2051, and the identification of the emerging issues over this time frame is the primary purpose of the model.

2.1.3 At the same time, it has been recognised and agreed that the model would also be used as the primary tool in the development of major scheme funding bids for the DfT, for the LEP and also to help secure other development-related funding. In particular, the model will be important in supporting, and then helping to provide, the evidence to deliver Core Strategies and associated Local Plans for each district within the county.

2.1.4 There are likely to be applications of the model over its lifetime that were not envisaged during the development of this version of the model. For these applications the suitability of the model both to represent the proposed intervention, and the performance of the model in terms of flow and journey time validation in the vicinity of the proposal, should be considered before applying the model.

2.1.5 In terms of the suitability of the model to represent a proposed development or transport scheme, the scale of the proposed scheme needs to be considered. Smaller developments and relatively minor alterations to the highway or public transport networks may not produce a significant enough model response to be represented within the PRTM.

2.2 Key Model Design Considerations

2.2.1 The key changes applied as part of the expansion of LLITM to PRTM were:

- inclusion of all motorways, most A-roads and a few critical B-roads in the PRTM area;
- revision of zoning across the Midlands where the highway network density was increased (an additional 187 zones) to load demand more realistically;
- use of speed-flow curves to model congestion in the buffer network across the Midlands;

- addition of calibration counts in the buffer network across the Midlands;
- addition of journey time validation routes taken from Highways England's Midlands Regional Traffic Model (MRTM) across the Midlands; and
- assignment of fixed speeds and no capacity restraint in selected urban areas within the Midlands area.

2.2.2 Further changes were made to PRTM as part of the A511 MRN Growth Corridor OBC project and it was this version of the base year that formed the basis of this model update. The original reason for undertaking this latest update was to support the assessment of the proposed M1 J20a scheme and possible associated development. The updates to the model are therefore focussed on the area of influence around this scheme, but also cover a variety of other updates identified in the proposal for this work. Updates include:

- Improvements to the journey time performance of the M69/M1 J21 junction.
- Corrections to network coding identified in a review of the network around the proposed M1 J20a site.
- A large number of network changes as part of general model calibration.
- Adoption of development zones 9049-9056 as part of the proposed Whetstone Pastures development.
- Review of M6 Toll representation.
- Introduction of counts around M69/M1 J21 and to support the model applications at Isley Walton and Padge Hall Farm.
- Corrections to network coding as identified by LCC in their snagging lists.
- Corrections to network coding to address LCC observations in Loughborough area.
- Adjustments to the matrix in Loughborough town centre and Castle Donington.
- Incorporating edits from the Melton Mowbray Distributor Road Full Business Case model improvement task.
- Setting most counts to calibration.

2.2.3 Other updates associated with the component models of PRTM were also undertaken and are explained in detail in the appropriate reports[1].

2.2.4 The following sections of this LMVR discuss in detail the updates made to the model as part of the latest PRTM update.

[1] PRTM2 Demand Model Development Report, PRTM2 Public Transport LMVR, Pan-Regional Transport Model v2.1 Forecasting Report

3. Model Standards

3.1 Introduction

3.1.1 This section details the model standards against which the PRTM highway model is assessed. These standards are derived from TAG Unit M3.1 on the acceptable differences between modelled and observed flows (Tables 1 and 2 in TAG Unit M3.1), the differences between modelled and observed journey times (Table 3 in TAG Unit M3.1) and the changes to the prior matrix as a result of matrix estimation (Table 5 in TAG Unit M3.1).

3.1.2 It should be stressed that meeting these guidelines or failing to meet these guidelines does not automatically result in a model being 'suitable', or 'not suitable' for use. TAG Unit M3.1 §3.2.2 states that:

> *"The achievement of the validation acceptability guidelines specified in Table 1, Table 2 and Table 3 does not guarantee that a model is 'fit for purpose' and likewise a failure to meet the specified validation standards does not mean that a model is not 'fit for purpose'."*

3.1.3 TAG also states that matrix estimation should not be allowed to make changes to the prior matrix beyond the limits set out in Table 5 of TAG Unit M3.1, even if this means that a lower standard of link and journey time validation is reported. TAG Unit M3.1 §8.3.16 states that:

> *"matrix estimation should not be allowed to make significant changes to the prior matrices in order that the validation standards are met."*

3.1.4 In addition to the acceptability guidelines on the performance of the highway model against observed data and the assessment of the changes to the prior matrix due to matrix estimation, this section also contains information on the convergence criteria used within the highway assignment.

3.2 Validation Criteria and Acceptability Guidelines

3.2.1 As outlined above, TAG Unit M3.1 contains four sets of validation acceptability guidelines for judging the performance of a highway model. The first of these relates to the differences between modelled and observed flows along screenlines in the model, and this is reproduced in Table 3.1 below.

Table 3.1: Screenline Flow Validation Criterion (TAG Unit M3.1: Table 1)

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

3.2.2 With regards to this validation criterion, the following points should be noted in-line with TAG:

- screenlines should normally consist of 5 or more links;
- the comparison of modelled and observed flows for screenlines containing high flow routes (such as motorways) should be presented both with and without such routes; and
- the comparison should be presented by vehicle type, i.e. for car, LGV and HGV traffic.

3.2.3 TAG also states that the performance of the model at a screenline level should be reported separately for those screenlines consisting of roadside interview sites, other screenlines used as constraints within matrix estimation, and validation screenlines. Given the use of mobile network data to build the highway prior matrices, there is no distinction between calibration screenlines at roadside interview locations and other calibration locations. Therefore, the screenline performance for PRTM has been reported separately for calibration and validation screenlines.

3.2.4 Within the highway model calibration and validation data sets there are several screenlines / cordons with fewer than five count locations and / or a relatively low observed flow for the screenline. It has been noted that such screenlines / cordons have the tendency to fail the 5% TAG criterion for screenline / cordon flows even when all individual links are within the TAG criteria (discussed later). For this reason, the flow criterion has been adjusted for screenlines / cordons with fewer than five counts and / or low observed flows.

3.2.5 This revised criterion has been based on the individual link validation criteria and is given in Table 3.2. This uses the individual link flow TAG criteria for screenlines with one count, and the standard screenline criterion for screenlines with five or more counts, and interpolates between these two points for screenlines with between two and four counts. These revised criteria have been used in the assessment of the modelled screenline flows against observed data.

Table 3.2: Revised Screenline Flow Validation Criteria

Number of Counts on Screenline	Acceptability Guideline
5 or more counts	Within ±5% or ±100 vehicles of observed count
4 counts	Within ±7.5% or ±100 vehicles of observed count
3 counts	Within ±10% or ±100 vehicles of observed count
2 counts	Within ±12.5% or ±100 vehicles of observed count
1 count	Within ±15% or ±100 vehicles of observed count

3.2.6 As discussed in the Data Collection Report, 95% confidence intervals have been calculated at each of the observed count locations apart from those in the PRTM area where data were not available. These confidence intervals have then been combined to estimate a 95% confidence interval around an observed screenline count. Where a screenline confidence interval is wider than the criteria set out in TAG, and if a modelled screenline flow fails to meet the TAG criteria but is inside the calculated 95% confidence interval, this screenline is deemed to have passed.

3.2.7 In addition to validation of total screenline flows, TAG Unit M3.1 also contains guidelines on the validation criteria for individual links or turning movements. These criteria are detailed in Table 3.3 and include reference to the GEH statistic of the difference between modelled and observed flows. The GEH statistic is of the form:

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

where M is the modelled flow and C is the observed count.

Table 3.3: Link & Turning Movement Flow Validation Criteria (TAG Unit M3.1: Table 2)

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

3.2.8 TAG states that the above comparison of modelled and observed flows should be presented for total vehicle flows and for car flows, but not for LGV and HGV flows due to there being insufficient accuracy in the individual link counts for these vehicle types.

3.2.9 TAG Unit M3.1 §3.2.7 states that:

> *"These two measures are broadly consistent and link flows that meet either criterion should be regarded as satisfactory."*

3.2.10 As with screenline flows, using the calculated 95% confidence intervals at a count location, where a count fails to meet TAG criteria but is within the 95% confidence interval, it is assumed to have passed the required level of fit between modelled and observed flows.

3.2.11 TAG also contains acceptability guidelines for the validation of journey times as shown in Table 3.4.

Table 3.4: Journey Time Validation Criterion (TAG Unit M3.1: Table 3)

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

3.2.12 As with link flows, 95% confidence internals have also been calculated for journey time routes (see Section 5.13) apart from those in the PRTM area where data were not available. In cases where the 95% confidence internal is wider than ±15%, if a modelled journey time is within the calculated 95% confidence interval it is deemed to have met the required standards.

3.2.13 With regards to the journey time validation, TAG states that it is expected that if different speed-flow relationships are used for light and heavy traffic then validation of journey times by vehicle type is desirable in order to validate these assumptions.

3.2.14 As defined in the PRTM highway model coding manual different speeds are assumed for HGV traffic for some of the speed-flow curves used within the model in accordance with national speed limits. However, the observed data are not readily available in order to undertake journey time validation separately by vehicle type, and so the journey time validation has been undertaken for light vehicles only (i.e. based on modelled speeds for car and LGV traffic).

3.2.15 In addition to the above three criteria regarding the performance of the highway model against observed data, TAG also provides guidance as to the acceptable changes to the highway prior matrices that should result from the application of matrix estimation. These have been reproduced in Table 3.5.

Table 3.5: Matrix Estimation Change Criteria (TAG Unit M3.1: Table 5)

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

3.2.16 It should be noted that at the time of development, there was no guidance within TAG as to the movements that should be considered as part of the assessment of the changes to the demand matrices as a result of matrix estimation. Including large external-external movements (which are unlikely to be affected by matrix estimation) and intrazonal demand will improve the performance of the prior and matrix estimated matrices against these criteria. For the purposes of reporting the change to the demand matrices due to matrix estimation, intrazonal demand has been removed (as this is unaltered by matrix estimation) but all other movements have been included.

3.3 Convergence Criteria and Standards

3.3.1 When using the highway model in forecasting mode, achieving a good level of convergence is important for several reasons. A tight level of convergence reduces model noise allowing easier comparison of assignment flows and times between scenarios. Tight convergence also results in lower levels of 'noise' in the cost skims (time, distance and potentially tolls) between scenarios, which are used by the PRTM variable demand model, and in economic appraisal of proposed schemes.

3.3.2 TAG Unit M3.1 details a number of acceptable convergence levels, with particular emphasis on the %Gap measure of convergence. These guidelines should be seen as minimum standards that should be aimed for in the development of a highway model, and if tighter levels of convergence are achievable these should be adopted.

3.3.3 Table 3.6 shows the convergence measures and their base model acceptable values provided in TAG.

Table 3.6: Assignment Convergence Measures (TAG Unit M3.1: Table 4)

Measure of Convergence	Base Model Acceptable Values
Delta and %Gap	Less than 0.1% or at least with convergence fully documented and all other criteria met
Percentage of links with flow change <1%	Four consecutive iterations greater than 98%
Percentage of links with cost change <1%	Four consecutive iterations greater than 98%
Percentage change in total user costs	Four consecutive iterations less than 0.1% (SUE[2] only)

[2] Stochastic User Equilibrium – not applicable to the PRTM highway model

4. Key Features of the Model

4.1 Introduction

4.1.1 This section looks at some of the key dimensions and structures of the PRTM highway model. This includes the network coverage and coding, including the use of speed-flow relationships, as well as the model zone system. Also covered in this section are the time periods and user classes of demand represented in the highway model, along with the assignment procedures and the generalised cost formulation and parameters used in the assignment.

4.1.2 This section also outlines the other elements of the wider PRTM model suite, and how the highway model interacts with these. These other elements include a public transport assignment model and a variable demand model.

4.1.3 PRTM has been developed using SATURN version 11.4.07H and the base year model has been developed to represent a typical weekday within April, May and June during 2014, with the network, counts and journey times defined on this basis.

4.2 Area of Detailed Modelling, Fully Modelled Area and External Area

4.2.1 The PRTM highway network covers all of Great Britain and can be broken down into three distinct areas in-line with TAG Unit M3.1. These are the Area of Detailed Modelling (AoDM) where the level of detail within the network and demand matrices is at its greatest, the rest of the Fully Modelled Area (FMA) where the level of detail is not as great, but capacity restraint is still modelled, and the External Area where the level of detail is at its lowest.

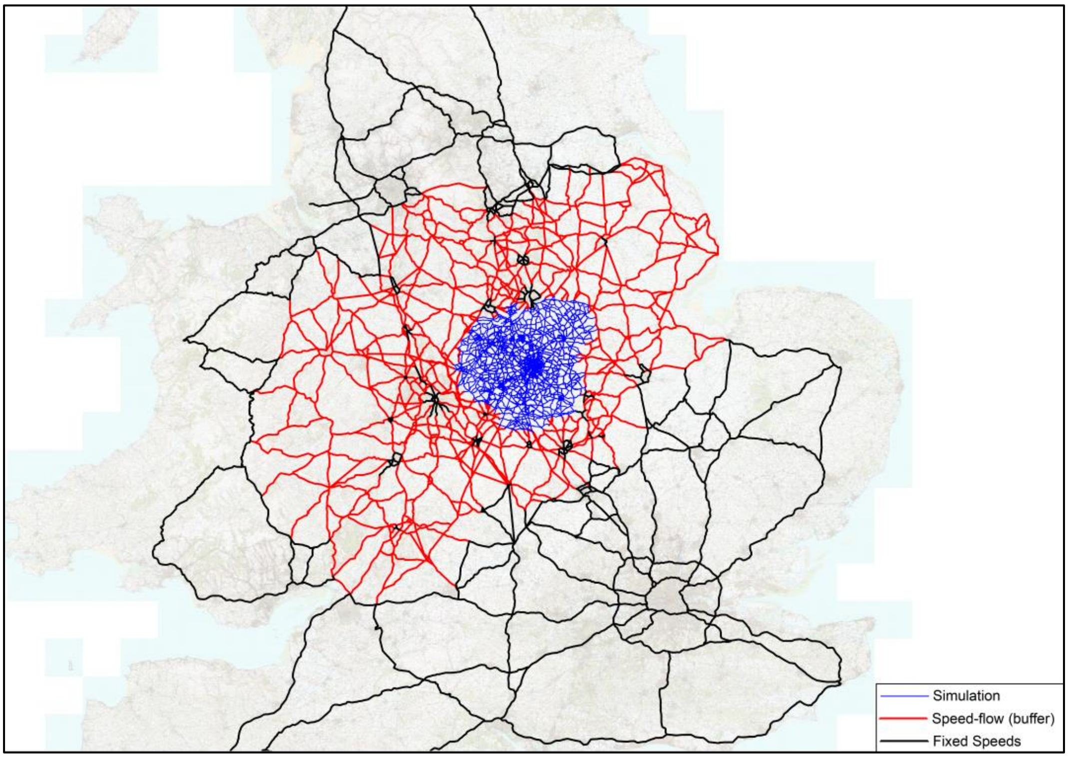
4.2.2 The AoDM, where the network and zone detail are at its greatest, was broadly defined as the Leicestershire county boundary but given the expected areas of focus for development in and around the county, further simulation network was included outside Leicestershire to the north, south and west of the county.

4.2.3 The FMA is defined as Leicestershire and the additional network, where capacity restraint is modelled, to the north, south and west of the county. The PRTM network and zoning across the Midlands are less detailed than in the AoDM but, other than for some town centres, use SATURN buffer speed-flow modelling to provide a feedback process between traffic flows and speeds in the network.

4.2.4 Outside the Midlands, buffer links are coded with fixed speeds rather than speed-flow relationships. These fixed speeds vary by time period and modelled year (derived from the DfT’s Road Traffic Forecasts).

4.2.5 Figure 4.1 shows the PRTM highway network, with simulation network shown in blue, the speed-flow buffer network in red and the fixed speed buffer in black.

Figure 4.1: PRTM Highway Network Topology



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4.3 Zoning System

4.3.1 In developing the zone system, consideration was given not just to its application within the highway model, but also to the highway model's interaction with the other elements of the PRTM model suite.

4.3.2 The zone system was developed from LLITM, remapping to 2011 Census geography boundaries and adding additional detail in key areas of the model. It covers all of Great Britain so as to include a representation of varying trip lengths between zones in the external area of the model.

4.3.3 This process resulted in a total of 1,474 geographical zones in the model, with the addition of 60 'development zones' for use in forecasting. From these, four development zones are used to represent the Saxon Drive development south of Rothley and three areas of the Coalville SUE. A further eight have been allocated to the proposed Whetstone Pastures development, and another to the Tesco Express development at the Hinckley Road/Kirby Lane junction in Blaby, as part of this model update. The 47 remaining development zones are unallocated for future use. This results in a total of 1,534 zones within PRTM. These development zones contain no trips in the base year model and are therefore solely for forecasting. Of the 1,474 geographical zones, Table 4.1 shows the breakdown of these by district within Leicestershire.

Table 4.1: Breakdown of Model Zones by District within Leicestershire

Area	Number of zones
Leicester City	285
Blaby	81
Charnwood	184
Melton	95
Harborough	151
Oadby and Wigston	48
Hinckley and Bosworth	134
North-West Leicestershire	140
Leicestershire Total	***1,118***
External	356
Geographical Zone Total	***1,474***

4.3.4 The following show different areas of the model zone system. Figure 4.2 shows an overview of the model zoning for Leicestershire and the immediate surrounding area, with Figure 4.3 showing zone detail of the urban areas within Leicester City. Figure 4.4 shows the model zoning for Great Britain.

Figure 4.2: Highway Model Zone System - Leicestershire

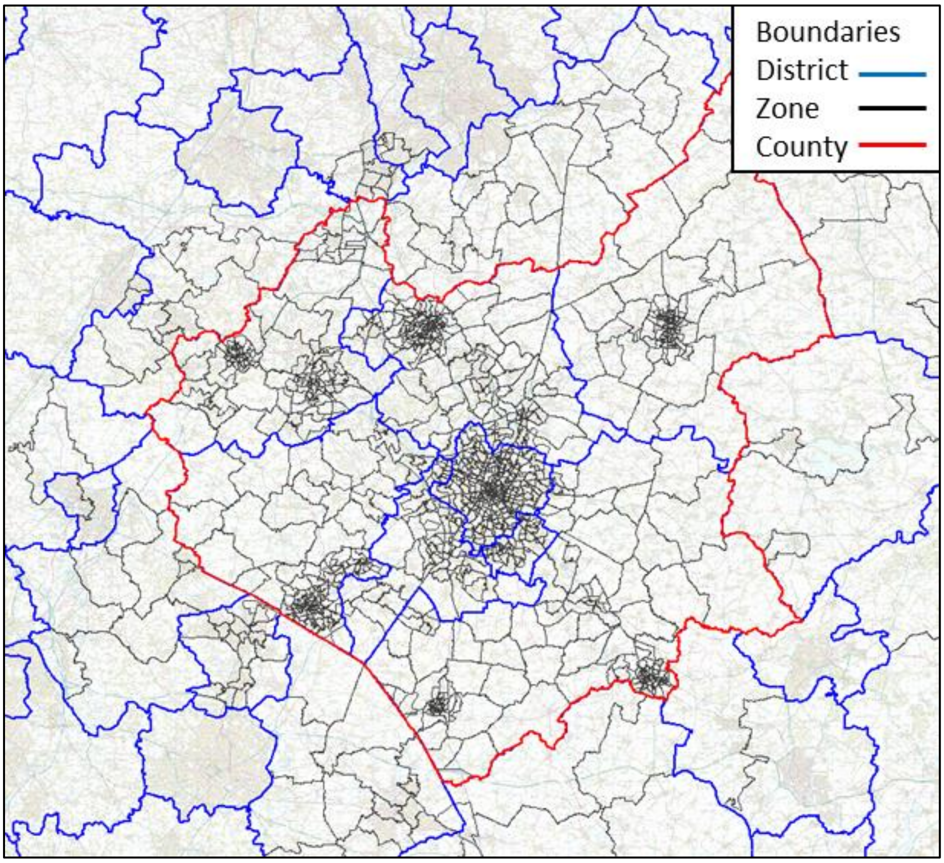

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Figure 4.3: Highway Model Zone System – Leicester City

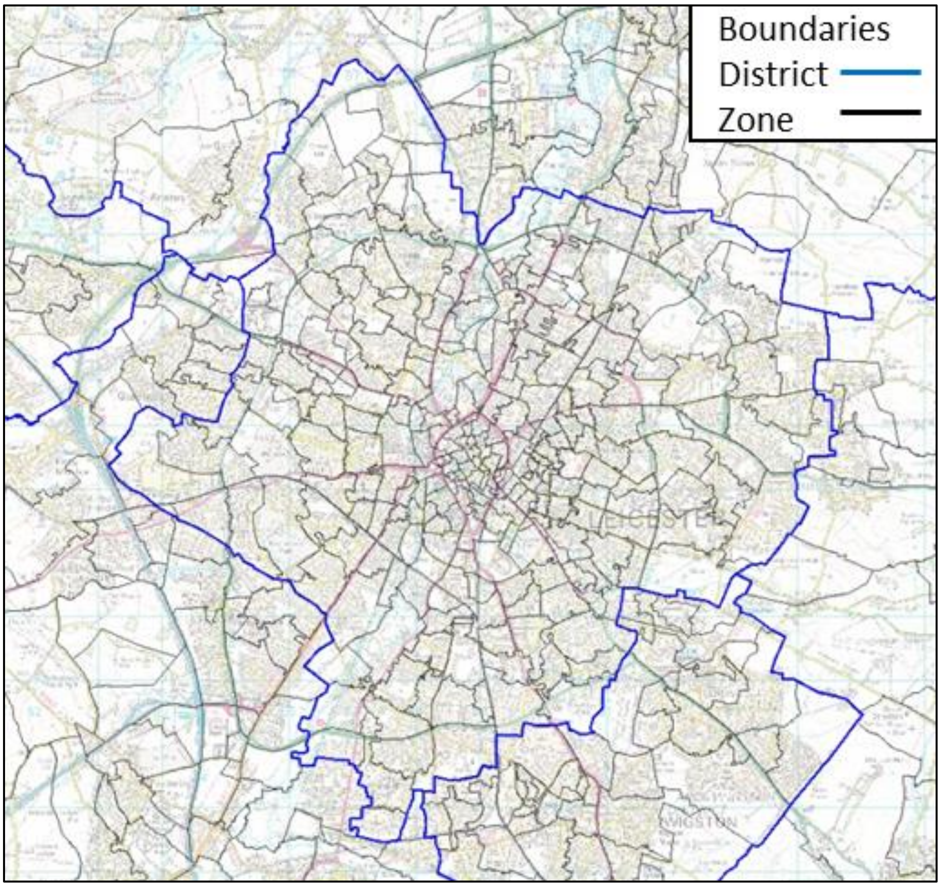

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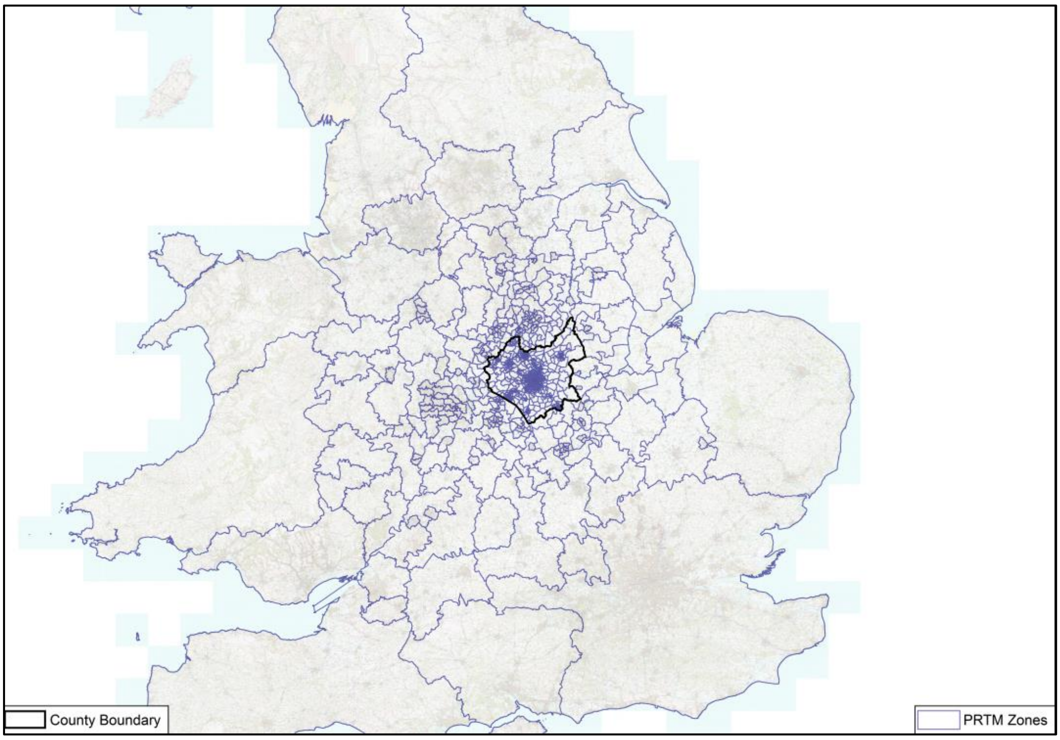
Figure 4.4: Highway Model Zone System – Great Britain



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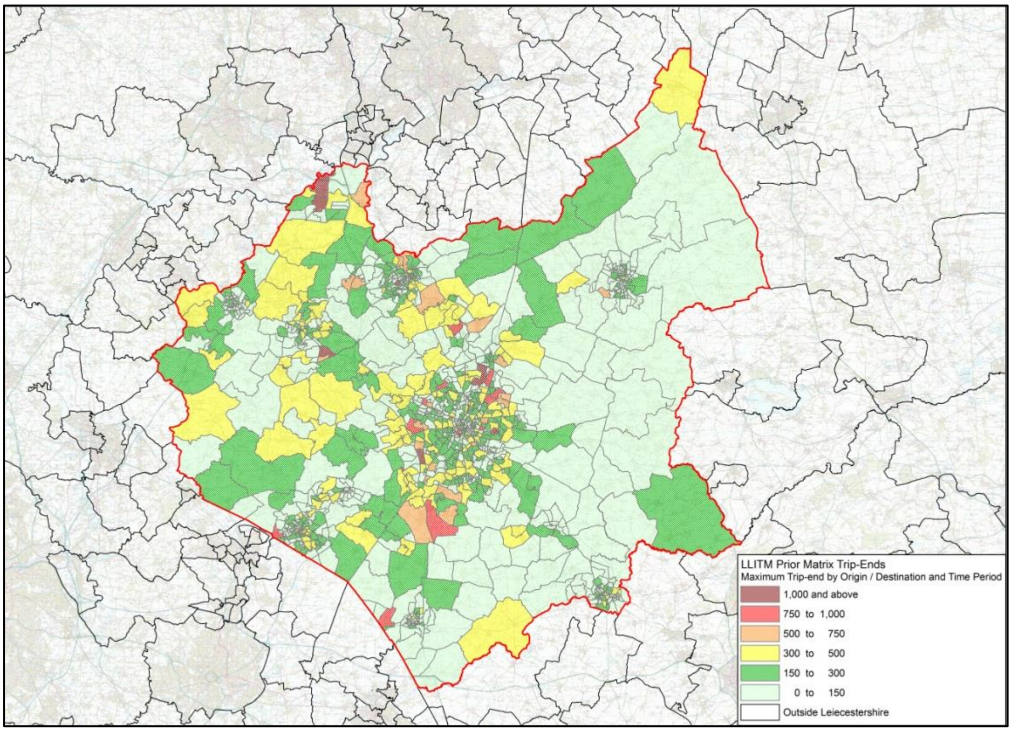
4.3.5 TAG Unit M3.1 §2.3.11 states that in the AoDM:

> *"the number of trips to and from each zone should be some relatively small number, such as 200 or 300 per hour, to avoid unrealistically high loads appearing at some points in the network."*

4.3.6 On this basis, and using the prior matrices used in this calibration of the highway model, the maximum trip-end by origin or destination and across the three modelled time periods has been calculated for all modelled zones within Leicestershire. The result of this analysis, in terms of PCUs[3], is shown in Figure 4.5.

4.3.7 Zones in shades of green have a maximum trip-end, by origin or destination and across the three modelled time periods, of less than 300 PCUs. This shows that most zones within Leicestershire meet the aforementioned TAG criterion. Those not shaded in green tend to be in the more rural areas of the model where the model zoning is coarser.

Figure 4.5: Maximum Trip-Ends by Origin / Destination within Leicestershire (PCUs)



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4.3.8 Of the 1,118 zones within Leicestershire, 909 (or 81%) have a maximum trip-end by origin or destination across modelled hours of less than 300 PCUs. 1,071 zones, or 96%, of the zones within Leicestershire have a maximum trip-end below 500 PCUs per hour.

4.4 Network Coding

4.4.1 The PRTM highway network coding manual has been developed in consultation with Highways England (TAME/TPG) and forms the basis of any SATURN coding to be undertaken by LCC or its consultants during forecasting or future development of the model. We note that the PRTM coding manual was used as the basis for the coding manual used by Highways England for the development of the Regional Traffic Models (RTMs); there is therefore a high level of consistency between the coding standards in PRTM and the RTMs.

[3] Passenger Car Unit

4.4.2 LCC has provided signal timings and stage plans for the majority of signalised junctions within Leicester City and Leicestershire. This information has been coded into the highway networks as the starting point for model calibration.

4.5 Centroid Connectors

4.5.1 In-line with TAG Unit M3.1, the number of centroid connectors has been minimised when coding the base year highway model. In general, each model zone has one centroid connector, but there are exceptions to this where zones require multiple centroid connectors to accurately represent the loading points to / from the zone.

4.5.2 All centroid connectors have been coded to represent 'real' junctions where the demand to / from a given zone would access the coded network. These have been coded using 'spigot' style centroid connectors with junctions coded in-line with the coding manual, rather than the 'spanning' centroid connectors available within SATURN whereby demand is loaded onto the midpoint of the link.

4.6 Time Periods

4.6.1 The PRTM highway model has been built to represent three time periods. These are:

- AM Peak hour between 08:00 and 09:00;
- average Interpeak hour between 10:00 and 16:00; and
- PM Peak hour between 17:00 and 18:00.

4.6.2 In addition to this, the SATURN PassQ functionality has been used in the AM Peak and PM Peak hour models with demand initially assigned onto the network to represent the hour preceding the peak hour itself. The queues left at the end of this assignment hour are then loaded into the peak hour assignment as additional volumes.

4.6.3 By definition, the hour preceding the peak hour contains less demand than in the peak hour itself. Therefore, when assigning the peak hour demand to represent the preceding hour, the demand matrix is globally factored based on observed flows from a set of counts covering Leicester City and Leicestershire. The resulting factors used in the two PassQ assignments are 0.88 in the AM Peak and 0.961 in the PM Peak.

4.7 User Classes

4.7.1 The demand contained within the demand model element of PRTM is segmented into 19 categories. These are based on trip purposes and income levels. Further details on the demand model can be found within the '*Demand Model Development Report*', with further information on the allocation of demand to income levels contained in '*TN51 - Demand Matrix Income Segmentation*'. In summary the 19 demand model categories are:

- commuting, subdivided into low, medium and high income;
- education, subdivided into low, medium and high income;
- home-based and non-home-based other, each subdivided into low, medium and high income;
- shopping, subdivided into low, medium and high income;
- home-based and non-home-based business; and
- LGV and HGV.

4.7.2 These demand categories are aggregated into nine assignment user classes for the purposes of base model calibration, with the low, medium and high value of time segments combined separately for 'other' and commuting to give five assignment user classes for the demand model:

- HGV demand;
- LGV demand;
- business demand (the aggregation of home-based and non-home-based business demand);
- 'other' low value of time demand (the aggregation of education, home-based other, non-home-based other and shopping for low income);
- 'other' medium value of time demand (the aggregation of education, home-based other, non-home-based other and shopping for medium income);
- 'other' high value of time demand (the aggregation of education, home-based other, non-home-based other and shopping for high income);
- commuting low value of time demand;
- commuting medium value of time demand; and
- commuting high value of time demand.

4.7.3 A PCU factor of 2.0 is applied to HGV demand. This is to reflect the greater size of HGVs compared with cars, with the assumption being that each HGV is equivalent to two cars within the assignment. No PCU factor is applied to the other assignment user classes.

4.7.4 The choice of applying a PCU factor of 2.0 for HGV demand is based on TAG Unit M3.1 Appendix D. Section 7 states that a PCU factor of 2.5 should be used on motorways and all-purpose dual carriageway routes, with a factor of 2.0 being applied on all other roads. This guidance derives from CoBA guidance where different PCU factors can be applied on a link basis. However, in SATURN only a global PCU factor can be applied to the assignment matrix. While the motorways and key strategic routes within Leicestershire are important to the proposed uses of the highway model, the main foci of anticipated applications are within or adjacent to urban areas and therefore a PCU factor of 2.0 has been used.

4.8 Assignment Methodology

4.8.1 The assignment of demand on the network is based on Wardrop's principle of traffic equilibrium. This can be stated as follows:

> *"Traffic arranges itself onto a congested network in such a way that the cost of travel on all routes used between an origin-destination pair is equal to the minimum cost of travel, and that all other possible routes which are unused have a greater or equal cost."*

4.8.2 The calculation of cost for each route is based on that calculated after all demand has been loaded onto the network. This takes into account delays due to the coded speed-flow relationships and modelled junction delays along each route.

4.8.3 This principle of traffic equilibrium as implemented in SATURN is based on the Frank-Wolfe algorithm. This employs an iterative process based on successive 'all-or-nothing' assignments to generate a set of combined flows on links that minimise an objective function. The travel costs are recalculated at the end of each iteration and then compared with those from the previous iteration. This iterative process is then terminated when the chosen criteria for convergence are met.

4.9 Generalised Cost Formulations and Parameter Values

4.9.1 Within the SATURN assignment, two parameters are defined for each user class to calculate generalised cost. This combines journey times, journey distances and any tolls included in the model into a standard unit of generalised time based on these two parameters.

4.9.2 These two parameters are the pence per minute (ppm) and the pence per kilometre (ppk) associated with each user class, and are used in the following formula to determine generalised cost:

$$GeneralisedCost_{minutes} = JourneyTime_{minutes} + \left(\frac{ppk}{ppm}\right) * JourneyDistance_{km} + \left(\frac{1}{ppm}\right) * Toll_{pence}$$

4.9.3 In the base year of the PRTM highway model there are no link tolls present. However, the functionality has been retained such that link tolls could be added to the highway network as part of any potential testing of pricing policies on the highway network in a given forecast scenario.

4.9.4 The values of the ppm and ppk parameters within the assignment are based on the latest TAG data book available at the time of highway model calibration, namely the corrected May 2020 data book which was published in July 2020.

4.9.5 It should be noted that the TAG values of time for HGV relate to the drivers' value of time and do not account for the influence of haulage companies on the routeing of HGV traffic. In-line with TAG Unit M3.1 §2.8.8, the HGV value of time derived from TAG has been multiplied by a factor of 2 to account for this fact in model assignment.

4.9.6 TAG Unit M2 Appendix C provides estimates and guidance for deriving values of time for non-work trips by income group. The standard values given in this section of TAG have not been used within PRTM as information on the household income levels within Leicestershire is provided by the land-use model. The ratios between low, medium and high values of time for consumer trips have been derived from this data, with details on this process given in '*TN51 - Demand Matrix Income Segmentation*'.

4.9.7 The 2014 base year values used within the assignment, in 2010 prices, are detailed in Table 4.2 (the combined 'other' and commuting user classes adopt their respective medium value of time parameters in the demand model assignment).

Table 4.2: 2014 Base Year ppm and ppk Parameters (2010 prices)

	AM Peak		Interpeak		PM Peak	
User Class	**ppm**	**ppk**	**ppm**	**ppk**	**ppm**	**ppk**
HGV	42.55	46.45	42.55	46.45	42.55	46.45
LGV	21.36	14.98	21.36	14.98	21.36	14.98
Employers' Business	29.48	13.39	30.21	13.39	29.91	13.39
'Other' Low Value of Time	12.22	7.11	13.02	7.11	12.80	7.11
'Other' Medium Value of Time	13.64	7.11	14.53	7.11	14.28	7.11
'Other' High Value of Time	15.14	7.11	16.13	7.11	15.86	7.11
Commuting Low Value of Time	15.38	7.11	15.63	7.11	15.43	7.11
Commuting Medium Value of Time	19.77	7.11	20.09	7.11	19.84	7.11
Commuting High Value of Time	25.11	7.11	25.52	7.11	25.20	7.11

4.10 Capacity Restraint Mechanisms: Junction Modelling and Speed Flow Relationships

4.10.1 Junctions in the simulation network are modelled with saturation flows (the theoretical amount of traffic that could make a turn if unopposed). From these, capacities are calculated based on the assigned movements through the junction.

4.10.2 All nodes within the simulation network have been coded in-line with the updated coding manual. In addition to this, the junction characteristics such as the junction type, the number of lanes approaching the junction, the presence of any flared approaches to the junction and the give-way and opposed movements at a junction have also been reviewed and updated where necessary.

4.10.3 Speed-flow curves have been coded on a subset of simulation links. The general rule of whether to use a fixed cruise speed on a given link or a speed-flow curve relates to whether the majority of the delay on the link is likely to be as a result of junction delays or weight of traffic on the link. Where the majority of delay is related to the junction, a fixed cruise speed has been coded whereas when the delay is likely to be caused by the weight of traffic, a speed-flow relationship has been coded.

4.10.4 In general, this rule results in fixed cruise speeds being coded within urban areas, and speed-flow relationships being coded on longer rural links. The application of fixed cruise speeds and speed-flow curves is discussed further in Section 6.3.

4.10.5 Junction modelling is not represented within the external buffer network area. Where there are no speed-flow curves, all links are coded with fixed cruise speeds with the coded speeds for routes on the SRN being derived from HATRIS journey time data. For non-SRN links in the buffer network, standard cruise speeds have been adopted based on the characteristics of the link such as the speed limit along the route, and whether the link is within an urban or rural context.

4.11 Relationships with Other Elements of the Integrated Model

4.11.1 The wider PRTM model contains a number of additional elements to the highway model described in this report. The key components of the model are:

- a SATURN-based highway assignment model (as detailed in this report);
- an Emme-based public transport assignment model (as detailed in the *'Public Transport Local Model Validation Report'*);
- an Emme-based variable demand model, including a parking model representing parking choices within Leicester City centre and Loughborough town centre (as detailed in the *'Demand Model Development Report'*); and
- a spreadsheet-based process forecasting household (and population) and employment growth.

4.11.2 In addition to these four key elements there are a number of other components to the overall model suite. These include a bespoke version of the DfT's trip-end forecasting process (CTripEnd) and an environmental assessment tool (EASE) which makes use of Defra's Emissions Factor Toolkit (EFT).

4.11.3 The interrelationship of the parking model and the highway model is key to the model performance information included in this report. Matrix estimation is undertaken on the prior matrices and does not include the running (and thus reflect the impact) of the parking model. This is for reasons of run time practicality.

4.11.4 However, the parking model only adjusts the origin / destination of trips which choose to use park-and-ride services in the base year. Therefore, the impact of running the parking model after the calibration of the base year highway model is limited to the impact of the park-and-ride services within Leicester City. (There are no park-and-ride services present within Loughborough, the other urban area considered by the parking model.)

4.11.5 For the purposes of this report, all assignment results from the base year model (link flows, journey times and routeing analysis for example) have been taken from the base year model after adjustment for the parking model. Results detailed in this report in terms of matrix analysis (such as the change in the matrices due to matrix estimation) have been taken from the model before the application of the parking model to isolate the effect of matrix estimation on the demand matrices.

4.11.6 It is also worth noting at this point the interrelationship between the highway and public transport supply models. The highway model represents the bus routes within Leicester City and Leicestershire, and these have been converted from the service coding contained within the base year public transport model. This ensures that there is consistency in terms of modelled route and frequency of bus services between the two models.

5. Calibration and Validation Data

5.1 Introduction

5.1.1 This section discusses the observed data used in the calibration and validation of the PRTM highway model. This includes the link flow observations used in the calibration and validation of the modelled flows within the highway assignment and observed journey time data used for the validation of the modelled journey times.

5.1.2 The observed count dataset was derived from a mixture of temporary counts collected in neutral months between 2010 and 2015, data from permanent counts sites from 2012 to 2015, and TRADS/WebTRIS data. Data for the PRTM area were extracted from the Midlands Regional Traffic Model or supplied by the relevant authorities.

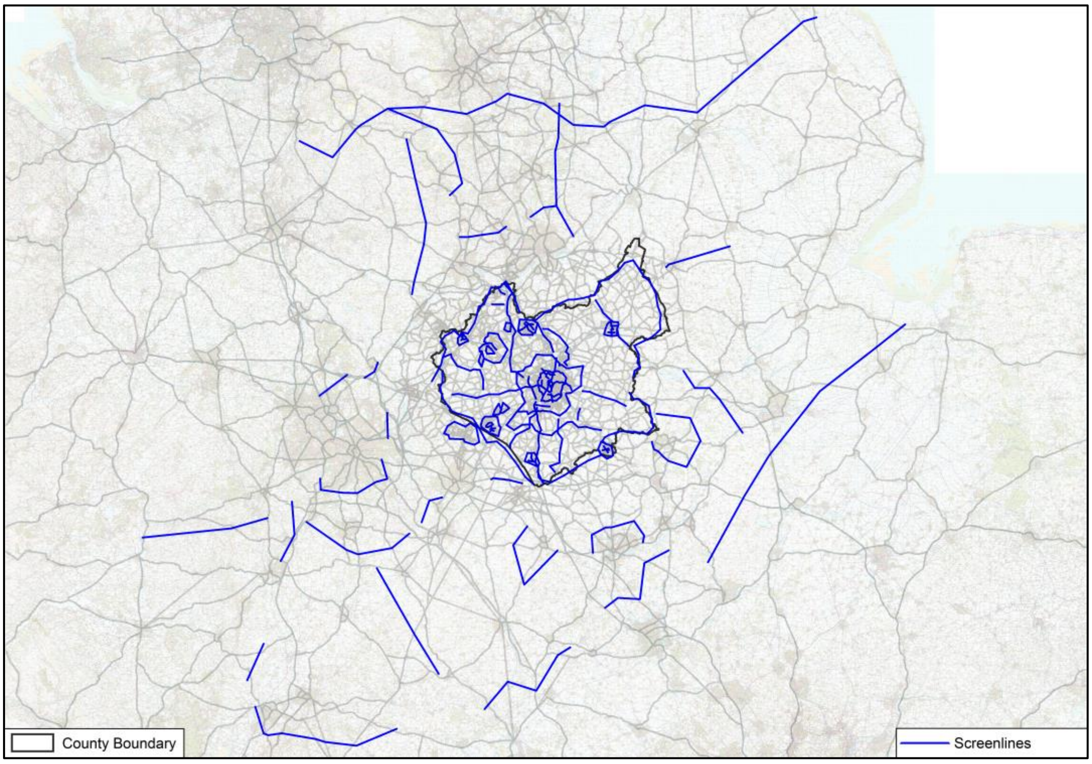
5.1.3 Journey time data from Trafficmaster were extracted for weekdays during school term times in April, May and June 2014 for the specified journey time validation routes within Leicester and Leicestershire. For the Highways England network, data were obtained from Highways England's HATRIS database for April, May and June. Data extracted from the Midlands Regional Traffic Model covers the PRTM area.

5.2 Definitions of Screenlines and Cordons

5.2.1 A total of 72 screenlines have been defined, along with 17 cordons, each of which is defined with two directions. In addition there are 28 groupings of counts (each with two directions) defined for reporting purposes. These screenlines and cordons are shown in Figure 5.1. There is a mixture of urban cordons, strategic inter-urban screenlines and intra-urban screenlines in the market towns and Leicester City. There is also a complete cordon of Leicestershire that is split into four screenlines.

5.2.2 As there was an extensive count data collection programme there are no holes in these cordons and screenlines for modelled links i.e. for roads of any significance.

Figure 5.1: PRTM Screenlines and Cordons



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5.2.3 The screenlines and cordons consist of 1443 single direction counts, and a further 221 single direction counts are included in the model which are not associated with a screenline or cordon. This data set has been extensively reviewed and processed as discussed below, and each screenline and cordon has been split into 'short screenlines' as recommended by TAG.

5.3 Traffic Counts at Roadside Interview Sites

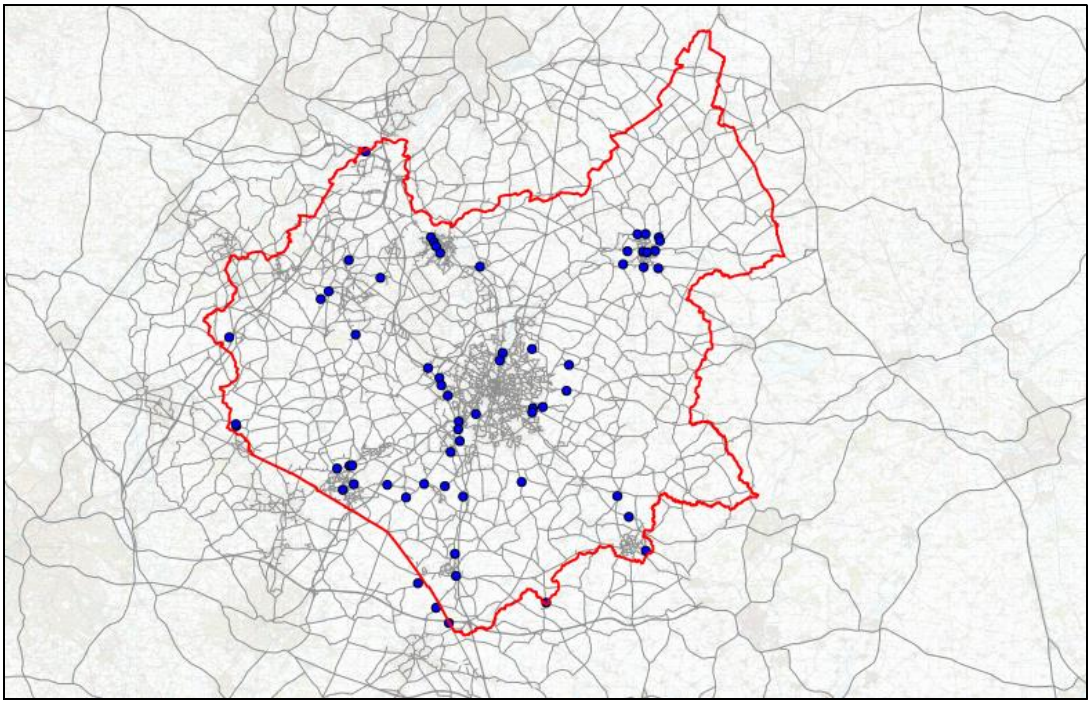
5.3.1 Although the prior highway matrices for the PRTM were derived using mobile network data (see Section 7 for more details), roadside interview surveys (RSIs) at 106 locations were commissioned to augment the mobile network data. Although not used directly to build the highway matrices, the RSIs were critical in the verification of mobile network data and were available for the fall-back option of a traditional matrix build if required.

5.3.2 At each of these RSI locations an automatic traffic count (ATC) was undertaken for a two-week period: one week prior to the survey and one week after, in addition to a manual classified count (MCC) undertaken on the day of the survey. This MCC is used to provide a vehicle split between car, LGV and HGV traffic (discussed further in Section 5.7) which is applied to the total traffic count from the ATC.

5.3.3 The RSI locations were organised into a number of screenlines and cordons, in order to aid verification of the mobile network data at a sector level. They generally form cordons of urban areas, including cordons for movements entering and leaving Leicester City. Some counts are part of larger screenlines that capture movements between urban centres, such as can be seen between Leicester and South Leicestershire, or intraurban movements, as can be seen in Loughborough. There were some holes in these screenlines either because the roads were too minor or, in a few instances, because the RSI was cancelled.

5.3.4 The 62 counts associated with RSIs used in the calibration of the model are shown in Figure 5.2.

Figure 5.2: Counts at RSI Locations used in PRTM



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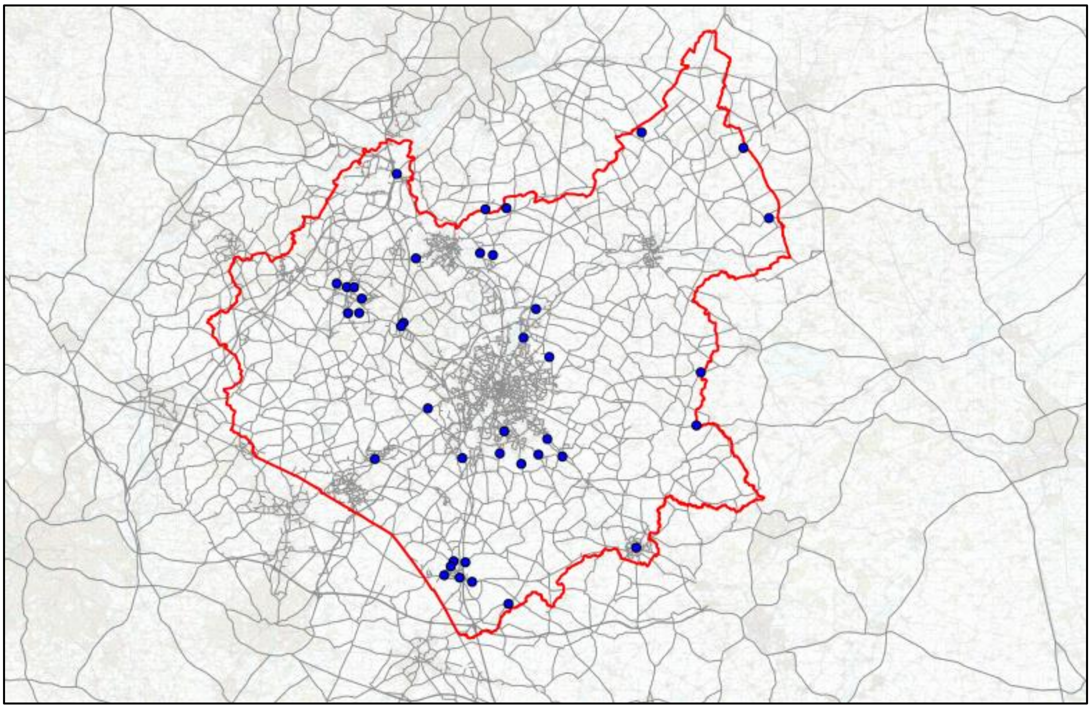
5.4 Permanent Traffic Counts

5.4.1 As part of LCC's continuous monitoring, there are 108 permanent traffic count sites throughout Leicester and Leicestershire. The data collected from these were made available to AECOM through Leicester County Council's access to the C2 count website. Permanent counts are preferred to temporary counts because of their sample size. Rather than the standard two weeks, there is potential for data to be obtained for all days in neutral months in 2014.

5.4.2 39 of these permanent counts were used in the final calibration and validation screenlines and cordons alongside RSI counts and temporary counts. They were also used to provide seasonality and annual growth factors. More detail on their use can be found in Section 5.7. The location of the counts that have been used are shown in Figure 5.3.

Figure 5.3: Permanent Traffic Counts used in PRTM



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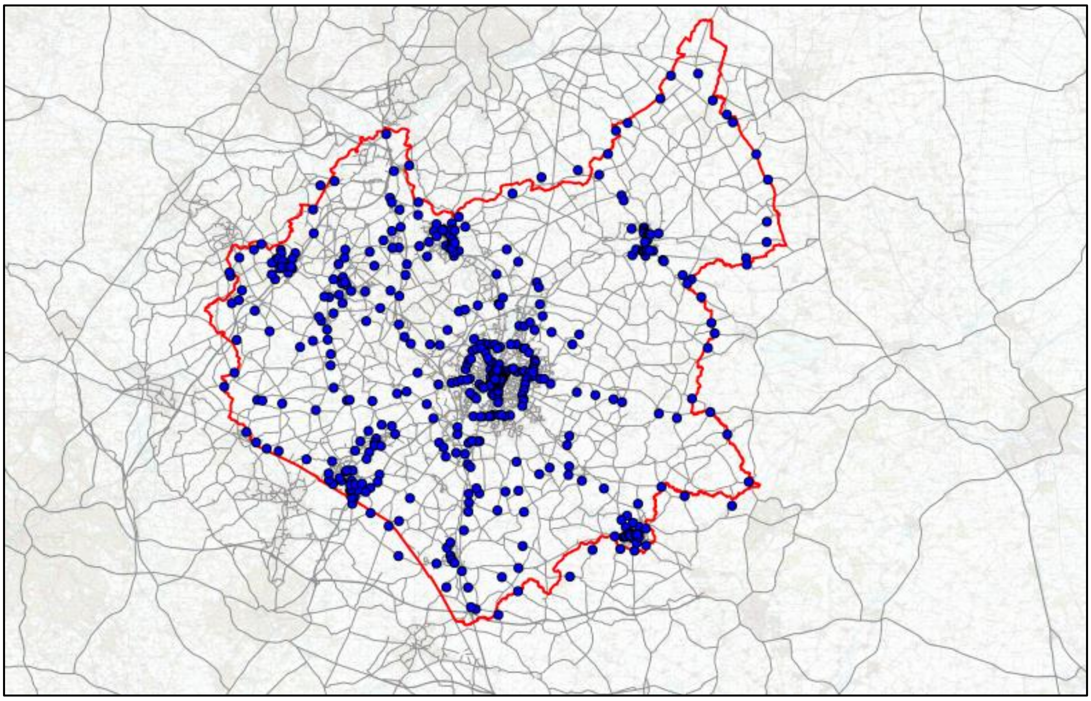
5.5 Traffic Counts at Temporary Locations

5.5.1 In order to define enough screenlines and cordons within each district, there was a need to collect further temporary counts, beyond the counts that were collected for the RSIs (as shown in Figure 5.2) and the permanent counts (as shown in Figure 5.3). There were a number of temporary counts, available on the C2 website, that were reviewed for suitability. Despite including some of these, there were still several holes in screenlines and cordons. Therefore, there was a requirement to commission a number of 2-week ATCs to fill in the gaps in screenlines and cordons. These counts were collected in neutral months only, so that there would be less reliance on seasonal adjustment factors. The 480 temporary counts that have been used are shown in Figure 5.4.

Figure 5.4: Temporary Traffic Counts used in PRTM



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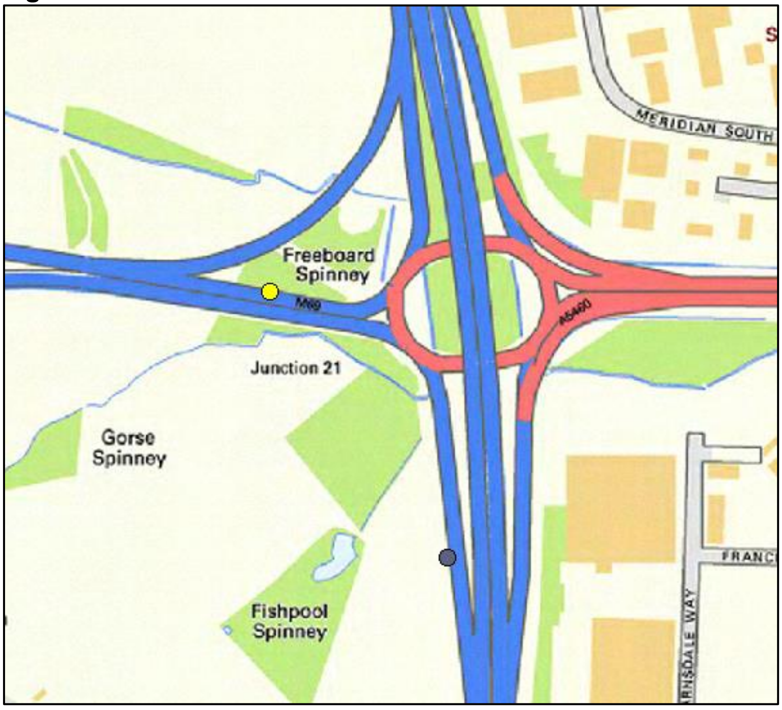
5.6 Additional Traffic Counts Introduced during Applications

5.6.1 As PRTM has been used for various applications, it has been necessary to include additional counts to improve model performance in the areas of interest associated with the development or schemes being assessed.

5.6.2 Additional traffic counts were introduced as part of the Leicester City JAQU Study. These were collated from two sources: existing traffic count surveys available via Leicestershire County and Leicester City councils; and new traffic count surveys undertaken primarily in February 2019 for a minimum of a two-week period. Adjustment factors were derived from long-term count data to normalise these counts to April, May and June 2014. A total of 66 additional traffic count surveys were introduced and used to define four new screenlines within Leicester City and three new groupings of individual counts.

5.6.3 As part of the model refinement around the proposed M1 J20a intervention, two additional counts were introduced at J21 in order to better control base model flows and assist with matching observed delay on the M69 approach to this junction. Counts were added on the M69 northbound approach to the J21 gyratory, and on the M1 northbound off-slip. These temporary counts were obtained from the C2 count database and are akin to those described in Section 5.5. Figure 5.5 shows the location of these counts.

Figure 5.5: Additional Counts Added at M1 Junction 21



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5.6.4 In anticipation of the Padge Hall Farm development assessment, an additional count was added on the A5 west of Wolvey Road. This was a permanent count taken from the C2 count database and was included in the ‘A5 Calibration’ set of counts for the purposes of reporting.

5.6.5 For the Isley Walton development assessment, it was considered important that flows on the roads north of Castle Donnington were represented well in the model. As a result, a new screenline was created taking counts from the C2 count database, covering Station Road, Ryecroft Road and Main Street. A further count was added, again from C2, on the A453 just east of East Midlands Airport. A new reporting group, ‘A453 validation’, was created for this count.

5.7 Processing of Traffic Counts

5.7.1 The methodology of processing the TRADS/WebTRIS traffic count data into the required vehicle class traffic flows is discussed in Section 5.9 and a similar process was required for all ATC data used within the model calibration and validation.

5.7.2 For non-TRADS/WebTRIS ATC data, a manual classified link or turning count at the same location or a nearby location on the same road was used to provide vehicle splits for the observed ATC traffic flow. This is in part due to the additional confidence in vehicle classifications resulting from a manual count as opposed to an automated traffic count, and also due to the fact that ATCs cannot accurately distinguish between car and LGV traffic.

5.7.3 In summary, the total flow at a given location is derived from the ATC data, with the allocations of this total flow to vehicle types taken from an associated MCC. As part of this process, buses, motorcycles and bicycles (if recorded) were removed from the total flow as part of this processing. Buses are modelled as fixed routes with defined frequencies (taken from the public transport model), with motorcycle and bicycle flows not represented within the highway model.

5.7.4 In addition to applying MCC vehicle splits to the observed ATC traffic flows, all count data were required to be estimated for April/May/June 2014 (the base year and time period of the highway model) if that count had not been undertaken during this period. This process was generally not required for the processed TRADS/WebTRIS data as these were usually available for April/May/June 2014.

5.7.5 A set of long-term continuous ATC data were analysed to provide factors from which to estimate the likely traffic flow at a given location if that traffic count was not undertaken in April/May/June 2014. These long-term ATCs were grouped by road type and geographical location to provide conversion factors for roads within Leicester City, and for A-roads, B-roads and other roads within market towns or rural areas. These factors were calculated for the three modelled time periods, as well as 24-hour flows.

5.7.6 Each traffic count was allocated to one of these groupings and, based on the date on which the count was undertaken and the time period which that count represents, a conversion factor was applied to estimate the traffic count during April/May/June 2014.

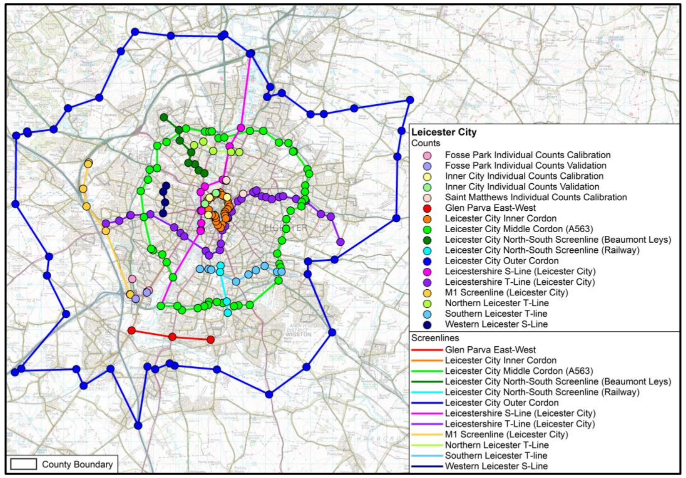
5.8 Leicestershire Traffic Counts

5.8.1 Each of the counts, screenlines and cordons within Leicestershire have been allocated to one of a number of reporting areas. These can be broadly defined as countywide, Leicester City and surrounding areas, North Leicestershire, North-East Leicestershire, South Leicestershire, South-West Leicestershire and North-West Leicestershire. In addition to this there is separate reporting for the SRN (as shown in Figure 5.8).

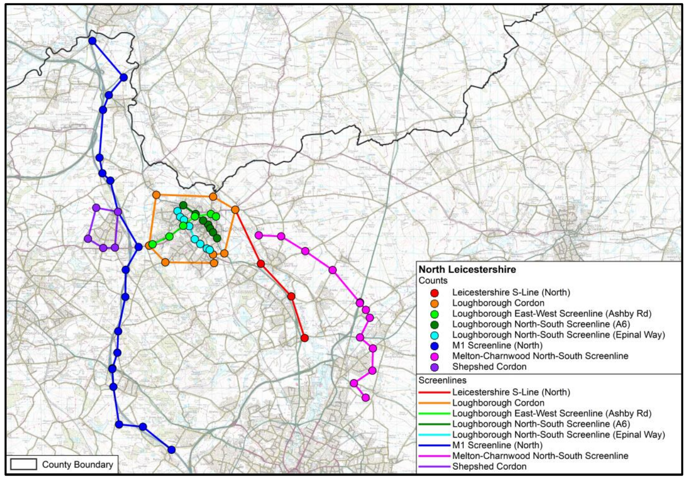
5.8.2 The allocation of the screenlines and cordons to the geographical areas within Leicestershire is shown in Figure 5.6. The four countywide screenlines are shown in Figure 5.7.

Figure 5.6: Traffic Counts by Leicestershire Reporting Area

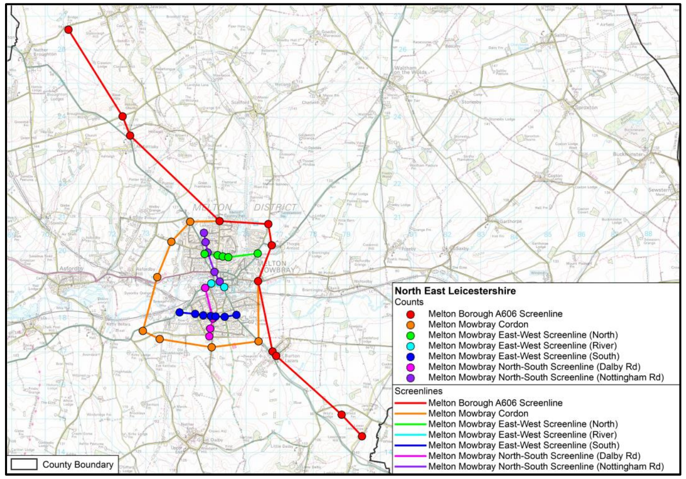
Leicester City and Surrounding Areas



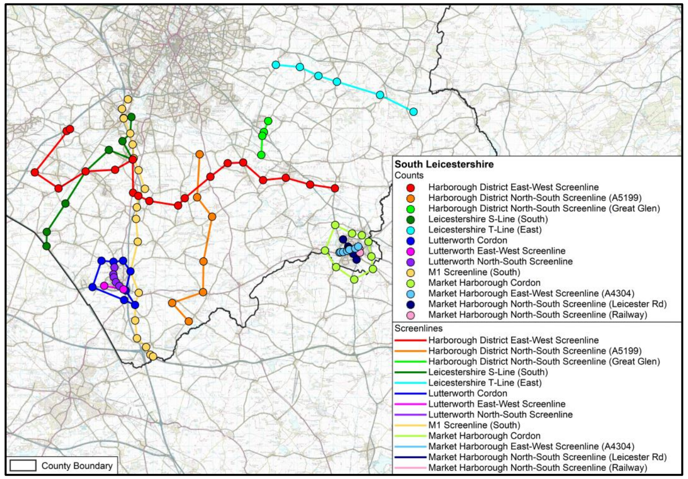
North Leicestershire



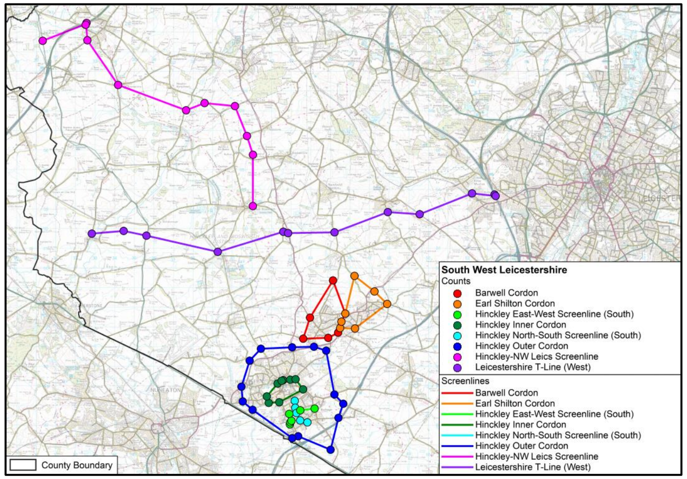
North East Leicestershire



South Leicestershire



South West Leicestershire



North West Leicestershire

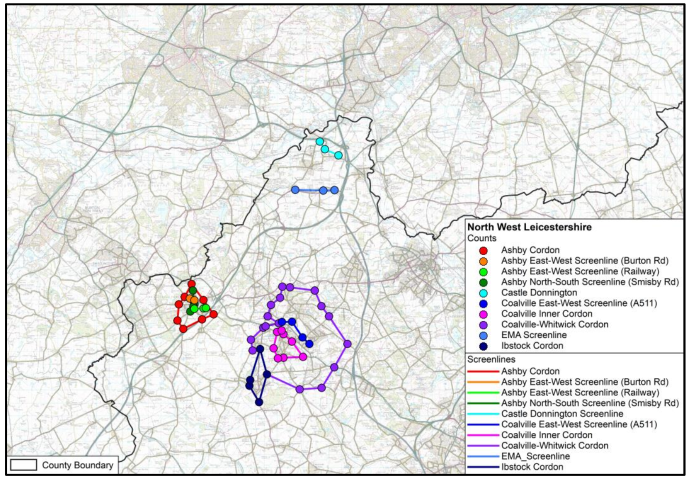


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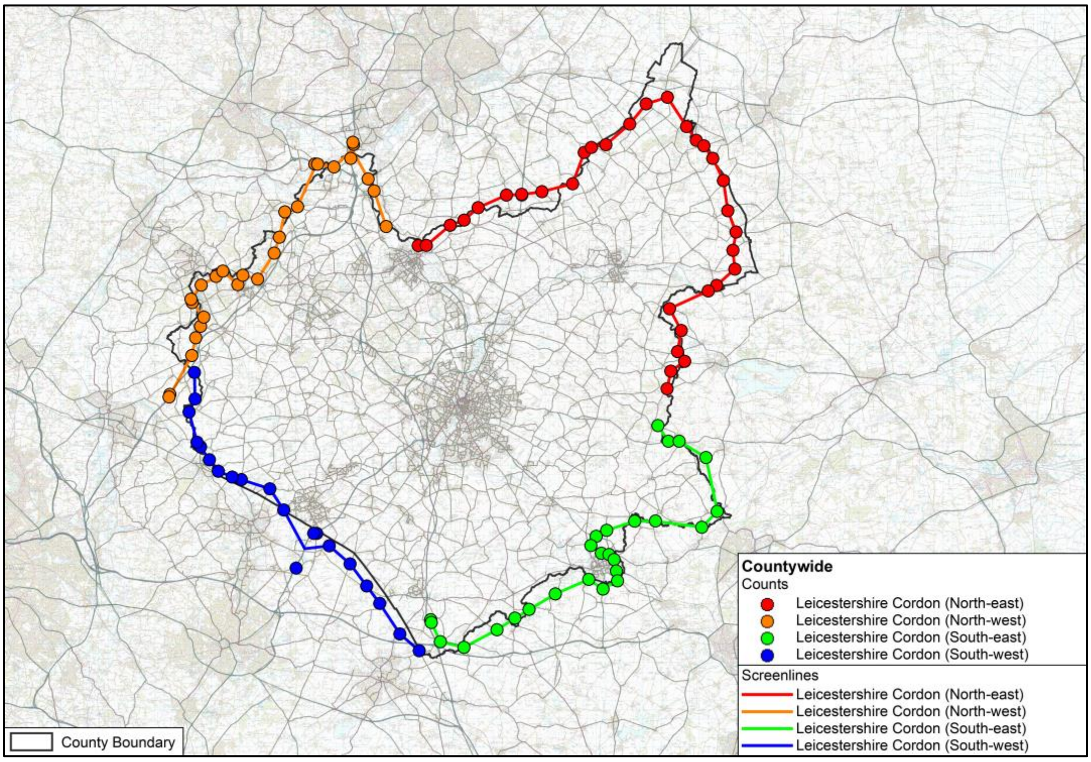
Figure 5.7: Traffic Counts in Countywide Screenlines



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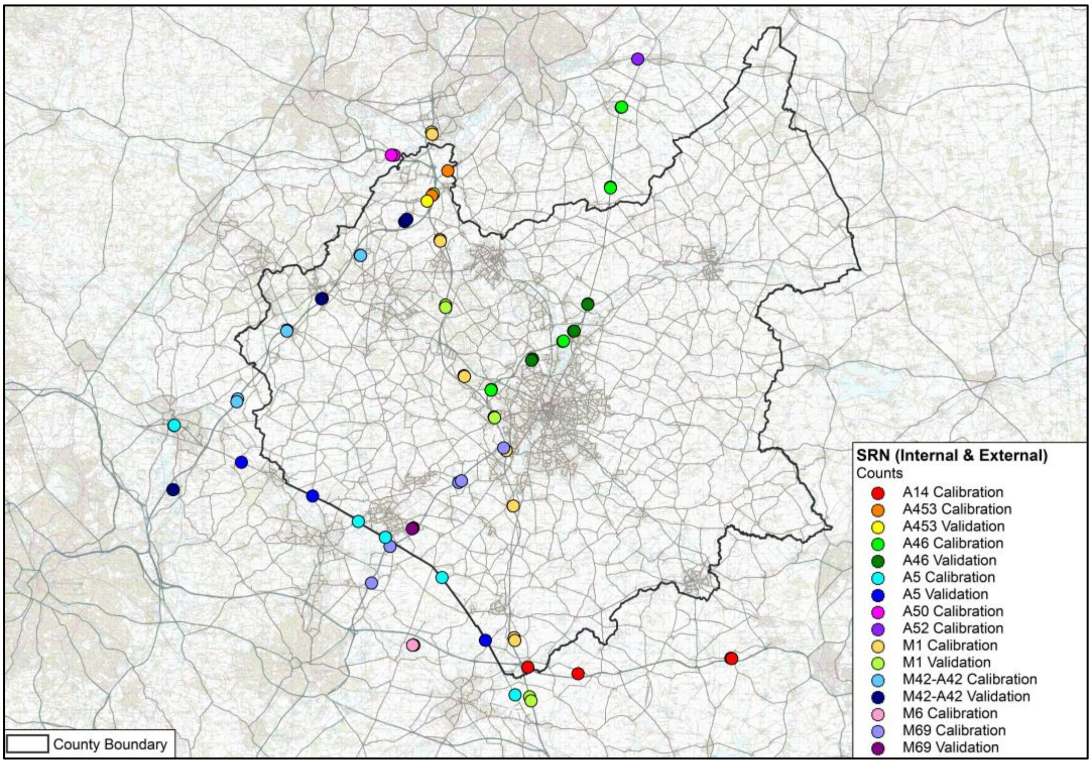
5.9 Traffic Counts at SRN Locations

5.9.1 Figure 5.8 shows the locations for which count data have been processed along the SRN. Along each strategic route the counts alternate between validation and calibration.

