Sheffield City Region Transport Model

Highway Model
Local Model Development and Validation Report

Sheffield City Region Combined Authority

Project number: 60526021

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Quality information

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Revision History

Revision	Revision date	Details	Authorized	Name	Position
1.0	17/10/18	Draft to Client		Stuart Dalgleish	Project Manager
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3.01	18/04/19	Updated model to improve convergence		Stuart Dalgleish	Project Manager

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1. Introduction

1.1 Purpose of Report

This report sets out the work undertaken to develop a strategic highway assignment model for the Sheffield City Region. This model sits within a wider suite of models which make up the Sheffield City Region Transport Model (SCRTM1) comprising of a Public Transport assignment model and a transport demand model.

The report also details how well the highway model validates against observed data in general and for particular scheme areas.

AECOM was commissioned to develop SCRTM1 with SYSTRA as partners. AECOM have been responsible for the development of the highway model while SYSTRA were responsible for the public transport model.

1.2 Background

A number of transport models have been developed over the past 10 years that cover the city region or parts of it. The main models are set out in Figure 1 below. These models have served various purposes during this time but the travel demand data on which they were built are no longer considered a valid representation of travel in the region as they are generally more than six years old. (WebTAG Unit 3.1 para 8.1.1).

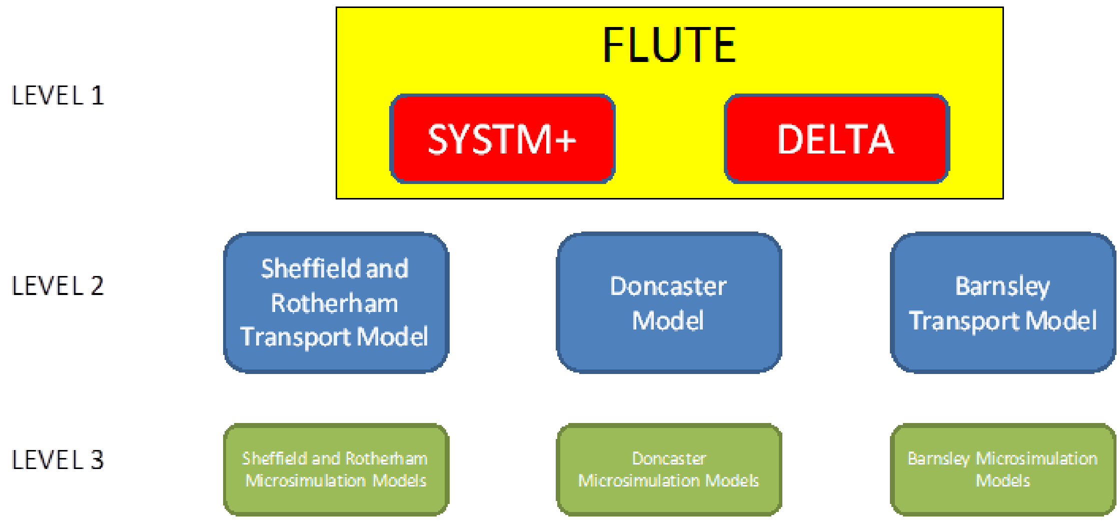

Figure 1. Previous Transport and Land Use Models within the SCR

- SYSTM+ – Strategic multi-modal transport model covering the whole of the SCR
- DELTA – Land Use model covering the whole of the SCR
- FLUTE – the combination of SYSTM+ and DELTA to form a land use transport interaction model
- Sheffield and Rotherham Transport Model (SRTM3) – Strategic multi-modal transport model covering the whole of Sheffield and Rotherham
- Doncaster Transport Model – Strategic multi-modal transport traffic model covering part of the Doncaster area
- Barnsley Transport Model – Strategic multi-modal transport model covering the whole of Barnsley

- Microsimulation Models – a number of highway models exist in each of the South Yorkshire districts. These range from small corridor models, using various software, to an AIMSUN model of the whole of Sheffield

In addition to these models a strategic highway model of the Chesterfield area also exists.

The new model is intended to replace the Level 1 and 2 models. This results in a large strategic model with a reasonable amount of detail in the assignment models.

1.3 Structure of Report

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2	Proposed Uses of the Model
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2. Proposed Uses of Model

2.1 Introduction

The model has been developed with four uses in mind:

- Assess the Mass Transit scheme;
- Assess the Innovation corridor Scheme;
- Assess the Pan Northern Connectivity Scheme; and
- Provide a legacy model for assessing other schemes and policies.

At the time of developing the specification of the model the Pan Northern Connectivity scheme was included in the proposed uses of the model however a bid to DfT to grant Local Major scheme status to this scheme was unsuccessful and therefore there is no immediate need to use the model for this scheme. We have however been mindful of this scheme when calibrating and validating the model.

Table 1 below sets out the legacy uses that are envisaged for the model while Table 2 sets out the modelling functionality required to assess these potential scheme and policy types. Based on this the new model needed to have the following components:

- Transport Demand;
- Time of day choice;
- Mode choice (including PT sub mode choice);
- Parking / Park and Ride Choice; and
- Highway route choice and public transport service choice.

Where scheme types in Table 1 are marked in orange with a “(Yes)” in the Required Capability column there is a limitation in the ability of the model to represent these schemes. This may be a limitation in terms of available data or model functionality and therefore the model will only be capable of high level assessments of these schemes. For example, the ability of the model to assess area wide walking and cycling schemes is dependent on the quality of the walking and cycling demand data (which is synthetic in SCRTM1) and the functionality of the model (Mode choice in SCRTM1 is based on generalised cost change whereas there are other additional factors which influence walking and cycling mode share).

This report is only concerned with the highway route choice model.

Table 1: Potential uses of the Legacy Model

Scheme/Policy Measure		Capability Required	Comment on Model contribution or scope of use
Infrastructure Provision	Major **highway** widening / new highway links /junction improvements	**Yes**	This may include corridor level allocation of road space such as integrated bus priority measures. The model will be capable of assessing some of the external impacts in SCR of large transport schemes proposed in neighbouring regions and having local impacts, however, it will not be sufficient to undertake a business case for these schemes.
	Corridor public transport schemes e.g. Supertram replacement and extension, increased frequency, BRT or conventional bus priority throughout corridor	**Yes**	Note that the rail industry typically apply mode specific models and supplementary modelling using rail industry methods may be required, If so the role would be to provide evidence on impacts on highway travel conditions and inputs for associated environmental impacts. The model will be capable of assessing some of the external impacts in SCR of large transport schemes proposed in neighbouring regions and having local impacts, however, it will not be sufficient to undertake a business case for these schemes.
	City/Town centre wide changes in parking supply, e.g. parking restraint	**Yes**	
	Provision of park and ride facilities	**Yes**	
	Area wide policy level **investment in walking or cycling** provision and associated marketing	**(Yes)**	Based on input assumptions of direct impacts, the effects of the associated changes on highway and public transport networks could be assessed.
	Minor local junction improvements or traffic management measures	**No**	Would be capable of providing demand to facilitate development of local detailed modelling and if the interventions are of sufficient magnitude to influence demand an interpretation of the outcome network performance could be interpreted approximately in model inputs.
	Public transport vehicle capacity	**No**	Outputs could be linked with data on vehicle capacity to interpret forecasts in terms of potential crowding, and over provision.
	Local public transport interventions – such as relocating individual bus stops or service specific changes	**No**	Would be capable of providing demand to facilitate development of local detailed modelling and, if the interventions are of sufficient magnitude to influence demand, then an interpretation of the outcome network performance could be interpreted approximately in model inputs.
	Changes to capacity or provision of individual new car parks	**No**	
Non infrastructure Rela	**City / town centre parking**	**(Yes)**	Only some parking stock is under local authority control. Modest changes in average cost of parking may be represented but there is no requirement to undertake detailed appraisal of parking strategy.

Scheme/Policy Measure		Capability Required	Comment on Model contribution or scope of use
	Public transport fares	**(Yes)**	Modest changes, such as expected increases in average fare over time. It is not expected that the model will be used to investigate detailed fare policy or commercial pricing strategy. No significant change to concession policy is expected.
	Smarter choices	**(Yes)**	Based on input assumptions of direct impacts, the effects of the associated changes on highway and public transport networks could be assessed.
	Road user charging	**No**	Would require income segmentation and tour modelling.
	Workplace Parking Levy	**No**	Assumptions may be made regarding the net effect of WPL and the effects of this on network performance would be represented. An additional module could be added at a later date but it would also require additional data.
	Clean Air Zone	**No**	Would require an adjustment to the demand segmentation (compliant and non-compliant vehicles) and the development of an external module to assess the impact of the scheme on vehicle replacement. If scheme applied to cars and involved charges then income segmentation would also be required.
	High Occupancy Lanes / Tolls/rationing by registration number	**No**	These would require segmentation, for example, by occupancy and income and more complex mode choice model.
	Bus Franchising	**No**	Model would need significantly more supply-side detail / demand segmentation to support a franchising proposal, and this would undermine functionality required for the main model purposes.
Transport Impacts of Spatial and Land Use Policy (inc interface with land use model)	**Assessment of transport impacts of major developments**	**Yes**	In particular packages considered in developing alternative spatial strategies or input changes in the distribution of land use reflecting other policy initiatives.
	Small developments (eg <500 dwellings)	**No**	Where network and zone detail is increased compared with SYSTM+ then this would support more spatially detailed appraisal in these areas. Some increased level of detail can be added in Barnsley, Chesterfield, Doncaster, Rotherham and Sheffield but the ability of the model to forecast the impact of smaller developments in specific locations will be dependent on the level of calibration in these areas.
Other Impacts	**Journey Time Reliability**	**No**	No robust analytical tools available to predict impacts.

Table 2: Model Functionality Requirements

Scheme / Policy Measure	Principal Modelling Requirements
Mass Transit	Public transport assignment model Main mode choice model Sub mode choice between tram and bus (and rail) Detailed network coding and zoning in vicinity of Supertram stops
Innovation Corridor	Highway assignment model for route choice Trip distribution model Trip generation model Land use trip generation forecasting
Pan Northern Corridor	Highway assignment model for route choice Trip distribution model Trip generation model Land use trip generation forecasting
Major highway widening / new highway links / junction improvements	Highway assignment model for route choice required with junction modelling capability. Trip distribution model
Corridor public transport schemes e.g. Supertram replacement and extension, increased frequency, BRT or conventional bus priority throughout corridor	Public transport assignment model Main mode choice model Sub mode choice between tram and bus (and rail) Feedback of highway congested times into public transport assignment model
City/Town centre wide changes in parking supply, e.g. parking restraint	Park and Ride choice model reflecting parking choice between city centre and park and ride Mode choice model
Provision of park and ride facilities	Park and Ride choice model
Area wide policy level investment in walking or cycling provision and associated marketing	Active mode choice model reflecting transfer of trips from car / public transport to walking / cycling
Public transport fares	Mode choice model
Smarter choices	Limited to calculating mode changes outside of the model and inputting impacts to final assignments.

Scheme / Policy Measure	Principal Modelling Requirements
Assessment of transport impacts of major developments	Land use trip generation forecasting
	Highway and public transport assignment
	Mode choice model

In addition to the scheme impacts and principal modelling requirements listed, it is expected that several of the schemes will seek to relieve congestion, particularly in peak hours. This is likely to require some highway route choice modelling and lead to some element of time of day choice, therefore a time of day choice model was required.

2.2 Mass Transit Scheme

The Sheffield Supertram scheme has been running for over 20 years. Many of the schemes major assets are expected to get to the end of their economic life in the next few years and this is likely to coincide with the end of the current franchise agreement in 2024. A significant programme of track and vehicle replacement will need to be undertaken otherwise the scheme will have to be closed down.

The model is intended to inform the business case for investing in the maintenance and renewal of the tram so that it can continue to run for another 30 years.

2.3 Innovation Corridor

The Innovation Corridor area centres on extensive brownfield sites close to J33 and J34 of the M1 where major employment growth is planned. This is expected to become a world-class international centre of excellence for innovation, recognised as having the potential to be SCR's primary economic driver. Both of these junctions currently experience congestion, and there is poor air quality resulting from this congestion.

The Innovation Corridor Scheme is a major highway improvement scheme providing improved links between these employment sites and the areas of population either side of the M1.

2.4 Pan Northern Connectivity

This scheme aims to improve East-West movement between the M1 in the Barnsley / Rotherham area to the M18 north of Doncaster. This would be achieved through upgrading some existing roads, bypassing a number of existing congestion hotspots, making best use of proposed schemes related to opening up land for development and some new road proposals to create a high quality strategic road link.

While this scheme may have benefits in its own right it will have additional benefits should a TransPennine road tunnel be built.

As mentioned in 2.1 above, the Pan Northern Connectivity scheme does not currently have any allocated funding for development work. The development of the model structure has taken account of the scheme so that the model can be used in the future to assess the scheme however less effort has been expended on calibrating the model in this geographical area compared with the other two scheme areas.

2.5 Model Design Considerations

2.5.1 Overview of the Modelling Suite

The highway model (both the matrix and the network) is only one part of the full modelling suite. The relation the model has to the other parts of the suite is indicated in Figure 2 below. With the overall structure of the model is shown in Figure 3. This follows the 'Standard Model' recommended by WebTAG Unit M1 para 4.2. The demand model produces an estimate of demand based on land-use and perceived transport cost changes (incorporating changes in values of time, fuel cost, fuel efficiency, and highway congestion). The transport costs are produced by the assignment models which in turn are dependent on the demand. This inter-dependency is resolved by iterating between the demand and assignment models until a converged situation is reached.

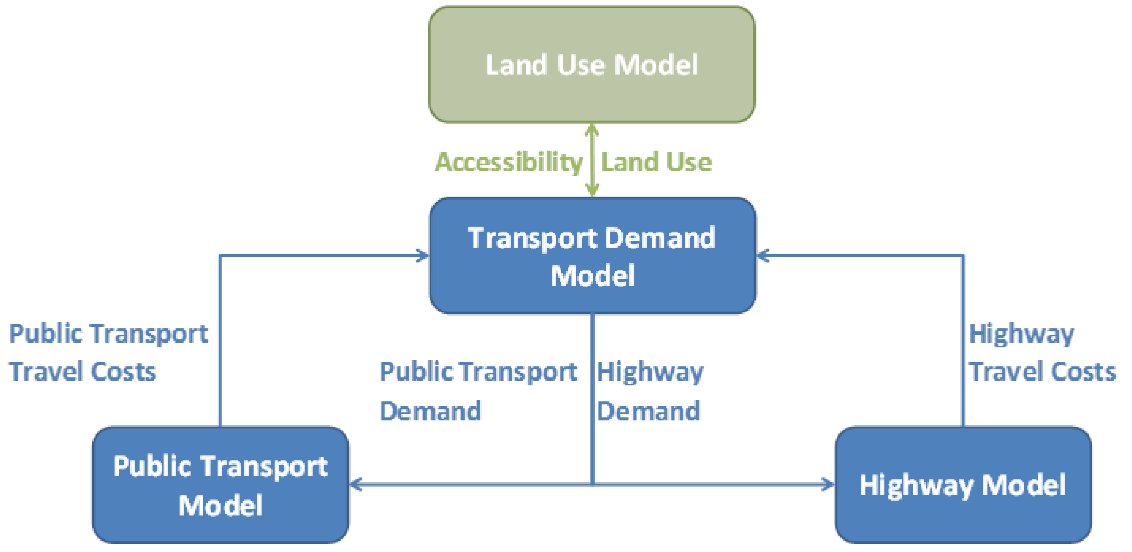


Figure 2. Summarised Overview of the Modelling Suite

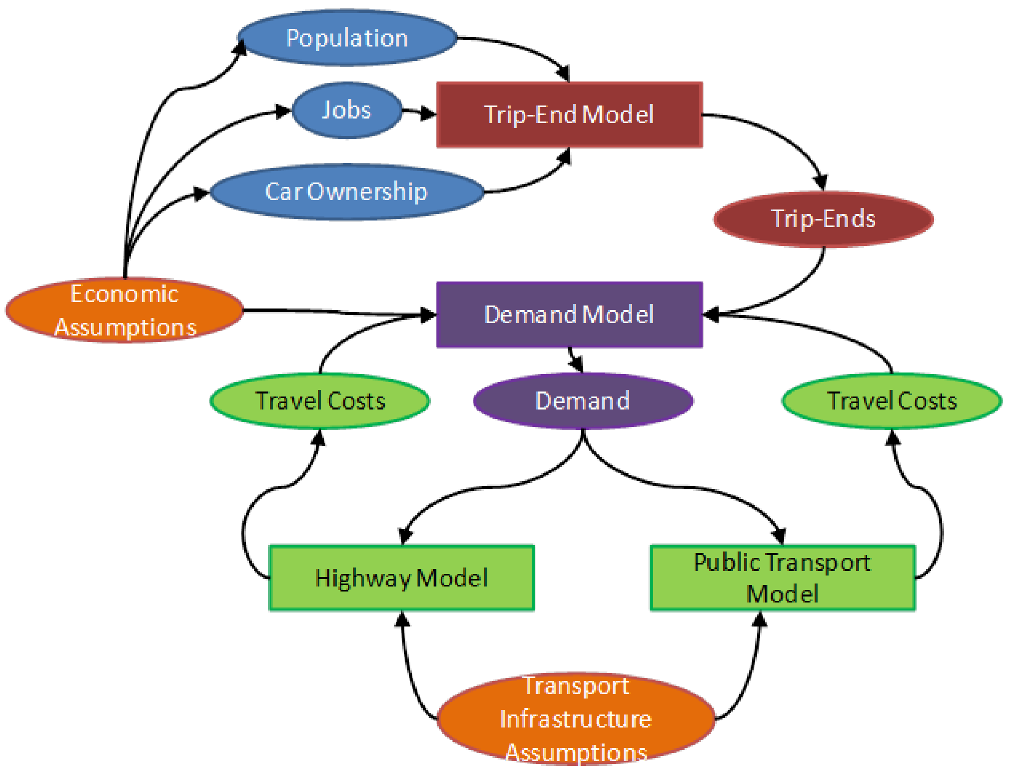


Figure 3. Model Structure

3. Model Standards

3.1 Introduction

This chapter outlines the validation criteria used in the modelling process, along with the relevant convergence criteria and standards that the model has been judged against.

3.2 Validation Criteria and Acceptability Guidelines

The validation criteria and acceptability guidelines for highway assignment models are set out in Table 11 below. These are principally aimed at models which are built for a specific scheme and therefore should be met over the area of influence of the scheme. Given that the initial uses of the model are for specific schemes then the criteria below will be used to judge those areas of the model where there is expected to be a scheme impact. This area is known as the Area of Detailed Modelling.

In other parts of the Fully Modelled Area where there are currently no specific uses for the model a more proportionate approach has been taken to calibrating the model. Traffic screenline counts in these areas have been used in adjusting the prior matrix however only a minimal level of checking and calibration of the network has been undertaken. To have calibrated the whole of the Fully Modelled Area to the same level as the Area of Detailed Modelling would have taken an inappropriate amount of time and effort. Where the model is to be used for assessing other schemes and policies it will first be necessary to check the level of calibration and validation in the area of influence and some further calibration may be necessary at that time.

Table 3. Validation Criteria and Acceptability Guidelines

Model	Indicator	Criteria	Acceptability Guideline
Highway	Screenline Flows	Differences between modelled and observed values should be less than 5% when at least 5 counts, other criteria (Table 4) applies for screenlines with fewer counts.	All or nearly all of the screenlines
Highway	Link Flows	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	>85% of cases
		Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	>85% of cases
		Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	>85% of cases
Highway	Link Flows	GEH < 5 for individual counts	>85% of cases
Highway	Journey Times	Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of cases
Change between prior and post estimation – highway model	Matrix zonal cell values	Slope within 0.98 and 1.02 Intercept near zero R2 in excess of 0.95	
	Matrix zonal trip-ends	Slope within 0.99 and 1.01 Intercept near zero R2 in excess of 0.98	
	Trip length distributions	Means within 5% Standard deviations within 5%	
	Sector to sector level matrices – for this model this will be District to District	Differences within 5% or 250	

Source: WebTAG / AECOM

There are two indicators where we have suggested alternatives to the standard WebTAG guidance. The first is altering the acceptability criteria for short screenlines, the second is measuring the change in sector to sector totals due to matrix estimation.

3.2.1 Short Screenlines

WebTAG suggests screenlines have at least 5 counts and are deemed to 'pass' if the total model flow crossing the screenline is within 5% of the total count. However, in SCRTM1 there are a number of screenlines which have less than 5 counts. Screenlines should aim to capture all movements between two areas or sectors. The size of these areas and the number of routes between them are key to determining how many counts should make up a screenline. We have less than 5 counts in some screelines as a result of the following situations:

1) it would not be possible or appropriate to extend to include 5 counts, as they would then represent different strategic movements. For example there are a number of valleys in the

area that are used strategic transport corridors. Only a small number of alternative routes occur in these valleys.

2) In some instances we actually want a short screenline. For example we have a two count screenline that only includes A6109 Brightside Lane and A6178 Attercliffe Common. This one aims to pick up movements that could switch to travelling by tram between Meadowhall and the City Centre and also tries to get the correct level of traffic / congestion within this corridor so that trips displaced by the tram closure option are faced with realistic traffic congestion. Having a longer screenline would include a lot of additional movements that are unlikely to be attracted to the tram so a short screenline is more desirable here.

3) In some cases we have simply used existing data where it formed a short screenline. This is an opportunistic approach and allows us to make best use of existing data and improve the quality of the model at a more local area.

Where a screenline crosses fewer than 5 roads it is likely that the traffic flow will be lower and therefore applying the criteria of 5% to these shorter screenlines would be overly stringent. For example, a 3 point screenline may have a total flow of 1500-2000 pcus. Applying a 5% tolerance would allow +-75-100 vehicles. This is more constrained than the tolerance applied to a single count of half of this level. We therefore consider that it is appropriate to present screenline results against a range of criteria.

We have therefore provided screenline information against 4 criteria to provide a view on how good the model reflects observed flows even if it doesn't meet the standard WebTAG test.

1) 5% as required by WebTAG

2) 10% (which is half way between the 5% required by WebTAG and the 15% that normally applies to a single count. It is recognised that this may be the most relaxed of all the alternative criteria.

3) GEH < 4. This used to be a WebTAG criteria but was removed from the recent versions of guidance as it wasn't always appropriate for higher flow ranges.

4) AECOM have developed a variable threshold (var%) based on the number of counts in the screenline. These variable thresholds are based on the following discussion:

    a. A 5% threshold is appropriate for screenlines with 5 or more counts

    b. At a single count location a threshold of 15% is normally applied (for flows between 700 and 2700)

    c. We have therefore applied a pro-rata threshold between 5% and 15% depending on the number of counts as set out in Table 4 below.

Of these alternatives we believe that the variable threshold provides the fairest comparison.

Table 4. Acceptability Criteria for Short Screenlines (var%)

Number of counts in screenline	Acceptability Criteria
5+	5% (as in WebTAG M3.1)
4	7.5%
3	10%
2	12.5%
1 (This isn't a screenline but has been included to show the pro-rata between 5% and 15%)	15%

Source: AECOM

3.2.2 Change in Sector to Sector Movements

In terms of data accuracy a 5% allowance is recommended in WebTAG for screenline flows. AECOM feel that applying a limit of 5% change to sector to sector matrices is also not appropriate. This would be particularly true for sectors with a small number of trips e.g. applying a 5% change criterion to a sector with 20 trips suggests that we have confidence in prior demand matrices to a level of a single vehicle – this would be unreasonable. We expect screenlines typically to have flows of a few thousand vehicles – and apply a 5% criterion – so for example 5000*5% = 250 i.e. an allowance of 250 would be typical for a screenline. We therefore feel that an allowance of +/- 250 or 5% would be an appropriate way to judge whether a change is significant or not. An identical approach has been used in the A630 Sheffield Parkway model which has recently been reviewed by DfT.

3.3 Convergence Measures and Acceptable Values

The WebTAG convergence criteria and acceptability guidelines are set out in Table 5. From experience in other similar models it is expected that a much higher level of convergence will be required in order to ensure that the overall demand / supply iterations converge quickly and to improve the confidence in any economic assessment undertaken using the model. A %Gap value of 0.002% has been sought over the final 4 assignment iterations.

Table 5. WebTAG Convergence Criteria and Acceptability Guidelines

Model	Indicator	WebTAG Criteria	Acceptability Guideline	Criteria Used in SCRTM1
Highway Convergence	%Gap	<0.05%	For final 4 assignment iterations	<0.002%
Highway Convergence	Link Flows	% Links changing by less than 1%	>98% of cases in final 4 assignment iterations	98%

Source: WebTAG / AECOM

4. Key Features of the Model

4.1 Introduction

This chapter sets out the key features of the highway assignment model. These include:

- Fully Modelled Area;
- Zones;
- Network;
- Time Periods;
- User Classes;
- Assignment Method;
- Definition of Generalised Cost;
- Capacity Restraint Mechanisms; and
- Relationship with Variable Demand and Public Transport Models.

4.2 Modelled Area

The SCRTM1 has been developed to cover the whole of Great Britain, with its main focus being on trips that have an origin, destination, or route that passes through the Sheffield City Region. Initially a task was undertaken to define which parts of the model should be included in the Fully Modelled and External Areas. The extent of the fully modelled area is displayed below in Figure 4, with the remaining areas throughout Great Britain classified as External.

The Fully Modelled Area is slightly larger than the SCR area, enabling the model to be capable of modelling range of schemes in any part of the SCR. This also accounts for any schemes that are near to the SCR boundary, and any potential rerouting being accounted for within the Fully Modelled Area, rather than in the External Area.

Within the Fully Modelled Area an Area of Detailed Modelling has been defined. This coincides with the area of influence of the three schemes that the model is being initially developed to assess. Given the importance of the Area of Detailed Modelled, additional work has been undertaken to ensure that these areas are as close to possible to WebTAG validation standards, whereas less effort has been spent in the remainder of the Fully Modelled Area. As calibration has been concentrated on the three specified schemes, then other schemes would require more detailed local checking, possibility resulting in some local calibration and validation.

The Detailed Modelling area for each scheme was defined as follows:

Innovation Corridor – A two stage approach was used to identify an area of scheme impact for this site. Initially, a 5km buffer was identified around J33 and 34 of the M1. Following this, an assessment of the scheme using an older model was undertaken and this was used to identify road links where a flow change of more than 5% or 50 pcus occurred in one of the peak hours. The two areas were then compared the area defined by the model was found to lie fully within the 5km buffer. It was therefore decided to retain the 5km buffer to ensure that the model was calibrated over a wider area.

Mass Transit – Passengers using the SuperTram scheme will generally have an origin and destination within 1 km of the tram route. The scheme area was therefore defined as a 1km buffer around the existing tram route.

Pan Northern Corridor – No existing model assessments have been undertaken for this scheme therefore the scheme impact area has been defined as a 5km buffer around the expected alignment of this scheme.

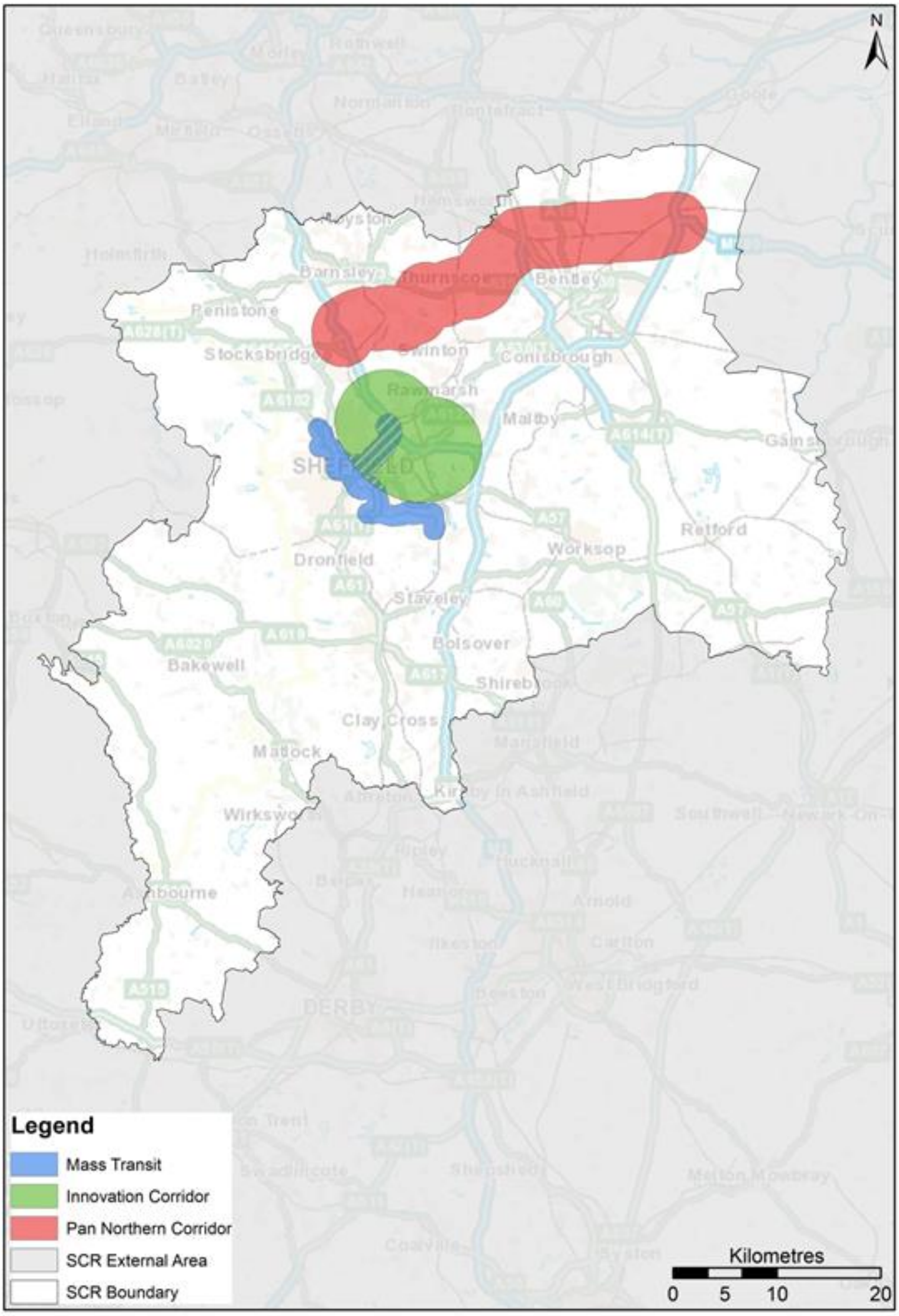


Figure 4. Definition of Model Detail areas, including the three 'Detailed Modelled Areas'

4.3 Zoning System

A principal requirement of the zoning system is that it would be consistent across the Fully Modelled Area with no distinction in the area of detailed modelling. This will allow the model to be used for future schemes across any part of the Fully Modelled Area subject to an appropriate level of calibration and validation in the area of impact of that scheme.

The zone system defined for the SCRTM1 has been developed to accommodate the highway model covering the whole of Great Britain. In total the zone system contains 1412 zones. Figure 5 shows the area covered by the full extent of the zone system.