Figure 5.8: Locations of SRN Counts



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5.9.2 SRN count data were extracted from the TRADS/WebTRIS[4] online database for all days, and individual hours within those days, for April, May and June 2014. There were a few sections of SRN that did not have an available count for either April, May or June of 2014. For these locations, an alternative has been downloaded for either the same months in 2013 or for October 2014 (a neutral month). For either methodology, count data were downloaded from the downstream and upstream link for this same period and for the April, May and June 2014 period to derive a suitable count adjustment factor.

5.9.3 Using this data set, recorded flows from Fridays, Saturdays and Sundays have been excluded, along with hours in which zero flow was recorded and those records with an associated event (such as roadworks or an accident). With these records removed from the data set, average flows have been calculated for the AM Peak hour (08:00 – 09:00), an average hour within the Interpeak (10:00 – 16:00) and the PM Peak hour (17:00 – 18:00).

5.9.4 For the purposes of calibration and validation of the PRTM highway model, traffic flows are required for cars, LGVs and HGVs separately. The data from TRADS/WebTRIS can be extracted to give an HGV proportion (based on a 7.2m vehicle length classification), but not the proportion of traffic which is LGV traffic. Therefore in order to split the total observed traffic flows from TRADS/WebTRIS into the required vehicle types, the DfT MCC database[5] has been used.

5.9.5 Given that MCC data are likely to be less reliable than ATC data, the data have been processed by taking all available counts from the DfT database, grouping by road name, county and modelled time period. The car, LGV and HGV records within these groups have been summed, and average vehicle type proportions have then been calculated from these aggregated data. These vehicle type proportions, available by road, county and modelled time period, have then been applied to the TRADS/WebTRIS data, resulting in a classified

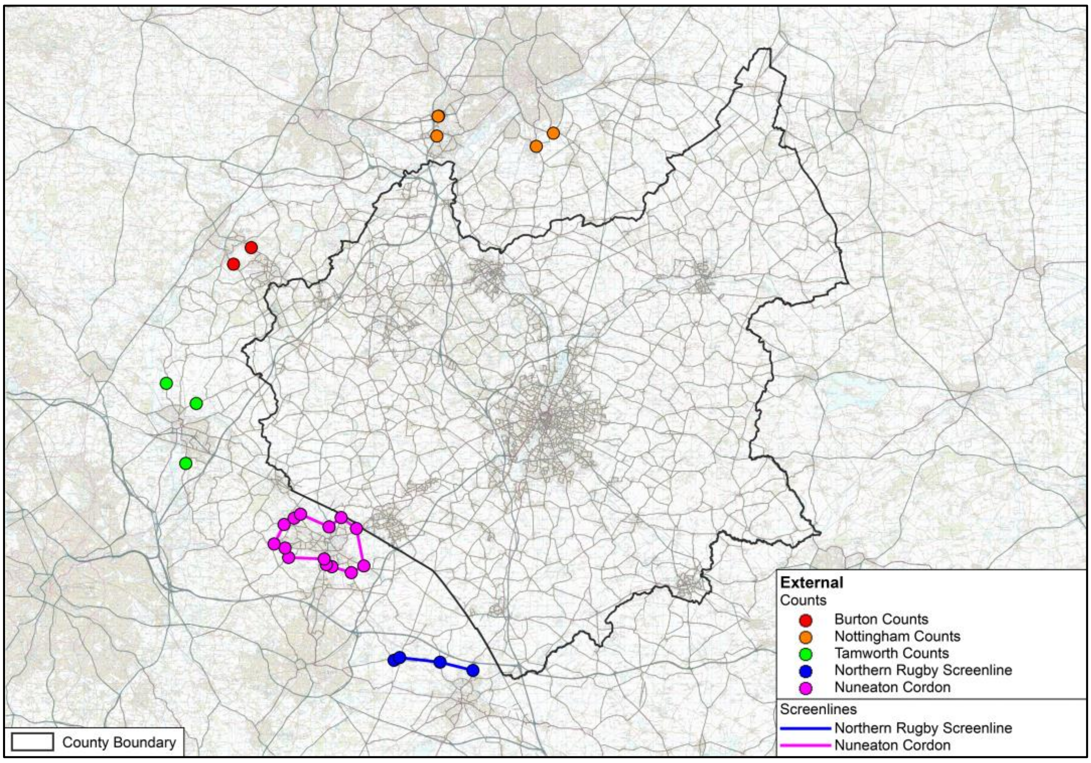
[4] [redacted]
[5] http://data.gov.uk/dataset/gb-road-traffic-counts

count data set for the SRN in the required format for the PRTM highway model calibration and validation.

5.10 Traffic Counts in the Extended Simulation Area

5.10.1 The highway simulation network extends beyond Leicestershire to include additional network in Warwickshire and South Nottinghamshire in particular. 54 additional counts have been defined in this extended area on ‘A’ roads and ‘B’ roads only. These have been derived from data already available from other authorities or supplementary counts that were commissioned in addition to Leicestershire and Leicester counts. There are counts on strategic movements from Nottingham, Burton and Tamworth to Leicestershire, a complete cordon around Nuneaton and a screenline capturing movements north of Rugby. The counts are shown in Figure 5.9.

Figure 5.9: External Calibration Counts and Screenlines



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5.11 PRTM Area Traffic Counts

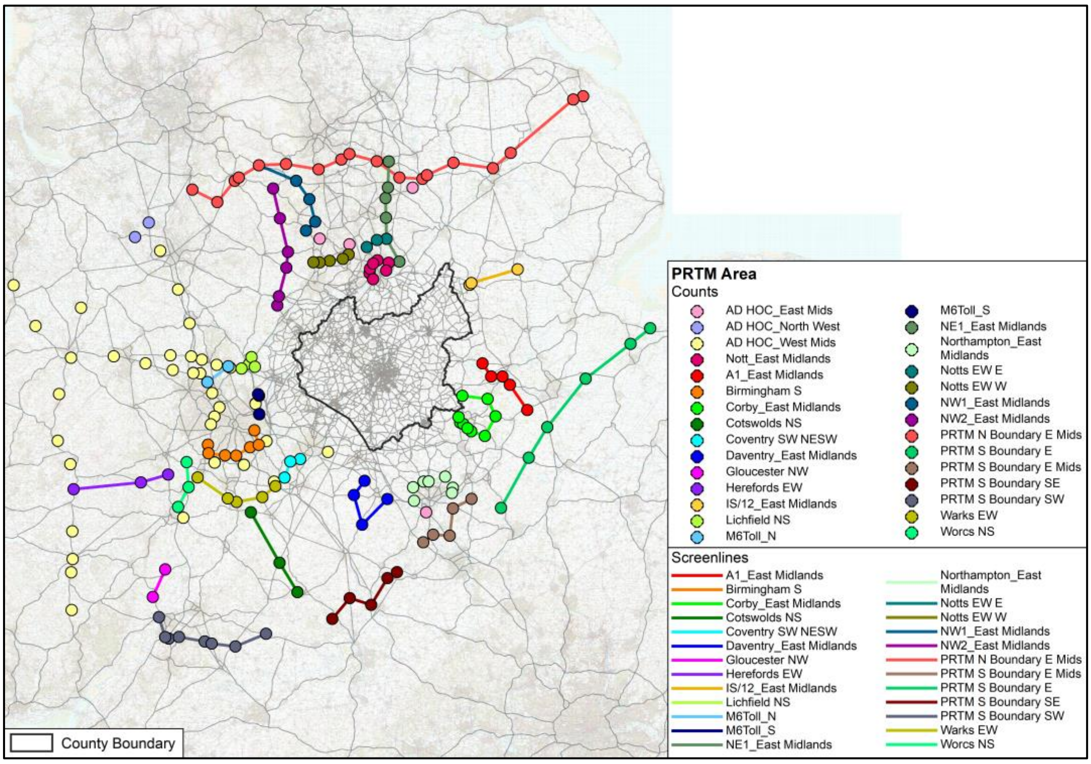
5.11.1 There are 335 counts spread throughout the PRTM area forming several screenlines and groups of counts, including the boundary of the PRTM area. These counts were derived from two sources: Highways England’s MRTM data set and LCC sources.

5.11.2 The Highways England MRTM data, representing May 2015, were received as processed final counts with no indication of sample size or errors and were used without further processing and adjustment.

5.11.3 The counts sourced by LCC included counts in Nottinghamshire, Derbyshire, Warwickshire and Northamptonshire. These counts, representing various years close to base year (2011-2016), were received as processed final counts with no indication of samples or errors and used without further processing; this is considered to be proportionate.

5.11.4 The additional counts and associated screenlines are shown in Figure 5.10. There are 95 counts not allocated to a screenline or cordon which are used as external individual counts and are grouped for reporting by region.

Figure 5.10: PRTM Area Counts and Screenlines



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5.11.5 In order to have meaningful regional samples for reporting, counts and screenlines are allocated to either East or West Midlands, or East or West of England. East of England is defined as the parts of the East of England and South East Government Regions which are within the PRTM area. West of England is defined as the parts of the South West, North West and Welsh Government Regions which are within the PRTM area.

5.11.6 For matrix estimation, the PRTM area counts are all used as calibration counts to allow for relatively greater matrix change outside Leicestershire where the input prior matrix is largely synthetic, hence subject to larger errors. All counts in the PRTM area are used as individual counts other than the pairs of counts on either end of the M6 and M6 Toll motorways which are grouped into short-screenlines.

5.12 Summary of Traffic Counts

5.12.1 These combined data sets result in a total of 1664 counts within the observed traffic flow data set. These have been used to form a total of 72 screenlines, 17 cordons and 28 additional groups of counts.

5.12.2 It is important when considering the results of the model performance against this observed count data set to consider the relative confidence in traffic count data obtained from different sources. All counts inside Leicestershire and Leicester are ATCs. There are five counts from Warwickshire County Council that are MCC counts. The remaining counts are ATCs.

5.13 Journey Time Surveys for Validation

5.13.1 In total 99 journey time routes (each defined in both directions of travel providing 198 observations by time period) have been defined within Leicester City, Leicestershire and for key SRN routes in the PRTM area.

5.13.2 Overall there are two data sources that have been used to construct the observed journey time data set: Trafficmaster data and the online HATRIS journey time database for the Highways England network. Trafficmaster data have been used within Leicester City and Leicestershire and are the primary source of data within the AoDM. Trafficmaster data have been supplemented with data from Highways England's journey time database HATRIS to add further journey time routes outside the county on SRN routes, and to extend some SRN journey time routes beyond the county boundary.

5.13.3 Trafficmaster data uses information collected from in-vehicle GPS systems installed in over 100,000 vehicles to provide historic journey time data across the UK road network. These data are mapped to the road network to provide average speeds and journey times within Leicester City and Leicestershire. Trafficmaster data were extracted for weekdays during school term times in April, May and June 2014 for the specified journey time validation routes. (HATRIS data for 2013 were used as the corresponding data for 2014 were not available at the time of developing the journey time validation data set. However, analysis of the available Trafficmaster data did not suggest that there is significant year-on-year change in observed journey speeds.)

5.13.4 For the SRN routes on the edge of Leicestershire, the HATRIS database contains observed journey time data for each selected section of the SRN, with hourly observations for every day of the year. These records have then been filtered as follows:

- only records for 'normal' working weekdays have been retained, i.e. days have been excluded from weeks containing school holidays and bank holidays;
- only records for the base year highway model hours have been retained; and
- only records for April, May and June 2013 have been retained.

5.13.5 As with the processing of the Trafficmaster journey time data, analysis of HATRIS data for the chosen routes suggested that there was no significant variation in observed journey times year-on-year, and so observed journey time data from April, May and June 2013 have been used for the journey time validation of the base year model.

5.13.6 The 24 journey time routes in the PRTM area, which include a large proportion of the motorway network and several SRN and other routes, use data from the MRTM data set. These journey times represent May 2015, though are actually based on data from June 2015. They were received with no indication of samples or errors, and so used unadjusted. The MRTM journey time routes were extracted and sequentially matched to the PRTM networks and then checked manually on a link-by link basis. This proved a reliable way of matching journey times to the PRTM network.

5.13.7 We note that Highways England considers HATRIS journey time data and Trafficmaster journey time data to be broadly consistent, enabling both sources to be combined. To illustrate this point, the Highways England RTMs used Trafficmaster journey time data to validate the models, and HATRIS journey time data to benchmark the models against observed data (an exercise separate from the formal calibration/validation process).

5.13.8 TAG Unit M3.1 §9.3.1 provides the following guidance on the use of observed journey time data:

> *"Modelled and surveyed journey times should be compared along routes, by vehicle type where separate speed-flow relationships have been used for light*

and heavy vehicles, and by time period. End to end route times should be analysed, with the means and 95% confidence intervals of observed times being presented alongside the modelled times. In addition, time / distance graphs should be produced for individual sections on each route."

5.13.9 With this guidance in mind, for each route, the following summary statistics have been calculated:

- sample size;
- mean;
- 95% confidence interval;
- 95% confidence interval upper bound;
- 95% confidence interval lower bound; and
- standard deviation.

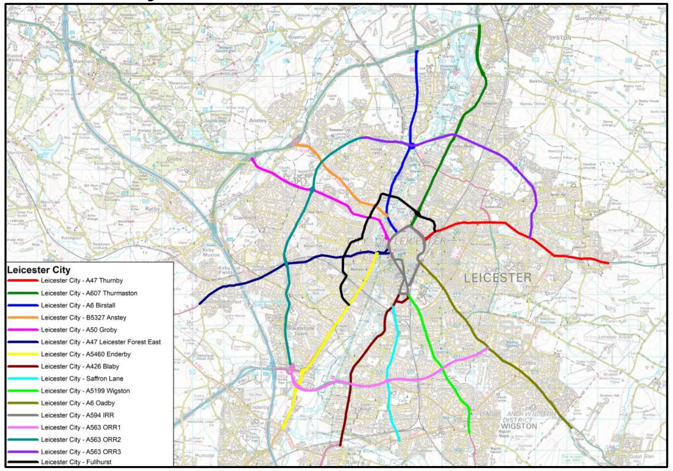
5.13.10 In the calculation of these summary statistics for both the Trafficmaster and HATRIS journey time data, records which are more than two standard deviations from the mean were removed from the sample. The mean, standard deviation, confidence interval and sample size were then recalculated without these outliers.

5.13.11 With the confidence intervals calculated for each observation, these were then combined to produce an overall confidence interval for the journey time route. This uses the same process as detailed for the calculation of screenline-based confidence intervals, as discussed in the '*Data Collection Report*'. This assumes that each observation is independent; however, with journey time data, the observed journey speed on a given section is likely to influence the journey speed on the preceding and subsequent sections. However, given that three months' data have been used to derive the observed journey time route, the observation on any given day will be independent to the observation on all other days within the three-month period. Based on this, it is considered appropriate to assume independence of observations within the calculation of confidence intervals for the journey time validation routes.

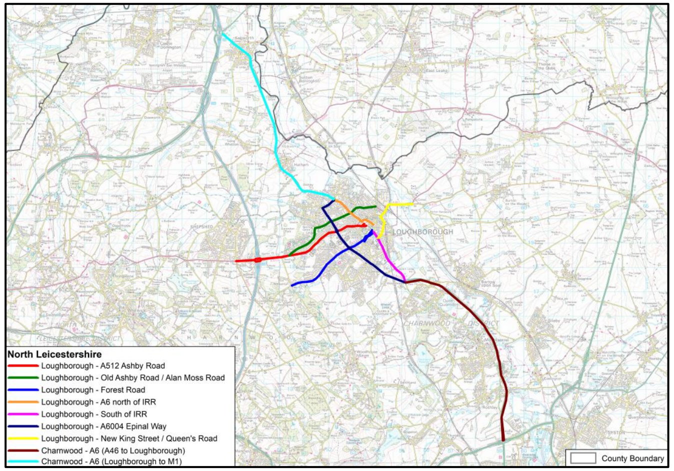
5.13.12 As with the observed traffic flow data set, these journey time routes were assigned to the six reporting areas used within the discussion of the model performance. These are Leicester City, North Leicestershire, North-East Leicestershire, South Leicestershire, South-West Leicestershire and North-West Leicestershire. The allocation of the journey time validation routes to these six reporting areas is shown in Figure 5.11.

Figure 5.11: Journey Time Validation Routes – by Reporting Area

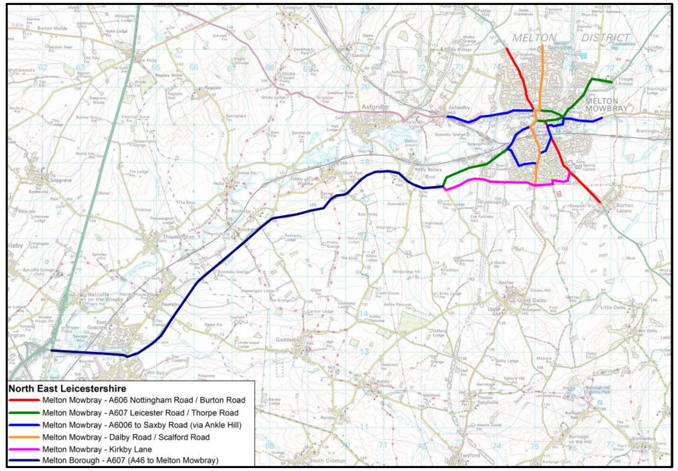
Leicester City



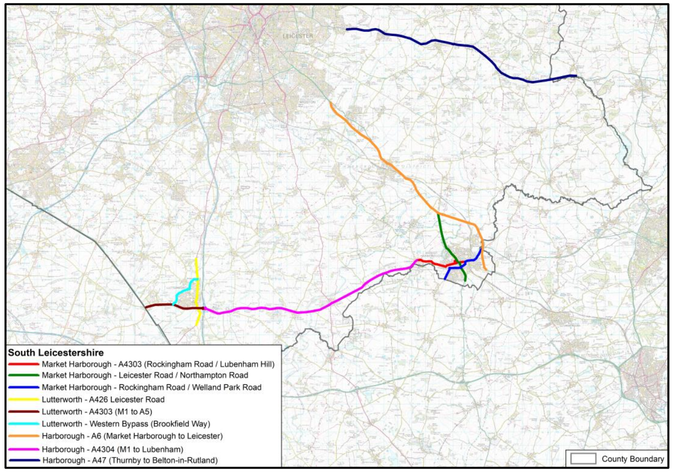
North Leicestershire



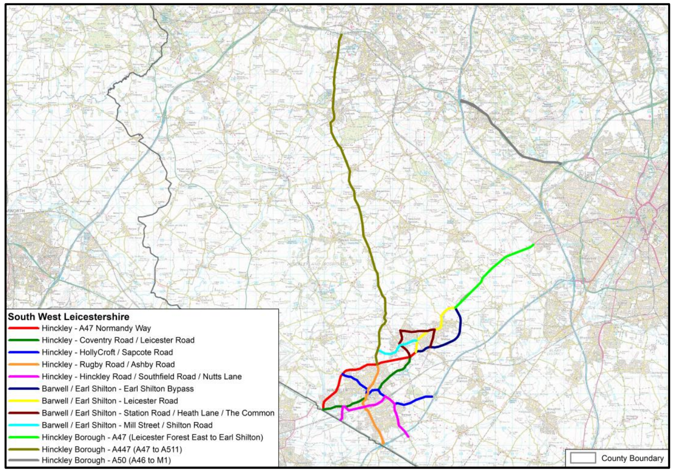
North-East Leicestershire



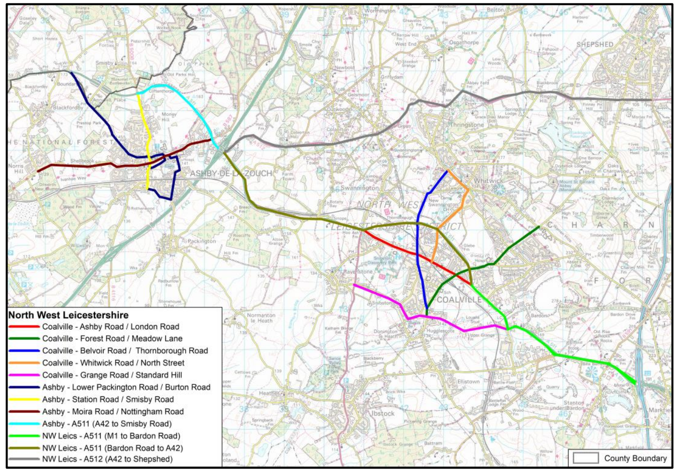
South Leicestershire



South-West Leicestershire



North-West Leicestershire



5.13.13 In addition to the Leicestershire reporting areas, there is also separate reporting on the performance of the SRN routes as shown in Figure 5.12 and the PRTM area routes as shown in Figure 5.13.

Figure 5.12: Journey Time Validation Routes – SRN

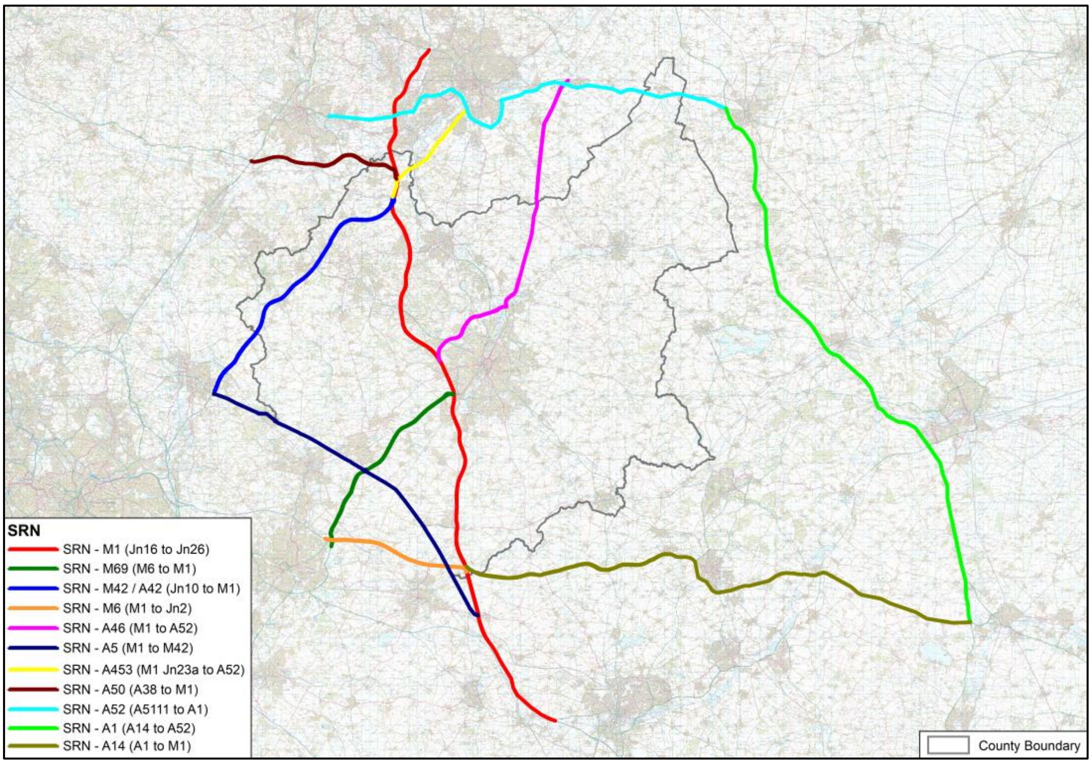


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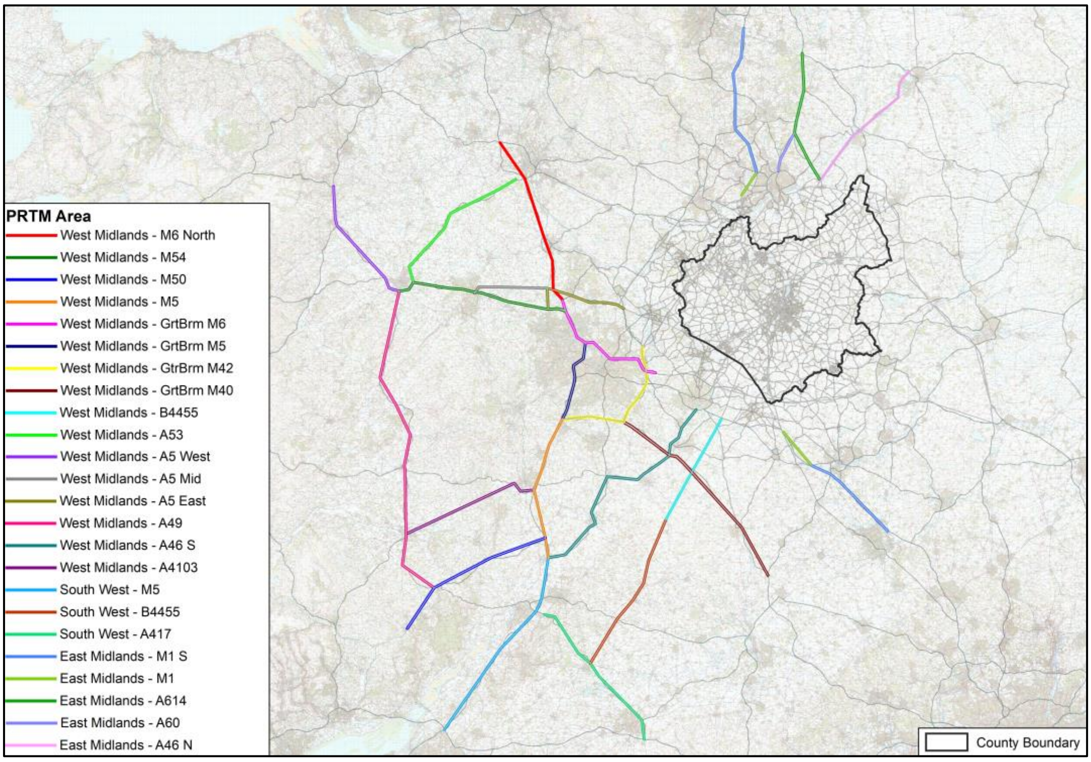
Figure 5.13: Journey Time Routes – PRTM Area



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6. Network Development

6.1 Introduction

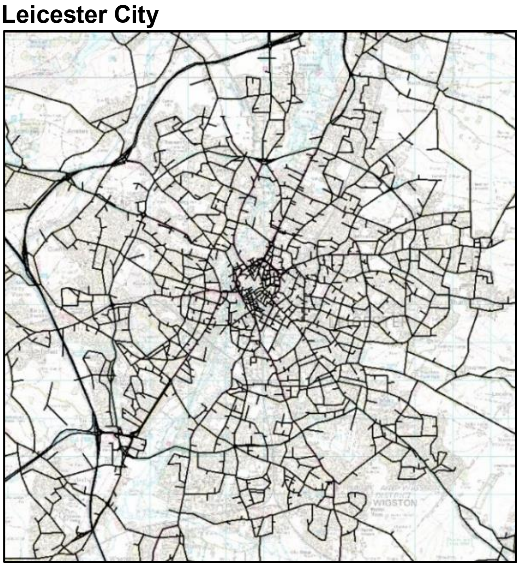
6.1.1 The network coding was undertaken using an up-to-date coding manual, reflecting lessons learnt from applications of the previous model and to include additional functionality that has been added to the SATURN software since the original LLITM network development. This manual has been developed in consultation with Highways England TAME/TPG, LCC and Jacobs/WSP to ensure that it reflects industry best practice.

6.2 Network Detail

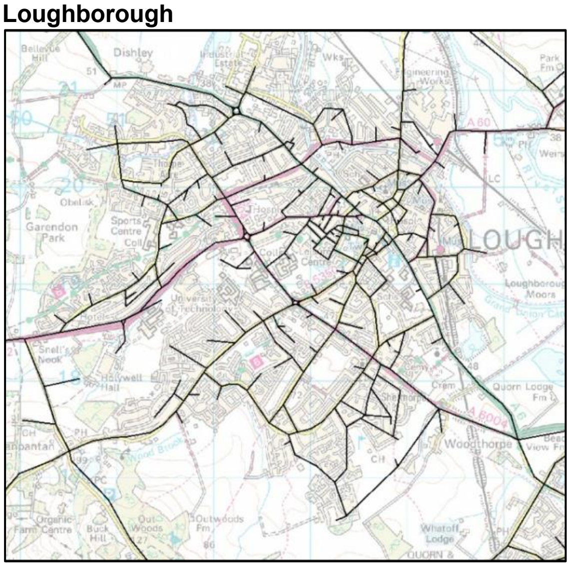
6.2.1 Following the principles of the coding manual, in the base year model, there are around 21,500 simulation links within the network constructed from a total of over 9,500 simulation nodes. Figure 6.1 shows the network detail within Leicester City, Loughborough, Hinckley and Ashby-de-la-Zouch as examples of the link coverage within the highway model.

Figure 6.1: Network Detail within Selected Urban Areas

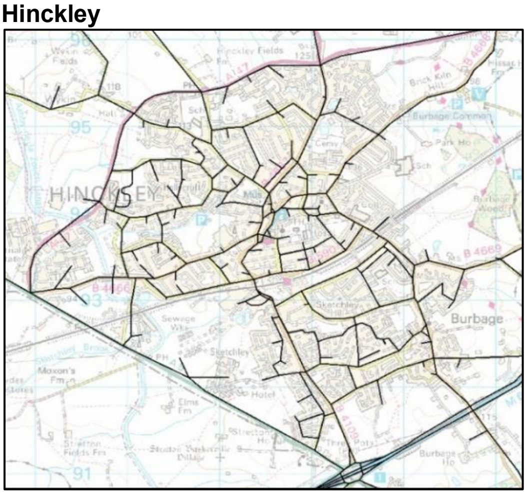
Leicester City



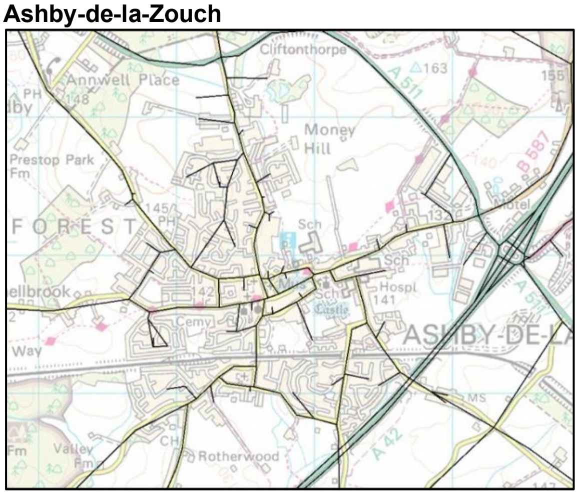
Loughborough



Hinckley



Ashby-de-la-Zouch



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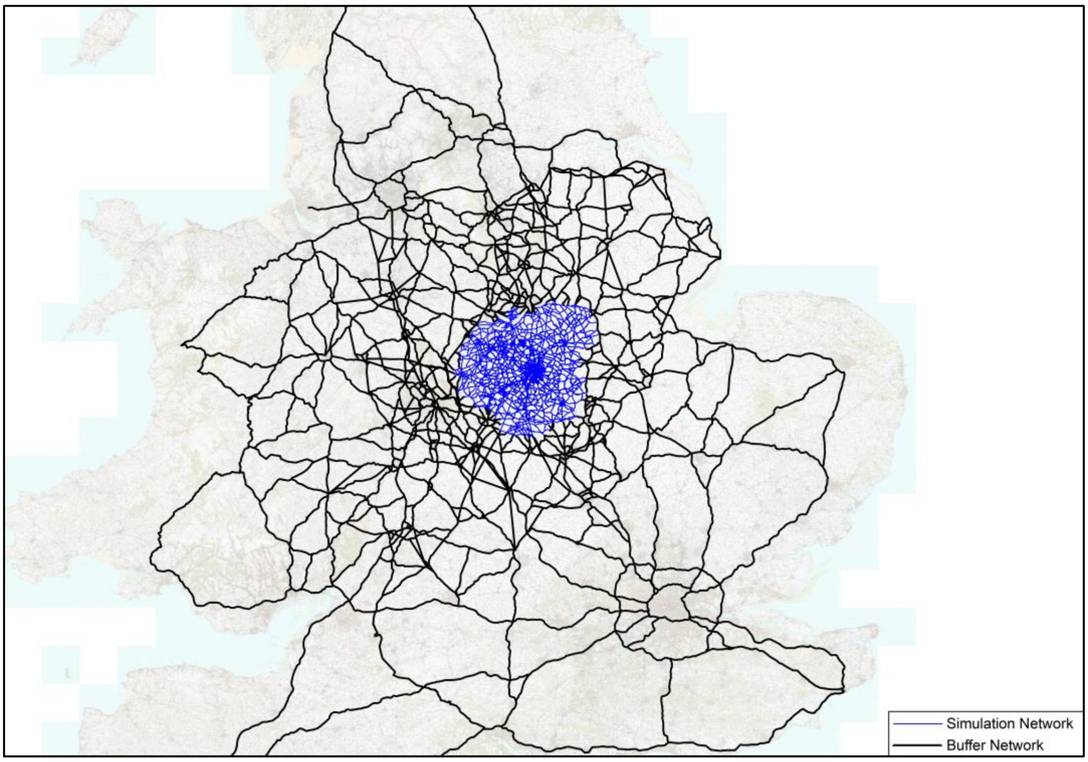
6.2.2 In addition to the simulation network, which covers Leicester City, Leicestershire, and some of the surrounding areas, the buffer network coded in the highway model provides coverage for the remainder of Great Britain. Figure 6.2 shows the network coverage in the external area of the model, with greater levels of network detail in the areas close to the simulation network, and the network detail decreasing with distance from Leicestershire. Simulation network is shown in blue and the buffer network in black.

Figure 6.2: Network Detail within the Buffer Network



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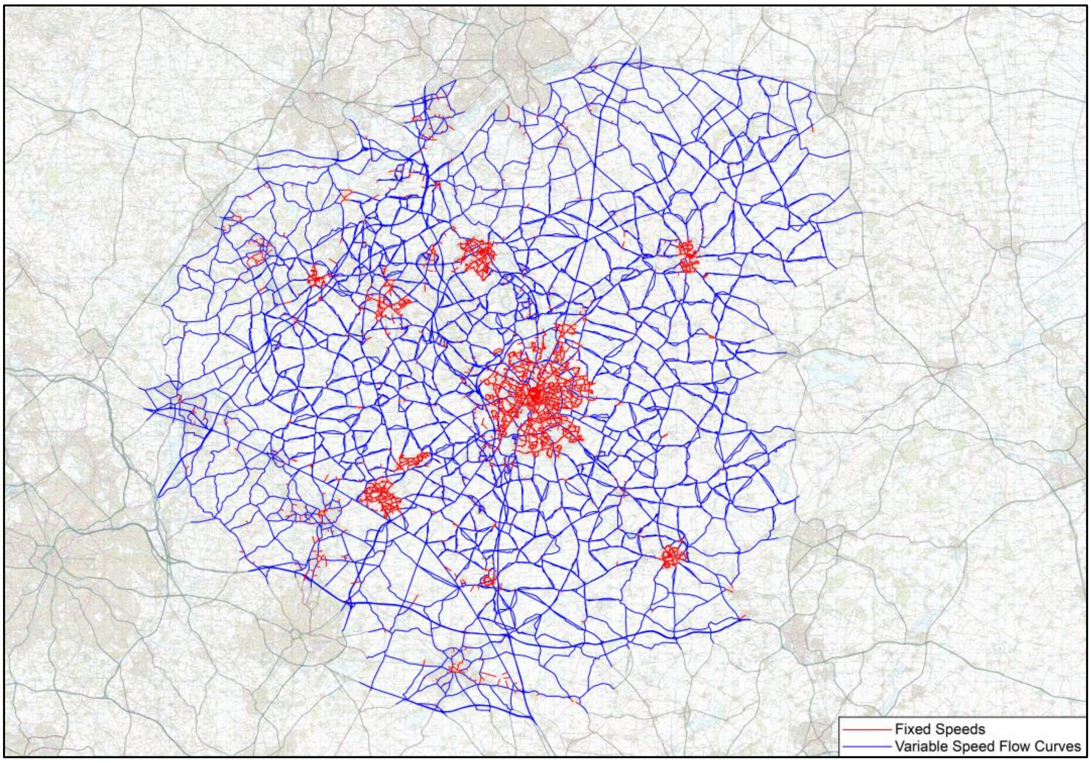
6.3 Network Coding – Link Data

6.3.1 As previously outlined, the decision on whether to apply a fixed cruise speed to a given simulation link is based on the judgement as to whether the majority of delay on a given link can be attributed to the junction at the end of the link or the weight of traffic along the link. In cases where the majority of the delay is likely to be due to the junction, then a fixed cruise speed is coded, whereas if the weight of traffic is the main source of delay then a variable speed-flow curve is coded.

6.3.2 In general, this means that fixed cruise speeds are coded within urban areas where the links are relatively short and the capacity restraints will be the junctions on the network, whereas variable speed-flow curves are assigned to longer and / or more rural links in the model. Figure 6.3 shows the simulation links in the highway model and whether a fixed cruise speed or a variable speed-flow curve has been applied.

Figure 6.3: Application of Fixed Cruise Speeds or Variable Speed-flow Curves



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6.3.3 Where fixed cruise speeds have been coded, in-line with TAG Unit M3.1, they have been coded such that they reflect any impedance, such as traffic calming or parked cars, which would slow down traffic, and any other local factors that might reduce the average speed of traffic such as the presence of pedestrian crossings or junctions not represented within the model.

6.3.4 In order to allow a standardised approach to be adopted across the model, a limited number of cruise speeds have been defined for use within PRTM, listed in Table 6.1. One of the key parameters within matrix estimation, to improve both the routeing within urban areas and the journey time performance, is the allocation of links to these classifications, and this allocation has been revised as part of the network calibration exercise.

Table 6.1: Urban Fixed Cruise Speeds within PRTM

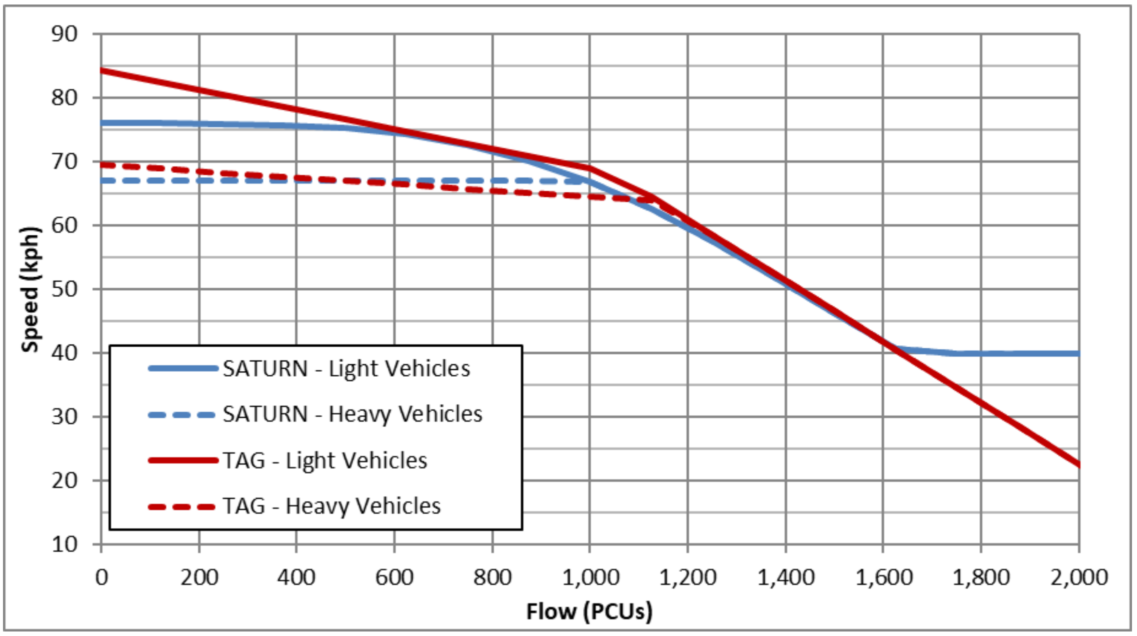
Description	Cruise Speed
30mph limit with no impedances	30mph / 48kph
30mph limit with limited impedances	25mph / 40kph
30mph limit with significant impedances, or 20mph limit with no impedances	20mph / 32kph
20mph limit with limited impedances	15mph / 24kph
Low capacity / significant impedances	10mph / 16kph

6.3.5 Where a fixed cruise speed has not been coded on a given link, a variable speed-flow curve has been applied. The details of the speed-flow curves applied within PRTM can be found in the highway model coding manual. These curves have been derived from the assumptions set out in TAG Unit M3.1 Appendix D and used by AECOM in the development of similar models.

6.3.6 The assumptions detailed in Appendix D of TAG Unit M3.1 are based on the approach detailed in CoBA. As such, the TAG speed-flow curves feature a defined breakpoint flow which cannot be represented within SATURN. Therefore, using the parameters available within SATURN, approximations to the TAG speed-flow curves have been defined, with the focus being on reproducing the TAG speeds at flows approaching capacity.

6.3.7 Figure 6.4 shows the result of this approximation for a single carriageway A-road or B-road with a road width of 7.3m. The estimated SATURN speed-flow curve reproduces the TAG speeds closely for flows between the breakpoint flow (around 1,100 PCUs) and the link capacity (around 1,600 PCUs). For flows below the breakpoint flow, the SATURN speed-flow curve generally overstates the speed on the link compared with TAG.

Figure 6.4: Comparison of TAG and PRTM Speed-Flow Curve (Rural S7.3 A-/B-road)



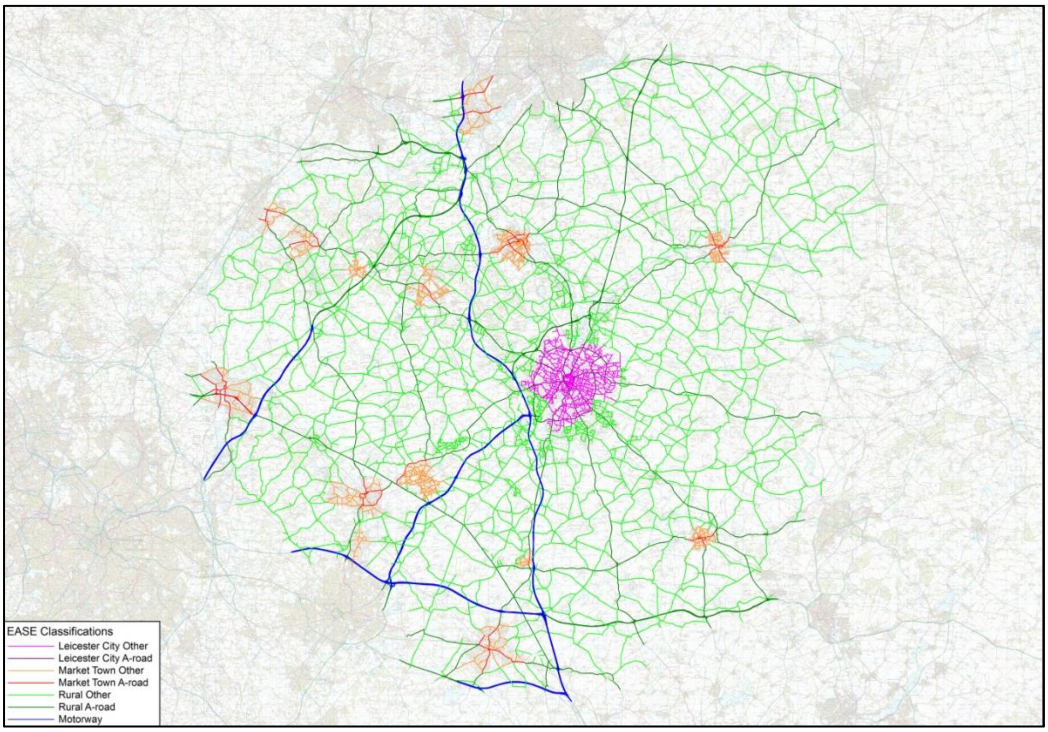
6.3.8 In summary, speed-flow curves have been defined based on road type (motorway, A-road, B-road, other roads), the number of lanes for a given road type, the speed limit of the route, and the standard of the road in question. The standard of road is particularly important when considering the application of speed-flow curves on rural routes where the road may be narrow, have poor visibility or have significant gradients. These factors contribute to the speed of traffic along these routes and have been considered in the application of speed-flow curves within PRTM.

6.3.9 There are two options provided in SATURN for representing the differential in speeds between HGV traffic and other traffic, one which caps the speeds of HGVs at a predefined value; and one that applies a time penalty to HGV traffic at all speeds. Based on the assumptions for HGV traffic in Appendix D of TAG Unit M3.1, the first of these two approaches have been adopted within PRTM. The assumed maximum speeds for HGVs by link type have been defined based on the assumptions given in TAG and are detailed in the highway model coding manual.

6.3.10 The wider PRTM model suite features a tool to forecast emissions based on link flows and speeds (using Defra's Emissions Factor Toolkit). This requires a mapping between modelled links and seven link types used in the calculation of emissions. These links are motorways, and A-roads or other roads within Leicester City, Leicestershire market towns and rural areas.

6.3.11 This mapping between highway model links and the emission calculation link types uses the coded speed-flow curve. The capacity indices used within PRTM, including those applied to fixed cruise speed links, have a two-digit ID which is preceded by a third digit that defines the emissions link type. Therefore, the capacity indices can be extracted from the model, with the first character of the coded speed-flow curve defining the emissions calculation link type. Figure 6.5 shows the result of this mapping in the base year highway network.

Figure 6.5: Application of Emissions Calculation Link Types



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6.3.12 The buffer highway network was based on Ordnance Survey's ITN layer. The number of shaping points along a link were rationalised, from the actual ITN shape, to enable the GIS layer to import into SATURN. Key strategic routes were selected that connect with the UK in increasing detail as the zoning system increases in detail nearer to the simulation area. To avoid a dramatic drop in the level of network detail at the simulation area boundary a number of minor roads were also included. Centroids were connected to the key junction or junctions that serve that zone.

6.3.13 In the PRTM area, coding includes all SRN, most primary and other A-roads and selected B-roads. Speed-flow curves are used, apart from in several urban areas where fixed speeds were used to avoid over-capacity links affecting route choice. A small number of additional fixed-speed links were also added where necessary around the perimeter of the PRTM area to improve network consistency and produce plausible routeing. Standard PRTM speed-flow curves were used unless the combination of road type and speed limit was not represented. Non-standard curves were required for fewer than 10 links.

6.3.14 Speed-flow curve selection is often somewhat subjective, and most speed-flow curves were reviewed and updated iteratively during network calibration and validation. Initially, the coded speeds and lanes in the MRTM model were mapped to PRTM speed-flow curves; however, this produced some significant anomalies due to differences in model assumptions and matching errors. Some MRTM speeds coded to the MRTM journey time data and associated speed-flow curves proved unreliable.

6.3.15 Also, unlike PRTM, MRTM was calibrated with roadworks in its base year (2015). Speed-flow curves were therefore checked against Google Street View and HATRIS data and routes checked for changes against Highways England data, particularly in areas where calibration was problematic.

6.3.16 Outside the PRTM area, the speed for each link was obtained by summing distance and time data from HATRIS (rather than using the HATRIS speeds directly). This allowed a weighting of the speed based on the length of the component HATRIS links. MapInfo polygons were used to match the buffer links to equivalent links in the HATRIS data set. As there are two directions of both HATRIS and PRTM buffer links in each polygon the direction was identified from the co-ordinates of the A and B node to correctly match the HATRIS data.

6.3.17 The HATRIS data used were from April, May and June 2013. The 2014 data were not available at the time the buffer network was developed; however observed growth in traffic in Leicestershire between these two years would not have affected speeds substantially. A z-test was performed and any records that were not statistically significant were removed from the data set, for each HATRIS link by direction.

6.3.18 There were a number of links for which there was no HATRIS data. For these, the average speeds were based on a default of 104kph for Motorway, 96 kph for trunk A roads, 80 kph for normal A roads, 72 kph for B roads and 64 kph for minor roads.

6.3.19 In several towns and cities, the network had insufficient detail for the level of demand being loaded, causing unreasonable route choice. This effect had been seen in development of the Highways England RTMs and the same, successful, solution of converting some urban centres to fixed speed infinite capacity links was applied. Fixed speeds for these towns were derived from the average market town speeds in Leicestershire, which are almost identical to the speeds reported in the DfT's National Transport Model (NTM) Road Traffic Forecasts.

6.3.20 On several motorway sections in the model it is necessary to model Smart Motorways with speed-flow curves. Best practice, adopted by Highways England, is to represent the increase in lanes as a capacity increase to avoid generating disbenefits in scheme appraisals by restricting maximum speeds. Standard speed-flow curves for the maximum number of lanes have been used as the available evidence[6] suggests that ALR maintains the usual speed-flow relationship to the higher capacity.

6.3.21 Junction restrictions are not coded by default in the buffer network, with all links modelled as two-way links allowing all movements at junctions. However, exit or entry-only motorway junctions can significantly affect routeing, including SRN routes into Leicestershire. Many motorway sections are therefore modelled in PRTM as separate one-way links for each direction, with junctions exploded into enough detail to model restricted movements.

6.4 Network Coding – Turn Data

6.4.1 As with the network link data, PRTM simulation nodes have been coded in-line with the PRTM highway coding manual. These parameters include:

- junction type and associated parameters;
- individual turning saturation flows including lane allocations;
- turn priority markers such as give-way, opposed turn and merging traffic; and
- signal timing data where available.

6.4.2 The coding of these network parameters has been undertaken using aerial photography. For all junctions excluding roundabouts, the standard saturation flows have been defined for 'tight' (junctions with small turning radii), 'average' (junctions with medium turning radii) and 'wide' (junctions with large turning radii) situations. The application of these three standards

[6] DfT revalidation document; http://assets.highways.gov.uk/specialist-information/knowledge-compendium/2014-2015/Re-Validation+of+Speed+Flow+Curves+Final+Report+Final.pdf

of junction is based solely on the radius of the turns for a given junction, and not on the geographic location of a given junction.

6.4.3 For roundabouts the classifications of saturation flows and other roundabout parameters, such as circulating capacity and the time to circulate the roundabout, are based on the roundabout size and the number of lanes approaching the roundabout. Roundabouts have been classified as mini-roundabouts, ‘normal’ roundabouts with single or flared approaches, and ‘large’ roundabouts with two or more lane approaches.

6.4.4 In general, the coding of priority junctions has used the direct application of SATURN give-way and opposed traffic turn priority markers to represent the individual movements at a junction. The exceptions to this are motorway or A-road merges where a specific set of coding assumptions has been applied. These standard assumptions are detailed in the highway coding manual and have been agreed with Highways England TAME/TPG.

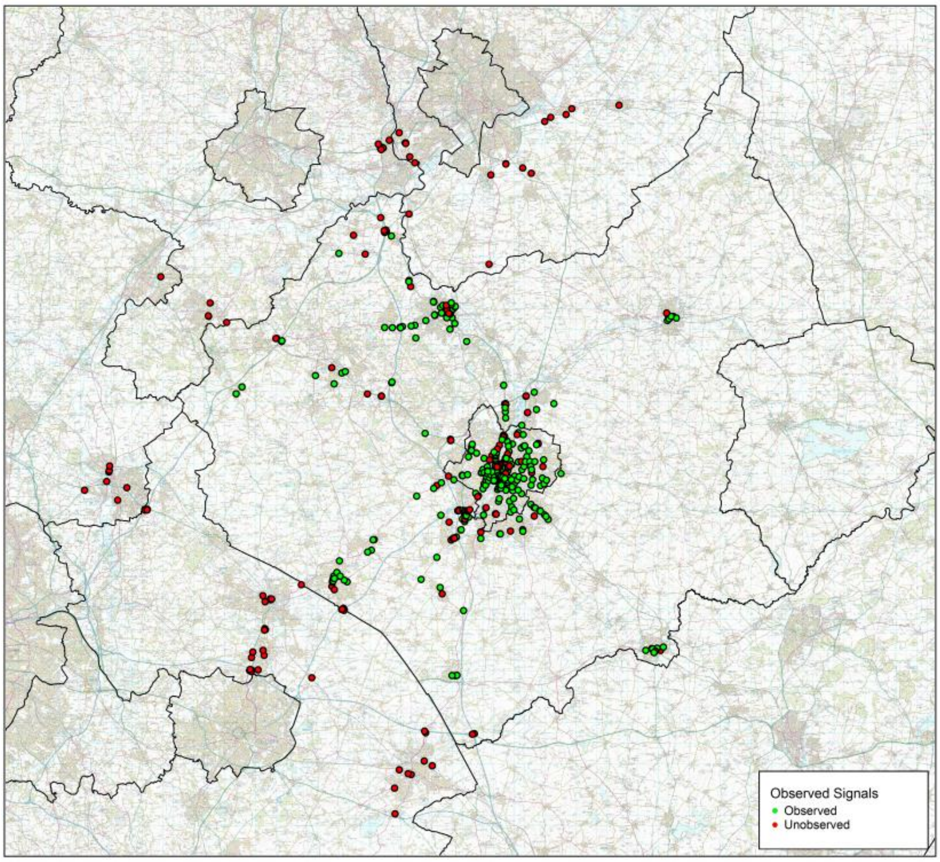
6.4.5 In summary, where the motorway or A-road merge is not a lane-gain merge, the merging traffic on the slip road has been coded with a ‘merge’ priority marker. Downstream from the node (representing the merge point between the mainline and slip road traffic) is a link either 300m (for motorways) or 100m (for A-roads) in length which is one lane wider than the mainline carriageway. This is to represent the section where the slip-road runs parallel to the mainline carriageway for a short period. At the end of this 300m or 100m section is a node with a Q-marker and a capacity equivalent to the number of lanes downstream for this point.

6.4.6 As part of the development of the PRTM highway model the signal staging and timings have been updated with observed data provided by LCC for most signalised junctions within the model. The locations of observed and unobserved signal timings are shown in Figure 6.6. The dots within this figure show the location of the signalised junctions within Leicestershire, with those shown in green being the locations where observed data have been provided and red dots where there were no data provided. This map does not include pedestrian crossings.

6.4.7 There are 301 signalised junction nodes in PRTM with observed signal timings. There are 105 signalised junction nodes inside Leicestershire that did not have observed timings or phasing. There are 77 signalised junctions outside Leicestershire, within the peripheral simulation network, modelled in the PRTM highway model. These figures do not necessarily correspond to the number of signalised junction records provided by LCC as:

- a signalised junction is sometimes represented by more than one SATURN node; and
- some signalised junctions are not included in the model.

Figure 6.6: Location of Observed Signal Timings – AM Peak Hour



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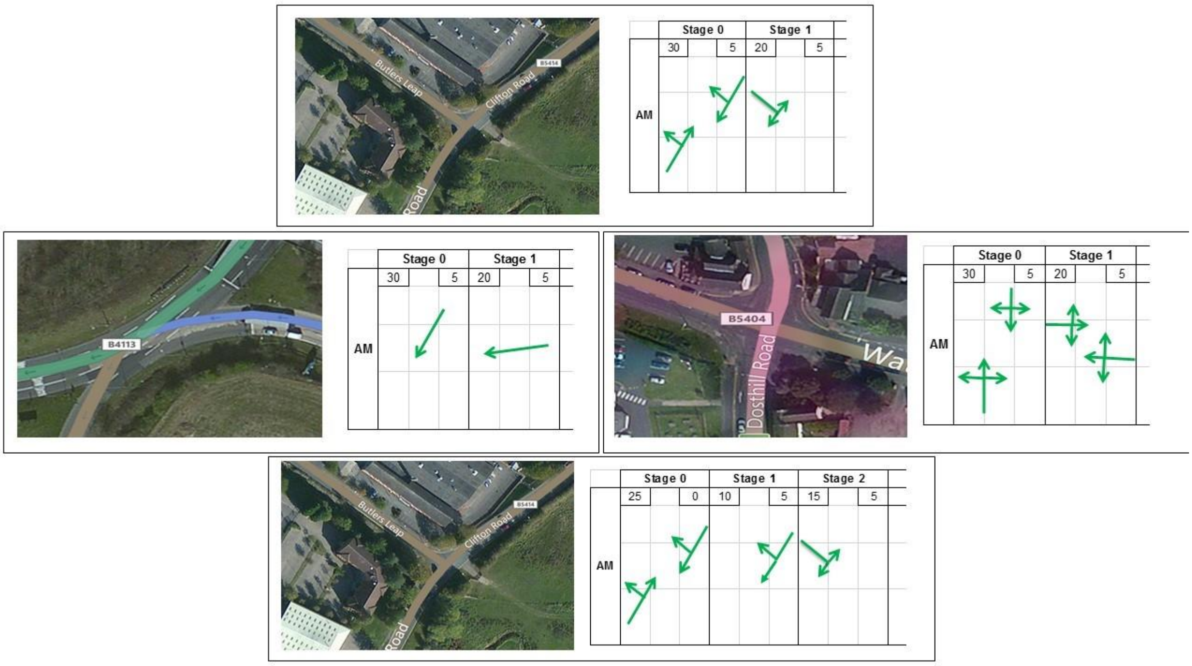
6.4.8 All unobserved signalised junctions have assumed staging and timings. Each junction has been reviewed in Google Street View for clues as to how the signalised junction operates. This could include the number of arms, the type e.g. signalised roundabout or town centre junction, the presence of a filter signal, the movements of traffic that have been observed as moving at the same time on Google Street View, lane markings and the relative hierarchy of each arm e.g. local side street joining an 'A' road.

6.4.9 Examples of the generic signal stages and timings used are shown in Figure 6.7. These were used as starting points for junctions without observations and all junctions outside the county and may not reflect the final timings in the model. There were some junctions that clearly did not fit any of these standard assumptions and so the information available from Google Street View was used to make appropriate assumptions, supported by analysis of levels of assigned flow (accepting any modelling uncertainty in doing this), to help support green time splits.

Figure 6.7: Example Generic Signal Timings



6.4.10 The signal timings for the unobserved signalised junctions were the first to undergo manual adjustments where required during the process of network calibration in response to the flow and journey time validation results. However, it was agreed with LCC that observed signal timings could also be reviewed where there were remaining routeing, flow and journey time issues in the network.

6.5 Network Checking

6.5.1 A number of checks have been undertaken on the PRTM base year highway network. These fall into one of the following four categories:

- automated checks to ensure high-level network consistency with the coding manual;
- a network coding review undertaken by an independent modelling team within AECOM;
- a review of all SATURN warnings for simulation nodes; and
- an assignment of base year demand and increased levels of demand using a global factor.

6.5.2 Taking each of these in turn, a number of automated checks were undertaken on the network to ensure high-level consistency between the network coding and the coding manual. These checks considered the following attributes within the highway model:

- consistency of coded distance by direction for two-way links;
- consistency of fixed cruise speed / speed-flow curve by direction (accounting for instances where road type, in general the number of lanes, genuinely varies by direction);
- coded saturation flows consistently coded at a junction, i.e. are all ‘tight’, ‘average’ or ‘wide’; and
- consistency of coding across modelled time periods.

6.5.3 It should be noted that whilst these checks consider that saturation flows and speed-flow curves have been applied consistently for a node or link, they do not seek to conclude if the ‘correct’ choice of speed-flow curve or saturation flows has been applied. To aid the review of these decisions, maps were produced that showed, for example, where 'tight', 'average' and 'wide' saturation flows have been applied for priority and signalised junctions. These maps were reviewed to assess if outliers existed e.g. where 'tight' saturation flows had been applied in rural areas. Another example of a map produced was of fixed vs. variable speed on links to review whether a suitable curve has been chosen for the road conditions.

6.5.4 As these classifications of saturation flows are based on turning radii and not on geographical location (see Paragraph 6.4.2) further investigation of potential outliers was undertaken to ensure that the assumptions set out in the coding manual had been applied consistently across simulation nodes.

6.5.5 In addition to this review, an independent review of the nodes was undertaken through the coding process by an independent modelling team. It was not possible with the timescales permitted for this team to audit all nodes as part of this exercise, so a sample of nodes were considered. This review was undertaken in parallel with the simulation network coding, with the coding team meeting to discuss the findings of the review to ensure that coding was undertaken consistently across the county, and that any remedial action was taken to address comments from the review.

6.5.6 As each node was reviewed or coded as part of the network development programme, the SATURN warnings were recorded. These were then investigated, and coding changes made where required, addressing the warnings produced within SATURN. In addition to this a review of the most significant warnings produced by the network was undertaken at the end of the process prior to model calibration.

6.5.7 Throughout the process of updating the highway network, assignments of the prior demand matrices were undertaken onto the network to identify any routeing problems and / or excessive delays within the network. If either of these issues, or other issues with the assignment, were identified within areas of the model reviewed at that stage then remedial action was taken to address these issues. Assignments were also taken with 10%, 20% and 30% increases in demand globally to stress test the base year network and highlight any coding issues which were not highlighted with lower levels of demand.

7. Trip Matrix Development

7.1 Introduction

7.1.1 When LLITM was specified, the project team was aware of the possibility of using mobile network data in developing travel demand matrices, but early efforts in using this information by a range of consultants had resulted in mixed outcomes regarding data quality and its potential for use in transport models.

7.1.2 A decision was therefore made to proceed with a full RSI data collection programme, and to also investigate the use of mobile network data to support the matrix building process. The RSI data would provide a rich source of data with which to verify the processed mobile network data, also drawing on the local planning data set developed by David Simmonds Consultancy, and 2009 Leicester and Leicestershire household survey data.

7.1.3 AECOM entered into a contractual relationship with Telefonica to review, verify, and refine Telefonica's processing assumptions in developing demand matrices from O2 mobile network data.

7.1.4 As part of this, the trip matrices developed by Telefonica was independently reviewed by AECOM, in order to verify whether the processed mobile network data were suitable to be used as the primary source of prior matrices in the highway model development. The findings suggested that the outcome of using the processed mobile network data to develop prior matrices did not look to be either biased or less accurate than a conventional methodology using RSI data. Given the potential advantages of mobile network data over RSI data, it was concluded that mobile network data should be used as the primary source of OD data to develop highway matrices for car trips.[7]

7.2 General Requirements

7.2.1 The following key steps were completed in order to process the mobile network data into prior matrices that could form the basis of matrix estimation:

- split the OD matrices by vehicle type and trip purpose;
- disaggregate the matrices from mobile network data sectors into model zones;
- convert matrices from OD level to PA level; and
- convert matrices from people to vehicles.

7.2.2 In terms of vehicle type and trip purpose, the following segmentation is required

- car commuting;
- car home-based education;
- car home-based employers' business;
- car non-home-based employers' business;
- car non-home-based other;
- LGV; and
- HGV.

[7] It should also be noted that recently published TAG Unit M2.2 was developed by AECOM on behalf of DfT and was not available at the time that these matrices were developed.

7.2.3 Various sources of secondary data were used to segment and disaggregate the mobile network data. The next section describes the data and the methodology used to undertake this process.

7.3 Overall Approach and Data

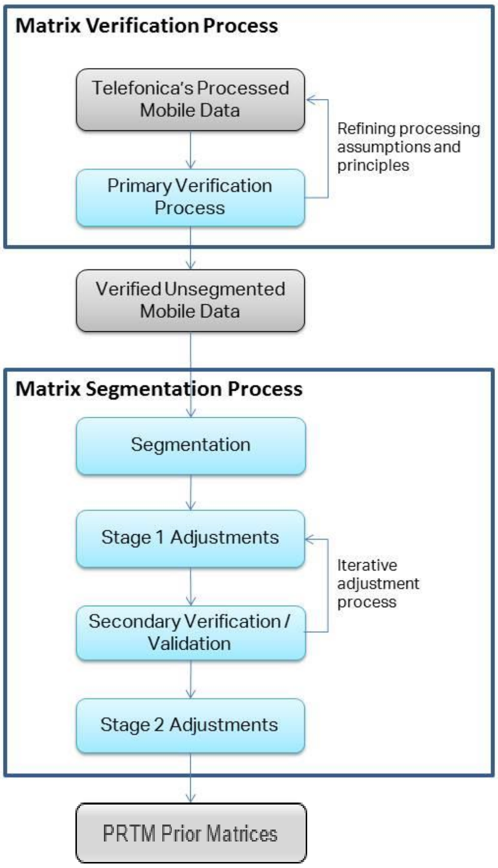
7.3.1 Origin-Destination (OD) matrices estimated from mobile network data have certain potential advantages when compared with conventional sources of OD information such as RSI data. These mainly include wider geographical coverage, higher sample size, capturing day-to-day variability of trips, and potential time and cost savings for data collection and processing.

7.3.2 However, this is a relatively new type of data which are not collected specifically for the purpose of transport planning. There are therefore key weaknesses and uncertainties associated with OD matrices derived from mobile network data which should be recognised and addressed. These include definition of trips and trip-ends, spatial resolution and data accuracy, identification of short trips, identification of vehicle types and vehicle occupancy, identification of trip purpose and mode, and expansion of mobile network data. A more detailed comparison of the characteristics of RSI data and mobile network data are available in Tolouei, et. al., 2015[8].

7.3.3 The overall process of matrix development, outlined in Figure 7.1 included two main stages: verification and segmentation. The verification process was used to assess usability of Telefonica’s processed OD data for matrix development and address identified limitations and biases within the data through a collaborative approach, working with Telefonica. The segmentation process was mainly used to split OD data by vehicle type and trip purpose, convert them from mobile network data sectors into model zones, and address various shortcomings and biases in the data. These are described in more detail in the next two sections.

[8] Tolouei, R., Álvarez, P., Duduta, N., “Developing and Verifying Origin-Destination Matrices using Mobile Phone Data: The LLITM Case”, proceedings of the European Transport Conference, Frankfurt, 2015.

Figure 7.1: Overall Approach to Car Prior Matrix Development



7.3.4 Various sources of data were used to verify, segment, adjust, and augment mobile network data. These include:

- 2011 Census population data;
- 2011 Census Journey to Work (JTW) data;
- RSI data;
- traffic count data;
- 2009 household survey data; and
- trip-end model estimates (based on revised 2014 local planning data).

7.4 Car Synthetic Matrices

7.4.1 Car synthetic matrices were required for the following purposes:

- mobile network data purpose split;
- to infill short trips in mobile network data; and
- to infill external-external trips not fully observed within the mobile network data matrices.

7.4.2 The gravity model is often used to solve trip distribution problems. It assumes that the interaction between two zones is inversely proportional to the distance between the zones or the cost/time of travel but is proportional to the number of trips between the zones. The gravity model can be expressed mathematically as:

$$T_{ij} = A_i B_j O_i D_j f(\boldsymbol{a}, C_{ij}), \qquad \sum_i T_{ij} = D_j, \sum_j T_{ij} = O_i,$$

and,

$$A_i = \frac{1}{\sum_j B_j D_j f(\boldsymbol{a}, C_{ij})}, \quad B_j = \frac{1}{\sum_i A_i O_i f(\boldsymbol{a}, C_{ij})},$$

where:

- T_{ij} is the matrix of trips between origin zone i and destination zone j;
- C_{ij} is the cost of travel between origin i and destination j;
- O_i is the total number of trips originating at zone i;
- D_j is the total number of trips destined for zone j;
- A_i, B_j are balancing factors, solved for iteratively using a Furness process; and
- f is the deterrence function, for which the parameter vector $\boldsymbol{a}$ needs to be calibrated.

7.4.3 The deterrence function, f, is a function of an unknown vector, $\boldsymbol{a}$, and the travel cost between zones i, j. $\boldsymbol{a}$ is calibrated by running an algorithm to find a set of parameters for which the squared error between the synthetic and observed distributions is minimal, i.e. to minimize e_{parms} where

$$e_{parms} = \sum_c (T_c^{obs} - T_c^{syn})^2,$$

where:

- T_c^{obs} is the number of observed trips in trip cost band c; and
- T_c^{syn} is the number of synthesized trips in trip cost band c.

7.4.4 There is then a process of furnessing and balancing to fit the synthetic matrices to the relevant trip cost distribution. A summary of the matrix build process is outlined in Figure 7.2.

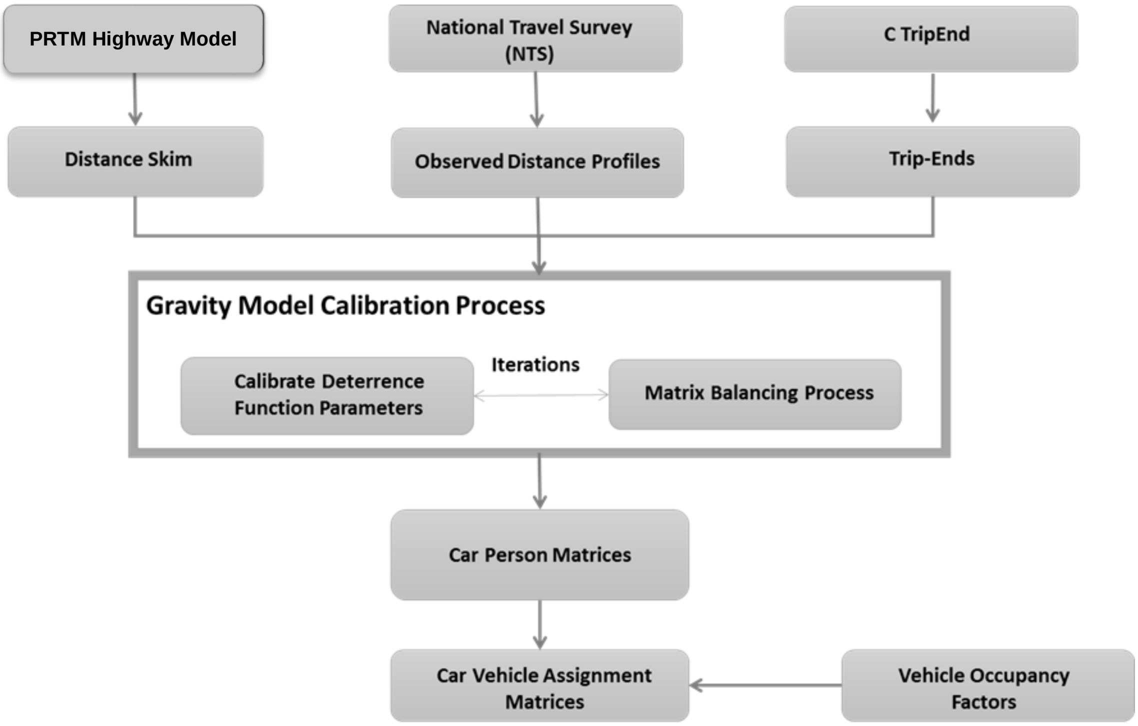
7.4.5 The standard approach for building synthetic matrices is to calibrate the parameters of a deterrence function, f, to fit the entire matrix with observed Trip Cost Distributions (TCDs). This approach usually returns matrices which fit the TCDs at an aggregate level, but often fail at sub-matrix level as the process does not take into account local travel patterns.

7.4.6 A new approach has been used to develop the synthetic matrices in this model which involves using multiple deterrence functions and calibrating the parameters simultaneously to match different TCDs. This means that distinct travel patterns for specific areas in the model are taken into account. This new synthetic matrix build approach is described fully in a recent paper presented in European Transport Conference in 2017[9].

7.4.7 The process of developing synthetic matrices is shown in Figure 7.2.

[9] A hybrid gravity modelling approach for trip matrix synthesis' (Tolouei et.al, 2017).

Figure 7.2: Overall Approach to Build Synthetic Matrices



7.4.8 Synthetic matrices are usually calibrated using observed trip length distributions (TLDs) of trips produced from the internal area of the model. The synthetic matrices developed for this model have been calibrated in three distinct geographical sub-areas. The three sub-areas have been chosen to reflect the difference in travel patterns within the internal area, according to the National Travel Survey (NTS). The Local Authority Districts which were aggregated to form the three sub-areas are shown in Figure 7.3. Table 7.1 defines the three sub-areas in terms of Local Authority Districts.

Figure 7.3: Leicestershire Local Authority Districts and Leicester City

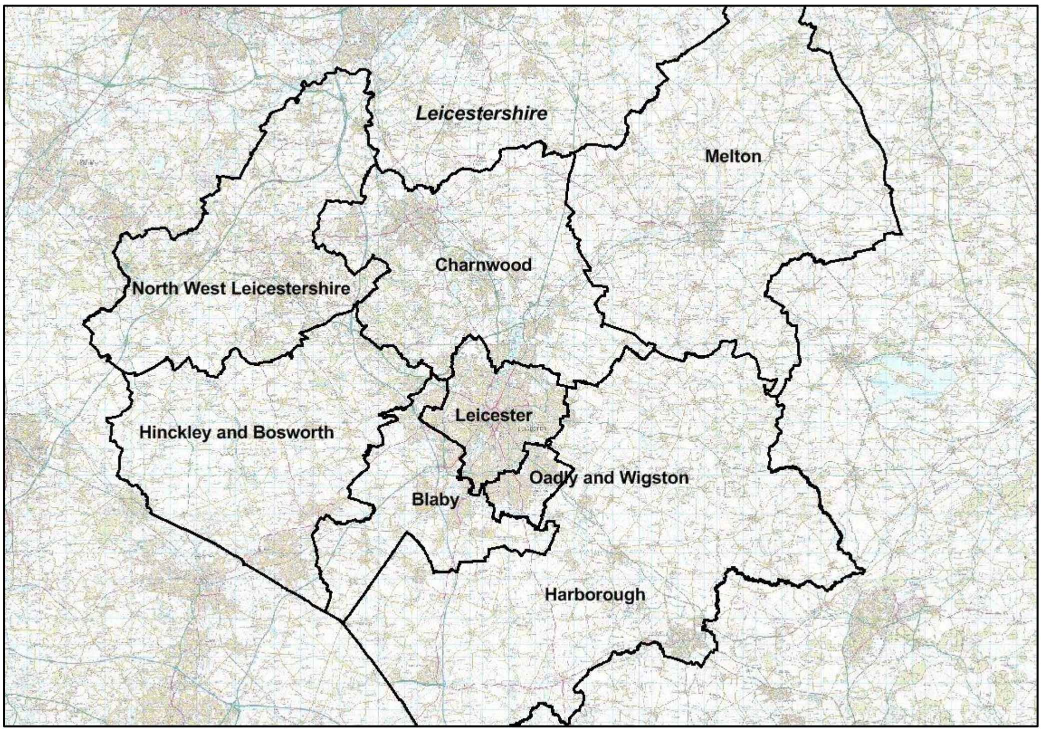


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Table 7.1: Internal Model Sub-Areas

Sub-areas	Model area(s)
1	Leicester City
2	Charnwood, Harborough, Hinckley & Bosworth, Melton
3	Blaby, NW Leicestershire, Oadby & Wigston

7.4.9 The synthetic matrices underwent calibration for each of the three geographical sub-areas, as described earlier. The TLDs were then compared with NTS, assignment results were compared with counts, and sector-sector movements were compared with the RSI data.

7.4.10 Figure 7.4, Figure 7.5 and Figure 7.6 show examples of TLD comparison between NTS and the synthetic matrices (i.e. calibrated with the spatial variation in travel patterns). The results show a reasonable fit between modelled and observed TLDs across all model purposes and sub-areas.

Figure 7.4: Observed vs Model TLDs, Sub-Area 1, Commuting Purpose

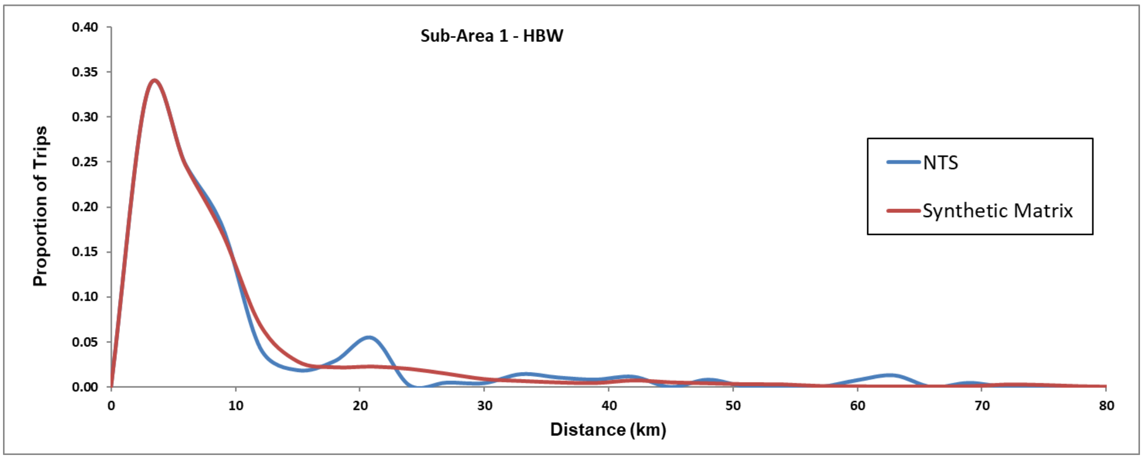


Figure 7.5: Observed vs Model TLDs, Sub-Area 1, Home-Based Other Purpose

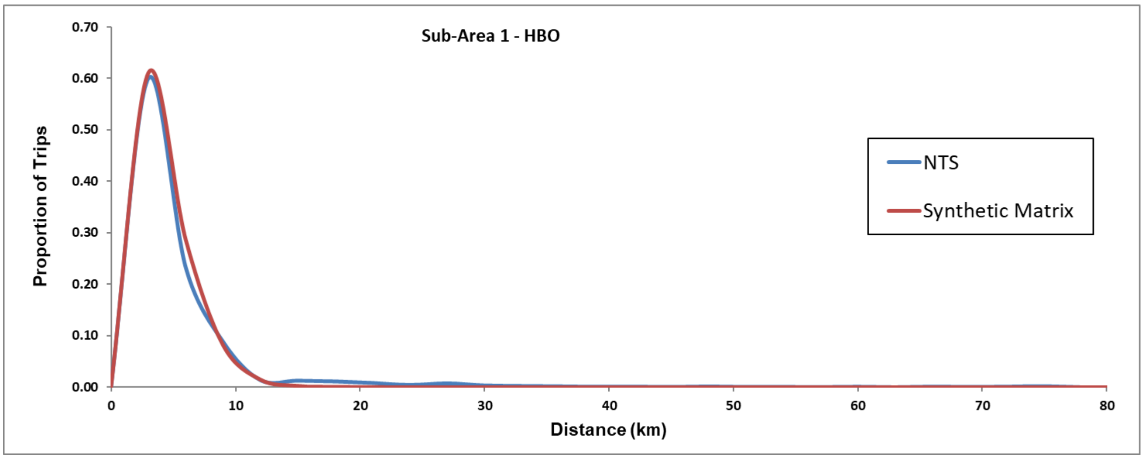
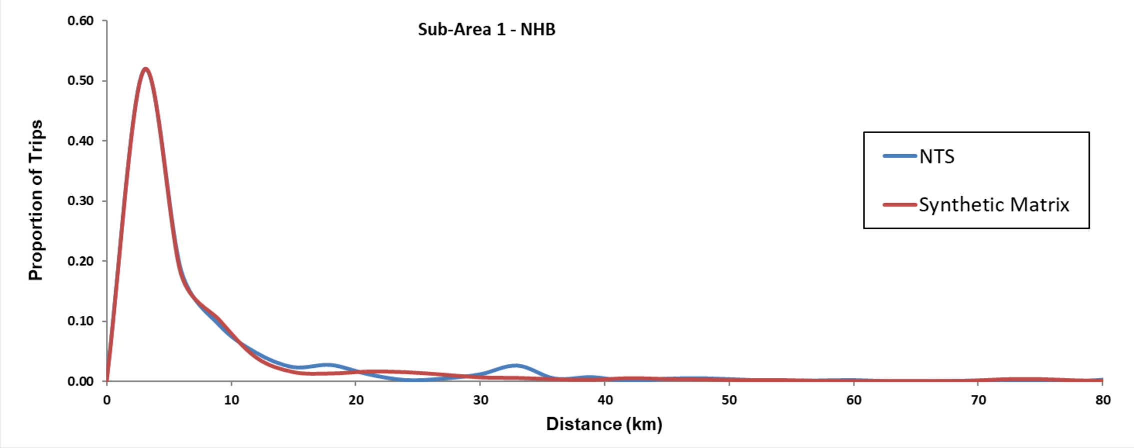


Figure 7.6: Observed vs Model TLDs, Sub-Area 1, Non-Home-Based Purpose

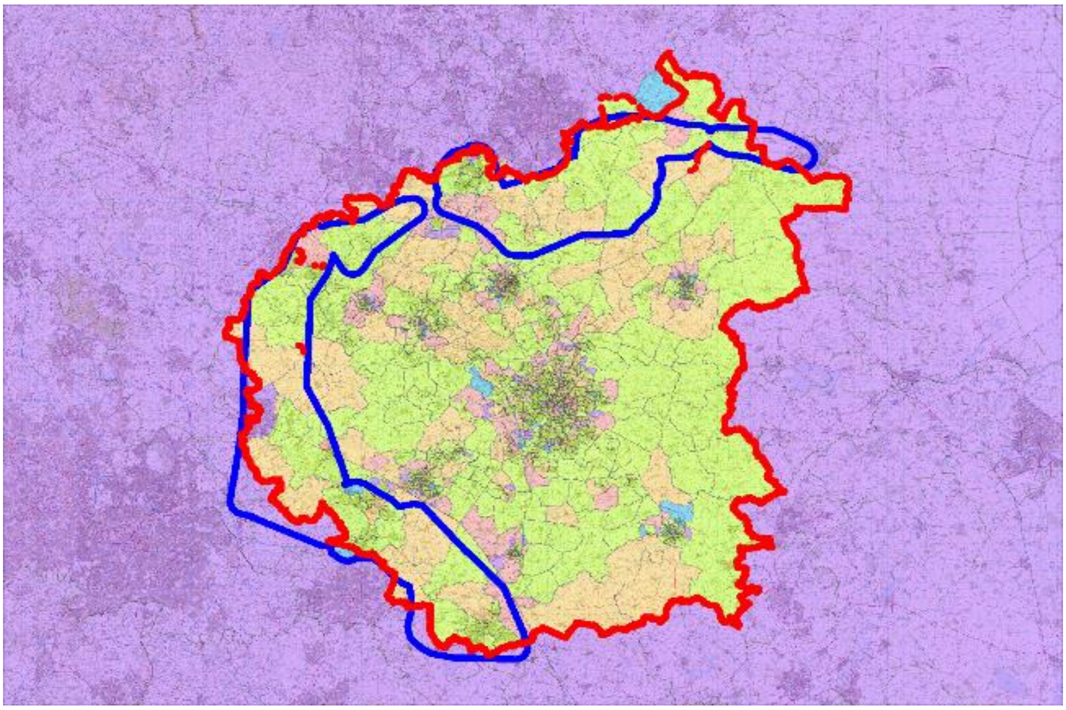


7.5 Mobile Network Data Specification

7.5.1 The methodology and outcome of the mobile network data verification process is described in detail in the Technical Note "*Mobile network data Verification - v1.0*". The following provides a brief summary of the approach taken and the key results.

7.5.2 Figure 7.7 shows the geographical definition used as the basis of mobile network data collection. The mobile network matrices include all trips starting, ending, or travelling through the cordon within the red boundary.

Figure 7.7: Geographical Coverage of Collected Mobile Network Data



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7.5.3 The mobile network data were provided for an average weekday, calculated using data from 24th February to 23rd March 2014. All figures were given post-extrapolation to represent trips by the whole UK population, rounded to the nearest integer.

7.5.4 The following time periods were provided:

- WDOPe: Weekday early off-peak trips starting between 00:00 and 07:00;
- AM: AM Peak trips starting between 07:00 and 10:00;
- IP: Interpeak trips starting between 10:00 and 16:00;
- PM: PM Peak trips starting between 16:00 and 19:00; and
- WDOPl: Weekday late off-peak trips starting between 19:00 and 00:00.

7.5.5 The matrices were segmented into the following vehicle types:

- road vehicles: all car drivers and passengers, motorcyclist, taxi, LGV, bus and coach (walking, cycling, rail and HGV are excluded using Telefonica's mode split algorithm); and
- HGVs.

7.5.6 In Telefonica's process, rail trips are identified separately based on the clustering of events on the journey and the route. Rail users tend to create clusters of events as they travel because large numbers of people travelling together will all create events at the same time when they move between Local Area Codes (LACs). Journeys will also be categorised as rail if they use a number of cells which cover the railway network.

7.5.7 HGV trips are identified based on the average speed of the trip (HGVs typically travel at a lower speed than cars on motorways) and on the characteristics of the user making the trips (HGV drivers tend to make more frequent long distance trips than car drivers).

7.5.8 The mobile network data matrices were split into the following purposes:

- Home-Based Work (HBW): trips between a place of residence and a regular place of work.
- Home-Based Other (HBO): trips between a place of residence and any other destinations, including education trips.
- Non-Home-Based (NHB): trips between two points neither of which is a place of residence.

7.5.9 Following the processing of mobile network records into OD matrices, Telefonica calculated expansion factors by comparing the number of users who have a home location (imputed) in each MSOA, with the usual resident adult population of that region as reported in the 2011 Census, but increased by a factor of 1.43% for population growth between 2011 and 2014 (based on ONS estimates).

7.5.10 A further adjustment was made to the weighting factors based on the age and gender of the users. This is to reflect variation in O2's market share and mobile penetration across different age and gender brackets. To adjust the weightings to reflect this, the gender and age profile of the mobile users was compared with the results of the 2011 Census. An adjustment factor was then applied to correct for any bias.

7.6 Mobile Network Data Verification

7.6.1 The mobile network data trip matrices were independently reviewed by AECOM staff, in order to verify whether they are suitable to be used as prior matrices in the highway model development. The independent verification was therefore mainly designed to gain reasonable confidence that the pattern of trips produced from mobile network data are consistent with independent sources.

7.6.2 Various sources of data used to verify the processed mobile network data include:

- 2011 Census population data;
- 2011 Census JTW data;
- RSI data;
- traffic count data;
- 2009 household survey data; and
- trip-end model estimates (based on revised 2014 local planning data).

7.6.3 The verification process and the findings are set out in detail in "*Mobile network data Verification - v1.0*". The key findings are summarised below.

- The verification exercise showed that there is a reasonable level of correlation and agreement between mobile network data matrices and other data sources.
- Derived 'home' and 'work' locations, and thus trip-ends, identified in mobile network data, were shown to highly correlate with Census population and JTW data.
- There was a strong correlation between mobile network data trip-ends and those estimated from the trip-end model (using local planning data), for all trip purposes.
- The patterns of demand in the mobile network data matrices for commuting trips were found to be consistent with those based on Census JTW data.
- The trip length distributions estimated from mobile network data commuting trips is, in statistical terms, the same as those derived from Census JTW and household survey data, taking into account sampling errors.
- The value and distribution of trip rates calculated from mobile network data trip matrices were plausible and consistent with estimates based on model trip-ends.
- The estimated total number of trips with a destination in five defined cordons (Leicestershire market towns) was consistent between mobile network data and expanded RSI data.
- The distribution of trips estimated from RSI data and mobile network data was found to be highly correlated.

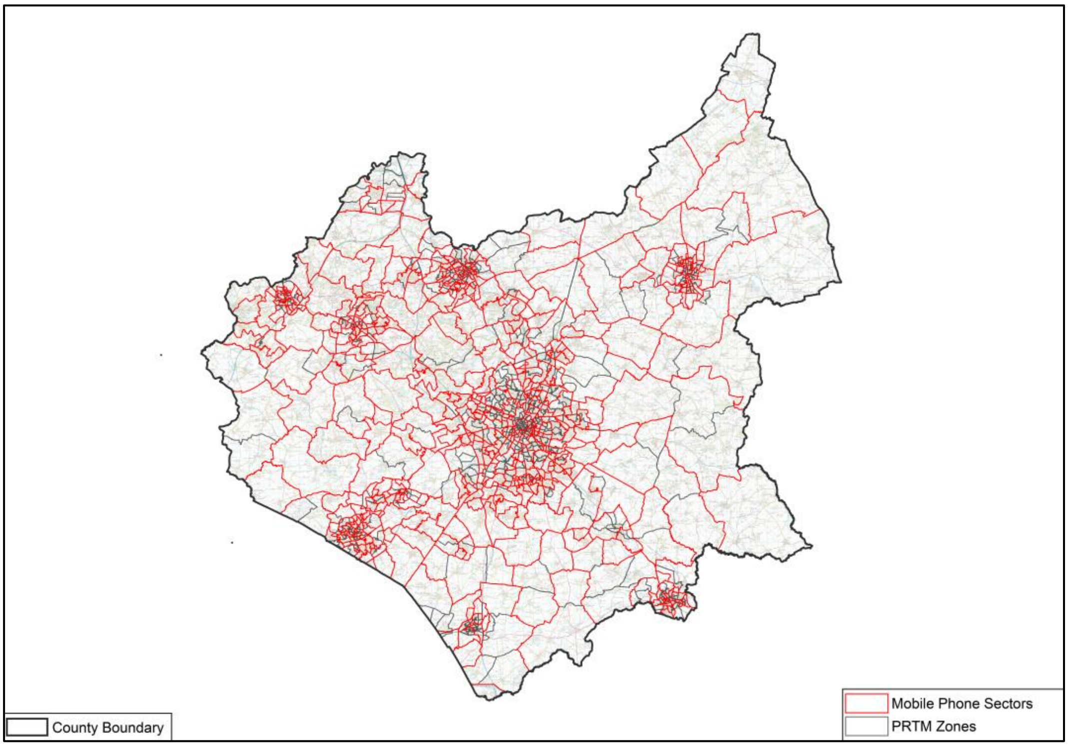
7.6.4 The above findings suggested that the outcome of using the processed mobile network data to develop prior matrices did not look to be either biased or less accurate than a conventional methodology using RSI data. We therefore concluded that mobile network data should be used in the highway matrix development.

7.6.5 However, there are certain limitations associated with trip matrices derived from mobile network data. These include distinguishing vehicle types (i.e. car, bus, LGV), distinguishing some trip purposes (shopping, education, employers' business, other), and detailed spatial resolution consistent with model zones. These issues were addressed independently using secondary sources of data, the methodology and outcome of which will be covered in the next sections.

7.7 Prior Matrix Development Methodology

7.7.1 One of the key limitations of mobile network data matrices is spatial accuracy of the trip-ends. Mobile phone matrices are only reliable at a certain spatial level which is generally more aggregate than PRTM zones. A specific sectoring system was therefore defined and used for the processing of mobile network data by Telefonica, and later by AECOM during the segmentation process, as detailed below. Figure 7.8 shows the defined mobile sectors and PRTM zones.

Figure 7.8: Mobile Phone Sectors and PRTM Zones



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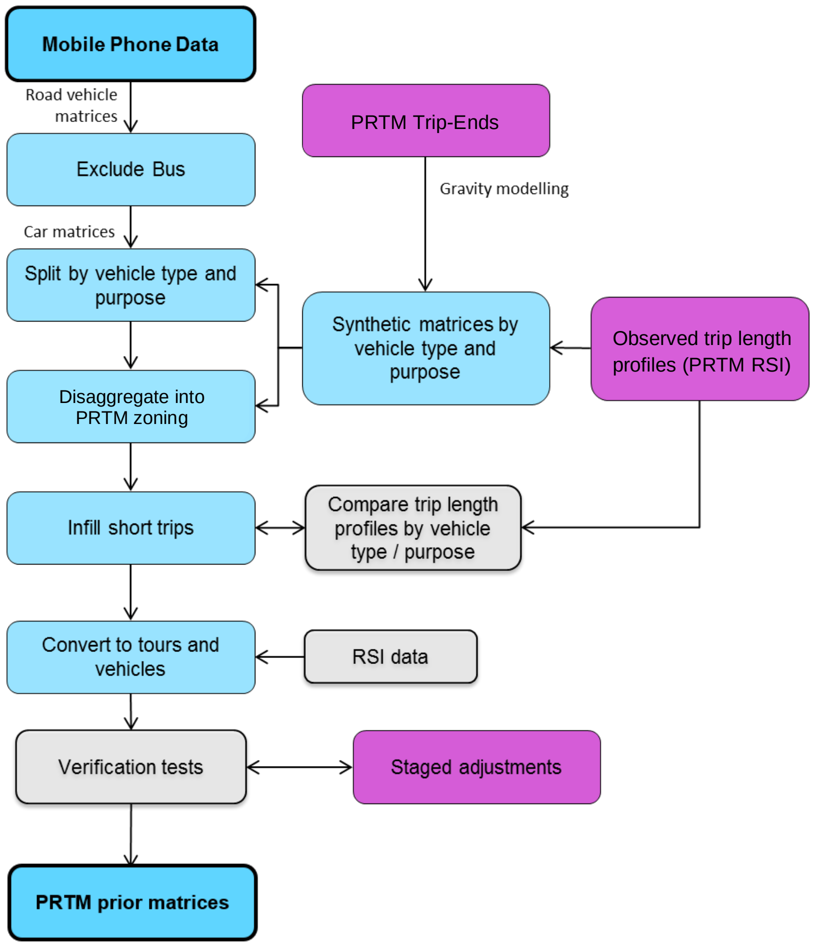
7.7.2 Figure 7.9 shows the process used to develop PRTM prior matrices from mobile network data. As stated above, the segmentation process was undertaken at mobile sector level, before the matrices were disaggregated into PRTM zones.

Figure 7.9: Mobile Network Data Matrix Development Steps



Exclusion of bus trips

7.7.3 In the first step of the segmentation process, bus trips were separated from other trips. Therefore, bus proportions were needed to be applied to each OD movement in the mobile network data. Ticket machine data were used to build bus OD matrices for the public transport model, representing an almost fully observed bus user matrix; these were aggregated into PRTM sectors, and used to estimate bus proportions to exclude bus trips from the mobile network data.

Segmentation

7.7.4 In the next step, the mobile matrices were segmented by vehicle type (i.e. car, HGV, and LGV) and trip purpose. There were two key criteria to be met:

- the segmentation should ensure that purpose split at each origin / destination reflects the diversity in the land-use, trip rates, and planning data; and
- the segmented matrices should reflect the differences in trip length distribution by vehicle type and trip purpose, as supported by independent observed data.

7.7.5 In order to meet both criteria, segmentation factors were required which not only reflect purpose splits at trip-ends, but also vary by distance to reflect differences in trip length distributions by vehicle type and trip purpose. For example, from total number of trips originating from a given zone, business trips tend to travel longer distances compared with education or shopping trips.

7.7.6 Synthetic matrices were developed, separately by vehicle type and trip purpose, and used to estimate segmentation factors described above for each OD pair. To develop these matrices, two sources of data were required for each PRTM segment: estimates of trip origins and destination in each model zone and estimates of trip length profiles.

Spatial disaggregation

7.7.7 The segmented matrices in mobile network data sectors were then disaggregated into model zones, based on trip-ends estimated by the trip-end model. This ensured that the link with observed planning data, which are inputs to the trip-end model, was retained in the disaggregated matrices.

7.7.8 The outcome of this process was segmented OD matrices in PRTM zones controlled to total trips from mobile network data in mobile network data sectors. Therefore, whilst the resultant trip length distributions are different for each segment, the overall trip length distribution from mobile network data for the aggregate matrix of all segments is retained.

Infilling short trips

7.7.9 One of the key limitations of mobile network data is the understatement of short distance trips; these were therefore amended by synthesising and replacing short trips so that the trip length distribution in the adjusted matrices matches those based on independent data.

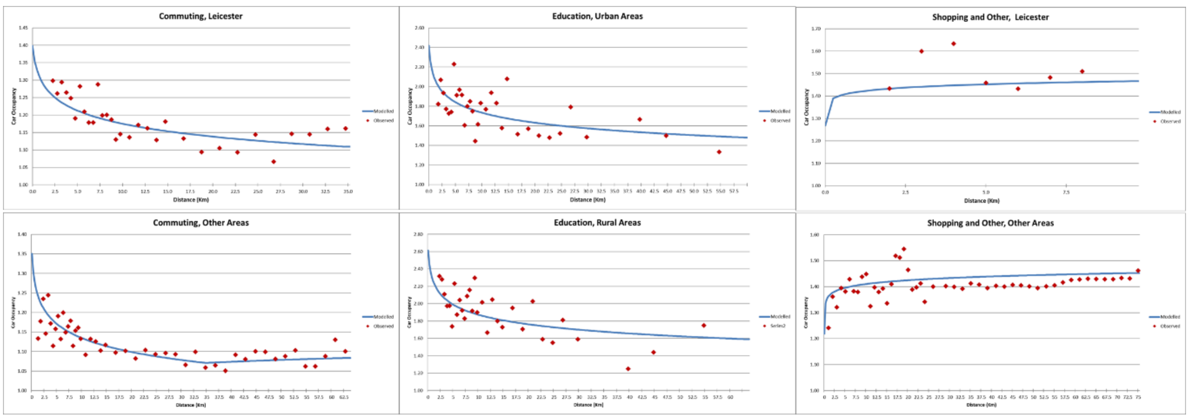
Occupancy and tour factors

7.7.10 For the purpose of the demand model, the matrices needed to be converted to tours, and for the purpose of the highway assignment model, vehicle trips. RSI data were analysed to estimate tour factors, to convert from OD to tours, and car occupancy factors, to convert from people to vehicles.

7.7.11 To estimate tour factors for each purpose and time-period pair, the RSI data for which return time was recorded were analysed.

7.7.12 As car occupancy tends to vary depending on type of zone (rural or urban), distance travelled, trip purpose, and time period, statistical models were developed using RSI records that estimated the car occupancy factor as a function of the above factors when occupancies were found to vary by these. Figure 7.10 shows the fitted functions and the observed average occupancies varying by trip distance for commuting, education, shopping and other purposes, estimated for peak periods. The observed occupancies were found to have limited and random variation for employers' business trips, therefore the average value of 1.2 was used.

Figure 7.10: Modelled versus Observed Occupancy Factors by Purpose and Area



Verifications for staged adjustments

7.7.13 Following the segmentation and disaggregation process described above, a secondary verification/validation process was undertaken to ensure that the overall trip pattern from mobile network data was retained at the sector levels identified. The resulting trip-ends, trip length distributions, and purpose splits were compared with observed data (RSI and NTS), and the Stage 1 adjustments process was applied when necessary to correct possible inconsistencies (see Section 7.9).

7.7.14 Following Stage 1 adjustments, vehicle matrices were assigned onto the network and modelled flows were compared against count data. Stage 2 adjustments (discussed in Section 7.10) were applied to address the remaining errors and discrepancies in the matrices.

7.8 PRTM Area Disaggregation

7.8.1 The original matrix development was undertaken in the LLITM zoning system and this section describes the process undertaken to disaggregate zones in the PRTM area.

7.8.2 The LLITM prior trip matrices were disaggregated to the PRTM zoning system and interzonal trips which were converted to intrazonal trips by disaggregation within the disaggregated PRTM area zones were factored to be consistent with the revised network density and the rest of the model.

7.8.3 Disaggregation was based on NTEM 7.2 population and employment data. Prior matrices were disaggregated using the following mapping shown as origin-destination pairs in Table 7.2, where 'E' represents weighting by employment and 'P' weighting by population. The first letter in each pair refers to the origin trip end, and the second refers to the destination trip end.

Table 7.2: Disaggregation Weighting by User Class and Time Period

Matrix level	User class	Basis for disaggregation for origin and destination trip ends by time period			
		AM	IP	PM	OP
1	HGV	EE	EE	EE	EE
2	LGV	EE	EE	EE	EE
3	Business	EE	EE	EE	EE
4	Other Low VoT	PE	PE	EP	EP
5	Other Medium VoT	PE	PE	EP	EP
6	Other High VoT	PE	PE	EP	EP
7	Commuting Low VoT	PE	PE	EP	PE
8	Commuting Medium VoT	PE	PE	EP	PE
9	Commuting High VoT	PE	PE	EP	PE

7.8.4 The large external zones in the model contain almost entirely intrazonal demand, as most trips are too short to be interzonal. As zone size decreases, the proportion of intrazonal trips decreases until, in the FMA, the proportion becomes negligible. Therefore disaggregating external zones almost always reduces the size of a zone to one where a lower proportion of intrazonal demand would be appropriate given a typical trip length distribution. Because of this, simple disaggregation in the PRTM area produced a 330% increase in the total interzonal trips, which is unreasonably large and unworkable for matrix estimation.

7.8.5 To overcome this issue a post-disaggregation process was developed and applied to the disaggregated zones in the PRTM area. It scales intrazonal trips up and interzonal trips down to achieve:

- an intrazonal / interzonal split more typical for the size of zone; and
- interzonal trips that are appropriate for the PRTM area network density and matrix estimation process.

7.8.6 Using the LLITM zones, which have a full range of intrazonal proportions, a model of intra/interzonal split as a function of zone size (demand) was developed. Factors were derived to scale up intrazonal trips in disaggregated PRTM area zones and applied with a process that limits the amount of matrix change. Changes were only made in disaggregated zones.

7.8.7 With this correction applied the increase in interzonal trips compared with before disaggregation is around 20%, representing a more plausible and workable increase in interzonal matrix size, given the density of the highway network in the PRTM area and its scale.

7.8.8 Once this correction generated a reasonable number of interzonal trips for most zones, it was seen that a number of peripheral rural zones were still producing excess trips relative to the network, causing high flows and delays. In these areas there was no scope to add further network (all significant roads were already included) or to revise zone loading, so a number of manual changes were made to the matrix in both directions for the zone pairs shown in Table 7.3. A small proportion of interzonal trips were retained to avoid zero flows.

7.8.9 Some external zones, outside the PRTM area, were also disaggregated, with the aim of more localised demand loading. These zones also had the new interzonal trips within the parent zone reassigned to intrazonal trips; firstly, to keep the external area consistent with previous versions of the model, and secondly to avoid routeing large flows through the edges of the PRTM area due to the lack of suitable external network, a situation which caused significant routeing issues when tested. Affected zone pairs (both directions) are shown in Table 7.3.

Table 7.3: Manual Matrix Adjustments

Zone	Zone	Origin	Destination	Model area	Trips retained
8172	8648	Southampton	Swindon	External	0%
8153	8640	Oxford	Chipping Norton	External	0%
8157	8641	Milton Keynes	High Wycombe	External	0%
8151	8642	Luton	Bedford	External	0%
8168	8644	Hull	Cleethorpes	External	0%
8168	8645	Hull	Scunthorpe	External	0%
8644	8645	Cleethorpes	Scunthorpe	External	0%
8177	8646	Plymouth	Bath	External	0%
8177	8647	Plymouth	Bristol	External	0%
8646	8647	Bath	Bristol	External	0%
8162	8643	Barnsley	Doncaster	External	0%
8162	8649	Barnsley	Rotherham	External	0%
8162	8650	Barnsley	Sheffield	External	0%
8643	8649	Doncaster	Rotherham	External	0%
8643	8650	Doncaster	Sheffield	External	0%
8649	8650	Rotherham	Sheffield	External	0%
8164	8502	Louth	Skegness	PRTM area	10%
8137	8532	Thrapston	Rushden	PRTM area	30%
8137	8533	Thrapston	Rushden	PRTM area	30%
8156	8505	Sutton Bridge	Boston	PRTM area	10%
8156	8506	Sutton Bridge	Spalding	PRTM area	10%
8505	8506	Boston	Spalding	PRTM area	10%

7.9 Matrix Adjustments Stage 1

Adjustments

7.9.1 Stage 1 of the matrix adjustments involved different adjustments in order to:

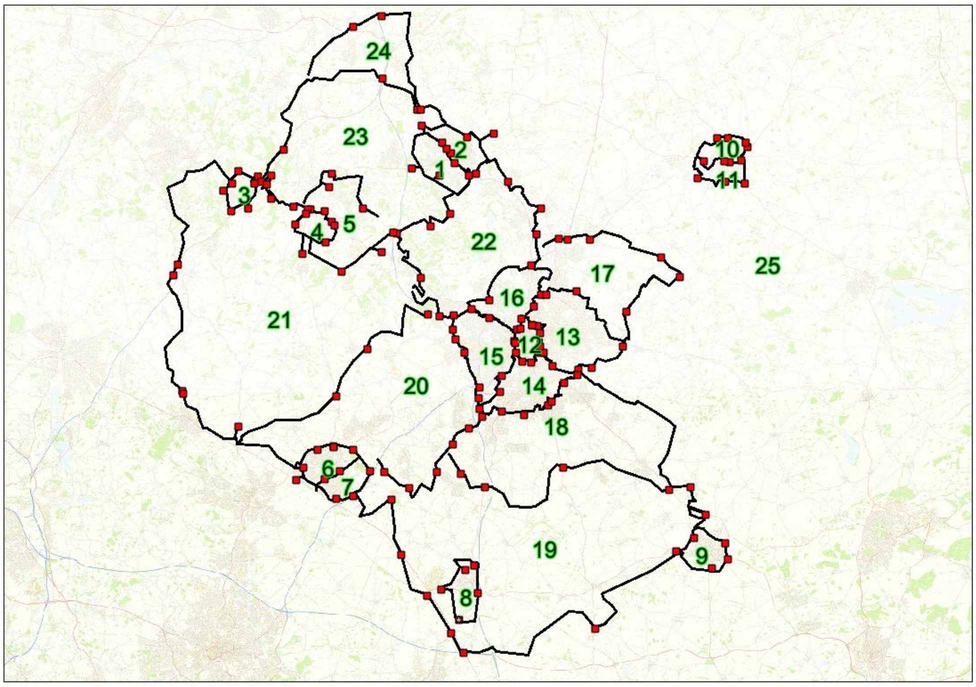
- correct the expansion biases in the mobile network data based on evidence from RSI and NTS data;
- infill external to external trips, which are not fully observed within mobile network data, from synthetic matrices;
- correct for trip misallocations due to spatial inaccuracy of mobile network data; and
- refine other processing assumptions (e.g. segmentation, short trip infilling, etc.).

7.9.2 In the first step, the following trips were replaced from synthetic matrices:

- external/external trips; and
- short trips (less than 2.5 km).

7.9.3 The areas with significant expansion issues were identified by comparing the trip-ends derived from mobile network data, aggregated to RSI cordons shown in Figure 7.11, with those from RSI data. An adjustment factor was calculated for each cordon and applied to total origins / destinations. The factors were applied only to trips to / from those cordons where the differences between RSI and mobile network data trips were statistically significant (based on estimated 95% confidence intervals for RSI trips). Application of these adjustment factors at an aggregate level minimises any distortion to the observed trip pattern of mobile network data.

Figure 7.11: RSI Cordons used for Mobile Network Data Trip-End Adjustments



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7.9.4 As stated earlier, zonal misallocation errors could be expected within mobile network data matrices in specific local areas, depending on mobile network cell density. An analysis was undertaken to compare trip-ends by zone derived from mobile network data with those from planning data, in order to find the key outliers. A process was set up to further aggregate these with their neighbouring zones, to / from which trips may have been misallocated, and they were disaggregated again to model zones based on planning data (using trip-ends from the trip-end model).

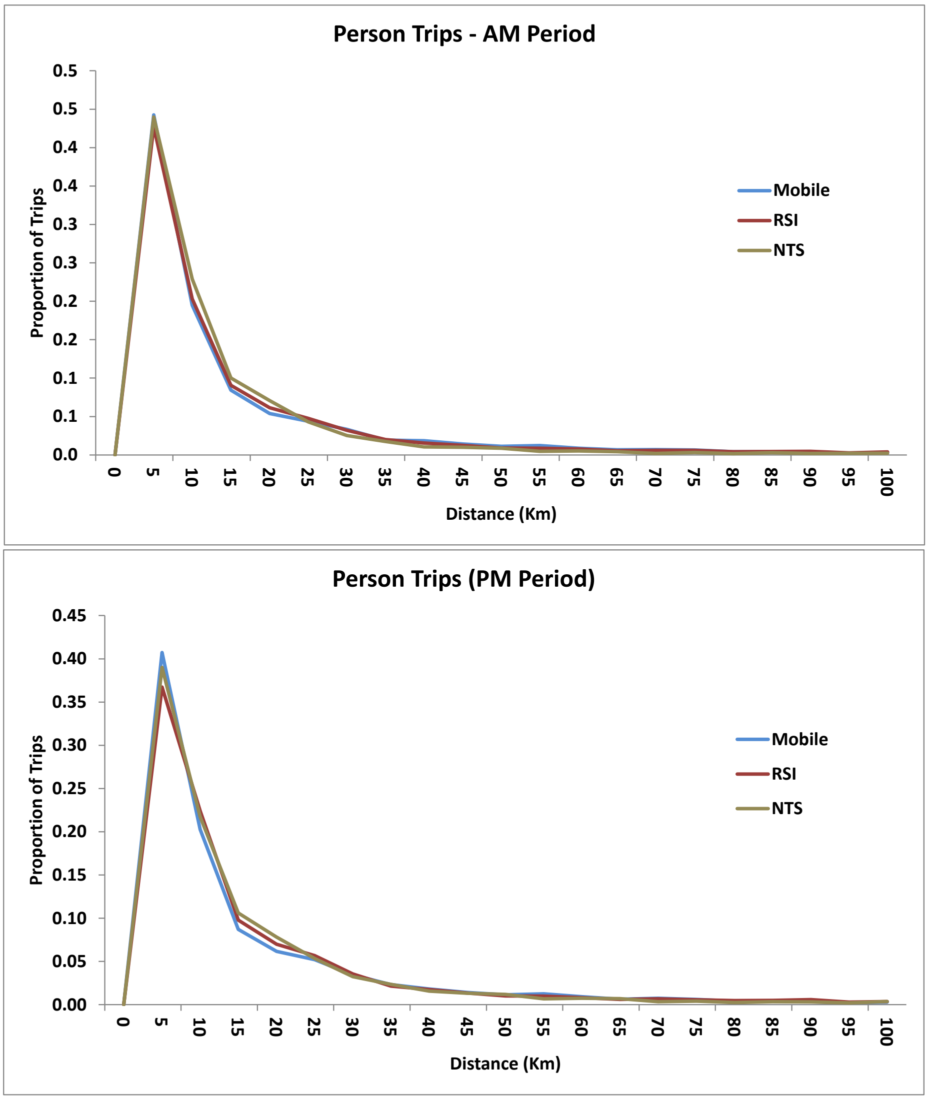
Verification

7.9.5 Several verification tests were undertaken following Stage 1 adjustments; these included comparisons of trip length distributions, trip-ends at zone level, and sectorised matrices.

7.9.6 The previous adjustments were performed in an iterative way so that the input assumptions (distance threshold for trips to be considered 'short', adjustment factors, aggregation areas, etc.) could be refined until the resulting mobile matrices were reasonably consistent with the secondary data.

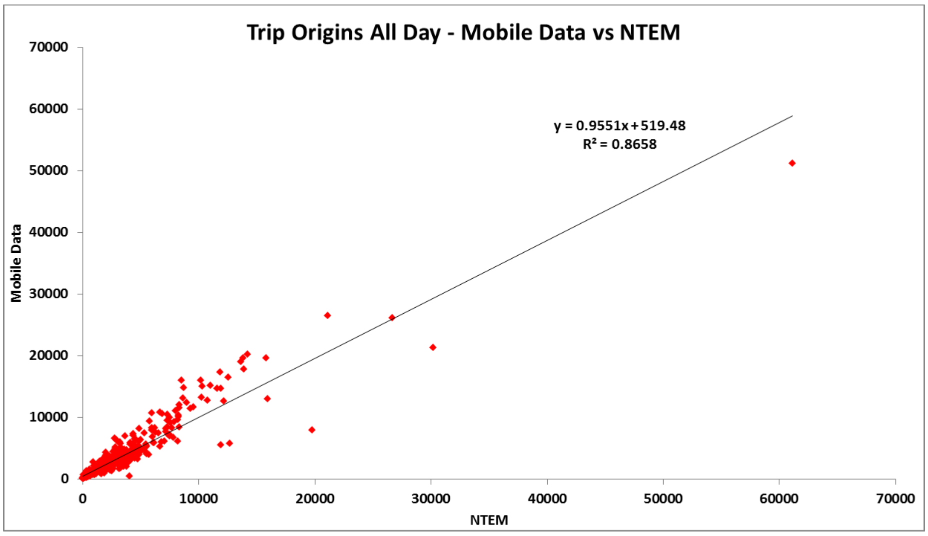
7.9.7 Figure 7.12 shows comparison of trip length distributions for total person trips obtained from adjusted mobile network matrices, RSI matrices and NTS data in the AM and PM Peak periods. This shows a similar pattern between these data sets. It should be noted that, in order to make the data consistent, intra-cordon trips which are not observed in the RSI data are excluded from the analysis.

Figure 7.12: TLD Comparison between Adjusted Mobile Network Data, RSI, and NTS



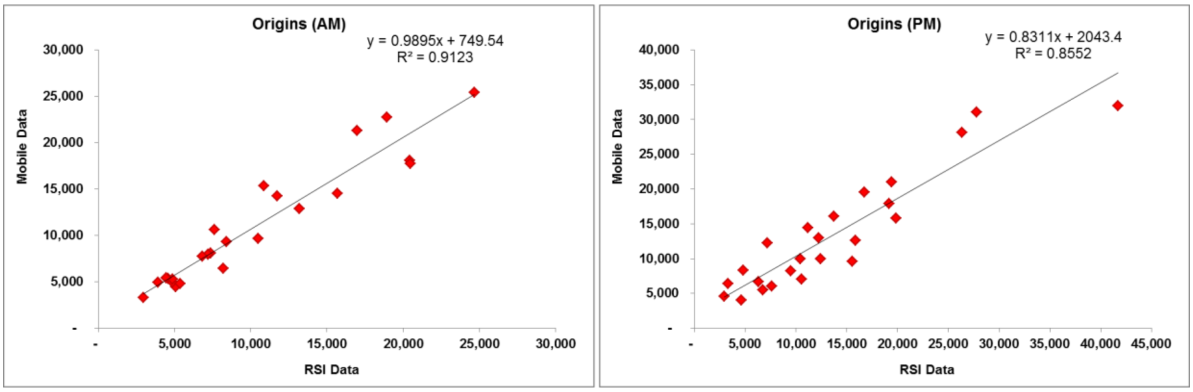
7.9.8 Figure 7.13 shows the relationship between all-day trip origins (total person trips), estimated from adjusted mobile network data, and data obtained from the trip-end model, at model zone level. The results show that there is generally a good correlation between mobile network data trip origins and the NTEM.

Figure 7.13: NTEM vs. Adjusted Mobile Network Data Trip Origins



7.9.9 Figure 7.14 shows the relationship between trip origins from adjusted mobile network and RSI data for the AM and PM periods. In general, there is a good correlation between the two sources of data, taking into account various sources of error and inconsistency between them.

Figure 7.14: Comparison of Trip Origins between RSI and Mobile Network Data (AM and PM Periods)



PRTM Update Matrix Adjustments

7.9.10 As part of the PRTM Update task (Autumn 2019 to Spring 2020) some minor adjustments were applied to the prior matrix to address local observations in two locations: Loughborough town centre and Castle Donington.

7.9.11 It was noted during a LCC review of the Loughborough town centre model performance that a number of zonal trip ends were inconsistent with local knowledge on the areas they represent. In both the AM and PM Peak matrices it was observed that trip ends for the Ratcliffe Road zone were very high and trip ends for the adjacent railway station zone were too low which indicated a misallocation of trips during the matrix development. An adjustment was therefore applied to move trips from the Ratcliffe Road zone to the railway station zone. Also in both peaks, an issue was identified with trips ends being too high in the Derby Square zone which is likely to be associated with car occupancy assumptions for car parks. The relevant trip ends were factored down to better reflect car park capacity. In addition, the two zones representing the Bishop Meadow industrial area were observed to have too many trips originating in the PM Peak and therefore these were also factored down to a more plausible level.

7.9.12 For Castle Donington, in association with the introduction of a new screenline to the north of the village, it was noted that freight trips to and from the non-industrial areas of the village were quite high. As a result it was decided to remove 90% of these to better reflect the new count information and limit the work that matrix estimation is required to do.

Validation

7.9.13 Before applying matrix estimation, and to minimise the impacts of matrix estimation on the prior matrices, the performance of the prior matrices against observed screenline flows was assessed; these are reported in Table 7.4. Comparing total screenline flows removes potential issues with localised routeing from the assessment of the prior matrices.

Table 7.4: Prior Matrix Link Flow Performance

	AM Peak Hour		**Interpeak Hour**		**PM Peak Hour**	
Area	Aggregate Flow	Screenline Passes (including 95% C.I.)	Aggregate Flow	Screenline Passes (including 95% C.I.)	Aggregate Flow	Screenline Passes (including 95% C.I.)
Leicester City	-0.8%	44%	-2.3%	59%	-1.5%	53%
North Leicestershire	-0.1%	31%	1.9%	31%	-1.5%	38%
North-East Leicestershire	2.8%	57%	-0.4%	93%	-2.3%	79%
South Leicestershire	-3.7%	38%	-5.1%	35%	-6.0%	50%
South-West Leicestershire	4.0%	25%	-2.9%	44%	3.5%	31%
North-West Leicestershire	-1.9%	56%	0.9%	75%	0.9%	69%
Countywide	3.0%	38%	-2.3%	50%	-2.5%	63%
SRN (Internal)	-6.8%	32%	-14.0%	36%	-7.8%	50%
Leicestershire	***-1.6%***	***40%***	***-4.8%***	***51%***	***-3.0%***	***53%***

7.9.14 In Table 7.4, for each time period two statistics are given: the aggregated difference between modelled and observed flows for all screenlines within an area; and the percentage of screenlines that pass the criteria in Table 3.2.

7.9.15 The screenlines defined in the model (as described in Section 5) have been allocated to broad geographical areas. These areas are used to summarise the model performance, and whilst broadly based on districts within Leicestershire, they should not be seen as an indication of the model performance within any given district.

7.9.16 TAG Unit M3.1 §8.2.2 states that if the comparison of modelled and observed screenline flows based on the criteria set out in Table 3.2 "*are not met for all or nearly all screenlines and cordons, remedial action should be considered*". Within Leicestershire the percentage of screenlines meeting these criteria are 40% in the AM Peak hour, 51% in the Interpeak hour and 53% in the PM Peak hour.

7.9.17 This performance of the prior matrix against observed screenline and cordon flows is far lower than all or nearly all screenlines and cordons. The prior matrix to this point was adjusted, using an evidence-based approach, as much as possible and the routeing was reviewed to ensure that any matrix adjustments were not based on unrealistic routeing. Therefore, it was deemed acceptable and necessary to apply sector-based updates to the prior matrix (Stage 2 adjustments); these are described in the next section.

7.10 Matrix Adjustments Stage 2

7.10.1 The intention of this stage of matrix adjustments was to address various remaining errors in the estimated trip patterns. In order to further refine the prior matrices, a methodology was developed to adjust the inter-sector movements based on an initial comparison of total observed and modelled flows across screenlines and cordons. In this update, all counts along a given screenline in the simulation area were summed as a single constraint. This minimised the impact of any localised routeing issues in the model at the time, and the results of this process were used to update the matrices at a sector level.

7.10.2 An important issue that should be taken into consideration is the resulting changes in the developed matrices. The adjusted matrices must retain as much of the information as possible from the observed data. The application of sector-based factoring, as compared with cell-based factoring, would significantly reduce changes to the developed matrices and would retain as much of the information as possible from the observed data.

7.10.3 It is also noted that the sectorised updates were applied after the network was reviewed by AECOM and LCC to remove all significant routeing discrepancies. This was an essential precursor as the routeing in the assignment had to be reliable enough to ensure that the movements that were adjusted were reasonable.

7.11 Updated Prior Matrix Performance

7.11.1 Table 7.5 summarises the performance of the updated prior matrix using the same criteria as those used following the Stage 1 adjustments.

7.11.2 The result within Leicestershire is a substantially better performance against TAG criteria. Within Leicestershire the percentage of screenlines meeting these criteria are 91% in the AM Peak hour, 93% in the Interpeak hour and 94% in the PM Peak hour. All areas of the model in Leicestershire have relatively good performance with a minimum of 80% of screenlines meeting criteria in the reported areas.

Table 7.5: Updated Prior Matrix Link Flow Performance

	AM Peak Hour		**Interpeak Hour**		**PM Peak Hour**	
Area	Aggregate Flow	Screenline Passes (including 95% C.I.)	Aggregate Flow	Screenline Passes (including 95% C.I.)	Aggregate Flow	Screenline Passes (including 95% C.I.)
Leicester City	1.2%	82%	1.5%	88%	1.1%	91%
North Leicestershire	1.3%	81%	1.3%	88%	0.9%	88%
North-East Leicestershire	-0.3%	100%	0.7%	100%	-0.2%	100%
South Leicestershire	-0.7%	92%	0.1%	88%	-0.1%	96%
South-West Leicestershire	0.3%	94%	0.3%	100%	0.5%	94%
North-West Leicestershire	0.3%	100%	1.2%	100%	0.8%	100%
Countywide	1.5%	88%	2.4%	75%	1.4%	100%
SRN (Internal)	-2.0%	95%	-0.4%	100%	-1.2%	91%
Leicestershire	0.2%	91%	0.9%	93%	0.4%	94%
Leicestershire External	-1.2%	100%	-2.0%	80%	-1.7%	90%
West Midlands	4.7%	23%	3.4%	32%	6.5%	32%
East Midlands	30.9%	41%	25.4%	38%	33.6%	34%
East of England	-5.2%	50%	-15.1%	0%	-9.6%	25%
West of England	7.2%	50%	1.4%	75%	8.5%	75%

Matrix changes

7.11.3 It is important to closely monitor changes to the matrices as a result of sectorised refinements. Changes to the number of trips at matrix cell level and trip-end level, as well as changes in the trip length distribution of matrices, were analysed by comparing the relevant statistics before and after sectored updates. For these analyses, the whole model was used as we are also considering calibration outside Leicestershire. Table 7.6, Table 7.7 and Table 7.8 show the regression analysis statistics for matrix cell changes for all movements. In all cases, the slope and R^2 is equivalent to 1.0, suggesting limited changes in number and patterns of trips.

Table 7.6: Regression Analysis of Interzonal Car Matrix Zone Changes (All Origins)

Regression Statistics	AM Peak Hour	Interpeak Hour	PM Peak Hour
Intercept	-0.01	-0.01	-0.02
Slope	1.00	1.00	1.00
R^2	1.00	1.00	1.00

Table 7.7: Regression Analysis of Interzonal LGV Matrix Zone Changes (All Origins)

Regression Statistics	AM Peak Hour	Interpeak Hour	PM Peak Hour
Intercept	0.00	0.00	0.00
Slope	1.00	1.00	1.00
R^2	1.00	1.00	1.00

Table 7.8: Regression Analysis of Interzonal HGV Matrix Zone Changes (All Origins)

Regression Statistics	AM Peak Hour	Interpeak Hour	PM Peak Hour
Intercept	0.00	0.00	0.00
Slope	1.00	1.00	1.00
R^2	1.00	1.00	1.00

7.12 Freight Matrices

7.12.1 There is generally a lack of reliable OD data for freight movements. Freight matrices are therefore subject to larger errors and uncertainties. The sample size of LGV and HGV trips in the RSI data was too small for this data to be used as the primary source to develop freight matrices.

7.12.2 Synthetic LGV and HGV matrices have been developed using the same approach used to develop car synthetic matrices, as described in Section 7.4. The HGV matrices were further adjusted using data from DfT’ s Base Year Freight Matrices (BYFM) at aggregate level (it should be noted that following the verification, mobile network data-derived HGV matrices were not found to be reliable, hence HGV matrices were developed separately).

7.12.3 The inputs to the matrix build process were distance from the highway assignment, an estimate of trip-ends based on planning data assumptions from the original LLITM land-use model linked to TRICS trip rates and observed trip length distributions.

7.12.4 Whilst RSI records for LGV and HGV could not be used to develop OD matrices due to small sample sizes, they could be used to create observed trip length distributions. The key limitation of this, however, is the fact that RSI records do not include a large proportion of short distance trips, as these do not cross the cordon boundaries. This is particularly important for LGV trips, where a significant number of intra-urban short trips are expected. The resulting trip length distributions are therefore biased towards longer distance trips.

7.12.5 Given this weakness, and in the absence of any other reliable data, NTS data were used to develop observed trips length distributions. Trip records for journeys made by ‘Van’ were used as a proxy for LGV trips. It is acknowledged that NTS van trips may be slightly biased towards personal use of vans; it was however assumed that this does not particularly introduce any bias in observed trip length distribution.

7.12.6 RSI records for HGVs were used to develop observed trip length distributions. This was because HGV trips are generally long distance and the proportion of short distance intra-urban trips made by HGVs, not observed in the RSI surveys, are assumed to be negligible.

7.12.7 The synthetic matrices for both LGV and HGV trips were developed at a 12-hour level, as the sample size of records used to develop observed TLDs was not sufficient for individual time periods. Factors derived from traffic count data were then used to split these to specific time periods. Figure 7.15 and Figure 7.16 show the comparison of TLDs between developed synthetic matrices and observed data, for LGV and HGV matrices, respectively.

Figure 7.15: Trip Length Distribution of LGV Matrices vs. NTS at 12-hour Level

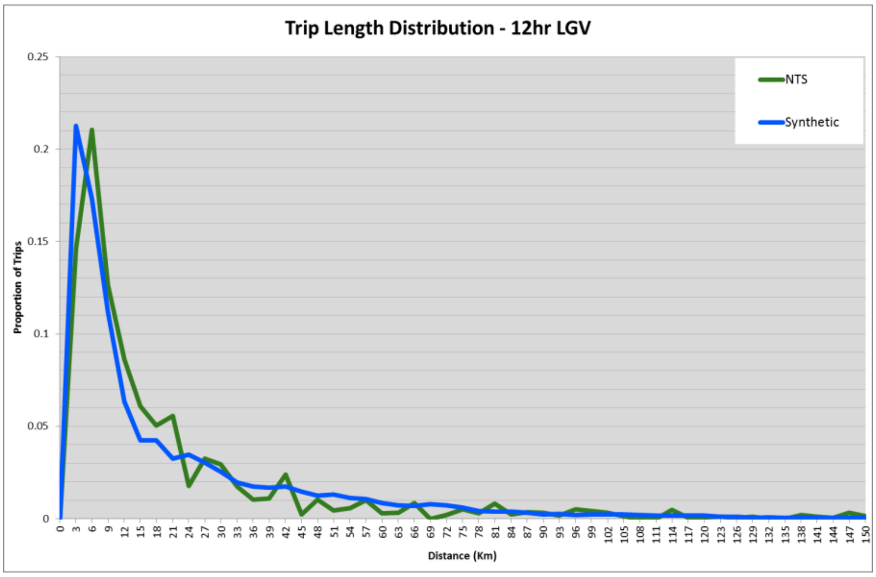
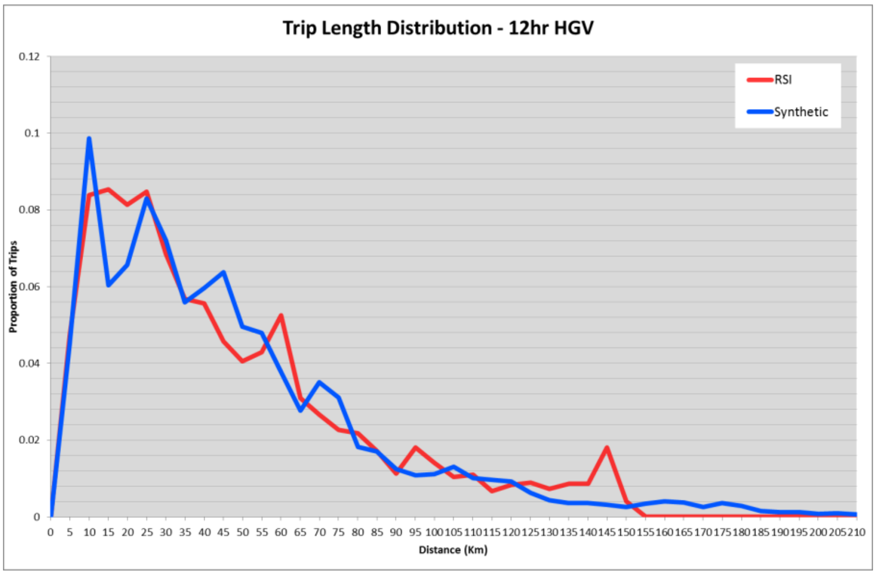


Figure 7.16: Trip Length Distribution of HGV Matrices vs. RSI records at 12-hour Level



7.12.8 As stated earlier, BYFM HGV matrices (originally sourced from CSRGT) were used to further adjust the developed HGV synthetic matrices. The distribution of trip-ends within

Leicestershire was controlled to that from the BYFM data at aggregate sector level (24 RSI cordons were used for this purpose, see Figure 7.11).

8. Network Calibration and Validation

8.1 Introduction

8.1.1 A number of checks have been undertaken on the coding as part of the development of the highway network for PRTM which are discussed in Section 6.5. However, it should be recognised that these automated checks and independent review cannot practically review in detail the entire network coding in the highway model, and this section looks at other data sources that have been used for additional checking, or calibration, of the highway network.

8.2 Network Calibration

8.2.1 Aside from the checks on the network coding, such as the consistency of link coding by direction and time period, the observed count and journey time data provide a useful source of information against which the highway network can be compared. Using an assignment of the prior matrix the calculated capacities and journey times have been compared with the observed data.

8.2.2 Taking the link counts and calculated capacities first, the outturn capacities from the assignment should always be greater than the observed count. If this is not the case then it suggests there is an error in the capacity of the network and / or the observed count, resulting in matrix estimation being unable to meet a given count (accepting that grouped short-screenlines constraints have generally been used).

8.2.3 It is important when undertaking this check to consider both the link capacity and the total junction capacity at the end of the link. The minimum of these two values limits the flow on a given link, and it is this minimum value that has been used to compare the modelled capacities against the observed counts. This process does not however account for limiting capacities upstream from the link in question that constrain the level of traffic able to reach the count location. Network errors of this nature have been investigated during the model calibration process.

8.2.4 This process highlighted a limited number of links with an incorrectly applied link capacity index, incorrect saturation flow or locations where adjustments were required to the observed signal time data, and also identified a small number of counts that had either been incorrectly processed or allocated to the incorrect link. These errors have been corrected prior to the application of matrix estimation.

8.2.5 The second check that was undertaken in comparing the highway network and observed data uses the journey time validation data. These data were used in two ways: firstly to compare the free-flow times within the network against the observed journey time data; and secondly to identify any excessive delays along journey time routes.

8.2.6 In the case of the free-flow assignment, the modelled free-flow journey times should be lower than the observed journey time data in all cases. Instances where this is not the case suggest that there is either an error in the coded speed along a journey time route and/or an error in the observed journey time data.

8.2.7 In addition to this, a number of excessive delays in relation to the observed journey time data were identified. Adjustments have been made to the highway network coding to remove these delays provided that there was no evidence that the modelled flow was also excessive at these locations. If an observed count showed that the flow arriving at a given junction was excessive and this caused excessive delay, then changes have been made to either the routeing or the matrix to reduce the modelled flow before reassessing the junction delays.

8.2.8 In the PRTM area, the calibration approach differs in that there are traffic count and journey time data with which to calibrate/validate the buffer network. This is done using the balance between supply (capacity) and demand (flow) to define the speeds.

8.2.9 When speed flow curves are used to introduce capacity restraint, several factors influence whether flows and journey times match the observed data:

- link capacity (lanes);
- zone loading locations;
- speed-flow curves;
- network density;
- restricted junctions; and
- distances.

8.2.10 Some of these factors and combinations of factors produce errors which are immediately apparent on checking the coded network, or as excessive flows (delays) or zero flows when a matrix is assigned. Other, often difficult to pinpoint, errors showed up later in the calibration process as the network became better calibrated (covered in more detail in subsequent sections).

8.2.11 Initial checks picked up incorrect lane definition on some motorway sections where reference had been made to post-2014 Google Street View images where Smart Motorways had been introduced since the base year. Some MRTM-based lane definitions were also inconsistent with the PRTM network as they contained coded roadworks.

8.2.12 Zone loading locations in the PRTM area were considered in the initial rezoning exercise with reference to the expected A-road and motorway network. Initially most town and city centres were coded without detail, with additional links and nodes coded later in areas with small zones (such as the Greater Birmingham conurbation) to have enough locations for zones to load.

8.2.13 Speed-flow curves were initially checked by looking at free-flow speeds to ensure that these were consistent along routes and lower in predominantly urban areas than in rural areas.

8.2.14 Network density in the PRTM area was intended to be all A-roads and motorways. Some A-roads were initially missed and later included when the network was checked against multiple mapping sources (Google, Open Street Map, Ordnance Survey). There is inconsistency in defining a network this way as there are inconsistencies between authorities in how A- and B- roads are defined. There are instances where better quality B-roads are important for routeing (e.g. Derbyshire-Nottinghamshire border, where few A-roads cross the M1, and the Fosse Way) and conversely some indirect slow rural A-roads are not important (A513 in Staffordshire). These more marginal roads were added and removed as necessary throughout the calibration process.

8.2.15 Restricted junctions almost exclusively occur on the motorway network. These are key in PRTM to achieving correct routeing as, if they are not coded correctly, they provide high capacity and fast short-cuts. These were reviewed junction-by-junction and several errors were found and corrected using the solution described in the network coding section.

8.2.16 Distances were checked against crow-fly distances and gross errors were apparent in any assigned network as very high or low (zero) flows in several cases. As the PRTM area grew, and more recoding was required, distances continued to be a source of error and needed to be carefully checked and corrected.

8.3 Network Validation

8.3.1 As recognised within TAG there are little or no data available that have not been used in the development or checking of the highway network for the purposes of network validation. TAG Unit M3.1 §6.3.1 states that:

> *"It is not possible to validate the network in isolation, since the output traffic flows and travel times will reflect not only errors in the network, but also those inherited from the input trip matrix. This is a particularly important consideration in congested urban areas, where relatively small discrepancies in a trip matrix can have a disproportionate impact on junction delays and hence on the routes taken by vehicles through the network."*

8.3.2 On this basis no independent validation of the highway network has been undertaken during the development of the PRTM highway model. The route choice calibration and validation (as discussed in Section 9), the trip matrix calibration and validation (as discussed in Section 10) and the assignment calibration and validation results (as discussed in Section 11) form the most appropriate validation of the network itself.

9. Route Choice Calibration and Validation

9.1 Introduction

9.1.1 As stated in TAG Unit M3.1 §7.1.1 the process of calibrating a highway model should be, as far as possible, a sequential process considering zones, network structure, centroid connectors, network coding, capacity restraint and trip matrices in-turn. However, it is recognised that a certain amount of iteration will be required to refine the assignment results.

9.1.2 It is unlikely that this refinement will reconsider the zone system or make any significant adjustments to the overall network structure, although there may be instances where a limited amount of additional network could be considered necessary to improve the model performance in a given location. The main focus of this iterative process is likely to focus on the network coding, including the application of capacity restraints on links and at junctions, with limited changes to the trip matrices.

9.1.3 This section looks at the performance of the highway model in terms of route choice between, primarily, key urban centres within Leicestershire which is part of this iterative process of refinement to the highway model. Assessing the route choice in the highway model outside the simulation network is not possible due to the relatively large nature of the zone system in this part of the model and the skeletal nature of the network.

9.2 Route Choice Calibration

9.2.1 Aside from adjustments to the network coding and / or the trip matrices, TAG Unit M3.1 states that there are limited alternative adjustments that should be made to a highway model in calibrating the route choice within the assignment. One possible calibration parameter that is discounted within TAG is to make adjustments to the generalised costs used in the assignment to put a greater or lesser weight on the trip distance.

9.2.2 TAG Unit M3.1 §7.2.1 states that *"changes to the distance coefficients should no longer be used as a means of calibrating route choice"*. However, it also states that these parameters may need to be adjusted in some way to account for the attractiveness of motorways and strategic A-roads to HGVs in preference over more local roads.

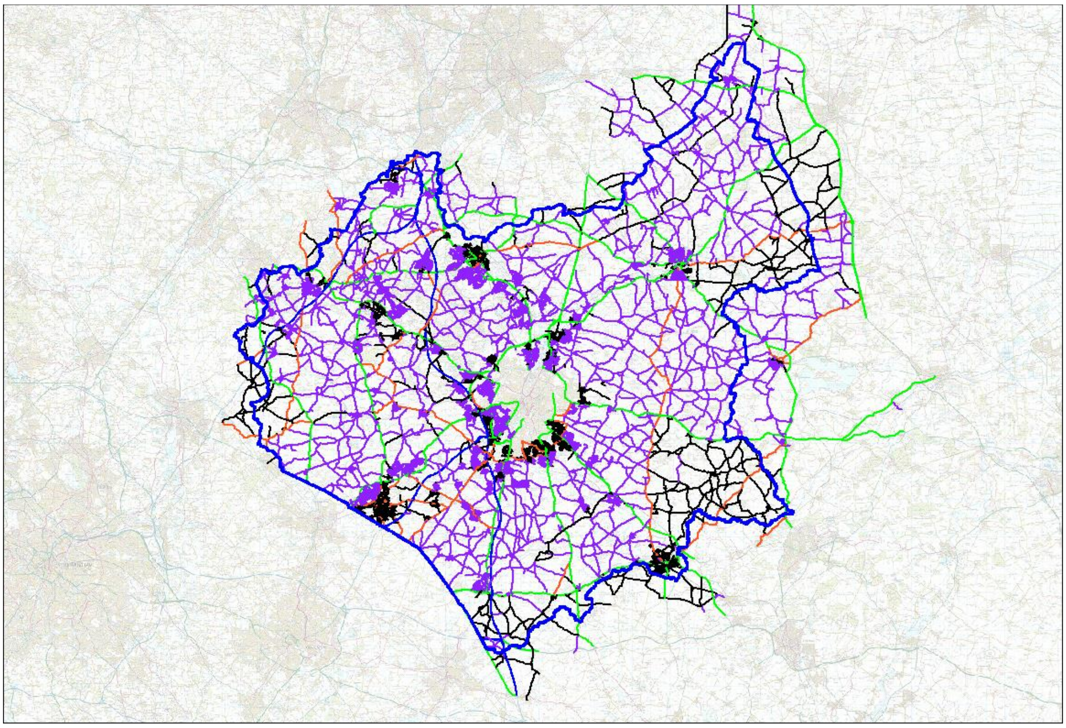
9.2.3 There are a number of possible adjustments that can be made to account for this. The first is to adjust the generalised cost parameters for HGV traffic by reducing the weight given to trip distance. Alternatively, additional cost could be applied to non-strategic routes for HGV traffic (or negative costs applied to strategic routes) to influence the routeing of HGV demand.

9.2.4 Within PRTM two adjustments have been made to the network to influence the routeing of HGV demand. The first is to apply different speed-flow relationships for HGV traffic compared with light vehicle traffic (as discussed in Section 6.3). In addition to this, HGV bans have been enforced by applying a high penalty to links where an HGV ban or restriction is in place. This high penalty, rather than a ban for a given link, allows HGV access to zones via these links with penalties but deters HGV traffic from using these routes for through-trips.

9.2.5 In order to code these HGV bans and restrictions, LCC has provided a map showing the locations of HGV bans and restrictions within the county (excluding Leicester City). This is shown in Figure 9.1, with the purple links indicating where an HGV ban or restriction is in place. Corresponding information detailing the HGV bans and restrictions within Leicester

City has also been provided and has been used as the basis for allocating HGV link penalties within the city.

Figure 9.1: Supplied Information on HGV Bans and Restrictions within Leicestershire



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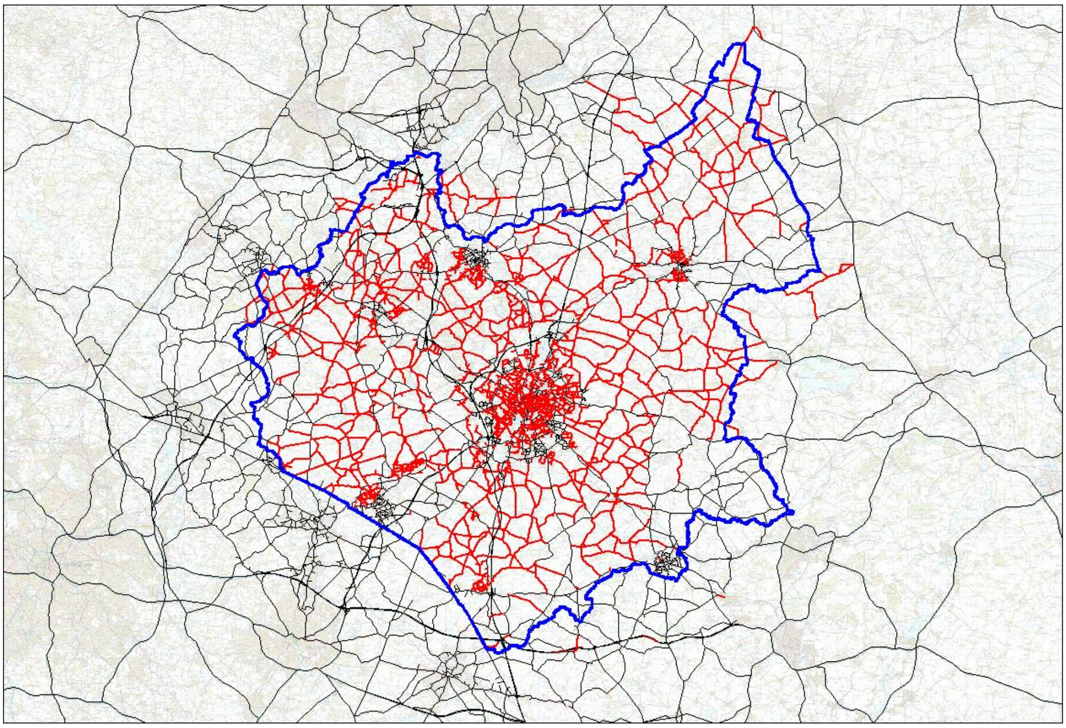
9.2.6 Using the information provided for Leicester City and Leicestershire, HGV penalties have been assigned to links within the highway model. Figure 9.2 shows the location of these penalties in the base year highway model, with the links where a high penalty is encountered by HGV traffic highlighted in red.

Figure 9.2: Location of HGV Bans / Penalties



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9.3 Route Choice Validation

9.3.1 As recognised within TAG, it is not possible to inspect all origin-destination routeing within the highway assignment, especially in a large model such as PRTM. Therefore, a selection of key traffic movements should be assessed focusing on key areas of population and / or employment and should be chosen so that the routes:

- relate to significant numbers of trips;
- are of significant length or cost (e.g. greater than 20 minutes)
- pass through areas of interest;
- include both directions of travel;
- link different compass directions (e.g. north to south and east to west); and
- coincide with journey time routes where appropriate.

9.3.2 In addition to this, as a guide to the number of routes that should be assessed within a given model, TAG suggests the following rule of thumb:

$$NumberOfODPairs = (NumberOfZones)^{0.25} * NumberOfUserClasses$$

9.3.3 Using the number of non-development zones within PRTM (1,474), this rule of thumb suggests that around 56 origin-destination pairs should be reviewed.