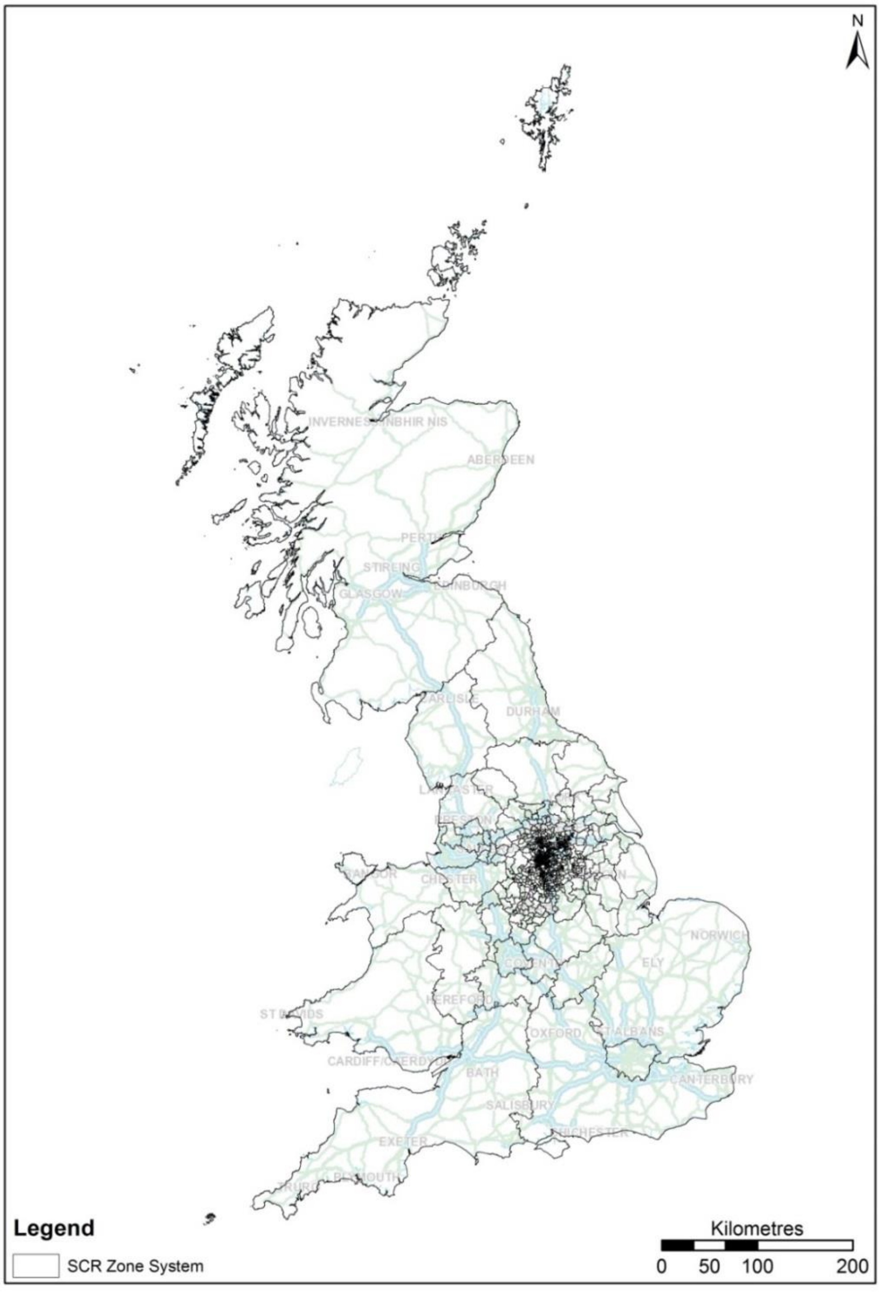


Figure 5. National Zone System for SCRTM1

The zone system distinguishes between internal and external zones using the SCR boundary, in the same way in which the transport model does between the internal simulation area and the buffer network. The internal zone system, displayed in Figure 6, represents the fully modelled area, while the external zones are located in the buffer network where there is less network detail.

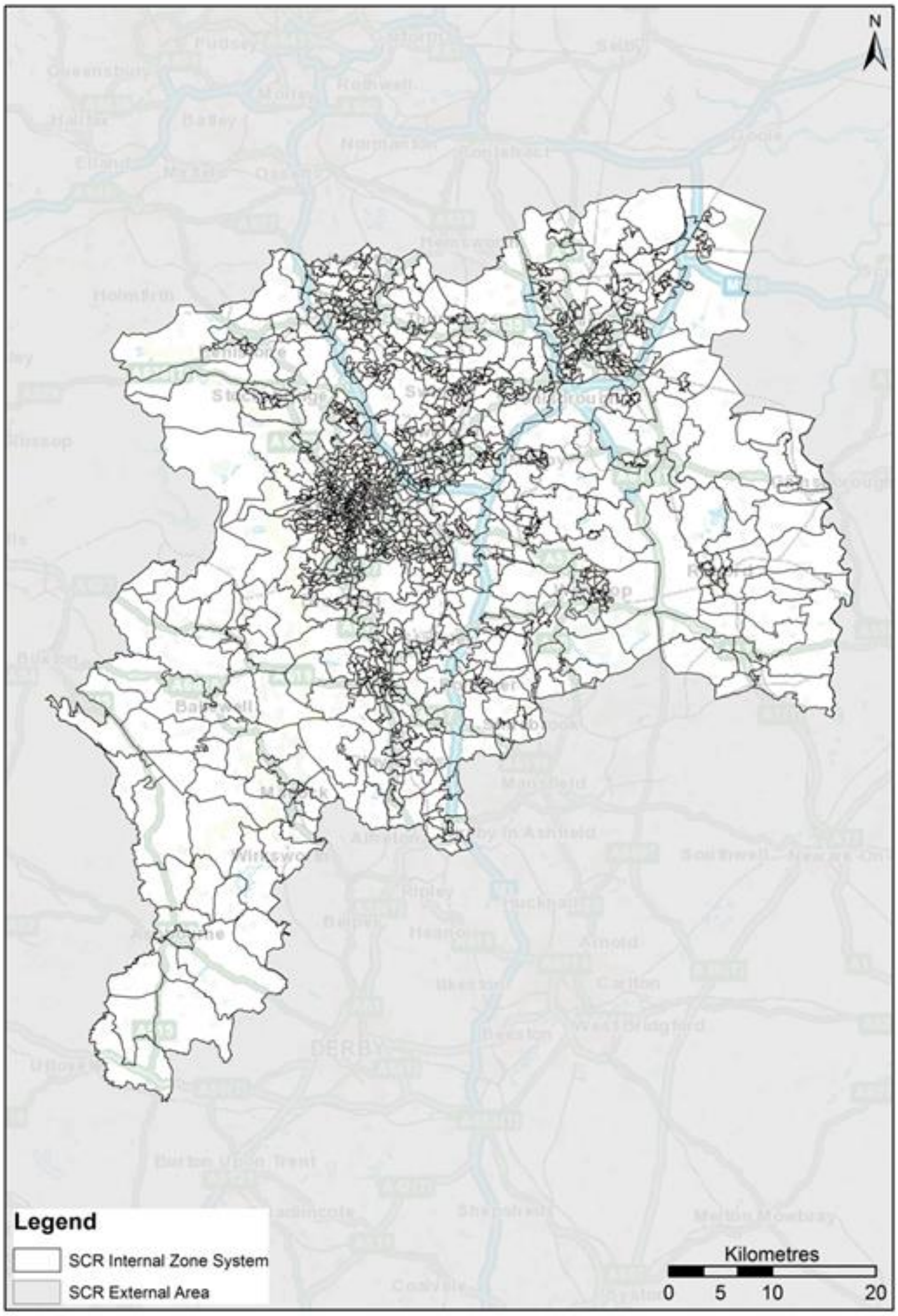


Figure 6. Internal zone system within the SCR boundary

Within the fully modelled area, the zones are much smaller than those in the external, buffer area. WebTAG recommends that each zone in the fully modelled area should have approximately 200-300 vehicle trip-ends in each time period. Based on the number of households within the SCR and the number of trips per household we estimated that around 1000 zones would be required to achieve this. In line with advice in WebTAG where possible we have ensured that zone boundaries match the boundaries used in presenting information from the Census.

4.3.1 Rules Applied for Zoning

The work undertaken to develop the zone system followed the advice given in WebTAG M3.1 paragraph 2.3.

The zones corresponded with Census boundaries in the following way:

- Within the fully modelled area (Internal Zones):
  - No zone crossed a Middle Super Output Area (MSOA) boundary;
  - MSOAs were further sub-divided into model zones using Census Output Area (OA) Boundaries; and
  - Where Census Output Areas were large and there were significant areas of development then these were subdivided using Workplace Zones;
    - Further subdivision was required in some areas (such as around Tinsley, shown in Figure 7) due to large OA and Workplace Zones and the potential for different land uses, or for multiple loading points on the transport model network. In these instances, OA's / Workplace Zones have, where possible, been split along physical barriers, such as motorways and railway lines. When a physical boundary has not been present, OA's/Workplace Zones have been split at appropriate areas in order to differentiate between different land uses, or future development sites.
  - Internal zones have been devised, where possible, by combining OA's in order to represent population, as described in the 'Zone Proportioning' section (4.3.2).
- Within neighbouring local authority districts (but outside the fully modelled area, External Zones):
  - Zones were built by combining MSOAs; and
  - No zone crossed a Middle Super Output Area (MSOA) boundary unless it incorporates the entire MSOA on either side of the boundary.
- Beyond the neighbouring districts (External Zones):
  - Zones are formed using district or government area boundaries.

Natural boundaries such as rivers, railways and major roads (including motorways) were considered to make sure wherever possible these did not split a zone into two segregated areas.

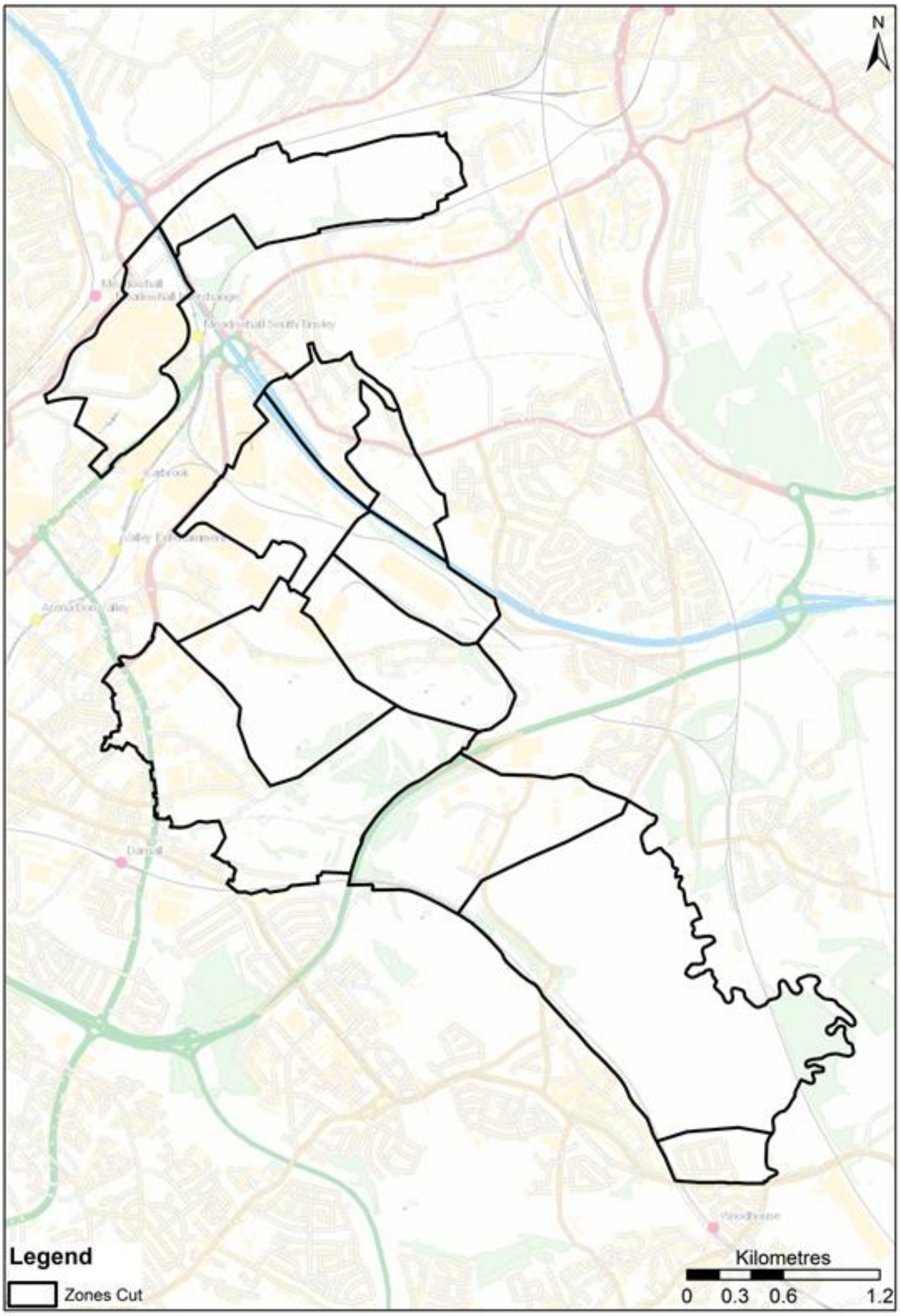


Figure 7. Examples of zones cut down further from OA's and Workplace Zones

4.3.2 Zone Proportioning

The SCR itself is comprised of nine local authority areas (LA), making up the internal zone system. The internal zone system accounts for 1232 zones. All zones outside of the SCR are classed as 'external' zones, of which there are 180 zones. The LA areas combining to make up the SCR are as follows;

- Barnsley;
- Bassetlaw;
- Bolsover;
- Chesterfield;
- Derbyshire Dales;
- Doncaster;
- North East Derbyshire;
- Rotherham;
- Sheffield.

Figure 8 indicates the extent of the SCR, along with its positioning in Great Britain, and the nine LA boundaries.

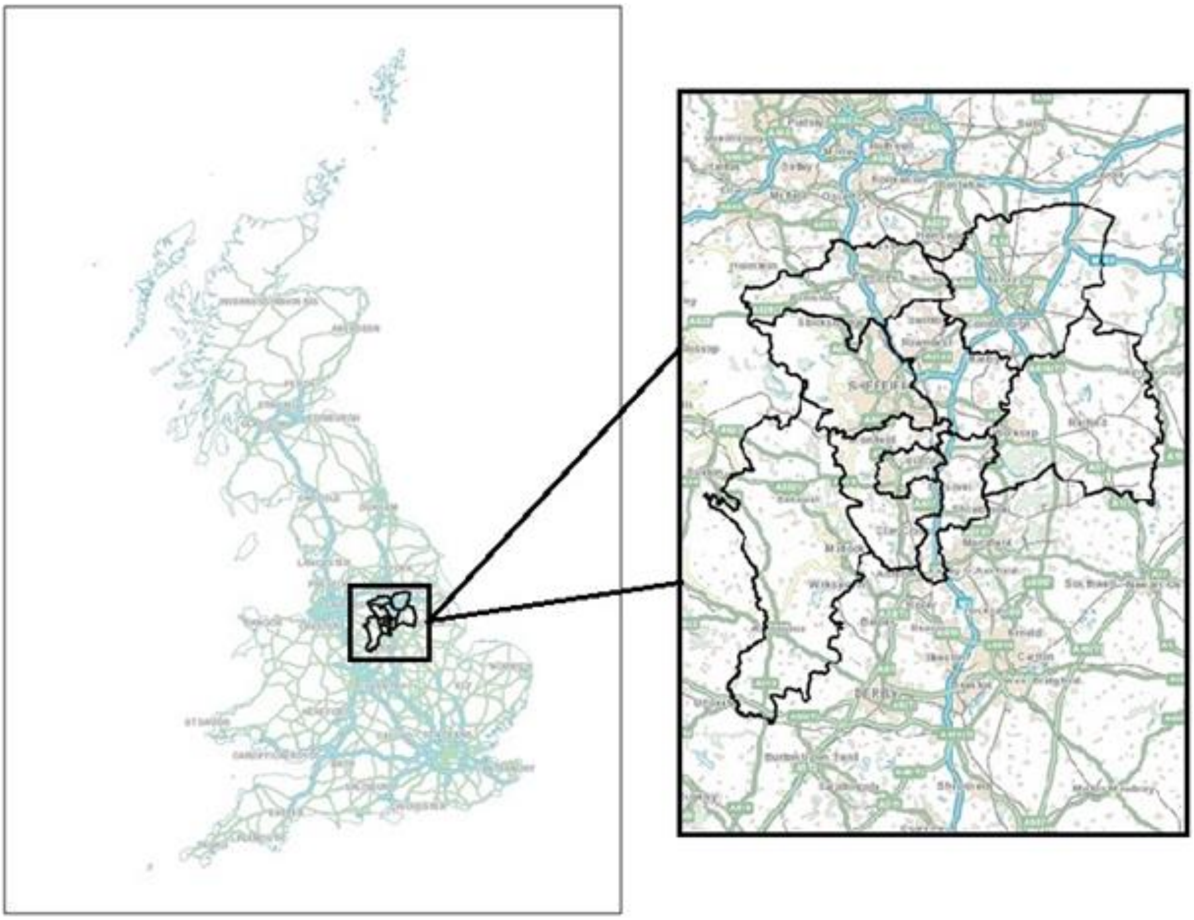


Figure 8. SCR's position in Great Britain and the LA's combining to form the region

In order to consistently represent each of the LA areas in the SCR zone system, the zones themselves have generally been produced by combining OA's, meaning each zone is of roughly equal population. Where possible, zones have been formed using the OA's to represent a population of between 1000 and 3000 people. This has been chosen to ensure the "numbers of trip to and from individual zones should be approximately the same for most zones and that the number of trips to and from each zone should be … relatively small". (WebTAG M3.1 2.3.11). By following this rule, the zone system has managed to roughly weight the number of zones in each LA across the geographic area based on population. The spread of population and the zone proportions are highlighted in Table 6. As can be seen the proportions are within 4% for each of the LA's.

Table 6. Number of zones per OA, with the total model proportions

	Population	Proportion	Actual Zones	Internal Zone Proportion	Full SCR Zone Proportion
Sheffield District	563,749	31%	380	35%	31%
Rotherham District	260,070	14%	163	14%	12%
Doncaster District	304,185	17%	172	14%	12%
Barnsley District	237,843	13%	130	11%	10%
Chesterfield District	104,288	6%	64	5%	4%
North East Derbyshire District	99,352	5%	65	5%	5%
Bolsover District	77,155	4%	58	5%	4%
Derbyshire Dales District	71,281	4%	74	5%	4%
Bassetlaw District	114,143	6%	75	6%	5%
External Zones	-----	-----	199	----	13%
Totals	**1,832,066**		**1380**	**100%**	**100%**

Source: ONS and AECOM

As a result of the zone system primarily being based on OA populations, the number of zones in urban areas is greater than in more rural locations. Figure 6 highlights the high density of zones in the urban area of Sheffield.

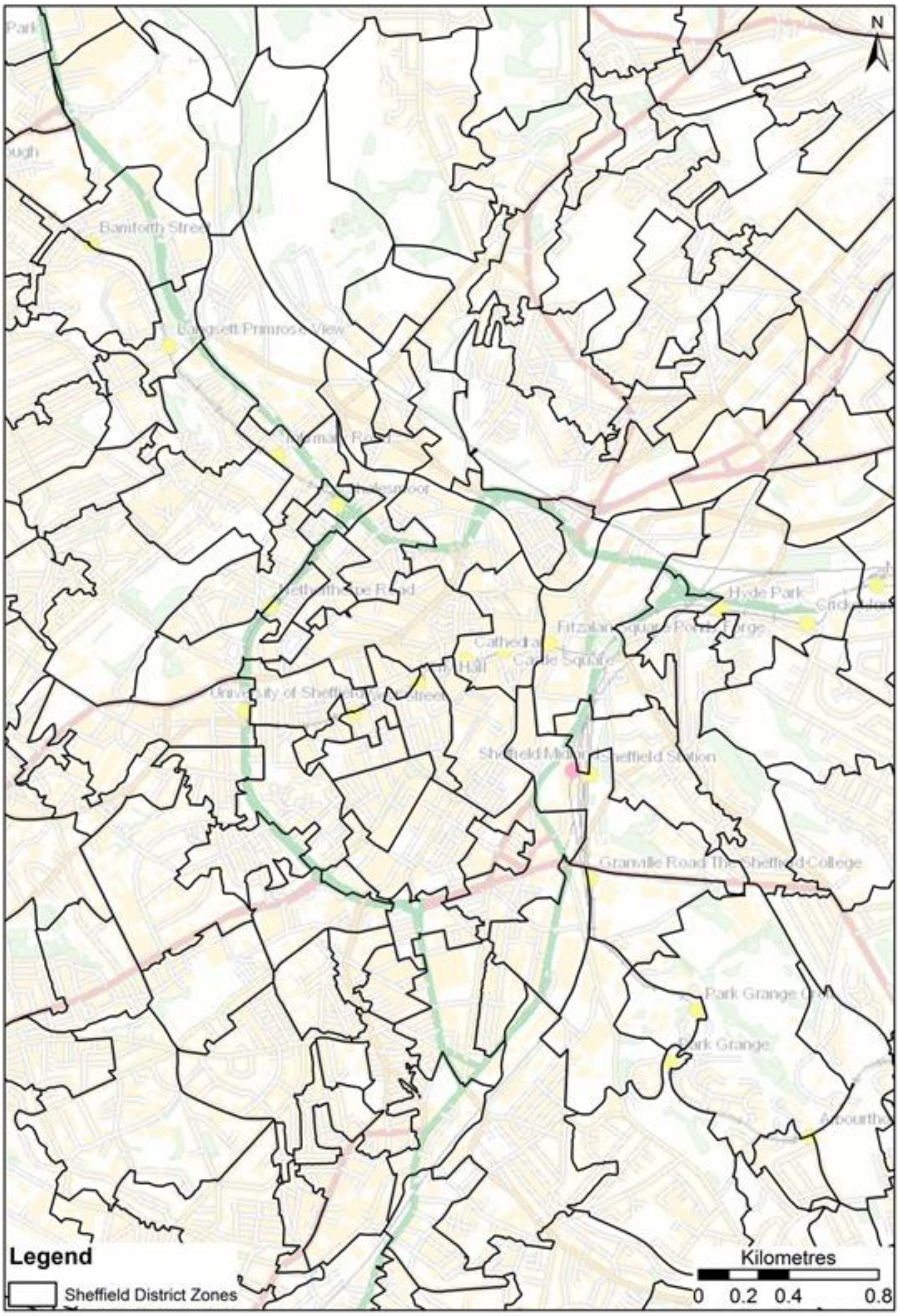


Figure 9. Sheffield city centre zones

4.3.3 Development zones

To allow for future developments to be represented within the highway, public transport and demand models, twenty empty development zones were added to the model. The demand matrix in the base model will have no trips within, to and from these zones. As shown in Table 7, these development zones are numbered sequentially between 30001 and 30020.

4.3.4 Zone Numbering

Definition between the different LA's has been clearly identified in the numbering of the zones which fall within each of the LA areas. Each zone number follows a consistent pattern, consisting of five numbers. The first digit identifies the whether a zone is internal (1XXXX), or external (2XXXX). For internal zones, the second number identifies the LA in which the zone is located (expressed in more detail in Table 2). For the final three digits zones towards the geographical centre of each district are given the lower numbers, with numbers increasing the further the zone falls. The zone numbering used for the SCR transport model is outlined in Table 7, with each LA two digit code being represented.

Table 7. Zone Numbering System

Zone Type	Local Authority	Starting Zone Number
Internal	Sheffield	10XXX
Internal	Rotherham	11XXX
Internal	Doncaster	12XXX
Internal	Barnsley	13XXX
Internal	Chesterfield	14XXX
Internal	North East Derbyshire	15XXX
Internal	Bolsover	16XXX
Internal	Derbyshire Dales	17XXX
Internal	Bassetlaw	18XXX
External	Elsewhere	20XXX
Future Development	Future Development Zones	30XXX

Source: AECOM

4.4 Network Structure

The structure of the SCRTM is derived from combining six existing models; SYSTM+, Sheffield and Rotherham Transport Model 3, Sheffield Aimsun Model, Barnsley Transport Model, Doncaster Transport model, and the Chesterfield Traffic Model. Given the number of different models combined to build the SCRTM, it is inevitable that there are differing levels of detail and coding approaches taken for each. With this in mind, it was accepted that the process of combining the models would involve various checks and changes being made. The following guidelines have been followed to ensure that network structure remains as comprehensive as possible throughout the entire fully modelled area, without losing the calibration work undertaken on the original models:

- All motorways are included;
- All A roads are included;
- Most B roads have been included, particularly where they represent a likely route between two zones;
- Minor roads have been included where they provide a plausible 'rat run' or where they are required to link centroid connectors to main roads;
- As we wished for a consistent highway and public transport network then links were added to represent bus and tram routes where required.

'Rat runs' have been perceived as being minor, typically residential streets, used by drivers during peak periods to avoid congestion on main roads.

Guidelines for coding the external areas have been set out, as below:

- Only motorways or A roads that provide a link between external zones and the boundary of the fully modelled area, or between the zones themselves.

Having combined the various existing networks, the resulting network structure is shown in Figure 10 and Figure 11. This network was shared with each highway authority in SCR to check that the coverage was sufficient and that no roads meeting the above criteria had been missed.

Within the fully modelled area (within the SCR boundary) the highway network has been coded using simulation detail, with buffer detail being used in the external model areas.

Simulation network uses information about the number of lanes, saturation flow for each turn, which turns are permitted in each lane, phases and stages for signalised junctions. Speeds on some of the links will depend on the vehicle demand. Delay at junctions will depend on the demand flow for a movement and, where appropriate, the volume of the conflicting flow.

Buffer detail means that no junction information is included other than which roads are connected where. Buffer links give a fixed speed and a distance, with no capacity restraint applied. There is no junction delay, so this must be taken account of in the buffer link speeds.

Further images of the network within SCR, such as the urban area around Sheffield are shown in Appendix C.

How the zones were connected to the network is discussed further in 6.3.

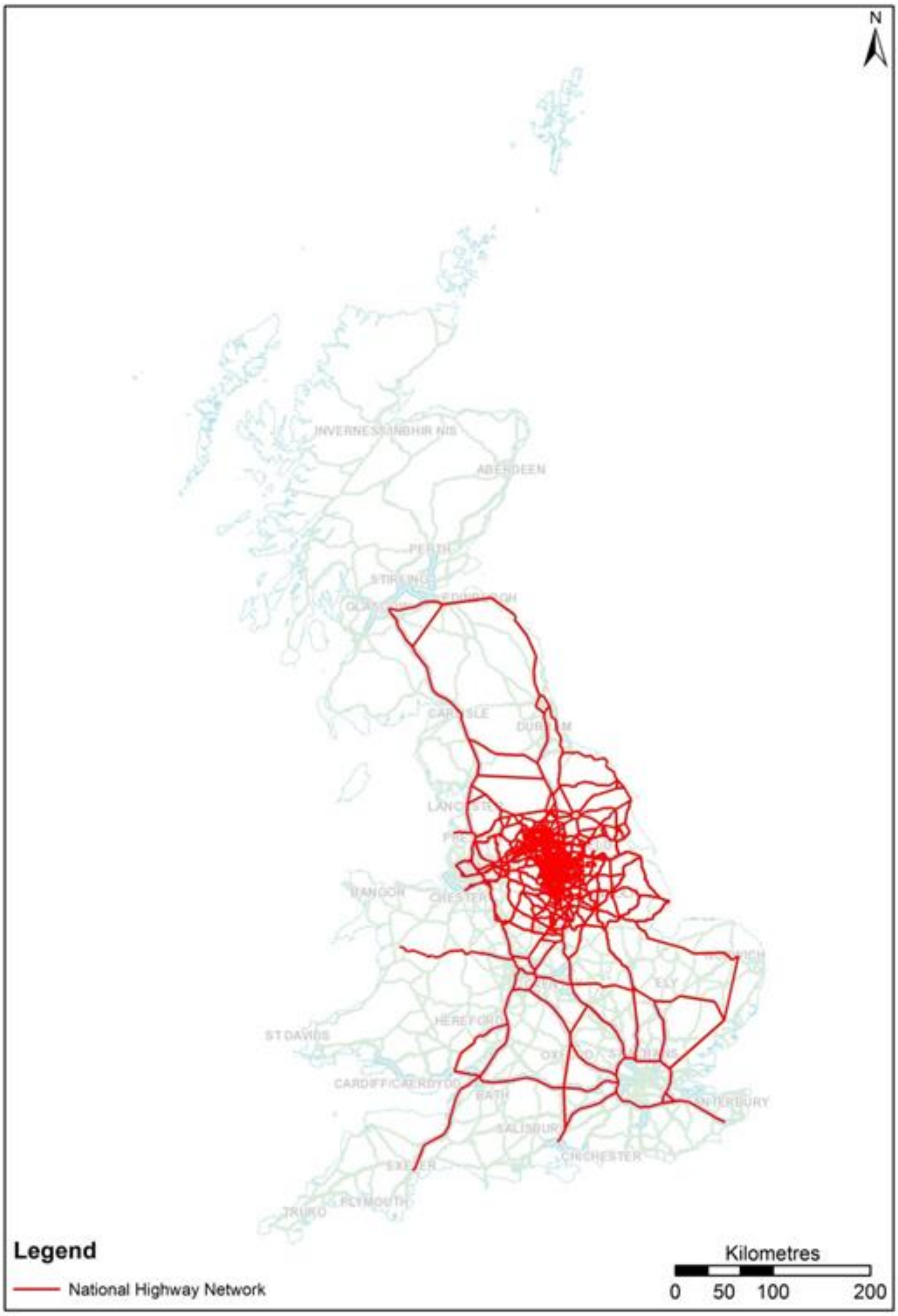


Figure 10. National highway network structure

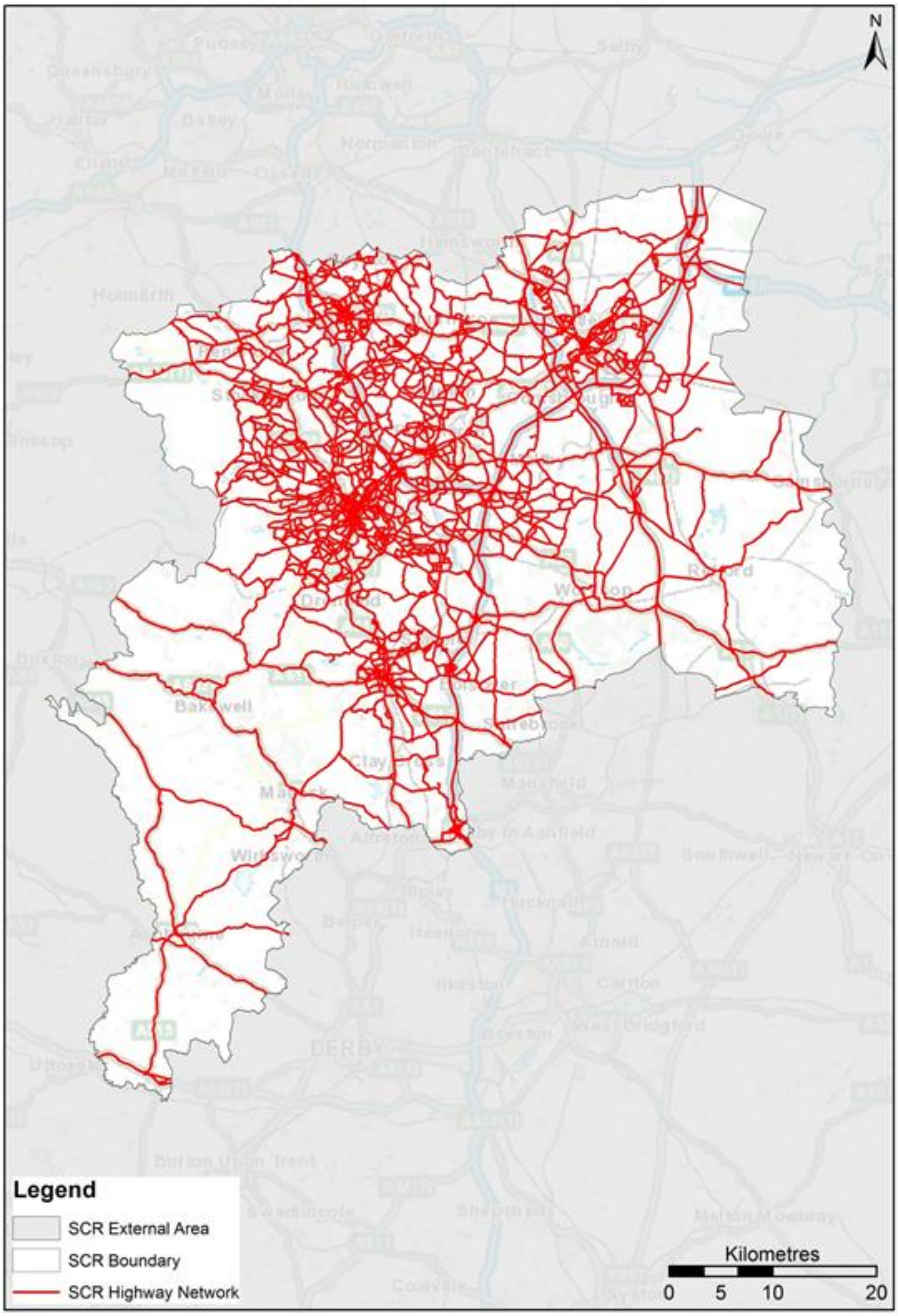


Figure 11. Sheffield City Region highway network structure

4.5 Time Periods

The model is intended to represent an average Tuesday to Thursday in October 2016. This covers the time period when the mobile phone data was collected.