9.3.4 In consultation with LCC a set of key inter-urban routes within Leicester City and Leicestershire, and to / from key urban centres outside Leicestershire, were defined, with the routeing between the urban areas being assessed for HGV, LGV and ‘other’ medium value of time trips between a randomly selected zone in the centre of each of the urban areas. The selected routes between urban areas are given in Table 9.1 and represent 84 origin-destination pairs, which is in excess of the guidance set out in TAG.

9.3.5 These routeing checks were performed for all movements indicated in Table 9.1, and were generally found to be plausible. Where there were potential anomalies, the network coding was checked and revised as appropriate. LCC staff then applied their local knowledge to investigate routeing in specific areas of the model, feeding back their findings for consideration in the refining the network.

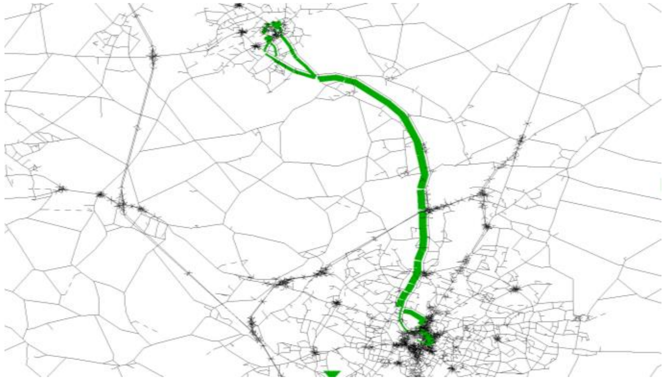
Table 9.1: Inter-Urban Routes Assessed

	Leicester City Centre	Leicester City North	Leicester City South	Leicester City East	Leicester City West	Loughborough	Melton Mowbray	Market Harborough	Lutterworth	Hinckley	Ashby	Coalville	Nottingham	Derby	Burton	Tamworth	Nuneaton	Rugby
Leicester City Centre						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Leicester City North			✓	✓	✓													
Leicester City South		✓		✓	✓													
Leicester City East		✓	✓		✓													
Leicester City West		✓	✓	✓														
Loughborough	✓						✓	✓	✓	✓	✓	✓						
Melton Mowbray	✓					✓		✓	✓	✓	✓	✓						
Market Harborough	✓					✓	✓		✓	✓	✓	✓						
Lutterworth	✓					✓	✓	✓		✓	✓	✓						
Hinckley	✓					✓	✓	✓	✓		✓	✓						
Ashby	✓					✓	✓	✓	✓	✓		✓						
Coalville	✓					✓	✓	✓	✓	✓	✓							
Nottingham	✓													✓				
Derby	✓												✓					
Burton	✓																	
Tamworth	✓																	✓
Nuneaton	✓																	
Rugby	✓															✓		

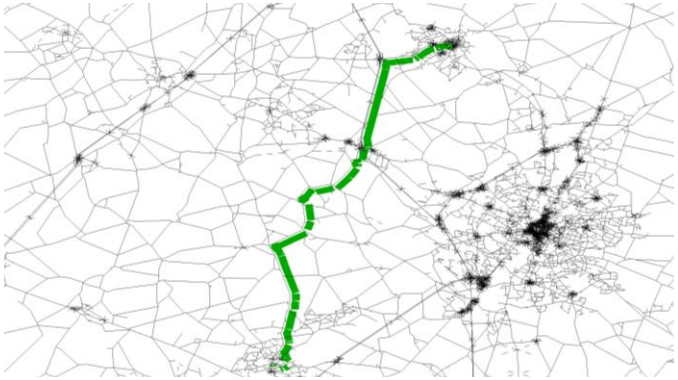
9.3.6 Figure 9.3 shows a selection of routes assessed in the AM Peak hour for consumer medium value of time cars, with Figure 9.4 showing the same analysis but for a different selection of routes in the AM Peak hour for HGV demand.

Figure 9.3: Selected AM Peak Routeing Validation – Commuting

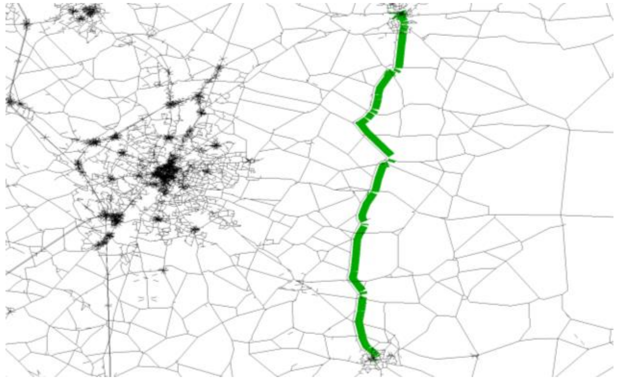
Leicester to Loughborough



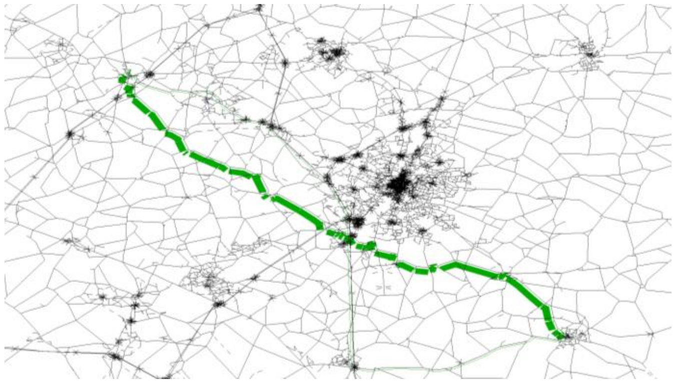
Loughborough to Hinckley



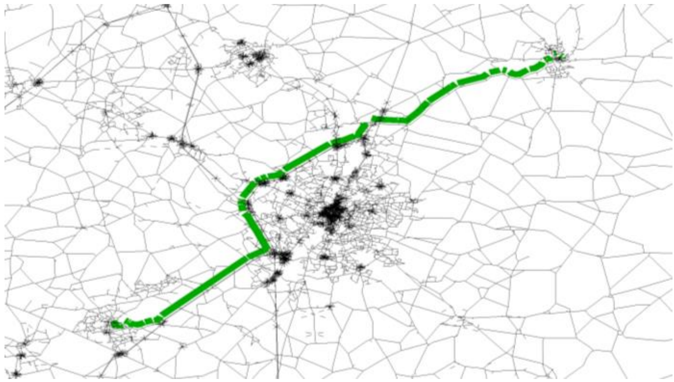
Melton Mowbray to Market Harborough



Market Harborough to Ashby/Coalville



Hinckley to Melton Mowbray



Ashby/Coalville to Lutterworth

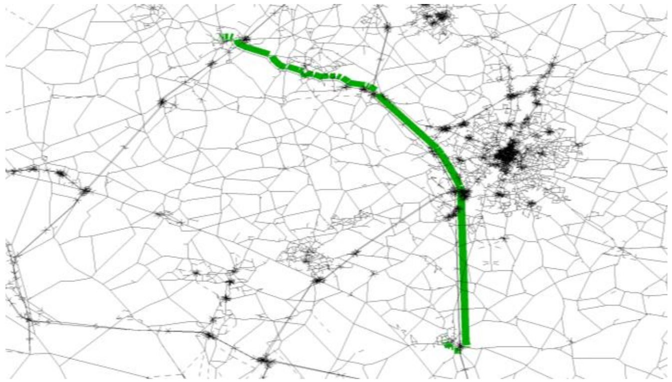
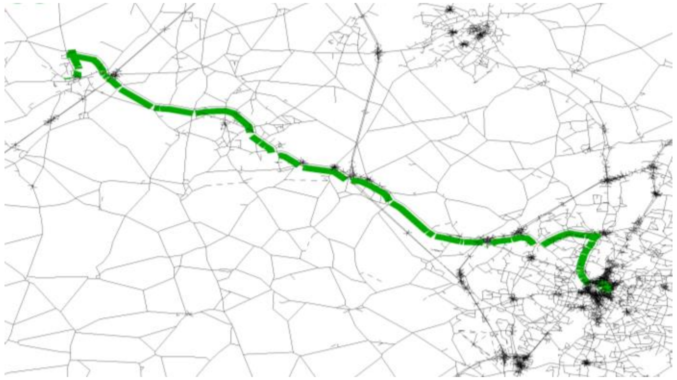
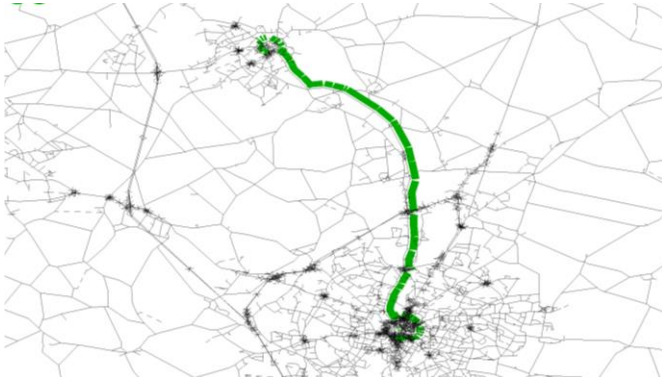


Figure 9.4: Selected AM Peak Routeing Validation – HGV Traffic

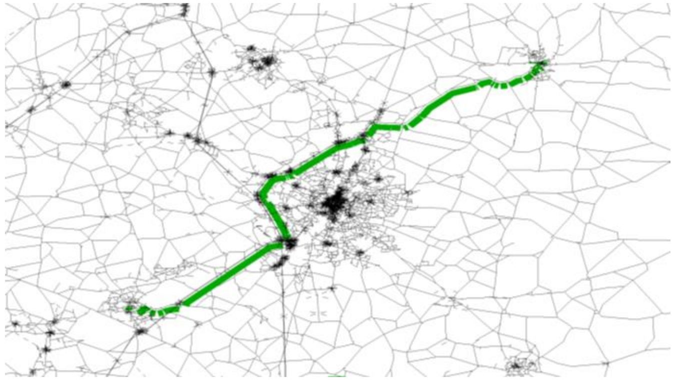
Leicester to Ashby/Coalville



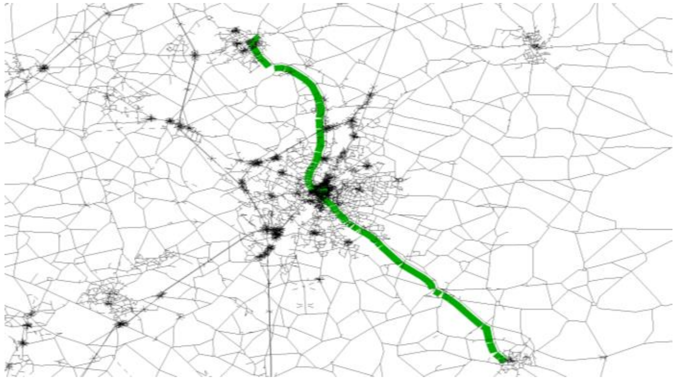
Loughborough to Leicester



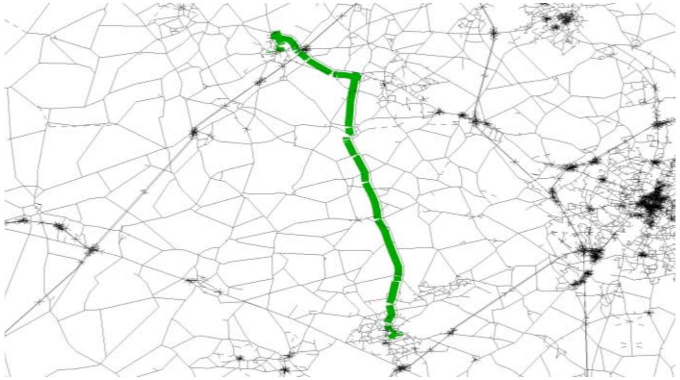
Melton Mowbray to Hinckley



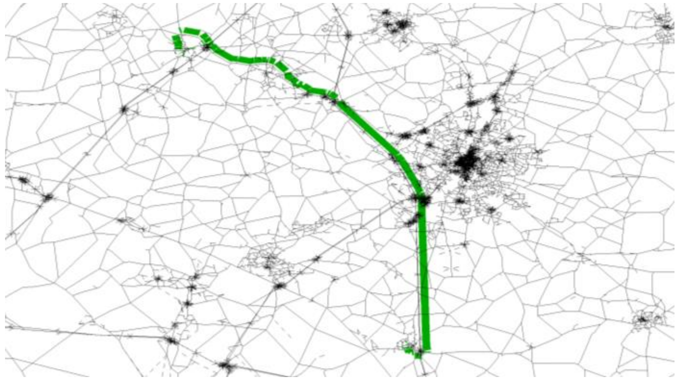
Market Harborough to Loughborough



Hinckley to Ashby/Coalville



Ashby/Coalville to Lutterworth



10. Trip Matrix Calibration and Validation

10.1 Introduction

10.1.1 This section describes the matrix estimation methodology, the updates that have been applied to the prior matrices after the adjustments described in Section 7, the performance of the updated prior matrix assignments and the impact of matrix estimation on the matrices. Discussion on the performance of the final calibrated base year model against observed flows and journey times is contained within Section 11.

10.2 Trip Matrix Validation

10.2.1 Section 7 describes the initial work that was undertaken to validate the trip matrix, including a methodology applied to adjust inter-sector movements based on a matrix estimation run with all counts along a given screenline being summed into a single constraint. The decision to use a sector-based matrix refinement process was based on a number of considerations. Firstly, there is a continuum between a global factor, which would not improve the prior matrix performance significantly, and a cell-based factoring process which would produce the best prior matrix performance based on this approach but could significantly distort the underlying data in the prior matrices. On balance it was decided to use a sectorised approach, so as to maximise the performance of the prior matrices but also retain as much of the information as possible from the mobile network data.

10.2.2 Table 7.5 summarised the performance of the adjusted prior matrix against observed flows. For each time period two statistics are given: the aggregated difference between modelled and observed flows for all screenlines within an area; and the percentage of screenlines that pass the criteria in Table 3.2. This includes a 95% confidence interval around the counts. TAG Unit M3 §8.3.19 states that if the comparison of modelled and observed screenline flows based on the criteria set out in Table 3.2 “are not met for all or nearly all screenlines and cordons, remedial action should be considered”.

10.3 Refinements to Prior Matrix through Matrix Estimation: Methodology

10.3.1 Based on the performance of the model using the prior matrices, matrix estimation was judged necessary to refine the prior matrices. This section details the assumptions and processes that have been applied within matrix estimation, and summarises the changes made to the prior matrices through this process.

10.3.2 Five iterations of matrix estimation have been run within the SATURN matrix estimation process. Initial testing of the matrix estimation process showed that there was limited to no additional model performance to be gained from running more than five iterations. The XAMAX parameter within SATURN’s matrix estimation process also helps to limit the potential change to the prior matrices. This parameter is the maximum factor that a zone-to-zone movement can be multiplied or divided by during matrix estimation which has been set to 5 for PRTM. Within Leicestershire, an XAMAX value of between 3.5 and 7 has been found to produce similar model performance, suggesting that the model is relatively insensitive to the XAMAX value within that range.

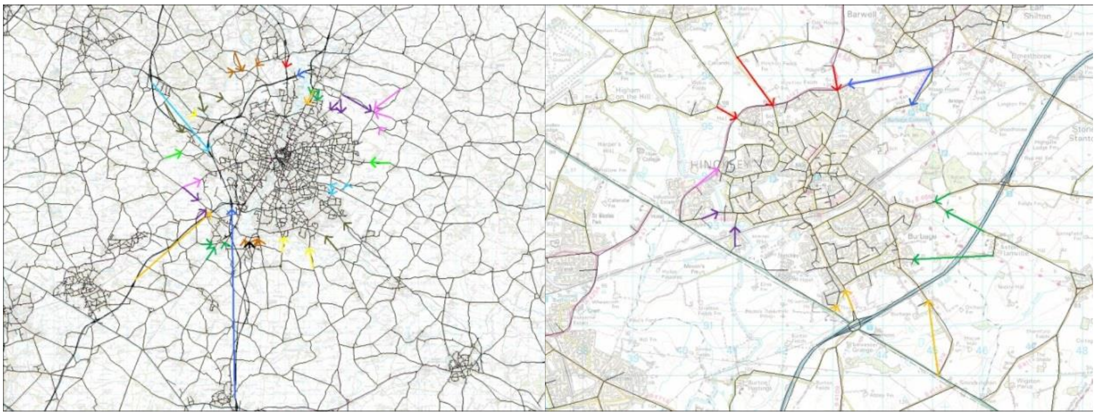
10.3.3 In the past, individual counts were used as single constraints for matrix estimation which would often compensate for routeing or count errors in the model during initial stages of the calibration process. The result was a model that appeared to match flows at individual locations, but with the underlying routeing problems remaining, and the network / count errors manifesting themselves in the estimated matrices.

10.3.4 To address this potential problem TAG Unit M3.1 §8.3.5 states that "count constraints should generally be grouped and applied at the short-screenline level. The use of counts at individual sites as constraints should be avoided". This process therefore controls the total traffic passing through a number of locations but does not attempt to adjust the matrix to meet the individual constraints. After applying these constraints within matrix estimation, the network coding should be reconsidered to influence the routeing between count locations within a short-screenline where necessary.

10.3.5 This process of using short-screenlines as constraints within matrix estimation was adopted in the development of the PRTM highway model. The short-screenlines were defined for each screenline or cordon in the model using the approach of grouping locations based on road type (A-road, residential road etc.) and / or roads that are likely to be used by similar origin-destination routes.

10.3.6 Figure 10.1 shows two examples of the definition of short-screenlines in PRTM. These plots show the counts on the Leicester City and Hinckley Outer cordons, with nearby counts grouped together to form a single constraint shown in the same colour.

Figure 10.1: Example Short-Screenlines (Leicester City and Hinckley Outer Cordons)



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10.3.7 For matrix estimation the solution developed for the PRTM area is to use all the counts as individual counts, other than the pairs of counts on either end of the M6 and M6 Toll motorways which are grouped into short-screenlines.

10.3.8 TAG Unit M3.1 §4.2.1 explains that: "The main purpose of matrix estimation is to refine estimates of movements which have been synthesised (rather than derived from surveys)." TAG Unit M3.1 §4.3.1 explains further that "Screenlines for model validation should be established which are independent from any screenlines used for matrix estimation or the roadside interview survey screenlines and cordons". §4.5.3 also explains that "The notion of using good quality counts for calibration and poorer quality counts for validation, or vice-versa, should not be considered.". §8.3.23 notes that: "In making these comparisons, care should be taken to ensure that the validation data are sufficiently up to date for their use to be worthwhile; it would not be sensible to make a comparison and then argue that the validation data were insufficiently accurate if the comparison turned out to be poor".

10.3.9 The quantity of reliable, and ATC based, count data available for PRTM highway model calibration is however limited. It is also worth noting that the matrices were derived using mobile network data and not the traditional roadside interview sources referred to in TAG. There is therefore a choice between undertaking limited matrix calibration with the consequence that the calibrated trip matrix is likely to be relatively poor, or calibration using the entire set of screenlines and cordons with the consequential lack of independent validation data.

10.3.10 In reviewing this choice between limited matrix calibration or using all screenlines and cordons for calibration it is worth reflecting on the definition and purpose of model validation. TAG Unit M3.1, §3.3.1 states: "Any adjustments to the model intended to reduce the differences between the modelled and observed data should be regarded as calibration. Validation simply involves comparing modelled and observed data that is independent from that used in calibration.".

10.3.11 The definitions given in TAG allow all the checks concerned with the validity of model output to be properly documented as validation. This definition is implicit in §3.3.8 which states that "With regard to screenline validation…the comparisons should be presented separately (a) where data were used to inform matrix development, (b) for screenlines used as constraints in matrix estimation; and (c) screenlines used for independent validation".

10.3.12 While TAG Unit M3.1 does not advocate that there should be no independent data, it is recognised that all the information available, whether used in calibration or not, aids understanding of the validity of the model. §3.3.1 additionally notes "The extent of data available for model development is often limited and it may be appropriate to use data first for validation through independent testing of other data and model relationships, and then to undertake additional calibration to refine the model.

10.3.13 In terms of flow validation, a key benefit of the use of short-screenlines in matrix estimation is that the estimation process does not constrain routeing, i.e. the flows at individual count locations. The comparison of flows at individual count sites is thus verification of routeing. Complemented with independent journey time verification and direct verification of a sample of routes provides evidence of the network model routeing performance that complies with guidance. On this basis all screenlines and cordons defined in the model are to be used within the model calibration. The model screenline performance therefore becomes the 'calibration' measure of the link flow performance, and the individual link flow performance becomes the 'validation' measure due to the use of short-screenlines.

10.3.14 It should be noted that individual count locations defined as 'validation' on the SRN have been omitted from the model calibration process as short-screenlines cannot be defined for these datasets. In addition to this, an 'independent validation' version of the base year model has also been produced, retaining the set of screenlines for validation that was used in previous versions of the model. The high-level results of this model are presented in Appendix D.

10.3.15 In conclusion, it is worth recollecting that the quality of the model reflects the quality of the data available and should be tailored (on grounds of proportionality) to the quality required. We should therefore anticipate the need for refinement for local application as new needs and data become available.

10.4 Refinements to Prior Matrix through Matrix Estimation: Changes

10.4.1 This section presents the impacts of matrix estimation on the prior matrix. As stated in Section 4.11, due to the interaction with the parking model in producing the final base year highway model the results given in this section exclude the impact of the parking model on the matrices. The matrix changes therefore isolate the changes introduced through matrix estimation.

10.4.2 TAG Unit M3.1 gives four measures against which the changes applied to the prior matrices due to matrix estimation are measured. These are given in Table 3.5 and consist of matrix cell value changes, matrix trip-end changes, matrix trip length changes, and changes to the matrices at a sector level.

Matrix Cell Changes

10.4.3 Taking each of these in turn, the first measure is to consider the regression statistics for individual cell-to-cell movements between the prior and post-matrix estimation matrices. For this comparison the slope of best fit should be between 0.98 and 1.02, with an intercept near 0 and an R^2 value in excess of 0.95.

10.4.4 There is no guidance within TAG as to which subset, if any, of the matrices should be considered for this analysis. Large external-to-external demand is likely to be unaffected by matrix estimation and weights the regression statistics towards a slope and R^2 of 1. Conversely, the internal area of the model is more likely to be affected by matrix estimation and it is less likely that the regression statistics produce a slope and R^2 of 1.

10.4.5 For the purposes of this analysis, intrazonal demand has been removed from the matrices prior to assessing the regression statistics between the prior and post-matrix estimation matrices, but all other movements, including external-to-external movements, have been included.

10.4.6 Based on these assumptions, Table 10.1 states the regression statistics between the prior and post-matrix estimation matrices for the three modelled hours and by vehicle type for all movements. This table shows that all the regression statistics meet TAG criteria.

Table 10.1: Regression Statistics for Matrix Zonal Changes (Interzonal Trips only, Whole Model)

Time Period	Vehicle Class	Intercept	Slope	R^2
AM Peak	HGV	0.00	1.00	1.00
	LGV	0.00	1.00	1.00
	Car	-0.01	1.00	1.00
Interpeak	HGV	0.00	1.00	1.00
	LGV	0.00	1.00	1.00
	Car	-0.01	1.00	1.00
PM Peak	HGV	0.00	1.00	1.00
	LGV	0.00	1.00	1.00
	Car	-0.01	1.00	1.00

Matrix Trip-end Changes

10.4.7 The second of the matrix-change measures is the change in the matrix trip-ends from the prior matrices to the matrices resulting from matrix estimation. For this comparison the slope of best fit should be between 0.99 and 1.01, with an intercept near 0 and an R^2 value in excess of 0.98.

10.4.8 As with the analysis of the matrix cell-to-cell values there is no guidance within TAG if any subset of the matrix should be taken for this assessment. Therefore, for consistency with the above analysis intrazonal demand has been removed from the trip-ends but large external zones and PRTM area zones have been retained. Table 10.2 shows the regression statistics for the three modelled hours, for all vehicle types and for both origin and destination trip-ends.

10.4.9 From this table it can be seen that the regression statistics meet TAG thresholds in all three time periods, and for origins and destinations for all vehicle types. It is not specified how close to zero the intercept should be. HGV and LGV have an intercept between -4 and 1 and car is between -22 and -12. Given the car matrix is larger this is still close to zero relative to average trip-ends per zone for car.

Table 10.2: Regression Statistics for Matrix Trip-end Changes (Interzonal Trips only, Whole Model)

		Origin Trip-ends			Destination Trip-ends		
		Intercept	**Slope**	**R^2**	**Intercept**	**Slope**	**R^2**
AM Peak	HGV	0.39	1.00	1.00	0.33	1.00	1.00
	LGV	-3.68	1.00	1.00	-3.76	1.00	1.00
	Car	-15.84	1.00	1.00	-16.40	1.00	1.00
Interpeak	HGV	0.62	1.00	1.00	0.74	1.00	1.00
	LGV	-1.01	1.00	1.00	-0.81	1.00	1.00
	Car	-13.36	1.00	1.00	-12.93	1.00	1.00
PM Peak	HGV	0.18	1.00	1.00	0.20	1.00	1.00
	LGV	-1.57	1.00	1.00	-1.49	1.00	1.00
	Car	-21.47	1.00	1.00	-21.11	1.00	1.00

Trip Length Distributions

10.4.10 The third assessment of the impact of matrix estimation on the prior matrices relates to changes in the trip length profile before and after matrix estimation. The criteria for this measure are that the mean trip length and standard deviation about this mean should not change by more than 5% due to matrix estimation. As with previous analysis there is no guidance as to whether a subset of matrix should be used for this assessment.

10.4.11 Table 10.3 shows the mean trip lengths and standard deviations in trip length by vehicle type and by time period for the prior matrices and the matrices resulting from matrix estimation. This analysis has been undertaken for all movements in the matrix.

10.4.12 For the statistics for all movements, changes in mean or standard deviation of trip lengths are not more than 1.5% between the prior and post-matrix estimation matrices across all three time periods and vehicle types; this is in-line with TAG guidance. The prior and post ME matrices therefore share good consistency with observed trip length patterns from the source data in the area, providing strong confidence in relation to modelled trip lengths.

Table 10.3: Change in Matrix Trip Length Averages and Standard Deviations (Interzonal Trips Only)

			Distance (km)		
Time Period	**Vehicle Type**	**Measure**	**Prior Matrix**	**Post ME Matrix**	**%Diff**
AM Peak	HGV	Mean	65.7	65.3	-0.6%
		St Dev	82.0	80.7	-1.5%
	LGV	Mean	41.3	41.4	0.1%
		St Dev	33.8	34.0	0.5%
	Car	Mean	41.6	41.6	0.0%
		St Dev	35.3	35.4	0.3%
Interpeak	HGV	Mean	65.8	65.4	-0.6%
		St Dev	85.1	83.9	-1.5%
	LGV	Mean	41.3	41.3	0.1%
		St Dev	34.4	34.6	0.6%
	Car	Mean	41.8	41.9	0.2%
		St Dev	35.9	36.1	0.5%
PM Peak	HGV	Mean	65.0	64.8	-0.3%
		St Dev	84.6	83.5	-1.2%
	LGV	Mean	41.3	41.4	0.1%
		St Dev	34.2	34.5	0.9%
	Car	Mean	42.0	42.0	0.0%
		St Dev	35.7	35.8	0.3%

10.4.13 Figure 10.2, Figure 10.3 and Figure 10.4 show the trip length profiles from the AM Peak model for all movements in the model for HGVs, LGVs and cars. The equivalent graphs for the other time periods show similar changes.

Figure 10.2: AM Peak Trip Length Profiles – HGV (All Movements)

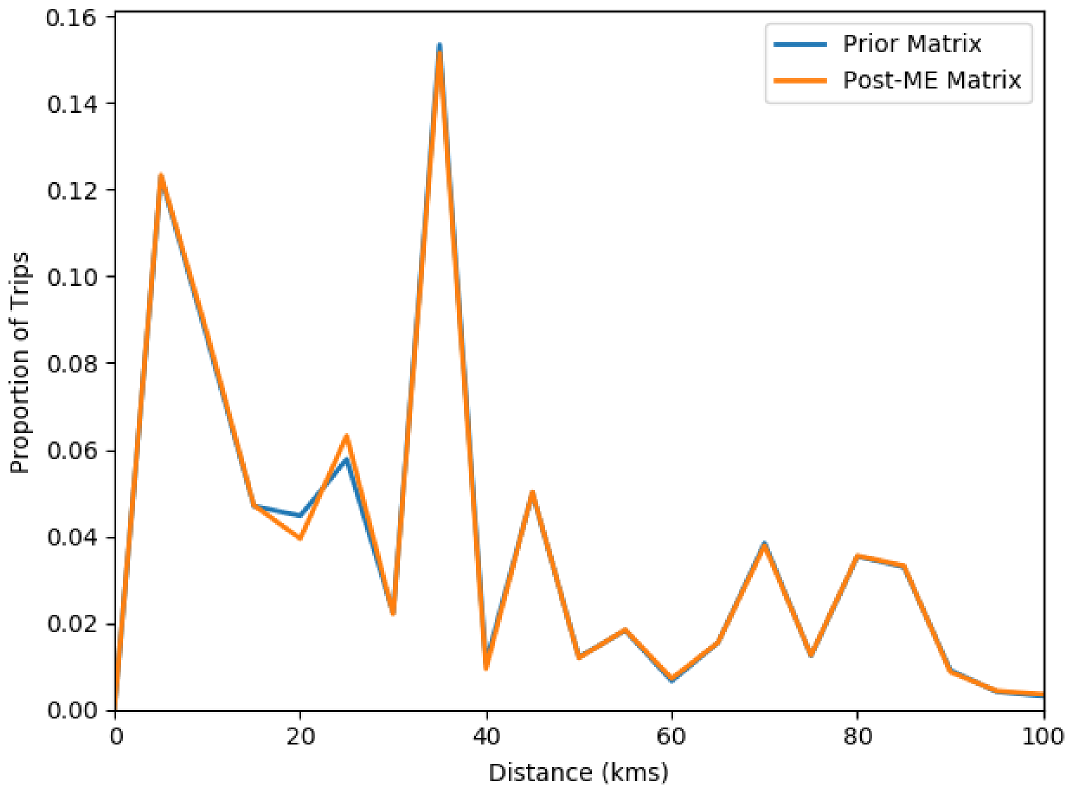


Figure 10.3: AM Peak Trip Length Profiles – LGV (All Movements)

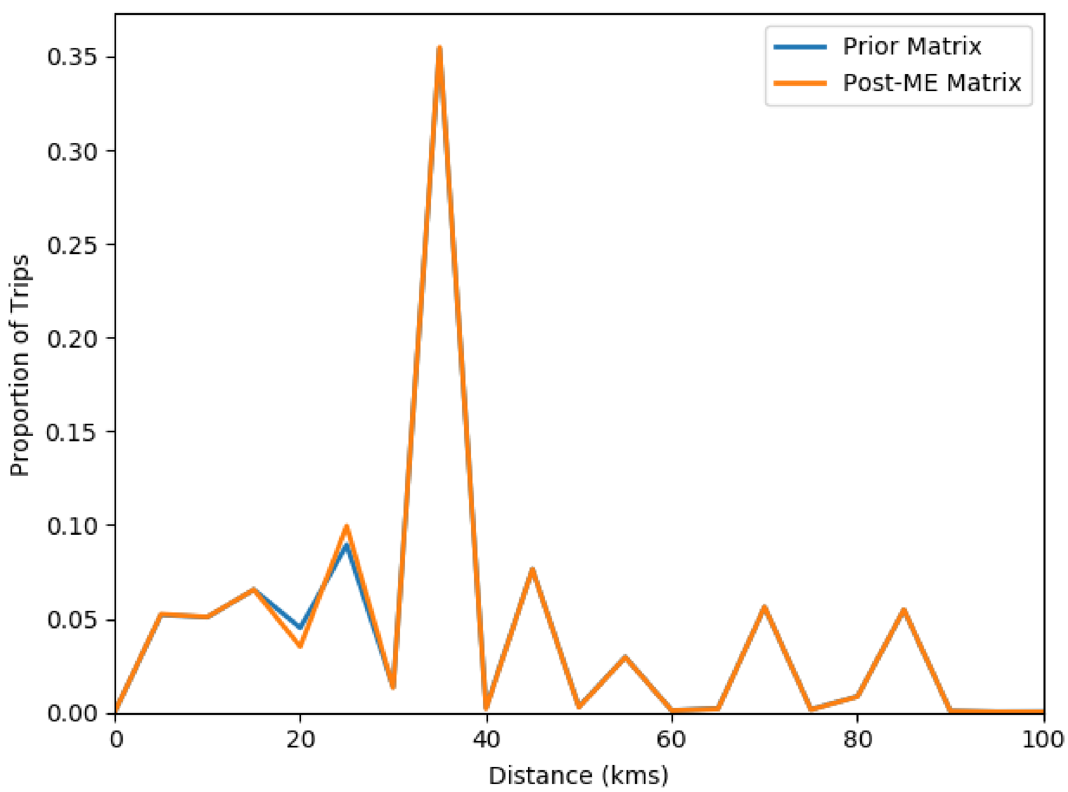
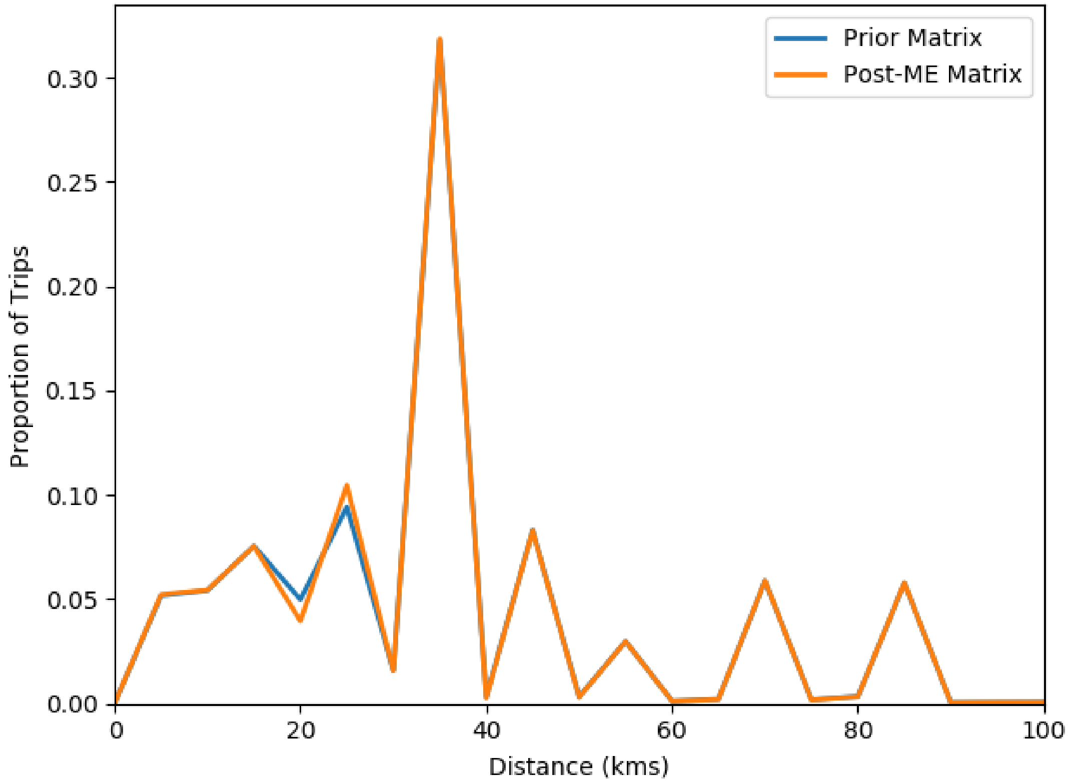


Figure 10.4: AM Peak Trip Length Profiles – Car (All Movements)



Sectored Demand Changes

10.4.14 The final piece of matrix analysis is to consider the changes matrix estimation makes to the prior matrix at a sector level. TAG Unit M3 states that the changes in sector-to-sector demand totals should be less than 5% although it does not give guidance as to how to define the sector system. The results of this analysis can be sensitive to the definition of the sector system: the more detailed the sector system the more likely it is that sector-to-sector movements change by more than 5%.

10.4.15 For the purposes of this highway model a sector system has been defined based on districts within Leicestershire, with the areas outside Leicestershire divided into four sectors based on the matrix-build sectors.

10.4.16 In analysing these results, it was found that a significant proportion of sector-to-sector movements changed by more than 5%, but the absolute changes in those movements were relatively small. Even with the relatively aggregate sector system there remains a number of sector-to-sector movements that have little demand and therefore a relatively modest change in the demand for these movements can result in a large percentage change. In order to address this, the TAG criterion has been adjusted to identify those sector movements which change by more than 5% and 250 vehicles, and these have been highlighted.

10.4.17 As shown in Table 10.4, Table 10.5 and Table 10.6, which report on the car matrices, the majority of sector-to-sector movements do not change by more than 5% and 250 vehicles. Most failures within Leicestershire are in the range of 5-25% and mainly in the peaks.

10.4.18 The majority of internal movements that show the largest change tend to be shorter distance trips either within sectors or between neighbouring sectors that may have large numbers of short distance trips between them. Given that mobile network data are strongest at a strategic level and weakest at a more localised level, this is the likely reason for the larger percentage changes in demand.

10.4.19 Table 10.7, Table 10.8 and Table 10.9 (results for LGV matrices) and Table 10.10, Table 10.11, and Table 10.12 (results for HGV matrices) show that the only sector-to-sector movement that has demand changes by more than 5% and 250 vehicles due to matrix estimation is LGVs from Leicester City to Leicester City in the Interpeak period. This lack of significant change reflects the relative sparsity of the freight matrices when compared with car.

10.4.20 Considering the greater uncertainty in the freight matrices (an issue common with all UK transport models), the scale of change is reassuring: often less than 15% and at an aggregated matrix level (not shown), never more than 0.3% for LGV and 0.9% for HGV.

Table 10.4: AM Peak Sectored Demand Changes - Car

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	13%	13%	-2%	0%	3%	10%	-14%	-9%	-39%	10%	-23%	2%
Charnwood	-3%	5%	-15%	-18%	6%	13%	-16%	16%	-14%	3%	7%	-2%
Harborough	-13%	-16%	11%	-4%	10%	10%	-44%	12%	-20%	4%	-17%	14%
Hinckley	12%	8%	20%	10%	-17%	-15%	-4%	-12%	-18%	2%	-15%	7%
Leicester	-1%	5%	17%	-23%	3%	-38%	-6%	23%	6%	7%	2%	-1%
Melton	-14%	29%	46%	-17%	-35%	3%	37%	-66%	7%	-5%	20%	5%
North West Leicestershire	-5%	-15%	-12%	-9%	-35%	49%	6%	-23%	-6%	11%	-1%	4%
Oadby and Wigston	-1%	-14%	8%	6%	21%	-72%	-36%	3%	6%	-17%	-21%	-14%
External (East)	-51%	8%	-30%	-12%	23%	22%	-37%	10%	0%	1%	2%	4%
External (North)	1%	16%	4%	-32%	-10%	-4%	-2%	-18%	3%	-1%	10%	-8%
External (South)	29%	4%	3%	-9%	3%	18%	-7%	-39%	-4%	-1%	-0%	5%
External (West)	40%	5%	36%	-8%	19%	-32%	-2%	-16%	-2%	-0%	7%	-2%

Table 10.5: Interpeak Sectored Demand Changes - Car

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	8%	17%	-19%	-0%	9%	-2%	-7%	18%	-39%	10%	3%	22%
Charnwood	6%	4%	-27%	5%	-0%	11%	-8%	-11%	-7%	3%	12%	2%
Harborough	-18%	-26%	12%	-8%	-4%	17%	-32%	18%	-36%	-5%	13%	48%
Hinckley	18%	10%	12%	4%	-7%	-25%	5%	30%	-29%	-9%	-8%	-5%
Leicester	-4%	2%	8%	-16%	-0%	-35%	-14%	-0%	13%	3%	1%	-6%
Melton	14%	16%	20%	22%	-37%	1%	-8%	-75%	31%	-2%	47%	0%
North West Leicestershire	-7%	-19%	-19%	3%	-21%	12%	4%	10%	-28%	2%	7%	-9%
Oadby and Wigston	19%	-13%	6%	8%	14%	-63%	15%	1%	-4%	13%	-18%	11%
External (East)	-51%	14%	-36%	-36%	9%	26%	-21%	-14%	0%	7%	-2%	-1%
External (North)	4%	11%	-16%	-19%	-9%	-1%	-2%	11%	8%	-0%	5%	6%
External (South)	-1%	13%	9%	-4%	-2%	22%	7%	-14%	-2%	3%	-0%	15%
External (West)	9%	-1%	53%	1%	-6%	-20%	-14%	6%	0%	4%	13%	-2%

Table 10.6: PM Peak Sectored Demand Changes - Car

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	18%	8%	-9%	2%	1%	-26%	-2%	24%	-19%	12%	14%	25%
Charnwood	7%	5%	-30%	-3%	4%	21%	-2%	-3%	-4%	-6%	-2%	-2%
Harborough	0%	-7%	13%	24%	10%	68%	19%	14%	-35%	-10%	7%	88%
Hinckley	10%	-6%	-8%	7%	-16%	-42%	-8%	-35%	-19%	-18%	-20%	-16%
Leicester	13%	7%	13%	-19%	6%	-42%	-9%	16%	10%	-3%	-3%	-0%
Melton	22%	9%	51%	-19%	-41%	2%	75%	-80%	14%	1%	18%	11%
North West Leicestershire	-5%	-7%	-37%	0%	-10%	61%	3%	21%	19%	1%	15%	1%
Oadby and Wigston	5%	4%	-3%	-17%	19%	-65%	-0%	2%	-18%	9%	-20%	-8%
External (East)	-49%	-15%	-28%	-37%	-3%	-0%	9%	-21%	0%	10%	-4%	-0%
External (North)	1%	8%	-13%	-9%	-12%	-4%	-0%	1%	3%	-1%	0%	-1%
External (South)	-16%	9%	-7%	-10%	0%	6%	-6%	-30%	2%	-2%	-0%	7%
External (West)	14%	-5%	33%	5%	-6%	-20%	-1%	-13%	-2%	-3%	6%	-2%

Table 10.7: AM Peak Sectored Demand Changes - LGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	12%	33%	8%	11%	-6%	29%	6%	-9%	-47%	26%	3%	24%
Charnwood	0%	6%	-8%	30%	6%	18%	-18%	3%	-43%	20%	16%	8%
Harborough	-8%	-5%	6%	43%	24%	20%	-8%	28%	-15%	16%	-18%	29%
Hinckley	10%	35%	25%	5%	-2%	0%	21%	-28%	-41%	17%	-20%	-4%
Leicester	1%	-8%	29%	-14%	10%	-29%	-8%	1%	-5%	-2%	4%	7%
Melton	-11%	11%	67%	-12%	-28%	8%	25%	-67%	-19%	28%	-10%	5%
North West Leicestershire	-23%	-20%	-4%	15%	-24%	43%	6%	-72%	-44%	16%	-9%	12%
Oadby and Wigston	-9%	-24%	24%	-13%	3%	-69%	-18%	-1%	-18%	-16%	-17%	1%
External (East)	-45%	-24%	-8%	-30%	2%	6%	-28%	-13%	0%	-1%	-2%	-7%
External (North)	-11%	-8%	-2%	-10%	-9%	16%	3%	-51%	1%	-0%	6%	-1%
External (South)	61%	18%	-9%	-6%	8%	-8%	11%	-22%	-4%	7%	-0%	7%
External (West)	97%	-1%	54%	21%	36%	4%	-2%	-2%	-1%	-6%	7%	-2%

Table 10.8: Interpeak Sectored Demand Changes - LGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	16%	21%	-7%	2%	-3%	11%	-4%	1%	-64%	8%	10%	40%
Charnwood	20%	8%	-19%	17%	-4%	26%	-21%	-25%	-43%	13%	6%	-7%
Harborough	-9%	-18%	13%	19%	20%	42%	-15%	17%	-15%	16%	-16%	54%
Hinckley	9%	23%	24%	8%	-13%	-15%	14%	-18%	-43%	-3%	-21%	-1%
Leicester	-10%	-2%	24%	-19%	14%	-20%	-4%	-8%	-12%	1%	12%	0%
Melton	29%	35%	53%	2%	-18%	10%	17%	-81%	-11%	28%	2%	8%
North West Leicestershire	12%	-28%	-9%	19%	0%	26%	9%	-17%	-49%	8%	6%	12%
Oadby and Wigston	13%	-19%	18%	-5%	-1%	-64%	-13%	0%	-22%	-6%	-18%	32%
External (East)	-66%	-44%	-20%	-66%	-1%	-2%	-45%	-33%	0%	0%	-2%	-7%
External (North)	8%	13%	5%	-6%	0%	34%	2%	-24%	2%	-0%	2%	-2%
External (South)	2%	17%	-19%	-17%	-4%	-10%	7%	-15%	0%	4%	0%	10%
External (West)	29%	-4%	74%	5%	1%	-3%	-6%	-7%	-5%	-4%	11%	-1%

Table 10.9: PM Peak Sectored Demand Changes - LGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	11%	31%	-11%	1%	-0%	-12%	0%	18%	-41%	11%	7%	45%
Charnwood	5%	6%	-16%	6%	-9%	3%	-9%	-13%	-11%	-9%	2%	-16%
Harborough	-4%	14%	16%	29%	37%	44%	6%	23%	-18%	16%	-10%	32%
Hinckley	10%	14%	30%	2%	-21%	-36%	0%	-30%	-15%	-3%	-13%	-0%
Leicester	-7%	0%	33%	-17%	9%	-38%	-6%	5%	-6%	-8%	-1%	-13%
Melton	-1%	14%	52%	-6%	-38%	8%	35%	-80%	-4%	9%	-9%	23%
North West Leicestershire	14%	-22%	23%	12%	11%	25%	2%	27%	-2%	8%	18%	10%
Oadby and Wigston	4%	0%	-0%	-22%	8%	-73%	-18%	1%	-36%	-13%	-34%	-2%
External (East)	-65%	-32%	-19%	-52%	-1%	-17%	-25%	-14%	-0%	-0%	-2%	-12%
External (North)	-7%	13%	1%	-17%	-10%	14%	0%	-13%	-2%	-0%	10%	1%
External (South)	-4%	19%	-2%	-9%	5%	-27%	8%	-13%	3%	15%	-0%	9%
External (West)	0%	2%	4%	13%	-8%	-14%	-1%	-15%	-11%	-5%	9%	-1%

Table 10.10: AM Sectored Demand Changes - HGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	62%	-1%	2%	34%	-8%	61%	65%	119%	-52%	7%	60%	23%
Charnwood	-34%	10%	2%	17%	-4%	78%	26%	36%	-11%	25%	49%	3%
Harborough	9%	-17%	-14%	24%	18%	58%	47%	-4%	43%	-11%	31%	146%
Hinckley	-5%	-23%	29%	28%	-31%	10%	42%	-38%	-22%	4%	77%	17%
Leicester	5%	-3%	-21%	3%	32%	44%	44%	66%	13%	2%	-1%	-26%
Melton	-40%	29%	6%	19%	2%	40%	95%	-35%	29%	-31%	18%	7%
North West Leicestershire	-12%	14%	32%	18%	9%	116%	-6%	-27%	6%	4%	59%	19%
Oadby and Wigston	171%	-9%	-7%	16%	114%	9%	40%	168%	-0%	-7%	9%	12%
External (East)	-41%	-32%	3%	-21%	30%	39%	9%	-30%	-0%	-7%	7%	10%
External (North)	-34%	-13%	-13%	-15%	-6%	-3%	7%	-53%	-9%	1%	-17%	15%
External (South)	88%	2%	-23%	-19%	2%	3%	31%	-39%	3%	-14%	0%	9%
External (West)	58%	-3%	65%	19%	-13%	16%	-1%	-26%	21%	10%	13%	-2%

Table 10.11: Interpeak Sectored Demand Changes - HGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	61%	29%	15%	36%	11%	49%	54%	141%	-48%	18%	38%	28%
Charnwood	-37%	28%	3%	8%	-10%	68%	26%	32%	-10%	-14%	35%	30%
Harborough	22%	15%	-17%	52%	8%	64%	79%	-32%	14%	11%	17%	170%
Hinckley	-5%	-4%	43%	17%	-12%	3%	23%	2%	-28%	-2%	84%	23%
Leicester	-6%	1%	-22%	7%	37%	36%	68%	94%	-14%	15%	-26%	-38%
Melton	-55%	51%	20%	-13%	4%	37%	34%	-26%	-5%	-9%	-2%	2%
North West Leicestershire	1%	38%	42%	38%	26%	103%	-3%	22%	47%	13%	73%	19%
Oadby and Wigston	105%	12%	-23%	-25%	100%	48%	-1%	179%	-18%	-10%	40%	-31%
External (East)	-52%	15%	-9%	-26%	16%	-1%	14%	-47%	0%	-7%	4%	11%
External (North)	-40%	-8%	-12%	-28%	-19%	4%	-3%	-34%	-9%	1%	-15%	13%
External (South)	56%	6%	-17%	-20%	-3%	-2%	19%	-1%	7%	-14%	-0%	12%
External (West)	70%	-2%	25%	39%	20%	-1%	-11%	26%	18%	11%	8%	-1%

Table 10.12: PM Peak Sectored Demand Changes – HGV

	Blaby	Charnwood	Harborough	Hinckley	Leicester	Melton	North West Leics	Oadby & Wigston	External (East)	External (North)	External (South)	External (West)
Blaby	58%	-10%	0%	1%	-1%	-16%	11%	184%	-43%	5%	52%	70%
Charnwood	-50%	7%	-13%	-34%	-14%	82%	-5%	43%	-26%	18%	14%	5%
Harborough	25%	16%	-17%	39%	1%	50%	69%	-38%	32%	0%	36%	95%
Hinckley	10%	-4%	21%	4%	-25%	-10%	-11%	37%	-57%	10%	85%	13%
Leicester	-3%	-6%	-9%	-20%	48%	9%	20%	135%	-28%	1%	-21%	-38%
Melton	-57%	58%	56%	-33%	1%	32%	16%	-18%	90%	-22%	67%	-5%
North West Leicestershire	58%	100%	87%	37%	46%	165%	-10%	98%	16%	19%	133%	8%
Oadby and Wigston	147%	6%	-15%	-65%	126%	22%	-42%	203%	-7%	-37%	-12%	-55%
External (East)	-53%	36%	9%	-39%	42%	41%	-12%	-40%	0%	-5%	3%	8%
External (North)	-21%	27%	-6%	-32%	-24%	-10%	1%	-5%	-13%	2%	-14%	17%
External (South)	60%	20%	1%	-18%	7%	11%	8%	-33%	6%	-11%	0%	12%
External (West)	120%	6%	47%	18%	42%	4%	-16%	117%	17%	13%	17%	-2%

11. Assignment Calibration and Validation

11.1 Introduction

11.1.1 This section details the assignment calibration and validation results after the application of matrix estimation and adjustment for the parking model in terms of screenline and link traffic volumes and journey times. Before considering these results, it is worth revisiting the matrix estimation methodology adopted for the PRTM highway model (see Section 10.3 for further discussion on this).

11.1.2 All counts used in matrix estimation in Leicestershire were combined into short-screenline constraints rather than using individual counts as constraints. Outside Leicestershire, in the PRTM area, counts are a mixture of short-screenlines and individual counts.

11.1.3 The overall performance of the model within Leicestershire is first considered at an aggregate level for screenlines, individual flows and journey times. This is the measure of performance within TAG that the model is assessed against. This section also includes the performance of PRTM against counts and journey times on the SRN and at several locations external to Leicestershire, but within the simulation area and within the buffer network of the PRTM area. Whilst it is not expected for the model performance to be of the same level as inside the county (due to network and zonal detail) this is still reported to provide an understanding of the performance of the model outside Leicestershire.

11.2 Assignment Convergence

11.2.1 Given TAG's emphasis on the %Gap measure of convergence, it is this that has been used as the basis for the assignment stopping criteria for PRTM. The stopping criteria has been set so that the %Gap value must fall below 0.006% for four consecutive iterations. This is significantly below the TAG %Gap acceptable value of 0.1% presented in Table 3.6.

11.2.2 Table 11.1 shows the %Gap statistics for the three modelled hours by iteration, with the addition of the alternative measure of convergence of %Delays. This %Delays figure is the percentage of turn delays that differ by less than 1% between the assignment and simulation elements of SATURN. The results from the highway assignments show that in all three time periods at least 99% of turn delays change by less than 1% in the final iteration.

Table 11.1: PRTM Base Year Highway Assignment Convergence

AM Peak Hour			Interpeak Hour			PM Peak Hour		
Iteration	%Delays	%Gap	Iteration	%Delays	%Gap	Iteration	%Delays	%Gap
1	93.3	0.1980	1	22.3	0.3840	1	96.3	0.1060
2	96.9	0.0720	2	96.4	0.0360	2	97.7	0.0580
3	97.8	0.0290	3	98.7	0.0170	3	98.2	0.0330
4	98.3	0.1100	4	99.2	0.0140	4	98.6	0.0240
5	98.3	0.0440	5	99.5	0.0068	5	98.9	0.0150
6	98.4	0.0220	6	99.7	0.0063	6	99	0.0130
7	98.8	0.0210	7	99.7	0.0066	7	99	0.0120
8	98.7	0.0150	8	99.8	0.0069	8	99.2	0.0094
9	99.1	0.0120	9	99.8	0.0035	9	99.3	0.0190
10	99.2	0.0073	10	99.8	0.0035	10	99.4	0.0069
11	99.4	0.0097	11	99.8	0.0042	11	99.4	0.0085
12	99.5	0.0068	12	99.9	0.0027	12	99.3	0.0089
13	99.4	0.0100				13	99.4	0.0065
14	99.4	0.0070				14	99.6	0.0045
15	99.6	0.0054				15	99.6	0.0057
16	99.6	0.0063				16	99.5	0.0045
17	99.5	0.0051				17	99.6	0.0180
18	99.6	0.0046				18	99.3	0.0074
19	99.7	0.0041				19	99.5	0.0038
20	99.7	0.0042				20	99.3	0.0470
						21	99	0.0330
						22	99	0.0110
						23	99.3	0.0060
						24	99.3	0.0095
						25	99.3	0.0052
						26	99.4	0.0042
						27	99.5	0.0046
						28	99.5	0.0043

11.3 Assignment Calibration and Validation – Model Overview

11.3.1 This section considers the aggregate performance of the highway model against screenline and individual counts and observed journey times. These three measures will be discussed in-turn, starting with the screenline performance, then the link flow performance and finally the journey time validation.

Screenline Performance

11.3.2 Table 11.2 shows the screenline performance within Leicestershire after matrix estimation and adjustment for the parking model in the three modelled hours, across both calibration and validation counts. For each modelled hour two statistics are given: firstly the aggregate difference between observed and modelled flows across all screenlines; and secondly the percentage of screenlines that pass the criteria set out in Table 3.2. This analysis is based on total vehicle flows, with the performance by vehicle type detailed in Appendix A.

11.3.3 Within Table 11.2 these measures are given for Leicestershire as a whole, the outcome from the model that should be assessed against TAG, and for six broad geographical areas within Leicestershire. These six areas form the basis of the discussion later throughout this section and are defined as:

- Leicester City (and surrounding areas): includes Leicester City and those counts and journey times focussed on traffic to / from the City;

- North Leicestershire: predominately Charnwood Borough;
- North-East Leicestershire: predominately Melton Borough;
- South Leicestershire: predominately Harborough district;
- South-West Leicestershire: predominately Hinckley and Bosworth district; and
- North-West Leicestershire: predominately North-West Leicestershire district.

11.3.4 In addition, the performance of the countywide screenlines, which come together to form a cordon, and the performance of the SRN internal to Leicestershire (indicated by a number of individual counts grouped together by road name, rather than screenline) is also reported in this section.

Table 11.2: Leicestershire Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	-1.0%	97%	0.1%	100%	0.2%	97%
North Leicestershire	-0.1%	100%	0.0%	100%	0.3%	100%
North-East Leicestershire	0.1%	100%	0.4%	100%	0.4%	100%
South Leicestershire	0.1%	96%	-0.2%	100%	0.2%	100%
South-West Leicestershire	0.4%	100%	0.2%	100%	0.3%	100%
North-West Leicestershire	0.1%	100%	-0.2%	100%	0.3%	100%
Countywide	0.3%	100%	0.6%	100%	0.1%	100%
SRN (int)	-0.7%	95%	0.5%	100%	-0.7%	100%
Leicestershire	***-0.4%***	***98%***	***0.2%***	***100%***	***0.0%***	***99%***

11.3.5 Table 11.2 shows that across the whole of Leicestershire 98%, 100% and 99% of screenlines meet the specified criteria in the AM Peak, Interpeak and PM Peak hours respectively. This table also suggests that in aggregate terms there is marginally more traffic in the Interpeak model than observed and marginally less traffic than observed in the AM Peak model. For the PM Peak model, the amount of traffic matches well with observed. There is therefore no systematic bias identifiable at this level.

11.3.6 TAG states that the screenline criterion should be met for “all or nearly all screenlines” which this model can be considered to meet in all time periods. Looking at the breakdown of this statistic by area in each time period the performance is between 95% and 100%, with Leicester City, South Leicestershire and the SRN all having one screenline failure each in the AM Peak, and no failures in the other time periods.

11.3.7 In summary Table 11.2 shows that the highway assigned flows within Leicestershire produce a good fit against observed data at a screenline level.

11.3.8 Table 11.3 shows the screenline performance in the PRTM area after matrix estimation in the three modelled hours, across both calibration and validation counts. For each modelled hour two statistics are given: firstly the aggregate difference between observed and modelled flows across all screenlines; and secondly the percentage of screenlines that pass the criteria set out in Table 3.2. This analysis is based on total vehicle flows, with the performance by vehicle type detailed in Appendix A.

Table 11.3: PRTM Area Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
West Midlands	-4.3%	73%	-3.4%	82%	-4.7%	73%
East Midlands	0.8%	88%	-0.3%	88%	0.3%	88%
East of England	-4.5%	50%	-5.7%	50%	-5.8%	50%
West of England	-0.8%	100%	-1.0%	100%	-0.4%	100%
PRTM Area	***-2.4%***	***81%***	***-2.3%***	***84%***	***-2.9%***	***81%***

11.3.9 Screenline performance in the PRTM area is not as good as in Leicestershire as would be expected. The failures in the West Midlands are in areas remote from Leicestershire (Herefordshire and Gloucestershire) and are unlikely to affect results in Leicestershire. In the East Midlands and West of England the screenline performance is good. The screenline performance for the East of England is only 50% however this equates to two out of only four screenlines passing. Given their distance from the area of detailed modelled, and the presence of well performing screenlines in between, this is not of concern.

11.3.10 As well as overall statistics, TAG states that both calibration and validation sets should be presented. Table 11.4 shows the performance of calibration screenlines in Leicestershire and in each district. Across Leicestershire, 99% of screenlines meet the criteria in each of the peak hours. In aggregate terms there is the same traffic in the model compared with observed data except in the AM Peak which has slightly less traffic in the model.

Table 11.4: Leicestershire Calibration Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	-1.0%	97%	0.1%	100%	0.2%	97%
North Leicestershire	-0.1%	100%	0.0%	100%	0.3%	100%
North-East Leicestershire	0.1%	100%	0.4%	100%	0.4%	100%
South Leicestershire	0.1%	96%	-0.2%	100%	0.2%	100%
South-West Leicestershire	0.4%	100%	0.2%	100%	0.3%	100%
North-West Leicestershire	0.1%	100%	-0.2%	100%	0.3%	100%
Countywide	0.3%	100%	0.6%	100%	0.1%	100%
SRN (Internal)	-0.6%	100%	0.0%	100%	-0.3%	100%
Leicestershire	***-0.4%***	***99%***	***0.1%***	***100%***	***0.1%***	***99%***

11.3.11 The minor AM Peak failures seen in the combined calibration and validation results in Table 11.2 are also seen in the calibration screenline results in Table 11.4 for Leicester City and South Leicestershire.

11.3.12 All counts, except those individual counts retained as validation counts on the SRN, are calibration. Therefore independent validation only refers to these validation counts, grouped by road number. The overall performance in Leicestershire is good, with 90% passing in the AM Peak, 100% passing in the PM Peak, and 100% passing in the Interpeak. The performance of validation screenlines in Leicestershire and each district is shown in Table 11.5.

Table 11.5: Leicestershire Validation Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	-	-	-	-	-	-
North Leicestershire	-	-	-	-	-	-
North-East Leicestershire	-	-	-	-	-	-
South Leicestershire	-	-	-	-	-	-
South-West Leicestershire	-	-	-	-	-	-
North-West Leicestershire	-	-	-	-	-	-
Countywide	-	-	-	-	-	-
SRN (Internal)	-0.8%	90%	1.0%	100%	-1.1%	100%
Leicestershire	***-0.8%***	***90%***	***1.0%***	***100%***	***-1.1%***	***100%***

Link Flow Performance

11.3.13 Based on the same definitions of sub-areas within Leicestershire, Table 11.6 shows the percentages of links that pass the ‘flow’ or ‘GEH’ criteria defined within TAG (see Table 3.3) in the three modelled hours, based on total vehicle flows, across both calibration and validation counts.

Table 11.6 : Leicestershire Link Flow Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	84%	83%	94%	93%	86%	86%
North Leicestershire	87%	86%	93%	93%	82%	81%
North-East Leicestershire	99%	99%	98%	98%	93%	93%
South Leicestershire	90%	89%	95%	95%	90%	90%
South-West Leicestershire	89%	88%	98%	98%	87%	86%
North-West Leicestershire	96%	96%	98%	98%	90%	90%
Countywide	90%	89%	98%	97%	88%	87%
SRN (Internal)	97%	97%	100%	100%	97%	97%
Leicestershire	***89%***	***89%***	***96%***	***96%***	***88%***	***88%***

11.3.14 TAG guidelines are that 85% or more of individual counts meet the ‘flow’ or ‘GEH’ criteria within the model. From Table 11.6, 89%, 96% and 88% of individual counts meet the ‘flow’ criteria or the ‘GEH’ criteria in the AM Peak, Interpeak and PM Peak hours respectively.

11.3.15 Considering the breakdown in this performance by sub-area within Leicestershire, the 85% criterion for links within the ‘flow’ or ‘GEH’ criteria is met for all sub-areas except for Leicester City in the AM Peak and North Leicestershire in the PM Peak. As with the performance of screenlines by area, this test is beyond TAG requirements and is presented to provide an indication of the performance of the model in different areas within Leicestershire. Nevertheless, the performance in these weaker areas is close to the overall model-wide standards specified by TAG.

11.3.16 The PRTM area link flow results for the areas surrounding Leicestershire, across both calibration and validation counts, are shown in Table 11.7 and are generally good with at least 83% pass rate in all three time periods.

Table 11.7: PRTM Area Link Flow Performance (Total Vehicle Flows)

Area	AM Peak Hour		Interpeak Hour		PM Peak Hour	
	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)
West Midlands	83%	82%	85%	85%	85%	84%
East Midlands	94%	94%	96%	95%	96%	95%
East of England	86%	86%	82%	82%	86%	86%
West of England	100%	100%	100%	100%	100%	100%
PRTM Area	***90%***	***90%***	***91%***	***91%***	***91%***	***91%***

11.3.17 As required by TAG, these statistics are also presented separately for calibration data sets in Table 11.8, and for validation data set in Table 11.9.

Table 11.8: Leicestershire Calibration Link Flow Performance (Total Vehicle Flows)

Area	AM Peak Hour		Interpeak Hour		PM Peak Hour	
	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)
Leicester City	84%	83%	94%	93%	86%	86%
North Leicestershire	87%	86%	93%	93%	82%	81%
North-East Leicestershire	99%	99%	98%	98%	93%	93%
South Leicestershire	90%	89%	95%	95%	90%	90%
South-West Leicestershire	89%	88%	98%	98%	87%	86%
North-West Leicestershire	96%	96%	98%	98%	90%	90%
Countywide	90%	89%	98%	97%	88%	87%
SRN (Internal)	98%	98%	100%	100%	100%	100%
Leicestershire	***89%***	***88%***	***96%***	***95%***	***88%***	***87%***

Table 11.9: Leicestershire Validation Link Flow Performance (Total Vehicle Flows)

Area	AM Peak Hour		Interpeak Hour		PM Peak Hour	
	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)	%Links (including 95% C.I.)	%Links (including 95% C.I., excluding duplicates)
Leicester City	-	-	-	-	-	-
North Leicestershire	-	-	-	-	-	-
North-East Leicestershire	-	-	-	-	-	-
South Leicestershire	-	-	-	-	-	-
South-West Leicestershire	-	-	-	-	-	-
North-West Leicestershire	-	-	-	-	-	-
Countywide	-	-	-	-	-	-
SRN (Internal)	97%	97%	100%	100%	93%	93%
Leicestershire	**97%**	**97%**	**100%**	**100%**	***93%***	***93%***

11.3.18 For calibration screenlines in Leicestershire 87% or more of individual counts meet the 'flow' or 'GEH' criteria in the AM Peak and PM Peak hours and 95% in the Interpeak. This is a strong performance and the percentage of link flows passing being over 85% in every district except Leicester City in the AM Peak and North Leicestershire in the PM Peak illustrates the strong performance of the model as a whole and in individual geographies when considering calibration data.

11.3.19 In the validation results there are 97%, 100% and 90% of individual counts that meet the 'flow' or 'GEH' criteria in the AM Peak, Interpeak and PM Peak respectively. Considering this is validation data and TAG requires 85% of links to pass, this is further demonstration of the quality of this highway model. Further, the similarity between the level of performance presented for calibration data and validation data for the whole model suggests that the achievement of TAG criteria is not a result of calibration data 'fitting' the model.

11.3.20 As required within TAG, the link flow performance for car-only traffic, excluding LGV and HGV demand, has also been reported. These results are given in Table 11.10 and show that there is little difference between the link performance with all vehicle types and car traffic only, both in terms of overall performance and performance by sub-area within Leicestershire. The car-only performance statistics tend to be marginally better than the total vehicle flow statistics as expected as the major vehicle with more availability of data.

Table 11.10: Leicestershire Link Flow Performance (Car Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	85%	85%	94%	94%	88%	87%
North Leicestershire	91%	90%	93%	93%	84%	82%
North-East Leicestershire	97%	96%	98%	98%	96%	95%
South Leicestershire	92%	91%	99%	98%	91%	91%
South-West Leicestershire	93%	92%	99%	99%	89%	88%
North-West Leicestershire	97%	98%	100%	100%	91%	91%
Countywide	95%	94%	99%	99%	91%	89%
SRN (Internal)	97%	97%	100%	100%	97%	97%
Leicestershire	***91%***	***91%***	***97%***	***97%***	***90%***	***89%***

11.3.21 For completeness, the same link flow performance data are provided for LGV and HGV in Table 11.11 and Table 11.12 below; these statistics reflect the TAG flow criteria set out in Table 3.3, and hence the active criterion is "*Individual flows within 100 veh/hr of counts for flows less than 700 veh/hr*"; as HGV and LGV flows tend to be low relative to car. The reported statistics are consequently higher than those in Table 11.10.

Table 11.11: Leicestershire Link Flow Performance (LGV Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	100%	100%	100%	100%	100%	100%
North Leicestershire	100%	100%	100%	100%	100%	100%
North-East Leicestershire	100%	100%	100%	100%	100%	100%
South Leicestershire	100%	100%	100%	100%	100%	100%
South-West Leicestershire	100%	100%	100%	100%	100%	100%
North-West Leicestershire	100%	100%	100%	100%	100%	100%
Countywide	100%	100%	100%	100%	100%	100%
SRN (Internal)	100%	100%	100%	100%	100%	100%
Leicestershire	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

Table 11.12: Leicestershire Link Flow Performance (HGV Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	100%	100%	100%	100%	100%	100%
North Leicestershire	100%	100%	100%	100%	100%	100%
North-East Leicestershire	100%	100%	100%	100%	100%	100%
South Leicestershire	100%	100%	100%	100%	100%	100%
South-West Leicestershire	100%	100%	100%	100%	100%	100%
North-West Leicestershire	100%	100%	100%	100%	100%	100%
Countywide	100%	100%	100%	100%	100%	100%
SRN (Internal)	99%	99%	96%	96%	100%	100%
Leicestershire	**100%**	**100%**	**100%**	**100%**	**100%**	**100%**

11.3.22 The PRTM area link flow performances are shown for car, LGV and HGV in Table 11.13, Table 11.14 and Table 11.15 respectively. The performance is similar to that in Leicestershire. The flow totals are also included and show flows to be at a reasonable total level. The relatively low West Midlands HGV flow shown in Table 11.15 relates to areas to the south and west of the Birmingham conurbation and are unlikely to have an impact on the Leicestershire area.

Table 11.13: PRTM Area Link Flow Performance and Flow Totals (Car)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**
West Midlands	84%	-4.5%	92%	-3.1%	88%	-4.2%
East Midlands	96%	0.8%	96%	-0.2%	96%	0.0%
East of England	91%	-4.1%	86%	-6.2%	86%	-6.0%
West of England	100%	-0.8%	100%	-1.3%	100%	-0.5%
PRTM Area	***91%***	***-2.4%***	***94%***	***-2.2%***	***93%***	***-2.7%***

Table 11.14 : PRTM Area Link Flow Performance and Flow Totals (LGV)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**
West Midlands	97%	1.5%	100%	1.1%	99%	-0.4%
East Midlands	99%	0.8%	99%	-0.3%	99%	0.9%
East of England	100%	-8.9%	100%	-7.7%	100%	-8.1%
West of England	100%	-0.6%	100%	-0.1%	100%	0.0%
PRTM Area	***99%***	***0.5%***	***100%***	***0.0%***	***99%***	***-0.5%***

Table 11.15: PRTM Area Link Flow Performance and Flow Totals (HGV)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**	**%Links no C.I.**	**Total%**
West Midlands	91%	-8.7%	91%	-7.6%	88%	-12.6%
East Midlands	99%	0.8%	98%	-0.7%	99%	2.2%
East of England	100%	-2.8%	100%	-2.1%	100%	-1.9%
West of England	100%	-0.9%	100%	-0.2%	100%	-0.1%
PRTM Area	***96%***	***-5.3%***	***96%***	***-5.0%***	***95%***	***-7.4%***

Journey Time Validation

11.3.23 The final measure against which to assess the assignment performance is the journey time validation. The TAG guidelines for comparing modelled journey times with observed data are detailed in Table 3.4. Table 11.16 gives the performance of the highway assignment in the three modelled hours broken down by sub-area and for the SRN routes within Leicestershire, with overall totals for all journey time routes in Leicestershire. The SRN routes within the simulation network included in the journey time validation are the M1, M69, M42 / A42, M6, A46, A5, A453, A1, A50, A52 and the A14. In addition it presents SRN routes external to Leicestershire and routes in the PRTM area grouped into the West Midlands, the East Midlands and the South West.

11.3.24 In addition to the 15% threshold discussed above, 95% confidence intervals were also calculated using the journey time data, but these result in identical statistics to those presented in Table 11.16 below, and so are not presented separately.

Table 11.16: Journey Time Validation Summary

Area	No. of Routes	AM %Pass	IP %Pass	PM %Pass
Leicester City	32	94%	81%	91%
North Leicestershire	18	83%	94%	83%
North-East Leicestershire	12	92%	100%	100%
South Leicestershire	18	100%	100%	94%
South-West Leicestershire	24	100%	100%	92%
North-West Leicestershire	24	96%	100%	100%
SRN (Internal)	10	100%	100%	100%
Leicestershire	**138**	**95%**	**95%**	**93%**
SRN (External)	12	83%	100%	92%
East Midlands	10	100%	100%	100%
South West	6	100%	100%	100%
West Midlands	32	100%	100%	94%

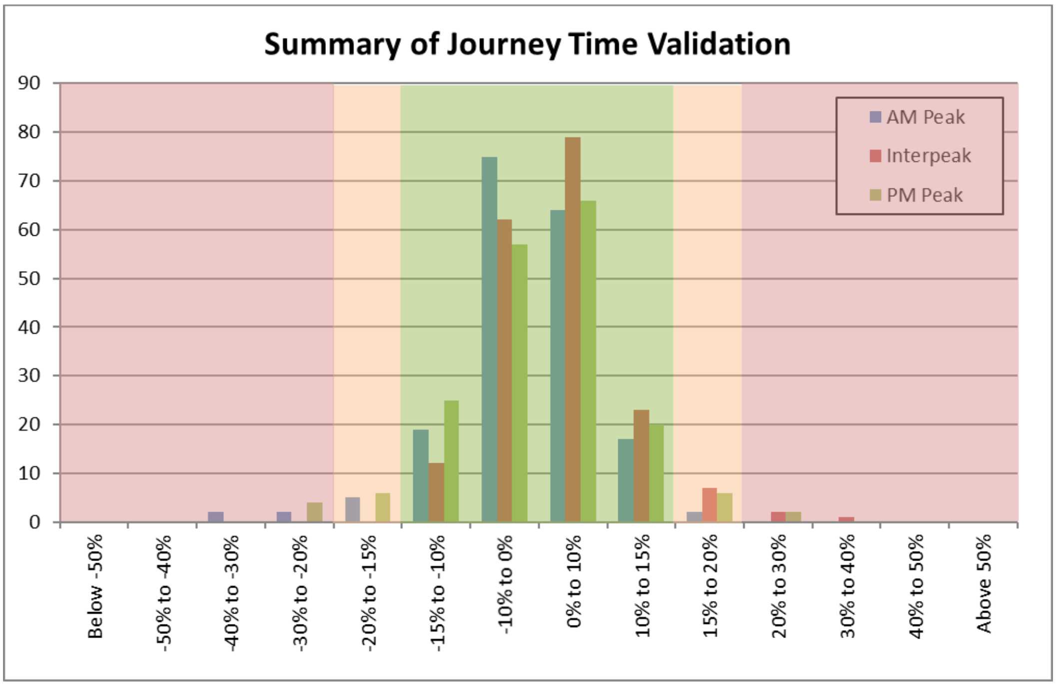
11.3.25 Table 11.16 shows for the journey time routes defined in Leicestershire, 95%, 95% and 93% of these routes meet TAG criteria for the AM Peak, Interpeak and PM Peak, respectively. These are all above the 85% of journey time routes set out in TAG Unit M3.1 and therefore demonstrate that the model performs well against observed journey time data in Leicestershire.

11.3.26 Table 11.16 also shows that for the journey time routes defined in the PRTM area, at least 95% meet TAG criteria in the AM Peak, Interpeak and PM Peak respectively.

11.3.27 In order to assess if there is any bias in the modelled journey times in comparison with the observed data (for example, that the model is generally slower or faster than the observed data), Figure 11.1 shows the distribution of journey time validation results in the three modelled hours.

11.3.28 In this figure the area shaded green represents those journey times that fall within the TAG criteria of ±15%, the orange area shows those that marginally fail to meet this criterion but are within ±20%, with the red shaded areas being those journey time routes outside ±20% of the observed data.

Figure 11.1: Distribution of Journey Time Validation Results



11.3.29 From Figure 11.1 it can be seen that the majority of journey time routes fall within the green shaded area, as reported in Table 11.16, with a limited number of routes outside ±20% of the observed data. This figure also shows that the journey time validation results are broadly evenly distributed about the centre value of matching the observed journey time data. The performance of the Interpeak model implies that the fixed speeds and speed flow curves used in the model are broadly unbiased.

12.

12. Summary of Model Development, Standards Achieved and Suitability for Use

12.1 Introduction

12.1.1 The preceding sections of this report detail the development of the highway model, the definition and derivation of the observed data used to assess the model, the calibration process adopted, and the results of this calibration process assessed against standards defined in TAG. This section summarises these processes and results, and assesses the model performance against TAG guidelines in light of the known and expected applications of the model.

12.2 Summary of Model Development

12.2.1 This version of the PRTM highway model is an updated version of PRTM, drawing on versions of PRTM recently updated for other applications and additional validation data added in Leicester City as part of the previous Leicester City JAQU recalibration.

12.2.2 Updates to the base year model as part of the PRTM Update task include:

- Improvements to the journey time performance of the M69/M1 J21 junction.
- Corrections to network coding identified in a review of the network around the proposed M1 J20a site.
- A large number of network changes as part of general model calibration.
- Adoption of development zones 9049-9056 as part of the proposed Whetstone Pastures development.
- Review of M6 Toll representation.
- Introduction of counts around M69/M1 J21 and to support the model applications at Isley Walton and Padge Hall Farm.
- Corrections to network coding as identified by LCC in their snagging lists.
- Corrections to network coding to address LCC observations in Loughborough area.
- Adjustments to the matrix in Loughborough town centre and Castle Donington.
- Incorporating edits from the Melton Mowbray Distributor Road Full Business Case model improvement task.
- Setting most counts to calibration.

12.3 Summary of Standards Achieved

12.3.1 Based on the approach outlined above the resulting highway model can be assessed against the acceptability guidelines detailed in TAG Unit M3.1 (and in Section 3.2 within this report). These acceptability guidelines can be broken down into two main areas: those that relate to the assignment results in terms of modelled flows and journey times; and those that relate to the changes made to the prior matrices through the process of matrix estimation.

12.3.2 Whether or not these acceptability guidelines are met by a given model does not determine whether a model is ‘suitable for use’. As stated in TAG Unit M3.1 §3.4.2:

"The achievement of the validation acceptability guidelines specified in Table 1, Table 2 and Table 3 does not guarantee that a model is 'fit for purpose' and likewise a failure to meet the specified validation standards does not mean that a model is not 'fit for purpose'.

12.3.3 With this in mind Table 12.1 summarises the results of the model calibration against the acceptability guidelines set out in TAG Unit M3.1. This gives details of the model assignment performance in terms of flows on screenlines and at individual locations, and the journey time validation within the key area of Leicestershire and the SRN. Also included in this table are the changes made to the prior matrices due to matrix estimation. This analysis has been undertaken on the whole matrix, excluding intrazonal, and including external-to-external demand.

Table 12.1: Summary of Model Performance against TAG Guidelines

<table>
<tr><th></th><th colspan="2">Measure</th><th>TAG</th><th>AM Peak</th><th>Interpeak</th><th>PM Peak</th></tr>
<tr><td rowspan="3">Assignment Performance</td><td colspan="2">Screenline</td><td>All or nearly all</td><td>98%</td><td>100%</td><td>99%</td></tr>
<tr><td colspan="2">'Flow'</td><td>>85%</td><td>89%</td><td>96%</td><td>88%</td></tr>
<tr><td colspan="2">Journey Times</td><td>>85%</td><td>95%</td><td>95%</td><td>93%</td></tr>
<tr><td rowspan="7">Matrix Changes</td><td rowspan="2">Zonal</td><td>R^2</td><td>>0.95</td><td>1.00</td><td>1.00</td><td>1.00</td></tr>
<tr><td>Slope</td><td>0.98 – 1.02</td><td>1.00</td><td>1.00</td><td>1.00</td></tr>
<tr><td rowspan="2">Trip-end</td><td>R^2</td><td>>0.98</td><td>1.00</td><td>1.00</td><td>1.00</td></tr>
<tr><td>Slope</td><td>0.99 – 1.01</td><td>1.00</td><td>1.00</td><td>1.00</td></tr>
<tr><td rowspan="2">Trip length</td><td>Mean</td><td><5%</td><td>0.0%</td><td>0.2%</td><td>0.0%</td></tr>
<tr><td>St. Dev.</td><td><5%</td><td>0.3%</td><td>0.5%</td><td>0.3%</td></tr>
<tr><td colspan="2">Sector Movements</td><td><5% (or 250 veh)</td><td>92%</td><td>95%</td><td>91%</td></tr>
</table>

12.3.4 The assignment performance results detailed in Table 12.1 show that more than most screenlines meet TAG guidelines in each of the three modelled hours, with the individual flow performance above the 85% criterion. The percentage of journey times that meet TAG guidelines is significantly above the 85% criterion in each of the three modelled hours.

12.3.5 The matrix change acceptability guidelines, in terms of changes to individual cell values, matrix trip-ends and the trip length distributions, are all reached within this version of the highway model. It should be noted that the inclusion of the large external-to-external movements, which are generally unaltered by matrix estimation, tends to move the matrix change analysis towards slopes and R^2 values towards 1. No advice is given in TAG as to the removal of these movements from this analysis.

12.3.6 The changes to the prior matrix at a sector level due to matrix estimation show that there are a limited number of sector movements that do not meet TAG guidelines, although these are generally either intra-sector movements (which were not observed as part of the matrix development) or external movements where there is a greater level of uncertainty.

12.4 Summary of Suitability of Use

12.4.1 Based on the results detailed in Table 12.1, the PRTM highway model meets and generally exceeds TAG acceptability guidelines for all measures.

Appendix A – Detailed Screenline Performance

Table A1: Detailed Screenline Performance – AM Peak Hour

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Leicestershire Cordon Inbound	100	35,925	36,051	127	0%	27,961	27,920	-41	0%	4,845	4,876	31	1%	3,156	3,256	100	3%
Leicestershire Cordon Inbound (excluding SRN counts)	92	17,043	17,212	169	1%	14,122	14,183	61	0%	2,131	2,171	40	2%	827	858	31	4%
Leicestershire Cordon Outbound	100	35,926	36,010	84	0%	27,867	27,848	-19	0%	4,747	4,839	91	2%	3,347	3,323	-24	-1%
Leicestershire Cordon Outbound (excluding SRN counts)	92	16,741	16,902	161	1%	13,953	13,953	-1	0%	2,055	2,142	87	4%	768	807	40	5%
Leicestershire T-Line Northbound	46	22,223	22,138	-85	0%	18,331	18,188	-143	-1%	2,643	2,670	27	1%	1,273	1,280	8	1%
Leicestershire T-Line Northbound (excluding SRN counts)	45	16,782	16,626	-157	-1%	14,372	14,197	-175	-1%	1,958	1,948	-10	-1%	475	480	5	1%
Leicestershire T-Line Southbound	46	22,028	22,060	31	0%	18,119	18,025	-94	-1%	2,653	2,658	5	0%	1,280	1,376	96	8%
Leicestershire T-Line Southbound (excluding SRN counts)	45	15,773	15,725	-48	0%	13,517	13,399	-118	-1%	1,857	1,857	-0	0%	422	469	47	11%
Leicestershire S-Line Eastbound	24	21,657	21,478	-179	-1%	17,344	17,165	-179	-1%	2,790	2,808	18	1%	1,532	1,506	-27	-2%
Leicestershire S-Line Eastbound (excluding SRN counts)	21	14,609	14,217	-392	-3%	12,339	11,985	-355	-3%	1,825	1,812	-13	-1%	454	420	-33	-7%
Leicestershire S-Line Westbound	24	21,277	20,927	-351	-2%	17,378	17,053	-326	-2%	2,619	2,599	-20	-1%	1,289	1,275	-14	-1%
Leicestershire S-Line Westbound (excluding SRN counts)	21	14,463	14,247	-217	-1%	12,375	12,169	-205	-2%	1,671	1,661	-11	-1%	426	417	-10	-2%
M1 Screenline Eastbound	42	23,498	23,739	241	1%	19,032	19,222	190	1%	2,982	3,046	64	2%	1,501	1,471	-29	-2%
M1 Screenline Eastbound (excluding SRN counts)	39	18,933	19,213	279	1%	15,775	16,013	238	2%	2,354	2,409	54	2%	821	791	-30	-4%
M1 Screenline Westbound	42	23,081	22,885	-196	-1%	18,465	18,272	-193	-1%	2,986	2,986	1	0%	1,647	1,627	-20	-1%
M1 Screenline Westbound (excluding SRN counts)	39	17,548	17,330	-218	-1%	14,496	14,240	-256	-2%	2,218	2,210	-8	0%	850	880	30	4%
Leicester City Inner Cordon Inbound	14	4,293	4,238	-55	-1%	3,796	3,722	-75	-2%	483	489	6	1%	26	28	2	8%
Leicester City Inner Cordon Outbound	22	3,363	3,093	-270	-8%	2,973	2,709	-264	-9%	378	365	-13	-3%	32	19	-13	-42%
Leicester City Middle Cordon (A563) Inbound	49	23,174	22,597	-577	-2%	19,840	19,172	-668	-3%	2,701	2,680	-21	-1%	661	745	84	13%
Leicester City Middle Cordon (A563) Outbound	49	19,115	18,910	-205	-1%	16,337	16,085	-252	-2%	2,235	2,241	6	0%	571	584	13	2%
Leicester City Outer Cordon Inbound	40	30,400	30,310	-90	0%	24,130	24,021	-109	0%	3,810	3,833	23	1%	2,476	2,455	-21	-1%
Leicester City Outer Cordon Inbound (excluding SRN counts)	36	18,191	18,253	62	0%	15,254	15,271	18	0%	2,201	2,233	32	1%	753	749	-4	0%
Leicester City Outer Cordon Outbound	41	25,830	26,268	438	2%	20,112	20,433	320	2%	3,342	3,461	119	4%	2,394	2,375	-19	-1%
Leicester City Outer Cordon Outbound (excluding SRN counts)	37	13,553	13,809	256	2%	11,259	11,464	205	2%	1,739	1,779	40	2%	573	566	-7	-1%
Leicester City North-South Screenline (Beaumont Leys) Eastbound	8	3,027	2,958	-69	-2%	2,609	2,537	-73	-3%	347	346	-1	0%	76	75	-0	0%
Leicester City North-South Screenline (Beaumont Leys) Westbound	8	4,456	4,350	-106	-2%	3,841	3,720	-121	-3%	511	505	-7	-1%	109	126	17	15%
Leicester City North-South Screenline (Railway) Eastbound	4	2,200	2,105	-96	-4%	1,902	1,816	-86	-5%	250	245	-5	-2%	50	44	-6	-12%
Leicester City North-South Screenline (Railway) Westbound	4	2,412	2,410	-2	0%	2,084	2,078	-6	0%	273	277	3	1%	56	55	-1	-2%
Western Leicester S-Line Eastbound	4	2,019	1,983	-36	-2%	1,705	1,702	-3	0%	241	239	-2	-1%	73	43	-30	-42%
Western Leicester S-Line Westbound	4	1,591	1,548	-43	-3%	1,338	1,323	-15	-1%	190	190	-0	0%	63	35	-28	-44%
Northern Leicester T-Line Northbound	5	2,109	2,126	17	1%	1,765	1,782	16	1%	253	254	1	0%	91	90	-0	0%
Northern Leicester T-Line Southbound	5	3,839	3,819	-20	-1%	3,229	3,204	-25	-1%	459	463	3	1%	150	153	2	1%
Glen Parva East-West Northbound	3	3,659	3,683	23	1%	2,932	2,953	21	1%	451	457	6	1%	277	273	-4	-1%
Glen Parva East-West Southbound	3	2,819	2,818	-1	0%	2,258	2,253	-5	0%	347	351	4	1%	213	213	0	0%
Southern Leicester T-line Northbound	9	4,587	4,483	-105	-2%	3,728	3,626	-102	-3%	560	556	-4	-1%	299	300	1	0%
Southern Leicester T-line Southbound	9	3,207	3,164	-42	-1%	2,584	2,541	-43	-2%	393	394	0	0%	229	230	1	0%
Fosse Park Individual Counts Calibration Inbound	3	2,364	2,317	-48	-2%	1,944	1,900	-45	-2%	287	286	-1	0%	133	131	-2	-2%
Fosse Park Individual Counts Calibration Outbound	3	1,705	1,647	-59	-3%	1,397	1,346	-52	-4%	207	204	-3	-1%	101	97	-4	-4%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Fosse Park Individual Counts Validation Inbound	2	3,823	3,847	25	1%	3,063	3,088	26	1%	471	478	7	1%	289	281	-8	-3%
Fosse Park Individual Counts Validation Outbound	2	3,467	3,428	-39	-1%	2,778	2,755	-23	-1%	427	414	-13	-3%	262	259	-4	-1%
Inner City Individual Counts Calibration Clockwise	3	5,565	5,487	-79	-1%	4,459	4,400	-58	-1%	686	688	2	0%	421	398	-23	-5%
Inner City Individual Counts Calibration Anti-Clockwise	3	5,712	5,372	-340	-6%	4,576	4,266	-310	-7%	704	687	-17	-2%	432	419	-13	-3%
Inner City Individual Counts Validation Clockwise	2	4,332	4,296	-36	-1%	3,471	3,430	-40	-1%	534	540	6	1%	327	326	-1	0%
Inner City Individual Counts Validation Anti-Clockwise	2	4,264	4,218	-46	-1%	3,416	3,372	-45	-1%	525	533	7	1%	322	314	-9	-3%
Saint Matthews Individual Counts Calibration Inbound	2	2,134	2,170	36	2%	1,710	1,727	17	1%	263	278	15	6%	161	165	3	2%
Saint Matthews Individual Counts Calibration Outbound	2	1,431	1,395	-35	-2%	1,146	1,111	-35	-3%	176	177	1	0%	108	108	-0	0%
Loughborough Cordon Inbound	8	6,742	6,716	-26	0%	5,570	5,573	3	0%	837	838	1	0%	338	305	-32	-10%
Loughborough Cordon Outbound	8	4,123	4,175	52	1%	3,435	3,447	12	0%	507	504	-2	0%	184	224	40	22%
Loughborough North-South Screenline (Epinal Way) Eastbound	8	3,728	3,707	-21	-1%	3,260	3,263	4	0%	382	382	-0	0%	87	62	-25	-29%
Loughborough North-South Screenline (Epinal Way) Westbound	8	2,562	2,541	-21	-1%	2,161	2,160	-1	0%	310	311	0	0%	93	71	-22	-23%
Loughborough North-South Screenline (A6) Eastbound	7	3,483	3,497	14	0%	2,972	2,985	13	0%	397	399	2	0%	114	113	-1	-1%
Loughborough North-South Screenline (A6) Westbound	6	2,769	2,780	11	0%	2,343	2,351	8	0%	319	320	1	0%	108	110	2	2%
Loughborough East-West Screenline (Ashby Rd) Northbound	6	2,449	2,448	-2	0%	2,095	2,096	1	0%	281	275	-6	-2%	76	77	1	2%
Loughborough East-West Screenline (Ashby Rd) Southbound	6	2,971	2,964	-6	0%	2,537	2,534	-3	0%	341	337	-4	-1%	94	93	-2	-2%
Shepshed Cordon Inbound	5	1,075	1,080	6	1%	923	926	3	0%	134	134	-0	0%	21	21	0	0%
Shepshed Cordon Outbound	5	1,298	1,304	6	0%	1,116	1,118	2	0%	162	162	-0	0%	24	24	0	2%
Melton Mowbray Cordon Inbound	11	3,235	3,227	-8	0%	2,581	2,577	-4	0%	440	438	-3	-1%	216	213	-3	-1%
Melton Mowbray Cordon Outbound	11	3,054	3,005	-48	-2%	2,409	2,378	-32	-1%	450	432	-19	-4%	195	196	1	0%
Melton Mowbray North-South Screenline (Nottingham Rd) Eastbound	4	1,044	1,079	36	3%	890	894	4	0%	120	121	1	1%	36	64	28	77%
Melton Mowbray North-South Screenline (Nottingham Rd) Westbound	5	1,430	1,431	1	0%	1,218	1,220	1	0%	165	165	-0	0%	50	47	-3	-6%
Melton Mowbray North-South Screenline (Dalby Rd) Eastbound	4	1,107	1,118	11	1%	954	954	-0	0%	127	126	-0	0%	30	38	8	28%
Melton Mowbray North-South Screenline (Dalby Rd) Westbound	4	944	958	14	2%	810	804	-7	-1%	108	109	1	1%	28	45	17	62%
Melton Mowbray East-West Screenline (River) Northbound	2	1,554	1,558	4	0%	1,265	1,271	6	0%	197	197	-1	0%	91	90	-1	-1%
Melton Mowbray East-West Screenline (River) Southbound	2	1,494	1,504	11	1%	1,181	1,190	9	1%	217	218	1	0%	95	97	1	2%
Melton Mowbray East-West Screenline (South) Northbound	7	1,846	1,876	30	2%	1,563	1,570	7	0%	216	216	0	0%	71	90	19	27%
Melton Mowbray East-West Screenline (South) Southbound	7	1,716	1,758	42	2%	1,446	1,458	12	1%	202	204	2	1%	72	96	24	34%
Melton Mowbray East-West Screenline (North) Northbound	5	1,031	1,040	9	1%	880	881	1	0%	119	118	-1	-1%	36	41	6	16%
Melton Mowbray East-West Screenline (North) Southbound	5	1,759	1,754	-5	0%	1,510	1,512	3	0%	202	194	-8	-4%	50	47	-3	-7%
Market Harborough Cordon Inbound	9	2,724	2,642	-82	-3%	2,270	2,181	-89	-4%	329	331	2	1%	125	130	5	4%
Market Harborough Cordon Outbound	9	2,425	2,298	-126	-5%	2,006	1,880	-126	-6%	298	298	-0	0%	121	120	-1	-1%
Market Harborough North-South Screenline (Leicester Rd) Eastbound	7	1,730	1,694	-36	-2%	1,481	1,452	-29	-2%	196	190	-6	-3%	53	51	-2	-4%
Market Harborough North-South Screenline (Leicester Rd) Westbound	7	1,538	1,489	-48	-3%	1,318	1,279	-39	-3%	174	164	-10	-6%	46	46	-0	0%
Market Harborough North-South Screenline (Railway) Eastbound	2	826	818	-8	-1%	704	697	-7	-1%	94	94	-0	0%	28	28	-0	-1%
Market Harborough North-South Screenline (Railway) Westbound	2	795	797	2	0%	678	681	3	0%	91	90	-1	-1%	27	27	-0	0%
Market Harborough East-West Screenline (A4304) Northbound	9	1,351	1,351	-0	0%	1,155	1,156	1	0%	153	153	-0	0%	43	41	-2	-4%
Market Harborough East-West Screenline (A4304) Southbound	8	1,239	1,244	5	0%	1,060	1,064	4	0%	141	141	0	0%	40	38	-1	-3%
Lutterworth Cordon Inbound	8	4,108	4,222	114	3%	3,286	3,377	91	3%	462	467	6	1%	363	377	14	4%
Lutterworth Cordon Outbound	8	3,813	3,872	59	2%	2,762	2,945	182	7%	485	484	-1	0%	569	444	-125	-22%
Lutterworth North-South Screenline Eastbound	5	970	985	15	2%	854	863	10	1%	116	117	1	1%	5	5	0	0%

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Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Lutterworth North-South Screenline Westbound	5	923	931	8	1%	811	817	6	1%	112	113	1	1%	5	1	-4	-80%
Lutterworth East-West Screenline Northbound	2	1,067	1,061	-6	-1%	869	891	22	3%	135	137	1	1%	64	33	-31	-48%
Lutterworth East-West Screenline Southbound	2	1,385	1,425	40	3%	1,151	1,162	11	1%	175	174	-1	-1%	59	89	29	50%
Hinckley Outer Cordon Inbound	14	5,342	5,356	14	0%	4,565	4,577	12	0%	630	632	2	0%	148	148	-0	0%
Hinckley Outer Cordon Outbound	14	5,485	5,496	11	0%	4,654	4,657	3	0%	675	677	2	0%	157	162	5	3%
Hinckley Inner Cordon Inbound	9	4,591	4,607	16	0%	4,010	4,024	14	0%	506	509	3	1%	77	75	-2	-3%
Hinckley Inner Cordon Outbound	9	3,235	3,253	18	1%	2,783	2,799	16	1%	395	397	3	1%	59	57	-3	-5%
Hinckley North-South Screenline (South) Eastbound	5	821	823	2	0%	716	723	7	1%	91	90	-1	-1%	15	10	-5	-31%
Hinckley North-South Screenline (South) Westbound	5	820	828	8	1%	714	723	8	1%	91	91	-0	0%	15	14	-0	-3%
Hinckley East-West Screenline (South) Northbound	6	1,492	1,507	15	1%	1,300	1,314	14	1%	165	165	-0	0%	27	28	0	2%
Hinckley East-West Screenline (South) Southbound	6	1,710	1,727	17	1%	1,490	1,502	12	1%	189	190	0	0%	31	35	4	12%
Barwell Cordon Inbound	8	1,477	1,404	-74	-5%	1,284	1,218	-66	-5%	186	177	-10	-5%	14	10	-4	-29%
Barwell Cordon Outbound	8	1,901	1,878	-23	-1%	1,650	1,628	-22	-1%	240	237	-3	-1%	17	13	-4	-22%
Earl Shilton Cordon Inbound	7	907	933	26	3%	792	812	20	3%	115	116	1	1%	7	4	-3	-40%
Earl Shilton Cordon Outbound	7	1,361	1,391	30	2%	1,188	1,212	24	2%	173	174	2	1%	7	4	-3	-42%
Coalville-Whitwick Cordon Inbound	19	7,160	7,166	6	0%	5,873	5,888	15	0%	946	948	2	0%	347	330	-18	-5%
Coalville-Whitwick Cordon Outbound	19	5,888	5,914	26	0%	4,840	4,869	29	1%	794	793	-1	0%	260	252	-8	-3%
Coalville Inner Cordon Inbound	8	2,128	2,134	6	0%	1,834	1,842	9	0%	265	264	-0	0%	33	27	-6	-18%
Coalville Inner Cordon Outbound	8	2,176	2,175	-2	0%	1,866	1,874	8	0%	277	276	-1	0%	36	24	-11	-32%
Coalville East-West Screenline (A511) Northbound	4	1,353	1,355	2	0%	1,196	1,194	-2	0%	158	157	-1	0%	4	4	-0	-9%
Coalville East-West Screenline (A511) Southbound	4	1,742	1,743	2	0%	1,536	1,535	-1	0%	206	205	-1	0%	4	3	-1	-19%
Ibstock Cordon Inbound	5	1,673	1,668	-4	0%	1,404	1,401	-4	0%	212	210	-1	-1%	59	57	-2	-3%
Ibstock Cordon Outbound	5	1,992	1,990	-2	0%	1,663	1,660	-3	0%	252	252	0	0%	80	78	-2	-3%
Ashby Cordon Inbound	8	2,355	2,356	1	0%	2,060	2,054	-6	0%	284	285	1	0%	18	18	-0	-1%
Ashby Cordon Outbound	8	2,211	2,183	-29	-1%	1,936	1,899	-36	-2%	268	269	1	0%	15	14	-0	-2%
Ashby North-South Screenline (Smisby Rd) Eastbound	5	1,441	1,450	8	1%	1,279	1,283	4	0%	163	162	-1	0%	5	5	-0	0%
Ashby North-South Screenline (Smisby Rd) Westbound	5	1,002	1,007	4	0%	889	890	1	0%	113	112	-1	-1%	5	5	-0	0%
Ashby East-West Screenline (Burton Rd) Northbound	2	308	315	7	2%	273	278	4	2%	35	35	0	1%	2	2	-0	-1%
Ashby East-West Screenline (Burton Rd) Southbound	2	426	428	2	0%	378	378	0	0%	48	48	-0	-1%	2	2	-0	0%
Ashby East-West Screenline (Railway) Northbound	3	1,092	1,093	1	0%	969	969	-0	0%	123	123	-0	0%	3	1	-2	-53%
Ashby East-West Screenline (Railway) Southbound	3	846	849	2	0%	751	751	0	0%	95	96	0	0%	3	2	-1	-40%
Melton Borough A606 Screenline North-Eastbound	11	1,280	1,211	-70	-5%	1,047	995	-52	-5%	163	144	-20	-12%	74	72	-2	-2%
Melton Borough A606 Screenline South-Westbound	11	1,180	1,185	5	0%	979	982	3	0%	147	147	-1	0%	57	56	-1	-2%
Melton-Charnwood North-South Screenline Eastbound	12	4,335	4,340	5	0%	3,535	3,532	-3	0%	575	574	-1	0%	235	234	-1	0%
Melton-Charnwood North-South Screenline Eastbound (excluding SRN counts)	11	2,989	3,007	18	1%	2,539	2,548	10	0%	379	378	-1	0%	81	81	-1	-1%
Melton-Charnwood North-South Screenline Westbound	12	4,788	4,800	13	0%	3,892	3,894	2	0%	652	655	3	0%	253	252	-1	-1%
Melton-Charnwood North-South Screenline Westbound (excluding SRN counts)	11	2,900	2,904	4	0%	2,444	2,437	-8	0%	367	370	3	1%	98	97	-1	-1%
Harborough District North-South Screenline (A5199) Eastbound	7	1,306	1,305	-2	0%	1,103	1,094	-8	-1%	165	163	-2	-1%	43	48	5	11%
Harborough District North-South Screenline (A5199) Westbound	7	1,844	1,863	19	1%	1,552	1,566	15	1%	232	233	0	0%	64	64	-0	0%

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Harborough District North-South Screenline (Great Glen) Eastbound	4	1,165	1,189	24	2%	961	978	17	2%	147	147	-1	0%	59	64	5	9%
Harborough District North-South Screenline (Great Glen) Westbound	4	1,189	1,213	24	2%	966	988	22	2%	151	153	2	1%	76	72	-3	-4%
Harborough District East-West Screenline Northbound	18	9,990	9,847	-144	-1%	7,752	7,594	-157	-2%	1,247	1,231	-16	-1%	998	1,021	23	2%
Harborough District East-West Screenline Northbound (excluding SRN counts)	16	4,255	4,338	83	2%	3,582	3,644	62	2%	505	505	-0	0%	174	189	15	8%
Harborough District East-West Screenline Southbound	18	10,668	10,978	310	3%	8,072	8,292	220	3%	1,384	1,455	71	5%	1,218	1,231	13	1%
Harborough District East-West Screenline Southbound (excluding SRN counts)	16	4,602	4,615	13	0%	3,776	3,774	-2	0%	618	614	-4	-1%	213	227	13	6%
Hinckley-NW Leics Screenline North-Eastbound	10	3,736	3,732	-4	0%	2,829	2,822	-7	0%	468	468	1	0%	446	442	-4	-1%
Hinckley-NW Leics Screenline North-Eastbound (excluding SRN counts)	9	1,433	1,441	8	1%	1,212	1,219	7	1%	180	179	-1	0%	47	43	-4	-8%
Hinckley-NW Leics Screenline South-Westbound	10	3,939	3,956	17	0%	3,060	3,070	10	0%	500	498	-2	0%	385	388	3	1%
Hinckley-NW Leics Screenline South-Westbound (excluding SRN counts)	9	1,857	1,880	22	1%	1,562	1,578	16	1%	233	232	-2	-1%	67	70	3	4%
Nuneaton Cordon Inbound	14	5,887	5,916	29	0%	4,878	4,891	13	0%	730	730	1	0%	279	294	15	5%
Nuneaton Cordon Outbound	14	6,670	6,686	17	0%	5,550	5,552	2	0%	828	827	-1	0%	292	307	15	5%
Northern Rugby Screenline Northbound	4	2,244	2,260	16	1%	1,833	1,849	16	1%	281	281	0	0%	129	129	-0	0%
Northern Rugby Screenline Southbound	4	2,612	2,616	4	0%	2,126	2,124	-2	0%	328	334	7	2%	158	158	-0	0%
Tamworth Counts Northbound	3	672	671	-1	0%	548	545	-3	-1%	84	85	1	1%	40	41	1	3%
Tamworth Counts Southbound	3	1,234	1,231	-3	0%	1,007	1,003	-4	0%	155	156	1	1%	73	73	0	0%
Burton Counts Eastbound	2	1,267	1,268	1	0%	1,009	1,009	0	0%	160	161	1	0%	98	98	1	1%
Burton Counts Westbound	2	1,519	1,521	2	0%	1,209	1,212	3	0%	192	192	-0	0%	117	117	0	0%
Nottingham Counts Northbound	4	3,868	3,896	28	1%	3,094	3,118	24	1%	500	503	4	1%	274	274	0	0%
Nottingham Counts Southbound	4	4,213	4,247	34	1%	3,393	3,427	34	1%	552	550	-2	0%	268	270	1	1%
M1 Calibration Northbound	6	18,839	18,478	-362	-2%	13,521	13,183	-338	-2%	2,471	2,462	-9	0%	2,847	2,832	-15	-1%
M1 Calibration Southbound	5	19,536	19,844	308	2%	13,673	13,967	294	2%	2,517	2,544	28	1%	3,346	3,333	-14	0%
M1 Validation Northbound	4	17,759	18,074	315	2%	12,817	12,912	95	1%	2,243	2,384	141	6%	2,699	2,778	79	3%
M1 Validation Southbound	4	19,499	19,926	427	2%	13,923	14,170	246	2%	2,433	2,562	129	5%	3,143	3,194	52	2%
M69 Calibration Northbound	3	5,424	5,073	-352	-6%	4,202	3,864	-339	-8%	765	739	-26	-3%	457	470	13	3%
M69 Calibration Southbound	2	5,684	5,745	61	1%	4,414	4,424	9	0%	800	850	50	6%	470	471	1	0%
M69 Validation Northbound	1	1,970	1,991	21	1%	1,459	1,453	-6	0%	269	281	13	5%	242	256	14	6%
M69 Validation Southbound	1	2,495	2,429	-67	-3%	1,778	1,773	-5	0%	327	382	54	17%	390	274	-116	-30%
M42-A42 Calibration Northbound	3	6,739	6,639	-99	-1%	4,842	4,741	-101	-2%	833	835	2	0%	1,064	1,063	-1	0%
M42-A42 Calibration Southbound	3	6,506	6,408	-99	-2%	4,639	4,617	-22	0%	791	790	-1	0%	1,077	1,001	-76	-7%
M42-A42 Validation Northbound	3	7,241	6,870	-371	-5%	5,174	4,865	-309	-6%	882	832	-50	-6%	1,185	1,173	-12	-1%
M42-A42 Validation Southbound	3	6,867	6,493	-374	-5%	4,948	4,561	-387	-8%	839	787	-52	-6%	1,080	1,145	65	6%
A46 Calibration Northbound	4	7,425	7,367	-58	-1%	5,476	5,393	-83	-2%	1,119	1,131	12	1%	830	843	13	2%
A46 Calibration Southbound	4	9,269	9,325	55	1%	6,962	7,006	45	1%	1,431	1,441	10	1%	877	877	1	0%
A46 Validation Northbound	3	5,875	5,635	-240	-4%	4,363	4,116	-247	-6%	858	863	4	1%	654	656	2	0%
A46 Validation Southbound	3	7,780	7,754	-25	0%	5,952	5,936	-16	0%	1,171	1,147	-24	-2%	656	671	15	2%
A5 Calibration North-Westbound	5	5,756	5,756	-0	0%	4,149	4,147	-2	0%	1,029	1,028	-1	0%	579	581	2	0%
A5 Calibration South-Eastbound	5	5,885	5,890	5	0%	4,209	4,212	3	0%	1,032	1,024	-8	-1%	644	653	9	1%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
A5 Validation North-Westbound	3	2,537	2,282	-255	-10%	1,696	1,541	-155	-9%	427	433	6	1%	414	308	-106	-26%
A5 Validation South-Eastbound	3	2,679	2,471	-208	-8%	1,827	1,693	-135	-7%	460	455	-5	-1%	392	323	-69	-18%
A453 Calibration North-Eastbound	2	1,476	1,433	-43	-3%	1,111	1,106	-5	0%	170	170	1	0%	195	157	-39	-20%
A453 Calibration South-Westbound	2	1,186	1,195	9	1%	898	905	7	1%	150	151	1	1%	138	138	0	0%
M6 Calibration Northbound	1	3,375	3,385	10	0%	2,320	2,331	11	0%	491	491	-0	0%	563	563	-0	0%
M6 Calibration Southbound	1	3,071	3,063	-9	0%	2,130	2,120	-10	0%	451	451	0	0%	491	492	1	0%
A50 Calibration North-Westbound	1	2,941	2,981	40	1%	2,191	2,229	38	2%	411	410	-1	0%	339	341	3	1%
A50 Calibration South-Eastbound	1	2,752	2,751	-1	0%	2,043	2,046	3	0%	383	381	-2	-1%	326	323	-2	-1%
A14 Calibration Eastbound	2	3,437	3,444	7	0%	2,345	2,351	6	0%	439	439	0	0%	653	654	1	0%
A14 Calibration Westbound	2	3,474	3,469	-5	0%	2,313	2,303	-9	0%	433	437	4	1%	729	729	-0	0%
A52 Calibration Eastbound	1	891	893	2	0%	672	676	5	1%	116	116	0	0%	104	101	-3	-3%
A52 Calibration Westbound	1	1,003	1,015	12	1%	768	775	8	1%	133	134	1	1%	103	105	3	2%
A1_East Midlands North-Eastbound	5	2,767	2,772	5	0%	2,118	2,124	6	0%	450	451	1	0%	199	198	-1	-1%
A1_East Midlands South-Westbound	5	2,106	2,100	-6	0%	1,550	1,544	-6	0%	371	371	-0	0%	185	185	0	0%
AD HOC_East Mids Eastbound	2	1,045	1,059	14	1%	842	856	14	2%	110	110	0	0%	93	93	0	0%
AD HOC_East Mids Northbound	2	3,795	3,718	-77	-2%	2,704	2,638	-66	-2%	417	417	0	0%	674	664	-10	-2%
AD HOC_East Mids Southbound	2	4,402	4,332	-71	-2%	3,105	3,127	22	1%	682	590	-92	-13%	615	614	-1	0%
AD HOC_East Mids Westbound	2	913	915	3	0%	731	733	3	0%	99	99	0	0%	83	83	-0	0%
AD HOC_North West Northbound	2	4,636	4,548	-88	-2%	3,019	2,954	-65	-2%	524	523	-1	0%	1,093	1,071	-22	-2%
AD HOC_North West Southbound	2	5,188	5,166	-22	0%	3,521	3,525	4	0%	675	656	-19	-3%	992	985	-7	-1%
AD HOC_West Mids Eastbound	17	18,651	17,355	-1,296	-7%	13,344	12,077	-1,267	-9%	2,642	2,580	-62	-2%	2,666	2,698	32	1%
AD HOC_West Mids Northbound	21	50,344	49,080	-1,263	-3%	35,368	34,825	-543	-2%	7,156	7,138	-18	0%	7,820	7,118	-702	-9%
AD HOC_West Mids Southbound	21	45,469	42,416	-3,053	-7%	30,139	29,032	-1,107	-4%	6,705	6,461	-244	-4%	8,624	6,923	-1,701	-20%
AD HOC_West Mids Westbound	16	17,862	16,117	-1,745	-10%	12,394	10,677	-1,718	-14%	2,824	2,938	114	4%	2,644	2,502	-142	-5%
Birmingham S Inbound	7	11,170	10,825	-345	-3%	9,039	8,609	-430	-5%	1,250	1,248	-2	0%	881	967	86	10%
Birmingham S Outbound	7	10,494	10,086	-407	-4%	8,240	7,686	-554	-7%	1,419	1,408	-10	-1%	835	993	157	19%
Corby_East Midlands North-Eastbound	9	3,839	3,830	-10	0%	3,351	3,349	-2	0%	149	162	13	9%	339	319	-20	-6%
Corby_East Midlands South-Westbound	9	3,381	3,320	-62	-2%	2,929	2,814	-116	-4%	155	186	31	20%	297	320	23	8%
Cotswolds NS Eastbound	3	1,560	1,548	-12	-1%	1,225	1,213	-12	-1%	180	180	-0	0%	155	155	-0	0%
Cotswolds NS Westbound	3	1,075	1,074	-1	0%	783	782	-1	0%	153	153	0	0%	139	139	0	0%
Coventry SW NESW North-Eastbound	3	1,367	1,371	4	0%	1,032	1,036	4	0%	280	280	-0	0%	55	55	0	0%
Coventry SW NESW South-Westbound	3	1,695	1,693	-2	0%	1,272	1,270	-2	0%	363	363	0	0%	60	60	0	0%
Daventry_East Midlands North-Eastbound	4	2,058	2,115	57	3%	1,768	1,811	43	2%	89	103	14	15%	201	201	-0	0%
Daventry_East Midlands South-Westbound	4	2,116	2,127	11	1%	1,883	1,884	2	0%	62	68	6	9%	171	174	3	2%
Gloucester NW Eastbound	2	2,034	1,853	-181	-9%	1,623	1,598	-26	-2%	232	234	2	1%	179	22	-157	-88%
Gloucester NW Westbound	2	1,421	1,084	-337	-24%	899	790	-108	-12%	275	275	-0	0%	247	19	-228	-92%
Herefordshire EW Northbound	3	2,228	2,152	-76	-3%	1,591	1,515	-76	-5%	305	305	0	0%	332	332	-0	0%
Herefordshire EW Southbound	3	1,902	1,919	17	1%	1,461	1,467	6	0%	214	225	11	5%	227	227	-0	0%
IS/12_East Midlands Northbound	3	1,925	1,924	-1	0%	1,243	1,241	-3	0%	234	235	1	1%	448	448	0	0%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
IS/12_East Midlands Southbound	3	2,422	2,415	-7	0%	1,498	1,493	-5	0%	379	379	-0	0%	545	543	-2	0%
Lichfield NS Eastbound	4	3,016	2,888	-127	-4%	2,199	2,051	-148	-7%	476	477	1	0%	341	360	19	6%
Lichfield NS Westbound	4	2,415	2,439	24	1%	1,702	1,678	-24	-1%	389	408	19	5%	324	353	29	9%
M6Toll_N Northbound	2	5,165	5,539	375	7%	3,709	3,648	-60	-2%	539	973	434	81%	917	918	1	0%
M6Toll_N Southbound	2	5,371	5,502	131	2%	3,815	3,797	-18	0%	450	608	158	35%	1,106	1,097	-9	-1%
M6Toll_S Northbound	2	6,243	6,234	-9	0%	4,222	4,210	-11	0%	940	942	2	0%	1,081	1,082	1	0%
M6Toll_S Southbound	2	7,026	7,012	-14	0%	4,805	4,791	-13	0%	1,067	1,065	-2	0%	1,154	1,155	1	0%
NE1_East Midlands Eastbound	6	3,282	3,576	294	9%	2,505	2,754	248	10%	506	543	37	7%	271	279	8	3%
NE1_East Midlands Westbound	6	3,697	3,979	282	8%	2,923	3,165	242	8%	489	521	32	7%	285	293	8	3%
Northampton_East Midlands North-Eastbound	7	5,372	5,223	-149	-3%	4,420	4,340	-80	-2%	572	573	1	0%	380	309	-71	-19%
Northampton_East Midlands South-Westbound	7	7,112	7,107	-5	0%	6,127	6,116	-12	0%	615	617	2	0%	370	375	5	1%
Nott_East Midlands North-Eastbound	7	6,323	6,914	591	9%	5,147	5,740	593	12%	545	625	80	15%	631	549	-82	-13%
Nott_East Midlands South-Westbound	7	7,585	8,076	491	6%	6,294	6,697	403	6%	556	639	83	15%	735	740	5	1%
Notts EW E Northbound	3	2,371	2,344	-27	-1%	1,754	1,757	3	0%	368	338	-30	-8%	249	249	-0	0%
Notts EW E Southbound	3	2,324	2,318	-6	0%	1,720	1,714	-6	0%	347	347	-0	0%	257	257	-0	0%
Notts EW W Northbound	5	3,643	3,520	-123	-3%	2,714	2,602	-113	-4%	489	478	-11	-2%	440	440	0	0%
Notts EW W Southbound	5	5,456	5,444	-12	0%	4,180	4,173	-8	0%	773	768	-5	-1%	503	504	1	0%
NW1_East Midlands Eastbound	5	1,826	1,880	54	3%	1,542	1,542	0	0%	165	200	35	21%	119	139	20	16%
NW1_East Midlands Westbound	5	1,978	2,013	34	2%	1,688	1,689	0	0%	169	203	34	20%	121	122	1	0%
NW2_East Midlands Eastbound	6	3,320	3,328	8	0%	2,513	2,521	8	0%	446	446	0	0%	361	361	-0	0%
NW2_East Midlands Westbound	6	3,007	3,003	-5	0%	2,257	2,253	-5	0%	454	454	-0	0%	296	296	0	0%
PRTM N Boundary E Mids Northbound	18	11,787	11,578	-209	-2%	8,967	8,695	-272	-3%	1,325	1,336	11	1%	1,497	1,547	50	3%
PRTM N Boundary E Mids Southbound	18	10,451	10,324	-127	-1%	7,922	7,912	-10	0%	1,359	1,231	-128	-9%	1,172	1,181	9	1%
PRTM S Boundary E Northbound	6	5,912	5,904	-8	0%	3,972	3,964	-8	0%	841	841	0	0%	1,099	1,099	0	0%
PRTM S Boundary E Southbound	6	7,442	7,439	-4	0%	5,257	5,254	-4	0%	1,009	1,009	-0	0%	1,176	1,176	-0	0%
PRTM S Boundary E Mids Northbound	5	5,486	5,493	7	0%	4,119	3,979	-140	-3%	817	817	0	0%	550	697	147	27%
PRTM S Boundary E Mids Southbound	5	6,247	6,308	61	1%	4,719	4,760	41	1%	785	788	3	0%	743	760	17	2%
PRTM S Boundary SE Northbound	5	4,436	4,096	-340	-8%	3,390	3,197	-193	-6%	487	378	-109	-22%	559	521	-38	-7%
PRTM S Boundary SE Southbound	5	5,802	5,086	-715	-12%	4,353	3,864	-488	-11%	780	612	-168	-22%	669	610	-59	-9%
PRTM S Boundary SW Northbound	8	7,156	7,076	-80	-1%	5,296	5,216	-80	-2%	1,103	1,103	-0	0%	757	757	-0	0%
PRTM S Boundary SW Southbound	8	7,636	7,627	-9	0%	5,755	5,748	-7	0%	1,091	1,091	0	0%	790	788	-2	0%
Warwickshire EW Northbound	5	2,166	2,051	-115	-5%	1,656	1,554	-102	-6%	327	330	3	1%	183	168	-15	-8%
Warwickshire EW Southbound	5	2,774	2,547	-227	-8%	2,165	1,971	-195	-9%	365	365	-0	0%	244	211	-33	-13%
Worcestershire NS Eastbound	3	2,576	2,578	2	0%	2,064	2,055	-9	0%	316	327	11	3%	196	196	0	0%
Worcestershire NS Westbound	3	2,076	2,012	-64	-3%	1,510	1,446	-64	-4%	271	271	0	0%	295	295	-0	0%

Table A2 : Detailed Screenline Performance – Average Interpeak hour

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Leicestershire Cordon Inbound	100	24,754	24,990	237	1%	17,868	17,899	32	0%	3,638	3,637	-2	0%	3,282	3,454	172	5%
Leicestershire Cordon Inbound (excluding SRN counts)	92	10,352	10,510	158	2%	8,116	8,158	42	1%	1,545	1,549	3	0%	726	803	78	11%
Leicestershire Cordon Outbound	100	24,714	24,795	81	0%	17,608	17,658	50	0%	3,579	3,598	20	1%	3,563	3,539	-24	-1%
Leicestershire Cordon Outbound (excluding SRN counts)	92	10,420	10,532	112	1%	8,174	8,201	27	0%	1,557	1,577	20	1%	724	754	31	4%
Leicestershire T-Line Northbound	46	16,076	16,229	153	1%	12,581	12,649	69	1%	2,096	2,096	-1	0%	1,423	1,484	61	4%
Leicestershire T-Line Northbound (excluding SRN counts)	45	11,709	11,863	154	1%	9,749	9,821	72	1%	1,545	1,544	-1	0%	439	498	60	14%
Leicestershire T-Line Southbound	46	15,379	15,570	191	1%	12,128	12,153	24	0%	2,027	2,026	-1	0%	1,247	1,392	145	12%
Leicestershire T-Line Southbound (excluding SRN counts)	45	11,131	11,235	105	1%	9,268	9,302	35	0%	1,469	1,469	-1	0%	417	464	47	11%
Leicestershire S-Line Eastbound	24	15,288	15,478	190	1%	11,742	11,922	180	2%	2,088	2,102	14	1%	1,468	1,454	-14	-1%
Leicestershire S-Line Eastbound (excluding SRN counts)	21	10,606	10,755	149	1%	8,716	8,858	141	2%	1,453	1,466	13	1%	446	432	-14	-3%
Leicestershire S-Line Westbound	24	15,774	15,597	-177	-1%	12,145	11,942	-203	-2%	2,165	2,162	-3	0%	1,473	1,494	21	1%
Leicestershire S-Line Westbound (excluding SRN counts)	21	10,901	10,733	-168	-2%	8,938	8,772	-167	-2%	1,494	1,500	5	0%	477	462	-15	-3%
M1 Screenline Eastbound	42	14,747	14,782	35	0%	11,068	11,063	-5	0%	2,136	2,135	-1	0%	1,560	1,583	23	2%
M1 Screenline Eastbound (excluding SRN counts)	39	11,180	11,220	39	0%	8,820	8,818	-2	0%	1,651	1,658	7	0%	726	743	17	2%
M1 Screenline Westbound	42	14,995	14,907	-89	-1%	11,233	11,197	-36	0%	2,171	2,178	7	0%	1,608	1,532	-77	-5%
M1 Screenline Westbound (excluding SRN counts)	39	11,276	11,248	-28	0%	8,891	8,846	-45	-1%	1,666	1,663	-3	0%	736	739	3	0%
Leicester City Inner Cordon Inbound	14	3,114	3,138	23	1%	2,727	2,743	16	1%	373	367	-6	-2%	27	27	1	2%
Leicester City Inner Cordon Outbound	22	3,564	3,414	-151	-4%	3,122	2,948	-174	-6%	427	443	15	4%	35	23	-11	-33%
Leicester City Middle Cordon (A563) Inbound	49	15,957	16,124	167	1%	13,266	13,350	84	1%	2,079	2,074	-5	0%	639	700	61	10%
Leicester City Middle Cordon (A563) Outbound	49	16,259	16,243	-16	0%	13,521	13,473	-48	0%	2,114	2,114	-1	0%	651	657	6	1%
Leicester City Outer Cordon Inbound	40	19,025	19,051	26	0%	13,848	13,813	-36	0%	2,700	2,691	-9	0%	2,494	2,548	54	2%
Leicester City Outer Cordon Inbound (excluding SRN counts)	36	10,060	10,086	26	0%	7,976	7,975	-1	0%	1,485	1,487	2	0%	615	624	8	1%
Leicester City Outer Cordon Outbound	41	19,191	19,272	80	0%	13,971	14,030	59	0%	2,703	2,714	11	0%	2,535	2,528	-7	0%
Leicester City Outer Cordon Outbound (excluding SRN counts)	37	10,285	10,331	45	0%	8,194	8,217	23	0%	1,505	1,516	10	1%	604	598	-6	-1%
Leicester City North-South Screenline (Beaumont Leys) Eastbound	8	2,869	2,867	-2	0%	2,401	2,390	-11	0%	369	371	2	1%	104	105	2	2%
Leicester City North-South Screenline (Beaumont Leys) Westbound	8	2,860	2,862	2	0%	2,405	2,394	-11	0%	366	364	-1	0%	95	104	9	10%
Leicester City North-South Screenline (Railway) Eastbound	4	1,838	1,843	5	0%	1,548	1,557	9	1%	231	233	2	1%	60	53	-7	-12%
Leicester City North-South Screenline (Railway) Westbound	4	1,826	1,808	-18	-1%	1,539	1,525	-15	-1%	229	228	-1	0%	60	55	-4	-7%
Western Leicester S-Line Eastbound	4	1,176	1,168	-8	-1%	950	974	24	3%	156	156	1	0%	71	38	-33	-46%
Western Leicester S-Line Westbound	4	1,185	1,168	-17	-1%	956	972	16	2%	157	157	0	0%	72	40	-33	-45%
Northern Leicester T-Line Northbound	5	2,346	2,362	16	1%	1,891	1,906	15	1%	311	312	1	0%	144	144	0	0%
Northern Leicester T-Line Southbound	5	2,347	2,354	7	0%	1,887	1,905	18	1%	311	312	1	0%	148	136	-12	-8%
Glen Parva East-West Northbound	3	2,315	2,313	-3	0%	1,755	1,753	-3	0%	316	315	-0	0%	244	245	0	0%
Glen Parva East-West Southbound	3	2,396	2,387	-9	0%	1,817	1,821	4	0%	327	327	0	0%	253	239	-14	-6%
Southern Leicester T-line Northbound	9	2,939	2,944	5	0%	2,243	2,249	7	0%	399	398	-1	0%	297	297	-0	0%
Southern Leicester T-line Southbound	9	3,440	3,389	-51	-1%	2,629	2,625	-4	0%	467	467	-0	0%	344	297	-47	-14%
Fosse Park Individual Counts Calibration Inbound	3	1,355	1,375	20	1%	1,064	1,085	21	2%	182	182	-0	0%	109	108	-1	-1%
Fosse Park Individual Counts Calibration Outbound	3	1,351	1,350	-1	0%	1,067	1,066	-1	0%	181	181	0	0%	104	103	-1	-1%
Fosse Park Individual Counts Validation Inbound	2	2,750	2,765	16	1%	2,085	2,118	33	2%	375	377	2	0%	290	271	-19	-7%
Fosse Park Individual Counts Validation Outbound	2	2,478	2,533	55	2%	1,879	1,931	53	3%	338	340	2	1%	261	261	0	0%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Inner City Individual Counts Calibration Clockwise	3	4,716	4,740	24	1%	3,575	3,592	17	0%	643	644	0	0%	497	504	7	1%
Inner City Individual Counts Calibration Anti-Clockwise	3	4,700	4,470	-230	-5%	3,563	3,369	-195	-5%	641	612	-29	-5%	496	490	-6	-1%
Inner City Individual Counts Validation Clockwise	2	3,756	3,781	25	1%	2,848	2,871	23	1%	512	513	1	0%	396	397	0	0%
Inner City Individual Counts Validation Anti-Clockwise	2	3,379	3,388	9	0%	2,562	2,574	12	0%	461	460	-1	0%	356	354	-2	-1%
Saint Matthews Individual Counts Calibration Inbound	2	1,524	1,537	12	1%	1,156	1,168	12	1%	208	209	1	1%	161	160	-1	-1%
Saint Matthews Individual Counts Calibration Outbound	2	1,674	1,677	3	0%	1,269	1,271	1	0%	228	230	1	1%	177	177	0	0%
Loughborough Cordon Inbound	8	3,441	3,462	21	1%	2,730	2,729	-1	0%	481	491	10	2%	232	242	11	5%
Loughborough Cordon Outbound	8	3,543	3,549	6	0%	2,813	2,814	1	0%	498	497	-1	0%	233	237	4	2%
Loughborough North-South Screenline (Epinal Way) Eastbound	8	2,419	2,393	-26	-1%	2,054	2,052	-2	0%	291	293	2	1%	77	49	-28	-36%
Loughborough North-South Screenline (Epinal Way) Westbound	8	2,492	2,475	-17	-1%	2,108	2,105	-2	0%	297	296	-1	0%	91	74	-17	-18%
Loughborough North-South Screenline (A6) Eastbound	7	2,342	2,333	-8	0%	1,935	1,928	-7	0%	302	300	-2	-1%	105	105	1	1%
Loughborough North-South Screenline (A6) Westbound	6	2,578	2,570	-9	0%	2,117	2,110	-7	0%	337	335	-1	0%	124	124	-0	0%
Loughborough East-West Screenline (Ashby Rd) Northbound	6	2,135	2,134	-0	0%	1,766	1,764	-2	0%	277	277	0	0%	94	93	-1	-1%
Loughborough East-West Screenline (Ashby Rd) Southbound	6	2,136	2,139	3	0%	1,766	1,766	1	0%	278	277	-1	0%	95	95	0	0%
Shepshed Cordon Inbound	5	933	936	3	0%	771	771	-0	0%	140	140	-0	0%	24	24	-0	0%
Shepshed Cordon Outbound	5	909	913	4	0%	750	751	1	0%	137	137	0	0%	25	25	0	0%
Melton Mowbray Cordon Inbound	11	2,125	2,138	13	1%	1,654	1,657	3	0%	305	306	1	0%	167	174	8	5%
Melton Mowbray Cordon Outbound	11	2,200	2,203	3	0%	1,692	1,695	3	0%	325	325	1	0%	184	183	-2	-1%
Melton Mowbray North-South Screenline (Nottingham Rd) Eastbound	4	930	943	13	1%	770	770	0	0%	122	122	0	0%	42	51	9	22%
Melton Mowbray North-South Screenline (Nottingham Rd) Westbound	5	1,231	1,232	1	0%	1,010	1,010	0	0%	162	162	-1	0%	61	60	-1	-2%
Melton Mowbray North-South Screenline (Dalby Rd) Eastbound	4	756	765	8	1%	632	631	-1	0%	98	97	-1	-1%	30	36	7	22%
Melton Mowbray North-South Screenline (Dalby Rd) Westbound	4	792	798	6	1%	660	660	0	0%	103	102	-1	-1%	33	36	4	11%
Melton Mowbray East-West Screenline (River) Northbound	2	1,192	1,190	-1	0%	962	961	-1	0%	151	150	-0	0%	79	79	0	0%
Melton Mowbray East-West Screenline (River) Southbound	2	1,301	1,303	1	0%	1,052	1,053	1	0%	172	172	-0	0%	77	77	0	0%
Melton Mowbray East-West Screenline (South) Northbound	7	1,277	1,291	14	1%	1,042	1,044	2	0%	169	168	-1	-1%	70	79	9	13%
Melton Mowbray East-West Screenline (South) Southbound	7	1,333	1,348	15	1%	1,091	1,095	4	0%	176	175	-1	-1%	70	79	9	13%
Melton Mowbray East-West Screenline (North) Northbound	5	1,138	1,137	-1	0%	945	943	-2	0%	148	148	0	0%	48	46	-1	-3%
Melton Mowbray East-West Screenline (North) Southbound	5	1,092	1,088	-4	0%	910	910	0	0%	141	140	-1	-1%	44	38	-6	-14%
Market Harborough Cordon Inbound	9	1,882	1,881	-1	0%	1,492	1,488	-4	0%	269	268	-1	0%	121	125	4	3%
Market Harborough Cordon Outbound	9	1,904	1,883	-21	-1%	1,511	1,483	-27	-2%	273	274	1	0%	120	126	6	5%
Market Harborough North-South Screenline (Leicester Rd) Eastbound	7	1,408	1,341	-68	-5%	1,172	1,116	-56	-5%	179	169	-10	-6%	58	56	-3	-4%
Market Harborough North-South Screenline (Leicester Rd) Westbound	7	1,234	1,136	-97	-8%	1,028	943	-84	-8%	157	145	-12	-8%	51	48	-2	-5%
Market Harborough North-South Screenline (Railway) Eastbound	2	651	651	1	0%	538	539	1	0%	84	84	0	0%	29	29	-0	0%
Market Harborough North-South Screenline (Railway) Westbound	2	641	643	2	0%	531	533	3	1%	82	82	-1	-1%	28	28	-0	0%
Market Harborough East-West Screenline (A4304) Northbound	9	1,154	1,158	3	0%	961	962	1	0%	147	147	0	0%	48	48	0	0%
Market Harborough East-West Screenline (A4304) Southbound	8	980	983	3	0%	818	818	0	0%	124	125	1	1%	40	40	0	0%
Lutterworth Cordon Inbound	8	2,487	2,489	2	0%	1,806	1,800	-6	0%	375	376	1	0%	309	313	4	1%
Lutterworth Cordon Outbound	8	2,442	2,460	18	1%	1,774	1,777	3	0%	335	348	13	4%	337	336	-1	0%
Lutterworth North-South Screenline Eastbound	5	644	650	7	1%	556	557	1	0%	88	88	0	0%	5	5	-0	0%
Lutterworth North-South Screenline Westbound	5	630	636	5	1%	544	545	1	0%	86	86	-0	0%	5	5	-0	-1%
Lutterworth East-West Screenline Northbound	2	818	809	-9	-1%	634	633	-1	0%	123	123	-0	0%	62	53	-9	-14%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Lutterworth East-West Screenline Southbound	2	738	739	2	0%	571	571	0	0%	111	111	0	0%	57	57	0	1%
Hinckley Outer Cordon Inbound	14	3,886	3,881	-5	0%	3,207	3,202	-5	0%	531	531	-0	0%	149	148	-1	-1%
Hinckley Outer Cordon Outbound	14	3,782	3,797	15	0%	3,128	3,126	-2	0%	513	514	1	0%	141	157	16	11%
Hinckley Inner Cordon Inbound	9	3,193	3,210	17	1%	2,755	2,773	17	1%	378	378	-0	0%	62	59	-2	-4%
Hinckley Inner Cordon Outbound	9	3,187	3,208	21	1%	2,749	2,768	19	1%	380	382	1	0%	60	59	-2	-3%
Hinckley North-South Screenline (South) Eastbound	5	581	579	-2	0%	501	501	0	0%	68	68	-0	0%	12	10	-2	-14%
Hinckley North-South Screenline (South) Westbound	5	567	569	1	0%	489	490	1	0%	67	67	-0	0%	12	12	-0	0%
Hinckley East-West Screenline (South) Northbound	6	1,083	1,094	10	1%	934	943	9	1%	128	128	1	0%	23	22	-0	-1%
Hinckley East-West Screenline (South) Southbound	6	1,044	1,052	8	1%	900	909	9	1%	123	122	-1	-1%	22	21	-1	-3%
Barwell Cordon Inbound	8	1,388	1,347	-40	-3%	1,165	1,128	-37	-3%	212	206	-6	-3%	17	14	-3	-20%
Barwell Cordon Outbound	8	1,355	1,308	-47	-3%	1,137	1,095	-42	-4%	207	200	-7	-3%	18	14	-4	-23%
Earl Shilton Cordon Inbound	7	880	882	2	0%	745	743	-2	0%	136	135	-1	0%	7	4	-3	-41%
Earl Shilton Cordon Outbound	7	853	857	4	0%	721	722	0	0%	131	131	-0	0%	7	4	-3	-42%
Coalville-Whitwick Cordon Inbound	19	4,096	4,082	-14	0%	3,206	3,196	-11	0%	623	622	-1	0%	273	265	-8	-3%
Coalville-Whitwick Cordon Outbound	19	4,153	4,147	-5	0%	3,247	3,238	-9	0%	635	637	2	0%	277	272	-5	-2%
Coalville Inner Cordon Inbound	8	1,862	1,818	-45	-2%	1,593	1,557	-35	-2%	240	239	-1	0%	32	21	-11	-33%
Coalville Inner Cordon Outbound	8	1,865	1,865	-0	0%	1,595	1,601	5	0%	241	241	0	0%	31	23	-8	-27%
Coalville East-West Screenline (A511) Northbound	4	1,178	1,181	3	0%	1,023	1,023	-1	0%	154	155	1	0%	4	3	-1	-22%
Coalville East-West Screenline (A511) Southbound	4	1,125	1,129	4	0%	978	977	-1	0%	147	148	1	1%	4	4	-0	-7%
Ibstock Cordon Inbound	5	1,098	1,094	-4	0%	874	870	-5	-1%	167	166	-1	0%	60	58	-2	-3%
Ibstock Cordon Outbound	5	1,067	1,063	-4	0%	850	846	-4	0%	162	161	-1	-1%	58	56	-2	-4%
Ashby Cordon Inbound	8	1,486	1,492	6	0%	1,273	1,272	-0	0%	205	205	-0	0%	15	15	0	0%
Ashby Cordon Outbound	8	1,514	1,521	7	0%	1,297	1,297	-0	0%	209	209	-0	0%	15	15	-0	0%
Ashby North-South Screenline (Smisby Rd) Eastbound	5	925	933	8	1%	814	816	2	0%	111	112	1	1%	5	5	-0	0%
Ashby North-South Screenline (Smisby Rd) Westbound	5	846	851	4	0%	745	745	-0	0%	102	101	-1	-1%	5	5	-0	0%
Ashby East-West Screenline (Burton Rd) Northbound	2	232	233	1	0%	205	204	-1	-1%	28	28	0	0%	2	2	-0	-1%
Ashby East-West Screenline (Burton Rd) Southbound	2	234	236	3	1%	205	206	1	0%	28	28	-0	0%	2	2	-0	0%
Ashby East-West Screenline (Railway) Northbound	3	564	561	-3	0%	496	491	-4	-1%	68	68	0	0%	3	1	-2	-51%
Ashby East-West Screenline (Railway) Southbound	3	588	587	-1	0%	518	514	-3	-1%	71	71	0	0%	3	2	-1	-43%
Melton Borough A606 Screenline North-Eastbound	11	808	808	-0	0%	642	641	-1	0%	112	112	-0	0%	58	55	-2	-4%
Melton Borough A606 Screenline South-Westbound	11	799	803	4	0%	641	634	-7	-1%	115	116	1	1%	47	53	6	13%
Melton-Charnwood North-South Screenline Eastbound	12	2,720	2,723	2	0%	2,068	2,062	-6	0%	412	412	-0	0%	251	249	-1	0%
Melton-Charnwood North-South Screenline Eastbound (excluding SRN counts)	11	1,798	1,801	3	0%	1,458	1,452	-5	0%	274	274	-1	0%	77	75	-1	-2%
Melton-Charnwood North-South Screenline Westbound	12	2,737	2,740	3	0%	2,114	2,107	-7	0%	420	421	1	0%	213	212	-1	-1%
Melton-Charnwood North-South Screenline Westbound (excluding SRN counts)	11	1,860	1,871	10	1%	1,506	1,507	1	0%	283	284	1	0%	81	80	-1	-2%
Harborough District North-South Screenline (A5199) Eastbound	7	785	782	-3	0%	628	620	-8	-1%	119	118	-1	-1%	42	44	2	5%
Harborough District North-South Screenline (A5199) Westbound	7	785	786	1	0%	629	627	-2	0%	119	118	-1	-1%	41	41	-0	-1%
Harborough District North-South Screenline (Great Glen) Eastbound	4	696	704	8	1%	541	542	2	0%	105	105	0	0%	54	56	3	5%
Harborough District North-South Screenline (Great Glen) Westbound	4	726	730	4	1%	557	558	1	0%	109	112	3	3%	63	60	-3	-5%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Harborough District East-West Screenline Northbound	18	7,233	7,223	-10	0%	5,059	5,010	-50	-1%	1,011	999	-12	-1%	1,169	1,214	45	4%
Harborough District East-West Screenline Northbound (excluding SRN counts)	16	2,789	2,804	15	1%	2,195	2,194	-1	0%	418	418	-0	0%	183	192	9	5%
Harborough District East-West Screenline Southbound	18	6,942	7,018	76	1%	4,840	4,893	52	1%	965	972	7	1%	1,143	1,153	10	1%
Harborough District East-West Screenline Southbound (excluding SRN counts)	16	2,682	2,701	19	1%	2,118	2,119	1	0%	399	399	0	0%	172	183	11	7%
Hinckley-NW Leics Screenline North-Eastbound	10	2,806	2,804	-2	0%	1,934	1,930	-3	0%	374	373	-0	0%	504	500	-4	-1%
Hinckley-NW Leics Screenline North-Eastbound (excluding SRN counts)	9	985	985	0	0%	789	786	-3	0%	149	149	0	0%	53	50	-3	-6%
Hinckley-NW Leics Screenline South-Westbound	10	2,703	2,709	7	0%	1,941	1,942	2	0%	375	374	-1	0%	393	393	0	0%
Hinckley-NW Leics Screenline South-Westbound (excluding SRN counts)	9	955	960	5	1%	767	768	0	0%	144	143	-1	-1%	50	50	-0	0%
Nuneaton Cordon Inbound	14	4,527	4,526	-1	0%	3,552	3,540	-12	0%	670	670	1	0%	305	316	10	3%
Nuneaton Cordon Outbound	14	4,435	4,467	32	1%	3,484	3,486	2	0%	656	657	1	0%	295	324	29	10%
Northern Rugby Screenline Northbound	4	1,428	1,421	-7	0%	1,101	1,094	-7	-1%	213	212	-0	0%	114	114	0	0%
Northern Rugby Screenline Southbound	4	1,370	1,372	2	0%	1,056	1,057	2	0%	204	204	0	0%	110	111	0	0%
Tamworth Counts Northbound	3	535	537	2	0%	411	418	7	2%	80	80	-0	0%	44	40	-5	-11%
Tamworth Counts Southbound	3	525	532	7	1%	403	410	6	2%	78	79	1	1%	43	44	0	0%
Burton Counts Eastbound	2	1,168	1,170	2	0%	872	874	2	0%	175	175	0	0%	121	121	-0	0%
Burton Counts Westbound	2	1,163	1,166	3	0%	869	871	2	0%	174	174	0	0%	120	121	0	0%
Nottingham Counts Northbound	4	2,977	2,974	-3	0%	2,276	2,275	-1	0%	423	421	-2	0%	278	278	-0	0%
Nottingham Counts Southbound	4	2,990	2,948	-42	-1%	2,293	2,276	-18	-1%	425	425	-0	0%	271	248	-24	-9%
M1 Calibration Northbound	6	15,766	15,695	-70	0%	10,218	10,143	-76	-1%	2,093	2,077	-16	-1%	3,455	3,476	21	1%
M1 Calibration Southbound	5	14,746	14,844	98	1%	9,540	9,629	89	1%	1,958	1,964	6	0%	3,248	3,252	3	0%
M1 Validation Northbound	4	14,980	15,394	414	3%	9,687	9,922	235	2%	1,911	1,985	74	4%	3,382	3,486	104	3%
M1 Validation Southbound	4	14,751	15,144	393	3%	9,664	9,914	250	3%	1,905	1,971	66	3%	3,181	3,258	77	2%
M69 Calibration Northbound	3	4,143	4,209	66	2%	2,962	2,955	-7	0%	650	647	-3	0%	531	607	76	14%
M69 Calibration Southbound	2	3,250	3,250	-0	0%	2,247	2,248	1	0%	492	492	0	0%	512	510	-2	0%
M69 Validation Northbound	1	1,534	1,530	-4	0%	1,023	989	-34	-3%	231	230	-1	-1%	280	311	31	11%
M69 Validation Southbound	1	1,470	1,424	-46	-3%	872	915	42	5%	197	213	16	8%	401	296	-105	-26%
M42-A42 Calibration Northbound	3	5,452	5,442	-10	0%	3,543	3,537	-6	0%	688	687	-1	0%	1,221	1,218	-3	0%
M42-A42 Calibration Southbound	3	5,266	5,193	-73	-1%	3,448	3,453	5	0%	660	660	0	0%	1,159	1,081	-78	-7%
M42-A42 Validation Northbound	3	5,895	5,816	-79	-1%	3,799	3,738	-62	-2%	724	696	-28	-4%	1,372	1,382	10	1%
M42-A42 Validation Southbound	3	5,612	5,535	-76	-1%	3,736	3,627	-109	-3%	712	662	-50	-7%	1,163	1,246	82	7%
A46 Calibration Northbound	4	4,977	4,960	-17	0%	3,322	3,302	-21	-1%	763	750	-13	-2%	892	909	17	2%
A46 Calibration Southbound	4	4,930	4,948	18	0%	3,329	3,350	21	1%	764	768	4	0%	838	830	-7	-1%
A46 Validation Northbound	3	4,051	4,015	-36	-1%	2,747	2,697	-50	-2%	619	612	-7	-1%	686	706	21	3%
A46 Validation Southbound	3	3,888	3,913	26	1%	2,661	2,681	20	1%	599	608	9	1%	628	625	-3	-1%
A5 Calibration North-Westbound	5	4,132	4,163	31	1%	2,823	2,815	-8	0%	679	680	1	0%	629	668	39	6%
A5 Calibration South-Eastbound	5	4,062	4,050	-11	0%	2,812	2,797	-15	-1%	678	678	0	0%	572	576	4	1%
A5 Validation North-Westbound	3	1,787	1,765	-21	-1%	1,147	1,160	13	1%	270	292	22	8%	370	313	-57	-15%
A5 Validation South-Eastbound	3	1,751	1,702	-50	-3%	1,141	1,168	27	2%	269	284	15	6%	341	250	-91	-27%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
A453 Calibration North-Eastbound	2	1,371	1,360	-11	-1%	976	974	-1	0%	165	165	0	0%	230	221	-10	-4%
A453 Calibration South-Westbound	2	1,072	1,070	-1	0%	757	757	-1	0%	136	136	-0	0%	178	177	-1	0%
M6 Calibration Northbound	1	2,712	2,713	1	0%	1,673	1,677	3	0%	399	405	6	1%	639	631	-8	-1%
M6 Calibration Southbound	1	2,574	2,587	13	1%	1,585	1,597	13	1%	378	378	0	0%	611	612	1	0%
A50 Calibration North-Westbound	1	1,806	1,805	-1	0%	1,209	1,207	-2	0%	252	251	-1	0%	345	347	2	1%
A50 Calibration South-Eastbound	1	1,702	1,708	5	0%	1,119	1,125	5	0%	234	234	1	0%	349	349	-1	0%
A14 Calibration Eastbound	2	2,742	2,745	3	0%	1,586	1,588	2	0%	326	325	-0	0%	830	832	1	0%
A14 Calibration Westbound	2	2,792	2,738	-54	-2%	1,666	1,605	-60	-4%	342	348	6	2%	784	784	-0	0%
A52 Calibration Eastbound	1	830	830	-0	0%	606	605	-0	0%	108	108	-0	0%	117	117	-0	0%
A52 Calibration Westbound	1	828	824	-5	-1%	598	593	-5	-1%	107	107	0	0%	124	123	-0	0%
A1_East Midlands North-Eastbound	5	1,854	1,843	-11	-1%	1,259	1,255	-4	0%	427	419	-8	-2%	168	170	2	1%
A1_East Midlands South-Westbound	5	1,703	1,703	0	0%	1,154	1,154	0	0%	392	392	0	0%	157	157	-0	0%
AD HOC_East Mids Eastbound	2	930	947	18	2%	754	775	21	3%	93	94	1	1%	82	79	-4	-4%
AD HOC_East Mids Northbound	2	3,893	3,809	-84	-2%	2,683	2,599	-84	-3%	436	432	-4	-1%	774	778	4	1%
AD HOC_East Mids Southbound	2	3,566	3,551	-15	0%	2,341	2,367	26	1%	534	493	-41	-8%	691	691	-0	0%
AD HOC_East Mids Westbound	2	886	887	1	0%	712	712	-1	0%	92	92	0	0%	82	83	1	2%
AD HOC_North West Northbound	2	4,640	4,630	-10	0%	2,905	2,898	-7	0%	571	569	-2	0%	1,164	1,163	-1	0%
AD HOC_North West Southbound	2	4,739	4,611	-128	-3%	3,112	2,993	-119	-4%	574	573	-1	0%	1,053	1,046	-7	-1%
AD HOC_West Mids Eastbound	17	14,838	14,331	-507	-3%	9,675	8,947	-728	-8%	2,326	2,399	73	3%	2,837	2,985	148	5%
AD HOC_West Mids Northbound	21	44,489	43,463	-1,026	-2%	29,159	28,968	-191	-1%	6,618	6,569	-49	-1%	8,712	7,926	-786	-9%
AD HOC_West Mids Southbound	21	41,830	39,043	-2,787	-7%	27,610	26,190	-1,420	-5%	5,770	5,764	-6	0%	8,450	7,088	-1,362	-16%
AD HOC_West Mids Westbound	16	13,417	12,949	-468	-3%	8,957	8,544	-412	-5%	2,107	2,131	25	1%	2,354	2,273	-80	-3%
Birmingham S Inbound	7	7,992	8,047	55	1%	5,843	5,827	-16	0%	1,158	1,159	0	0%	991	1,062	70	7%
Birmingham S Outbound	7	7,737	7,379	-358	-5%	5,885	5,441	-444	-8%	1,088	1,088	-1	0%	763	850	87	11%
Corby_East Midlands North-Eastbound	9	2,979	2,960	-19	-1%	2,540	2,533	-7	0%	136	144	8	6%	303	283	-20	-7%
Corby_East Midlands South-Westbound	9	3,063	2,907	-156	-5%	2,625	2,455	-170	-6%	133	142	9	6%	305	311	6	2%
Cotswolds NS Eastbound	3	1,202	1,200	-2	0%	888	886	-2	0%	156	155	-1	-1%	158	159	1	0%
Cotswolds NS Westbound	3	1,174	1,181	7	1%	862	869	7	1%	161	161	0	0%	151	151	-0	0%
Coventry SW NESW North-Eastbound	3	1,216	1,238	21	2%	919	941	21	2%	246	245	-1	0%	51	52	1	2%
Coventry SW NESW South-Westbound	3	1,090	1,082	-8	-1%	796	786	-10	-1%	248	250	2	1%	46	46	-0	0%
Daventry_East Midlands North-Eastbound	4	1,421	1,426	5	0%	1,173	1,165	-8	-1%	51	61	10	20%	197	200	3	2%
Daventry_East Midlands South-Westbound	4	1,429	1,423	-6	0%	1,195	1,183	-12	-1%	63	69	6	9%	171	171	-0	0%
Gloucester NW Eastbound	2	1,290	1,048	-242	-19%	858	841	-17	-2%	193	190	-3	-1%	239	17	-222	-93%
Gloucester NW Westbound	2	1,378	1,074	-304	-22%	934	846	-88	-9%	210	210	-0	0%	234	19	-215	-92%
Herefordshire EW Northbound	3	1,566	1,571	5	0%	1,107	1,112	5	0%	207	207	-	0%	252	252	0	0%
Herefordshire EW Southbound	3	1,562	1,574	12	1%	1,104	1,115	11	1%	205	205	-	0%	253	254	1	0%
IS/12_East Midlands Northbound	3	2,236	2,233	-3	0%	1,391	1,388	-3	0%	311	311	-0	0%	534	534	0	0%
IS/12_East Midlands Southbound	3	1,943	1,944	1	0%	1,210	1,211	1	0%	253	253	0	0%	480	480	0	0%
Lichfield NS Eastbound	4	2,156	1,981	-175	-8%	1,467	1,278	-189	-13%	356	357	1	0%	333	346	13	4%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Lichfield NS Westbound	4	2,168	2,192	24	1%	1,477	1,470	-7	0%	375	375	0	0%	316	347	31	10%
M6Toll_N Northbound	2	5,399	5,409	10	0%	3,830	3,718	-112	-3%	602	723	121	20%	967	968	1	0%
M6Toll_N Southbound	2	5,191	5,197	6	0%	3,482	3,377	-105	-3%	507	614	107	21%	1,202	1,206	4	0%
M6Toll_S Northbound	2	5,980	6,003	23	0%	3,585	3,609	24	1%	1,085	1,084	-1	0%	1,310	1,310	-0	0%
M6Toll_S Southbound	2	5,650	5,645	-5	0%	3,713	3,710	-3	0%	764	764	-0	0%	1,173	1,172	-1	0%
NE1_East Midlands Eastbound	6	2,632	2,786	154	6%	2,008	2,156	148	7%	391	393	2	0%	233	238	5	2%
NE1_East Midlands Westbound	6	2,870	2,957	88	3%	2,203	2,283	80	4%	425	425	-0	0%	241	250	8	3%
Northampton_East Midlands North-Eastbound	7	4,857	4,827	-30	-1%	3,922	3,921	-1	0%	531	531	-0	0%	404	375	-29	-7%
Northampton_East Midlands South-Westbound	7	4,523	4,348	-175	-4%	3,706	3,555	-151	-4%	489	490	1	0%	328	302	-26	-8%
Nott_East Midlands North-Eastbound	7	6,123	6,511	388	6%	4,869	5,373	504	10%	593	623	31	5%	661	514	-147	-22%
Nott_East Midlands South-Westbound	7	7,078	6,945	-133	-2%	5,748	5,779	31	1%	626	657	30	5%	704	510	-194	-28%
Notts EW E Northbound	3	1,498	1,498	0	0%	1,042	1,042	0	0%	227	227	-	0%	229	229	0	0%
Notts EW E Southbound	3	1,447	1,416	-31	-2%	1,014	983	-31	-3%	218	218	0	0%	215	215	-0	0%
Notts EW W Northbound	5	3,772	3,507	-265	-7%	2,740	2,476	-264	-10%	539	537	-2	0%	493	494	1	0%
Notts EW W Southbound	5	4,047	3,954	-93	-2%	3,140	3,054	-86	-3%	504	497	-7	-1%	403	403	-0	0%
NW1_East Midlands Eastbound	5	1,673	1,715	42	3%	1,399	1,400	1	0%	156	181	25	16%	118	134	16	14%
NW1_East Midlands Westbound	5	1,683	1,720	37	2%	1,418	1,416	-2	0%	154	181	28	18%	111	122	12	10%
NW2_East Midlands Eastbound	6	2,628	2,643	15	1%	1,834	1,849	15	1%	420	420	0	0%	374	374	-0	0%
NW2_East Midlands Westbound	6	2,702	2,701	-1	0%	1,946	1,945	-1	0%	434	434	-0	0%	322	323	1	0%
PRTM N Boundary E Mids Northbound	18	10,443	10,319	-124	-1%	7,664	7,527	-137	-2%	1,213	1,212	-1	0%	1,566	1,580	14	1%
PRTM N Boundary E Mids Southbound	18	9,030	8,851	-179	-2%	6,609	6,547	-62	-1%	1,281	1,156	-125	-10%	1,140	1,147	7	1%
PRTM S Boundary E Northbound	6	6,051	5,960	-91	-2%	3,942	3,871	-71	-2%	858	837	-21	-2%	1,251	1,251	0	0%
PRTM S Boundary E Southbound	6	5,517	5,517	-0	0%	3,601	3,601	-0	0%	748	748	-0	0%	1,168	1,168	0	0%
PRTM S Boundary E Mids Northbound	5	4,793	5,000	207	4%	3,265	3,265	0	0%	919	915	-4	0%	609	820	211	35%
PRTM S Boundary E Mids Southbound	5	4,531	4,609	78	2%	3,246	3,278	32	1%	604	605	1	0%	681	726	45	7%
PRTM S Boundary SE Northbound	5	4,849	4,182	-667	-14%	3,450	2,923	-527	-15%	655	554	-101	-15%	744	705	-39	-5%
PRTM S Boundary SE Southbound	5	4,276	3,861	-415	-10%	3,154	2,873	-281	-9%	539	444	-95	-18%	583	544	-39	-7%
PRTM S Boundary SW Northbound	8	6,537	6,536	-1	0%	4,798	4,797	-1	0%	952	951	-1	0%	787	788	1	0%
PRTM S Boundary SW Southbound	8	5,833	5,758	-75	-1%	4,365	4,290	-75	-2%	830	830	0	0%	638	638	-0	0%
Warwickshire EW Northbound	5	2,761	2,707	-53	-2%	2,066	2,065	-1	0%	419	419	0	0%	276	223	-52	-19%
Warwickshire EW Southbound	5	2,649	2,616	-33	-1%	1,984	2,016	32	2%	382	383	1	0%	283	217	-66	-23%
Worcestershire NS Eastbound	3	1,818	1,817	-1	0%	1,352	1,348	-4	0%	248	248	-0	0%	218	221	3	1%
Worcestershire NS Westbound	3	1,921	1,898	-23	-1%	1,305	1,282	-23	-2%	248	248	-0	0%	368	368	0	0%