The SCRTM1 highway model has been designed to cover three time periods, covering AM, Inter Peak (IP) and PM, between the hours of 0700 and 1900. The AM and PM will represent the morning and evening peak hours respectively. The interpeak will represent an average hour between 10 am and 4 pm.

The AM and PM peak hours were defined using the following methodology, using traffic counts from different areas of the model to provide the rationale behind the decision. Ideally we would also have used journey time data to identify the peak hours however, due to a database problem, these data were not available from DfT until late in the model development programme.

Traffic counts were split into 3 different groups, namely urban, rural and motorway counts. From this 6 different urban Automated Traffic Counts (ATCs) were analysed along with 6 different rural ATC's and 2 motorway counts.

4.5.1 Traffic Count Analysis

Urban traffic counts were taken from the main urban areas in South Yorkshire, with 3 counts from Sheffield and 1 count each from Rotherham, Doncaster and Barnsley. The values presented within Table 8 show the percentage of traffic within a 1 hour period from the amount of traffic within the 3 hour period between 0700 - 1000. As can be seen the most traffic occurs within the 0745 - 0845 and 0800 - 0900 with a 37% share followed by a 36% share for traffic between 0730 - 0830 and 0815 - 0915.

Table 8. Urban Counts - AM

AM	Urban Site 1	Urban Site 2	Urban Site 3	Urban Site 4	Urban Site 5	Urban Site 6	Average
0700 - 0800	28%	38%	32%	27%	26%	33%	31%
0715 - 0815	31%	38%	35%	33%	30%	36%	34%
0730 - 0830	34%	36%	36%	36%	34%	37%	36%
0745 - 0845	36%	34%	37%	38%	38%	37%	37%
0800 - 0900	37%	32%	37%	38%	40%	36%	37%
0815 - 0915	37%	30%	37%	37%	40%	35%	36%
0830 - 0930	37%	30%	35%	37%	39%	34%	35%
0845 - 0945	36%	30%	33%	35%	36%	32%	34%
0900 - 1000	35%	30%	31%	34%	33%	31%	33%

Source: AECOM analysis

Within the PM, the same process was followed of determining the hourly percentage for each 1 hour interval across 15 minutes within the 3 hours between 4 and 7. The results in Table 4 show that there is 36% split between 1600 - 1700, 1615 - 1715 and 1630 - 1730, closely followed by a 35% split between 1645 - 1745 and 1700 - 1800. It can therefore be argued that is no real difference between the counts within 1600-1800.

Table 9. Urban Counts - PM

AM	Urban Site 1	Urban Site 2	Urban Site 3	Urban Site 4	Urban Site 5	Urban Site 6	Average
1600 - 1700	34%	34%	37%	38%	36%	36%	36%
1615 - 1715	34%	34%	37%	39%	36%	36%	36%
1630 - 1730	35%	34%	38%	38%	35%	36%	36%
1645 - 1745	33%	34%	37%	37%	34%	36%	35%
1700 - 1800	33%	34%	36%	35%	34%	35%	35%
1715 - 1815	32%	34%	34%	32%	33%	34%	33%
1730 - 1830	31%	33%	32%	31%	32%	33%	32%
1745 - 1845	32%	33%	30%	29%	31%	30%	31%
1800 - 1900	33%	32%	27%	28%	30%	28%	30%

Source: AECOM analysis

Rural traffic counts were taken from the rural areas in South Yorkshire, with 3 counts from Sheffield region and 1 count each from the Rotherham, Doncaster and Barnsley regions. As shown in Table 10, the time period with the greatest percentage of traffic is between 0745 - 0845 and 0730 - 0845 followed by a 39% split between 0715 - 1815 and 38% between 0800 - 0900. It is worth noting that there is a deal of variability between the time splits at each of the sites. Similarly to the urban PM results, the results of rural AM suggest that there is no one peak hour within the AM time period.

Table 10. Rural Counts - AM

AM	Rural Site 1	Rural Site 2	Rural Site 3	Rural Site 4	Rural Site 5	Rural Site 6	Average
0700 - 0800	41%	31%	33%	42%	38%	30%	36%
0715 - 0815	39%	33%	37%	45%	42%	37%	39%
0730 - 0830	38%	34%	40%	43%	44%	43%	40%
0745 - 0845	35%	34%	42%	39%	42%	48%	40%
0800 - 0900	33%	34%	41%	35%	39%	47%	38%
0815 - 0915	32%	34%	37%	30%	34%	44%	35%
0830 - 0930	29%	34%	34%	26%	29%	37%	32%
0845 - 0945	27%	34%	30%	24%	26%	28%	28%
0900 - 1000	25%	35%	26%	23%	24%	23%	26%

Source: AECOM analysis

The rural PM results, presented below in Table 11, suggest that there is no real difference between the different time periods with a 38% spit within 1615 - 1715, 1630 - 1730 and 1645 - 1745, followed by a 37% between 1700 - 1800. Like before there is no one period of time that stands out as being significant.

Table 11. Rural Counts - AM

AM	Rural Site 1	Rural Site 2	Rural Site 3	Rural Site 4	Rural Site 5	Rural Site 6	Average
1600 - 1700	34%	36%	36%	40%	36%	34%	36%
1615 - 1715	36%	36%	40%	40%	38%	35%	38%
1630 - 1730	37%	37%	41%	40%	40%	36%	38%
1645 - 1745	37%	37%	40%	39%	40%	37%	38%
1700 - 1800	37%	36%	39%	36%	38%	37%	37%
1715 - 1815	36%	35%	35%	33%	35%	36%	35%
1730 - 1830	33%	33%	32%	30%	32%	34%	32%
1745 - 1845	32%	30%	28%	27%	29%	31%	30%
1800 - 1900	29%	28%	24%	24%	26%	28%	27%

Source: AECOM analysis

Table 12below highlights the results of the motorway counts between 0700 - 1000. As can be seen there is a 36% split between 0715 - 0815 and 0730 - 08.30, a 35% split between 0745 - 0845 and a 34% split between 0800 - 0900.

Table 12. Motorway Counts - AM

AM	M187670A	M187670B	M14315A	M115B	Average
0700 - 0800	36%	34%	33%	34%	34%
0715 - 0815	37%	36%	34%	35%	36%
0730 - 0830	38%	37%	35%	35%	36%
0745 - 0845	36%	36%	34%	35%	35%
0800 - 0900	35%	35%	34%	34%	34%
0815 - 0915	32%	34%	34%	33%	33%
0830 - 0930	30%	32%	33%	32%	32%
0845 - 0945	30%	31%	33%	32%	32%
0900 - 1000	30%	31%	33%	32%	31%

Source: AECOM Analysis

Within the PM motorway counts, shown in Table 13, there is no discernible difference between any of the specified time periods with a 36% share between 1600 - 1700 and then a 35% split for the 5 hourly periods from 1615 up to 1800. Therefore based on this information there is no definite peak within the PM motorway counts with a mainly equal share around 35% between 1600 - 1800.

Table 13. Motorway Counts - PM

PM	M187670A	M187670B	M14315A	M115B	Average
1600 - 1700	36%	37%	35%	36%	36%
1615 - 1715	36%	35%	35%	36%	35%
1630 - 1730	36%	35%	35%	36%	35%
1645 - 1745	36%	35%	34%	35%	35%
1700 - 1800	35%	35%	34%	34%	35%
1715 - 1815	34%	35%	33%	34%	34%
1730 - 1830	33%	33%	33%	33%	33%
1745 - 1845	32%	31%	32%	31%	32%
1800 - 1900	29%	28%	31%	30%	29%

Source: AECOM Analysis

When compiling all of the above data, assumptions have been made as to the appropriate time periods to report from the model in order to accurately portray the AM and PM peak periods. An overview of the compiled results for AM and PM periods can be seen in Table 14.

Table 14. Overall AM and PM Counts

Time Period AM	Percentage of AM period	Time Period PM	Percentage of PM period
0700 - 0800	34%	1600 - 1700	36%
0715 - 0815	36%	1615 - 1715	36%
0730 - 0830	37%	1630 - 1730	37%
0745 - 0845	37%	1645 - 1745	36%
0800 - 0900	36%	1700 - 1800	35%
0815 - 0915	35%	1715 - 1815	34%
0830 - 0930	33%	1730 - 1830	32%
0845 - 0945	31%	1745 - 1845	31%
0900 - 1000	30%	1800 - 1900	29%

Source: AECOM analysis

The results of the AM peak suggest that there is no identifiable definitive peak with the proportions being consistent across much of the morning before dropping off between the hours of 0830 - 0930 onwards. For the PM period, the percentage split is fairly consistent between 1600 and 1815.

4.5.2 Modelled Hours Conclusion

WebTAG Unit 3.1 section 2.5 provides useful advice on selection of modelled hours. Following this advice it would be appropriate to either model an average peak hour or a specific peak hour as there are only minor differences between a number of the individual hours. In these cases WebTAG suggests that there are advantages to having a specific hour.

Based on this information it is therefore reasonable to assume that the traditional peak hours of 0800 - 0900 and 1700 - 1800 are acceptable, as they are representative of the peak hour in most cases, particularly in urban areas.

When assessing the impact of schemes the annualisation factors will need to take account of the specific hours that are being modelled.

It is important to remember that the model's focus is solely on weekday traffic data, therefore this model is less suitable for assessing weekend benefits.

This approach also maintains consistency with the previous models in the area.

4.6 User Classes

As costs and values of time vary by journey purpose, and also income groups, different user classes have been identified and included in the model to represent the different vehicle and user types. The trip matrices for the SCRTM have been split into six user classes, which are then given different values of time and distance in their generalised cost formulae prior to being input into SATURN:

- Car – Commuting;
- Car – Business;
- Car – Other;
- LGV;
- MGV;
- HGV.

It was not considered necessary to segment demand by income as this was not a requirement that came out of the analysis of the required model functionality in Chapter 2.

There is a possibility of the model being used to assess Clean Air Zone schemes in the future. While it is recognised that some adjustments would have to be made to the model in order to achieve this it was felt prudent that some of the required functionality should be built into the initial model. One of the requirements is to model HGV routes with more accuracy than normally included in strategic highway models. In reality there are a number of "HGV" bans on the network. These may apply to the height or weight of the HGV. In general these bans only apply to the largest HGVs and don't normally apply to MGVs. It was considered important that both of these vehicle types had access to the appropriate parts of the network in choosing their routes. To do this meant having them in separate user classes while recognising that trip data at this level is difficult to source. All of the observed Manually Classified Counts (MCC) data was collected with the appropriate classification to allow this split to be achieved in calibration and validation data.

4.7 Assignment Methods

Highway trips are assigned to the highway network using the SATALL module in SATURN. This is based on the Wardrop Equilibrium Assignment. Further details on Wardrop's Equilibrium Assignment can be found in the SATURN MANUAL (V11.3), chapter 7, *Assignment – the role of SATEASY / SATALL*.

4.8 Generalised Cost

Generalised cost forms the basis for route choice in highway assignment models, and is defined as;

$$G = M + PPM * Minutes + PPK * Kilometres$$

Where G = Generalised Cost, M = Money Cost (e.g. tolls), PPM = pence per minutes to represent value of time, and PPK = pence per kilometre to represent value of distance.

Generalised cost parameters have been calculated for value of time (PPM) and value of distance (PPK) using the economic values specified in the WebTAG Data Book (July 2017). PPM and PPK values were calculated for each time period and each user class. These are 2016 values in 2010 prices. To obtain values of time and distance for MGV and HGVs, the OGV1 and OGV2 numbers from the DataBook were used respectively.

Clearly, there have been updates to the WebTAG data book since July 2017 although these changes only affect forecast values and not values for the 2016 base year.

Values were outputted in a SATURN format in order to input them directly into the network coding files. Below, Table 10 shows an example of the values outputted into SATURN format. The matrix factor shown in the table relates to if the matrix should be scaled to turn from vehicles to PCUs, as the matrices are already in PCUs then no factor is needed so it is set to 1.00.

Table 15. Example of PPM/PPK Values Outputted in SATURN Format

User Class	User Class	Vehicle Type	Matrix Level	Matrix Factor*	PPM	PPK
Commuting	1	1	1	1.00	20.18	5.93
Business	2	1	2	1.00	30.10	12.56
Other	3	1	3	1.00	13.92	5.93
LGV	4	2	4	1.00	21.27	13.32
MGV	5	3	5	1.00	43.19	31.35
HGV	6	4	6	1.00	43.19	57.33

Source: WebTAG Databook July 2017

4.9 Capacity Restraint Mechanisms

Applying capacity restraints to the model allows for the adjustment of speeds, and therefore travel times and generalised costs, so that they are consistent with the assigned traffic flows. Two forms of capacity restraint are applied within the SCRTM1, through:

- Junction capacity; and
- Link based speed / flow relationships.

Junction modelling is key where junction capacities have significant impact on driver's route choice, and where delays are not adequately represented by speed / flow relationships on links. As a measure to ensure consistency between the model and reality, turn saturations at an individual junction level have been applied to represent the junction as realistically as possible. The capacity of each turn is calculated within the simulation step within SATURN.

Links in urban areas are often shorter than those in more rural locations, due to the greater complexity of the road network. While all junctions in the Fully Modelled Area help to represent junction delay, this is particularly important within the urban areas. Not only are links generally shorter, but urban links within the SCRTM1 have been modelled with fixed cruise speeds, emphasising the importance of model junction delay in these areas.

4.9.1 Junction Modelling and Speeds between Junctions

Capacity is restrained at a junction level within the fully modelled area of the SCRTM, where junctions are modelled in sufficient detail to account for junction delays. Given the characteristics of urban road networks, it is usually assumed that flow does not greatly influence link speeds between junctions (cruise speeds). Speed / Flow Relationships

For urban roads, cruise speeds are more closely related to the road type and activity levels alongside links, i.e. pedestrian movements, the level of urban developments, etc. To take account of this, different categories of geographical location will be used, such as rural, non-central urban, and central urban. This is in addition to the Good / Typical / Poor category.

While the cruise speed of many urban links is often characterised by the general activity along the link, and therefore modelled as a fixed cruise speed (WebTAG Unit 3.1 para 2.9.5), this cannot be said for suburban, rural and motorway links within the simulation area. Here, speed / flow relationships are used to represent the link characteristics.

All links outside of the Fully Modelled Area (see 2.2) are in buffer and have been coded using fixed speeds, allowing for more stable routing of high volume trips between large external zones. From experience, it has been evident that relatively sparse buffer networks don't always have the capacity to cope with the modelled demand. In these cases unrealistically high volumes of trips can be attracted to using the more comprehensive simulation network, causing unrealistic traffic flows, routing, delays and congestion in the Fully Modelled Area. Speeds in the external network have been reviewed, and will be adjusted in future year scenarios to reflect the general increase in journey times expected across the whole road network.

When using the model in for forecasting it will be necessary to make adjustments to the speeds of the buffer network so that cost changes of trips with an external origin or destination are comparable to those which have both origin and destination within the Fully Modelled Area. The methodology for doing this is described in the Forecasting Report.

4.10 Relationships with Variable Demand and Public Transport Assignment Models

The highway assignment model does not operate in isolation (see Figure 2). The travel demand is an output from the demand model while the highway travel costs are skimmed from the highway assignment model and passed to the demand model.

In addition, the changes in highway journey times between the base year and the forecast scenario are also calculated at a link level and passed to the public transport model so that bus speeds can be adjusted accordingly. This adjustment only takes place where buses use general traffic links and not on sections which have segregation for public transport.

5. Calibration and Validation Data

5.1 Introduction

The purpose of this chapter is to outline the role and type of data used in different parts of the calibration and validation process. As part of this, the location of count sites are considered, alongside the considerations taken when determining whether data is used in the calibration or validation stages of the model development.

The calibration and validation data used for the SCRTM1 which were collected specifically for this purpose are:

- Roadside interviews (RSIs);
- Mobile phone origin destination data;
- Traffic counts;
- Journey times.

As part of the modelling process, an extensive data collection exercise in the form of a survey programme was conducted. Here, AECOM commissioned Tracsis to collect Automatic Traffic Counts (ATC) and Manual Classified Counts (MCC) throughout the fully modelled area of the SCR. Much of the data collection was conducted in May and June, 2017, although a small number of count locations were collected in October and November, 2017. AECOM also used counts available from other sources such as Local Authorities, Webtris, and from the HS2 project.

Webtris is an online database which monitors speeds and flows of motorways and other trunk roads using inductive loops and radar sites. Radar sites are a relatively recent implementation, with a device on the outside of the motorway using radar to count vehicles across all lanes. As shall be discussed further in 5.3.2, we were less confident in the count data from radar sites compared with data from inductive loops.

A further commission by AECOM saw Nationwide conduct Roadside Interviews at specified locations within the fully modelled area of the SCR. The purpose of the RSIs is to provide greater detail to the origin and destination of trips, reinforcing confidence in the matrix derived from mobile phone data and other sources.

For journey time information, Trafficmaster journey times extracted using Strat-e-gis was used. It was decided to use these as the sample size is much larger from TrafficMaster than a commissioned observed moving car survey.

5.2 Data Accuracy

The following 95% confidence intervals for traffic counts should be assumed:

• Automatic Traffic Counts:	Total vehicles:	± 5%;
• Manual Classified Counts:	Total vehicles:	± 10%;
	Cars and taxis:	± 10%;
	Light goods vehicles:	± 24%;
	Other goods vehicles:	± 28%;
	All goods vehicles:	± 18%.

(WebTAG Unit M1.2 Section 3.3.32.)

While the ATC confidence intervals relate to counters with tube detectors, counters with inductive loops may achieve greater levels of accuracy. All the ATC data, with the exception of motorway counts, have been conducted using tube detectors.

While ATC tube counters give an indication of vehicle type, this is based on vehicle lengths and not considered to be accurate enough for use in the model. This was a determining reason why MCC survey data is required. To maximise the accuracy of the model a corresponding MCC was undertaken at virtually all ATC sites. The duration of the ATC and MCC surveys was in line with WebTAG Unit M1.2 Section 3.3.35 i.e. a continuous two week period for ATC surveys and one 12-hour period for MCCs. The advantage of ATCs being carried out for two weeks or longer is that the average is more likely to be representative of a typical day.

The accuracy of ATC derived flows is allowed for in the model through the WebTAG calibration and validation traffic flow tolerances.

5.3 Checking of ATC data

5.3.1 Removal of Outliers

To remove outliers from ATC data AECOM used a process they have applied in previous models. This is known as the Median Absolute Deviation (MAD) process:

1. Each site, time period and direction is treated independently;
2. The median of the raw data is calculated;
3. The absolute difference between the observed number and the median is calculated for each observation, this calculates how far the each observed data deviates from the median;
4. The median of these deviations is calculated;
5. Any data point which is more than 2.9652 times the median deviation (4) from the median (2) is suggested to be removed. The figure 2.9652 has been used as this is related to the variation of the normal distribution.
6. Data points which are suggested to be removed are reviewed manually as an extra check.

5.3.2 Consistency between counts

Where we had multiple counts nearby or on the same corridor, consistency checks were made. In fact these checks helped establish that the few sites where radar equipment had been used to collect the data were less reliable and in many cases had to be removed from the database, this included some of the motorway count sites.

Radar data can be accurate but it is dependent on the set up and configuration of the count location. Where radar equipment is positioned at the roadside and is required to monitor multiple lanes then the height of the equipment is critical. If the radar is installed too low then highsided vehicles in the nearside lane can mask vehicles in lanes further from the roadside. Radar data was therefore only included where an independent data set confirmed that it was likely to be reliable.

5.3.3 Realism of counts

Flows showing tidality were checked to see that the higher flow matched expectations. E.g for the counts on the corridors leading to Sheffield, the counts on the inbound link were highest in the morning. This helped correct where the directions had been incorrectly recorded by the survey company.

Counts were also subject to further checks if the counted flow was significantly different to the assigned flow but in these cases the assumption was that the count was correct unless it could be proved otherwise.

5.3.4 Removal of count data

Where we had reasonable doubt about a count, a decision was made to remove it from the count database for this model. This left the count sites shown in Figure 12 below.

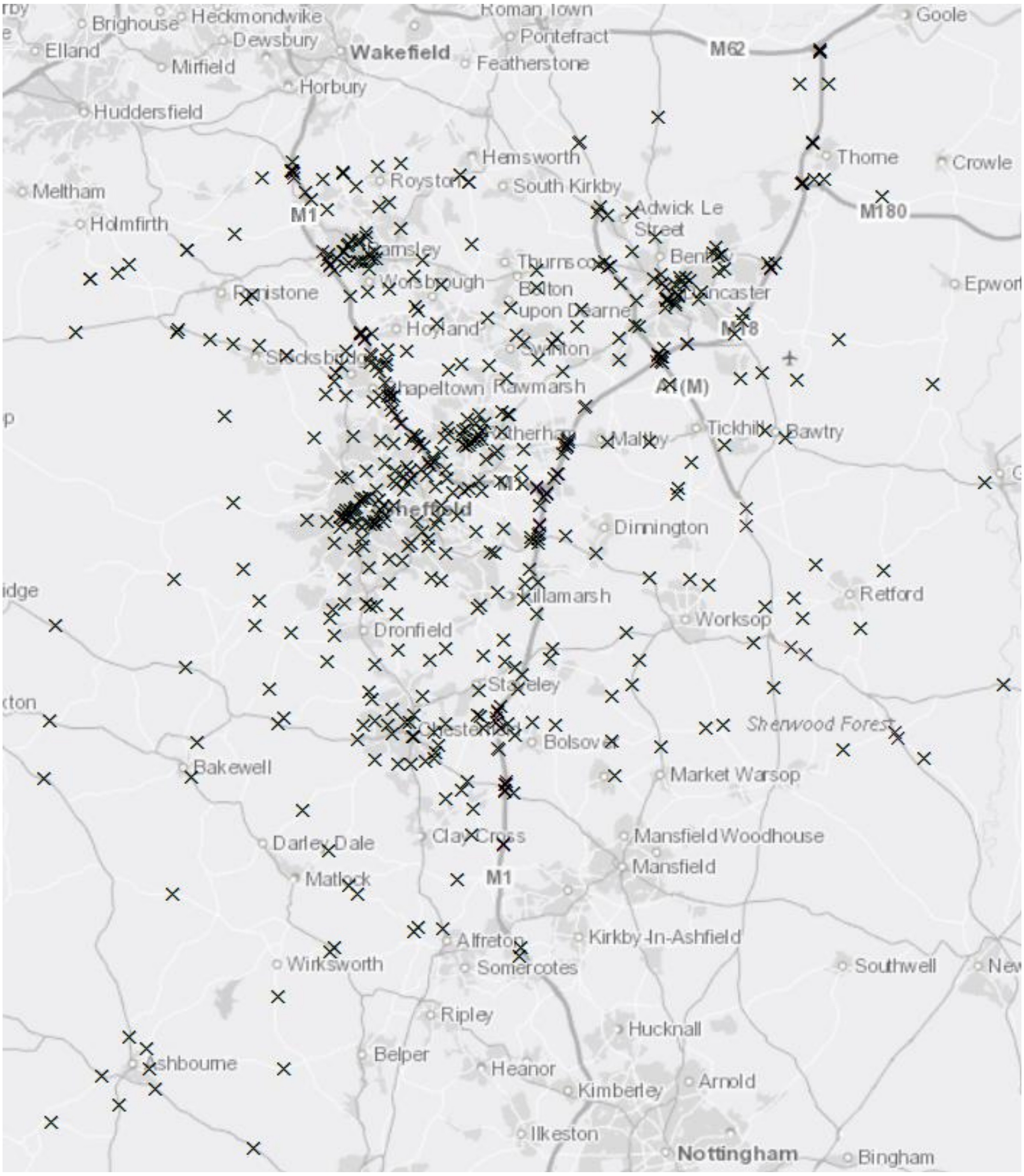


Figure 12. ATC Count site locations used in SCRTM1

5.4 Manual Classified Counts

MCCs were carried out at each ATC site location for one day using portable CCTV or Radar Counters at the roadside, which were reviewed by the survey company. Where possible the survey date was within the two week survey period of the ATC survey. The only exceptions to this were at sites where there were issues with the initial ATC or MCC data collection, in these instances the disrupted survey was recounted at a later date. All counts were bi-directional and conducted in accordance to WebTAG guidance, as set out in TAG Unit M1.2 Chapter 3.3.

Enumerators undertook classified counts of vehicles passing through each site in 15-minute intervals. Vehicle categories used in the MCCs and roadside interview surveys (RSIs) described in 5.8 are set out below. This is more detailed than used in the model and is in line with the categories used in the roadside interview surveys:

- Pedal Cycles;
- Motor Cycles;
- Cars and Taxis;
- Buses and Coaches;
- LGV;
- MGV;
- HGV.

5.5 Determining vehicle type splits for the SRN mainline

AECOM also used information from WebTRIS, from April 2017 with locations including flows from the mainline and slip roads on the strategic road network (SRN). Following the same process as ATCs an average was calculated for AM, IP and PM for the required sections. Some of the managed motorway sections now record vehicle counts using radar rather than the traditional induction loops.

Following consistency checks between consecutive radar sites we decided were not reliable enough to use.

It was required to split the ATC count into Cars, LGVs, MGV and HGVs,

From previous experience AECOM are aware that the percentage of freight differs between the following sections:

- The A1 / A1(M);
- M1 north of M18;
- M1 south of M18; and
- The M18.

Therefore, for the mainline sites, a separate factor was used based on which ‘section’ of motorway the count fell into.

Table 16. Vehicle Splits used for Motorway Mainlines

Area	Direction	AM Car	AM LGV	AM MGV	AM HGV	IP Car	IP LGV	IP MGV	IP HGV	PM Car	PM LGV	PM MGV	PM HGV
M1_27_28	NB	72%	14%	3%	10%	64%	20%	4%	12%	78%	14%	2%	6%
M1_28_27	SB	71%	16%	3%	9%	66%	18%	4%	12%	78%	12%	2%	8%
M18SB_M1WB	SB	72%	14%	3%	11%	63%	19%	4%	13%	77%	14%	1%	7%
M1EB_M18NB	EB	72%	16%	3%	8%	65%	19%	4%	12%	80%	13%	2%	6%
M1_NB	NB	66%	22%	4%	8%	67%	19%	4%	10%	83%	12%	1%	4%
M1_SB	SB	75%	15%	3%	8%	66%	20%	4%	9%	80%	14%	2%	4%
M1NB_M18NB	NB	70%	16%	3%	10%	63%	19%	4%	14%	79%	13%	2%	7%
M18SB_M1SB	SB	71%	16%	3%	10%	65%	18%	4%	13%	77%	12%	2%	9%
M180WB_M18NB	NB	59%	14%	4%	23%	57%	17%	4%	21%	75%	12%	2%	11%
M18SB_M180EB	SB	64%	16%	4%	17%	56%	16%	4%	24%	75%	11%	1%	13%
M180_EB	EB	61%	18%	3%	18%	58%	16%	3%	22%	79%	10%	1%	11%
M180_WB	WB	53%	15%	2%	29%	60%	18%	3%	19%	76%	13%	1%	10%

Source: Various, with AECOM analysis

5.6 Determining vehicle splits for SRN slip roads

A number of the motorway slip roads did not have a reliable vehicle type split from observed data therefore following methodology was used:

5.6.1 Slip roads between a motorway and local road network

If the slip road provides a connection between the motorway and the road network then an average split is used based on combining counts at similar nearby slip roads, where reliable manual classified counts were available. This covered the majority of the slip road count sites.

5.6.2 Motorway to Motorway slip roads

For the A1(M) / M18 interchange near Doncaster, there are multiple movements using each slip road. For off-slip the upstream mainline vehicle split was used, with the on-slips using the downstream mainline vehicle split.

At the M1 and M18 junction an average of the upstream and downstream mainline splits was taken. This was repeated for the M18 and M180 junction.

5.7 HS2 Count Sites

At the same time that SCRTM1 was being built, work to assess the impact of HS2 was being conducted by other consultancies. This included count data which concentrated around Sheffield and allowed some of the screenlines to become more comprehensive.

5.8 Road Side Interview (RSI) sites

To check the reliability of the prior matrices, AECOM decided to use data collected from RSI sites. There were 13 RSI sites, which were combined into 4 screenlines, across the study area. The sites and screenlines are shown in Figure 13 below. Whilst traditionally these would have been used to develop the highway demand matrix, for movements between sectors; for this model they were used to validate the prior matrix built from mobile phone, TPS, and synthetic sources. This approach had to be adopted due to the programme constraints and there not being a suitable survey window at the correct time in the programme before commencing the matrix build.

Sites were chosen to represent different types of movements across SCR. Following discussions with the Police and client we agreed on the following 13 sites across South Yorkshire and Derbyshire:

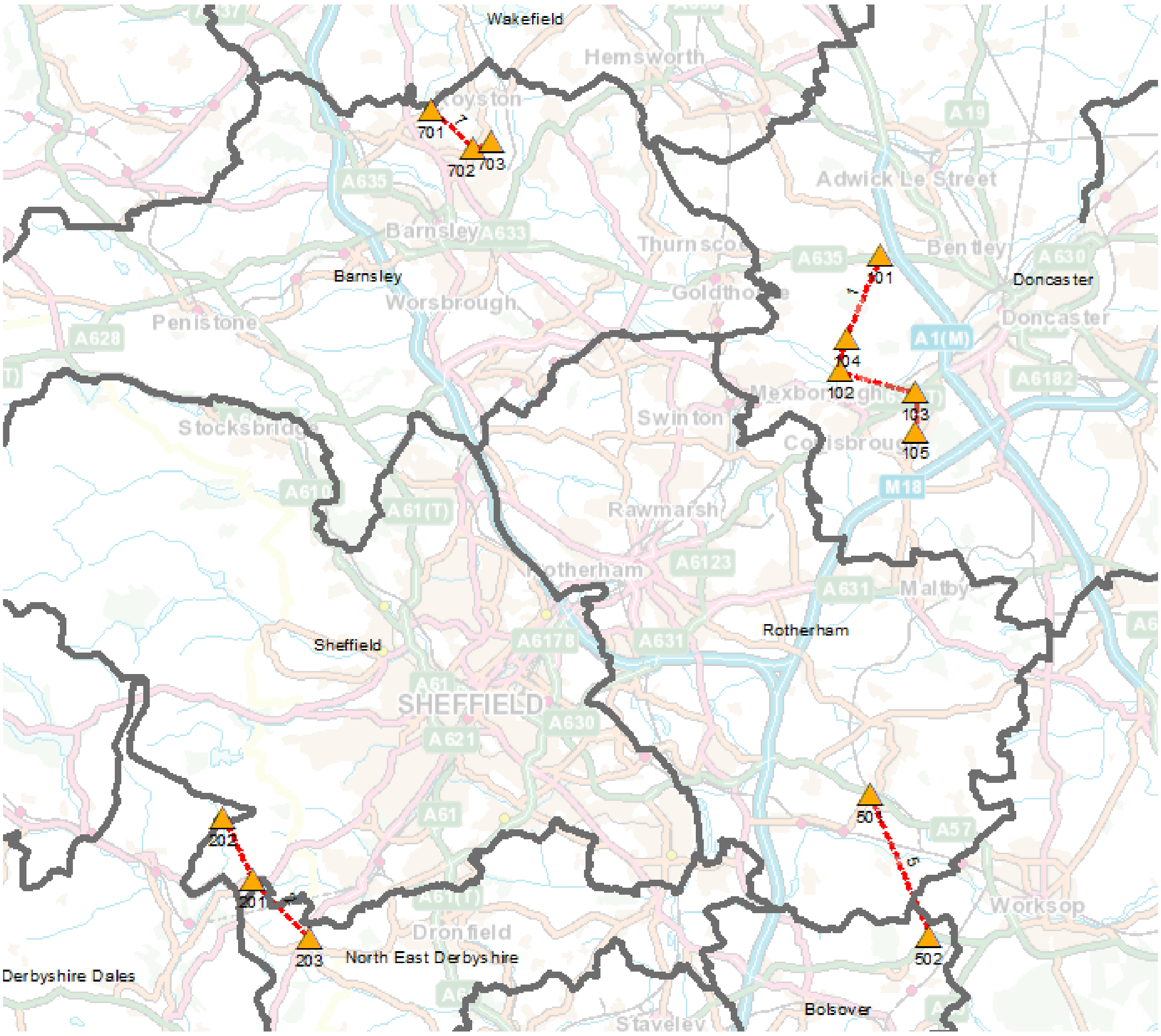


Figure 13. RSI All Screenlines locations

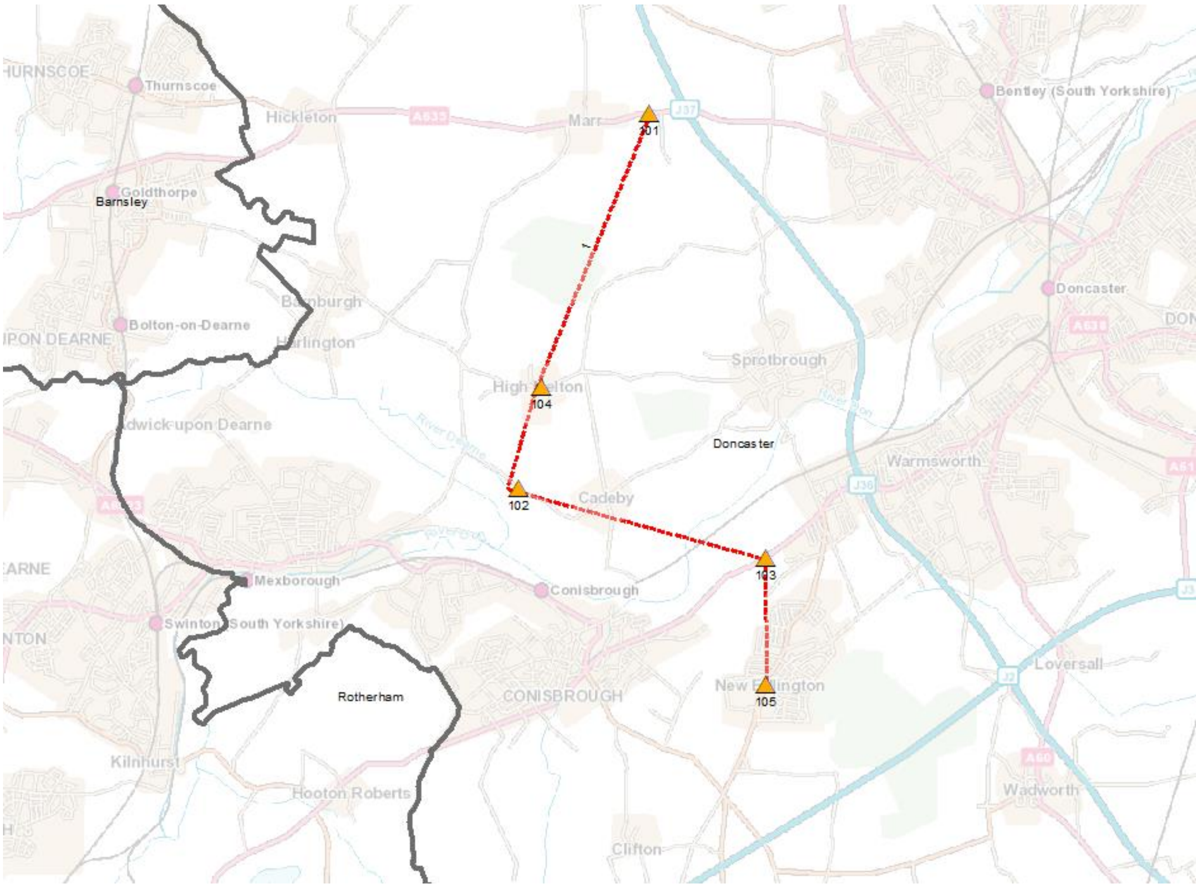


Figure 14. RSI Screenline 1 Locations

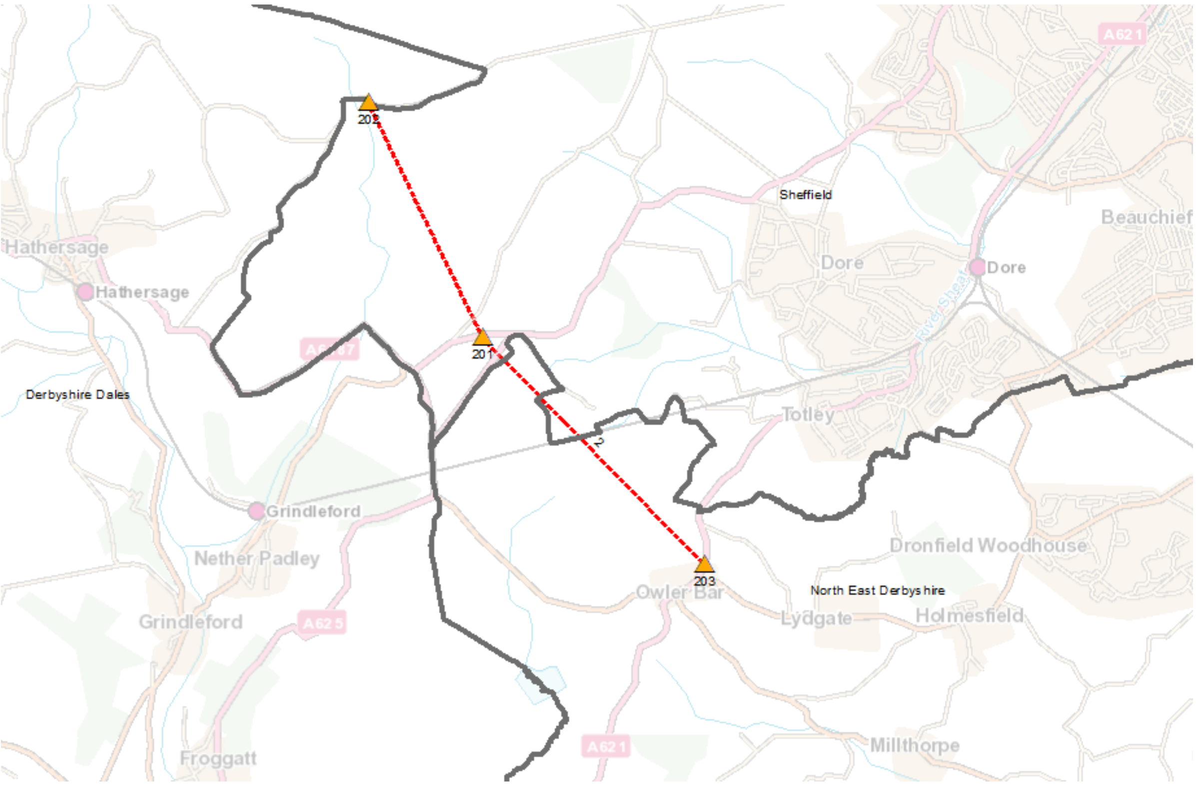


Figure 15. RSI Screenline 2 Locations

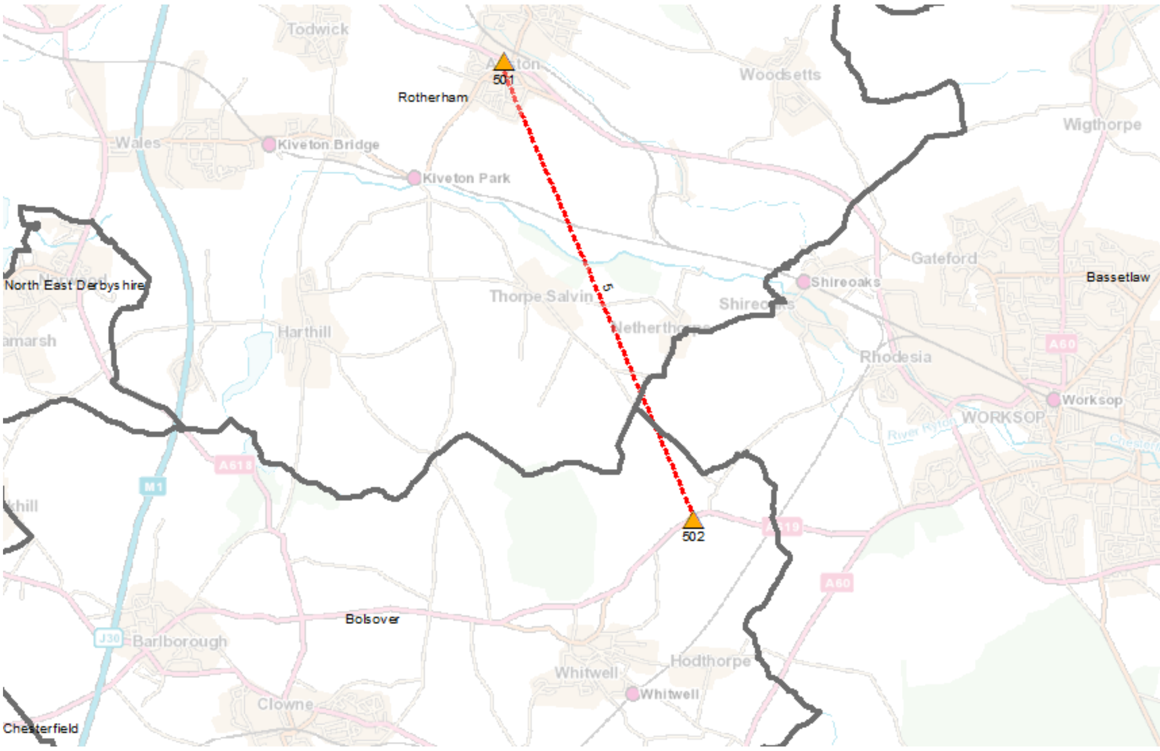


Figure 16. RSI Screenline 5 Locations

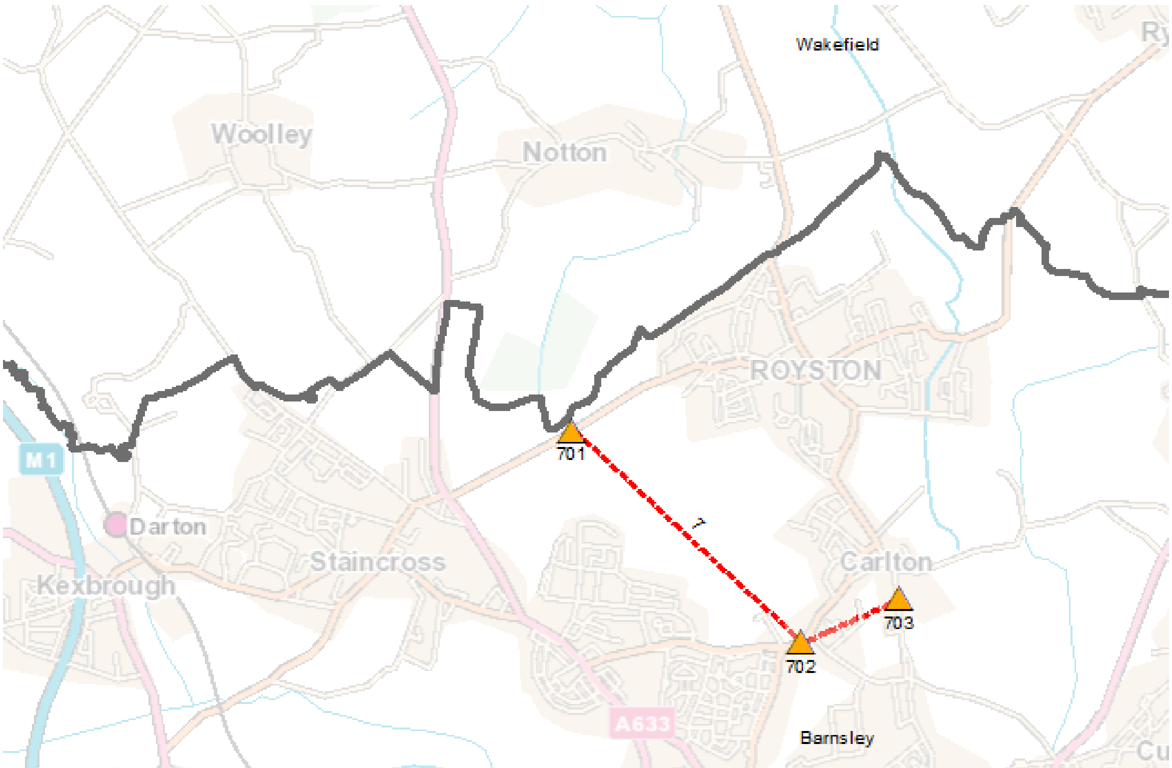


Figure 17. RSI Screenline 7 Locations

The 13 sites were combined into 4 screenlines; 1, 2, 5 and 7. Unfortunately, due to safety concerns at sites 101 and 702, it was not possible to survey these sites in the same direction as other sites in the screenline. Separate steps had to be undertaken at these sites and these are detailed in Appendix K. Appendix K also gives further details about the RSI data collection.

5.9 Traffic Counts for Matrix Estimation and Validation

Counts were combined into screenlines, as can be seen in Figure 18 these screenlines have a good coverage across the SCR.

WebTAG suggests that screenlines used for estimation should intercept intra-sector movements and be distinct from RSI screenlines. This guidance clearly relates to models which are built from RSI data. As mobile phone data have been used for this case then it isn't possible to apply this guidance verbatim however the spirit of the guidance has been followed with screenlines being formed to intercept common movements on competing corridors.

Where possible screenlines have been made out of 5 or more counts, but as noted in 3.2 above there are some places where it was deemed appropriate to have shorter screenlines. There is a mix of calibration and validation screenlines throughout the modelled area. There have been allocated so that there is a good geographical spread in each category and that there is a reasonable level of separation between parallel calibration and validation screenlines as recommended in WebTAG. The screenlines in each of the scheme areas are shown in Figure 19, Figure 20 and Figure 21. Each screenline is shown twice as it represents the two directions of travel across the screenline.

Figure 18. Screenlines in model (Green are Calibration, Red are Validation)

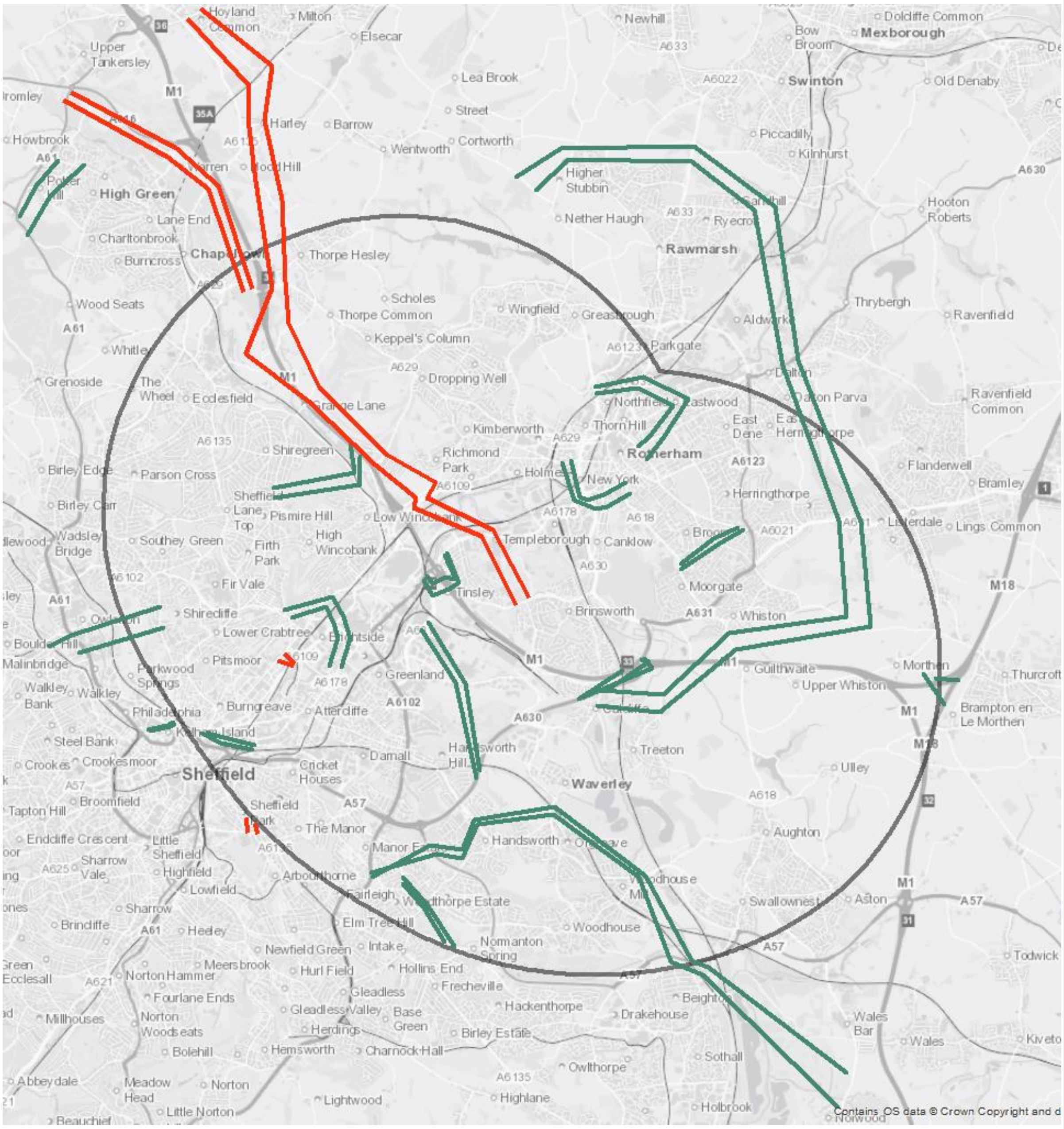


Figure 19. Screenlines in Innovation Corridor Area

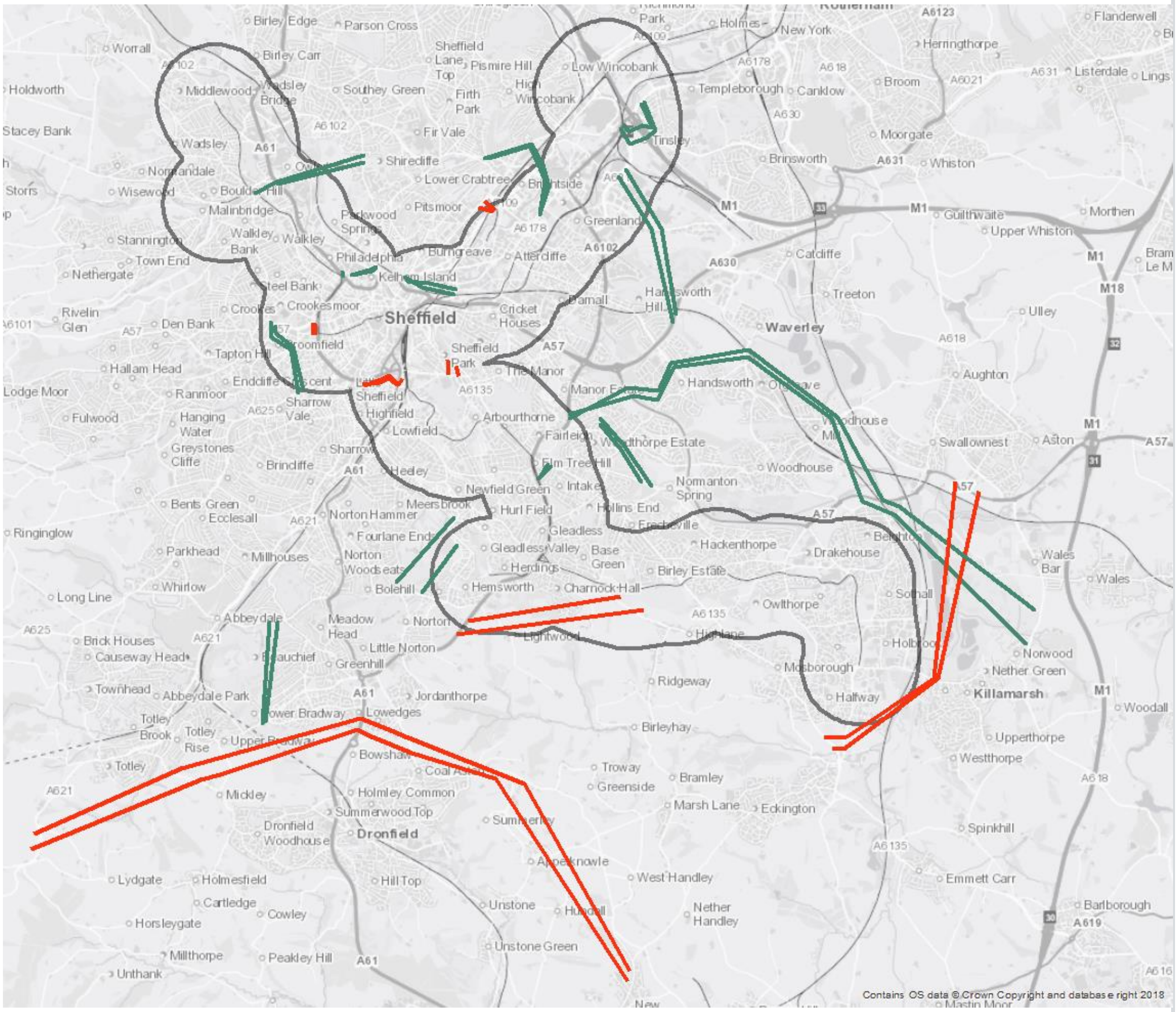


Figure 20. Screenlines in Mass Transit Area

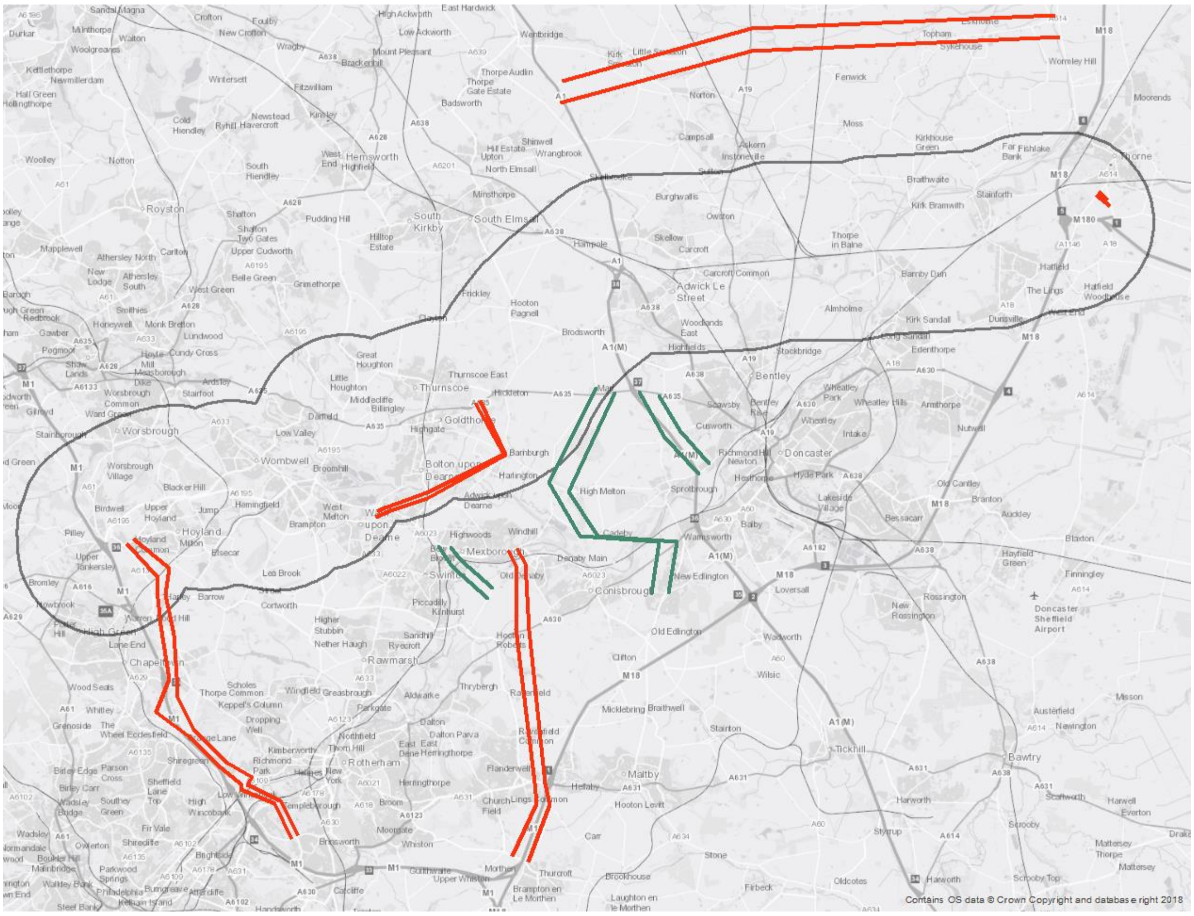


Figure 21. Screenlines in Pan Northern Connectivity Area

5.10 Journey Times for Calibration and Validation

75 bi-directional journey time routes were chosen across the SCR, in line with WebTAG these were chosen to cover the Fully Modelled Area. The density of routes was slightly higher in and around the three scheme areas. Our observed journey time data came from TrafficMaster / Strat-e-gis:

- During calendar year 2016;
- Tuesday to Thursday;
- Excluding weeks with bank holidays;
- Excluding school holidays;
- Including all vehicle types; and
- Using the mean value of time.

This period included when roadworks were on the M1 between J32 and J35, so no journey time information was available on the mainline for this section of the motorway. It is not thought that the M1 roadworks had any significant impact on the journey times on the M1 at least during the peak periods as the same level of capacity was maintained during the works. A 50mph speed limit was in place during the works however, during the peaks the speeds prior to and during the works regularly dropped below this level. This suggests that there would be little if any impact of these roadworks on the local road network during the peak periods. During the interpeak it is likely that that the 50mph limit may have reduced average speeds slightly and this may have caused a small number of trips to divert on to the local network but these were unlikely to have a significant impact on local road journey times as there is little flow related delays during this period.

Most (83%) of the journey time routes fell within the 3km to 15km distance bands suggested in WebTAG. All the journey times were completed in an average time under 45 minutes in each time period: with around 85% taking between 5 and 25 minutes.

Table 17. Summary of JT routes by distance

Distance Band	Number of JT routes in Band	% of JT routes in this band
< 3 km	10	7%
3 – 7 km	42	28%
7 – 11 km	40	27%
11 – 15 km	42	28%
15 – 20 km	14	9%
20 – 25 km	2	1%
> 25 km	0	0%

Source: AECOM

Table 18. Number of Observed Journey Times by duration and time period

Duration	AM		IP		PM	
	#	%	#	%	#	%
< 5 mins	9	6%	16	11%	7	5%
5 - 10 mins	45	30%	46	31%	43	29%
10 - 15 mins	39	26%	47	31%	38	25%
15 - 20 mins	27	18%	24	16%	35	23%
20 - 25 mins	20	13%	11	7%	16	11%
25 - 30 mins	6	4%	6	4%	6	4%
30 - 35 mins	2	1%	0	0%	4	3%
35 - 40 mins	1	1%	0	0%	1	1%
40 - 45 mins	1	1%	0	0%	0	0%
> 45 mins	0	0%	0	0%	0	0%

Source: AECOM

The locations of these routes are shown in Figure 22 to Figure 25, a significant proportion of the major roads within SCR belong to a journey time route.

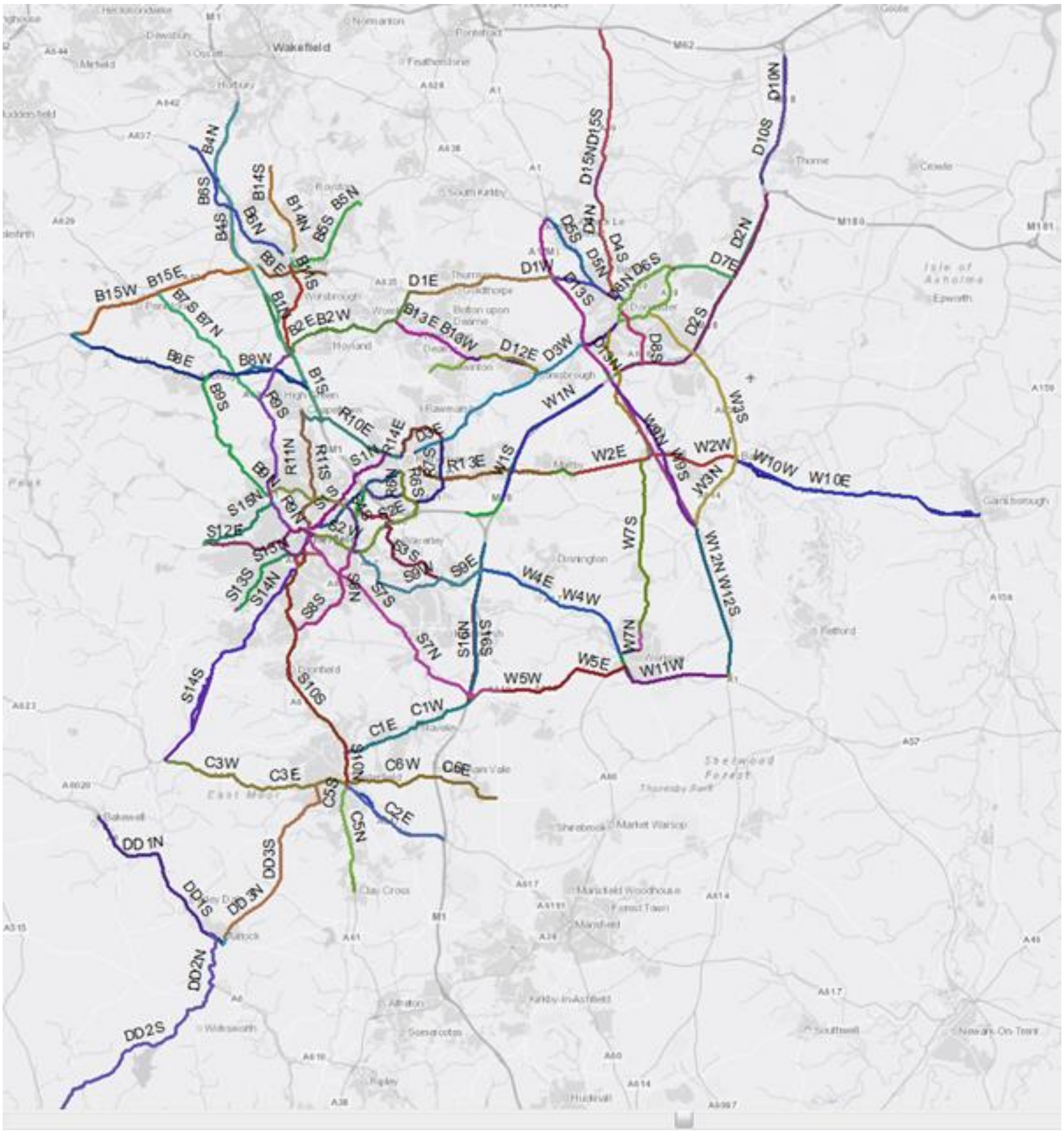


Figure 22. Journey Time Routes – SCR

Figure 23. Journey Time Routes - Sheffield Area

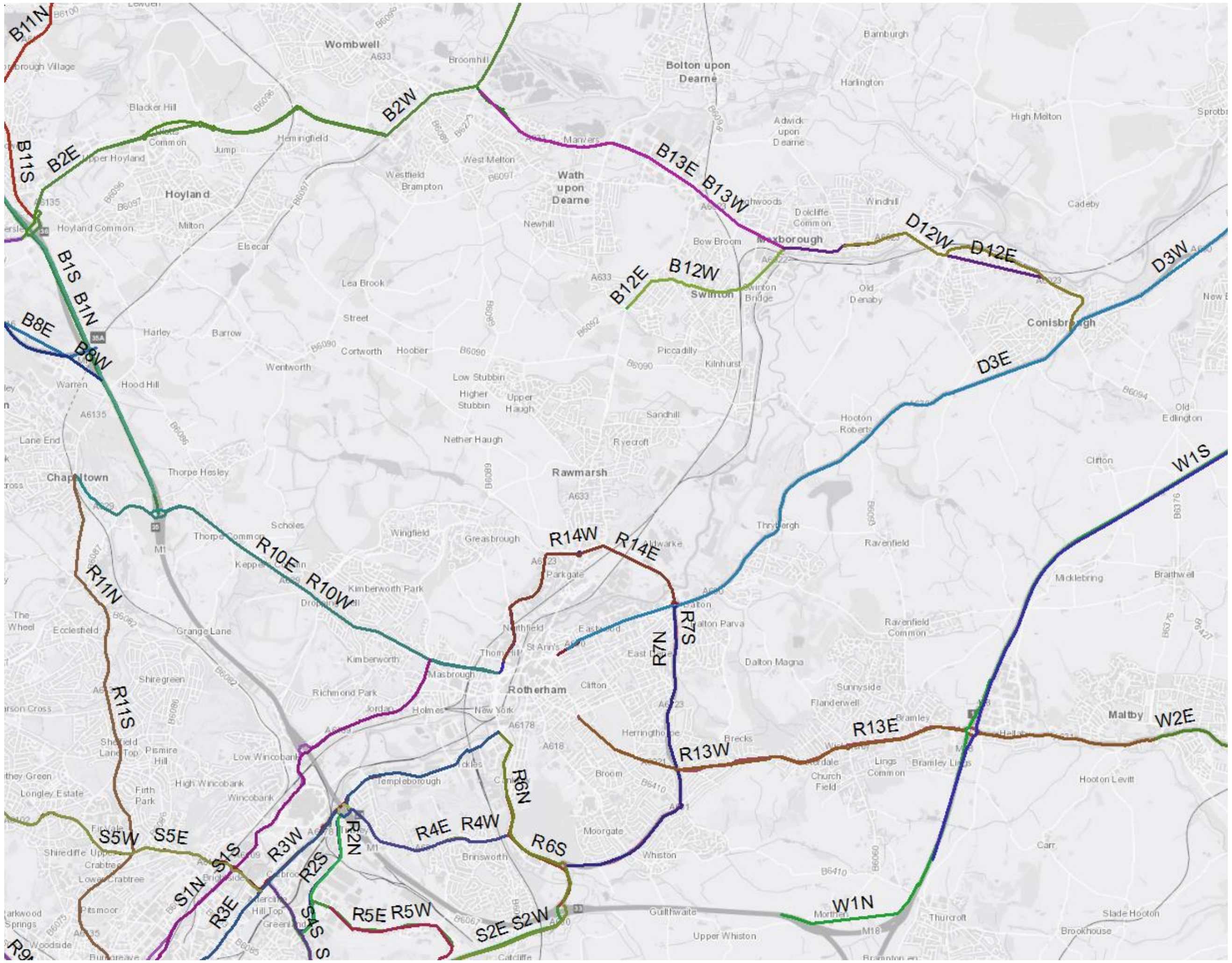


Figure 24. Journey Time Routes – Rotherham Area

Figure 25. Journey Time Routes – Doncaster Area

For each of the journey time routes AECOM extracted the observed data from the Strat-e-gis online system. This was done for each of the corresponding model time periods (0800-0900, 1000-1600, 1700-1800). The resulting data was checked for common errors such as empty records or unrealistic implied speeds, with corrections made where required.