Table A3: Detailed Screenline Performance – PM Peak hour

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Leicestershire Cordon Inbound	100	37,884	38,006	122	0%	32,203	32,204	0	0%	3,456	3,492	36	0%	2,272	2,310	38	5%
Leicestershire Cordon Inbound (excluding SRN counts)	92	17,733	17,909	177	1%	15,452	15,515	63	1%	1,810	1,845	35	0%	517	549	32	11%
Leicestershire Cordon Outbound	100	38,420	38,392	-29	0%	32,570	32,561	-9	0%	3,521	3,490	-31	1%	2,375	2,341	-35	-1%
Leicestershire Cordon Outbound (excluding SRN counts)	92	18,264	18,344	80	0%	15,867	15,915	48	0%	1,887	1,869	-18	1%	556	560	4	4%
Leicestershire T-Line Northbound	46	21,949	21,975	26	0%	19,171	19,136	-35	1%	1,949	1,952	3	0%	854	887	33	4%
Leicestershire T-Line Northbound (excluding SRN counts)	45	15,333	15,397	64	0%	13,721	13,722	1	1%	1,421	1,426	5	0%	216	249	34	14%
Leicestershire T-Line Southbound	46	21,962	22,091	129	1%	19,213	19,213	-0	0%	1,954	1,960	7	0%	819	918	99	12%
Leicestershire T-Line Southbound (excluding SRN counts)	45	16,399	16,474	75	0%	14,670	14,693	23	0%	1,514	1,519	5	0%	240	262	22	11%
Leicestershire S-Line Eastbound	24	21,366	21,259	-107	-1%	18,544	18,482	-63	2%	1,899	1,872	-27	1%	932	906	-27	-1%
Leicestershire S-Line Eastbound (excluding SRN counts)	21	14,527	14,483	-45	0%	12,947	12,928	-19	2%	1,376	1,351	-24	1%	214	204	-10	-3%
Leicestershire S-Line Westbound	24	22,802	23,019	218	1%	19,817	19,961	143	-2%	2,073	2,130	57	0%	921	929	8	1%
Leicestershire S-Line Westbound (excluding SRN counts)	21	15,318	15,570	251	2%	13,609	13,786	177	-2%	1,492	1,561	69	0%	227	223	-4	-3%
M1 Screenline Eastbound	42	24,247	23,915	-332	-1%	20,917	20,645	-272	0%	2,369	2,287	-81	0%	979	983	3	2%
M1 Screenline Eastbound (excluding SRN counts)	39	18,547	18,250	-297	-2%	16,157	15,929	-228	0%	1,941	1,859	-83	0%	467	463	-4	2%
M1 Screenline Westbound	42	23,635	24,304	669	3%	20,315	20,979	664	0%	2,329	2,352	23	0%	1,008	973	-35	-5%
M1 Screenline Westbound (excluding SRN counts)	39	18,849	19,481	632	3%	16,428	17,027	599	-1%	1,980	1,996	16	0%	459	458	-0	0%
Leicester City Inner Cordon Inbound	14	3,469	3,390	-78	-2%	3,172	3,092	-80	1%	292	283	-9	-2%	17	15	-2	2%
Leicester City Inner Cordon Outbound	22	4,519	4,528	10	0%	4,132	4,076	-56	-6%	381	431	50	4%	26	22	-4	-33%
Leicester City Middle Cordon (A563) Inbound	49	19,254	19,273	19	0%	17,225	17,168	-57	1%	1,754	1,771	17	0%	303	334	31	10%
Leicester City Middle Cordon (A563) Outbound	49	22,578	22,460	-118	-1%	20,160	19,999	-161	0%	2,072	2,072	0	0%	375	388	14	1%
Leicester City Outer Cordon Inbound	40	27,528	27,802	275	1%	23,310	23,528	218	0%	2,526	2,549	23	0%	1,710	1,726	16	2%
Leicester City Outer Cordon Inbound (excluding SRN counts)	36	14,808	14,917	109	1%	12,872	12,966	94	0%	1,564	1,567	4	0%	390	384	-7	1%
Leicester City Outer Cordon Outbound	41	30,721	30,797	76	0%	26,149	26,240	91	0%	2,791	2,823	31	0%	1,800	1,734	-67	0%
Leicester City Outer Cordon Outbound (excluding SRN counts)	37	17,851	18,065	214	1%	15,627	15,800	172	0%	1,823	1,853	30	1%	420	412	-9	-1%
Leicester City North-South Screenline (Beaumont Leys) Eastbound	8	3,903	3,904	1	0%	3,509	3,496	-13	0%	348	350	2	1%	51	58	8	2%
Leicester City North-South Screenline (Beaumont Leys) Westbound	8	3,452	3,389	-63	-2%	3,104	3,042	-62	0%	308	300	-7	0%	45	46	1	10%
Leicester City North-South Screenline (Railway) Eastbound	4	2,527	2,488	-39	-2%	2,276	2,242	-34	1%	223	221	-2	1%	30	25	-5	-12%
Leicester City North-South Screenline (Railway) Westbound	4	2,074	2,035	-39	-2%	1,870	1,833	-37	-1%	182	181	-1	0%	24	20	-3	-7%
Western Leicester S-Line Eastbound	4	1,580	1,541	-39	-2%	1,392	1,382	-10	3%	142	142	-1	0%	46	17	-29	-46%
Western Leicester S-Line Westbound	4	1,800	1,735	-65	-4%	1,590	1,560	-29	2%	162	158	-5	0%	48	17	-31	-45%
Northern Leicester T-Line Northbound	5	3,690	3,739	49	1%	3,252	3,300	48	1%	333	334	1	0%	105	105	0	0%
Northern Leicester T-Line Southbound	5	2,631	2,608	-23	-1%	2,317	2,300	-17	1%	237	238	1	0%	77	70	-6	-8%
Glen Parva East-West Northbound	3	2,858	2,973	115	4%	2,457	2,560	103	0%	259	269	10	0%	142	144	2	0%
Glen Parva East-West Southbound	3	3,393	3,373	-20	-1%	2,917	2,920	2	0%	308	312	4	0%	169	142	-27	-6%
Southern Leicester T-line Northbound	9	2,997	2,980	-17	-1%	2,583	2,566	-16	0%	271	270	-1	0%	143	144	1	0%
Southern Leicester T-line Southbound	9	5,185	5,079	-106	-2%	4,481	4,433	-47	0%	469	464	-6	0%	235	182	-53	-14%
Fosse Park Individual Counts Calibration Inbound	3	1,895	1,851	-44	-2%	1,646	1,606	-40	2%	171	171	-1	0%	78	75	-3	-1%
Fosse Park Individual Counts Calibration Outbound	3	2,123	2,100	-23	-1%	1,861	1,838	-22	0%	192	192	0	0%	70	69	-1	-1%
Fosse Park Individual Counts Validation Inbound	2	3,775	3,808	33	1%	3,245	3,287	41	2%	342	350	7	0%	187	171	-16	-7%
Fosse Park Individual Counts Validation Outbound	2	3,287	3,301	14	0%	2,826	2,869	43	3%	298	278	-20	1%	163	154	-9	0%

Screenline	# Counts	Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Inner City Individual Counts Calibration Clockwise	3	5,644	5,703	59	1%	4,852	4,901	49	0%	512	519	7	0%	280	283	3	1%
Inner City Individual Counts Calibration Anti-Clockwise	3	5,612	5,486	-125	-2%	4,824	4,703	-121	-5%	509	500	-9	-5%	279	283	4	-1%
Inner City Individual Counts Validation Clockwise	2	4,569	4,577	8	0%	3,928	3,941	13	1%	414	418	4	0%	227	217	-10	0%
Inner City Individual Counts Validation Anti-Clockwise	2	4,289	4,482	193	4%	3,687	3,868	181	0%	389	400	11	0%	213	214	1	-1%
Saint Matthews Individual Counts Calibration Inbound	2	1,480	1,507	27	2%	1,272	1,285	13	1%	134	144	10	1%	73	77	4	-1%
Saint Matthews Individual Counts Calibration Outbound	2	2,130	2,103	-27	-1%	1,831	1,808	-23	0%	193	191	-2	1%	106	104	-1	0%
Loughborough Cordon Inbound	8	4,529	4,568	39	1%	3,979	3,995	16	0%	444	455	11	2%	109	118	9	5%
Loughborough Cordon Outbound	8	6,317	6,318	1	0%	5,509	5,503	-6	0%	630	632	1	0%	179	183	4	2%
Loughborough North-South Screenline (Epinal Way) Eastbound	8	2,674	2,654	-20	-1%	2,447	2,442	-5	0%	196	188	-8	1%	34	24	-11	-36%
Loughborough North-South Screenline (Epinal Way) Westbound	8	3,062	3,093	31	1%	2,789	2,822	33	0%	232	237	5	0%	44	34	-10	-18%
Loughborough North-South Screenline (A6) Eastbound	7	2,620	2,624	4	0%	2,339	2,336	-3	0%	238	240	2	-1%	44	48	4	1%
Loughborough North-South Screenline (A6) Westbound	6	3,837	3,855	18	0%	3,425	3,437	12	0%	348	353	5	0%	64	64	0	0%
Loughborough East-West Screenline (Ashby Rd) Northbound	6	2,693	2,670	-22	-1%	2,409	2,388	-20	0%	243	240	-3	0%	42	42	-1	-1%
Loughborough East-West Screenline (Ashby Rd) Southbound	6	2,792	2,826	34	1%	2,499	2,528	29	0%	252	255	3	0%	43	43	0	0%
Shepshed Cordon Inbound	5	1,451	1,454	3	0%	1,289	1,290	2	0%	153	152	-1	0%	12	12	0	0%
Shepshed Cordon Outbound	5	1,220	1,217	-3	0%	1,084	1,080	-4	0%	129	127	-2	0%	11	10	-0	0%
Melton Mowbray Cordon Inbound	11	3,184	3,179	-5	0%	2,728	2,726	-2	0%	357	354	-3	0%	103	99	-4	5%
Melton Mowbray Cordon Outbound	11	2,920	2,922	2	0%	2,494	2,498	3	0%	313	315	2	0%	116	110	-7	-1%
Melton Mowbray North-South Screenline (Nottingham Rd) Eastbound	4	1,266	1,277	11	1%	1,136	1,133	-3	0%	114	114	0	0%	19	30	11	22%
Melton Mowbray North-South Screenline (Nottingham Rd) Westbound	5	1,556	1,569	13	1%	1,386	1,399	13	0%	143	140	-3	0%	30	30	-0	-2%
Melton Mowbray North-South Screenline (Dalby Rd) Eastbound	4	1,054	1,063	8	1%	947	942	-5	0%	94	94	-0	-1%	16	26	11	22%
Melton Mowbray North-South Screenline (Dalby Rd) Westbound	4	1,049	1,051	2	0%	942	941	-1	0%	94	93	-1	-1%	16	17	1	11%
Melton Mowbray East-West Screenline (River) Northbound	2	1,526	1,534	9	1%	1,315	1,324	8	0%	166	166	0	0%	45	45	0	0%
Melton Mowbray East-West Screenline (River) Southbound	2	1,686	1,703	18	1%	1,482	1,498	16	0%	169	170	1	0%	34	35	1	0%
Melton Mowbray East-West Screenline (South) Northbound	7	1,830	1,842	12	1%	1,617	1,619	2	0%	172	174	2	-1%	45	49	4	13%
Melton Mowbray East-West Screenline (South) Southbound	7	1,788	1,807	19	1%	1,592	1,602	10	0%	164	166	1	-1%	36	40	4	13%
Melton Mowbray East-West Screenline (North) Northbound	5	1,728	1,732	3	0%	1,548	1,549	1	0%	156	155	-1	0%	27	27	0	-3%
Melton Mowbray East-West Screenline (North) Southbound	5	1,451	1,448	-4	0%	1,300	1,298	-2	0%	131	129	-2	-1%	23	20	-3	-14%
Market Harborough Cordon Inbound	9	2,748	2,621	-126	-5%	2,404	2,272	-132	0%	274	274	-1	0%	70	76	6	3%
Market Harborough Cordon Outbound	9	3,000	2,906	-93	-3%	2,631	2,531	-101	-2%	299	299	-0	0%	70	77	7	5%
Market Harborough North-South Screenline (Leicester Rd) Eastbound	7	1,765	1,777	12	1%	1,585	1,603	18	-5%	156	151	-5	-6%	25	23	-2	-4%
Market Harborough North-South Screenline (Leicester Rd) Westbound	7	1,533	1,460	-73	-5%	1,376	1,313	-63	-8%	136	126	-10	-8%	22	21	-1	-5%
Market Harborough North-South Screenline (Railway) Eastbound	2	1,011	1,011	-0	0%	904	904	-0	0%	91	91	-0	0%	16	16	0	0%
Market Harborough North-South Screenline (Railway) Westbound	2	862	867	6	1%	771	776	5	1%	77	78	0	-1%	13	13	0	0%
Market Harborough East-West Screenline (A4304) Northbound	9	1,532	1,567	35	2%	1,374	1,406	32	0%	136	136	-0	0%	25	25	0	0%
Market Harborough East-West Screenline (A4304) Southbound	8	1,250	1,259	9	1%	1,121	1,127	6	0%	111	112	1	1%	20	20	-0	0%
Lutterworth Cordon Inbound	8	3,920	3,939	19	0%	3,276	3,297	22	0%	409	407	-2	0%	238	234	-4	1%
Lutterworth Cordon Outbound	8	4,107	4,128	20	0%	3,516	3,509	-7	0%	349	378	29	4%	246	241	-6	0%
Lutterworth North-South Screenline Eastbound	5	1,002	1,011	9	1%	906	910	4	0%	96	95	-0	0%	5	5	-0	0%
Lutterworth North-South Screenline Westbound	5	1,040	1,045	5	0%	941	942	1	0%	99	98	-1	0%	5	5	-0	-1%
Lutterworth East-West Screenline Northbound	2	1,557	1,563	6	0%	1,350	1,356	6	0%	165	166	0	0%	43	42	-1	-14%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Lutterworth East-West Screenline Southbound	2	1,001	1,005	4	0%	864	867	3	0%	106	106	-0	0%	32	32	0	1%
Hinckley Outer Cordon Inbound	14	6,384	6,393	9	0%	5,662	5,667	5	0%	632	634	2	0%	93	93	-0	-1%
Hinckley Outer Cordon Outbound	14	5,312	5,328	16	0%	4,713	4,704	-8	0%	528	531	3	0%	73	93	20	11%
Hinckley Inner Cordon Inbound	9	3,892	3,950	58	1%	3,521	3,570	49	1%	348	356	7	0%	25	24	-1	-4%
Hinckley Inner Cordon Outbound	9	4,420	4,470	50	1%	4,011	4,055	45	1%	382	389	8	0%	29	25	-4	-3%
Hinckley North-South Screenline (South) Eastbound	5	913	938	26	3%	830	852	22	0%	76	80	4	0%	6	6	0	-14%
Hinckley North-South Screenline (South) Westbound	5	907	907	-0	0%	825	824	-1	0%	76	77	1	0%	7	7	-0	0%
Hinckley East-West Screenline (South) Northbound	6	1,910	1,954	44	2%	1,737	1,774	37	1%	160	164	4	0%	14	16	2	-1%
Hinckley East-West Screenline (South) Southbound	6	1,608	1,603	-5	0%	1,463	1,458	-5	1%	135	133	-1	-1%	12	12	0	-3%
Barwell Cordon Inbound	8	2,176	2,153	-23	-1%	1,940	1,916	-24	-3%	231	230	-1	-3%	11	7	-4	-20%
Barwell Cordon Outbound	8	1,750	1,679	-72	-4%	1,561	1,493	-68	-4%	186	179	-6	-3%	10	6	-3	-23%
Earl Shilton Cordon Inbound	7	1,539	1,551	12	1%	1,375	1,381	5	0%	163	166	2	0%	7	4	-3	-41%
Earl Shilton Cordon Outbound	7	1,093	1,105	12	1%	977	984	6	0%	116	118	1	0%	7	4	-3	-42%
Coalville-Whitwick Cordon Inbound	19	6,541	6,557	16	0%	5,663	5,670	7	0%	717	723	6	0%	169	164	-5	-3%
Coalville-Whitwick Cordon Outbound	19	7,252	7,252	0	0%	6,280	6,276	-5	0%	799	800	1	0%	181	176	-5	-2%
Coalville Inner Cordon Inbound	8	2,418	2,382	-36	-1%	2,174	2,139	-35	-2%	228	228	0	0%	19	15	-4	-33%
Coalville Inner Cordon Outbound	8	2,212	2,230	18	1%	1,986	2,004	19	0%	214	213	-1	0%	15	13	-2	-27%
Coalville East-West Screenline (A511) Northbound	4	1,869	1,900	31	2%	1,697	1,724	27	0%	172	172	1	0%	4	4	-0	-22%
Coalville East-West Screenline (A511) Southbound	4	1,353	1,356	3	0%	1,230	1,229	-1	0%	123	123	-0	1%	4	4	-0	-7%
Ibstock Cordon Inbound	5	2,095	2,093	-2	0%	1,828	1,824	-4	-1%	223	224	1	0%	48	46	-2	-3%
Ibstock Cordon Outbound	5	1,853	1,847	-6	0%	1,618	1,611	-6	0%	197	197	-0	-1%	41	39	-2	-4%
Ashby Cordon Inbound	8	2,429	2,444	15	1%	2,188	2,193	5	0%	237	240	3	0%	11	11	0	0%
Ashby Cordon Outbound	8	2,295	2,308	13	1%	2,068	2,071	4	0%	224	225	2	0%	11	11	0	0%
Ashby North-South Screenline (Smisby Rd) Eastbound	5	1,156	1,165	9	1%	1,058	1,063	4	0%	97	97	-0	1%	5	5	-0	0%
Ashby North-South Screenline (Smisby Rd) Westbound	5	1,506	1,514	9	1%	1,379	1,381	2	0%	127	128	1	-1%	5	5	-0	0%
Ashby East-West Screenline (Burton Rd) Northbound	2	444	452	8	2%	407	413	6	-1%	37	37	-0	0%	2	2	-0	-1%
Ashby East-West Screenline (Burton Rd) Southbound	2	426	447	21	5%	390	409	19	0%	36	36	-0	0%	2	2	-0	0%
Ashby East-West Screenline (Railway) Northbound	3	959	965	6	1%	878	881	3	-1%	81	82	1	0%	3	1	-2	-51%
Ashby East-West Screenline (Railway) Southbound	3	1,055	1,054	-0	0%	966	965	-1	-1%	89	87	-2	0%	3	2	-1	-43%
Melton Borough A606 Screenline North-Eastbound	11	1,107	1,106	-2	0%	961	953	-8	0%	120	119	-0	0%	33	34	1	-4%
Melton Borough A606 Screenline South-Westbound	11	1,248	1,244	-3	0%	1,085	1,083	-2	-1%	135	132	-3	1%	34	29	-5	13%
Melton-Charnwood North-South Screenline Eastbound	12	4,899	4,810	-89	-2%	4,277	4,186	-90	0%	468	460	-8	0%	164	164	-0	0%
Melton-Charnwood North-South Screenline Eastbound (excluding SRN counts)	11	2,994	2,918	-76	-3%	2,627	2,549	-78	0%	318	311	-7	0%	59	58	-1	-2%
Melton-Charnwood North-South Screenline Westbound	12	4,351	4,364	13	0%	3,791	3,795	4	0%	423	422	-1	0%	148	147	-0	-1%
Melton-Charnwood North-South Screenline Westbound (excluding SRN counts)	11	2,950	2,951	0	0%	2,591	2,584	-7	0%	313	312	-2	0%	56	55	-1	-2%
Harborough District North-South Screenline (A5199) Eastbound	7	1,663	1,666	3	0%	1,451	1,446	-5	-1%	176	175	-1	-1%	40	44	4	5%
Harborough District North-South Screenline (A5199) Westbound	7	1,267	1,273	6	1%	1,112	1,114	2	0%	134	134	-0	-1%	25	25	0	-1%
Harborough District North-South Screenline (Great Glen) Eastbound	4	1,175	1,180	6	0%	1,013	1,019	6	0%	125	124	-1	0%	40	37	-3	5%
Harborough District North-South Screenline (Great Glen) Westbound	4	1,268	1,292	24	2%	1,087	1,108	21	0%	135	137	2	3%	49	47	-3	-5%

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Harborough District East-West Screenline Northbound	18	11,629	11,826	197	2%	9,781	9,926	145	-1%	1,054	1,069	15	-1%	800	831	30	4%
Harborough District East-West Screenline Northbound (excluding SRN counts)	16	5,300	5,332	32	1%	4,600	4,615	15	0%	586	584	-2	0%	121	133	13	5%
Harborough District East-West Screenline Southbound	18	10,220	10,233	12	0%	8,524	8,527	3	1%	888	895	7	1%	815	811	-4	1%
Harborough District East-West Screenline Southbound (excluding SRN counts)	16	4,290	4,318	28	1%	3,751	3,755	4	0%	461	462	1	0%	85	101	16	7%
Hinckley-NW Leics Screenline North-Eastbound	10	4,246	4,235	-11	0%	3,539	3,528	-11	0%	397	396	-1	0%	316	311	-5	-1%
Hinckley-NW Leics Screenline North-Eastbound (excluding SRN counts)	9	1,938	1,935	-3	0%	1,687	1,682	-5	0%	205	205	-0	0%	51	47	-4	-6%
Hinckley-NW Leics Screenline South-Westbound	10	3,745	3,757	13	0%	3,130	3,141	11	0%	346	343	-2	0%	275	273	-2	0%
Hinckley-NW Leics Screenline South-Westbound (excluding SRN counts)	9	1,452	1,468	17	1%	1,275	1,290	15	0%	154	152	-2	-1%	29	26	-2	0%
Nuneaton Cordon Inbound	14	8,037	8,029	-9	0%	7,030	7,011	-19	0%	843	845	2	0%	165	172	8	3%
Nuneaton Cordon Outbound	14	5,796	5,799	4	0%	5,049	5,031	-18	0%	607	605	-2	0%	139	163	24	10%
Northern Rugby Screenline Northbound	4	2,594	2,606	12	0%	2,242	2,253	11	-1%	274	275	1	0%	77	78	0	0%
Northern Rugby Screenline Southbound	4	2,282	2,293	11	1%	1,968	1,979	11	0%	241	242	1	0%	73	72	-1	0%
Tamworth Counts Northbound	3	1,330	1,333	3	0%	1,143	1,145	2	2%	141	143	2	0%	47	45	-1	-11%
Tamworth Counts Southbound	3	807	800	-7	-1%	696	687	-9	2%	85	87	2	1%	26	26	0	0%
Burton Counts Eastbound	2	1,689	1,723	33	2%	1,433	1,471	38	0%	179	177	-3	0%	77	75	-2	0%
Burton Counts Westbound	2	1,641	1,650	9	1%	1,392	1,401	10	0%	174	174	-1	0%	75	75	0	0%
Nottingham Counts Northbound	4	4,698	4,476	-222	-5%	4,114	3,917	-197	0%	404	389	-14	0%	180	169	-11	0%
Nottingham Counts Southbound	4	4,766	4,592	-174	-4%	4,186	4,032	-154	-1%	411	408	-3	0%	169	152	-18	-9%
M1 Calibration Northbound	6	21,063	20,956	-107	-1%	16,967	16,890	-77	-1%	1,729	1,722	-7	-1%	2,367	2,344	-23	1%
M1 Calibration Southbound	5	18,669	18,559	-110	-1%	14,712	14,625	-86	1%	1,501	1,497	-5	0%	2,456	2,437	-19	0%
M1 Validation Northbound	4	20,121	20,717	596	3%	16,279	16,715	436	2%	1,604	1,665	60	4%	2,239	2,338	99	3%
M1 Validation Southbound	4	18,879	19,068	189	1%	15,049	15,164	115	3%	1,484	1,503	18	3%	2,345	2,401	56	2%
M69 Calibration Northbound	3	6,958	7,108	150	2%	6,084	6,216	132	0%	495	515	21	0%	379	377	-3	14%
M69 Calibration Southbound	2	4,894	4,899	4	0%	4,226	4,224	-1	0%	344	349	5	0%	325	325	1	0%
M69 Validation Northbound	1	2,521	2,499	-22	-1%	2,179	2,119	-60	-3%	178	179	1	-1%	163	200	37	11%
M69 Validation Southbound	1	2,127	2,155	28	1%	1,698	1,806	108	5%	139	151	12	8%	290	198	-92	-26%
M42-A42 Calibration Northbound	3	6,983	6,960	-23	0%	5,683	5,661	-22	0%	588	587	-1	0%	712	712	0	0%
M42-A42 Calibration Southbound	3	6,769	6,702	-66	-1%	5,428	5,408	-20	0%	528	528	0	0%	813	766	-47	-7%
M42-A42 Validation Northbound	3	7,900	7,361	-539	-7%	6,415	5,920	-495	-2%	612	595	-16	-4%	874	846	-28	1%
M42-A42 Validation Southbound	3	7,071	6,531	-540	-8%	5,724	5,208	-516	-3%	553	515	-38	-7%	794	808	14	7%
A46 Calibration Northbound	4	9,753	9,657	-97	-1%	8,405	8,304	-101	-1%	832	827	-6	-2%	516	526	10	2%
A46 Calibration Southbound	4	7,577	7,515	-62	-1%	6,401	6,348	-53	1%	623	622	-1	0%	553	545	-8	-1%
A46 Validation Northbound	3	8,049	7,765	-284	-4%	7,024	6,725	-299	-2%	639	630	-9	-1%	386	410	24	3%
A46 Validation Southbound	3	5,970	6,043	73	1%	5,093	5,158	66	1%	463	476	13	1%	414	408	-5	-1%
A5 Calibration North-Westbound	5	6,168	6,150	-17	0%	5,264	5,252	-12	0%	514	507	-7	0%	389	391	2	6%
A5 Calibration South-Eastbound	5	6,071	6,019	-52	-1%	5,208	5,157	-51	-1%	516	512	-4	0%	348	350	3	1%
A5 Validation North-Westbound	3	2,779	2,598	-181	-7%	2,303	2,173	-130	1%	222	211	-11	8%	255	214	-40	-15%
A5 Validation South-Eastbound	3	2,624	2,414	-210	-8%	2,191	2,017	-174	2%	211	199	-12	6%	222	198	-25	-27%

		Total Vehicles				Car				LGV				HGV			
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A453 Calibration North-Eastbound	2	1,943	1,928	-15	-1%	1,680	1,689	9	0%	137	137	1	0%	126	102	-25	-4%
A453 Calibration South-Westbound	2	931	1,035	104	11%	775	877	101	0%	59	59	0	0%	96	99	2	0%
M6 Calibration Northbound	1	3,295	3,311	16	0%	2,558	2,573	14	0%	283	284	1	1%	454	454	0	-1%
M6 Calibration Southbound	1	3,397	3,413	17	0%	2,657	2,672	15	1%	294	295	1	0%	445	446	1	0%
A50 Calibration North-Westbound	1	3,261	3,240	-20	-1%	2,785	2,764	-21	0%	239	239	-0	0%	237	238	1	1%
A50 Calibration South-Eastbound	1	2,656	2,655	-1	0%	2,238	2,230	-8	0%	192	197	5	0%	226	228	2	0%
A14 Calibration Eastbound	2	3,642	3,644	3	0%	2,799	2,801	2	0%	267	267	1	0%	576	576	-0	0%
A14 Calibration Westbound	2	3,328	3,332	4	0%	2,528	2,527	-1	-4%	241	246	5	2%	559	559	-0	0%
A52 Calibration Eastbound	1	1,273	1,274	1	0%	1,134	1,131	-2	0%	82	83	1	0%	57	60	2	0%
A52 Calibration Westbound	1	1,051	1,052	1	0%	919	919	0	-1%	67	68	1	0%	66	65	-0	0%
A1_East Midlands North-Eastbound	5	2,136	2,130	-6	0%	1,744	1,745	1	0%	236	236	-0	-2%	156	149	-7	1%
A1_East Midlands South-Westbound	5	2,149	2,146	-3	0%	1,775	1,772	-3	0%	235	235	-0	0%	139	139	-0	0%
AD HOC_East Mids Eastbound	2	835	842	7	1%	717	718	1	3%	56	62	6	1%	62	62	-0	-4%
AD HOC_East Mids Northbound	2	4,548	4,494	-54	-1%	3,592	3,535	-57	-3%	391	391	-0	-1%	565	569	4	1%
AD HOC_East Mids Southbound	2	4,266	4,213	-53	-1%	3,315	3,287	-28	1%	448	449	1	-8%	503	477	-26	0%
AD HOC_East Mids Westbound	2	974	991	17	2%	848	856	8	0%	68	76	8	0%	58	59	1	2%
AD HOC_North West Northbound	2	4,960	4,924	-36	-1%	3,543	3,505	-38	0%	639	639	0	0%	778	780	2	0%
AD HOC_North West Southbound	2	5,150	5,126	-24	0%	3,717	3,696	-21	-4%	625	625	0	0%	808	804	-4	-1%
AD HOC_West Mids Eastbound	17	18,239	17,052	-1,187	-7%	14,296	13,264	-1,032	-8%	2,154	2,163	9	3%	1,789	1,625	-164	5%
AD HOC_West Mids Northbound	21	50,725	48,587	-2,138	-4%	38,430	37,236	-1,194	-1%	6,199	6,149	-50	-1%	6,096	5,202	-894	-9%
AD HOC_West Mids Southbound	21	49,962	46,567	-3,395	-7%	38,188	36,971	-1,217	-5%	5,271	4,810	-461	0%	6,503	4,786	-1,717	-16%
AD HOC_West Mids Westbound	16	18,348	17,054	-1,294	-7%	14,791	13,377	-1,414	-5%	2,009	2,115	106	1%	1,548	1,563	15	-3%
Birmingham S Inbound	7	11,571	10,654	-917	-8%	9,678	8,654	-1,025	0%	1,248	1,237	-11	0%	644	763	119	7%
Birmingham S Outbound	7	10,655	10,322	-333	-3%	9,283	8,828	-455	-8%	937	937	-1	0%	435	557	122	11%
Corby_East Midlands North-Eastbound	9	3,130	3,047	-83	-3%	2,850	2,728	-122	0%	122	140	18	6%	158	179	21	-7%
Corby_East Midlands South-Westbound	9	3,057	3,120	63	2%	2,789	2,788	-1	-6%	102	137	35	6%	166	195	29	2%
Cotswolds NS Eastbound	3	1,301	1,298	-3	0%	1,056	1,053	-3	0%	132	132	-0	-1%	113	113	0	0%
Cotswolds NS Westbound	3	1,628	1,623	-5	0%	1,386	1,380	-6	1%	140	140	0	0%	102	103	1	0%
Coventry SW NESW North-Eastbound	3	1,352	1,385	33	2%	1,069	1,100	31	2%	250	250	-	0%	33	35	2	2%
Coventry SW NESW South-Westbound	3	1,159	1,172	13	1%	903	906	3	-1%	236	233	-4	1%	20	34	14	0%
Daventry_East Midlands North-Eastbound	4	1,447	1,477	30	2%	1,323	1,341	18	-1%	38	45	7	20%	86	90	4	2%
Daventry_East Midlands South-Westbound	4	1,617	1,645	28	2%	1,466	1,473	7	-1%	62	68	6	9%	89	104	15	0%
Gloucester NW Eastbound	2	1,383	1,131	-252	-18%	1,016	926	-90	-2%	197	197	0	-1%	170	8	-162	-93%
Gloucester NW Westbound	2	1,989	1,804	-185	-9%	1,654	1,605	-49	-9%	188	188	-0	0%	147	12	-135	-92%
Herefordshire EW Northbound	3	1,920	1,943	23	1%	1,552	1,575	23	0%	191	191	-0	0%	177	177	0	0%
Herefordshire EW Southbound	3	2,261	2,243	-18	-1%	1,668	1,665	-3	1%	276	276	0	0%	317	302	-15	0%
IS/12_East Midlands Northbound	3	2,498	2,496	-2	0%	1,794	1,792	-2	0%	323	323	0	0%	381	381	-0	0%
IS/12_East Midlands Southbound	3	2,130	2,130	-0	0%	1,553	1,552	-1	0%	206	206	0	0%	371	372	1	0%
Lichfield NS Eastbound	4	2,517	2,464	-53	-2%	2,045	1,950	-95	-13%	263	274	11	0%	209	240	31	4%

		Total Vehicles				Car				LGV				HGV			
Screenline	**# Counts**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**	**Observed**	**Modelled**	**Diff**	**%**
Lichfield NS Westbound	4	3,159	3,171	12	0%	2,588	2,585	-3	0%	354	354	-0	0%	217	232	15	10%
M6Toll_N Northbound	2	6,672	6,699	27	0%	5,040	4,901	-139	-3%	527	693	166	20%	1,105	1,106	1	0%
M6Toll_N Southbound	2	5,198	5,360	162	3%	3,755	3,756	1	-3%	358	520	162	21%	1,085	1,084	-1	0%
M6Toll_S Northbound	2	7,490	7,478	-12	0%	5,702	5,694	-8	1%	994	990	-4	0%	794	793	-1	0%
M6Toll_S Southbound	2	6,585	6,561	-24	0%	5,117	5,094	-23	0%	743	743	0	0%	725	725	-0	0%
NE1_East Midlands Eastbound	6	2,993	3,451	458	15%	2,525	2,958	433	7%	292	310	18	0%	176	183	7	2%
NE1_East Midlands Westbound	6	2,993	3,186	193	6%	2,524	2,694	170	4%	291	308	17	0%	178	184	6	3%
Northampton_East Midlands North-Eastbound	7	7,372	7,344	-28	0%	6,632	6,546	-86	0%	513	518	5	0%	227	280	53	-7%
Northampton_East Midlands South-Westbound	7	5,677	5,632	-45	-1%	4,995	4,903	-92	-4%	467	462	-5	0%	215	268	53	-8%
Nott_East Midlands North-Eastbound	7	6,096	6,146	50	1%	5,288	5,348	61	10%	277	331	54	5%	531	467	-64	-22%
Nott_East Midlands South-Westbound	7	6,856	7,321	465	7%	6,092	6,535	443	1%	300	364	64	5%	464	421	-43	-28%
Notts EW E Northbound	3	2,363	2,348	-15	-1%	1,890	1,894	4	0%	263	263	-0	0%	210	191	-19	0%
Notts EW E Southbound	3	2,401	2,383	-18	-1%	1,943	1,948	5	-3%	266	243	-23	0%	192	192	-0	0%
Notts EW W Northbound	5	5,325	5,156	-169	-3%	4,403	4,251	-152	-10%	596	588	-8	0%	326	318	-8	0%
Notts EW W Southbound	5	4,061	3,765	-296	-7%	3,441	3,140	-301	-3%	434	427	-7	-1%	186	197	11	0%
NW1_East Midlands Eastbound	5	1,415	1,481	66	5%	1,267	1,295	28	0%	97	126	29	16%	51	61	10	14%
NW1_East Midlands Westbound	5	1,424	1,470	46	3%	1,282	1,284	2	0%	98	133	35	18%	44	53	9	10%
NW2_East Midlands Eastbound	6	3,276	3,271	-5	0%	2,655	2,655	-0	1%	386	381	-5	0%	235	235	-0	0%
NW2_East Midlands Westbound	6	3,365	3,357	-8	0%	2,776	2,767	-9	0%	376	376	-0	0%	213	213	0	0%
PRTM N Boundary E Mids Northbound	18	12,452	12,383	-69	-1%	10,077	10,000	-77	-2%	1,307	1,307	-0	0%	1,068	1,076	8	1%
PRTM N Boundary E Mids Southbound	18	10,662	10,413	-249	-2%	8,613	8,518	-95	-1%	1,231	1,073	-158	-10%	818	822	4	1%
PRTM S Boundary E Northbound	6	8,071	8,008	-63	-1%	6,304	6,241	-63	-2%	857	857	0	-2%	910	910	0	0%
PRTM S Boundary E Southbound	6	6,155	6,158	3	0%	4,704	4,707	3	0%	684	684	0	0%	767	767	-0	0%
PRTM S Boundary E Mids Northbound	5	6,405	6,509	104	2%	5,178	5,171	-7	0%	762	762	-0	0%	465	576	111	35%
PRTM S Boundary E Mids Southbound	5	5,980	5,854	-126	-2%	4,761	4,627	-134	1%	680	685	5	0%	539	541	2	7%
PRTM S Boundary SE Northbound	5	6,128	5,448	-680	-11%	4,975	4,445	-530	-15%	653	530	-123	-15%	500	473	-27	-5%
PRTM S Boundary SE Southbound	5	4,870	4,153	-717	-15%	4,066	3,460	-606	-9%	426	338	-88	-18%	378	356	-22	-7%
PRTM S Boundary SW Northbound	8	8,584	8,550	-34	0%	7,063	7,028	-35	0%	970	970	-0	0%	551	551	0	0%
PRTM S Boundary SW Southbound	8	7,358	7,352	-6	0%	6,044	6,039	-5	-2%	881	881	0	0%	433	432	-1	0%
Warwickshire EW Northbound	5	2,227	2,246	19	1%	1,820	1,880	60	0%	255	234	-21	0%	152	132	-20	-19%
Warwickshire EW Southbound	5	1,976	1,819	-157	-8%	1,656	1,507	-149	2%	210	215	5	0%	110	97	-13	-23%
Worcestershire NS Eastbound	3	2,109	2,066	-43	-2%	1,770	1,690	-80	0%	215	215	0	0%	124	161	37	1%
Worcestershire NS Westbound	3	2,757	2,633	-124	-4%	2,176	2,147	-29	-2%	261	261	-0	0%	320	226	-94	0%

Appendix B – Detailed Journey Time Performance

Table B1 : Network Statistics Detailed Journey Time Validation

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
Leicester City	A47 Thurnby Inbound	15:03	14:01	-01:02	-6.8%	✓	12:03	13:09	01:06	9.1%	✓	12:15	13:06	00:51	7.0%	✓
Leicester City	A47 Thurnby Outbound	13:03	12:42	-00:21	-2.6%	✓	12:34	12:40	00:06	0.7%	✓	16:00	13:38	-02:22	-14.8%	✓
Leicester City	A607 Thurmaston Inbound	13:27	13:53	00:26	3.2%	✓	12:41	11:49	-00:52	-6.9%	✓	12:57	12:34	-00:23	-3.0%	✓
Leicester City	A607 Thurmaston Outbound	11:47	12:12	00:25	3.6%	✓	12:19	12:07	-00:12	-1.7%	✓	14:36	15:19	00:43	4.9%	✓
Leicester City	A6 Birstall Inbound	15:14	13:40	-01:35	-10.4%	✓	10:30	10:49	00:19	3.0%	✓	11:33	11:38	00:05	0.7%	✓
Leicester City	A6 Birstall Outbound	10:47	10:48	00:00	0.0%	✓	09:50	10:41	00:51	8.6%	✓	12:37	13:00	00:23	3.0%	✓
Leicester City	B5327 Anstey Inbound	10:17	09:06	-01:11	-11.6%	✓	05:50	06:49	00:58	16.6%	✓	06:22	07:26	01:04	16.8%	×
Leicester City	B5327 Anstey Outbound	06:15	06:34	00:19	5.0%	✓	06:03	06:29	00:26	7.1%	✓	07:59	07:58	-00:01	-0.2%	✓
Leicester City	A50 Groby Inbound	15:18	10:27	-04:52	-31.8%	×	08:31	08:54	00:23	4.4%	✓	11:29	09:59	-01:30	-13.0%	✓
Leicester City	A50 Groby Outbound	08:24	09:29	01:05	12.9%	✓	08:01	08:52	00:51	10.6%	✓	12:13	11:58	-00:15	-2.0%	✓
Leicester City	A47 Leicester Forest East Inbound	17:38	19:01	01:23	7.8%	✓	11:04	12:30	01:26	12.9%	✓	13:46	14:21	00:35	4.3%	✓
Leicester City	A47 Leicester Forest East Outbound	13:09	14:07	00:58	7.3%	✓	11:34	12:11	00:36	5.2%	✓	15:37	17:24	01:47	11.4%	✓
Leicester City	A5460 Enderby Inbound	18:29	16:27	-02:02	-11.0%	✓	11:48	12:55	01:07	9.4%	✓	13:28	13:21	-00:06	-0.8%	✓
Leicester City	A5460 Enderby Outbound	15:00	13:57	-01:03	-7.0%	✓	11:28	12:18	00:50	7.3%	✓	15:45	14:16	-01:29	-9.5%	✓
Leicester City	A426 Blaby Inbound	18:09	15:53	-02:15	-12.4%	✓	10:01	11:08	01:07	11.1%	✓	12:34	11:14	-01:20	-10.6%	✓
Leicester City	A426 Blaby Outbound	13:04	14:18	01:14	9.4%	✓	10:41	12:55	02:14	20.9%	×	16:10	16:23	00:14	1.4%	✓
Leicester City	Saffron Lane Inbound	11:43	11:41	-00:02	-0.3%	✓	07:53	08:58	01:05	13.7%	✓	08:32	09:19	00:47	9.2%	✓
Leicester City	Saffron Lane Outbound	09:52	09:58	00:06	1.0%	✓	08:27	09:44	01:17	15.1%	×	12:21	10:49	-01:32	-12.4%	✓
Leicester City	A5199 Wigston Inbound	12:23	12:35	00:12	1.6%	✓	08:44	09:20	00:35	6.8%	✓	09:34	09:45	00:12	2.0%	✓
Leicester City	A5199 Wigston Outbound	09:48	10:38	00:50	8.5%	✓	09:10	09:53	00:43	7.8%	✓	11:05	12:30	01:25	12.7%	✓
Leicester City	A6 Oadby Inbound	18:29	17:48	-00:40	-3.6%	✓	12:45	13:55	01:10	9.1%	✓	15:10	14:59	-00:12	-1.3%	✓
Leicester City	A6 Oadby Outbound	12:24	13:42	01:18	10.4%	✓	11:52	13:13	01:21	11.4%	✓	15:56	17:06	01:10	7.3%	✓
Leicester City	A594 IRR Clockwise	15:31	16:49	01:19	8.4%	✓	12:44	14:52	02:08	16.8%	×	15:59	15:30	-00:29	-3.0%	✓
Leicester City	A594 IRR Anti-Clockwise	12:29	14:33	02:04	16.6%	×	10:20	11:40	01:20	13.0%	✓	12:43	13:02	00:18	2.4%	✓
Leicester City	A563 ORR1 Clockwise	18:33	17:09	-01:24	-7.5%	✓	11:25	14:17	02:52	25.0%	×	13:42	15:17	01:35	11.5%	✓
Leicester City	A563 ORR1 Anti-Clockwise	16:07	14:53	-01:14	-7.7%	✓	11:12	14:49	03:38	32.4%	×	21:30	17:50	-03:40	-17.0%	×
Leicester City	A563 ORR2 Clockwise	14:45	13:47	-00:59	-6.6%	✓	11:53	13:14	01:21	11.3%	✓	15:24	14:16	-01:09	-7.4%	✓
Leicester City	A563 ORR2 Anti-Clockwise	14:08	14:58	00:50	5.9%	✓	10:52	12:20	01:28	13.4%	✓	12:47	13:46	00:58	7.6%	✓
Leicester City	A563 ORR3 Clockwise	12:53	13:14	00:21	2.7%	✓	11:15	12:26	01:11	10.5%	✓	15:46	14:38	-01:08	-7.2%	✓
Leicester City	A563 ORR3 Anti-Clockwise	13:05	14:42	01:37	12.3%	✓	11:07	13:15	02:09	19.3%	×	11:28	13:43	02:14	19.5%	×
Leicester City	Fullhurst Clockwise	17:16	16:56	-00:20	-1.9%	✓	13:47	15:46	01:59	14.4%	✓	16:01	17:40	01:39	10.3%	✓
Leicester City	Fullhurst Anti-Clockwise	15:51	16:57	01:07	7.0%	✓	13:52	15:06	01:15	9.0%	✓	18:18	18:50	00:32	2.9%	✓
Loughborough	A512 Ashby Road Eastbound	11:57	10:43	-01:14	-10.3%	✓	08:58	09:28	00:30	5.5%	✓	11:23	10:09	-01:14	-10.8%	✓
Loughborough	A512 Ashby Road Westbound	09:36	10:03	00:28	4.8%	✓	09:02	10:06	01:04	11.8%	✓	12:43	12:03	-00:40	-5.3%	✓
Loughborough	Old Ashby Road / Alan Moss Road Eastbound	08:55	09:12	00:17	3.2%	✓	08:13	08:50	00:37	7.5%	✓	12:04	09:17	-02:47	-23.0%	×
Loughborough	Old Ashby Road / Alan Moss Road Westbound	09:18	08:42	-00:36	-6.4%	✓	07:46	08:29	00:43	9.3%	✓	08:25	09:08	00:44	8.7%	✓
Loughborough	Forest Road Eastbound	10:27	08:28	-01:59	-19.0%	×	06:56	07:48	00:52	12.5%	✓	07:04	07:59	00:55	12.9%	✓
Loughborough	Forest Road Westbound	07:23	08:08	00:45	10.1%	✓	06:08	07:16	01:08	18.5%	×	09:31	09:51	00:20	3.4%	✓

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
Loughborough	A6 north of Inner Relief Road Northbound	04:37	04:21	-00:16	-5.7%	✓	04:47	04:32	-00:15	-5.3%	✓	05:51	04:41	-01:10	-20.0%	×
Loughborough	A6 north of Inner Relief Road Southbound	05:26	04:21	-01:05	-20.1%	×	04:36	04:07	-00:29	-10.4%	✓	04:55	04:23	-00:32	-10.7%	✓
Loughborough	A6 south of Inner Relief Road Northbound	06:08	05:47	-00:21	-5.8%	✓	03:39	04:03	00:24	11.1%	✓	04:04	04:16	00:12	5.0%	✓
Loughborough	A6 south of Inner Relief Road Southbound	03:49	03:42	-00:07	-3.2%	✓	03:22	03:31	00:10	4.9%	✓	04:28	04:09	-00:19	-7.0%	✓
Loughborough	A6004 Epinal Way Northbound	11:26	09:38	-01:48	-15.7%	×	08:38	09:12	00:34	6.6%	✓	09:56	09:54	-00:03	-0.4%	✓
Loughborough	A6004 Epinal Way Southbound	09:13	09:10	-00:03	-0.5%	✓	08:15	08:30	00:14	2.9%	✓	11:23	08:47	-02:35	-22.7%	×
Loughborough	New King Street / Queen's Road Eastbound	04:31	04:55	00:24	8.8%	✓	04:08	04:40	00:32	13.0%	✓	04:59	05:50	00:51	17.0%	✓
Loughborough	New King Street / Queen's Road Westbound	06:16	06:43	00:27	7.1%	✓	04:26	05:11	00:45	16.7%	✓	05:23	05:44	00:21	6.5%	✓
Charnwood	A6 (A46 to Loughborough) Northbound	05:56	05:53	-00:03	-0.9%	✓	05:40	05:43	00:03	1.0%	✓	05:36	05:57	00:21	6.3%	✓
Charnwood	A6 (A46 to Loughborough) Southbound	06:05	05:55	-00:10	-2.8%	✓	05:53	05:42	-00:11	-3.2%	✓	05:30	05:51	00:22	6.5%	✓
Charnwood	A6 (Loughborough to M1) Northbound	12:08	12:34	00:26	3.5%	✓	10:27	10:27	00:00	-0.1%	✓	17:43	15:42	-02:01	-11.4%	✓
Charnwood	A6 (Loughborough to M1) Southbound	11:28	11:44	00:16	2.3%	✓	09:40	10:10	00:30	5.2%	✓	10:42	10:54	00:12	1.9%	✓
Melton Mowbray	A606 Nottingham Road / Burton Road Northbound	09:04	08:30	-00:34	-6.3%	✓	08:30	08:11	-00:19	-3.8%	✓	09:52	09:02	-00:50	-8.4%	✓
Melton Mowbray	A606 Nottingham Road / Burton Road Southbound	11:05	12:04	01:00	9.0%	✓	10:28	11:07	00:39	6.2%	✓	11:24	11:39	00:15	2.2%	✓
Melton Mowbray	A607 Leicester Road / Thorpe Road Northbound	11:02	10:37	-00:25	-3.8%	✓	10:13	10:39	00:26	4.3%	✓	11:04	11:25	00:21	3.2%	✓
Melton Mowbray	A607 Leicester Road / Thorpe Road Southbound	10:31	09:38	-00:53	-8.3%	✓	09:08	09:12	00:04	0.7%	✓	09:50	09:30	-00:20	-3.4%	✓
Melton Mowbray	A6006 to Saxby Road (via Ankle Hill) Eastbound	14:53	13:22	-01:31	-10.2%	✓	12:51	13:07	00:16	2.1%	✓	14:43	13:17	-01:26	-9.8%	✓
Melton Mowbray	A6006 to Saxby Road (via Ankle Hill) Westbound	13:37	12:46	-00:50	-6.2%	✓	12:42	12:34	-00:08	-1.1%	✓	14:11	12:44	-01:27	-10.3%	✓
Melton Mowbray	Dalby Road / Scalford Road Northbound	09:41	08:09	-01:32	-15.8%	×	07:50	08:15	00:25	5.4%	✓	09:25	09:29	00:04	0.8%	✓
Melton Mowbray	Dalby Road / Scalford Road Southbound	07:44	07:54	00:10	2.1%	✓	06:52	07:35	00:44	10.6%	✓	06:56	07:44	00:48	11.5%	✓
Melton Mowbray	Kirby Lane Eastbound	05:10	05:07	-00:03	-1.1%	✓	04:57	05:06	00:09	3.1%	✓	05:07	05:08	00:00	0.1%	✓
Melton Mowbray	Kirby Lane Westbound	04:58	05:10	00:12	4.0%	✓	04:53	05:08	00:15	5.1%	✓	05:08	05:09	00:02	0.5%	✓
Melton Borough	A607 (A46 to Melton Mowbray) Northbound	11:09	10:33	-00:36	-5.4%	✓	10:27	10:08	-00:19	-3.1%	✓	10:39	10:51	00:12	1.9%	✓
Melton Borough	A607 (A46 to Melton Mowbray) Southbound	11:04	10:47	-00:17	-2.6%	✓	10:37	10:09	-00:28	-4.4%	✓	10:32	10:34	00:02	0.4%	✓
Market Harborough	A4303 (Rockingham Road / Lubenham Hill) Eastbound	10:40	11:13	00:33	5.2%	✓	10:26	10:57	00:30	4.8%	✓	10:59	11:16	00:18	2.7%	✓
Market Harborough	A4303 (Rockingham Road / Lubenham Hill) Westbound	09:37	10:46	01:08	11.8%	✓	09:43	10:24	00:41	7.1%	✓	11:45	10:45	-01:00	-8.6%	✓
Market Harborough	Leicester Road / Northampton Road Northbound	08:14	08:51	00:37	7.5%	✓	08:41	08:17	-00:24	-4.6%	✓	09:08	08:32	-00:36	-6.6%	✓
Market Harborough	Leicester Road / Northampton Road Southbound	08:48	08:32	-00:16	-2.9%	✓	09:06	08:14	-00:51	-9.4%	✓	08:43	08:19	-00:23	-4.4%	✓
Market Harborough	Rockingham Road / Welland Park Road Eastbound	08:31	09:18	00:48	9.4%	✓	07:53	08:43	00:50	10.7%	✓	09:39	09:33	-00:05	-0.9%	✓
Market Harborough	Rockingham Road / Welland Park Road Westbound	08:32	09:07	00:35	6.7%	✓	07:51	08:33	00:43	9.1%	✓	09:37	08:50	-00:48	-8.3%	✓
Lutterworth	A426 Leicester Road Northbound	07:00	06:02	-00:58	-13.9%	✓	05:48	05:42	-00:06	-1.7%	✓	06:14	06:36	00:22	5.9%	✓
Lutterworth	A426 Leicester Road Southbound	06:18	06:45	00:27	7.1%	✓	05:48	05:39	-00:09	-2.6%	✓	07:46	06:02	-01:44	-22.4%	×
Lutterworth	A4303 (M1 to A5) Eastbound	03:48	03:11	-00:38	-16.5%	✓	03:39	03:08	-00:31	-14.2%	✓	03:53	03:13	-00:40	-17.1%	✓
Lutterworth	A4303 (M1 to A5) Westbound	03:47	03:28	-00:19	-8.2%	✓	03:35	03:20	-00:15	-7.1%	✓	03:40	03:22	-00:18	-8.2%	✓
Lutterworth	Western Bypass (Brookfield Way) Northbound	03:27	03:26	-00:01	-0.7%	✓	03:25	03:25	00:00	-0.1%	✓	03:27	03:44	00:17	8.1%	✓
Lutterworth	Western Bypass (Brookfield Way) Southbound	03:26	04:01	00:35	17.2%	✓	03:24	03:41	00:18	8.7%	✓	03:20	03:46	00:26	12.9%	✓
Harborough	A6 (Market Harborough to Leicester) Northbound	14:44	14:28	-00:16	-1.8%	✓	14:06	13:44	-00:22	-2.6%	✓	14:34	15:37	01:03	7.2%	✓
Harborough	A6 (Market Harborough to Leicester) Southbound	14:45	15:12	00:26	3.0%	✓	13:45	13:20	-00:26	-3.1%	✓	13:29	14:16	00:46	5.7%	✓
Harborough	A4304 (M1 to Lubenham) Eastbound	15:03	14:32	-00:31	-3.4%	✓	14:44	14:26	-00:18	-2.0%	✓	14:34	15:07	00:33	3.8%	✓
Harborough	A4304 (M1 to Lubenham) Westbound	15:26	15:35	00:09	0.9%	✓	14:56	14:25	-00:31	-3.5%	✓	14:41	14:41	00:00	0.0%	✓

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
Harborough	A47 (Thurnby to Belton-in-Rutland) Eastbound	13:25	12:32	-00:54	-6.6%	✓	13:31	12:21	-01:10	-8.6%	✓	13:08	12:32	-00:36	-4.6%	✓
Harborough	A47 (Thurnby to Belton-in-Rutland) Westbound	13:25	12:41	-00:44	-5.4%	✓	13:26	12:24	-01:02	-7.7%	✓	12:48	12:38	-00:09	-1.2%	✓
Hinckley	A47 Normandy Way Eastbound	07:38	08:10	00:33	7.2%	✓	07:31	08:06	00:35	7.8%	✓	08:03	08:45	00:42	8.8%	✓
Hinckley	A47 Normandy Way Westbound	10:42	09:51	-00:52	-8.0%	✓	07:53	08:06	00:13	2.8%	✓	08:54	08:54	00:00	0.0%	✓
Hinckley	Coventry Road / Leicester Road Eastbound	11:19	12:36	01:17	11.3%	✓	10:16	11:47	01:31	14.8%	✓	10:28	13:05	02:37	25.0%	✗
Hinckley	Coventry Road / Leicester Road Westbound	12:23	11:48	-00:35	-4.7%	✓	10:25	10:53	00:27	4.4%	✓	12:52	11:48	-01:04	-8.3%	✓
Hinckley	HollyCroft / Sapcote Road Eastbound	12:25	11:05	-01:20	-10.8%	✓	10:03	10:15	00:12	2.0%	✓	10:22	10:42	00:20	3.3%	✓
Hinckley	HollyCroft / Sapcote Road Westbound	12:40	13:17	00:36	4.8%	✓	11:15	12:38	01:22	12.2%	✓	14:07	14:07	00:00	0.0%	✓
Hinckley	Rugby Road / Ashby Road Northbound	13:46	12:15	-01:31	-11.0%	✓	09:33	10:48	01:14	13.0%	✓	15:52	11:44	-04:08	-26.0%	✗
Hinckley	Rugby Road / Ashby Road Southbound	10:04	11:03	00:59	9.7%	✓	09:22	10:21	00:59	10.5%	✓	09:50	10:47	00:58	9.8%	✓
Hinckley	Hinckley Road / Southfield Road / Nutts Lane Eastbound	14:36	13:55	-00:41	-4.7%	✓	12:32	13:31	00:58	7.7%	✓	15:04	14:24	-00:40	-4.4%	✓
Hinckley	Hinckley Road / Southfield Road / Nutts Lane Westbound	13:41	13:40	-00:01	-0.1%	✓	12:01	12:55	00:54	7.5%	✓	16:01	13:58	-02:03	-12.8%	✓
Barwell / Earl Shilton	Earl Shilton Bypass Eastbound	04:06	04:31	00:25	10.0%	✓	03:49	04:25	00:35	15.5%	✓	03:53	04:40	00:47	20.1%	✓
Barwell / Earl Shilton	Earl Shilton Bypass Westbound	04:11	04:47	00:36	14.4%	✓	03:57	04:29	00:31	13.3%	✓	04:02	04:39	00:37	15.2%	✓
Barwell / Earl Shilton	Leicester Road Northbound	05:25	06:11	00:46	14.2%	✓	05:37	06:05	00:28	8.2%	✓	05:24	06:13	00:50	15.3%	✓
Barwell / Earl Shilton	Leicester Road Southbound	05:52	06:22	00:30	8.4%	✓	05:46	06:17	00:31	9.1%	✓	05:38	06:26	00:48	14.2%	✓
Barwell / Earl Shilton	Station Road / Heath Lane / The Common Clockwise	08:37	09:15	00:37	7.2%	✓	08:24	09:00	00:36	7.2%	✓	08:22	09:14	00:51	10.2%	✓
Barwell / Earl Shilton	Station Road / Heath Lane / The Common Anti-Clockwise	08:07	09:10	01:02	12.7%	✓	08:02	08:54	00:52	10.7%	✓	08:46	09:10	00:24	4.6%	✓
Barwell / Earl Shilton	Mill Street / Shilton Road Eastbound	04:14	04:23	00:08	3.2%	✓	04:09	04:22	00:13	5.4%	✓	04:12	04:25	00:13	5.2%	✓
Barwell / Earl Shilton	Mill Street / Shilton Road Westbound	04:15	04:23	00:07	2.8%	✓	04:08	04:21	00:13	5.3%	✓	04:05	04:22	00:17	6.8%	✓
Hinckley Borough	A47 (Leicester Forest East to Earl Shilton) Eastbound	06:36	06:04	-00:32	-8.1%	✓	05:38	05:41	00:03	0.9%	✓	06:50	06:06	-00:44	-10.6%	✓
Hinckley Borough	A47 (Leicester Forest East to Earl Shilton) Westbound	05:39	05:25	-00:14	-4.1%	✓	05:23	05:07	-00:17	-5.1%	✓	05:30	05:18	-00:12	-3.6%	✓
Hinckley Borough	A447 (A47 to A511) Northbound	22:11	21:24	-00:48	-3.6%	✓	21:06	20:28	-00:38	-3.0%	✓	21:28	21:05	-00:23	-1.8%	✓
Hinckley Borough	A447 (A47 to A511) Southbound	22:24	21:04	-01:20	-6.0%	✓	21:48	20:24	-01:24	-6.5%	✓	21:45	21:20	-00:25	-1.9%	✓
Hinckley Borough	A50 (A46 to M1) Northbound	06:37	05:43	-00:54	-13.7%	✓	05:57	05:33	-00:24	-6.8%	✓	06:04	06:54	00:49	13.6%	✓
Hinckley Borough	A50 (A46 to M1) Southbound	06:43	06:06	-00:37	-9.1%	✓	05:57	05:47	-00:10	-2.7%	✓	05:51	06:10	00:19	5.5%	✓
Coalville	Ashby Road / London Road Eastbound	06:53	06:10	-00:42	-10.2%	✓	06:28	06:02	-00:26	-6.7%	✓	07:58	08:24	00:26	5.4%	✓
Coalville	Ashby Road / London Road Westbound	06:14	06:46	00:32	8.6%	✓	06:33	06:31	-00:02	-0.5%	✓	09:05	09:18	00:13	2.3%	✓
Coalville	Forest Road / Meadow Lane Eastbound	09:06	08:26	-00:41	-7.4%	✓	07:11	07:34	00:22	5.2%	✓	07:38	08:01	00:23	5.0%	✓
Coalville	Forest Road / Meadow Lane Westbound	08:47	08:07	-00:40	-7.5%	✓	07:13	07:38	00:26	5.9%	✓	08:21	07:48	-00:33	-6.6%	✓
Coalville	Belvoir Road / Thornborough Road Northbound	07:26	07:05	-00:21	-4.8%	✓	07:00	06:54	-00:05	-1.2%	✓	08:06	08:14	00:09	1.8%	✓
Coalville	Belvoir Road / Thornborough Road Southbound	07:23	07:15	-00:08	-1.8%	✓	07:51	08:04	00:14	2.9%	✓	07:00	06:50	-00:10	-2.4%	✓
Coalville	Whitwick Road / North Street Northbound	05:21	05:01	-00:20	-6.2%	✓	05:14	05:00	-00:14	-4.4%	✓	05:51	05:13	-00:38	-10.9%	✓
Coalville	Whitwick Road / North Street Southbound	05:04	05:17	00:13	4.4%	✓	05:02	05:06	00:04	1.2%	✓	05:16	05:08	-00:07	-2.3%	✓
Coalville	Grange Road / Standard Hill Eastbound	06:25	06:06	-00:19	-4.9%	✓	05:31	05:39	00:08	2.3%	✓	06:09	05:44	-00:25	-6.7%	✓
Coalville	Grange Road / Standard Hill Westbound	07:04	07:23	00:19	4.4%	✓	05:30	06:01	00:31	9.3%	✓	06:52	07:07	00:15	3.6%	✓
Ashby	Lower Packington Road / Burton Road Northbound	12:01	10:28	-01:33	-12.8%	✓	09:39	10:16	00:37	6.3%	✓	12:27	10:41	-01:46	-14.1%	✓
Ashby	Lower Packington Road / Burton Road Southbound	08:43	08:29	-00:14	-2.7%	✓	07:55	08:14	00:19	4.0%	✓	07:24	08:28	01:04	14.4%	✓
Ashby	Station Road / Smisby Road Northbound	04:50	04:55	00:05	1.6%	✓	04:32	04:43	00:12	4.4%	✓	05:35	05:01	-00:34	-10.1%	✓
Ashby	Station Road / Smisby Road Southbound	04:38	04:42	00:05	1.7%	✓	04:09	04:32	00:23	9.4%	✓	04:18	04:44	00:26	10.2%	✓