The routes were also coded into the Saturn Highway Network, with intermediate journey time points selected where the route crosses a major junction, or is expected to encounter large delay. In this way the journey time profiles can be compared and checked to see if that delay occurs in the same locations, not just that the total journey time is within the required tolerance.

The journey times were examined to see if they fell within any of scheme areas, to allow reporting by scheme area results.

The total distance of each journey time route within any of our scheme areas was compared to the total route distance in Saturn. Where this differed by more than 5%, the two datasets were reviewed. This helped to reduce the risk that the route from Strat-e-gis and Saturn were not like-for-like. Some minor trip length differences remain in the routes outside the scheme areas, but these should not affect overall reporting statistics.

5.11 Summary of Counts, Screenlines and JT Routes by Scheme Area

Table 19 below sets out the number of traffic counts, screenlines and journey times routes that are in each scheme area as well as across the whole of the Fully Modelled Area.

Table 19. Counts, screenlines and JT routes by scheme area

Geographical area	Counts sites by direction	Count Sites Calibration	Count Sites Validation	Screenlines Both	Screenlines Calibration	Screenlines Validation	JT Routes
Mass Transit	164	115	49	64	50	14	46
Innovation Corridor	214	172	42	76	66	10	54
Pan Northern Connectivity	102	46	56	40	30	10	68
Fully modelled area	1004	531	473	304	232	72	150

Source: AECOM

Note that some of the counts, screenlines and JT routes, lie in more than one scheme area.

6. Network Development

6.1 Introduction

Over the past decade or so, various highway models have been built for different areas within Sheffield City Region. It was decided at an early stage of this project that the highway network would be based on updating and combining six existing models:

- SYSTM+ (South Yorkshire Strategic Transport Model);
- SRTM3 (Sheffield and Rotherham Transport Model 3);
- Doncaster (including FARRRS)
- Hatfield: built as an update to the SYSTM+ model to assess Hatfield Link Road;
- North East Derbyshire;
- Barnsley Transport Model.

Due to the complexity of the modelling process, with regard to bringing a number of existing SATURN models together to form one regional model, there have been a number of checks and process conducted to ensure the models accuracy. The following sub sections detail the coding checks that have been adopted in the modelling process, when developing the SCRTM1. The development of this checking system has been to achieve the guidelines set out in in TAG unit M3.1, Section 5: Network Data, Coding and Checking, and ultimately looks to ensure the model network is suitably prepared for calibration and validation.

6.2 Network Data and Coding

Attention is now turned to the links and junctions coded within the model and the checks performed to ensure they have been represented correctly.

6.2.1 Link Representation

The nature of SATURN coding means that links are coded as a direct result of coding of junctions, or 'nodes'. Links are therefore described as being an A-B node pair.

The coding of links takes account of link length, which is ideally measured from a reliable mapping source, such as maps available from the Ordnance Survey Meridian 2 dataset. The use of a reliable dataset ensures accurate link lengths are used, rather than crow-fly distances between node coordinates. While using a reliable data source is desirable when coding a new network, this approach cannot be guaranteed in this instance as the nature of the model is a combination of a number of smaller, existing models. While the initial coding was not, in all cases, conducted by AECOM appropriate measures and checks have been conducted to ensure accuracy throughout the model (as discussed in Section 8).

6.2.2 Speed flow curves in Simulation

The donor networks contained a variety of approaches to coding speed flow relationships. Some models had some form of speed flow relationship (even if it was a fixed speed) allocated to every simulation link while the application in others was more sporadic or even non-existent. Each model used a different version of speed flow curves although all used the Capacity Index method that is available in SATURN. This sets up a numbered list of standard speed flow relationships and they are applied through allocating the index number to the link.

A set of speed flow relationships was developed for SCRTM1 (as set out in Appendix D) and all of those used in donor models were mapped to the new list. This enabled the donor coding to be updated to a common set of relationships. Where there was no relationship in the donor model an appropriate relationship was assigned. This assignment was based on a combination of characteristics, including the number of lanes, the speed limit, roadside activity, sightlines. This was extended to include the key remaining links in other districts. The resulting network was checked within GIS to ensure that links with similar characteristics had been assigned similar speed flow curves.

6.2.3 Changing capacities of speed flow curves from Vehicles to PCUs

The development of the standard speed flow relationships was based initially on COBA curves however these are based in vehicles rather than PCUs which are used in the model. Using average vehicle splits obtained from MCC data, a correction factor was made to convert vehicles to PCUs for each link type: this is shown in Table 20 below. These factors were applied to the capacities of the speed flow curves. The main impact of this is to take account of higher proportion of freight on motorway and rural ‘A’ roads.

Table 20. Vehicle to PCU Factors by COBA road type

Road Type Index	Road Type Description	Location	Vehicle to PCU Factor
1	Rural single carriageway	Minor rural roads	1.05
2&3	Rural all-purpose dual 2+-lane carriageway	All rural 'A' roads	1.08
4	Motorway, dual 2-lanes	Motorways	1.07
5	Motorway, dual 3-lanes	Motorways	1.16
6	Motorway, dual 4 or more lanes	Motorways	1.09
7	Urban, non-central	All urban 'A' roads	1.04
8	Urban, central	All urban 'A' roads	1.03
9	Small town	Minor urban roads	1.05
10	Suburban single carriageway	Minor urban roads	1.02
11	Suburban dual carriageway	Minor urban roads	1.05

Source: AECOM Analysis

Following an initial acceptance of the proposed speed flow curves and capacity indices (Appendix D.1), links were assigned to one of the speed flow curves, starting with the key routes in Sheffield and Rotherham. This assignment was based on a combination of characteristics, including the number of lanes, the speed limit, roadside activity, sightlines. This was extended to include many of the remaining links in the network. The resulting network was checked within GIS to ensure that links with similar characteristics had been assigned similar speed flow curves.

6.2.4 Speed flow curves in Buffer network

For all buffer zones a fixed speed of 80 kph (50 mph) was applied between the centroid and the node it connected to. (Capacity index of 305). The rest of the buffer links were assigned to one of the following categories:

- A fixed speed of 30 mph, used primarily for urban areas. (Capacity index of 301);
- A fixed speed of 50mph buffer links used for rural non-strategic roads. (Capacity index of 302);
- A fixed speed of 70mph buffer links used for rural strategic roads. (Capacity index of 304);
- A variable speed to represent strategic links that have different speeds in the morning and evening peaks compared to the interpeak. It is assumed that the speed will be 50 mph in the AM and PM, but 60 mph at other times. (Capacity index of 303)

6.2.5 Standardising Saturation Flows

As with link speeds and speed flow relationships, the “standard” values of saturation flow was slightly different in each donor model. A mapping exercise was undertaken to ensure consistency for similar turns, so that the saturation flow of a given turn does not significantly differ based on which model the coding came from. This led to the development of an equivalence list to convert the capacities from each donor model into a standard set that were defined in the SCRTM1 network coding manual.

6.2.6 Motorway Coding

Given the extensive motorway network within the SCR, particular emphasis has been put on the accurate coding of the motorways and key strategic routes. This meant that the coding for motorway sections within and just outside of the SCR were updated in order to maintain consistency having previously combined multiple existing models.

Motorway coding was conducted in conjunction with the guidance set out by Highways England in the *Regional Traffic Models Network Coding Manual (2015 V8)*. The network coding within the SCRTM1 represents the motorway network post the roadworks that had been undertaken between Junctions 32 and 35a on the M1. These roadworks were converting a standard D3M road into a Smart Motorway.

The mobile phone data was recorded during 2016 while these roadworks were in place but the traffic counts collected in spring 2017 were after the roadworks were completed. These roadworks involved a 50mph average speed control on the motorway between junctions 32 and 35a and anecdotal evidence suggests that the motorway generally operated at 50 mph in all time periods. When the roadworks were removed in early 2017 some speed restrictions were left in place due to air quality issues. The standard operation of this section of motorway is that it operates a 60mph speed limit during the AM and PM peak periods and 70mph unless congestion is such that a lower limit is necessary. It was therefore considered that the travel patterns collected in the Autumn 2016 would not be significantly affected by the roadworks and therefore it is appropriate to model the post roadwork situation as this represents the time when the count data was collected.

Coding along the motorway sections was done in accordance to the 2015 coding manual, with the capacity values being represented below in Table 21. For both mainline and slip road coding the median values have been taken, as per the guidance within the 2015 coding manual, and applied throughout the motorway network.

Table 21. Motorway Capacities

Location	1 Lanes	2 Lanes	3 Lanes	4 Lanes	5 lanes
Motorway	N/A	4,240	6,360	8,480	10,600
Slip Road	1,930	4,140	N/A	N/A	N/A

Source: Highways England in the Regional Traffic Models Network Coding Manual (2015 V8).

Initial analysis was conducted along the entirety of the motorway network within the SCR, with a note of the merge and diverge type, and the number of lanes along the mainline, in order to aid the motorway coding process. The schematic diagram used to aid motorway coding is seen in Appendix H.

6.2.7 Signal Data

The Sheffield and Rotherham parts of the model came from the 2008 SRTM3 model. A number of changes to signals have occurred in these areas since then, so it was decided to use the 2016 version of the Sheffield AIMSUM model to update signal settings. The signal timings in the AIMSUN model are continuously updated and are therefore considered to be the most up to date values. Checks and updates to the settings were focused on nodes:

- At critical intersections;
- Where the delay was large or unrealistic;
- Where journey times in the model did not match observed information;
- Where routing issues were identified.

Updates were completed to get the percentage green time for each movement in the model as close as possible to the AIMSUM model. Sometimes this required a change to phases and stages. The resulting coding was checked for reasonableness and making sure it could occur in reality.

This update covers the Innovation Corridor and Mass Transit scheme areas.

Further checking and analysis of signal data was undertaken. These included:

- When the sum of stage lengths doesn't match the cycle time;
- Very long inter-green times; and
- Conflicting movements (without priority markers) but have green time within the same stage.

All occurrences of these errors were checked and rectified where applicable.

6.3 Centroid Connectors and Count Locations

Centroid connectors are used to connect zones to the highway network, and for the SCRTM the 'along the link' approach in SATURN has been used. As a result of using this coding approach, the need for spigots within the simulation are has been significantly reduced, apart from in a very small number of isolated locations e.g. where a zone represents a development that accesses the network at one place. This task has been conducted with particular care, with the coding of centroid connectors being a critical part of the highway model. The initial attempt at coding the centroid connectors was an automated process, based on population weighted centroids for each individual zone being derived from postcode data. These weighted centroids were then connected automatically to the link with the nearest midpoint.

Following on from the initial automated connection process, each zone has been manually checked to ensure that connection is sensible and accurate, with regard to what real life traffic movements are likely to be. Centroid connectors have been changed from the initial automatic process where it was deemed appropriate to do so, whether this being due to a more appropriate connection being found, if the zone needed more than one connector, or if the automatic process had connected an individual centroid to a one way or motorway link.

Where there is sufficient network available the approach to coding centroid connectors has been to minimise the number of connections along any one individual link. The target was to initially ensure that any individual link could only have one centroid connector; however this rule had to be adjusted, particularly around the Chesterfield and North East Derbyshire model areas. The issues encountered around connecting centroids in these areas were due to the rural road network in some areas being too sparse for the zone system which was developed for the SCRTM1. An alternative would be to combine the zones together but then the zones would cover a large geographical area.

The resulting proposal to resolve this issue was to accept up to three individual zone connectors at a given link, providing there was sufficient reasoning to do so; i.e. that this was an accurate representation of real life movements and layouts. Where multiple zones loaded onto a link with a roundabout, U-turns were permitted to allow traffic to route logically between the two zones.

One of the checks Saturn performs is to see if a centroid connector 'straddles' a count site. This would have the consequence of meaning no trip either to or from this zone would go through the count site within the model. Though it is possible this may be the case, it is unlikely to be so in the majority of occasions. Therefore, when this situation arose the zone and count location was reviewed, and on most occasions either the count was moved to an adjacent upstream / downstream link or the centroid connector was altered. This is particularly important if the count forms part of a screenline used in estimation, as incorrect factoring would be applied to other movements through the count site.

7. Trip Matrix Development

7.1 Introduction

The primary source of data for generating current highway travel patterns is mobile phone data (MPD) received from Telefonica concerning the movement of mobile devices on their network. Before using these data AECOM needed to assess its reliability and what, if any, other data sources would needed to get the best possible prior matrix. The first part of this chapter provides a summary of the tests undertaken on the MPD. The later gives details of how the prior matrix was built from combining the mobile phone data with other data sources, including further checks and adjustments.

7.2 Background to Mobile Phone Data

Telefonica provided AECOM with data gained from mobile phone movements across Great Britain. In Telefonica's report (AECOM Sheffield Report v1.0 20170221.pdf (Appendix E) of the data processing, Telefonica detailed how the data was collected and processed.

Appendix F contains a report that discusses in detail the tests carried out by AECOM to analyse and check the mobile data received from Telefonica against other data sources to ensure we are making the best use of all the data we have available. References to the tests are in this report (Appendix F).

7.3 Telefonica Mobile Phone Data

Data were collected over 30 days between September 5th and October 21st 2016, comprising Mondays to Fridays only. Bank holidays, school holidays and five days when there were mobile network issues affecting data availability were excluded.

Telefonica use the movement patterns of mobile phones to generate "trips". Trips are allocated to a start and end zone based on the following zone system:

- MSOAs within Sheffield City Region (SCR), and
- Model zones outside SCR.

Previous experience with MPD from Telefonica suggested that MPD are unlikely to be reliable at a more detailed geography than MSOAs hence MSOAs were used as a starting point within SCR. All zones outside SCR are at least as large as an MSOA. Using methods described further in the Telefonica report (Appendix E) trips are assigned to a time period, a journey purpose, and a mode of travel.

Trips are expanded using the 2011 census total residential population.

Telefonica have undertaken several steps to anonymise the data, including but not limited to stochastic rounding.

Telefonica acknowledge a number of weaknesses in the data, all of which are confirmed by AECOM's analysis in this note:

- The data are very poor at estimating very short trips (under 2 miles). Mobile "cells" are too large to detect many trips of this length. This means that walk trips cannot be observed from the data, generally.
- There are too many non-home-based trips in the data relative to other sources such as NTEM. We believe this is largely due to inclusion of light goods vehicle (LGV) trips in the mobile data.
- The mobile data understates rail trip-making; it allocates many rail trips incorrectly to "road". Telefonica do not offer any explanation for this.
- There are relatively too few trips in the education travel peaks (8am to 9am and 3pm to 4pm) in the mobile data. This is because education trips tend to be very short, and are thus often missing from the mobile data due to cell size, as noted above.

7.4 Summary of Tests on Mobile Phone Data

The tests (see Appendix) were taken from those used in the regional transport models (RTM), however using the knowledge gained from building the RTM matrices and other models the tests have been applied more holistically and are summarised in the full report.

It should be noted that all the tests were undertaken on the adjusted provisional data matrices (referred to as MPD in this note) prior to any synthetic adjustment or merging with other data sources. Other data sources were used in addition to the MPD data in the development of demand estimates for SCRTM1; this verification work helped to understand where other data sources were required.

Four sources of data were primarily used to check the mobile phone data; these were the 2011 Census Journey To Work data, Version 7.2 of the National Trip End Model (NTEM), the National Travel Survey (NTS), and the Trans-Pennine South (TPS) model.

Some of the tests required using trip lengths. As no trip length was provided then an early version of the highway model was used to estimate a trip length for each movement.

The allocation of a trip to road or rail was checked against the Census JTW data for corridors with a high rail share.

The allocation of trip end to zones for commuting trips was checked by comparing the total number of production and attractions against the Census JTW.

The allocation of trip end from MSOA to zone for each trip purpose was checked by comparing the total number of production and attractions against the Census JTW.

The number of trips travelling between each pair of zones by home based trips (i.e. excluding Non-home based) was compared in each direction at a 24 hour level to check the symmetry of the matrix.

The HGV trip length distribution was checked against the trip length distribution of the TPS model HGV matrix to see if HGV trips had been correctly identified.

The total number of trip ends for each zone was examined to see if they were in line with expectations. Desire line plots were used to check that large movements were logical.

The expansion of the data was checked on a full SCR basis by comparing the number of trips by resident between the MPD and the National Travel Survey; this was done separately for each home based journey purpose.

The expansion was also checked by looking at the from home trip rate by MSOA and identifying any outliers.

The general flow of traffic around SCR was checked by comparing the number of commuting trips travelling between and within each local authority (within SCR) to the Census JTW.

Trip length distributions by journey were checked against the Census JTW (Commuting only) and the NTS (all purposes separately and combined).

The journey purpose split was compared against comparable analysis from the NTS to look for any large differences.

The time period split was compared against comparable analysis from the NTS to look for any large differences.

7.5 Conclusions from verification checks on MPD

After the MPD verification analysis our view remains, as it was from previous studies with mobile data, that mobile data are a valuable source of information about patterns of longer distance travel movements across the model area. Furthermore, they are able to identify times of travel, and reasonably allocate demand to different travel purposes within the categories used. However, as the full report details they do have weaknesses, as follows:

The MPD split between rail and road is not yet reliable and therefore, the majority of rail trips are expected to have been incorrectly allocated to road trips (Test A1).

The MPD split between vehicle classes and in particular between non- freight and freight trips is not considered to be accurate enough to rely on (Test A5).

Mobile Phone Data underestimate short distance trips up to 6 kms (4 miles) (Test D - Trip Length Distribution), severely so for very short trips (under 2 miles). In general, mobile phone data cannot be relied upon for patterns of short-distance travel.

An overstatement in the allocation of off peak demand is observed in the MPD matrices for home based other and non-home based trips compared to the NTS time period allocation (Test E). However, taking into account the low levels of demand in the off-peak period, the differences are not large. The high level of non-home-based demand in the off peak period is also explained by the inclusion of freight trips in Mobile Phone Data.

7.6 Prior Matrix Build Introduction

Following the MPD verification analysis detailed above, adjustments to the matrix were required in order to produce a prior matrix for use in the Highway Model.

A number of adjustments were implemented based on the outcome of the verification tests. Other secondary data sources such as demand estimates from local land-use planning data combined with the National Trip End Model (NTEM72), National Travel Survey (NTS) Household Data, 2011 Census Adjusted Journey To Work Data, various traffic count data (Automatic Traffic Counts, Manual Classified Counts, Roadside Interviews) and existing donor transport models developed for the SCR study area (SYSTM+, Sheffield-Rotherham and Barnsley Transport Model) were used to augment, disaggregate, verify and address the various limitations of the Provisional Mobile Phone Data.

The flow chart below (Figure 26) summarises the key steps involved in the Prior Matrix Development Process. Each green rectangular box is a step.

The full process is discussed in detail in Appendix G, references to parts of the appendix are provided for each step within this section.

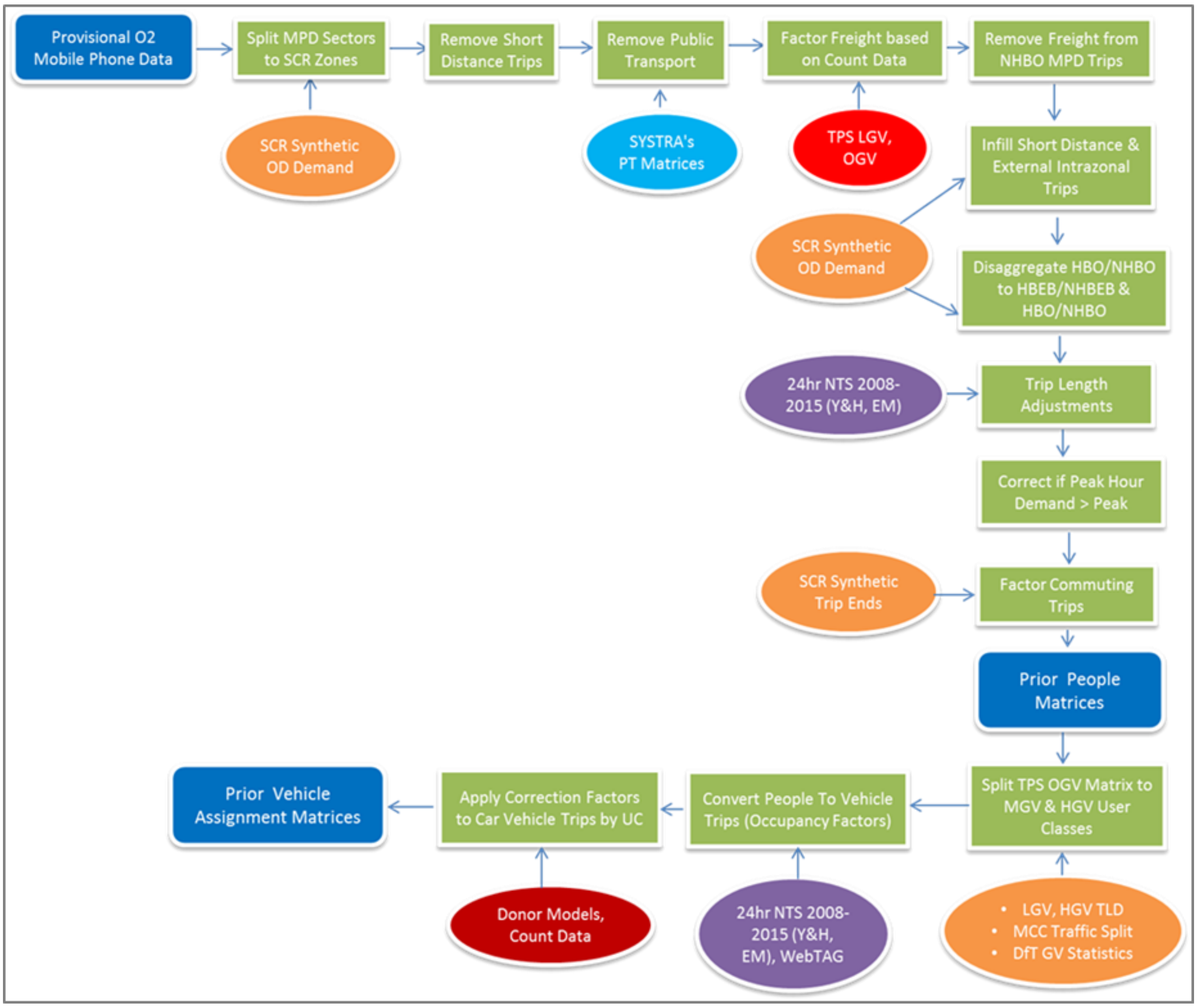


Figure 26. SCR Highway Matrix Build Methodology Outline - Flow Chart

7.6.1 Step1: Import all required Inputs

Combined Road, Rail and Freight OD Provisional Mobile Phone Data

Combined MPD data were imported by purpose (Home Based Commuting, Home Based Other, Non Home Based Other) at a time period and peak hour level by direction of travel (Outbound or "From Home" and Inbound or "To Home").

Telefonica's Provisional Mobile Phone OD matrices, initially segmented by mode into road, rail and HGV, were all aggregated into one combined matrix as the verification tests indicated that both rail and HGV trips are significantly understated by Mobile Phone Data and thus, neither the road-rail nor the freight-non freight split were thought to be reliable.

The SCR Synthetic matrices were imported by time period, purpose (Home Based Commuting, Home Based Employers Business, Home Based Other, Non Home Based Employers Business, Non Home Based Other) and direction of travel.

SCR Synthetic OD Highway Matrices

A set of Synthetic OD Highway Matrices were then developed for SCRTM1 based on:

- Local Sheffield City Region Planning Data (population, employment, households, car ownership) derived from planning data collated by David Simmonds Consultancy as part of their work to develop a land use model for the SCR area.
- The trip length profile of National Travel Survey (NTS) 2008-2015 Household Data for Yorkshire and Humber and East Midlands given that our study area overlaps the two regions. NTS data were used as they constitute the primary source of data for individuals' trip making behaviour in the UK.
- DfT's CTripEnd Model (based on *National Trip End Model, NTEM v72*) in terms of model structure, trip rates by area type and segmentation into population, employment and car ownership categories.

OD Public Transport Matrices

Public transport matrices were imported by mode (Rail, Bus and Tram), time period and direction of travel, as developed by SYSTRA for the PT model.

Freight TPS Matrices

Freight LGV and OGV Hourly Matrices (in PCUs) derived from the 2015 Highways' England TransPennine South Regional Traffic Model (TPS) were converted to Sheffield City Region Zoning System (1412 zones). A factor of 0.92 was applied to the OGV matrices to convert from the TPS to the SCR PCU factor. The factor 0.92 is a result of different OGV PCU factors being used in the TPS model (2.5) and the SCR model (2.3). See Appendix G.1.5 for further information.

LGV TPS matrices were originally based on TrafficMaster data, while OGV inputs were derived from DfT's 2006 Continuing Survey of Road Goods Transport (CSRGT).

Distance Skim (in kms)

The network skimmed distance was used to provide a complete distance matrix for all the origin destination zone pairs of the Sheffield City Region Model. In the case of intra-zonal movements where no distance could be provided, the matrix was infilled by half the minimum non-zero row distance for that origin zone capped to a minimum of 10 meters and a maximum of 10 kms. Tests were made to verify / check the symmetry of the distance matrix.

Further details about this step are provided in Appendix G.

7.6.2 Step 2: Geographically disaggregate the Provisional Mobile Phone Data within SCR

Within the SCR area the Provisional MPD matrices were disaggregated from the 232 existing Middle Layer Super Output Areas (MSOAs) to the 1232 SCR internal model zones based on the proportional zonal to MSOA split of the SCR Synthetic Matrices at an OD zone pair level.

Further details about this step are provided in Appendix G.

7.6.3 Step 3: Remove short distance trips (0 to 6 kms) and external intra-zonal trips.

Short distance trips were found to be underrepresented, while external intra-zonal trips were entirely excluded from the Provisional Mobile Phone Data. Therefore, the same trip segments had to be removed from public transport and freight matrices so that all sources of demand data are consistent.

Further details about this step are provided in Appendix G.

7.6.4 Step 4: Remove Public Transport trips by purpose and time period

According to test A1 (Appendix G) of the Verification process, the rail shares suggest that Mobile Phone Data are significantly lower than the corresponding Adjusted Census Journey To Work 2011 Data and thus, considered to be unreliable. It is likely that some rail trips, mainly short distance ones, are incorrectly allocated to road trips. Bus trips are also included in road matrices and should be removed.

To remove public transport trips we made use of SYSTRA's OD public transport matrices developed by mode (bus, rail and tram). Bus and tram matrices are focusing on Sheffield City Region only (internal area), while rail matrices cover the whole of the UK.

The methodology implemented for removing public transport trips makes use of a cap assuming a maximum percentage of MPD demand (25%) that can be removed at an OD zone pair level from the Provisional Data to represent public transport demand. Overall, the process resulted in the removal of approximately 93% of the total public transport demand as derived from SYSTRA's Public Transport Matrices.

The aim of our approach is to ensure that no car trips are removed while attempting to remove public transport from the combined road and rail provisional Mobile Phone matrices.

Further details about this step are provided in Appendix G.

7.6.5 Step 5: Factor TPS Freight trips (LGV, OGV) based on comparisons against the Count data

Comparison of the TPS freight data against the count data indicated that LGV trips were 30% lower on average across all time periods. This finding was also supported by comparison against TRICs trip end data (at an employee level), as TPS LGVs were found to be 32% lower than TRICs. Therefore, a global factor of 1.3 was applied to TPS LGV trips just before being removed from the combined MPD road-freight matrix.

On the other hand, compared against the count data, the TPS matrices were found to: significantly overstate OGV trips in the PM peak (~55%), moderately overstate OGV trips in the AM peak (~ 7%) and slightly underestimate OGV demand in the InterPeak (~ 4%).

Thus, appropriate factors were applied to OGV trips by time period to factor down the AM and PM peak OGV demand and slightly augment the number of OGV trips in the InterPeak.

Further details about this step are provided in Appendix G.

7.6.6 Step 6: Remove Freight trips from Non Home Based Other Mobile Phone Trips

As the verification tests suggested, the mobile phone data mode split between road and HGV trips is not considered to be correct, as HGV trips are significantly understated and many of them are likely to have been misallocated to non-home based road trips.

LGV trips are also included in the road matrix and have to be removed. The factored freight matrices (LGV, OGV) from Highway's England TransPennine South Regional Traffic Model were used to represent the correct freight demand that should be removed from the Provisional Mobile Phone combined road and freight matrix.

The methodology applied is the same with the one implemented for public transport removal, with the exception that freight demand is only removed from NHBO trips. A cap is also being applied representing the maximum percentage of freight demand that can be removed from non-home based trips at an OD zone pair level.

As the MPD matrices are in people units, the LGV TPS matrices were converted from vehicles to people assuming an average LGV occupancy of 1.23 people per vehicle (WebTAG Workbook).

Further details about this step are provided in Appendix G.

7.6.7 Step 7: Infill short distance (0-6 kms) and external intra-zonal trips

The outcome of Verification Test D showed that the derivation of short trips in the Provisional data is unreliable. Mobile Phone Data are not able to accurately capture and identify very short distance intra-zonal/intra-MSOA trips, whilst they completely exclude external intra-zonal trips. This was corrected by synthesising and replacing short trips, taken from the SCRTM1 Synthetic matrices.

The infilling was undertaken using 6 kms (4 miles) as the distance threshold used to define a short trip. Thus, all trips between 0-6 kms, as well as all internal and external trips that originate from and end at the same model zone were replaced by the Synthetic Car matrices by purpose, time period and direction of travel.

Further details of this step are available in Appendix G.

7.6.8 Step 8: Disaggregate "Other" Trips

Telefonica's Provisional Mobile Phone Matrices were initially segmented into five purposes: Home Based Commuting From Home, Home Based Commuting To Home, Home Based Other From Home (Including Home Based Education From Home), Home Based Other To Home (Including Home Based Education To Home trips) and Non Home Based Other trips.