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
Ashby	Moira Road / Nottingham Road Eastbound	07:51	07:42	-00:09	-1.9%	✓	07:12	07:32	00:20	4.6%	✓	08:38	07:39	-00:58	-11.2%	✓
Ashby	Moira Road / Nottingham Road Westbound	07:17	07:18	00:01	0.3%	✓	07:01	07:18	00:17	4.1%	✓	07:30	07:30	00:00	0.0%	✓
Ashby	A511 (A42 to Smisby Road) Northbound	02:29	02:36	00:07	4.5%	✓	02:26	02:30	00:04	2.5%	✓	02:29	02:58	00:29	19.3%	✓
Ashby	A511 (A42 to Smisby Road) Southbound	02:46	02:44	-00:02	-1.0%	✓	02:30	02:21	-00:09	-5.9%	✓	02:45	02:30	-00:14	-8.7%	✓
NW Leics	A511 (M1 to Bardon Road) Eastbound	08:25	05:45	-02:41	-31.8%	×	05:37	05:27	-00:10	-3.0%	✓	07:32	07:53	00:21	4.6%	✓
NW Leics	A511 (M1 to Bardon Road) Westbound	06:08	06:39	00:31	8.5%	✓	05:33	05:26	-00:07	-2.0%	✓	05:46	06:17	00:31	9.0%	✓
NW Leics	A511 (Bardon Road to A42) Eastbound	09:48	09:25	-00:22	-3.8%	✓	08:18	08:13	-00:05	-1.0%	✓	09:36	08:31	-01:05	-11.3%	✓
NW Leics	A511 (Bardon Road to A42) Westbound	10:07	09:03	-01:04	-10.6%	✓	08:27	08:26	-00:01	-0.1%	✓	10:46	09:39	-01:07	-10.3%	✓
NW Leics	A512 (A42 to Shepshed) Eastbound	12:58	12:45	-00:13	-1.7%	✓	11:35	10:50	-00:45	-6.4%	✓	12:18	12:04	-00:15	-2.0%	✓
NW Leics	A512 (A42 to Shepshed) Westbound	12:37	11:13	-01:24	-11.2%	✓	11:17	10:23	-00:54	-8.0%	✓	12:17	12:01	-00:16	-2.2%	✓
SRN	M1 (Jn16 to Jn26) Northbound	51:39	57:39	06:00	11.6%	✓	53:29	56:14	02:46	5.2%	✓	00:08	00:55	00:47	1.3%	✓
SRN	M1 (Jn16 to Jn26) Southbound	59:46	01:58	02:12	3.7%	✓	52:48	56:00	03:13	6.1%	✓	52:49	59:16	06:27	12.2%	✓
SRN	M69 (M6 to M1) Northbound	17:57	19:40	01:43	9.5%	✓	14:25	14:22	-00:03	-0.4%	✓	17:03	15:05	-01:58	-11.6%	✓
SRN	M69 (M6 to M1) Southbound	14:26	14:49	00:23	2.6%	✓	14:28	14:17	-00:11	-1.3%	✓	14:15	14:34	00:19	2.3%	✓
SRN	M42 / A42 (Jn10 to M1) Northbound	20:48	23:09	02:21	11.3%	✓	20:53	22:18	01:25	6.8%	✓	20:37	23:03	02:26	11.8%	✓
SRN	M42 / A42 (Jn10 to M1) Southbound	21:09	22:42	01:34	7.4%	✓	20:32	21:54	01:22	6.6%	✓	20:08	22:42	02:34	12.7%	✓
SRN	M6 (M1 to Jn2) Eastbound	11:34	11:37	00:03	0.5%	✓	10:56	11:30	00:33	5.1%	✓	13:19	11:49	-01:30	-11.3%	✓
SRN	M6 (M1 to Jn2) Westbound	10:04	11:11	01:07	11.1%	✓	10:11	10:54	00:43	7.0%	✓	10:04	11:05	01:01	10.1%	✓
SRN	A46 (M1 to A52) Northbound	25:17	26:32	01:15	4.9%	✓	24:21	25:26	01:05	4.5%	✓	28:33	29:28	00:54	3.2%	✓
SRN	A46 (M1 to A52) Southbound	27:25	29:49	02:24	8.8%	✓	24:35	25:35	01:00	4.0%	✓	24:13	26:44	02:31	10.4%	✓
SRN	A5 (M1 to M42) Eastbound	42:40	41:45	-00:54	-2.1%	✓	38:23	38:35	00:12	0.5%	✓	40:32	40:57	00:24	1.0%	✓
SRN	A5 (M1 to M42) Westbound	41:23	42:30	01:08	2.7%	✓	39:35	38:40	-00:55	-2.3%	✓	46:43	41:31	-05:13	-11.2%	✓
SRN	A453 (M1 Jn23a to A52) Northbound	20:32	16:09	-04:23	-21.4%	×	16:23	16:04	-00:19	-1.9%	✓	17:30	17:02	-00:28	-2.7%	✓
SRN	A453 (M1 Jn23a to A52) Southbound	16:21	16:51	00:30	3.1%	✓	15:54	16:29	00:35	3.7%	✓	21:11	17:01	-04:10	-19.7%	×
SRN	A50 (A38 to M1) Eastbound	14:09	14:06	-00:04	-0.4%	✓	11:52	13:34	01:42	14.3%	✓	12:43	14:00	01:17	10.1%	✓
SRN	A50 (A38 to M1) Westbound	11:47	12:40	00:52	7.4%	✓	11:37	12:08	00:31	4.5%	✓	12:06	12:59	00:53	7.4%	✓
SRN	A52 (A5111 to A1) Eastbound	00:46	50:35	-10:12	-16.8%	×	48:20	47:49	-00:32	-1.1%	✓	56:19	55:30	-00:49	-1.4%	✓
SRN	A52 (A5111 to A1) Westbound	56:10	50:43	-05:26	-9.7%	✓	48:58	48:08	-00:51	-1.7%	✓	54:46	51:00	-03:46	-6.9%	✓
SRN	A1 (A14 to A52) Northbound	42:20	43:08	00:49	1.9%	✓	43:21	44:05	00:45	1.7%	✓	43:01	44:01	01:00	2.3%	✓
SRN	A1 (A14 to A52) Southbound	44:19	45:18	00:59	2.2%	✓	43:02	44:06	01:04	2.5%	✓	41:46	43:13	01:27	3.5%	✓
SRN	A14 (A1 to M1) Eastbound	39:47	42:47	02:59	7.5%	✓	39:34	41:44	02:09	5.5%	✓	38:49	42:39	03:50	9.9%	✓
SRN	A14 (A1 to M1) Westbound	42:15	42:51	00:35	1.4%	✓	40:52	42:07	01:15	3.1%	✓	40:27	42:47	02:21	5.8%	✓
East Midlands	A46_N_NB	30:27	27:48	-02:39	-8.7%	✓	29:55	26:59	-02:56	-9.8%	✓	30:49	28:12	-02:37	-8.5%	✓
East Midlands	A46_N_SB	30:48	28:09	-02:39	-8.6%	✓	30:15	26:52	-03:23	-11.2%	✓	30:35	27:43	-02:52	-9.4%	✓
East Midlands	A60_NB	12:33	11:29	-01:04	-8.4%	✓	12:31	11:12	-01:20	-10.6%	✓	13:50	11:50	-02:00	-14.5%	✓
East Midlands	A60_SB	12:41	11:51	-00:50	-6.6%	✓	12:30	11:12	-01:18	-10.4%	✓	12:34	11:28	-01:06	-8.7%	✓
East Midlands	A614_NB	35:23	39:37	04:13	11.9%	✓	34:37	37:04	02:27	7.1%	✓	37:06	38:22	01:16	3.4%	✓
East Midlands	A614_SB	35:23	39:58	04:35	13.0%	✓	34:03	37:17	03:14	9.5%	✓	34:41	39:00	04:19	12.4%	✓
East Midlands	M1_NB	35:07	38:41	03:34	10.2%	✓	35:26	33:46	-01:40	-4.7%	✓	35:42	38:49	03:07	8.7%	✓
East Midlands	M1_S_NB	28:38	25:42	-02:56	-10.2%	✓	29:03	26:02	-03:01	-10.4%	✓	29:22	27:06	-02:15	-7.7%	✓

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
East Midlands	M1_S_SB	29:25	27:02	-02:22	-8.1%	✓	28:25	25:19	-03:05	-10.9%	✓	28:25	26:20	-02:04	-7.3%	✓
East Midlands	M1_SB	35:09	33:16	-01:53	-5.4%	✓	34:41	31:00	-03:41	-10.6%	✓	34:18	33:02	-01:17	-3.7%	✓
South West	A417_NB	31:25	29:13	-02:13	-7.0%	✓	31:14	29:10	-02:04	-6.6%	✓	34:25	29:24	-05:02	-14.6%	✓
South West	A417_SB	30:37	29:46	-00:51	-2.8%	✓	28:31	29:04	00:33	1.9%	✓	27:43	29:05	01:22	5.0%	✓
South West	B4455_NB	40:31	38:23	-02:08	-5.3%	✓	42:18	38:18	-04:00	-9.4%	✓	41:39	38:19	-03:20	-8.0%	✓
South West	B4455_SB	41:43	38:21	-03:22	-8.1%	✓	43:40	38:18	-05:22	-12.3%	✓	42:43	38:22	-04:21	-10.2%	✓
South West	M5_NB	32:14	34:15	02:01	6.3%	✓	32:46	33:32	00:46	2.3%	✓	32:07	34:06	01:59	6.2%	✓
South West	M5_SB	33:17	33:38	00:21	1.0%	✓	33:13	32:52	-00:21	-1.1%	✓	32:17	33:11	00:54	2.8%	✓
West Midlands	A4103_EB	40:47	39:35	-01:12	-3.0%	✓	40:14	39:04	-01:10	-2.9%	✓	40:44	39:10	-01:33	-3.8%	✓
West Midlands	A4103_WB	38:55	39:33	00:38	1.6%	✓	38:40	39:06	00:26	1.1%	✓	38:58	39:12	00:14	0.6%	✓
West Midlands	A46_S_NB	53:54	53:25	-00:29	-0.9%	✓	53:28	51:36	-01:52	-3.5%	✓	54:47	54:08	-00:38	-1.2%	✓
West Midlands	A46_S_SB	53:47	51:28	-02:19	-4.3%	✓	52:41	51:27	-01:14	-2.3%	✓	53:35	53:35	00:01	0.0%	✓
West Midlands	A49_NB	29:27	24:39	-04:48	-5.4%	✓	31:12	23:56	-07:16	-8.0%	✓	28:08	24:24	-03:44	-4.2%	✓
West Midlands	A49_SB	29:43	24:12	-05:32	-6.2%	✓	31:37	23:54	-07:43	-8.4%	✓	29:59	24:44	-05:16	-5.8%	✓
West Midlands	A5_E_NB	30:35	26:36	-03:58	-13.0%	✓	29:31	26:15	-03:15	-11.0%	✓	32:05	26:23	-05:42	-17.8%	×
West Midlands	A5_E_SB	30:51	27:29	-03:22	-10.9%	✓	29:19	26:29	-02:50	-9.7%	✓	33:47	27:29	-06:19	-18.7%	×
West Midlands	A5_Mid_EB	17:44	17:49	00:04	0.4%	✓	17:55	17:47	-00:08	-0.7%	✓	17:47	17:48	00:02	0.1%	✓
West Midlands	A5_Mid_WB	18:24	17:55	-00:28	-2.6%	✓	18:03	17:46	-00:16	-1.5%	✓	17:40	17:52	00:11	1.1%	✓
West Midlands	A5_W_NB	29:07	28:44	-00:22	-1.3%	✓	29:29	27:55	-01:34	-5.3%	✓	29:47	28:44	-01:03	-3.5%	✓
West Midlands	A5_W_SB	24:50	27:23	02:34	10.3%	✓	25:00	26:11	01:11	4.7%	✓	24:42	27:23	02:41	10.9%	✓
West Midlands	A53_NB	52:26	46:14	-06:12	-11.8%	✓	51:52	46:07	-05:45	-11.1%	✓	52:10	46:22	-05:47	-11.1%	✓
West Midlands	A53_SB	43:35	37:55	-05:40	-13.0%	✓	42:26	37:42	-04:44	-11.2%	✓	42:18	37:47	-04:31	-10.7%	✓
West Midlands	B4455_NB	26:18	25:32	-00:46	-2.9%	✓	26:59	25:00	-01:59	-7.3%	✓	27:54	25:57	-01:57	-7.0%	✓
West Midlands	B4455_SB	29:00	26:11	-02:49	-9.7%	✓	27:04	25:02	-02:02	-7.5%	✓	26:48	25:17	-01:30	-5.6%	✓
West Midlands	GtrBrm_M40_NB	24:03	26:03	02:00	8.3%	✓	25:12	26:29	01:17	5.1%	✓	26:24	27:52	01:28	5.6%	✓
West Midlands	GtrBrm_M40_SB	38:00	36:08	-01:52	-4.9%	✓	36:50	34:50	-01:59	-5.4%	✓	36:22	34:57	-01:25	-3.9%	✓
West Midlands	GtrBrm_M42_NB	26:29	25:06	-01:23	-5.2%	✓	25:14	24:03	-01:11	-4.7%	✓	28:29	24:34	-03:55	-13.7%	✓
West Midlands	GtrBrm_M42_SB	27:40	25:08	-02:31	-9.1%	✓	25:55	24:38	-01:17	-4.9%	✓	27:43	25:59	-01:44	-6.2%	✓
West Midlands	GtrBrm_M5_NB	21:21	20:09	-01:12	-5.6%	✓	21:15	19:15	-02:01	-9.5%	✓	22:24	19:32	-02:52	-12.8%	✓
West Midlands	GtrBrm_M5_SB	21:03	19:47	-01:16	-6.1%	✓	21:02	19:19	-01:43	-8.2%	✓	20:45	19:54	-00:51	-4.1%	✓
West Midlands	GtrBrm_M6_NB	31:22	30:46	-00:36	-1.9%	✓	29:22	29:12	-00:09	-0.5%	✓	31:03	34:02	02:59	9.6%	✓
West Midlands	GtrBrm_M6_SB	42:43	40:59	-01:44	-4.1%	✓	38:46	37:03	-01:43	-4.4%	✓	43:30	41:31	-02:00	-4.6%	✓
West Midlands	M5_NB	22:43	25:17	02:34	11.3%	✓	23:39	24:35	00:56	3.9%	✓	23:34	24:36	01:02	4.4%	✓
West Midlands	M5_SB	23:13	24:45	01:32	6.6%	✓	23:04	24:13	01:08	4.9%	✓	22:30	24:20	01:50	8.2%	✓
West Midlands	M50_NB	31:07	31:17	00:10	0.6%	✓	31:42	31:15	-00:28	-1.5%	✓	30:00	31:04	01:04	3.5%	✓
West Midlands	M50_SB	30:37	31:13	00:36	1.9%	✓	30:39	31:15	00:36	1.9%	✓	29:49	31:29	01:40	5.6%	✓
West Midlands	M54_EB	32:23	29:37	-02:46	-8.5%	✓	32:25	29:15	-03:10	-9.8%	✓	31:47	29:24	-02:23	-7.5%	✓
West Midlands	M54_WB	33:37	29:42	-03:55	-11.7%	✓	33:39	29:12	-04:27	-13.2%	✓	33:06	29:46	-03:20	-10.1%	✓
West Midlands	M6_N_NB	31:41	31:10	-00:30	-1.6%	✓	32:23	31:46	-00:37	-1.9%	✓	32:21	31:39	-00:42	-2.1%	✓

		AM Peak					Interpeak					PM Peak				
Location	**Route**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**	**Observed**	**Modelled**	**Diff**	**%**	**Pass**
West Midlands	M6_N_SB	32:37	31:42	-00:55	-2.8%	✓	32:59	31:33	-01:26	-4.3%	✓	32:33	31:11	-01:22	-4.2%	✓

Appendix C – Summary of Network Statistics

C.1 This appendix contains a series of high-level statistics from the PRTM highway assignment model. These statistics can be categorised into statistics regarding the network itself, information on the post-parking model assignment matrices, and summary assignment results.

C.2 The network statistics given in Table C1 give the number of zones, the number of simulation nodes broken down by junction type, the number of buffer nodes, and the number of simulation and buffer links in the highway model.

C.3 Table C2, Table C3 and Table C4 give the assignment matrix totals in the AM Peak, Interpeak and PM Peak hours respectively. These are the matrix totals after the application of the parking model and are in units of PCUs, so the HGV demand total should be divided by 2 to convert to vehicles. In addition to this the matrix totals are given for both interzonal and intrazonal demand within the matrices.

C.4 The summary assignment results given in Table C5 detail the vehicle-distance (in vehicle-kilometres), vehicle-delay (in vehicle-hours), average speeds (in kph) and delay/km (min/km) within each district in Leicestershire, the FMA, the PRTM area and the External Buffer Area. In order to produce these statistics each model link was allocated to a reporting area based on the location of the midpoint.

C.5 Table C6 and Figure C1 to Figure C4 show highway assignment statistics by government region. These demonstrate the level of network detail that is highest in the West and East Midlands, and gradually reduces with increased distance from the detailed modelled area. Delay statistics are affected by the level of simulation network coverage in each region. Where the network is largely buffer fixed speed network, the model represents delay using reduced fixed speeds which do not feature as delay in these statistics.

Table C1: Network Statistics

Component	Number
Zones	1534
…including spare zones	*47*
…allocated development zones	*13*
Simulation nodes	9629
...priority	*6707*
...signalised	*730*
...roundabout	*503*
...external	*1671*
…dummy	*18*
Buffer nodes	1101
Total nodes	**10730**
Simulation links	21637
Buffer links	3198
Total links	**24835**

Table C2: AM Peak Hour Assignment Matrix Totals (Post-Parking Model in PCUs)

User Class	Total	Interzonal	Intrazonal
HGV	243,733	86,451	157,282
LGV	1,590,889	89,947	1,500,942
Car – Business	412,400	63,525	348,875
Car – Other	2,675,974	191,045	2,484,929
Car - Commuting	3,613,325	279,549	3,333,777
Total	**8,536,321**	**710,517**	**7,825,804**

Table C3: Interpeak Hour Assignment Matrix Totals (Post-Parking Model in PCUs)

User Class	Total	Interzonal	Intrazonal
HGV	233,892	80,777	153,115
LGV	1,151,477	65,310	1,086,167
Car – Business	484,239	58,555	425,684
Car – Other	4,293,466	283,854	4,009,612
Car - Commuting	914,525	64,971	849,554
Total	**7,077,599**	**553,467**	**6,524,132**

Table C4: PM Peak Hour Assignment Matrix Totals (Post-Parking Model in PCUs)

User Class	Total	Interzonal	Intrazonal
HGV	160,445	57,027	103,418
LGV	1,045,351	63,967	981,384
Car – Business	448,870	73,165	375,705
Car – Other	3,236,454	226,730	3,009,724
Car - Commuting	3,550,667	265,418	3,285,249
Total	**8,441,787**	**686,308**	**7,755,480**

Table C5 : Highway Assignment Statistics by District

Time Period	District	Vehicle km	Vehicle delay (hours)	Speed (kph)	Vehicle delay/ Vehicle distance (min/km)
AM Peak	Leicester	268,155	4,451	26	1.00
	Blaby	279,842	1,898	50	0.41
	Charnwood	301,142	1,653	48	0.33
	Harborough	377,368	834	68	0.13
	Hinckley and Bosworth	278,870	915	58	0.20
	Melton	112,792	249	57	0.13
	North West Leicestershire	450,078	1,240	66	0.17
	Oadby and Wigston	33,359	384	28	0.69
	Rutland	13,190	6	79	0.03
	Leicestershire (exc City)	1,833,450	7,171	57	0.23
	Leicestershire (inc City)	2,101,606	11,623	49	0.33
	Fully Modelled Area	3,653,293	16,305	55	0.27
	PRTM Area	11,756,419	15,807	75	0.08
	External Buffer	9,608,897	16,362	94	0.10
Interpeak	Leicester	202,650	2,723	28	0.81
	Blaby	188,588	727	58	0.23
	Charnwood	192,924	808	50	0.25
	Harborough	264,123	381	73	0.09
	Hinckley and Bosworth	188,249	455	62	0.15
	Melton	77,073	169	56	0.13
	North West Leicestershire	332,257	647	71	0.12
	Oadby and Wigston	26,233	243	30	0.56
	Rutland	8,717	2	80	0.01
	Leicestershire (exc City)	1,269,447	3,431	62	0.16
	Leicestershire (inc City)	1,472,096	6,154	53	0.25
	Fully Modelled Area	2,630,830	8,526	59	0.19
	PRTM	9,588,134	8,895	78	0.06
	Buffer	6,736,264	7,748	99	0.07
PM Peak	Leicester	266,198	4,378	26	0.99
	Blaby	288,853	1,634	53	0.34
	Charnwood	307,003	1,590	50	0.31
	Harborough	386,406	787	69	0.12
	Hinckley and Bosworth	286,609	970	58	0.20
	Melton	116,569	288	56	0.15
	North West Leicestershire	468,516	1,429	65	0.18
	Oadby and Wigston	34,716	410	28	0.71
	Rutland	12,798	5	80	0.02
	Leicestershire (exc City)	1,888,673	7,107	58	0.23
	Leicestershire (inc City)	2,154,871	11,486	50	0.32
	Fully Modelled Area	3,799,313	17,185	55	0.27
	PRTM	11,898,146	17,128	75	0.09
	Buffer	8,169,880	12,668	95	0.09

Table C6 : Highway Assignment Statistics by Government Region

Time Period	Government Region	Vehicle km	Vehicle delay (hours)	Speed (kph)	Vehicle delay/ Vehicle distance (min/km)
AM Peak	**East Midlands**	7,130,689	20,331	62	0.17
	West Midlands	5,638,879	10,099	71	0.11
	Eastern	3,107,796	179	88	0.00
	North West	2,295,925	406	92	0.01
	South East	1,986,535	141	98	0.00
	Yorkshire & the Humber	1,712,060	142	95	0.00
	South West	1,397,459	563	94	0.02
	Wales Euro	790,837	42	99	0.00
	London	498,262	0	99	0.00
	North East	170,724	0	94	0.00
	Scotland	220,614	0	102	0.00
Interpeak	**East Midlands**	5,364,893	10,334	67	0.12
	West Midlands	4,692,550	6,104	74	0.08
	Eastern	1,970,795	90	94	0.00
	North West	1,810,346	229	99	0.01
	South East	1,474,178	154	101	0.01
	Yorkshire & the Humber	1,228,727	81	97	0.00
	South West	1,188,197	312	96	0.02
	Wales Euro	541,578	27	98	0.00
	London	288,739	0	100	0.00
	North East	149,701	0	97	0.00
	Scotland	194,509	0	102	0.00
PM Peak	**East Midlands**	7,199,125	20,402	63	0.17
	West Midlands	5,818,483	11,876	70	0.12
	Eastern	2,661,234	178	90	0.00
	North West	2,110,891	354	93	0.01
	South East	1,775,345	275	99	0.01
	Yorkshire & the Humber	1,504,209	179	95	0.01
	South West	1,288,909	593	93	0.03
	Wales Euro	600,581	44	97	0.00
	London	431,419	0	98	0.00
	North East	234,979	0	99	0.00
	Scotland	169,169	0	102	0.00

Figure C1: Vehicle Kilometres by Government Region

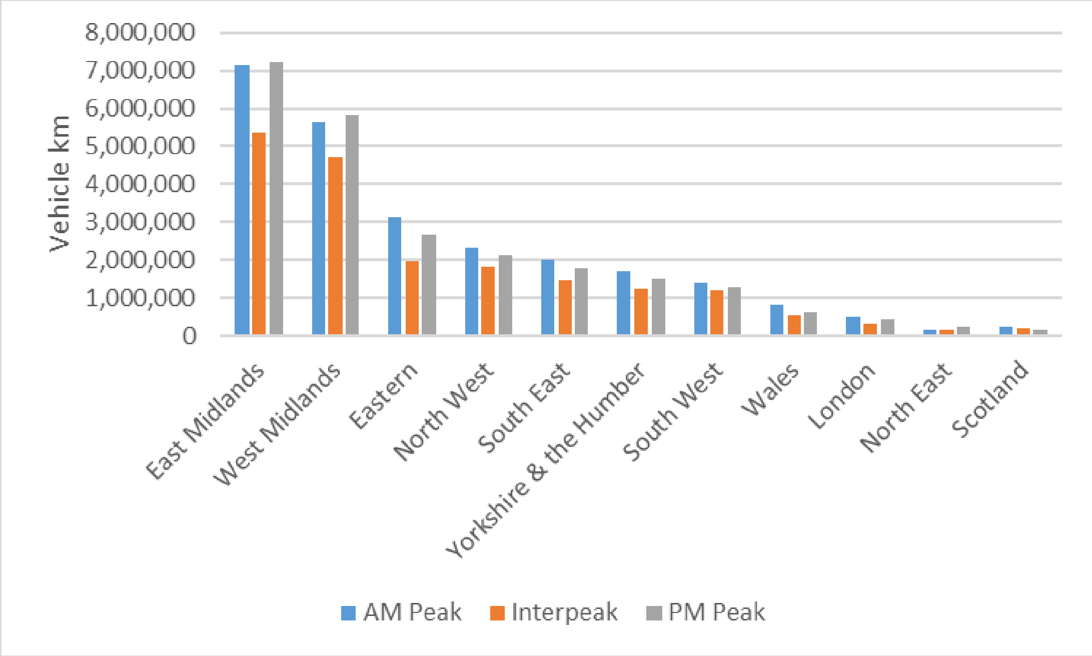


Figure C2: Vehicle Delay Hours by Government Region

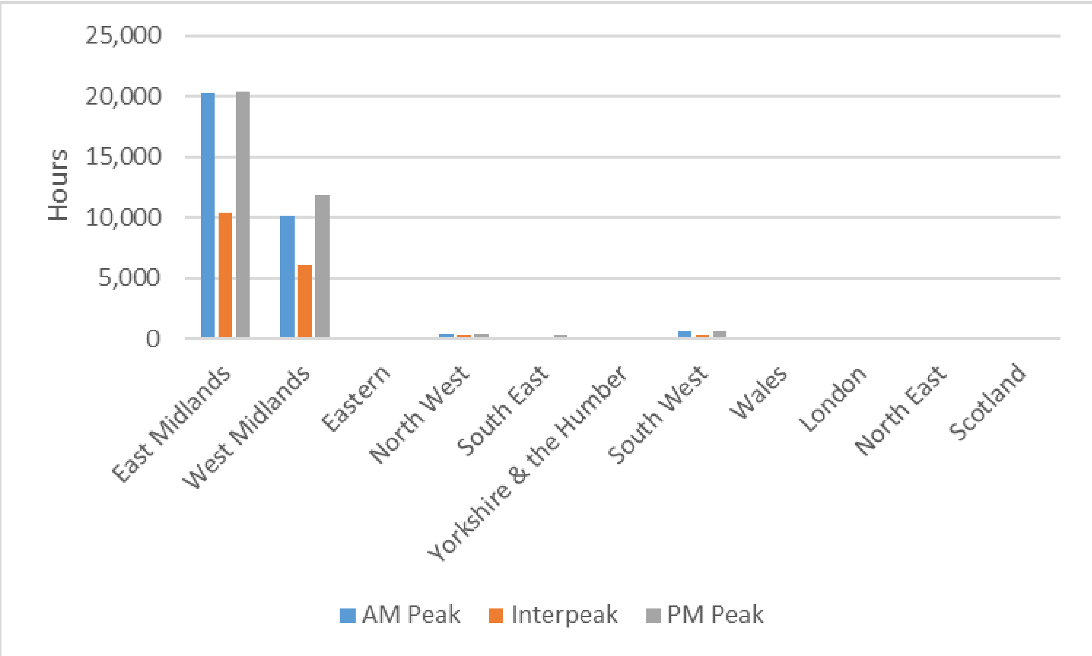


Figure C3: Average Speed by Government Region

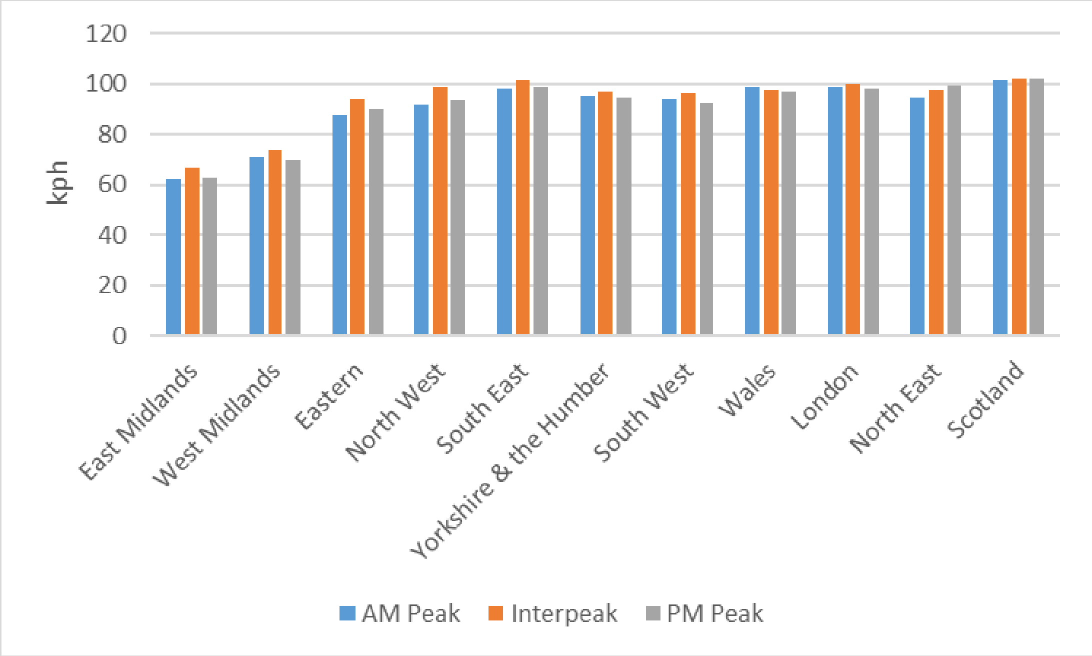
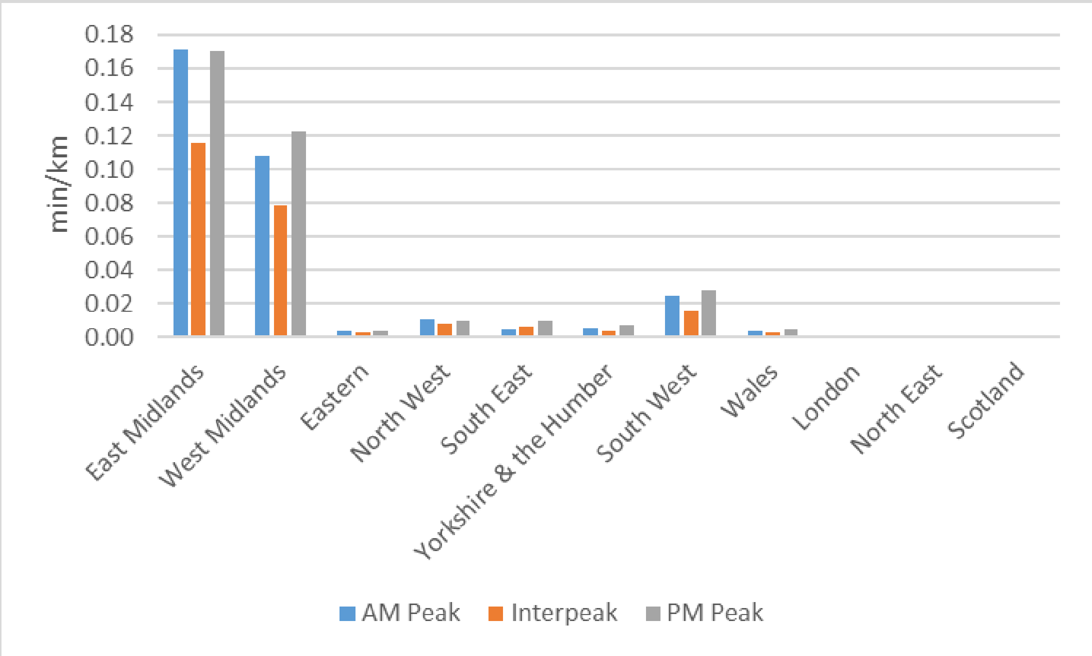


Figure C4: Vehicle Delay/Distance by Government Region



Appendix D – Assignment Calibration and Validation - Independent Validation Model

D.1 This section considers the aggregate performance of the independent validation version of the highway model against screenline and individual counts. This version of the base model retained the set of validation screenlines used in previous versions of the model.

Screenline Performance

D.2 Table D1 shows the screenline performance within Leicestershire after matrix estimation and adjustment for the parking model in the three modelled hours. For each modelled hour two statistics are given: firstly the aggregate difference between observed and modelled flows across all screenlines; and secondly the percentage of screenlines that pass the criteria set out in Table 3.2.

D.3 Within Table D1 these measures are given for Leicestershire as a whole, the outcome from the model that should be assessed against TAG, and for six broad geographical areas within Leicestershire. In addition, the performance of the countywide screenlines, which come together to form a cordon, and the performance of the SRN internal to Leicestershire (indicated by a number of individual counts grouped together by road name, rather than screenline) is also reported in this section.

Table D1: Leicestershire Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	0.3%	91%	0.6%	94%	0.7%	94%
North Leicestershire	-0.0%	81%	1.5%	81%	0.3%	81%
North-East Leicestershire	0.5%	86%	0.6%	100%	0.7%	100%
South Leicestershire	0.4%	96%	0.4%	96%	0.3%	96%
South-West Leicestershire	1.0%	94%	-0.1%	100%	0.1%	94%
North-West Leicestershire	-0.2%	88%	0.1%	94%	-0.6%	94%
Countywide	0.4%	100%	0.6%	100%	0.3%	100%
SRN (int)	-0.4%	100%	0.4%	100%	-0.5%	100%
Leicestershire	***0.2%***	***92%***	***0.5%***	***95%***	***0.2%***	***95%***

D.4 Table D1 shows that across the whole of Leicestershire 92%, 95% and 95% of screenlines meet the specified criteria in the AM Peak, Interpeak and PM Peak hours respectively. This table also suggests that in aggregate terms there is around 0.5% more traffic in the Interpeak model than observed and similar traffic in the peak models to observed data. There is therefore no systematic bias identifiable at this level.

D.5 Table D2 shows the screenline performance in the PRTM area after matrix estimation in the three modelled hours. For each modelled hour two statistics are given: firstly the aggregate difference between observed and modelled flows across all screenlines; and secondly the percentage of screenlines that pass the criteria set out in Table 3.2.

Table D2: PRTM Area Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
West Midlands	-3.1%	77%	-2.4%	86%	-3.6%	77%
East Midlands	0.7%	88%	-0.2%	91%	0.3%	88%
East of England	-4.6%	50%	-5.4%	50%	-5.8%	50%
West of England	-0.2%	100%	-0.1%	100%	-0.2%	100%
PRTM Area	***-1.7%***	***82%***	***-1.7%***	***87%***	***-2.3%***	***82%***

D.6 Screenline performance in the PRTM area is at a similar level to that in Leicestershire. The failures in the West Midlands causing the lower pass rate are in areas remote from Leicestershire, in Herefordshire and Gloucestershire, and are unlikely to affect results in Leicestershire. For the areas immediately surrounding Leicestershire, the screenline performance is good.

D.7 As well as overall statistics, TAG states that both calibration and validation sets should be presented. Table D3 shows the performance of calibration screenlines in Leicestershire and in each district. Across Leicestershire, 100%, 99% and 99% of screenlines meet the criteria in the AM Peak, Interpeak and PM Peak hours respectively. In aggregate terms there is the same traffic in the model compared with observed data.

Table D3: Leicestershire Calibration Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	-0.1%	100%	0.0%	100%	0.3%	96%
North Leicestershire	0.3%	100%	0.5%	100%	0.8%	100%
North-East Leicestershire	-0.7%	100%	0.3%	100%	-0.1%	100%
South Leicestershire	0.4%	100%	-0.3%	94%	0.1%	100%
South-West Leicestershire	-0.3%	100%	-0.3%	100%	-0.2%	100%
North-West Leicestershire	0.0%	100%	-0.0%	100%	0.1%	100%
Countywide	0.4%	100%	0.6%	100%	0.3%	100%
SRN (Internal)	-0.2%	100%	-0.0%	100%	-0.1%	100%
Leicestershire	***0.0%***	***100%***	***0.1%***	***99%***	***0.2%***	***99%***

D.8 The performance of validation screenlines in Leicestershire and each district is shown in Table D4.

Table D4: Leicestershire Validation Screenline Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**	**Total %**	**Screenline Passes including 95% C.I.**
Leicester City	3.0%	63%	5.1%	75%	3.3%	88%
North Leicestershire	-0.7%	50%	3.3%	50%	-0.6%	50%
North-East Leicestershire	2.2%	67%	1.1%	100%	1.8%	100%
South Leicestershire	0.9%	88%	6.7%	100%	2.1%	88%
South-West Leicestershire	2.3%	83%	0.1%	100%	0.5%	83%
North-West Leicestershire	-1.2%	67%	0.7%	83%	-4.3%	83%
Countywide	-	-	-	-	-	-
SRN (Internal)	-0.6%	100%	1.0%	100%	-1.0%	100%
Leicestershire	***0.6%***	***76%***	***2.0%***	***88%***	***0.1%***	***86%***

D.9 All countywide screenlines are calibration so there is no independent validation data. The overall performance in Leicestershire is reasonable considering this is independent data, with around 76% passing in the AM Peak, 88% passing in the PM Peak, and 86% passing in the Interpeak.

Link Flow Performance

D.10 Based on the same definitions of sub-areas within Leicestershire, Table D5 shows the percentages of links that pass the ‘flow’ or ‘GEH’ criteria defined within TAG (see Table 3.3) in the three modelled hours, based on total vehicle flows.

Table D5: Leicestershire Link Flow Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	84%	83%	92%	92%	86%	85%
North Leicestershire	88%	87%	89%	88%	81%	80%
North-East Leicestershire	94%	94%	96%	95%	92%	91%
South Leicestershire	93%	93%	95%	95%	89%	89%
South-West Leicestershire	90%	89%	96%	96%	86%	85%
North-West Leicestershire	95%	95%	97%	97%	94%	94%
Countywide	92%	90%	98%	97%	89%	87%
SRN (Internal)	97%	97%	100%	100%	96%	96%
Leicestershire	***90%***	***89%***	***95%***	***94%***	***88%***	***87%***

D.11 TAG guidelines are that 85% or more of individual counts meet the ‘flow’ or ‘GEH’ criteria within the model. From Table D5, 89%, 94% and 87% of individual counts meet the ‘flow’ criteria or the ‘GEH’ criteria in the AM Peak, Interpeak and PM Peak hours respectively.

D.12 In considering the breakdown in this performance by sub-area within Leicestershire, the 85% criterion for links within the ‘flow’ or ‘GEH’ criteria is met for all sub-areas except for Leicester City in the AM Peak and North Leicestershire in the PM Peak. As with the performance of screenlines by area, this test is beyond TAG requirements and is presented to provide an indication of the performance of the model in different areas within Leicestershire. Nevertheless, the performance in these weaker areas is close to the overall model-wide standards specified by TAG.

D.13 The PRTM area link flow results for the areas surrounding Leicestershire are shown in Table D6 and are very good with at above 90% pass rate in all time periods.

Table D6: PRTM Area Link Flow Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
West Midlands	84%	84%	88%	88%	86%	85%
East Midlands	95%	95%	96%	95%	96%	95%
East of England	91%	91%	86%	86%	86%	86%
West of England	100%	100%	100%	100%	100%	100%
PRTM Area	***91%***	***91%***	***92%***	***92%***	***92%***	***91%***

D.14 As required by TAG, these statistics are also presented separately for calibration data sets in Table D7, and for validation data set in Table D8.

Table D7: Leicestershire Calibration Link Flow Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	85%	84%	94%	94%	87%	87%
North Leicestershire	92%	91%	93%	92%	85%	83%
North-East Leicestershire	95%	94%	97%	96%	90%	89%
South Leicestershire	93%	93%	95%	95%	90%	90%
South-West Leicestershire	96%	95%	100%	100%	94%	94%
North-West Leicestershire	95%	96%	100%	100%	93%	92%
Countywide	92%	90%	98%	97%	89%	87%
SRN (Internal)	98%	98%	100%	100%	100%	100%
Leicestershire	***91%***	***90%***	***96%***	***96%***	***90%***	***89%***

Table D8: Leicestershire Validation Link Flow Performance (Total Vehicle Flows)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	71%	71%	71%	71%	63%	63%
North Leicestershire	82%	81%	82%	81%	76%	74%
North-East Leicestershire	93%	93%	93%	93%	96%	96%
South Leicestershire	91%	91%	94%	94%	85%	85%
South-West Leicestershire	80%	79%	90%	90%	72%	71%
North-West Leicestershire	94%	94%	83%	83%	100%	100%
Countywide	-	-	-	-	-	-
SRN (Internal)	97%	97%	100%	100%	90%	90%
Leicestershire	***86%***	***86%***	***88%***	***88%***	***81%***	***81%***

D.15 For calibration screenlines in Leicestershire 89% or more of individual counts meet the ‘flow’ or ‘GEH’ criteria in the AM Peak and PM Peak hours and 96% in the Interpeak. This is a strong performance and the percentage of link flows passing being over 85% in every district except Leicester City in the AM Peak and North Leicestershire in the PM Peak highlights the strong performance of the model as a whole and in individual geographies when considering calibration data.

D.16 In the validation results there are 86%, 88% and 81% of individual counts that meet the 'flow' or 'GEH' criteria in the AM Peak, Interpeak and PM Peak respectively. Considering this is validation data and TAG requires 85% of links to pass, this is further demonstration of the quality of this highway model. Further, the similarity between the level of performance presented for calibration data and validation data for the whole model suggests that the achievement of TAG criteria is not a result of calibration data 'fitting' the model.

D.17 As required within TAG, the link flow performance for car-only traffic, excluding LGV and HGV demand, has also been reported. These results are given in Table D9 and show that there is little difference between the link performance with all vehicle types and car traffic only, both in terms of overall performance and performance by sub-area within Leicestershire. The car-only performance statistics tend to be marginally better than the total vehicle flow statistics as expected as the major vehicle with more availability of data.

Table D9: Leicestershire Link Flow Performance (Car Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	86%	85%	94%	94%	87%	86%
North Leicestershire	89%	88%	90%	90%	81%	80%
North-East Leicestershire	96%	95%	98%	98%	96%	95%
South Leicestershire	93%	93%	97%	97%	91%	90%
South-West Leicestershire	91%	90%	98%	98%	89%	88%
North-West Leicestershire	96%	97%	98%	98%	95%	95%
Countywide	94%	92%	99%	99%	91%	89%
SRN (Internal)	97%	97%	100%	100%	97%	97%
Leicestershire	***91%***	***91%***	***96%***	***96%***	***90%***	***89%***

D.18 For completeness, the same link flow performance data are provided for LGV and HGV in Table D10 and Table D11 below; these statistics reflect the TAG flow criteria set out in Table 3.3, and hence the active criterion is "Individual flows within 100 veh/hr of counts for flows less than 700 veh/hr"; as HGV and LGV flows tend to be low relative to car. The reported statistics are consequently higher than those in Table D9.

Table D10: Leicestershire Link Flow Performance (LGV Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	100%	100%	100%	100%	100%	100%
North Leicestershire	100%	100%	100%	100%	100%	100%
North-East Leicestershire	100%	100%	100%	100%	100%	100%
South Leicestershire	100%	100%	100%	100%	100%	100%
South-West Leicestershire	100%	100%	100%	100%	100%	100%
North-West Leicestershire	100%	100%	100%	100%	100%	100%
Countywide	100%	100%	100%	100%	100%	100%
SRN (Internal)	100%	100%	100%	100%	100%	100%
Leicestershire	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

Table D11: Leicestershire Link Flow Performance (HGV Traffic Only)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Screenline	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City	100%	100%	100%	100%	100%	100%
North Leicestershire	100%	100%	100%	100%	100%	100%
North-East Leicestershire	100%	100%	100%	100%	100%	100%
South Leicestershire	100%	100%	100%	100%	100%	100%
South-West Leicestershire	100%	100%	100%	100%	100%	100%
North-West Leicestershire	100%	100%	100%	100%	100%	100%
Countywide	100%	100%	100%	100%	100%	100%
SRN (Internal)	100%	100%	100%	100%	100%	100%
Leicestershire	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***

D.19 The PRTM area link flow performances are shown for car, LGV and HGV in Table D12, Table D13 and Table D14 respectively. The performance is similar to that in Leicestershire. The flow totals are also included and show flows to be at a reasonable total level.

Table D12: PRTM Area Link Flow Performance and Flow Totals (Car)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**
West Midlands	87%	-2.8%	92%	-1.6%	88%	-2.7%
East Midlands	96%	0.7%	96%	-0.1%	96%	0.1%
East of England	91%	-4.2%	86%	-5.8%	86%	-6.0%
West of England	100%	-0.2%	100%	-0.1%	100%	-0.2%
PRTM Area	**92%**	**-1.5%**	**94%**	**-1.2%**	**93%**	**-1.9**

Table D13: PRTM Area Link Flow Performance and Flow Totals (LGV)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**
West Midlands	97%	1.1%	100%	1.0%	99%	-1.0%
East Midlands	99%	0.6%	99%	-0.3%	99%	0.9%
East of England	100%	-8.9%	100%	-7.7%	100%	-8.1%
West of England	100%	-0.0%	100%	-0.1%	100%	0.0%
PRTM Area	**99%**	**0.3%**	**100%**	**-0.1%**	**99%**	**-0.8%**

Table D14: PRTM Area Link Flow Performance and Flow Totals (HGV)

	AM Peak Hour		Interpeak Hour		PM Peak Hour	
Area	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**	**%Links no C.I.**	**Total %**
West Midlands	91%	-8.6%	91%	-8.0%	88%	-12.6%
East Midlands	99%	1.0%	98%	-0.8%	99%	2.0%
East of England	100%	-2.7%	100%	-2.1%	100%	-1.9%
West of England	100%	-0.4%	100%	-0.2%	100%	-0.1%
PRTM Area	**96%**	**-5.2%**	**96%**	**-5.3%**	**95%**	**-7.5%**

Appendix E – Model Performance by Area

E.1 This section considers the model performance for each individual district within Leicestershire as well as separately for the Strategic Road Network, Leicestershire Cordon and External and PRTM Area.

Assignment Calibration and Validation – Leicester City and Surrounding Areas

E.2 Table E1 shows the detailed screenline and link flow performance for those screenlines and counts categorised as within 'Leicester City and Surrounding Areas' (see Figure E1). This table shows whether the screenline or cordon meets the TAG criteria, and then the number of counts contained along that screenline or cordon that meet the 'flow' or 'GEH' criteria for individual counts. These results are given for the AM Peak, Interpeak and PM Peak modelled hours.

E.3 In addition to the assigned flow results, Table E2 states the journey time validation results by route within 'Leicester City and Surrounding Areas' (see Figure E1). For each route the absolute and percentage difference between the modelled and observed journey times are given, along with whether that route passes or fails the TAG journey time validation criteria.

E.4 Table E1 shows that at a screenline level the modelled flows match the observed flows. The percentage of screenlines and cordons that meet the TAG criteria are 96% in the AM Peak hour and 100% in the Interpeak and 92% in the PM Peak hour. This suggests that the matrix is broadly correct with the correct level of traffic into and out of Leicester City and within the City itself.

E.5 The percentage of links passing TAG's 'link' or 'GEH' criteria is 84% in the AM Peak hour model, 94% in the Interpeak model and 88% in the PM Peak model. Across the three modelled time periods and considering either the link 'flow' or 'GEH' criteria, the pass rate within this area tends to be between 65% and 85% with a few screenlines with pass rates in excess of 85% and some that are 50%. However, these do tend to be lower samples i.e. screenlines of four counts.

E.6 The routeing options within Leicester City are relatively complex in comparison to other areas of Leicestershire, and this is likely to be a key contributory factor in the link count performance within this area. There are also a significant number of signalised junctions within this part of the model with staging and / or timings that have not been observed or the signals are variable signals and the observed data may be subject to large daily differences in traffic flow. The strong performance of the majority of Leicester City journey time routes suggests that, although not perfect, the signal timings are reasonable.

E.7 In addition to this there are also a number of locations within Leicester City where counts are located on relatively minor, local roads. The model zone system within Leicester City is sufficiently detailed for the known applications of the model, but with this level of detail there may remain local zone loading issues between local residential roads. Without further zone disaggregation, which may be disproportionate for the proposed uses of the model, this localised loading of demand onto the network cannot be resolved.

E.8 Considering the journey time validation in more detail, 94% of routes pass the TAG guidelines in the AM Peak hour, and 84% in the PM Peak hour, with a 91% pass rate in the Interpeak hour. This level of validation would be considered acceptable for a local model of Leicester so to achieve it in a strategic model of Leicester and Leicestershire is beyond what is expected of the model. The following is a summary of the main observations on the journey time validation results. This does not report on all journey time routes that do not meet TAG criteria, but focuses on those routes that show a consistent bias across either time periods or direction.

- **A563 ORR Section 1**: Overall this journey time route fails to meet TAG criteria in the PM Peak hour (the modelled time is 17.0% lower than observed) and in both directions in the Interpeak (modelled times are 25% higher clockwise and 32% higher anti-clockwise than observed). The graphs suggest that each delay point is picked up in both the peaks and the Interpeak. The ORR is coded with the same speed flow curve in both periods and is responding to the additional traffic in the peaks by being slower overall. However that response is not quite enough in the PM Peak anti-clockwise and is too sensitive in the Interpeak. There is a finite number of options for speed flow curves and types of link have to be aggregated in some way. It could be that traffic conditions on ring roads which are dual-carriageway with several lanes and lower speed limits means that in the Interpeak when these speed limits are easily met or exceeded the model underestimates speed yet with closely spaced junctions and intersections with radial routes the speed is over estimated in the peaks.
- **A563 ORR Section 3 Anti-clockwise**: Overall this journey time route fails to meet TAG criteria in the Interpeak (modelled times being 20% higher than observed) and the PM Peak hour (modelled times being 20% higher than observed) although these are both marginal failures. In both graphs, there seems to be more delay at the roundabout with Victoria Road East in the model than observed. This is an unobserved signal and so alternatives in signal timings were tested. However, there was no viable solution as either the clockwise route was affected or the routeing was significantly disrupted.

Figure E1: Leicester City and Surrounding Area Screenlines and Journey Time Routes

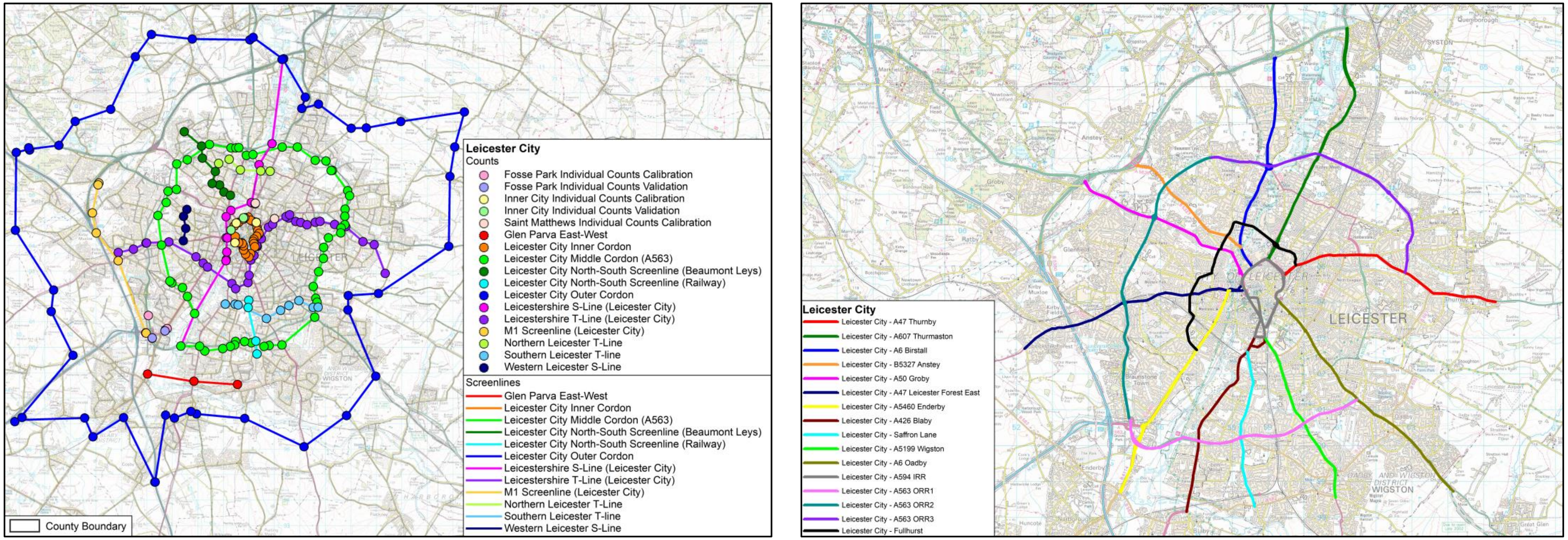


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Table E1: Leicester City and Surrounding Area Screenline and Link Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicestershire T-Line (Leicester City) Northbound	29	✓	90%	90%	✓	93%	93%	✓	86%	86%
Leicestershire T-Line (Leicester City) Southbound	29	✓	76%	76%	✓	86%	86%	✓	79%	79%
Leicestershire S-Line (Leicester City) Eastbound	11	✓	73%	63%	✓	100%	100%	✓	100%	100%
…excluding SRN counts	10	✓	70%	63%	✓	100%	100%	✓	100%	100%
Leicestershire S-Line (Leicester City) Westbound	11	✓	100%	100%	✓	91%	88%	✓	100%	100%
…excluding SRN counts	10	✓	100%	100%	✓	90%	88%	✓	100%	100%
M1 Screenline (Leicester City) Eastbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
…excluding SRN counts	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
M1 Screenline (Leicester City) Westbound	5	✓	100%	100%	✓	100%	100%	×	80%	75%
…excluding SRN counts	4	✓	100%	100%	✓	100%	100%	×	75%	75%
Leicester City Inner Cordon Inbound	14	✓	86%	86%	✓	93%	93%	✓	100%	100%
Leicester City Inner Cordon Outbound	22	×	82%	82%	✓	86%	86%	✓	95%	95%
Leicester City Middle Cordon (A563) Inbound	49	✓	90%	90%	✓	100%	100%	✓	94%	94%
Leicester City Middle Cordon (A563) Outbound	49	✓	94%	94%	✓	96%	96%	✓	92%	92%
Leicester City Outer Cordon Inbound	40	✓	73%	69%	✓	93%	92%	✓	85%	83%
…excluding SRN counts	36	✓	69%	69%	✓	92%	92%	✓	83%	83%
Leicester City Outer Cordon Outbound	41	✓	85%	84%	✓	95%	95%	✓	73%	70%
…excluding SRN counts	37	✓	84%	84%	✓	95%	95%	✓	70%	70%

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicester City North-South Screenline (Beaumont Leys) Eastbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Leicester City North-South Screenline (Beaumont Leys) Westbound	8	✓	75%	75%	✓	100%	100%	✓	100%	100%
Leicester City North-South Screenline (Railway) Eastbound	4	✓	50%	50%	✓	100%	100%	✓	50%	50%
Leicester City North-South Screenline (Railway) Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Leicester City	***329***	***94%***	***85%***	***84%***	***100%***	***95%***	***94%***	***94%***	***88%***	***88%***

Table E2: Leicester City and Surrounding Area Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Leicester City	A47 Thurnby Inbound	-01:02	-6.8%	✓	01:06	9.1%	✓	00:51	7.0%	✓
Leicester City	A47 Thurnby Outbound	-00:21	-2.6%	✓	00:06	0.7%	✓	-02:22	-14.8%	✓
Leicester City	A607 Thurmaston Inbound	00:26	3.2%	✓	-00:52	-6.9%	✓	-00:23	-3.0%	✓
Leicester City	A607 Thurmaston Outbound	00:25	3.6%	✓	-00:12	-1.7%	✓	00:43	4.9%	✓
Leicester City	A6 Birstall Inbound	-01:35	-10.4%	✓	00:19	3.0%	✓	00:05	0.7%	✓
Leicester City	A6 Birstall Outbound	00:00	0.0%	✓	00:51	8.6%	✓	00:23	3.0%	✓
Leicester City	B5327 Anstey Inbound	-01:11	-11.6%	✓	00:58	16.6%	✓	01:04	16.8%	×
Leicester City	B5327 Anstey Outbound	00:19	5.0%	✓	00:26	7.1%	✓	-00:01	-0.2%	✓
Leicester City	A50 Groby Inbound	-04:52	-31.8%	×	00:23	4.4%	✓	-01:30	-13.0%	✓
Leicester City	A50 Groby Outbound	01:05	12.9%	✓	00:51	10.6%	✓	-00:15	-2.0%	✓
Leicester City	A47 Leicester Forest East Inbound	01:23	7.8%	✓	01:26	12.9%	✓	00:35	4.3%	✓
Leicester City	A47 Leicester Forest East Outbound	00:58	7.3%	✓	00:36	5.2%	✓	01:47	11.4%	✓
Leicester City	A5460 Enderby Inbound	-02:02	-11.0%	✓	01:07	9.4%	✓	-00:06	-0.8%	✓
Leicester City	A5460 Enderby Outbound	-01:03	-7.0%	✓	00:50	7.3%	✓	-01:29	-9.5%	✓
Leicester City	A426 Blaby Inbound	-02:15	-12.4%	✓	01:07	11.1%	✓	-01:20	-10.6%	✓
Leicester City	A426 Blaby Outbound	01:14	9.4%	✓	02:14	20.9%	×	00:14	1.4%	✓
Leicester City	Saffron Lane Inbound	-00:02	-0.3%	✓	01:05	13.7%	✓	00:47	9.2%	✓
Leicester City	Saffron Lane Outbound	00:06	1.0%	✓	01:17	15.1%	×	-01:32	-12.4%	✓
Leicester City	A5199 Wigston Inbound	00:12	1.6%	✓	00:35	6.8%	✓	00:12	2.0%	✓
Leicester City	A5199 Wigston Outbound	00:50	8.5%	✓	00:43	7.8%	✓	01:25	12.7%	✓
Leicester City	A6 Oadby Inbound	-00:40	-3.6%	✓	01:10	9.1%	✓	-00:12	-1.3%	✓
Leicester City	A6 Oadby Outbound	01:18	10.4%	✓	01:21	11.4%	✓	01:10	7.3%	✓
Leicester City	A594 IRR Clockwise	01:19	8.4%	✓	02:08	16.8%	×	-00:29	-3.0%	✓
Leicester City	A594 IRR Anti-Clockwise	02:04	16.6%	×	01:20	13.0%	✓	00:18	2.4%	✓

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Leicester City	A563 ORR1 Clockwise	-01:24	-7.5%	✓	02:52	25.0%	×	01:35	11.5%	✓
Leicester City	A563 ORR1 Anti-Clockwise	-01:14	-7.7%	✓	03:38	32.4%	×	-03:40	-17.0%	×
Leicester City	A563 ORR2 Clockwise	-00:59	-6.6%	✓	01:21	11.3%	✓	-01:09	-7.4%	✓
Leicester City	A563 ORR2 Anti-Clockwise	00:50	5.9%	✓	01:28	13.4%	✓	00:58	7.6%	✓
Leicester City	A563 ORR3 Clockwise	00:21	2.7%	✓	01:11	10.5%	✓	-01:08	-7.2%	✓
Leicester City	A563 ORR3 Anti-Clockwise	01:37	12.3%	✓	02:09	19.3%	×	02:14	19.5%	×
Leicester City	Fullhurst Clockwise	-00:20	-1.9%	✓	01:59	14.4%	✓	01:39	10.3%	✓
Leicester City	Fullhurst Anti-Clockwise	01:07	7.0%	✓	01:15	9.0%	✓	00:32	2.9%	✓
Leicester City and Surrounding Areas				**94%**			**81%**			**91%**

Assignment Calibration and Validation – North Leicestershire

E.9 One of the key areas of focus for this sub-area within Leicestershire (predominantly Charnwood Borough) is Loughborough; the screenlines and journey time routes are shown in Figure E2.

E.10 The screenline performance within this sub-area is given in Table E3 and shows that the percentage of screenlines and cordons meeting the TAG criteria is 100% in all three time periods.

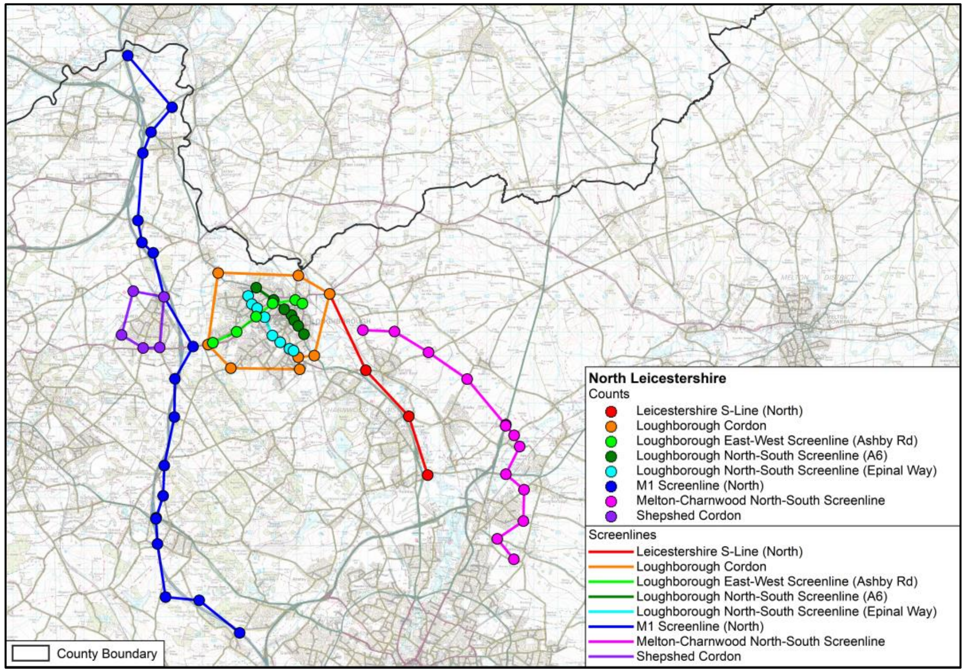
E.11 In North Leicestershire the number of links meeting TAG 'flow' or 'GEH' criteria is 86% in the AM Peak, 93% in the Interpeak and 81% in the PM Peak. For the majority of screenlines the number of links meeting TAG 'flow' or 'GEH' criteria is very good.

E.12 Considering the journey time validation within 'North Leicestershire' (as detailed in Table E4) the proportions of journey time routes meeting TAG criteria are 83%, 94% and 83% in the AM Peak, Interpeak and PM Peak models respectively. This equates to three routes failing to meet TAG criteria in the peaks and one in the Interpeak. The common reason for failure was overrepresentation of delay at signals. Loughborough contains a large number of signalised junctions, some of which had unobserved timings. Substantial effort has been made to review and update the signal timings in Loughborough but reached a point where improving one route would have a negative impact others.

E.13 Some of the failing routes are detailed below, along with the primary reason for each route failing to meet TAG guidelines:

- **Loughborough Old Ashby Road/Alan Moss Road PM Peak Eastbound:** underrepresentation of delay approaching the Meadow Lane signals. Each of these signals was reviewed aiming for the best solution in terms of routeing and journey time.
- **Forest Road AM Peak Eastbound & Interpeak Westbound:** There is an underestimation of delay in the AM Peak Eastbound at the Forest Road/Epinal Way roundabout and a slight overrepresentation of delay across the whole Westbound route.
- **A6004 Epinal Way AM Peak Northbound and PM Peak Southbound:** There is an underrepresentation of delay in both cases at the Forest Road/Epinal Way roundabout.

Figure E2: North Leicestershire Screenlines and Journey Time Routes



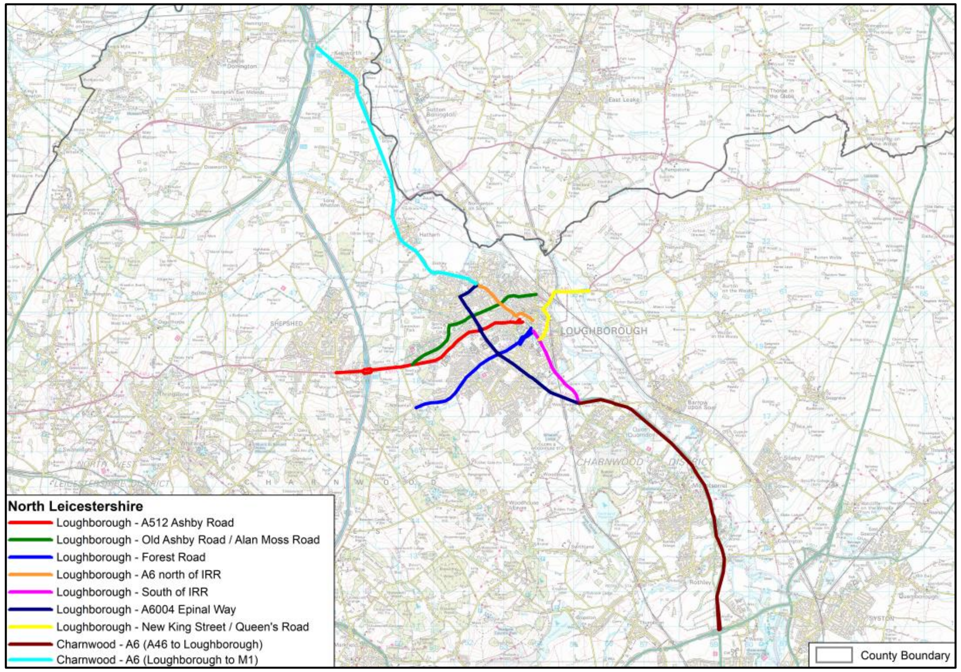


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Table E3: North Leicestershire Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicestershire S-Line (North) Eastbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Leicestershire S-Line (North) Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
M1 Screenline (North) Eastbound	18	✓	78%	73%	✓	94%	93%	✓	83%	80%
…excluding SRN counts	17	✓	76%	73%	✓	94%	93%	✓	82%	80%
M1 Screenline (North) Westbound	18	✓	89%	87%	✓	100%	100%	✓	78%	73%
…excluding SRN counts	17	✓	88%	87%	✓	100%	100%	✓	76%	73%
Loughborough Cordon Inbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Loughborough Cordon Outbound	8	✓	75%	75%	✓	88%	88%	✓	75%	75%
Loughborough N-S Screenline (Epinal Way) East	8	✓	100%	100%	✓	75%	75%	✓	50%	50%
Loughborough N-S Screenline (Epinal Way) West	8	✓	100%	100%	✓	75%	75%	✓	100%	100%
Loughborough N-S Screenline (A6) Eastbound	7	✓	100%	100%	✓	71%	71%	✓	86%	86%
Loughborough N-S Screenline (A6) Westbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
Loughborough E-W Screenline (Ashby Road) North	6	✓	67%	67%	✓	100%	100%	✓	67%	67%
Loughborough E-W Screenline (Ashby Road) South	6	✓	83%	83%	✓	100%	100%	✓	100%	100%
Shepshed Cordon Inbound	5	✓	100%	100%	✓	100%	100%	✓	80%	80%
Shepshed Cordon Outbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton-Charnwood North-South Screenline Eastbound	12	✓	83%	82%	✓	100%	100%	✓	75%	73%
…excluding SRN counts	11	✓	82%	82%	✓	100%	100%	✓	73%	73%
Melton-Charnwood North-South Screenline Westbound	12	✓	67%	64%	✓	92%	91%	✓	67%	64%

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
…excluding SRN counts	11	✓	64%	64%	✓	91%	91%	✓	64%	64%
North Leicestershire	***135***	***100%***	***87%***	***86%***	***100%***	***93%***	***93%***	***100%***	***82%***	***81%***

Table E4: North Leicestershire Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Loughborough	A512 Ashby Road Eastbound	-01:14	-10.3%	✓	00:30	5.5%	✓	-01:14	-10.8%	✓
Loughborough	A512 Ashby Road Westbound	00:28	4.8%	✓	01:04	11.8%	✓	-00:40	-5.3%	✓
Loughborough	Old Ashby Road / Alan Moss Road Eastbound	00:17	3.2%	✓	00:37	7.5%	✓	-02:47	-23.0%	×
Loughborough	Old Ashby Road / Alan Moss Road Westbound	-00:36	-6.4%	✓	00:43	9.3%	✓	00:44	8.7%	✓
Loughborough	Forest Road Eastbound	-01:59	-19.0%	×	00:52	12.5%	✓	00:55	12.9%	✓
Loughborough	Forest Road Westbound	00:45	10.1%	✓	01:08	18.5%	×	00:20	3.4%	✓
Loughborough	A6 north of Inner Relief Road Northbound	-00:16	-5.7%	✓	-00:15	-5.3%	✓	-01:10	-20.0%	×
Loughborough	A6 north of Inner Relief Road Southbound	-01:05	-20.1%	×	-00:29	-10.4%	✓	-00:32	-10.7%	✓
Loughborough	A6 south of Inner Relief Road Northbound	-00:21	-5.8%	✓	00:24	11.1%	✓	00:12	5.0%	✓
Loughborough	A6 south of Inner Relief Road Southbound	-00:07	-3.2%	✓	00:10	4.9%	✓	-00:19	-7.0%	✓
Loughborough	A6004 Epinal Way Northbound	-01:48	-15.7%	×	00:34	6.6%	✓	-00:03	-0.4%	✓
Loughborough	A6004 Epinal Way Southbound	-00:03	-0.5%	✓	00:14	2.9%	✓	-02:35	-22.7%	×
Loughborough	New King Street / Queen's Road Eastbound	00:24	8.8%	✓	00:32	13.0%	✓	00:51	17.0%	✓
Loughborough	New King Street / Queen's Road Westbound	00:27	7.1%	✓	00:45	16.7%	✓	00:21	6.5%	✓
Charnwood	A6 (A46 to Loughborough) Northbound	-00:03	-0.9%	✓	00:03	1.0%	✓	00:21	6.3%	✓
Charnwood	A6 (A46 to Loughborough) Southbound	-00:10	-2.8%	✓	-00:11	-3.2%	✓	00:22	6.5%	✓
Charnwood	A6 (Loughborough to M1) Northbound	00:26	3.5%	✓	00:00	-0.1%	✓	-02:01	-11.4%	✓
Charnwood	A6 (Loughborough to M1) Southbound	00:16	2.3%	✓	00:30	5.2%	✓	00:12	1.9%	✓
North Leicestershire				**83%**			**94%**			**83%**

Assignment Calibration and Validation – North-East Leicestershire

E.14 The screenlines, counts and journey times in this sub-area of Leicestershire (predominantly Melton Borough) are mainly focussed on Melton Mowbray. The screenlines and journey time routes for this district are shown in Figure E3.

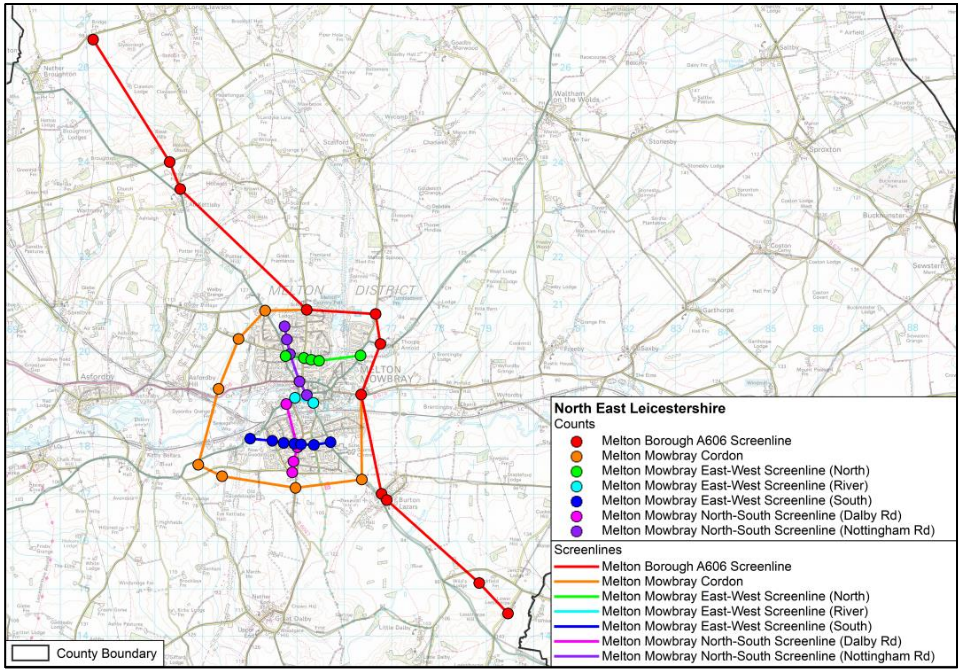
E.15 Table E5 gives the screenline and individual count performance within this sub-area of Leicestershire. From this it can be seen that 100% of screenlines and cordons are meeting the TAG criteria across all three time periods.

E.16 The individual link performance is also above the 85% criterion for the model as a whole, being 92% or above in all time periods for ‘flow’ or ‘GEH’ criteria. There is some variation by screenline in this performance. Melton Mowbray East-West Screenline (North) Southbound has a pass rate of 60% in the PM Peak. The other screenline worth highlighting is Melton Mowbray North-South Screenline (Dalby Road) Eastbound as this has 75% of links passing TAG ‘flow’ or ‘GEH’ criteria in the PM Peak.

E.17 The journey time validation results for North-East Leicestershire are given in Table E6 showing that the percentage of journey time routes that meet TAG criteria are 92% in the AM Peak hour and 100% in the Interpeak hour and PM Peak hour. All but one route meets TAG guidelines in the AM Peak hour:

- **Dalby Road/ Scalford Road Northbound:** this route is close to meeting TAG criteria in the AM Peak hour (being 15.8% quicker than the observed journey time). The section that contributes to this understatement of journey time is between Dalby Road and Asfordby Road, suggesting an underestimation of delay approaching the A606/A607 junction which has proved difficult to represent correctly during calibration.

Figure E3: North-East Leicestershire Screenlines and Journey Time Routes



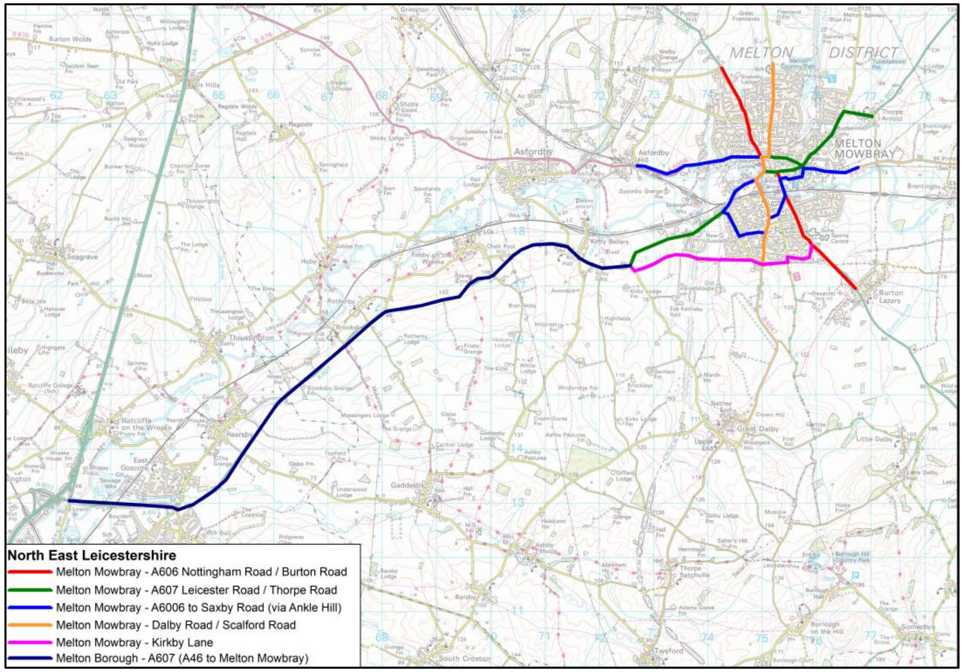


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Table E5: North-East Leicestershire Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Melton Mowbray Cordon Inbound	11	✓	100%	100%	✓	100%	100%	✓	82%	71%
Melton Mowbray Cordon Outbound	11	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray North-South Screenline (Nottingham Road) Eastbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray North-South Screenline (Nottingham Road) Westbound	5	✓	100%	100%	✓	60%	60%	✓	100%	100%
Melton Mowbray North-South Screenline (Dalby Road) Eastbound	4	✓	100%	100%	✓	100%	100%	✓	75%	75%
Melton Mowbray North-South Screenline (Dalby Road) Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray East-West Screenline (River) Northbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray East-West Screenline (River) Southbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray East-West Screenline (South) Northbound	7	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray East-West Screenline (South) Southbound	7	✓	86%	86%	✓	100%	100%	✓	86%	86%
Melton Mowbray East-West Screenline (North) Northbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Mowbray East-West Screenline (North) Southbound	5	✓	100%	100%	✓	100%	100%	✓	60%	60%
Melton Borough A606 Screenline North-Eastbound	11	✓	100%	100%	✓	100%	100%	✓	100%	100%
Melton Borough A606 Screenline South-Westbound	11	✓	100%	100%	✓	100%	100%	✓	100%	100%
North-East Leicestershire	***89***	***100%***	***99%***	***99%***	***100%***	***98%***	***98%***	***100%***	***93%***	***92%***

Table E6: North-East Leicestershire Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Melton Mowbray	A606 Nottingham Road / Burton Road Northbound	-00:34	-6.3%	✓	-00:19	-3.8%	✓	-00:50	-8.4%	✓
Melton Mowbray	A606 Nottingham Road / Burton Road Southbound	01:00	9.0%	✓	00:39	6.2%	✓	00:15	2.2%	✓
Melton Mowbray	A607 Leicester Road / Thorpe Road Northbound	-00:25	-3.8%	✓	00:26	4.3%	✓	00:21	3.2%	✓
Melton Mowbray	A607 Leicester Road / Thorpe Road Southbound	-00:53	-8.3%	✓	00:04	0.7%	✓	-00:20	-3.4%	✓
Melton Mowbray	A6006 to Saxby Road (via Ankle Hill) Eastbound	-01:31	-10.2%	✓	00:16	2.1%	✓	-01:26	-9.8%	✓
Melton Mowbray	A6006 to Saxby Road (via Ankle Hill) Westbound	-00:50	-6.2%	✓	-00:08	-1.1%	✓	-01:27	-10.3%	✓
Melton Mowbray	Dalby Road / Scalford Road Northbound	-01:32	-15.8%	×	00:25	5.4%	✓	00:04	0.8%	✓
Melton Mowbray	Dalby Road / Scalford Road Southbound	00:10	2.1%	✓	00:44	10.6%	✓	00:48	11.5%	✓
Melton Mowbray	Kirby Lane Eastbound	-00:03	-1.1%	✓	00:09	3.1%	✓	00:00	0.1%	✓
Melton Mowbray	Kirby Lane Westbound	00:12	4.0%	✓	00:15	5.1%	✓	00:02	0.5%	✓
Melton Borough	A607 (A46 to Melton Mowbray) Northbound	-00:36	-5.4%	✓	-00:19	-3.1%	✓	00:12	1.9%	✓
Melton Borough	A607 (A46 to Melton Mowbray) Southbound	-00:17	-2.6%	✓	-00:28	-4.4%	✓	00:02	0.4%	✓
North-East Leicestershire				**92%**			**100%**			**100%**

Assignment Calibration and Validation – South Leicestershire

E.18 This sub-area of Leicestershire (predominately Harborough District) contains screenlines and / or cordons of Market Harborough and Lutterworth as well as some rural screenlines away from these urban areas. The location of these screenlines included in this sub-area, is shown in Figure E4.

E.19 In terms of the screenline performance within this sub-area of Leicestershire (as shown in Table E7), 97% of screenlines meet the defined criteria for screenline performance in the AM Peak hour, 100% in the Interpeak hour and 97% in the PM Peak hour. The only AM Peak failure is the Market Harborough Cordon Outbound which is marginal.

E.20 This table also shows the individual link performance, with 89% or above of links within this area meeting the TAG 'flow' or 'GEH' criteria in all of the three modelled hours. Some individual screenlines such as 'Market Harborough North-South Screenline (Railway)' and 'Lutterworth East-West screenline' have two counts and so in some time periods have a pass rate of just 50% or even 0% due to a small number of failures. 'Leicestershire S-Line (South)' Westbound has a low pass rate in the PM Peak hour. A network review and consideration of the routeing in this area did not lead to the discovery of any incorrect network coding. Any signal timings were adapted where possible.

E.21 The journey time routes within this sub-area of Leicestershire focus on the urban areas of Market Harborough and Lutterworth, as well as rural Harborough routes (see Figure E4).

E.22 The journey time performance within this sub-area is given in Table E8 and shows that all routes meet the TAG guidelines except one in the in the PM Peak:

- **A426 Leicester Road Southbound:** this modelled journey time is 22% below the observed data in the PM Peak. The section where there is most underrepresentation of journey time is the approach to the Frank Whittle roundabout which suggest that the model is struggling to generate delay here.

Figure E4: South Leicestershire Screenlines and Journey Time Routes

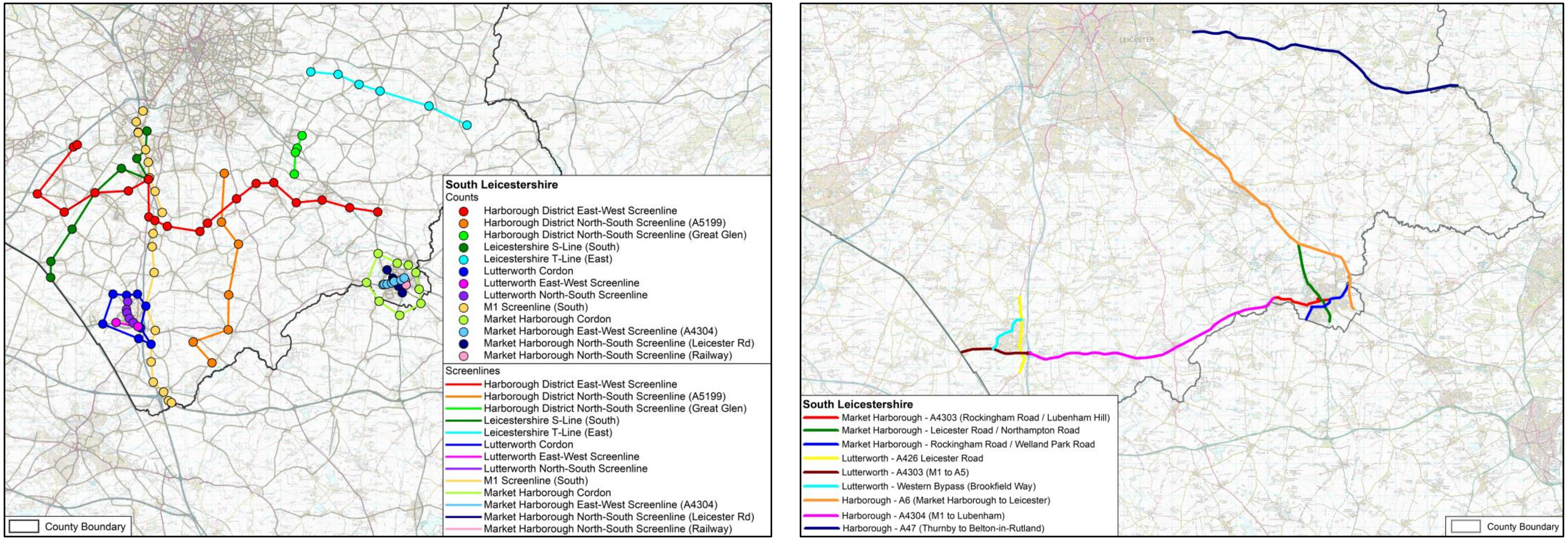

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Table E7: South Leicestershire Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicestershire T-Line (East) Northbound	6	✓	100%	100%	✓	100%	100%	✓	67%	67%
Leicestershire T-Line (East) Southbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
Leicestershire S-Line (South) Eastbound	9	✓	67%	60%	✓	100%	100%	✓	89%	100%
…excluding SRN counts	7	✓	57%	60%	✓	100%	100%	✓	86%	100%
Leicestershire S-Line (South) Westbound	9	✓	100%	100%	✓	100%	100%	✓	67%	60%
…excluding SRN counts	7	✓	100%	100%	✓	100%	100%	×	57%	60%
M1 Screenline (South) Eastbound	19	✓	84%	80%	✓	95%	93%	✓	89%	87%
…excluding SRN counts	18	✓	83%	80%	✓	94%	93%	✓	89%	87%
M1 Screenline (South) Westbound	19	✓	100%	100%	✓	89%	88%	✓	84%	81%
…excluding SRN counts	18	✓	100%	100%	✓	89%	87%	✓	83%	80%
Market Harborough Cordon Inbound	9	✓	100%	100%	✓	100%	100%	✓	89%	89%
Market Harborough Cordon Outbound	9	×	89%	89%	✓	100%	100%	✓	100%	100%
Market Harborough North-South Screenline (Leicester Road) Eastbound	7	✓	86%	83%	✓	100%	100%	✓	100%	100%
Market Harborough North-South Screenline (Leicester Road) Westbound	7	✓	86%	83%	✓	86%	100%	✓	86%	83%
Market Harborough North-South Screenline (Railway) Eastbound	2	✓	50%	50%	✓	100%	100%	✓	0%	0%
Market Harborough North-South Screenline (Railway) Westbound	2	✓	0%	0%	✓	100%	100%	✓	100%	100%

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts (including duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Market Harborough East-West Screenline (A4304) Northbound	9	✓	89%	89%	✓	78%	78%	✓	78%	78%
Market Harborough East-West Screenline (A4304) Southbound	8	✓	75%	75%	✓	63%	63%	✓	88%	88%
Lutterworth Cordon Inbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lutterworth Cordon Outbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lutterworth North-South Screenline Eastbound	5	✓	80%	80%	✓	100%	100%	✓	80%	80%
Lutterworth North-South Screenline Westbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lutterworth East-West Screenline Northbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lutterworth East-West Screenline Southbound	2	✓	100%	100%	✓	50%	50%	✓	100%	100%
Harborough District North-South Screenline (A5199) Eastbound	7	✓	100%	100%	✓	100%	100%	✓	100%	100%
Harborough District North-South Screenline (A5199) Westbound	7	✓	100%	100%	✓	100%	100%	✓	100%	100%
Harborough District North-South Screenline (Great Glen) Eastbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Harborough District North-South Screenline (Great Glen) Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Harborough District East-West Screenline Northbound	18	✓	83%	81%	✓	100%	100%	✓	100%	100%
…excluding SRN counts	16	✓	81%	81%	✓	100%	100%	✓	100%	100%
Harborough District East-West Screenline Southbound	18	✓	89%	88%	✓	100%	100%	✓	89%	88%
…excluding SRN counts	16	✓	88%	88%	✓	100%	100%	✓	88%	88%
South Leicestershire	***209***	***96%***	***90%***	***89%***	***100%***	***95%***	***95%***	***100%***	***90%***	***89%***

Table E8: South Leicestershire Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Market Harborough	A4303 (Rockingham Road / Lubenham Hill) Eastbound	00:33	5.2%	✓	00:30	4.8%	✓	00:18	2.7%	✓
Market Harborough	A4303 (Rockingham Road / Lubenham Hill) Westbound	01:08	11.8%	✓	00:41	7.1%	✓	-01:00	-8.6%	✓
Market Harborough	Leicester Road / Northampton Road Northbound	00:37	7.5%	✓	-00:24	-4.6%	✓	-00:36	-6.6%	✓
Market Harborough	Leicester Road / Northampton Road Southbound	-00:16	-2.9%	✓	-00:51	-9.4%	✓	-00:23	-4.4%	✓
Market Harborough	Rockingham Road / Welland Park Road Eastbound	00:48	9.4%	✓	00:50	10.7%	✓	-00:05	-0.9%	✓
Market Harborough	Rockingham Road / Welland Park Road Westbound	00:35	6.7%	✓	00:43	9.1%	✓	-00:48	-8.3%	✓
Lutterworth	A426 Leicester Road Northbound	-00:58	-13.9%	✓	-00:06	-1.7%	✓	00:22	5.9%	✓
Lutterworth	A426 Leicester Road Southbound	00:27	7.1%	✓	-00:09	-2.6%	✓	-01:44	-22.4%	×
Lutterworth	A4303 (M1 to A5) Eastbound	-00:38	-16.5%	✓	-00:31	-14.2%	✓	-00:40	-17.1%	✓
Lutterworth	A4303 (M1 to A5) Westbound	-00:19	-8.2%	✓	-00:15	-7.1%	✓	-00:18	-8.2%	✓
Lutterworth	Western Bypass (Brookfield Way) Northbound	-00:01	-0.7%	✓	00:00	-0.1%	✓	00:17	8.1%	✓
Lutterworth	Western Bypass (Brookfield Way) Southbound	00:35	17.2%	✓	00:18	8.7%	✓	00:26	12.9%	✓
Harborough	A6 (Market Harborough to Leicester) Northbound	-00:16	-1.8%	✓	-00:22	-2.6%	✓	01:03	7.2%	✓
Harborough	A6 (Market Harborough to Leicester) Southbound	00:26	3.0%	✓	-00:26	-3.1%	✓	00:46	5.7%	✓
Harborough	A4304 (M1 to Lubenham) Eastbound	-00:31	-3.4%	✓	-00:18	-2.0%	✓	00:33	3.8%	✓
Harborough	A4304 (M1 to Lubenham) Westbound	00:09	0.9%	✓	-00:31	-3.5%	✓	00:00	0.0%	✓
Harborough	A47 (Thurnby to Belton-in-Rutland) Eastbound	-00:54	-6.6%	✓	-01:10	-8.6%	✓	-00:36	-4.6%	✓
Harborough	A47 (Thurnby to Belton-in-Rutland) Westbound	-00:44	-5.4%	✓	-01:02	-7.7%	✓	-00:09	-1.2%	✓
South Leicestershire				**100%**			**100%**			**94%**

Assignment Calibration and Validation – South-West Leicestershire

E.23 The screenlines and journey times within this sub-area of Leicestershire (predominately Hinckley & Bosworth Borough) focus on the urban areas of Hinckley, Barwell and Earl Shilton. There are cordons of each of these three urban areas, with screenlines within Hinckley itself and a rural screenline to intercept intra district trips (see Figure E5).

E.24 In terms of screenline performance (shown in Table E9 the percentage of screenlines meeting the TAG criteria are 100% across all three time periods, with no screenline failures.

E.25 Considering the individual link performance within this sub-area the percentage of links that meet the TAG 'flow' or 'GEH' criteria is 88% in the AM Peak hour model, 98% in the Interpeak model and 87% in the PM Peak hour model. This demonstrates that there is a good correspondence between modelled and observed flows within this area of the model.

E.26 The Hinckley Inner Cordon is the worst performing in this district. This is to be expected, as often the routeing at the inner cordons becomes more complex as well as the counts being more variable (with traffic). Further, although the zoning system is more detailed, it is at this detailed level that mobile network data are at its weakest. London Road consistently has more modelled traffic than observed in both directions and all time periods. The signals in central Hinckley were reviewed to improve the routeing to Hinckley town centre. This had a limited effect. The upstream counts do not fail so there is either count inconsistency or an over representation in the matrix of short local trips from north-east Hinckley to the town centre.

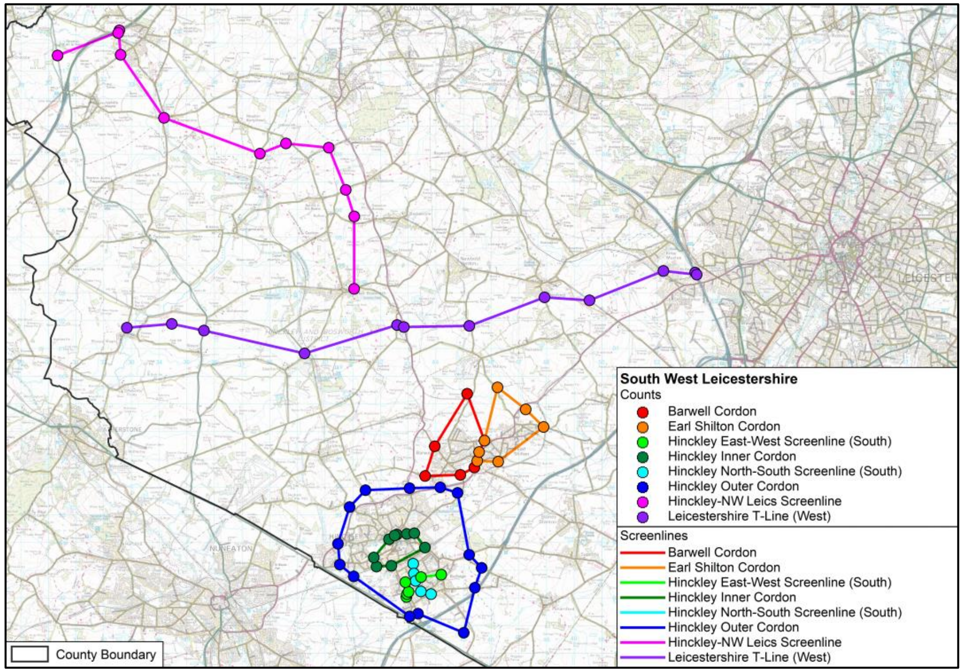
E.27 The Barwell and Earl Shilton cordons perform very well both inbound and outbound, as do the rural screenlines.

E.28 In terms of the journey time validation within this area of the model, the routes also focus on the urban areas of Hinckley, Barwell and Earl Shilton, and include the A47 between Earl Shilton and Leicester City, A447 (A47 to A511) and A50 (A46 to M1) (see Figure E5). The results of the journey time validation for these routes are reported in Table E10 and show that 100% of journey times meet the required TAG guidelines in the AM Peak and Interpeak and 92% in the PM Peak.

E.29 There are two routes with failures. The following is a summary of these locations:

- **Coventry Road / Leicester Road Eastbound:** The failure is in the PM Peak hour (+25.0%). This is related to overrepresentation of delay at the signals at the Mansion Street/The Borough junction through to Stockwell Head. Attempts were made during calibration to address this but resulted in adverse impacts on other routes.
- **Rugby Road/Ashby Road Northbound:** This failure in the PM Peak hour is related to underrepresentation of delay at the signals at the Rugby Road/Hawley Road junction.

Figure E5: South-West Leicestershire Screenlines and Journey Time Routes



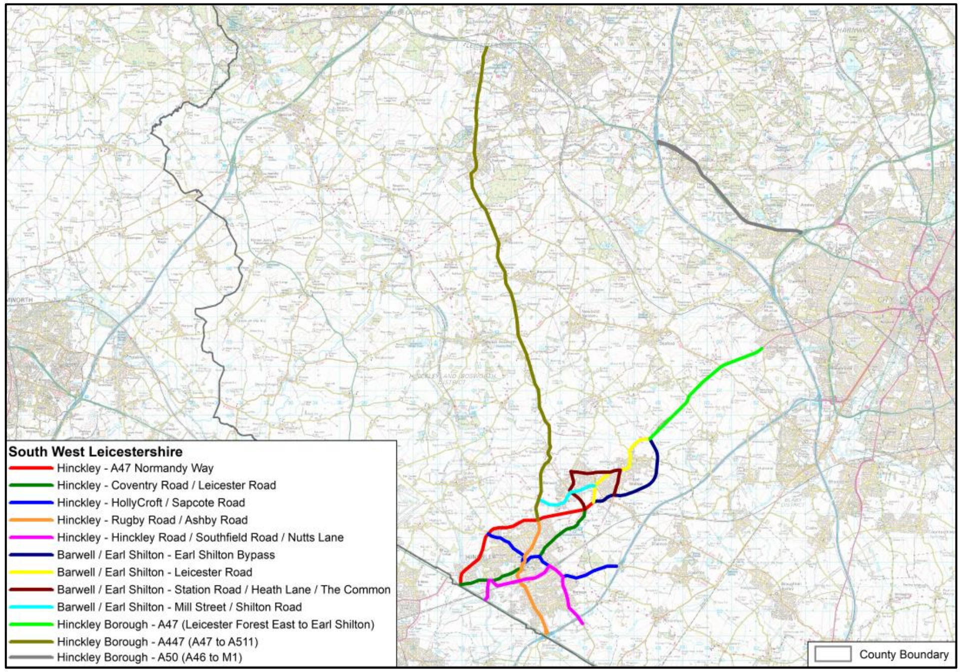


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Table E9: South-West Leicestershire Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Leicestershire T-Line (West) Northbound	11	✓	91%	90%	✓	100%	100%	✓	91%	90%
Leicestershire T-Line (West) Southbound	11	✓	91%	90%	✓	100%	100%	✓	91%	90%
Hinckley Outer Cordon Inbound	14	✓	86%	86%	✓	93%	93%	✓	71%	71%
Hinckley Outer Cordon Outbound	14	✓	79%	79%	✓	100%	100%	✓	100%	100%
Hinckley Inner Cordon Inbound	9	✓	56%	56%	✓	78%	78%	✓	67%	67%
Hinckley Inner Cordon Outbound	9	✓	78%	78%	✓	100%	100%	✓	78%	78%
Hinckley North-South Screenline (South) Eastbound	5	✓	100%	100%	✓	100%	100%	✓	80%	80%
Hinckley North-South Screenline (South) Westbound	5	✓	100%	100%	✓	100%	100%	✓	60%	60%
Hinckley East-West Screenline (South) Northbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
Hinckley East-West Screenline (South) Southbound	6	✓	83%	83%	✓	100%	100%	✓	67%	67%
Barwell Cordon Inbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Barwell Cordon Outbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Earl Shilton Cordon Inbound	7	✓	100%	100%	✓	100%	100%	✓	100%	100%
Earl Shilton Cordon Outbound	7	✓	100%	100%	✓	100%	100%	✓	100%	100%
Hinckley-NW Leicestershire Screenline North-Eastbound	10	✓	80%	78%	✓	100%	100%	✓	100%	100%
…excluding SRN counts	9	✓	78%	78%	✓	100%	100%	✓	100%	100%
Hinckley-NW Leicestershire Screenline South-Westbound	10	✓	100%	100%	✓	100%	100%	✓	80%	78%
…excluding SRN counts	9	✓	100%	100%	✓	100%	100%	✓	78%	78%
South-West Leicestershire	***140***	***100%***	***89%***	***88%***	***100%***	***98%***	***98%***	***100%***	***87%***	***87%***

Table E10: South-West Leicestershire Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Hinckley	A47 Normandy Way Eastbound	00:33	7.2%	✓	00:35	7.8%	✓	00:42	8.8%	✓
Hinckley	A47 Normandy Way Westbound	-00:52	-8.0%	✓	00:13	2.8%	✓	00:00	0.0%	✓
Hinckley	Coventry Road / Leicester Road Eastbound	01:17	11.3%	✓	01:31	14.8%	✓	02:37	25.0%	×
Hinckley	Coventry Road / Leicester Road Westbound	-00:35	-4.7%	✓	00:27	4.4%	✓	-01:04	-8.3%	✓
Hinckley	HollyCroft / Sapcote Road Eastbound	-01:20	-10.8%	✓	00:12	2.0%	✓	00:20	3.3%	✓
Hinckley	HollyCroft / Sapcote Road Westbound	00:36	4.8%	✓	01:22	12.2%	✓	00:00	0.0%	✓
Hinckley	Rugby Road / Ashby Road Northbound	-01:31	-11.0%	✓	01:14	13.0%	✓	-04:08	-26.0%	×
Hinckley	Rugby Road / Ashby Road Southbound	00:59	9.7%	✓	00:59	10.5%	✓	00:58	9.8%	✓
Hinckley	Hinckley Road/Southfield Road/Nutts Lane Eastbound	-00:41	-4.7%	✓	00:58	7.7%	✓	-00:40	-4.4%	✓
Hinckley	Hinckley Road/Southfield Road/Nutts Lane Westbound	-00:01	-0.1%	✓	00:54	7.5%	✓	-02:03	-12.8%	✓
Barwell / Earl Shilton	Earl Shilton Bypass Eastbound	00:25	10.0%	✓	00:35	15.5%	✓	00:47	20.1%	✓
Barwell / Earl Shilton	Earl Shilton Bypass Westbound	00:36	14.4%	✓	00:31	13.3%	✓	00:37	15.2%	✓
Barwell / Earl Shilton	Leicester Road Northbound	00:46	14.2%	✓	00:28	8.2%	✓	00:50	15.3%	✓
Barwell / Earl Shilton	Leicester Road Southbound	00:30	8.4%	✓	00:31	9.1%	✓	00:48	14.2%	✓
Barwell / Earl Shilton	Station Road/Heath Lane/The Common Clockwise	00:37	7.2%	✓	00:36	7.2%	✓	00:51	10.2%	✓
Barwell / Earl Shilton	Station Road/Heath Lane/The Common Anti-Clockwise	01:02	12.7%	✓	00:52	10.7%	✓	00:24	4.6%	✓
Barwell / Earl Shilton	Mill Street / Shilton Road Eastbound	00:08	3.2%	✓	00:13	5.4%	✓	00:13	5.2%	✓
Barwell / Earl Shilton	Mill Street / Shilton Road Westbound	00:07	2.8%	✓	00:13	5.3%	✓	00:17	6.8%	✓
Hinckley Borough	A47 (Leicester Forest East to Earl Shilton) Eastbound	-00:32	-8.1%	✓	00:03	0.9%	✓	-00:44	-10.6%	✓
Hinckley Borough	A47 (Leicester Forest East to Earl Shilton) Westbound	-00:14	-4.1%	✓	-00:17	-5.1%	✓	-00:12	-3.6%	✓
Hinckley Borough	A447 (A47 to A511) Northbound	-00:48	-3.6%	✓	-00:38	-3.0%	✓	-00:23	-1.8%	✓
Hinckley Borough	A447 (A47 to A511) Southbound	-01:20	-6.0%	✓	-01:24	-6.5%	✓	-00:25	-1.9%	✓
Hinckley Borough	A50 (A46 to M1) Northbound	-00:54	-13.7%	✓	-00:24	-6.8%	✓	00:49	13.6%	✓
Hinckley Borough	A50 (A46 to M1) Southbound	-00:37	-9.1%	✓	-00:10	-2.7%	✓	00:19	5.5%	✓
South-West Leicestershire				**100%**			**100%**			**92%**

Assignment Calibration and Validation – North-West Leicestershire

E.30 The screenlines and cordons within this sub-area of Leicestershire include cordons of Ashby, Coalville and Whitwick / Thringstone, plus a number of screenlines away from these urban areas. The screenlines included in this sub-area, are shown in Figure E6.

E.31 Considering the overall screenline performance firstly as reported in Table E11, the percentage of screenlines in this sub-area meeting the TAG criteria are 100% in all time periods.

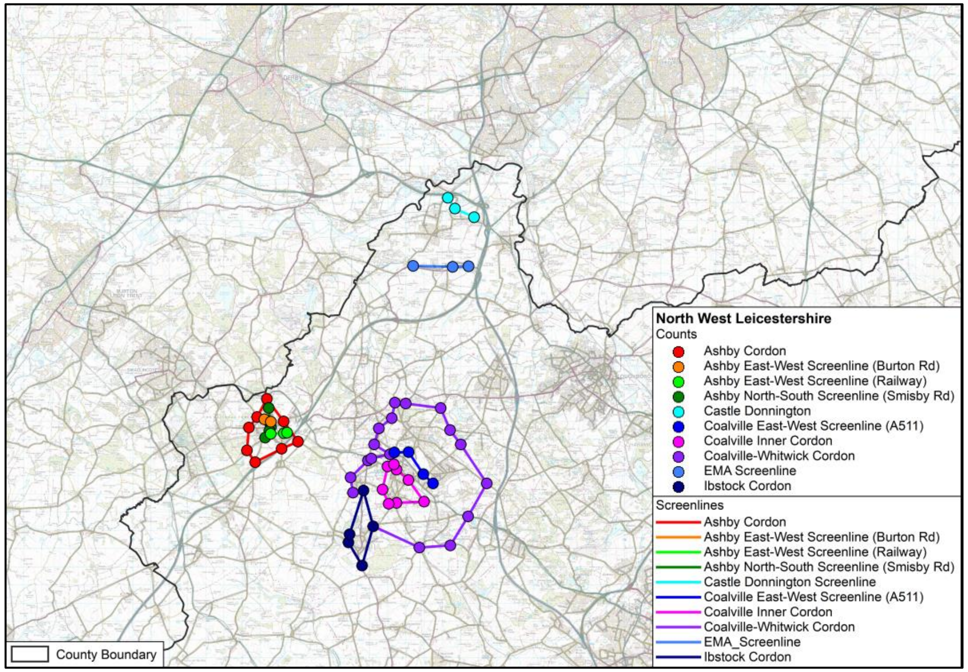
E.32 In terms of individual counts for these screenlines and cordons (as shown in Table E11) the percentage of locations that meet the TAG criteria is 94%, 98% and 89% respectively across the three time periods. This is in excess of the TAG criteria of more than 85% of links across the model as a whole.

E.33 There is some deviation from this high performance by screenline. 'Coalville East-West Screenline (A511) has a 50% pass rate in the Interpeak model southbound. The counts in question are on Thornborough Road and Hermitage Road where a pattern of overestimation of flow on the former and underestimation on the latter is reflected across all time periods and directions. The routeing has been reviewed in this area and routeing issues in earlier versions of the network were resolved as much as possible.

E.34 The journey time routes within this sub-area focus on Ashby and Coalville, and also include two routes on the A511 and one on the A512 (see Figure E6). In total, there are 96% of journey times that meet the required TAG criteria in the AM Peak hour model and 100% in the Interpeak and PM Peak hour models. The AM Peak hour failure is highlighted below:

- **A511 (M1 to Bardon Road) AM Peak Eastbound:** There is an underrepresentation of delay on the last section before M1 Junction 22.

Figure E6: North-West Leicestershire Screenlines and Journey Time Routes



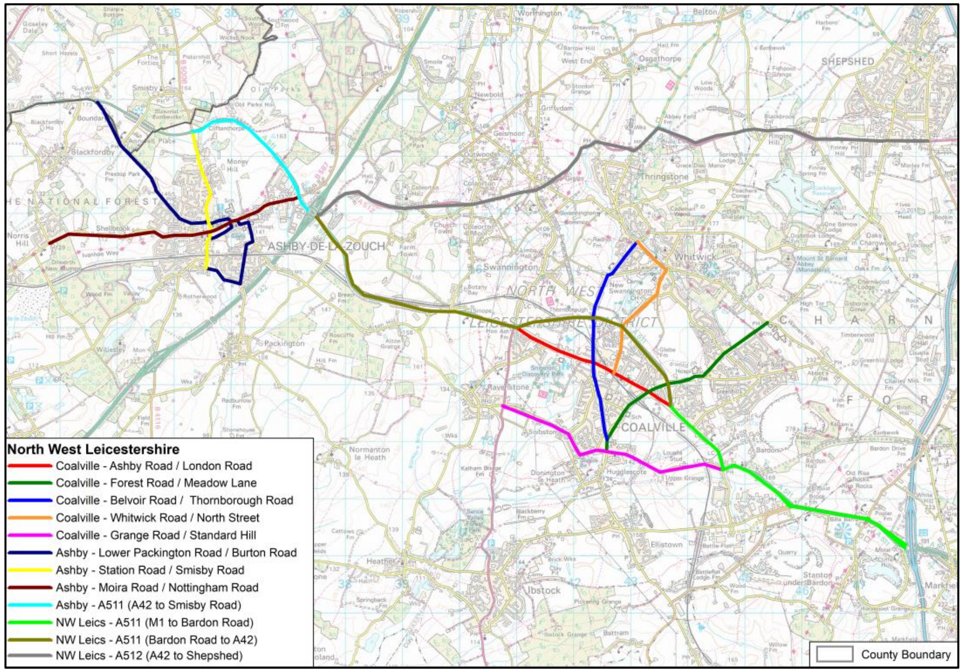


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Table E11: North-West Leicestershire Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**Screenline (including 95% C.I.)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
Castle Donnington Northbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Castle Donnington Southbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coalville-Whitwick Cordon Inbound	19	✓	95%	100%	✓	100%	100%	✓	84%	82%
Coalville-Whitwick Cordon Outbound	19	✓	100%	100%	✓	100%	100%	✓	95%	94%
Coalville Inner Cordon Inbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coalville Inner Cordon Outbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coalville East-West Screenline (A511) Northbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coalville East-West Screenline (A511) Southbound	4	✓	100%	100%	✓	50%	50%	✓	100%	100%
EMA_Screenline Northbound	3	✓	0%	0%	✓	100%	100%	✓	100%	100%
EMA_Screenline Southbound	3	✓	100%	100%	✓	100%	100%	✓	33%	33%
Ibstock Cordon Inbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
Ibstock Cordon Outbound	5	✓	80%	80%	✓	100%	100%	✓	100%	100%
Ashby Cordon Inbound	8	✓	75%	75%	✓	100%	100%	✓	75%	75%
Ashby Cordon Outbound	8	✓	88%	88%	✓	100%	100%	✓	88%	88%
Ashby North-South Screenline (Smisby Road) Eastbound	5	✓	100%	100%	✓	100%	100%	✓	60%	60%
Ashby North-South Screenline (Smisby Road) Westbound	5	✓	100%	100%	✓	100%	100%	✓	60%	60%
Ashby East-West Screenline (Burton Road) Northbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
Ashby East-West Screenline (Burton Road) Southbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
Ashby East-West Screenline (Railway) Northbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Ashby East-West Screenline (Railway) Southbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
North-West Leicestershire	***120***	***100%***	***93%***	***94%***	***100%***	***98%***	***98%***	***100%***	***89%***	***89%***

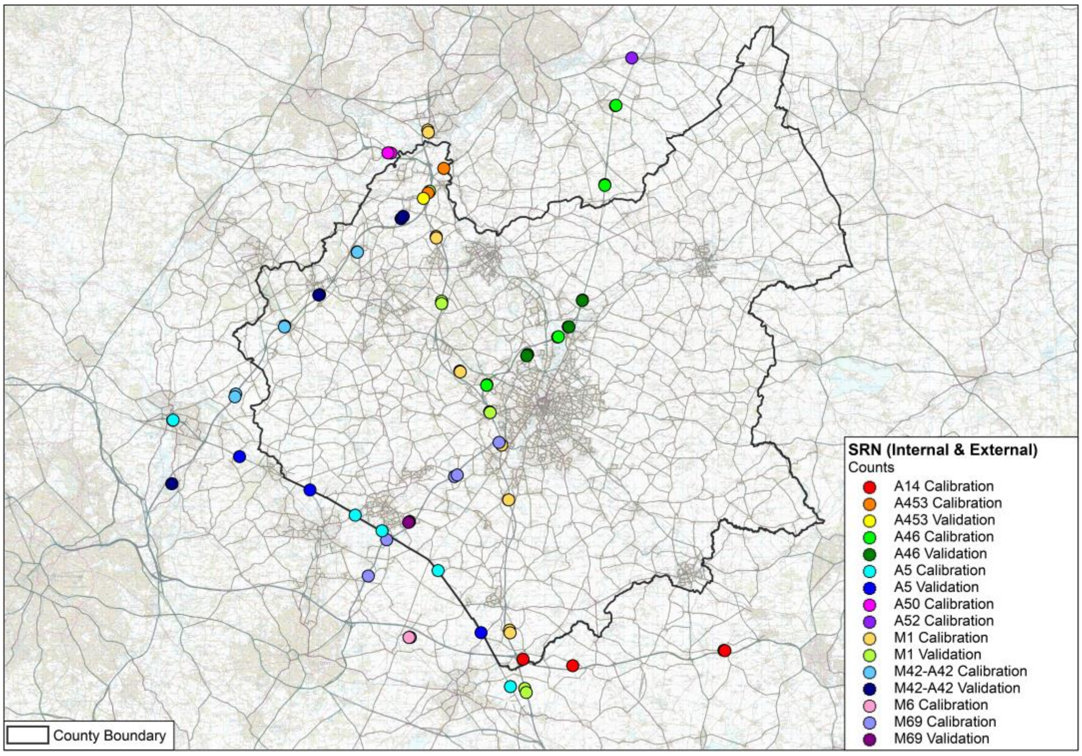
Table E12: North-West Leicestershire Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
Coalville	Ashby Road / London Road Eastbound	-00:42	-10.2%	✓	-00:26	-6.7%	✓	00:26	5.4%	✓
Coalville	Ashby Road / London Road Westbound	00:32	8.6%	✓	-00:02	-0.5%	✓	00:13	2.3%	✓
Coalville	Forest Road / Meadow Lane Eastbound	-00:41	-7.4%	✓	00:22	5.2%	✓	00:23	5.0%	✓
Coalville	Forest Road / Meadow Lane Westbound	-00:40	-7.5%	✓	00:26	5.9%	✓	-00:33	-6.6%	✓
Coalville	Belvoir Road / Thornborough Road Northbound	-00:21	-4.8%	✓	-00:05	-1.2%	✓	00:09	1.8%	✓
Coalville	Belvoir Road / Thornborough Road Southbound	-00:08	-1.8%	✓	00:14	2.9%	✓	-00:10	-2.4%	✓
Coalville	Whitwick Road / North Street Northbound	-00:20	-6.2%	✓	-00:14	-4.4%	✓	-00:38	-10.9%	✓
Coalville	Whitwick Road / North Street Southbound	00:13	4.4%	✓	00:04	1.2%	✓	-00:07	-2.3%	✓
Coalville	Grange Road / Standard Hill Eastbound	-00:19	-4.9%	✓	00:08	2.3%	✓	-00:25	-6.7%	✓
Coalville	Grange Road / Standard Hill Westbound	00:19	4.4%	✓	00:31	9.3%	✓	00:15	3.6%	✓
Ashby	Lower Packington Road / Burton Road Northbound	-01:33	-12.8%	✓	00:37	6.3%	✓	-01:46	-14.1%	✓
Ashby	Lower Packington Road / Burton Road Southbound	-00:14	-2.7%	✓	00:19	4.0%	✓	01:04	14.4%	✓
Ashby	Station Road / Smisby Road Northbound	00:05	1.6%	✓	00:12	4.4%	✓	-00:34	-10.1%	✓
Ashby	Station Road / Smisby Road Southbound	00:05	1.7%	✓	00:23	9.4%	✓	00:26	10.2%	✓
Ashby	Moira Road / Nottingham Road Eastbound	-00:09	-1.9%	✓	00:20	4.6%	✓	-00:58	-11.2%	✓
Ashby	Moira Road / Nottingham Road Westbound	00:01	0.3%	✓	00:17	4.1%	✓	00:00	0.0%	✓
Ashby	A511 (A42 to Smisby Road) Northbound	00:07	4.5%	✓	00:04	2.5%	✓	00:29	19.3%	✓
Ashby	A511 (A42 to Smisby Road) Southbound	-00:02	-1.0%	✓	-00:09	-5.9%	✓	-00:14	-8.7%	✓
NW Leics	A511 (M1 to Bardon Road) Eastbound	-02:41	-31.8%	×	-00:10	-3.0%	✓	00:21	4.6%	✓
NW Leics	A511 (M1 to Bardon Road) Westbound	00:31	8.5%	✓	-00:07	-2.0%	✓	00:31	9.0%	✓
NW Leics	A511 (Bardon Road to A42) Eastbound	-00:22	-3.8%	✓	-00:05	-1.0%	✓	-01:05	-11.3%	✓
NW Leics	A511 (Bardon Road to A42) Westbound	-01:04	-10.6%	✓	-00:01	-0.1%	✓	-01:07	-10.3%	✓
NW Leics	A512 (A42 to Shepshed) Eastbound	-00:13	-1.7%	✓	-00:45	-6.4%	✓	-00:15	-2.0%	✓
NW Leics	A512 (A42 to Shepshed) Westbound	-01:24	-11.2%	✓	-00:54	-8.0%	✓	-00:16	-2.2%	✓
North-West Leicestershire				**96%**			**100%**			**100%**

Assignment Calibration and Validation – Strategic Road Network

E.35 The preceding sections have considered the model performance on a geographical basis within Leicestershire. This section looks at the performance of the Strategic Road Network (SRN) in isolation in terms of counts and journey times. There are two sub-divisions, which are internal to Leicestershire and external, see Figure E7.

Figure E7: SRN Count Locations



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E.36 All SRN groups of counts pass TAG screenline criteria except 'M69 Calibration Northbound' in the AM Peak and 'M42-A42 Validation Northbound' in the PM Peak, at 67% (meaning one count fails in each).

E.37 In terms of journey times, all SRN journey times are reported in this section. For the purposes of the wider demand model the key attribute that the model needs to replicate in the external area is journey costs between zones (i.e. both distances and times) and therefore the journey time validation of the key SRN routes outside Leicestershire is important for the overall model performance.

E.38 Overall there is a very good match of modelled and observed journey times for these routes with only three minor failures across the 22 routes in the peak model hours and 100% pass rate in Interpeak model. The three failures are highlighted below:

- **A52 (A5111 to A1) AM Peak Eastbound:** There is an underrepresentation of delay along this section of the A52 which is in the buffer network and therefore the model does not represent the observed junction delay.
- **A453 (M1 Jn23a to A52) AM Peak Northbound & PM Peak Southbound:** There is an underrepresentation of journey time on this route; as there were roadworks here in 2014 it is probably that the delay from these has not been fully represented.

Table E13: Strategic Road Network Link Flow Performance (Total Vehicle Flows)

		AM Peak		Interpeak		PM Peak	
Screenline	**# Counts**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
M1 Calibration Northbound	6	100%	100%	100%	100%	100%	100%
M1 Calibration Southbound	5	100%	100%	100%	100%	100%	100%
M1 Validation Northbound	4	100%	100%	100%	100%	100%	100%
M1 Validation Southbound	4	100%	100%	100%	100%	100%	100%
M69 Calibration Northbound	3	67%	67%	100%	100%	100%	100%
M69 Calibration Southbound	2	100%	100%	100%	100%	100%	100%
M69 Validation Northbound	1	100%	100%	100%	100%	100%	100%
M69 Validation Southbound	1	100%	100%	100%	100%	100%	100%
M42-A42 Calibration Northbound	3	100%	100%	100%	100%	100%	100%
M42-A42 Calibration Southbound	3	100%	100%	100%	100%	100%	100%
M42-A42 Validation Northbound	3	100%	100%	100%	100%	100%	100%
M42-A42 Validation Southbound	3	100%	100%	100%	100%	100%	100%
A46 Calibration Northbound	4	100%	100%	100%	100%	100%	100%
A46 Calibration Southbound	4	100%	100%	100%	100%	100%	100%
A46 Validation Northbound	3	100%	100%	100%	100%	100%	100%
A46 Validation Southbound	3	100%	100%	100%	100%	100%	100%
A5 Calibration North-Westbound	5	100%	100%	100%	100%	100%	100%
A5 Calibration South-Eastbound	5	100%	100%	100%	100%	100%	100%
A5 Validation North-Westbound	3	100%	100%	100%	100%	100%	100%
A5 Validation South-Eastbound	3	100%	100%	100%	100%	100%	100%
A453 Calibration North-Eastbound	2	100%	100%	100%	100%	100%	100%
A453 Calibration South-Westbound	2	100%	100%	100%	100%	100%	100%
M6 Calibration Northbound	1	100%	100%	100%	100%	100%	100%

		AM Peak		Interpeak		PM Peak	
Screenline	**# Counts**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**	**%Links (including 95% C.I.)**	**%Links (including 95% C.I., excluding duplicates)**
M6 Calibration Southbound	1	100%	100%	100%	100%	100%	100%
A50 Calibration North-Westbound	1	100%	100%	100%	100%	100%	100%
A50 Calibration South-Eastbound	1	100%	100%	100%	100%	100%	100%
A14 Calibration Eastbound	2	100%	100%	100%	100%	100%	100%
A14 Calibration Westbound	2	100%	100%	100%	100%	100%	100%
A52 Calibration Eastbound	1	100%	100%	100%	100%	100%	100%
A52 Calibration Westbound	1	100%	100%	100%	100%	100%	100%
SRN Calibration	***22***	***98%***	***98%***	***100%***	***100%***	***100%***	***100%***
SRN Validation	***10***	***100%***	***100%***	***100%***	***100%***	***100%***	***100%***
SRN Combined	***32***	***99%***	***99%***	***100%***	***100%***	***100%***	***100%***

Table E14: Strategic Road Network Journey Time Validation

		AM Peak			Interpeak			PM Peak		
Location	**Route**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**	**Difference**	**% Difference**	**Pass**
SRN	M1 (Jn16 to Jn26) Northbound	06:00	11.6%	✓	02:46	5.2%	✓	00:47	1.3%	✓
SRN	M1 (Jn16 to Jn26) Southbound	02:12	3.7%	✓	03:13	6.1%	✓	06:27	12.2%	✓
SRN	M69 (M6 to M1) Northbound	01:43	9.5%	✓	-00:03	-0.4%	✓	-01:58	-11.6%	✓
SRN	M69 (M6 to M1) Southbound	00:23	2.6%	✓	-00:11	-1.3%	✓	00:19	2.3%	✓
SRN	M42 / A42 (Jn10 to M1) Northbound	02:21	11.3%	✓	01:25	6.8%	✓	02:26	11.8%	✓
SRN	M42 / A42 (Jn10 to M1) Southbound	01:34	7.4%	✓	01:22	6.6%	✓	02:34	12.7%	✓
SRN	M6 (M1 to Jn2) Eastbound	00:03	0.5%	✓	00:33	5.1%	✓	-01:30	-11.3%	✓
SRN	M6 (M1 to Jn2) Westbound	01:07	11.1%	✓	00:43	7.0%	✓	01:01	10.1%	✓
SRN	A46 (M1 to A52) Northbound	01:15	4.9%	✓	01:05	4.5%	✓	00:54	3.2%	✓
SRN	A46 (M1 to A52) Southbound	02:24	8.8%	✓	01:00	4.0%	✓	02:31	10.4%	✓
SRN	A5 (M1 to M42) Eastbound	-00:54	-2.1%	✓	00:12	0.5%	✓	00:24	1.0%	✓
SRN	A5 (M1 to M42) Westbound	01:08	2.7%	✓	-00:55	-2.3%	✓	-05:13	-11.2%	✓
SRN	A453 (M1 Jn23a to A52) Northbound	-04:23	-21.4%	×	-00:19	-1.9%	✓	-00:28	-2.7%	✓
SRN	A453 (M1 Jn23a to A52) Southbound	00:30	3.1%	✓	00:35	3.7%	✓	-04:10	-19.7%	×
SRN	A50 (A38 to M1) Eastbound	-00:04	-0.4%	✓	01:42	14.3%	✓	01:17	10.1%	✓
SRN	A50 (A38 to M1) Westbound	00:52	7.4%	✓	00:31	4.5%	✓	00:53	7.4%	✓
SRN	A52 (A5111 to A1) Eastbound	-10:12	-16.8%	×	-00:32	-1.1%	✓	-00:49	-1.4%	✓
SRN	A52 (A5111 to A1) Westbound	-05:26	-9.7%	✓	-00:51	-1.7%	✓	-03:46	-6.9%	✓
SRN	A1 (A14 to A52) Northbound	00:49	1.9%	✓	00:45	1.7%	✓	01:00	2.3%	✓
SRN	A1 (A14 to A52) Southbound	00:59	2.2%	✓	01:04	2.5%	✓	01:27	3.5%	✓
SRN	A14 (A1 to M1) Eastbound	02:59	7.5%	✓	02:09	5.5%	✓	03:50	9.9%	✓
SRN	A14 (A1 to M1) Westbound	00:35	1.4%	✓	01:15	3.1%	✓	02:21	5.8%	✓
Strategic Road Network				**91%**			**100%**			**95%**

Assignment Calibration and Validation – Leicestershire Cordon and External

E.39 Figure E8 and Figure E9 show the count and screenline/cordon locations for the external simulation area and Leicestershire cordon.

Figure E8: External Count and Screenline Locations

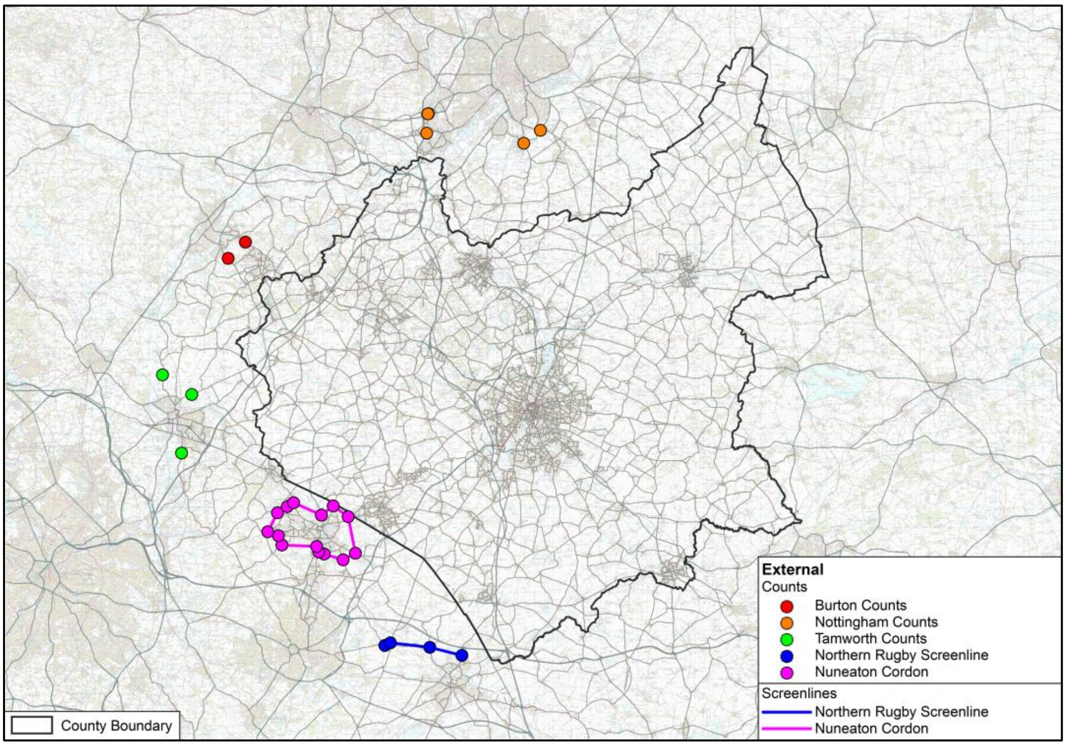

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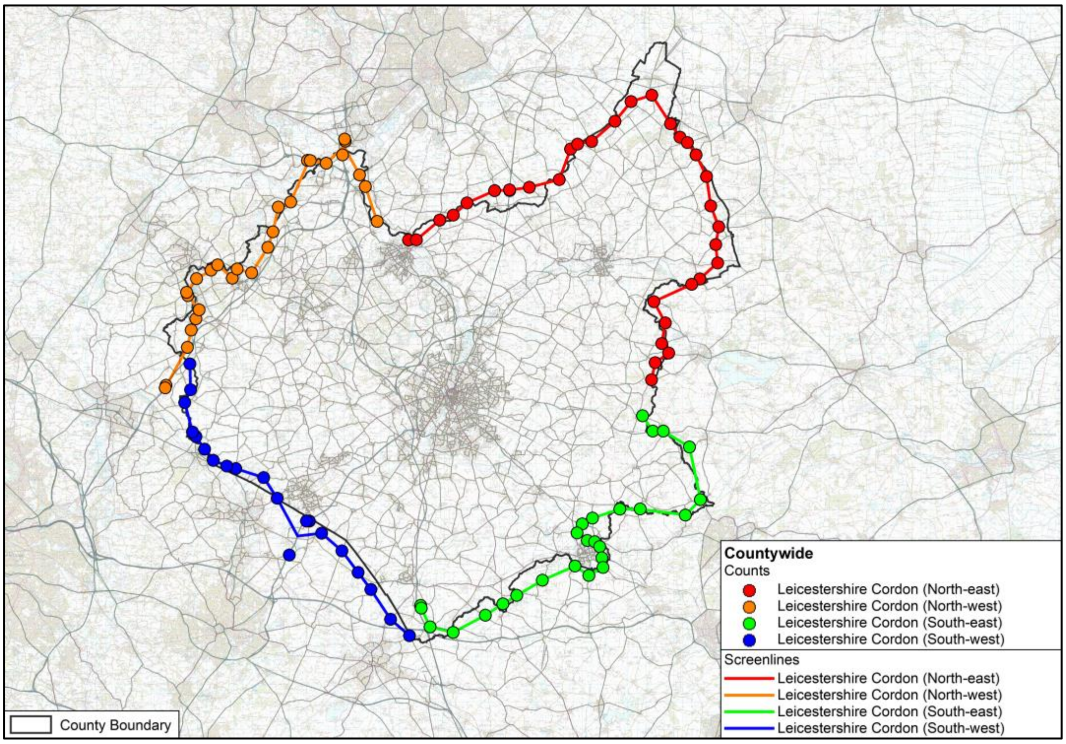
Figure E9: Leicestershire Cordon Count Locations



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E.40 All non-SRN counts external to Leicestershire were used within matrix estimation. Table E15 shows the performance of these screenlines in the three modelled hours. 100% of countywide and external screenlines pass TAG screenline criteria in all time periods.

E.41 Overall the individual link count performance is good along the countywide screenlines (the Leicestershire cordon). Despite the reduced network and zoning detail the pass rate in each time period is in excess of 85%. The link performance in the external areas is not as good as this or those counts within Leicestershire. There are 84% of links in the AM Peak hour model that pass TAG ‘link’ or ‘GEH’ criteria, 96% in the Interpeak model and 82% in the PM Peak hour model. The performance in each count set is as follows:

- **Nuneaton Cordon:** Effort was made to improve routeing and consequently link performance on the eastern side of Nuneaton so that flow to and from the A5 is close to observed. However issues still remain particularly in the AM Peak outbound and PM Peak inbound.
- **Northern Rugby Screenline:** The counts in this screenline perform well in the AM Peak and Interpeak. In the PM Peak the failures on Coventry Road and Lutterworth Road are close to passing.
- **Tamworth Counts:** Despite the screenlines passing in all time periods, the balance of flow between the A513 and B5493 impacts the individual link performance, particularly in the PM Peak northbound.
- **Burton Counts:** A lack of zonal detail in the town centre makes these counts difficult to pass TAG criteria. The routeing is reasonable between Ashby Road East and Woodland Road.
- **Nottingham Counts:** The AM Peak northbound and PM Peak southbound count perform well, as do counts in both directions in the Interpeak. However the AM Peak southbound and PM Peak northbound performance is not as good, despite overall screenline performance being good. Zoning and network detail in this area makes passing TAG criteria for links harder than in Leicestershire. The improvement in performance at the county boundary shows the zonal and network detail quickly gets to a level where a model can meet and exceed TAG criteria.

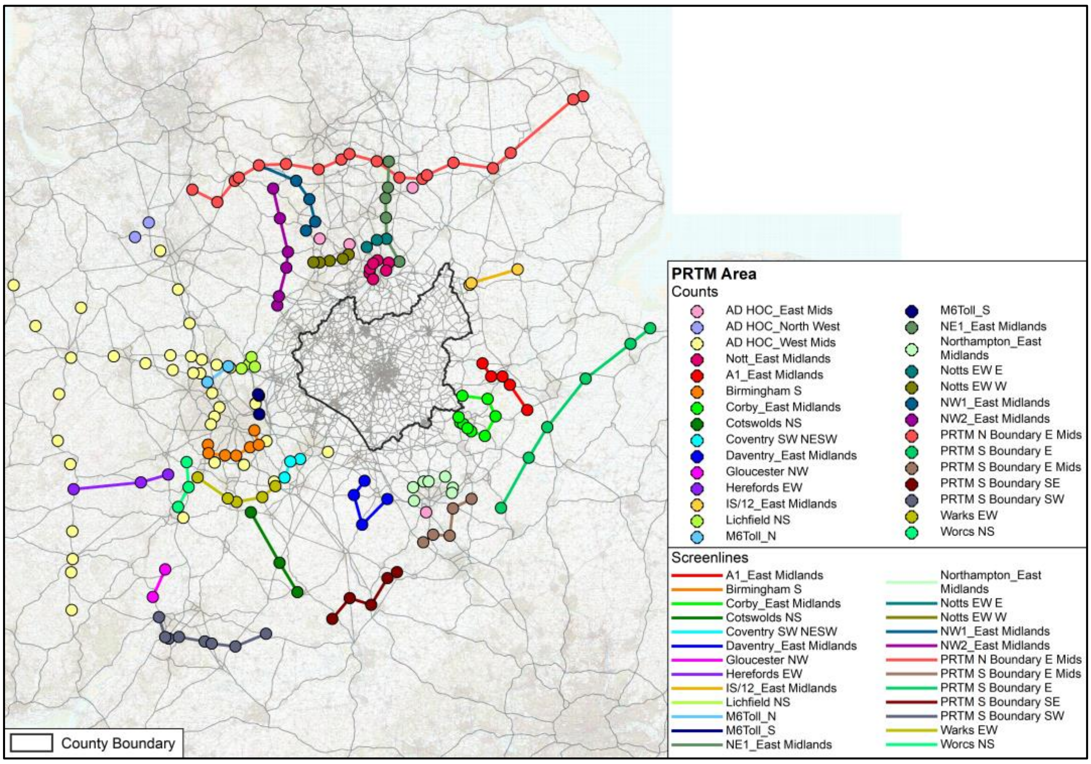
Table E15: Leicestershire Cordon & External Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**
Leicestershire Cordon (North-east) Inbound	32	✓	97%	84%	✓	97%	84%	✓	97%	84%
Leicestershire Cordon (South-east) Inbound	25	✓	96%	68%	✓	100%	68%	✓	92%	68%
Leicestershire Cordon (South-west) Inbound	19	✓	63%	47%	✓	95%	47%	✓	79%	47%
Leicestershire Cordon (North-west) Inbound	24	✓	92%	75%	✓	100%	75%	✓	88%	75%
Leicestershire Cordon (North-east) Outbound	32	✓	97%	72%	✓	97%	72%	✓	94%	72%
Leicestershire Cordon (South-east) Outbound	25	✓	92%	60%	✓	100%	60%	✓	92%	60%
Leicestershire Cordon (South-west) Outbound	19	✓	84%	68%	✓	89%	68%	✓	68%	68%
Leicestershire Cordon (North-west) Outbound	24	✓	88%	71%	✓	100%	71%	✓	83%	71%
Nuneaton Cordon Inbound	14	✓	79%	64%	✓	100%	64%	✓	43%	64%
Nuneaton Cordon Outbound	14	✓	57%	57%	✓	64%	57%	✓	86%	57%
Northern Rugby Screenline Northbound	4	✓	50%	50%	✓	100%	50%	✓	50%	50%
Northern Rugby Screenline Southbound	4	✓	75%	75%	✓	100%	75%	✓	50%	75%
Tamworth Counts Northbound	3	✓	100%	100%	✓	100%	100%	✓	33%	100%
Tamworth Counts Southbound	3	✓	33%	33%	✓	100%	33%	✓	33%	33%
Burton Counts Eastbound	2	✓	100%	100%	✓	50%	100%	✓	100%	100%
Burton Counts Westbound	2	✓	0%	0%	✓	100%	0%	✓	100%	0%
Nottingham Counts Northbound	4	✓	75%	50%	✓	100%	50%	✓	25%	50%
Nottingham Counts Southbound	4	✓	25%	25%	✓	100%	25%	✓	100%	25%
Leicestershire Cordon & External Screenlines	***254***	***100%***	***84%***	***67%***	***100%***	***96%***	***67%***	***100%***	***82%***	***67%***

Assignment Calibration and Validation – PRTM Area

E.42 The PRTM area represents a large part of the buffer network surrounding Leicestershire. This includes four groups of counts and 26 screenlines.

Figure E10: PRTM Area Count Locations



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E.43 In terms of screenline performance (shown in Table E16) the percentage of screenlines meeting the TAG criteria is 81% in all time periods. This can be considered relatively good performance since the PRTM area is modelled in less detail than areas in and around Leicestershire and available demand data are also less detailed. A number of screenlines are made up of less than just 5 counts resulting in a higher margin of percentage difference per failure. The performance of the individual counts that make up the M6 Toll screenlines are relatively poor due to the model not representing the charge experienced by drivers, thereby affecting the route choice between the M6 and the M6 toll. However total modelled flow across the screenlines is a good representation of observed flow.

E.44 Considering the individual link performance within this sub-area the percentage of links that meet the TAG 'flow' or 'GEH' criteria is 90% in the AM Peak hour model, 91% in the Interpeak model and 91% in the PM Peak hour model. This demonstrates that there is a good correspondence between modelled and observed flows within this area of the model.

Table E16: PRTM Area Screenline and Link Flow Performance (Total Vehicle Flows)

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**
A1_East Midlands North-Eastbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
A1_East Midlands South-Westbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_East Mids Eastbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_East Mids Northbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_East Mids Southbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_East Mids Westbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_North West Northbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_North West Southbound	2	✓	100%	100%	✓	100%	100%	✓	100%	100%
AD HOC_West Mids Eastbound	17	×	71%	65%	×	88%	65%	×	94%	65%
AD HOC_West Mids Northbound	21	✓	86%	81%	✓	95%	81%	✓	90%	81%
AD HOC_West Mids Southbound	21	×	90%	86%	×	90%	86%	×	90%	86%
AD HOC_West Mids Westbound	16	×	81%	81%	×	63%	81%	×	69%	81%
Birmingham S Inbound	7	✓	86%	86%	✓	100%	86%	✓	71%	86%
Birmingham S Outbound	7	✓	86%	86%	✓	86%	86%	✓	86%	86%
Corby_East Midlands North-Eastbound	9	✓	100%	100%	✓	100%	100%	✓	89%	100%
Corby_East Midlands South-Westbound	9	✓	89%	89%	✓	89%	89%	✓	100%	89%
Cotswolds NS Eastbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Cotswolds NS Westbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coventry SW NESW North-Eastbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Coventry SW NESW South-Westbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Daventry_East Midlands North-Eastbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Daventry_East Midlands South-Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Gloucester NW Eastbound	2	✓	100%	100%	✓	50%	100%	✓	50%	100%
Gloucester NW Westbound	2	×	0%	0%	×	50%	0%	×	100%	0%
Herefordshire EW Northbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**
Herefordshire EW Southbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
IS/12_East Midlands Northbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
IS/12_East Midlands Southbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lichfield NS Eastbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
Lichfield NS Westbound	4	✓	100%	100%	✓	100%	100%	✓	100%	100%
M6Toll_N Northbound	2	✓	50%	50%	✓	50%	50%	✓	0%	50%
M6Toll_N Southbound	2	✓	50%	50%	✓	0%	50%	✓	0%	50%
M6Toll_S Northbound	2	✓	0%	0%	✓	0%	0%	✓	0%	0%
M6Toll_S Southbound	2	✓	100%	100%	✓	50%	100%	✓	100%	100%
NE1_East Midlands Eastbound	6	×	83%	83%	×	83%	83%	×	83%	83%
NE1_East Midlands Westbound	6	×	83%	83%	×	100%	83%	×	83%	83%
Northampton_East Midlands North-Eastbound	7	✓	86%	86%	✓	100%	86%	✓	100%	86%
Northampton_East Midlands South-Westbound	7	✓	100%	100%	✓	86%	100%	✓	100%	100%
Nott_East Midlands North-Eastbound	7	×	86%	86%	×	86%	86%	×	100%	86%
Nott_East Midlands South-Westbound	7	×	86%	86%	×	100%	86%	×	86%	86%
Notts EW E Northbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Notts EW E Southbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Notts EW W Northbound	5	✓	80%	80%	✓	60%	80%	✓	80%	80%
Notts EW W Southbound	5	✓	100%	100%	✓	100%	100%	✓	80%	100%
NW1_East Midlands Eastbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
NW1_East Midlands Westbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
NW2_East Midlands Eastbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
NW2_East Midlands Westbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
PRTM N Boundary E Mids Northbound	18	✓	89%	89%	✓	94%	89%	✓	100%	89%
PRTM N Boundary E Mids Southbound	18	✓	94%	94%	✓	94%	94%	✓	94%	94%
PRTM S Boundary E Northbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%

		AM Peak			Interpeak			PM Peak		
Screenline	**# Counts**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**	**Screenline**	**%Flow**	**%GEH**
PRTM S Boundary E Southbound	6	✓	100%	100%	✓	100%	100%	✓	100%	100%
PRTM S Boundary E Mids Northbound	5	✓	100%	100%	✓	100%	100%	✓	100%	100%
PRTM S Boundary E Mids Southbound	5	✓	100%	100%	✓	100%	100%	✓	80%	100%
PRTM S Boundary SE Northbound	5	×	80%	80%	×	60%	80%	×	80%	80%
PRTM S Boundary SE Southbound	5	×	60%	60%	×	60%	60%	×	60%	60%
PRTM S Boundary SW Northbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
PRTM S Boundary SW Southbound	8	✓	100%	100%	✓	100%	100%	✓	100%	100%
Warwickshire EW Northbound	5	×	80%	80%	×	100%	80%	×	100%	80%
Warwickshire EW Southbound	5	×	80%	80%	×	100%	80%	×	80%	80%
Worcestershire NS Eastbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
Worcestershire NS Westbound	3	✓	100%	100%	✓	100%	100%	✓	100%	100%
PRTM Area	359	81%	90%	89%	81%	91%	89%	81%	91%	89%