For the requirements of the assignment and the demand model, the "Other" demand segment had to be further split into "Employer's Business" and "Other" trips for both home and non-home based trip categories. This was achieved using the relevant purpose split from the Synthetic car matrices.

After the purpose split, the total number of car people mobile phone trips on an average weekday and by time period remained the same; it's only a redistribution of trips that occurred amongst purposes other than commuting.

Further details of this step are available in Appendix G.

7.6.9 Step 9: Apply Trip Length Adjustment Factors

The verification tests indicated that the Provisional MPD were generally biased towards longer distance trips.

At this stage of the Matrix Build Process, the trip length profile of trips originating within Sheffield City Region was extracted at a trip purpose (HBW, HBEB, HBO, NHBEB, NHBO), all-day level and compared against the relevant 24hr NTS profile. This comparison included short distance infill trips as well.

The NTS profile used in the process was derived from 2008-2015 National Travel Survey (NTS) Household Data for Yorkshire and Humber and East Midland Regions that are both relevant to the model's Internal Area.

A number of supplementary tests were also undertaken to compare and verify the level of mobile phone demand in each demand segment against secondary sources of data.

In particular, OD MPD trip ends by Sheffield City Region district were compared against the relevant trip ends derived from the SCR Synthetic matrix and the National Trip End Model (NTEM v72). For commuting trips, the total number of production tours by SCR district to district movement was also compared against Adjusted 2011 Census Journey to Work Data.

Thus, a set of distance based, trip length adjustment factors were calculated by purpose of travel considering the performance of Mobile Phone Data against all the above mentioned sources of data.

In particular, the selection of the TLD factors implemented was the outcome of an iterative process aiming to correct for all the inconsistencies amongst the data sources and to satisfy all of the following conditions:

- Produce a smooth TLD profile for the Mobile Phone matrices similar to NTS at a trip purpose, all day level
- End up with trip ends consistent with TEMPRO v72 and the SCR Synthetic trip ends across all trip purposes and
- Result in the least possible change in the matrix totals (total volume of MPD trips) by demand segment.

Different factors were calculated for different distance bands depending on the shape of the distribution and the divergence from the NTS profile. The factors were estimated based on the trip length distribution of the Mobile Phone average weekday (24hr) trips that have their origin within Sheffield City Region (Internal To Internal and Internal To External trips). The same factors were implemented to trips that originate outside of our study area but have their destination within Sheffield City Region, as their trip length profile should be similar to that of the outbound (internal to external trips) to ensure the matrix is symmetrical.

Short distance trips between 0 and 6 kms have been already infilled from the Synthetic Matrix and thus, no trip length adjustment factors were applied to them.

The factors implemented to home based "from home" and "to home" trips by purpose are similar but not identical, as they were calculated separately by direction of travel.

Figure 27 below summarises the trip length adjustment factors calculated by purpose and direction of travel and the relevant distance bands to which they were applied. The factors were calculated at a 24hr level but implemented by time period with the same factors being applied across all time periods.

With the exception of home based commuting and other trips, in the rest of the purposes (HBEB, NHBEB, NHBO), trip length adjustment factors lower than unity were applied, aiming to reduce longer distance trips.

This is supported by the fact that the NTS TLD profile, as well as comparisons against NTEM v72, SCR Synthetic trip ends and adjusted Census 2011 Journey to work data all indicated that Mobile Phone Data were slightly understating commuting trips, while significantly overstating employer's business and non-home based trips.

To be more specific, MPD commuting trips appeared to be particularly short of trips within the distance band of 6 to 10 kms, while also slightly lacking longer distance trips.

Trip Purpose	Distance Band (kms)	Adjustment Factor
HBW FH	6 to 10	1.29
	10 to 999	1.07
HBW TH	6 to 10	1.16
	10 to 999	1.08
HBEB FH	6 to 11	1.00
	11 to 999	0.82
HBEB TH	6 to 11	1.00
	11 to 999	0.87
HBO FH	6 to 999	1.00
HBO TH	6 to 999	1.00
NHBEB	6 to 10	0.82
	10 to 999	0.75
NHBO	6 to 999	0.87

Figure 27. Trip Length Adjustment Factors

No trip length adjustments were undertaken in the case of HBO trips, as the specific trip category was considered to include the right level of demand based on comparisons against NTEMv72 and SCR Synthetic trip ends; the trip length profile of the MPD HBO trips was found to be indistinguishable from what the NTS suggests. This is key if it is taken into account that home based other trips count for around 60% of trips in the Prior Matrix (Appendix G).

Regarding HBEB trips, it occurred that the mobile phone data included a number of business trips with a trip length greater than 280 kms. If we consider that the distance from Sheffield to London is approximately 270 kms, we wouldn't expect to observe many business trips longer than that on an average weekday. Thus, we decided to remove these trips from Mobile Phone Data just before applying the trip length adjustment factors, as these probably constitute long distance freight trips (of the HGV band) incorrectly allocated to home-based travel.

Before removing freight from non-home based mobile phone matrices, the TPS HGV matrices were first factored down by the percentage of HBEB trips above 280 kms over the total number of OGV trips (factor ~3%), to avoid removing twice the specific part of the freight matrix.

Further details of this step are available in Appendix G.

7.6.10 Step 10: Correct OD demand where peak hour demand is greater than time period demand.

In the case of OD pairs where the peak hour demand was found to be greater than the respective peak period demand, the peak hour demand was set equal to the peak period demand to correct for error in the data. This occurred in about 3% of the OD pairs for both the AM and PM peak hour demand.

Further details of this step are available in Appendix G.

7.6.11 Step 11: Adjust MPD Commuting Trips to the SCR Synthetic Trip Ends

Although trip length adjustments increased commuting trips produced within Sheffield City Region by about 7%, commuting trips were still found to be slightly understated in Mobile Phone Data based on comparisons against Census 2011 Adjusted Journey to Work Data and the SCR Synthetic trip ends.

Commuting trips comprise more than 20% of total number of Mobile Phone trips and thus, it is important that they represent the right level of demand.

Thus, further tests were undertaken to compare the Mobile Phone commuting trip ends by SCR district against the SCR Synthetic trip ends at a time period level, separately for origin and destination trip ends.

The results of these tests indicated that:

- In reference to the main commuting flows, namely the HBW from home trips in the AM and the HBW to home trips in the PM, MPD origin and destination trip ends respectively are close enough to the SCR Synthetic trip ends, as the difference amongst them is, across all SCR districts, within plus/minus 10%. This is very important as approximately 70% of commuting from home trips on an average weekday occur in the AM peak period and 60% of commuting to home trips occur in the PM.
- The MPD matrices are significantly lacking counter-peak flow trips. In particular, HBW to home trips in the AM peak and HBW from home trips in the PM period appear to be significantly understated compared against the SCR Synthetic trip ends. Although only a 3% of the daily commuting from home trips occur in the PM and a 2% of commuting to home trips occur in the AM, it is important to fix the tidality issue identified in the model. Interpeak commuting from home trips also seems to be underrepresented in the adjusted Mobile Phone matrix.

Hence, a set of factors (Table 103 in Appendix G) were applied to mobile phone commuting trips to adjust them to the Sheffield City Region SCR Synthetic trip end estimates and to augment volume of trips in the counter-peak direction. The factors were calculated based on the ratio of the SCR Synthetic to MPD trip ends by time period at a production level; namely by trip origin for HBW "from home" trips and by destination for HBW "to home" trips.

The factors were applied at a district level for all trips produced within Sheffield City Region. For reasons of consistency and matrix symmetry, factors were also applied on trips produced outside of Sheffield City Region.

Further details of this step are available in Appendix G.

7.7 Prior People Matrix Validation – Post Adjustments Verification tests

The outcome of all the adjustments described in steps 1 to 11 above was the development of the Prior People Matrix. The term "Prior" refers to the adjusted Mobile Phone Data matrix, namely the output of the matrix development process.

The next step involved the validation of the Prior against other reliable, secondary data sources relevant to Sheffield City Region to ensure that it is indeed appropriate for use in the context of Sheffield City Region Transport Model (SCRTM1). Prior People Matrices were used instead of vehicle matrices as the tests were conducted at a demand segment, trip purpose level disaggregated to home based and non-home based trips and direction of travel.

Most of the validation tests had been previously conducted on the Provisional Mobile Phone Data at an MSOA level and are thoroughly reported in the Mobile Phone Data Verification report (Appendix F).

The main verification tests undertaken in the Prior Matrix are summarised below.

7.7.1 Test 1: Purpose Split - 24hr Prior People Matrix against SCR Synthetic Data

This validation test compares the purpose split of the 24hr Prior Matrix against that of the SCR Synthetic car trip matrices.

Figure 28 below compares the split across all five modelled purposes (by direction of travel) for the Prior and the Synthetic Car Matrix on an average weekday.

Across all trip purposes the difference amongst the Prior and the Synthetic matrix is less than 1%. Thus, it is inferred that the purpose split of the Prior is compliant with the split of the Synthetic 24hr matrices.

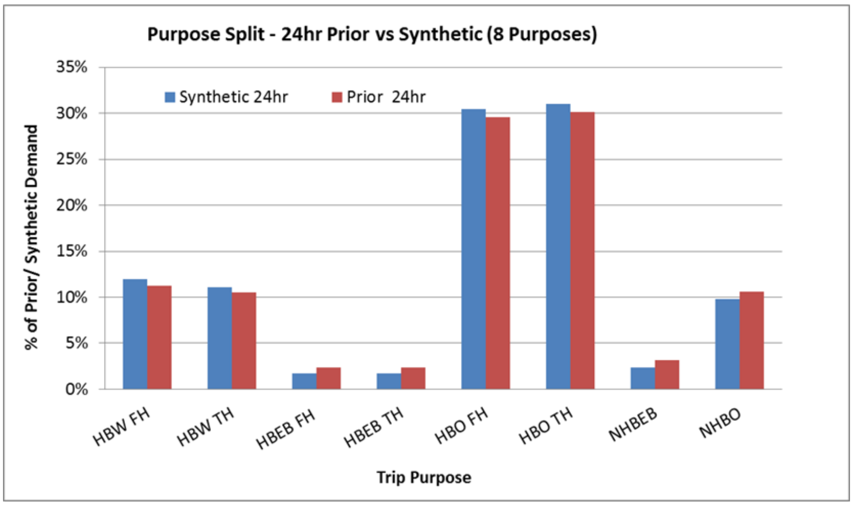


Figure 28. Purpose Split Comparison; Prior vs Synthetic Matrix

Further details of this test are available in Appendix G.

7.7.2 Test 2: Time Period Split

Figure 29 below compares the distribution of the 24hr Prior MPD demand across the time periods of the day against the time period allocation of the Provisional MPD data and NTS Data for Yorkshire and Humber and East Midlands for the years 2008-2015.

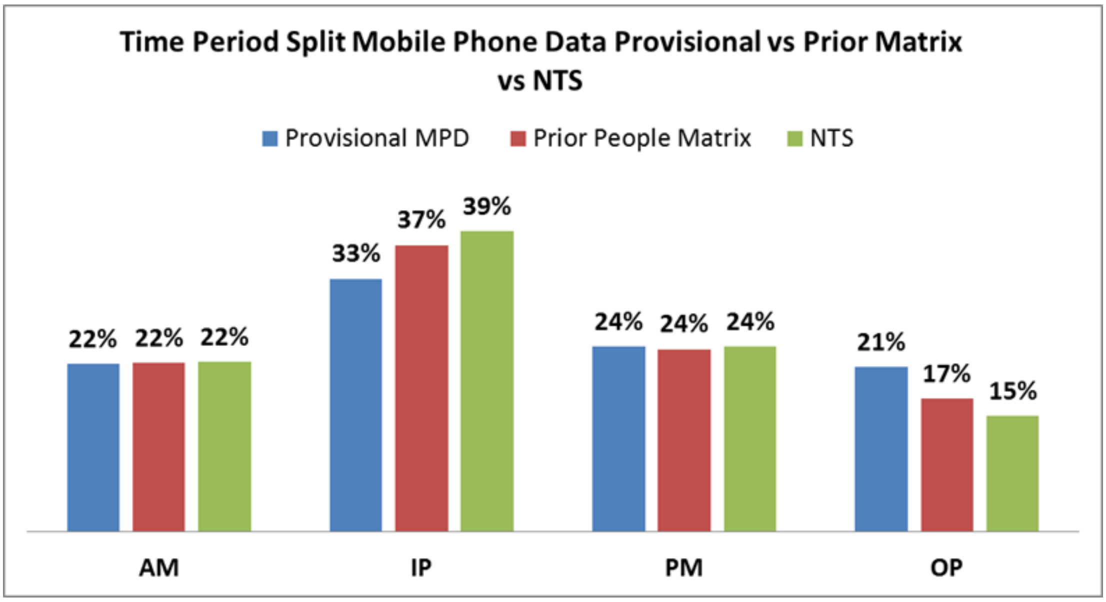


Figure 29. Time Period Split for MPD, Prior Matrix and NTS Data

It is noted that, even without making any explicit adjustment to alter the allocation of MPD demand in the different time periods of the day, the time period split of the Prior Matrix is very close to the NTS evidence, as a result of the overall Matrix Development Process and the adjustments implemented.

The share of AM and PM peak period demand over the total all day Prior demand is identical with the time period split that NTS suggests.

The share of the InterPeak period, that was found to be rather low in the Provisional Matrices (33% against 39% in NTS), has increased by 4% as a result of the adjustments, reaching a 37% of the total all day Prior demand.

On the contrary, the off peak period split, considered to be too high in the Provisional Data, was dropped by 4% post adjustments, resulting in being only 2% higher than the NTS off peak period split. This is considered an acceptable difference, taking into consideration the low level of demand in the off peak and the fact that the off peak demand is not assigned onto the network.

Further details of this test are available in Appendix G.

7.7.3 Test 3: Comparison of All Day Prior Trip Ends by SCR District

The Prior Matrix trip ends on an average weekday were validated by trip purpose against the Synthetic trip ends. Table 22 below summarises the results of that comparison. Total SCR OD trip ends across all internal districts are also presented; as well OD trip ends from/ to the rest of the country outside Sheffield City Region.

As implied from the table, commuting and HBO trips are the two categories that perform best in comparisons against the synthetic data. The total number of commuting and home based other origin trips ends across all internal SCR districts differ by less than 0.7% from the synthetic matrix. This is noteworthy as these two trip purposes together count for 82% of the total Prior demand.

In reference to HBEB trips, the total number of Prior SCR OD trip ends at a 24hr level is 10% higher than the respective Synthetic trip ends. NHBEB trip ends derived from the Prior differ by about 20% from the synthetic matrix, whereas NHBO trips are higher by approximately 11% compared against the synthetic. The 20% difference of the NHBEB trip ends from the synthetic is a remarkable difference but it only affects a 3% of total number of trips. The same applies to the HBEB category that counts for a 4% of total number of trips.

In the case of non-home based other trips, it should be noted that freight has already been removed and that the trip length adjustments have further decreased the number of NHBO trips by 8%.

It is key to consider in parallel the changes in MPD trip ends as a result of the matrix build adjustments rather than independently examine these results. To be more specific, before the trip length adjustments, the MPD trip ends compared against the synthetic were as described below:

- Commuting origin and destination trip ends 14% lower
- Home based employer’s business OD trip ends about 23% higher
- Home based other trip ends as good as in the Prior - no TLD adjustments were applied
- Non home based employers business trips roughly 50% higher
- Non home based other trips about 22% higher

The difference in these numbers reflects the impact of solely the trip length adjustments for all trip purposes apart from commuting.

For commuting trips, the difference is attributed to the combined effect of both trip length adjustments and the adjustment to the Synthetic SCR trip ends.

Table 22. 24hr OD Prior and SCR Synthetic Trip Ends Comparison

HBW		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	200,880	197,436	1.02
Rotherham	all	97,405	97,284	1.00
Doncaster	all	112,971	112,535	1.00
Barnsley	all	78,054	82,629	0.94
Chesterfield	all	43,150	42,190	1.02
NE Derbyshire	all	33,898	34,403	0.99
Bolsover	all	27,766	28,558	0.97
Derbyshire Dales	all	29,501	31,071	0.95
Bassetlaw	all	45,978	46,631	0.99
External	all	22,127,701	22,063,111	1.00
Total Internal Origins	all	669,601	672,738	1.00

HBW		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	206,791	197,720	1.05
all	Rotherham	95,422	97,953	0.97
all	Doncaster	113,016	112,593	1.00
all	Barnsley	77,665	81,987	0.95
all	Chesterfield	44,066	42,235	1.04
all	NE Derbyshire	33,374	34,070	0.98
all	Bolsover	27,107	28,565	0.95
all	Derbyshire Dales	29,442	31,059	0.95
all	Bassetlaw	45,149	46,901	0.96
all	External	22,125,270	22,062,770	1.00
All	All Internal Destinations	672,033	673,083	1.00

HBEB		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	28,282	26,275	1.08
Rotherham	all	15,225	13,433	1.13
Doncaster	all	17,272	15,391	1.12
Barnsley	all	10,156	11,202	0.91
Chesterfield	all	6,867	5,784	1.19
NE Derbyshire	all	5,503	5,129	1.07
Bolsover	all	4,877	4,164	1.17
Derbyshire Dales	all	6,079	4,793	1.27
Bassetlaw	all	8,475	6,803	1.25
External	all	4,879,083	3,260,678	1.50
Total Internal Origins	all	102,735	92,973	1.10

HBEB		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	27,463	26,316	1.04
all	Rotherham	14,966	13,442	1.11
all	Doncaster	17,285	15,356	1.13
all	Barnsley	10,179	11,209	0.91
all	Chesterfield	6,915	5,798	1.19
all	NE Derbyshire	5,476	5,095	1.07
all	Bolsover	4,908	4,161	1.18
all	Derbyshire Dales	6,445	4,665	1.38
all	Bassetlaw	8,568	6,785	1.26
all	External	4,879,614	3,260,825	1.50
All	All Internal Destinations	102,205	92,826	1.10

HBO		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	515,357	535,935	0.96
Rotherham	all	261,412	252,685	1.03
Doncaster	all	310,161	309,320	1.00
Barnsley	all	211,998	226,073	0.94
Chesterfield	all	124,202	118,758	1.05
NE Derbyshire	all	93,108	93,186	1.00
Bolsover	all	78,710	76,708	1.03
Derbyshire Dales	all	92,270	95,088	0.97
Bassetlaw	all	131,674	123,599	1.07
External	all	60,602,918	58,809,046	1.03
Total Internal Origins	all	1,818,892	1,831,351	0.99

HBO		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	515,773	536,288	0.96
all	Rotherham	259,805	252,203	1.03
all	Doncaster	309,901	309,438	1.00
all	Barnsley	212,382	226,744	0.94
all	Chesterfield	124,053	118,805	1.04
all	NE Derbyshire	92,748	93,531	0.99
all	Bolsover	78,876	76,654	1.03
all	Derbyshire Dales	92,367	95,400	0.97
all	Bassetlaw	131,380	123,419	1.06
all	External	60,604,520	58,807,928	1.03
All	All Internal Destinations	1,817,286	1,832,481	0.99

NHBEB		Prior vs Synthetic Orig Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	25,318	20,213	1.25
Rotherham	all	13,004	9,356	1.39
Doncaster	all	13,424	10,805	1.24
Barnsley	all	7,880	7,041	1.12
Chesterfield	all	5,405	4,370	1.24
NE Derbyshire	all	3,283	2,797	1.17
Bolsover	all	2,872	2,583	1.11
Derbyshire Dales	all	3,616	3,296	1.10
Bassetlaw	all	5,204	4,605	1.13
External	all	3,182,286	2,234,701	1.42
Total Internal Origins	all	80,005	65,065	1.23

NHBEB		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	25,504	19,370	1.32
all	Rotherham	13,331	9,572	1.39
all	Doncaster	12,210	11,108	1.10
all	Barnsley	7,988	7,381	1.08
all	Chesterfield	4,853	4,397	1.10
all	NE Derbyshire	3,115	2,918	1.07
all	Bolsover	2,781	2,754	1.01
all	Derbyshire Dales	3,399	3,164	1.07
all	Bassetlaw	5,698	4,889	1.17
all	External	3,183,413	2,234,212	1.42
All	All Internal Destinations	78,878	65,554	1.20

NHBO		Prior vs Synthetic Orig Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	104,193	89,677	1.16
Rotherham	all	48,956	38,219	1.28
Doncaster	all	52,794	49,061	1.08
Barnsley	all	33,836	31,941	1.06
Chesterfield	all	22,101	19,740	1.12
NE Derbyshire	all	12,884	11,726	1.10
Bolsover	all	11,132	10,966	1.02
Derbyshire Dales	all	19,779	19,503	1.01
Bassetlaw	all	21,705	20,416	1.06
External	all	10,719,225	9,405,762	1.14
Total Internal Origins	all	327,380	291,251	1.12

NHBO		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	101,885	85,928	1.19
all	Rotherham	48,699	37,595	1.30
all	Doncaster	54,194	52,667	1.03
all	Barnsley	35,095	32,839	1.07
all	Chesterfield	22,763	21,151	1.08
all	NE Derbyshire	13,115	12,033	1.09
all	Bolsover	10,973	11,964	0.92
all	Derbyshire Dales	20,277	20,388	0.99
all	Bassetlaw	21,752	20,758	1.05
all	External	10,717,853	9,401,689	1.14
All	All Internal Destinations	328,753	295,323	1.11

Therefore, it is concluded that, overall, post the matrix build adjustments, the differences have been more than halved and the mobile phone data matrices have been significantly improved.

Overall, the total number of SCR all-day origin trip ends across all trip purposes is only 1.5% higher compared to the SCR Synthetic Data. A similar difference (about 1.3%) is also observed in the destination trip ends.

Further details of this test are available in Appendix G.

7.7.4 Test 4: Trip Length Distribution Profile of the 24hr Prior People Matrices

The 24hr trip length profiles of the Prior People matrices by trip purpose for trips originating within Sheffield City Region are shown in Figure 30 to Figure 34 below by distance bands of 1 km. The figures also depict the relevant NTS trip length profiles (2008-2015 data for Yorkshire & Humber and East Midlands), enabling the comparison amongst the two datasets.

The NTS TLD graphs appear to have various spikes that are mainly observed because of:

- the distance travelled per trip is not directly measured but reported from individuals that take part in the National Travel Survey (NTS) and thus, tend to round their responses to the nearest integer number (in miles),
- following each individual's answer in miles, the distance travelled per trip will then be converted to actual kms that will be introducing some further round off error in the reported results.

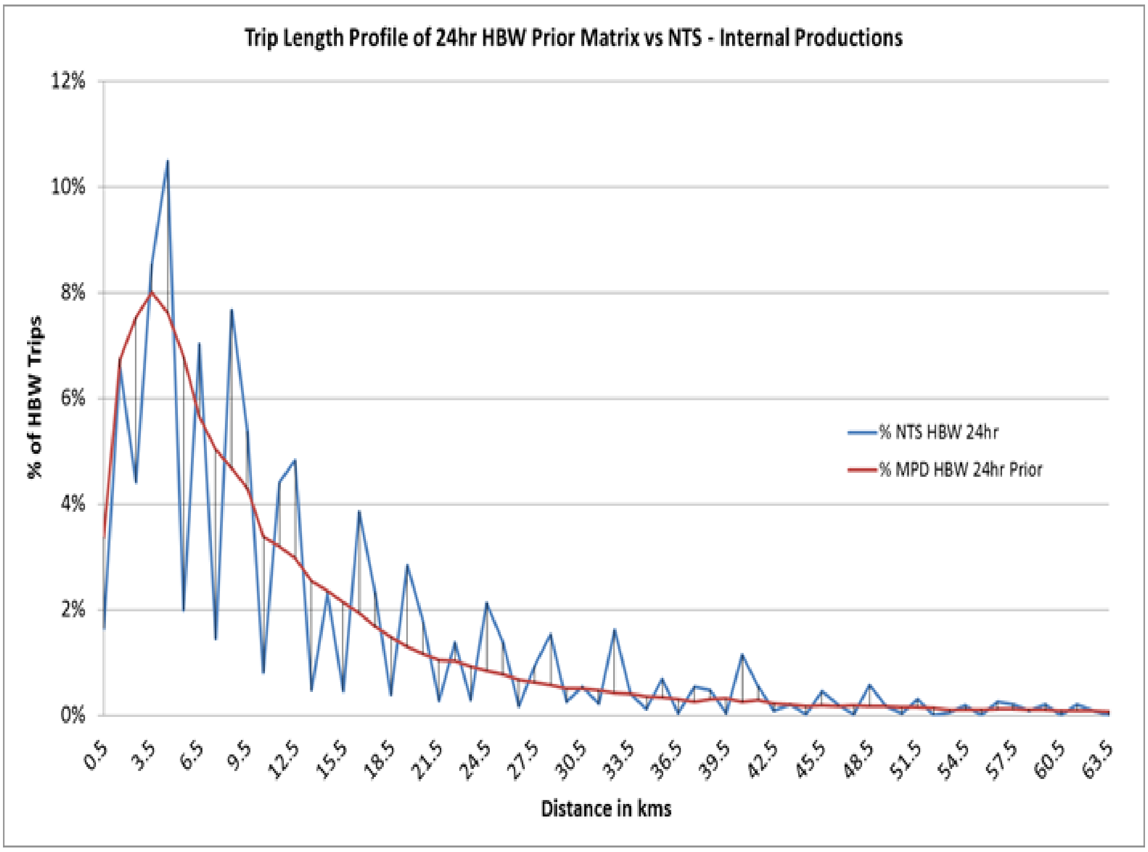


Figure 30. Trip Length Distribution of 24hr HBW Prior Matrix Compared to NTS Data

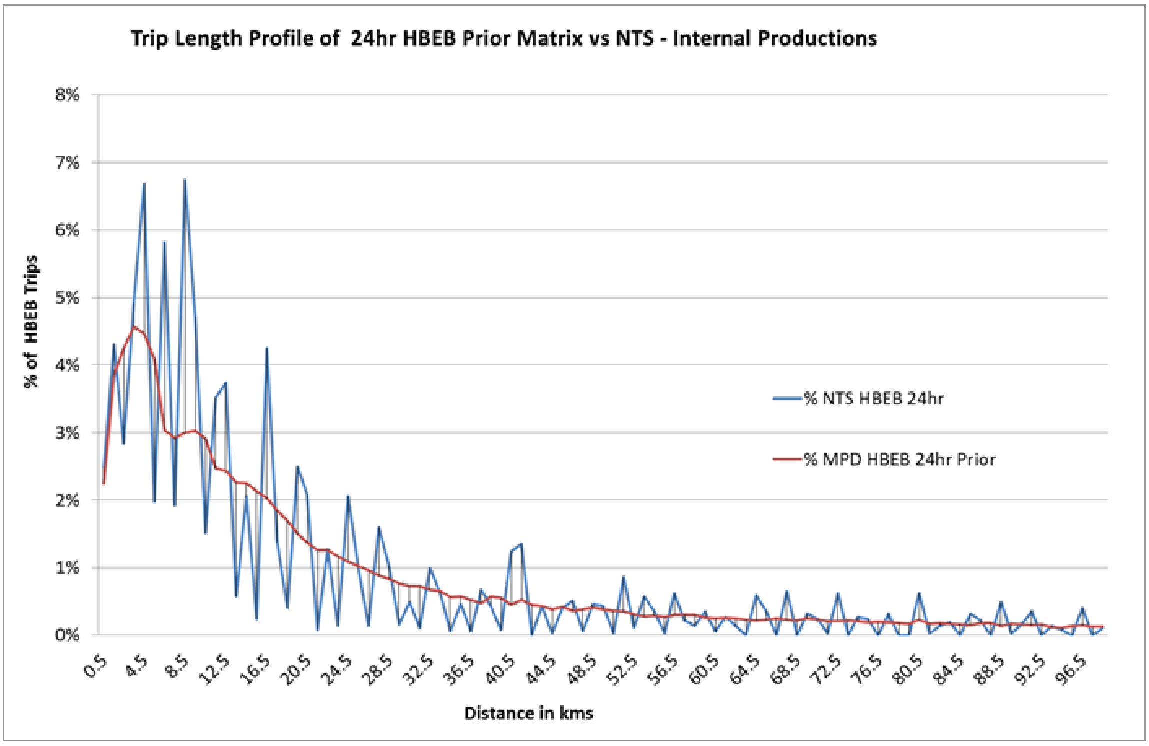


Figure 31. Trip Length Distribution of 24hr HBEB Prior Matrix Compared to NTS Data

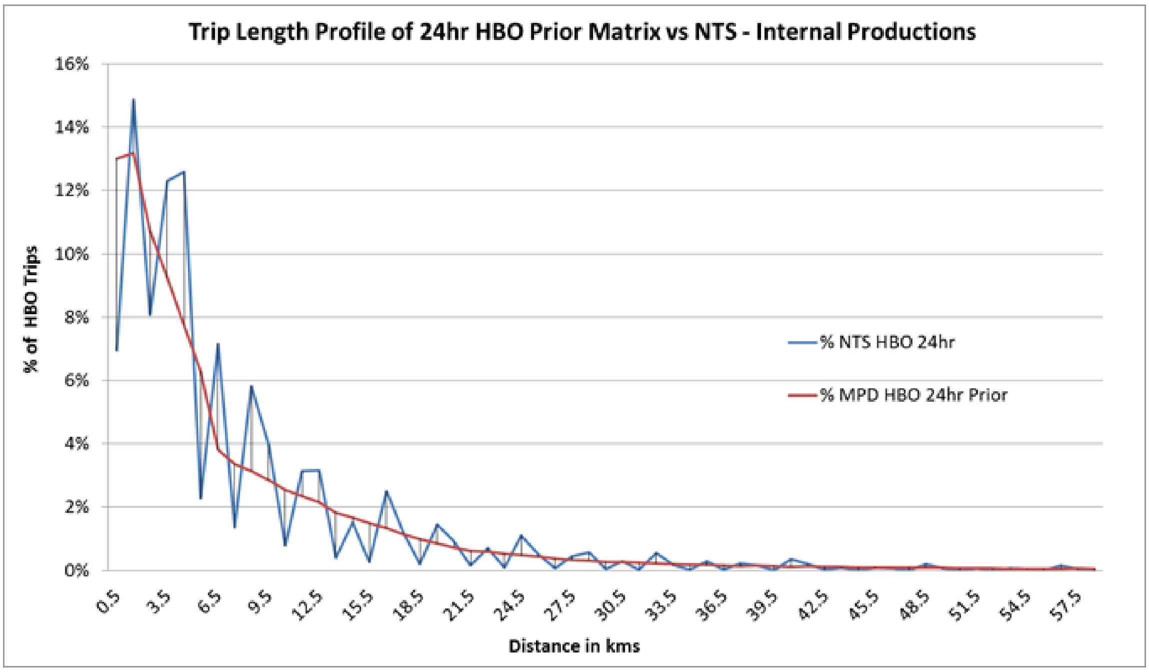


Figure 32. Trip Length Distribution of 24hr HBO Prior Matrix Compared to NTS Data

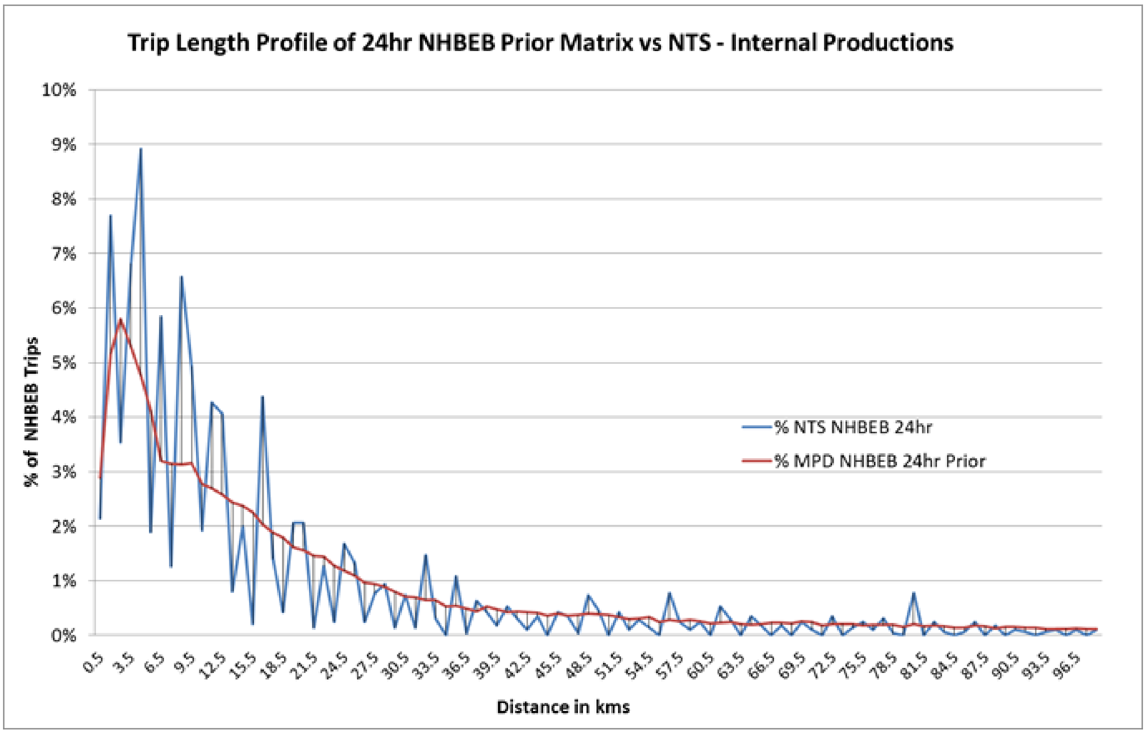


Figure 33. Trip Length Distribution of 24hr NHBEB Prior Matrix Compared to NTS Data

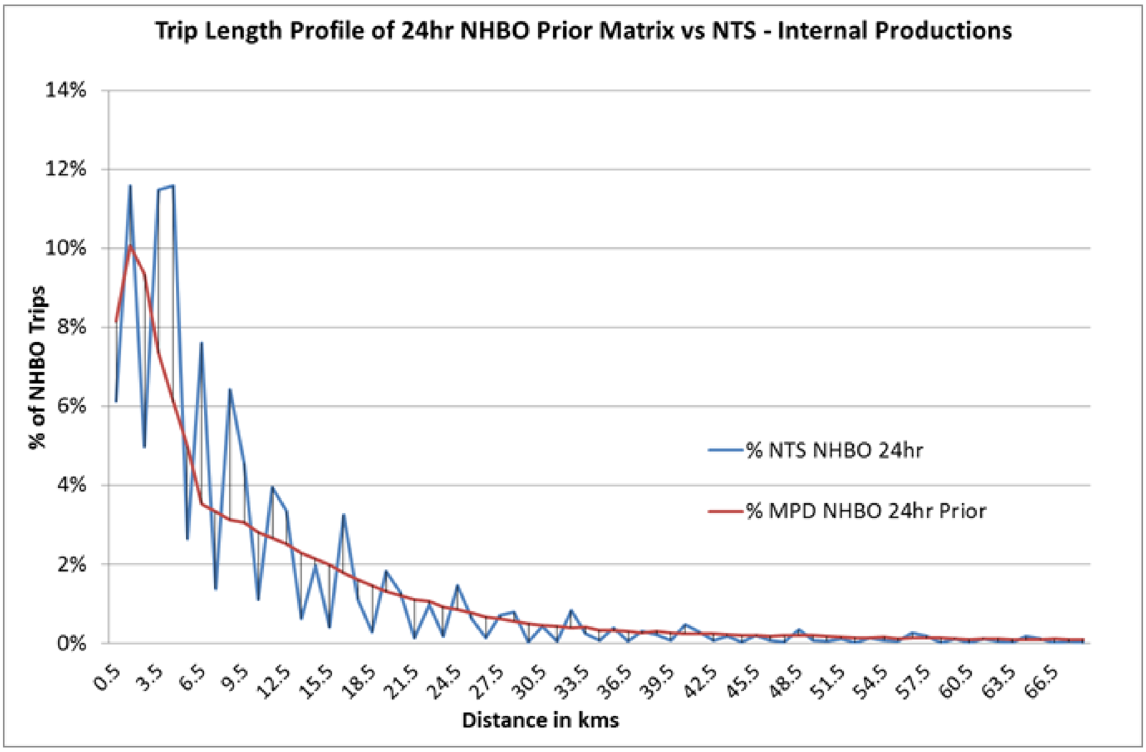


Figure 34. Trip Length Distribution of 24hr NHBO Prior Matrix Compared to NTS Data

All the graphs above indicate that the Prior People Matrix, across all purposes, is consistent with the National Travel Survey (NTS) trip length profile and is no longer biased towards longer distance trips.

Figure 35 below summarises and compares the average trip length by purpose and direction of travel between the Prior Matrix and NTS Data for all trips originating within Sheffield City Region on an average weekday.

24hr People Matrices by Trip Purpose	Average Trip Length (in kms)	
	Prior Matrix	NTS
HBW FH	13.5	14.8
HBW TH	12.7	14.8
HBW	13.1	14.8
HBEB FH	41.4	30.6
HBEB TH	37.8	30.6
HBEB	39.6	30.6
HBO FH	11.1	9.9
HBO TH	8.9	9.9
HBO	10.0	9.9
NHBEB	38.5	22.0
NHBO	17.3	11.3

Figure 35. Comparison of the Average trip length (in kms)

It is observed that for commuting and HBO trips, the average trip length of the Prior people matrices is close enough to what the NTS suggests.

In reference to employer's business and NHBO trips, they appear to have an average trip length significantly longer than the NTS trip length. However, the small sample size of the NTS data should be taken into consideration along with the fact that the employer's business demand segment is the one with the lowest number of trips. Hence, even a small percentage of very long distance employer's business trips (outliers) in the mobile phone data trip matrix have an impact on the average trip length.

In particular, it was identified that only a 5% of the total number of 24hr Prior HBEB trips originating from Sheffield City Region have a trip length greater than 180 kms. The average trip length for HBEB trips up to 180 kms was estimated to be equal to 29 kms and therefore, very close to the NTS equivalent (30.6 kms).

The results were similar for the Prior NHBEB trips, where the 95% of trips originating from the model's internal area are shorter than 180 kms and have an average trip length of about 26kms. This is not far from what NTS suggests; 22kms.

As far as the Prior NHBO trips are concerned, it was observed that only 3% of trips of that demand segment are actually longer than 100 kms. The average trip length for NHBO trips up to 100kms was found to be equal to 12.7 kms and thus, close enough to the NTS estimate of 11.3 kms.

Further details of this test are available in Appendix G.

7.7.5 Test 5: Inter-District Symmetry

A symmetry test was also undertaken as part of the Prior matrix validation, to examine the relation between the Prior Matrix all day outbound and inbound trips at a district level and verify the symmetry of the Prior Matrix. The test was undertaken by calculating the percentage difference between outbound and inbound trips for each district to district combination in the Internal SCR area.

Figure 36 presents the results of the symmetry test. The percentages % depicted on the symmetry table below represent the percentage difference of each outbound district to district movement from the average of the specific outbound and the symmetric inbound movement.

The Prior matrix appears to be satisfactorily symmetric, as no outbound district to district movement differs more than 6% than the respective symmetric inbound one. The symmetry is quite good for movements between the internal districts and the external area as no difference greater than 3% was observed.

24hr Prior Matrix Symmetry	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External
Sheffield		-2%	-1%	-1%	-1%	-1%	0%	0%	-1%	3%
Rotherham			0%	1%	2%	-1%	0%	2%	-1%	0%
Doncaster				1%	1%	-5%	-3%	6%	-1%	0%
Barnsley					-3%	-3%	-5%	3%	1%	-1%
Chesterfield						-1%	-1%	-1%	-1%	0%
NE Derbyshire							0%	-2%	-1%	-1%
Bolsover								2%	-2%	0%
Derbyshire Dales									2%	-1%
Bassetlaw										-1%
External										

Figure 36. Symmetry test for the 24hr Prior People Matrix (All Purposes)

Further details of this test are available in Appendix G.

7.8 Preparation for Network Assignment

7.8.1 Step 12: Conversion of the Prior People Matrices to Vehicle Matrices

The conversion of the Prior Matrix from People to Vehicle matrices was necessary so that the modelled demand can be assigned onto the highway network.

For that purpose, National Travel Survey (NTS) Household Data relevant to the SCR (Yorkshire and Humber and East Midlands) were extracted by purpose of travel (HBW, HBEB, HBO, NHBEB, NHBO) and distance band (for every 1 km) separately for drivers and passengers. For each distance band and journey purpose, total number of NTS driver and passenger trips were calculated. Adding passenger trips to driver trips and dividing the sum by the number of driver trips, provided an occupancy factor by distance band for each purpose. These data were sequentially used to develop continuous linear functions, where for each journey purpose occupancy (number of people per vehicle) is dependent on the distance travelled in kms.

In the case of Employer's Business trips, both home and non-home based, not much variation of occupancy with the distance travelled was observed. For that reason, a demand weighted average of occupancy was calculated by the relevant NTS Data and applied to Prior People matrices. For HBEB trips, the weighted average occupancy was estimated to be equal to 1.10 people per vehicle, while for non-home based trips of the same user class a slightly lower occupancy of 1.08 was calculated.

For commuting trips, the occupancy range was found to be between 1 to 1.2 people per vehicle with the occupancy value decreasing as the distance travelled increases. Our approach was that, although there is some variation of occupancy with distance for commuting trips, it is not that significant to necessitate the use of a linear function and therefore, the weighted average occupancy as derived from NTS data (1.17 persons per vehicle) would be adequate.

However, it was considered more appropriate to introduce an element of variation of commuting occupancy with the time of the day and thus, we decided to use the recommended WebTAG vehicle occupancies at a time period level (TAG Unit 3.5.6 Values of Time and Vehicle Operating Costs, Section 2.5, Table 4). The occupancy values applied to commuting trips were the following: a fixed occupancy factor of 1.16 for the AM period, 1.14 for the IP and PM peak period and 1.13 for the off peak.

For HBO and NHBO other trips, a significant fluctuation of occupancy with distance was observed and hence, instead of applying a single occupancy factor, an occupancy function that varies with distance was used.

The following linear distance-based occupancy functions were applied to home and non-home based other trips respectively:

- Home-Based Other trips: Occupancy (OD matrix) = 1.666 + 0.00414 * "Distance"
- Non-Home Based Other trips: Occupancy (OD matrix) = 1.510 + 0.00569 * "Distance"

The two functions above were applied to home and non-home based trips up to 40 kms. For longer trips, a fixed occupancy was calculated, equivalent to the occupancy value in the distance of 40kms (cap), as derived from the linear functions for home and non-home based trips respectively. The reason for capping off at 40kms was the fact that there were too few NTS observations in distance bands greater than 40kms. The output of the process was the generation of an Origin Destination (OD) Occupancy Matrix based on the skimmed distance of each OD Zone Pair.

Further details of this step are available in Appendix G.

7.8.2 Step 13: MGV Assignment User Class

As discussed earlier in this report, the OGV freight demand in Sheffield City Region Transport Model was derived from the TPS freight matrices, factored to match the count data.

However, the OGV user class in the TPS model includes both MGV and HGV trips while MGVs form a separate assignment class in SCRTM1. Thus, the factored OGV TPS matrix had to be further split into the two different vehicle types.

The use of CSRGT was explored as a source of data to undertake this split however there was insufficient data even at the national level therefore the other data sources mentioned below were used. These sources gave an incomplete picture of the MGV / HGV split therefore it is recognised that the quality of the MGV and HGV matrices are poorer than other vehicle types. However we believe that they are as good as can be achieved with the data that were available.

To estimate the proportion of MGV over OGV trips, observed data was required. According to MCC (Manual Classified Count) Traffic data, the proportion of MGV over total OGV traffic for Sheffield City Region is, on average, equal to 25% in the morning peak period, 24% in the Inter Peak and 19% during the evening peak period. The MGV over OGV traffic split derived from MCC count data was also validated against DfT statistics for “Heavy goods vehicle traffic by axle configuration and road category in Great Britain, 2016” (Table TRA3105). According to that source of data, rigid vehicles with 2 axles constitute about 32% of total OGV vehicle-kms across all road types for the whole of Great Britain, a percentage close to the split that the MCC counts suggest for our internal area.

To convert the proportion of MGV traffic to actual number of MGV trips, total OGV vehicle-kms were calculated from the model matrices. Then, the total number of MGV vehicle-kms was calculated by multiplying the total TPS OGV vehicle-kms with the relevant proportion of MGV over OGV traffic. Using the above number of total MGV vehicle-kms as a constraint, a calibration process was developed to generate a smooth trip length distribution for MGV trips. It was assumed that the trip length profile of MGV trips is similar to the LGV trip length profile but also includes some longer distance trips. The average MGV trip length is expected to be higher than the average LGV but lower than the average HGV trip length.

Overall, the process was largely based on the assumption that MGV trips that originate in Sheffield City Region broadly follow the trip length distribution of the LGV trips, while satisfying at the same time the following constraints:

- the level of MGV demand by distance band cannot be greater than the relevant number of total TPS OGV trips;
- the total MGV vehicle-kms by time period should be equal to the product of total OGV vehicle-kms and the average proportion of MGV over OGV traffic, as estimated by MCC count data.

The LGV curve was shifted gradually via a single adjustment factor towards longer trips, until it was possible that these two constraints were satisfied; this occurred when MGV average trip length was roughly twice that of LGV. A number of MGV trips are still expected in longer distance bands, as well as a number of HGV trips in the short distance bands.

The output of the process was the calculation of a smooth MGV proportion curve across distance separately for each time period, where the MGV demand % for each Origin Destination Zone pair is described by a power function of the distance between these zones (trip length).

Thus, the Prior MGV OD matrix was generated by applying this power function of distance to the OGV user class. The remaining TPS OGV demand was assigned to the HGV user class.

The MGV curve was calculated based only on freight trips that are generated in Sheffield City Region, as the process makes use of the LGV trip length distribution for internal productions only. However, it was applied also to trips that have as destination Sheffield City Region, as they are expected to have a similar trip length profile with the outbound trips originating from Sheffield City Region.

For external to external trips, that have a completely different trip length distribution compared to the rest of the matrix, the average proportion of MGV over OGV traffic was used to split the total external OGV demand to MGV and HGV trips.

It should be mentioned that the PCU factor applied to MGV trips was 1.5, whilst 2.3 was used for HGV trips.

Figure 37 to Figure 39 below show the trip length distributions of all freight user classes by time period only for trips that originate in the internal area, after splitting OGV to MGV and HGV vehicle types.

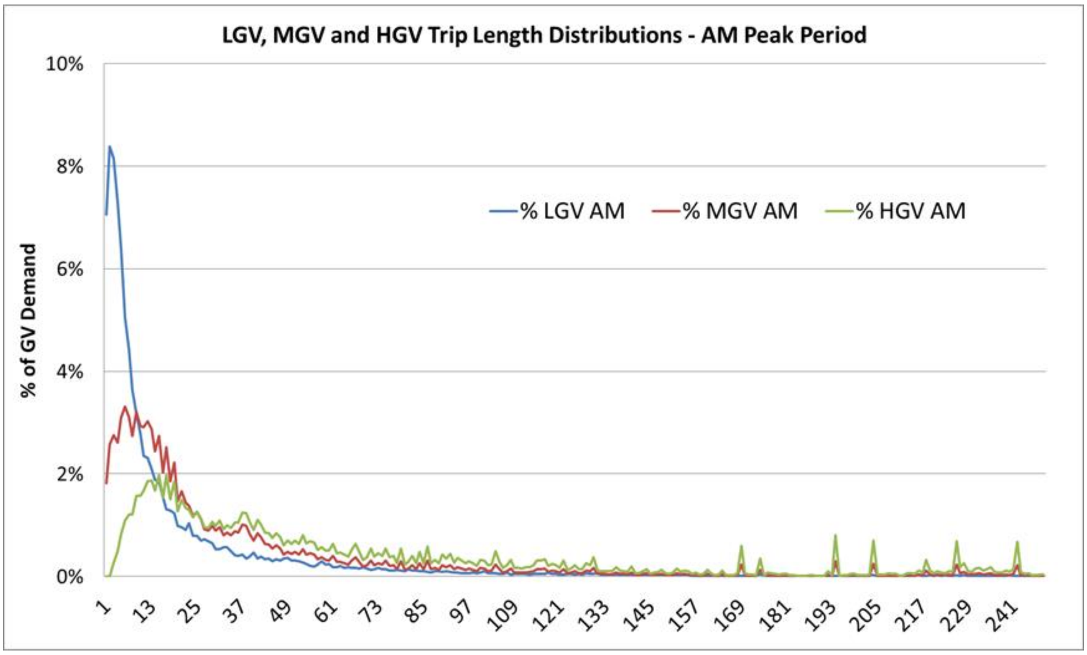


Figure 37. Freight Trip Length Distributions – AM Peak Period

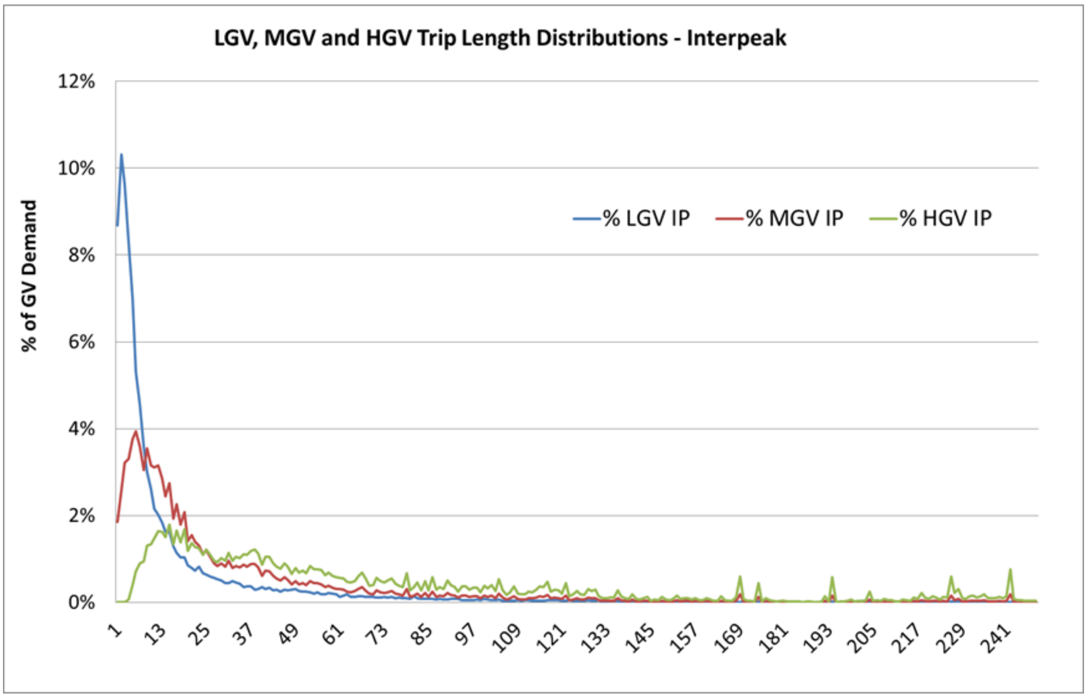


Figure 38. Freight Trip Length Distributions – Interpeak Period

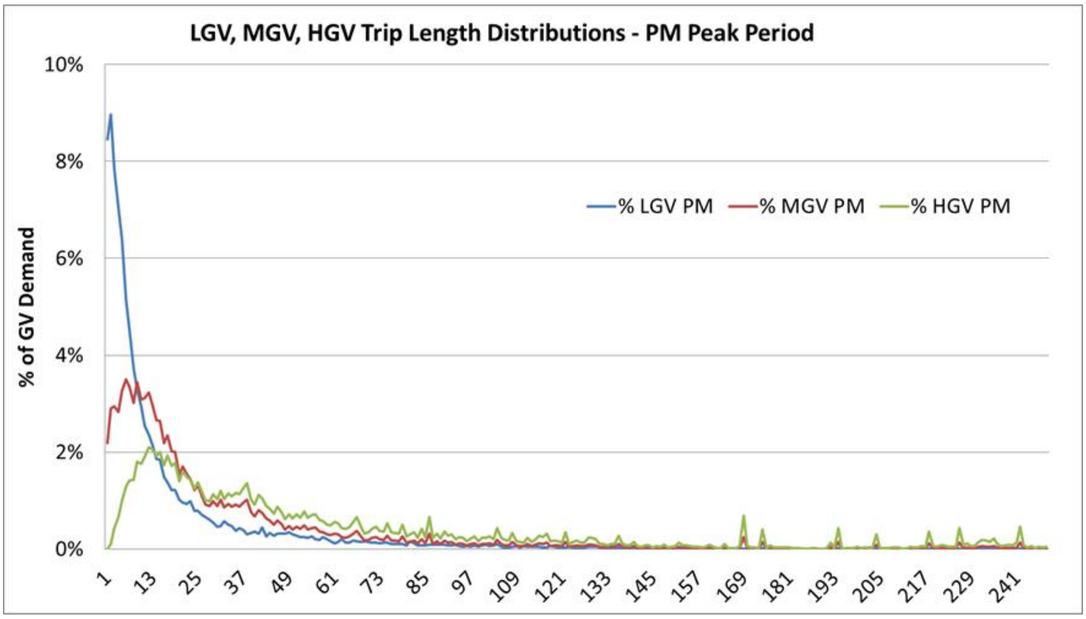


Figure 39. Freight Trip Length Distributions – PM Peak Period

MGV trips, despite comprising a 19% to 25% of total OGV traffic (vehicle-kms), count for a significantly higher proportion of total OGV trips across all time periods (between 30% and 41%) because of their average trip length being shorter than that of the HGV trips. In particular, MGV average trip length varies from a minimum of 34 kms in the PM peak period to a maximum of 38 kms in the AM peak period.

Further details of this step are available in Appendix G.

7.8.3 Step 14: Apply factors to Vehicle Prior Trips based on existing donor models and count data

After the conversion of the Prior People matrices to the six vehicle user classes (Commuting, Employer's Business, Other, LGV, MGV & HGV) by time period at a peak hour level, the matrix was assigned onto the highway network.

This allowed the comparison of i) the modelled flows against the count data and ii) the model's journey time routes against the observed TrafficMaster data. Both comparisons indicated that the Prior matrix demand was lower in volume of trips compared against the counts (about 20% overall), whilst the model's journey times on the primary routes within Sheffield City Region were generally quicker than what TrafficMaster data were suggesting. The prior matrix was also validated against existing donor models for Sheffield City Region (SYSTM+, SRTM and the Barnsley Transport Model) and a matrix estimation run was undertaken to enable us quantify the impact of estimation on our matrices and the matrix changes brought about.

Comparison against the donor models also suggested that the Prior Matrix had the right level of demand for movements between Sheffield City Region and the external area but was found to be lacking shorter distance, intra-district trips. This was found to be the case for intra-district movements within Sheffield, Rotherham, Doncaster, Barnsley and Bolsover. This finding was also supported by the results of matrix estimation, where the specific movements were factored up resulting in a significant increase in the total number of trips.

Therefore, we came to the conclusion that, although the Prior Matrix passed all of the validation tests and was found to be consistent with other secondary sources of data, it does still have a few weaknesses that should be addressed before actually being used in our model. Thus, some further factoring had to be applied at a vehicle, user class level by time period.

The set of factors applied, summarised in Figure 40 below, were based on:

- Comparison of district to district movements between the Prior vehicle matrices and the respective donor models (SYSTM+, SRTM and Barnsley Model);
- Comparison against the count data;
- The actual change observed amongst the Prior Matrix (Pre estimation) and the Post Matrix Estimation Matrix in terms of trip totals at an SCR district to district level.

The highest factors are applied on intra-district trips within Barnsley across all time periods and on trips within Rotherham during the Interpeak.

From	To	AM	IP	PM
Sheffield	Sheffield	1.00	1.54	1.21
Rotherham	Rotherham	1.25	1.74	1.35
Doncaster	Doncaster	1.21	1.28	1.31
Barnsley	Barnsley	1.70	1.68	1.75
Bolsover	Bolsover	1.30	1.30	1.30

Figure 40. Factors applied to car vehicle intra-district movements

Further analysis was undertaken to understand the trip length profile and the proportion of short distance trips over the total number trips for the specific factored intra-district movements.

It is observed that in all cases, short distance trips count for the majority of intra-district trips. The lowest percentage of short distance trips is equal to 55% for trips within Doncaster in the AM peak hour and the highest reaches 89% for Bolsover intra-district trips in the PM peak hour.

In the Prior Matrix, the short distance trips are not derived from the provisional Mobile Phone Data but are instead infilled from the SCR synthetic matrices. As discussed earlier in the report, synthetic matrices have been built using DfT's CTripEnd Model structure and are based on NTS trip rates that vary based on area type.

NTEM v72 includes eight different levels of area classification based on population. However, each level covers a wide range of population bands and Sheffield, for example, is included in the same category with other less populated areas such as Stockport, Tameside or Salford.

Therefore, NTS trip rates, although providing us with accurate information about the demand for trips at a whole country level, they tend to underestimate the trip rates for model areas of a smaller size, such as Sheffield City Region, in our case. This finding explains why we are lacking trips in the short distance bands.

Figure 41 below summarises the total number of district to district movements between Sheffield City Region and the External Area after factoring the vehicle Prior Matrix.

All Purposes Car Vehicles 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	434,996	56,890	7,297	19,812	11,144	21,138	3,761	4,158	3,622	32,279	595,096
Rotherham	59,916	156,117	21,794	22,214	1,910	3,432	2,218	344	9,696	18,112	295,754
Doncaster	7,559	22,157	250,792	9,207	460	446	432	120	10,771	40,652	342,595
Barnsley	20,513	21,775	9,023	140,998	299	341	206	106	517	36,945	230,722
Chesterfield	11,357	1,849	445	316	75,362	21,950	8,195	4,816	1,080	10,924	136,296
NE Derbyshire	21,866	3,478	493	359	22,294	28,597	5,844	3,329	1,070	13,194	100,524
Bolsover	3,812	2,218	454	224	8,474	5,930	29,290	784	4,038	29,301	84,525
Derbyshire Dales	4,102	337	103	102	4,920	3,459	749	57,644	180	29,608	101,204
Bassetlaw	3,729	9,868	11,004	500	1,096	1,109	4,239	172	87,477	24,574	143,769
External	30,870	18,425	41,013	38,009	11,013	13,535	29,050	30,247	25,088	68,705,410	68,942,660
Total	598,719	293,114	342,418	231,743	136,972	99,937	83,982	101,721	143,539	68,941,000	70,973,146

Figure 41. Final Prior Matrix Vehicle Trips at an SCR District level

Further details of this step are available in Appendix G.

As a sense check of the distribution of trips we have compared the 24 hour origin trip ends with population in each district. We would expect there to be a reasonable correlation between them although differences in modal share and the amount of trips crossing in and out of each district will weaken the relationship. The relationship is shown in Figure 42. This shows an excellent correlation between the two adding weight to the quality of the prior trip matrix.

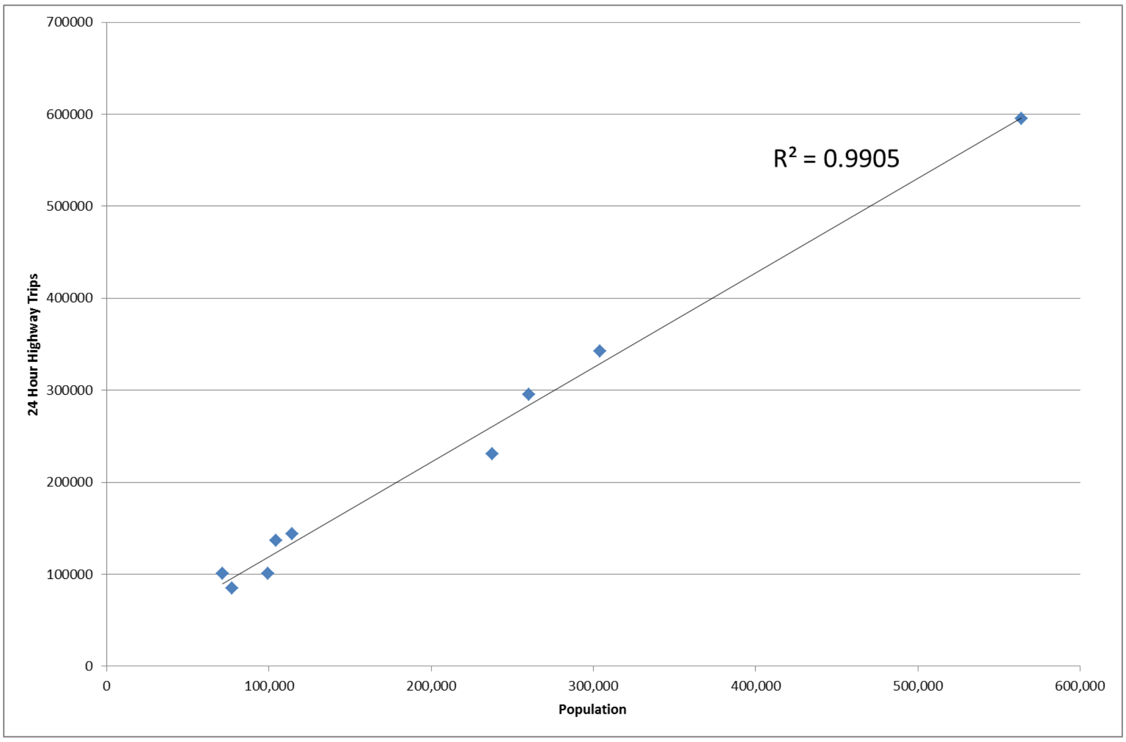


Figure 42. Comparison of Vehicle Trips and Population

7.9 Conclusions - Final Outputs

The Highway Matrix Development Process resulted in the derivation of the Prior Matrices for each of the six assignment user classes:

- User Class 1: Car Commuting
- User Class 2: Car Employers Business (Including Home and Non Home Based Trips)
- User Class 3: Car Other (Including Home and Non Home Based Trips)
- User Class 4: LGV
- User Class 5: MGV and
- User Class 6: HGV

After the adjustments undertaken, the Prior Matrix is considered to adequately reflect and to be representative of the trip making behaviour and the main travel patterns observed in the model's area of focus (Sheffield City Region), and thus is regarded appropriate for use in the context of the SCRTM model.

A series of tests have been made to compare the prior matrix against other data sources. These show a good level of comparison.

Test 1 - Journey Purpose – There is a very good match against the synthetic matrix purpose splits which in turn are based on NTEM.

Test 2 - Time period splits – The prior matrix splits are a good match to the NTS splits

Test 3 – Trip Ends by District and Journey Purpose – There is a reasonable fit between the prior matrix and the Synthetic matrix.

Test 4 – Trip Lengths – There is a reasonable fit between the prior matrix and the synthetic matrix

Test 5 – Matrix Symmetry – The matrix has a high level of symmetry, particularly for the larger movements.

In addition, there is a high level of correlation between the trip ends at a district level and the population of that district.

A thorough and more detailed description of the highway matrix build process is included in the Matrix Development Report that can be found in Appendix G.

8. Network Calibration and Validation

8.1 Pre Calibration Network Checks

A wide range of network checks were undertaken as part of the calibration of the model.

8.1.1 Junction Types

The appropriateness of each junction type within the model was visually checked against aerial photography, to ensure an accurate representation of the on the ground network. The visual check was conducted in SATURN's P1X programme, displaying node shapes based on the selected node type. Each of the node types were displayed and checked individually.

8.1.2 Entry Lanes

In order to determine whether the correct number of lanes have been allocated at junctions, the number of lanes per link were plotted in P1X and checked visually against aerial photography and Google StreetView.

8.1.3 Turn Restrictions

Routeing was checked between many zone pairs and through key junctions, where unexpected movements occur then these where investigated. This was supported by further checks, detailed in 8.2 and 8.3.

8.1.4 One-way Roads and No Entries

One-way Roads and No Entries were plotted in P1X and a visual check undertaken. These were correlated against aerial photography, and all were found to be sensible.

8.1.5 Saturation Flows

Where new coding was inserted into the model the Highways England Regional Model Coding manual was used as a guide. As discussed earlier, saturation flows from the various contributor models had been harmonised to this standard. Checks were done to compare the number of lanes at the stop line against the saturation flow and outliers investigated. Whilst coding and using the model, visual ad-hoc observations checked that the coding of adjacent junctions was consistent and did not vary unacceptably. Checks for delay and routeing within the assigned model helped to further identify incorrect saturation flows. (See 8.2 and 8.3)

8.1.6 Link lengths

As discussed in 6.2.1, checks to link lengths were conducted to ensure they were correct. The LPN file was used to check all links where the distance differed in opposite directions. In some cases the difference was understandable e.g. a highly curved link. Further checks were carried out to ensure that the coded link lengths were accurate, using SATURN's built in function to identify links outside of the value of 1.1 and 1.3 times the crow-fly distance through error messages. Where instances of these errors occurred, link measurements were checked and amended, if appropriate.

Analysis was also conducted along longer corridors through the simulation network, further ensuring accuracy in link lengths. This was undertaken using the Joy Ride function within P1X, allowing the user to traverse a selected route and calculate the cumulative distance. This was then compared to point to point route distances from Google Maps. The following route types were checked:

- Motorway sections;
- Primary rural routes;
- Radial routes; and
- Orbital routes.

In addition many of the key links in the model are included in journey time routes. The length of these journey time routes were checked against ITN layer information (via TrafficMaster/Strat-e-gis).

Finally, it is worth remembering that the majority of the network has come from other calibrated and validated models. So many of these checks will already have been performed and the coding revised where necessary on nearly all the network.

8.1.7 Network Documentation and Completeness

At this stage there were 9638 nodes in the SCR model and 14582 simulation links. In total, there are 51634 links, including simulation and buffer links, along with simulation and buffer centroid connectors. For the network development, including all aspects of network coding, checking and calibration/validation, the ‘SATURN version 11.4.07F - Level N4’ was used for assignment.

Appendix C shows images of the network in greater detail to see exactly which roads are included within the model.

8.1.8 Network Compilation

Warnings generated during the network build have been analysed, with all Fatal and Semi Fatal (NAFF) errors removed. SATURN produces an “ERL” file which provides a summary of the number of various warning and error codes and their locations on the network. This file has been analysed and, where necessary, changes to the network coding have been made.

The table in Appendix I provides a summary of the checking process and details what steps, if any, were undertaken to remedy the error.

8.1.9 Consistency of Coding

To ensure consistency in network coding throughout the model, a system has been developed and implemented to make sure that the speed flow curve is representative of all road types. This has been checked in P1X, with the display of capacity index on each link. Particular checking has focussed around urban areas and key / major routes.
Plots of different types of speed flow curves were done within P1X and GIS to check consistency of coding. Using GIS software also made sure that the central / non-central / rural distinction was logical. Finally routeing checks and journey time analysis on key routes would identify where inappropriate was used, and allow correction.

8.1.10 Check of Key Junctions

Further analysis using P1X has been focussed around the coding of key junctions, which have been identified within the simulation network. The key junctions within the network have been identified through analysis of the Primary Road Network (PRN). The PRN is defined as “roads that provide the most satisfactory route between places of traffic importance” (Department for Transport (DfT), 2012). These checks have been conducted to ensure that correct coding procedures have been followed to ensure that the model behaves as close to reality as possible.

8.1.11 Network Connectivity

The checking of network connectivity has been undertaken using the ‘Joy Ride’ function within P1X. This allows the user to traverse a selected route and calculates the cumulative distance. This was compared to point to point distances from Google Maps. Further analysis of route choice can be conducted through the ‘Tree’ function within P1X, allowing the user to select an origin and destination, with SATURN then calculating and plotting the most efficient route. This route can be compared to that of the route in Google maps in order to assess the effectiveness and logic of the coded SATURN network.

8.2 Network Calibration

After the network was fully coded, tests against Trafficmaster journey times were performed, it was found that it was not possible to create the required junction delay with the observed count. To check that the journey times were not unrealistically slow, TrafficMaster times were compared to the same route out of Google Maps. In the majority of cases the time prediction interval included the Trafficmaster time albeit towards the slower end of the interval. This gave some confidence that the model was too fast. This model being too fast was likely down to a combination of the following:

- Speeds on links were coded too high;
- Saturation flows had been coded too high.

Both the speeds at free flow and capacity were reduced by 5%, for all speed flow curves other than those that are based directly on COBA. All turning saturation flows were reduced by 15% across the whole model.

It was considered that the distinction between Central Urban and Non-Central Urban speeds was not sufficient, this was reflected in journey times being too quick in Central areas. Therefore the speed at free flow and capacity was reduced by 10 kph for each of these links.

It was found that in the model traffic was using too many 'rat-runs' and not sticking to the main roads. This could be down to many reasons, including possibly that in reality the average speed on these types of roads would be lower than what had been coded. It was decided to split the network into, primary and secondary links. The primary network consisted of all the Strategic Road Network, and the major routes across SCR, Most of the B-roads were designated as being Secondary Network, except for where there was no A-road equivalent. Nearly all the links in the journey times routes, mentioned in 5.10, belong to the Primary Network.

Different percentage reductions were applied to the link speeds on the secondary network, with the model resulting checked against counts and journey times. Looking at the total amount of time over all journey time routes, this was 9% too quick in the two peak hours, but only 1% too quick in the Interpeak. Table 23 shows the result of different reductions being applied to the secondary network. However, this needed to be balanced against the change in counts. The best balance between the two was at 30% reduction for secondary network. This can be considered as a calibration of the speeds on the secondary road network where speed and journey time information was not available. The capacities and 'n' value of Speed Flow curves remained unaltered. These revised capacity index numbers are shown in Appendix D.2.

Table 23. JT Passing compared to reduction factor applied

Reduction applied to secondary network	AM Difference	IP Difference	PM Difference
0%	-9%	-1%	-9%
10%	-7%	0%	-7%
20%	-6%	1%	-6%
30%	-4%	3%	-3%
40%	-1%	4%	-1%
50%	2%	7%	3%

Source: AECOM

As a number of junctions now had significantly reduced capacity, the model was again reviewed for large delays, and local changes made where required. Capacities were also checked against counts, and coding revised where the capacity was below the count.

8.3 Network Validation

Delays in the model were checked against other sources such as Google Traffic and local knowledge to make sure that delays were reflective and plausible. Now that the model was assigned we could look into areas with large delay and unrealistic flow.

Some ad-hoc routeing checks between areas of the model were checked which helped discover errors with:

- banned turns;
- permitted turns;
- signal settings;
- link distances;
- speed flow curves;
- fixed link speeds;

Further validation of the network occurred during the rest of the process and is detailed in subsequent chapters.

9. Route Choice Calibration and Validation

9.1 Route Choice Calibration

The main purpose of the highway assignment model is to assign travel demand to the road network and thus fulfil the route choice stage of the modelling process. The choice of route is therefore one of the most critical elements of the model.

Route choice is at the heart of assignment models. It is a function of the relative costs of competing routes which in turn is a function of the traffic using them. This cyclical problem is resolved within SATURN through an internal iterative process but this in turn depends on the ability of the model to provide a realistic assessment of journey cost.

Route choice is also a function of the values of time (PPM) and distance (PPK) used in the model calculated as described in Section 4. The Department for Transport (2.8.6 of M3.1 Webtag) now recommends against changing the relationship between the PPK and PPM values as a means of calibrating the route choice and therefore the assignment, meaning that the general options available for calibrating route choice are limited to making corrections to the network where inappropriate routes are identified.

Journey cost consists of two basic elements: journey time and journey distance. Each of these must be modelled as accurately as possible in order that routes can be chosen correctly. Journey distance is easily measured and is a parameter that is input directly into the model. Journey time is calculated within the model as a combination of input speed data and calculated delays.

Incorrect route choice usually shows itself as model flows that are significantly higher or lower than the observed flows. This is best done using the prior matrix assignment but should also be checked after matrix estimation. A high modelled flow on one corridor with a corresponding low modelled flow on a neighbouring corridor is generally an indication of incorrect routing. Checks were made for each time period to identify problems of this nature. These were then examined to understand the reasons for the incorrect routeing. In many cases the delays at nodes were either under or over represented due to incorrect coding of saturation flows or gap acceptance parameters.

9.2 Route Choice Validation

Following WebTAG guidance 40 routes were chosen to consider route choice. These cover a wide range of distances (6 km to 310 km), journey times and are spread throughout the region. Routes were chosen: within local authorities, between local authorities and strategic trips passing through SCR. These were extracted in both directions and for each of the three modelled time periods, as routeing may differ by direction and time of day.

Diagrams showing all the routes individually are presented in Appendix J alongside analysis of the routes taken. This analysis suggests that routeing is sensible across the Detailed Modelled area. There is also consistency across the three time periods.

In one case the routeing diagram identified a road which had recently been closed to traffic. The highway network was updated to reflect this and to correct the routing. There are a small number of cases where there are some queries about routeing in the wider Fully Modelled Area however none of these have an impact on the two scheme areas.

10. Trip Matrix Calibration and Validation

10.1 Introduction

Matrix estimation was carried out according to the guidance in WebTAG Unit M3-1 in order to calibrate the trip matrix.

The observed data was split into two groups – counts on calibration screenlines, and counts on validation screenlines. Matrix estimation was therefore applied using counts along calibration screenlines as constraints. This is reported as Step 1 of the calibration.

A final run of estimation was undertaken using all the screenline data in order to further improve the trip matrix calibration and make maximum use of the available data. This is reported as Step 2 of the calibration. This is considered an appropriate approach providing the additional impact of the second estimation is minor.

These counts were grouped together to produce screenline constraints, which were ultimately applied at the mini screenline level, separately for each of the four vehicle types (car, LGV, MGV and HGV). Results are only reported and assessed at car and total vehicle level, in line with WebTAG guidance. The matrix estimation process is summarised below.

- Assignment of prior matrix
- Loop 1 - Calculation of PIJA file (using the SATPIJA module of SATURN, this file contains information on the pattern of trips crossing each screenline i.e. origin, destination and volume information).
- Loop 1 – Estimation of matrix (using SATME2 module of SATURN, this process uses the output from the PIJA file produced above to selectively factor the prior matrix to better fit the screenline count constraints)
- Loop 1 – Assignment of estimated matrix.
- Loop 2 – Calculation of PIJA file based on assignment of estimated matrix created in previous loop.
- Loop 2 – Estimation of matrix (still using prior matrix as starting point).
- Loop 2 – Assignment of estimated matrix.
- loop repeated 6 times in all…
- Assignment of final matrix.
- Results analysis.

Assigned flows from the model were checked for each time periods against screenline totals and individual count sites. The comparisons were done separately for each scheme area and all information across the fully modelled area. In line with WebTAG, we have reported for all vehicles and cars.

As mentioned in Chapter 5 earlier, there are the following number of count sites, screenlines, and journey times (Table 24). These have been split into calibration and validation sets although a final run of estimation was undertaken using all screenlines.

Table 24. Counts, screenlines and JT routes by scheme area

Geographical area	Counts sites by direction	Screenlines	JT Routes
Mass Transit	164	64	46
Innovation Corridor	214	76	54
Pan Northern Connectivity	102	40	68
Fully modelled area	1004	304	150

Source: AECOM

Note that some of the counts, screenlines and JT routes, lie in multiple scheme areas.

The statistics are reported for count sites broken down by:

- All sites, calibration sites, validation sites (note that estimation is not used for the Prior assignment);
- All vehicles and Cars by time period;
- For each of the three scheme areas, and for the fully modelled area.

Screenlines are reported using the same categories with journey times also reported by scheme area and time period.

Finally counts sites are broken down by:

- Counts categories, less than 700, between 700 and 2700, and greater than 2700 vehicles per hour;
- All vehicles and Cars by time period;
- For each of the three scheme areas, and for the fully modelled area.

10.2 Prior assignment – Comparison to Screenline Counts

This section looks at the count sites, screenlines and journey times when assigning the prior matrices to the highway model without any matrix estimation. For a description of var% see Table 4.This is a variable threshold that takes account of screenlines that have fewer than 5 points. Additional comparisons against alternative thresholds (including the standard WebTAG criteria) are contained in Appendix O.

10.2.1 Comparison of Screenline Flows – Prior

Table 25. Calibration Screenlines by Scheme Area within var% for Prior Assignment

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	52%	60%	56%	48%	38%	36%
Innovation Corridor	55%	74%	55%	56%	42%	44%
Pan Northern Connectivity	53%	57%	47%	30%	67%	53%
Fully modelled Area	51%	59%	49%	44%	50%	45%

Table 26. Validation Screenlines by Scheme Area within var% for Prior Assignment

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	57%	71%	71%	36%	57%	79%
Innovation Corridor	70%	60%	50%	20%	70%	70%
Pan Northern Connectivity	30%	40%	60%	40%	30%	30%
Fully modelled Area	54%	60%	56%	35%	60%	58%

Table 27. All Screenlines by Scheme Area within var% for Prior Assignment

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	53%	63%	59%	45%	42%	45%
Innovation Corridor	57%	72%	54%	51%	46%	47%
Pan Northern Connectivity	48%	53%	50%	33%	58%	40%
Fully modelled Area	52%	59%	51%	42%	52%	48%

Around half of screenlines meet the var% criteria. This is below the WebTAG criteria therefore it suggests that some matrix estimation is required.

10.3 Refinement of Prior Matrices by Matrix Estimation – First Stage of Calibration

During the first stage of calibration only the calibration screenlines were used in the matrix estimation process.

Matrix estimation was completed on a screenline basis by time periods for each of the four vehicles classes (Cars, LGV, MGV, HGV). The estimation process in SATURN uses a parameter, XAMAX, to limit the scale of change in the matrix. The parameter XAMAX was set as 3 for cars and 5 for all freight categories. This maintains some control over the changes to the prior matrix while recognising that there is a lower level of confidence in the freight matrices and they may need greater adjustment than the car one. XAMAX is a parameter in SATURN which controls how much a single count can alter the number of trips between two zones. A value of 3 means that the number of trips can be adjusted to be up to three times higher or lower than the prior value.[1].

10.3.1 Comparison of Screenline Flows – First Calibration

Table 28. Calibration Screenlines by Scheme Area within var% for First Stage Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	90%	80%	98%	98%	94%	90%
Innovation Corridor	91%	80%	100%	100%	94%	89%
Pan Northern Connectivity	97%	97%	90%	90%	90%	90%
Fully modelled Area	95%	92%	98%	98%	96%	94%

Table 29. Validation Screenlines by Scheme Area within var% for First Stage Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	57%	71%	79%	86%	93%	93%
Innovation Corridor	50%	60%	70%	70%	90%	90%
Pan Northern Connectivity	40%	40%	40%	50%	60%	60%
Fully modelled Area	56%	57%	64%	68%	65%	60%

Table 30. All Screenlines by Scheme Area within var% for First Stage Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	83%	78%	94%	95%	94%	91%
Innovation Corridor	86%	78%	96%	96%	93%	89%
Pan Northern Connectivity	83%	83%	78%	80%	83%	83%
Fully modelled Area	86%	84%	90%	91%	88%	86%

The percentage of calibration screenlines passing has increased across all time periods with many values above 90% as Table 28 shows.

At a screenline level, the estimation process had a modest positive impact on validation screenline results (Table 29 compared with Table 26) across the whole model area with larger improvements for the Mass Transit and Innovation Corridor scheme areas. Estimation had a much larger positive impact on the fit of the individual counts in the validation screenlines (see 11.2.2). This suggests that some validation screenlines only just fail to meet the acceptability criteria.

Clearly, the values for the Mass Transit and Innovation Corridor areas are lower in the AM peak in particular. However, when judged against a 10% criteria (Table 134 in Appendix O) or GEH<4 (Table

[1] Most factors will not reach the limit. The factor of 3 applies to every site the movement passes through, so sites through multiple sites may be changed by up to a multiple of 3.

137) then the results are considerably higher. This again shows that those screenlines which are not meeting the %var criteria are close to achieving it.

10.3.2 Impact of Estimation – First Calibration

To ensure that the Matrix Estimation (ME2) does not cause a significant change in the matrices then various checks are recommended in WebTAG M3.1.

The criteria used are given in Table 31. These are extracted from WebTAG

Table 31. Reporting Change in Matrix Estimation

Measure	Significance Criteria
Matrix zonal cell values (O-D)	Slope within 0.98 and 1.02
	Intercept near zero
	R2 greater than 0.95
Matrix Trip Ends (Origins and Destinations)	Slope within 0.99 and 1.01
	Intercept near zero
	R2 greater than 0.98
Trip length distributions (User class)	Means within 5%
	Standard deviations within 5%
Sector to sector matrices (user class)	Differences within 5% or 250 vehicles

Source: WebTAG / AECOM

10.3.2.1 Sector system definition and reasoning

A sector system has been developed to allow a comparison of the key movements in the model.

Originally the comparison was going to be performed at a district to district level. However, for some districts these were too large. Therefore it was decided to split the SCR districts into 22 sectors. This was based on population of the districts, so Sheffield was split into 7 sectors, though Chesterfield remained at the district level; see Table 32 for a full breakdown.

Sectors were built using MSOA boundaries, and no sector crossed a district boundary. Sectors were built following natural and physical boundaries wherever appropriate. Many sector boundaries also coincide with screenlines.

In previous model developments we have found it necessary to relax the WebTAG criteria for sector to sector movements where the flows are low. It is not normally possible to achieve an accuracy of +/-5% for low flow movements when building the prior matrix. We therefore normally apply a threshold of 5% or 250 whichever is the greater. The 5% limit will be applied where the flow is greater than 5000 vehicles per hour, which is about the vehicle volume you would expect over a screenline.

Table 32. Number of sectors in each SCR District

District Code	District name	Sectors
10	Sheffield	7
11	Rotherham	3
12	Doncaster	3
13	Barnsley	3
14	Chesterfield	1
15	NE Derbyshire	1
16	Bolsover	1
17	D. Dales	1
18	Bassetlaw	1
20	External	1
---	All	22

Source: AECOM

Figure 43 to Figure 47 show the sector system used for the comparison.

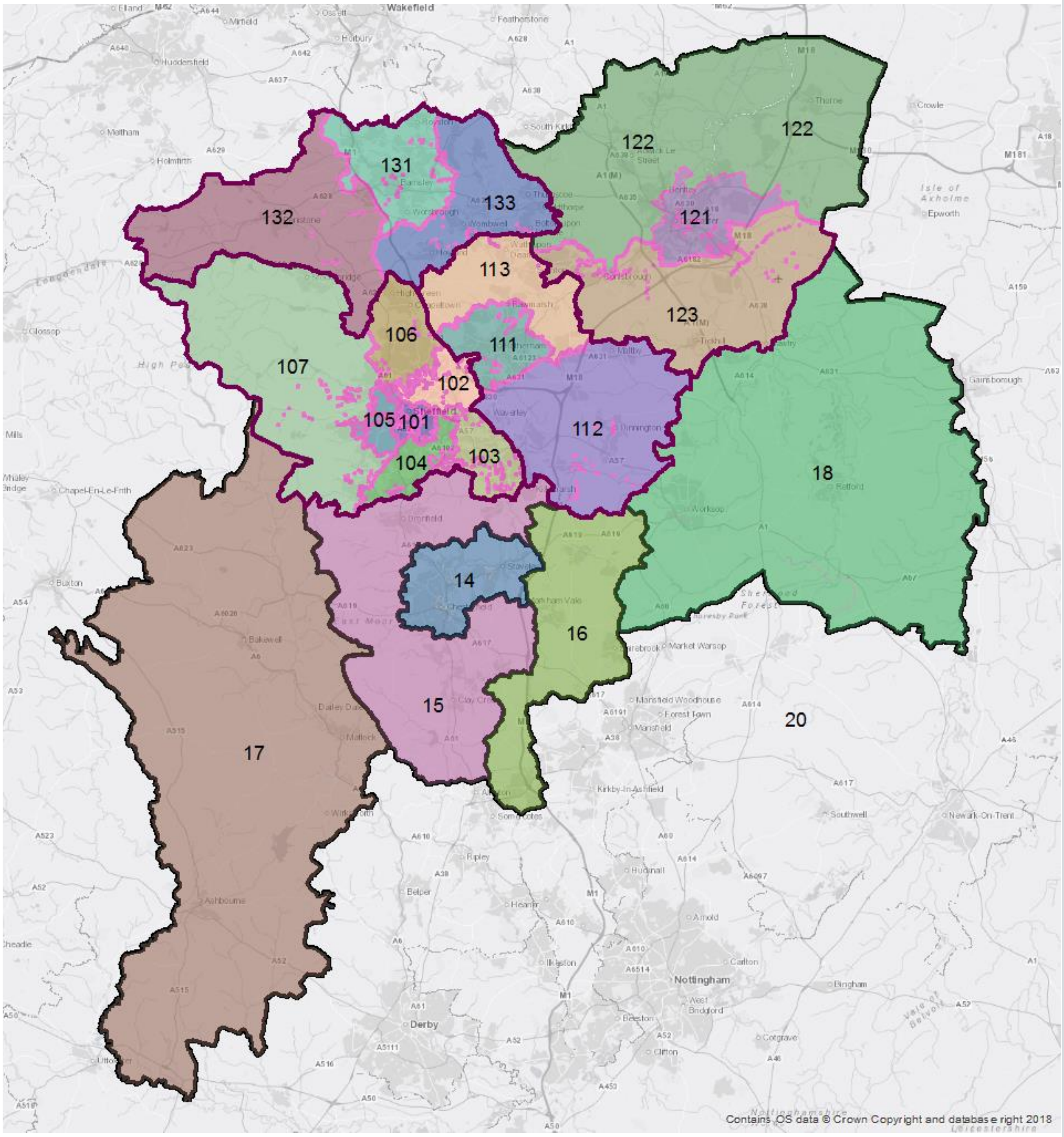


Figure 43. Sector system for SCR

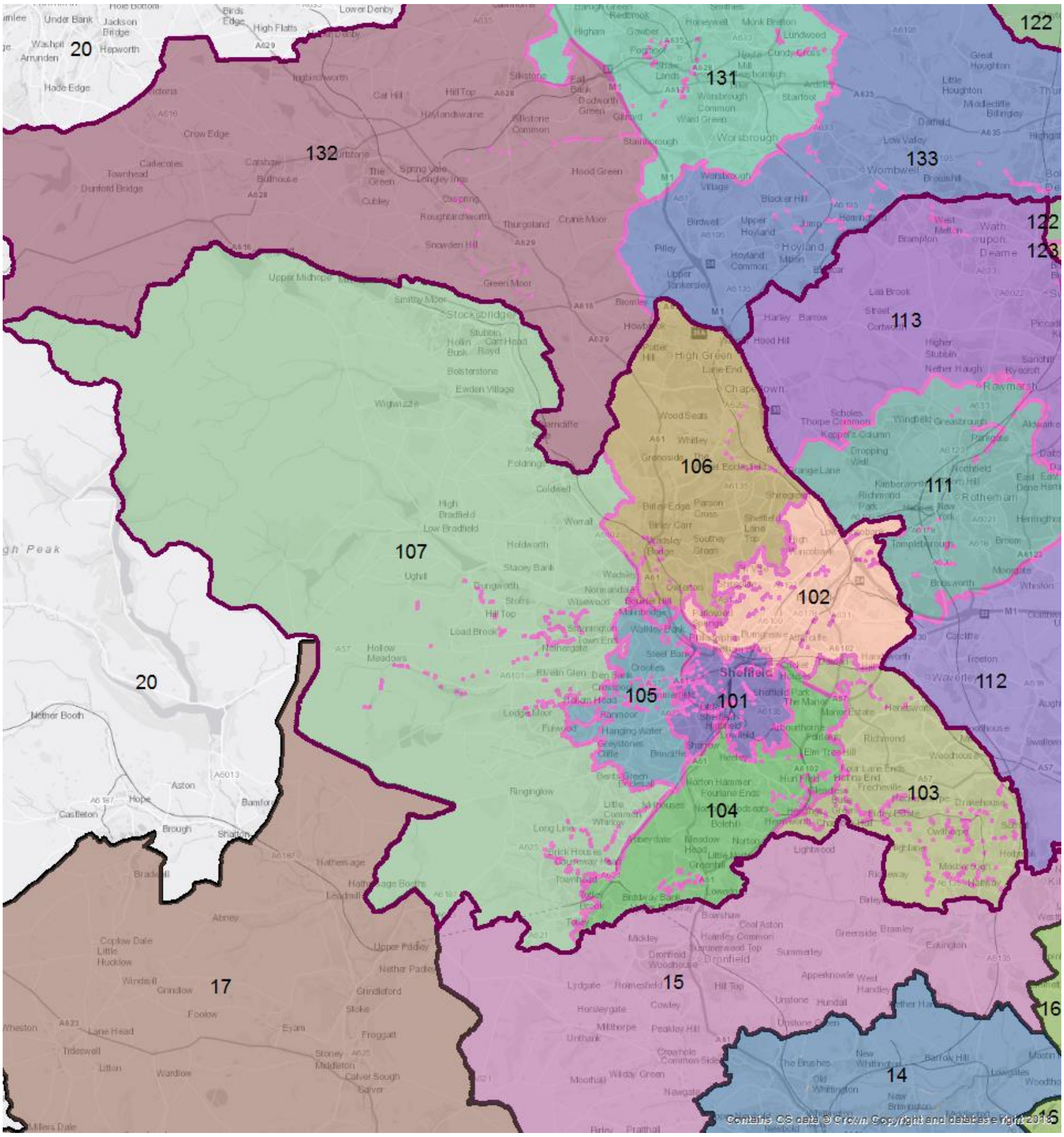


Figure 44. Sector system for Sheffield District

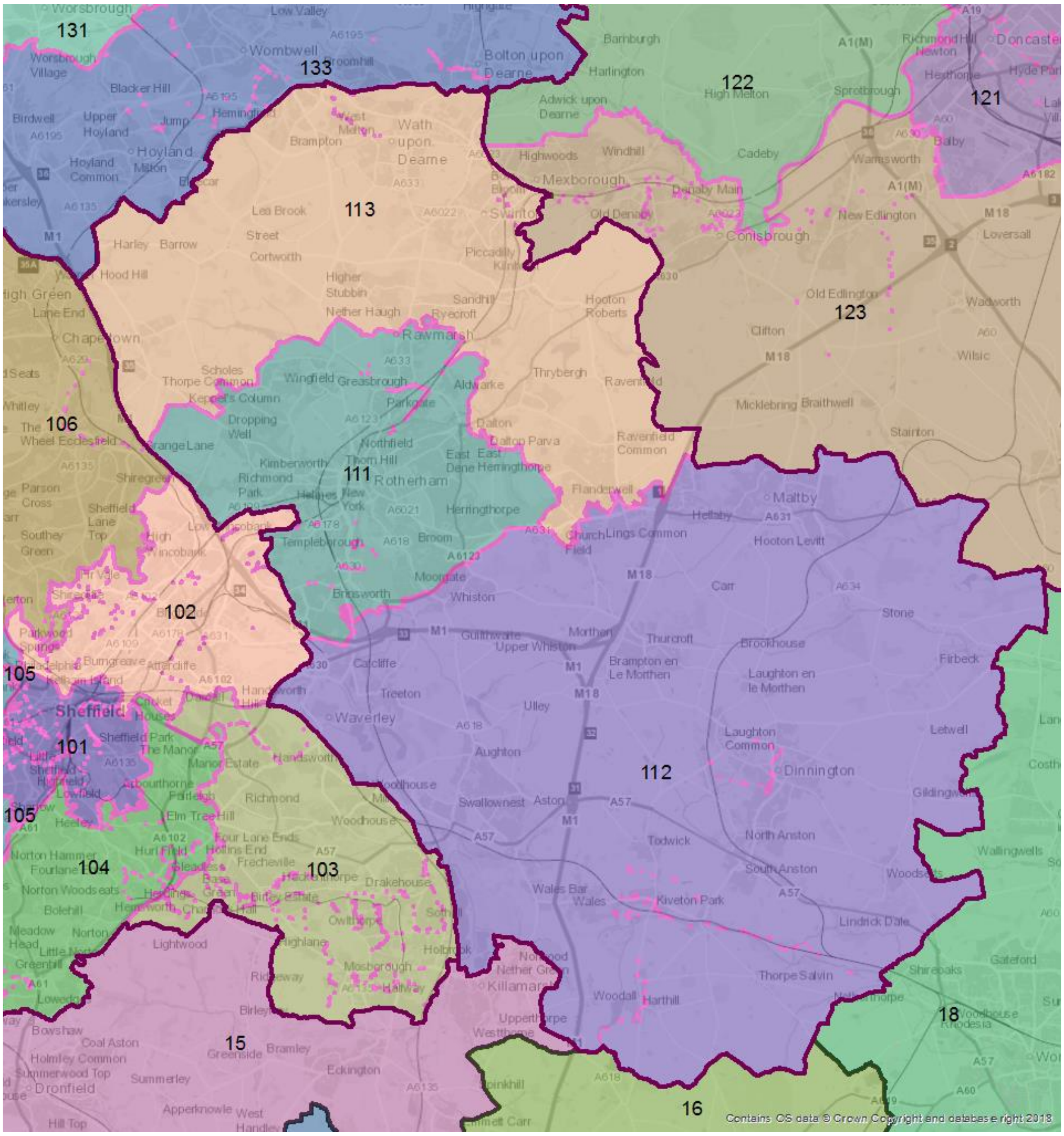


Figure 45. Sector system for Rotherham District

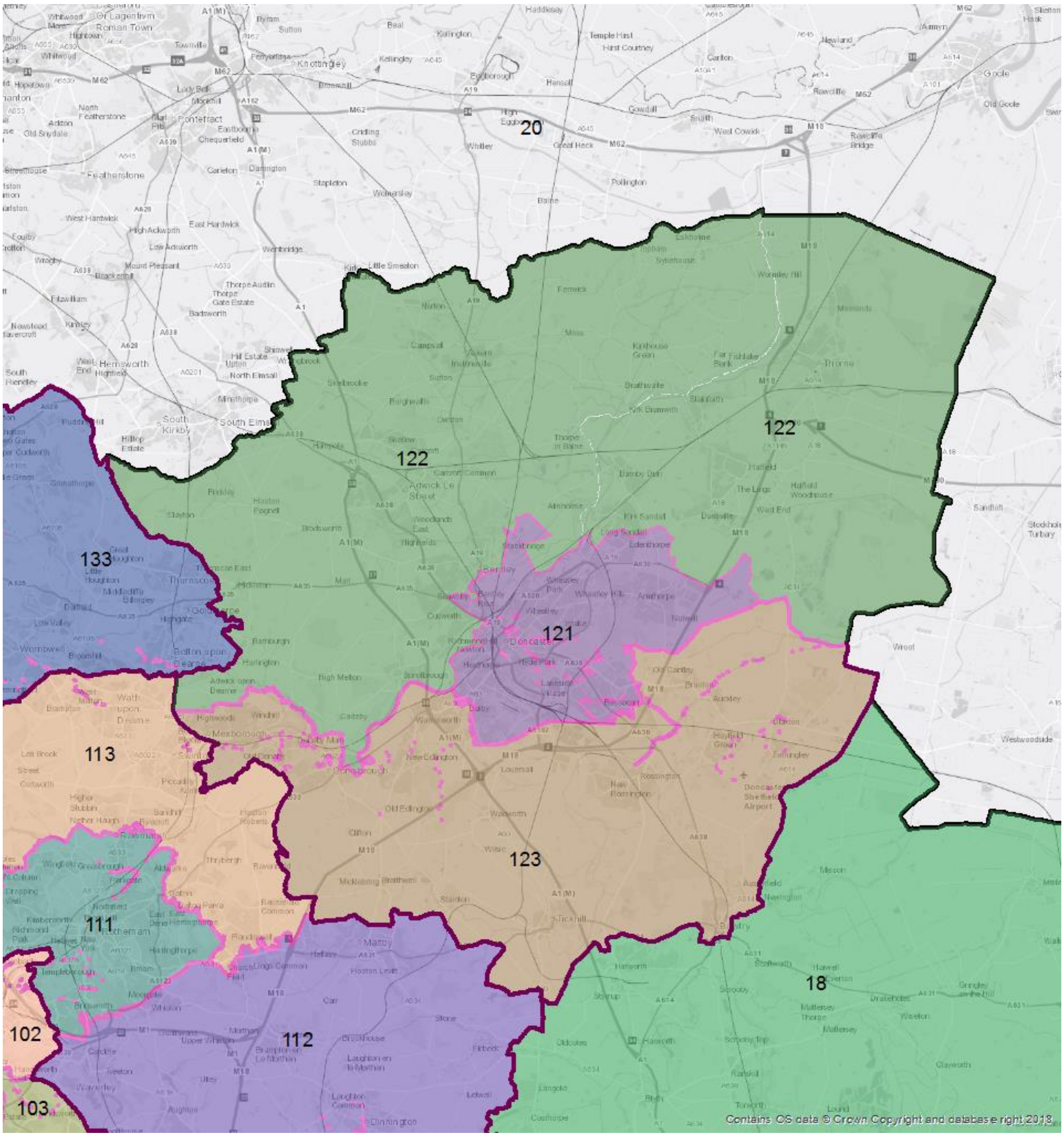


Figure 46. Sector system for Doncaster District

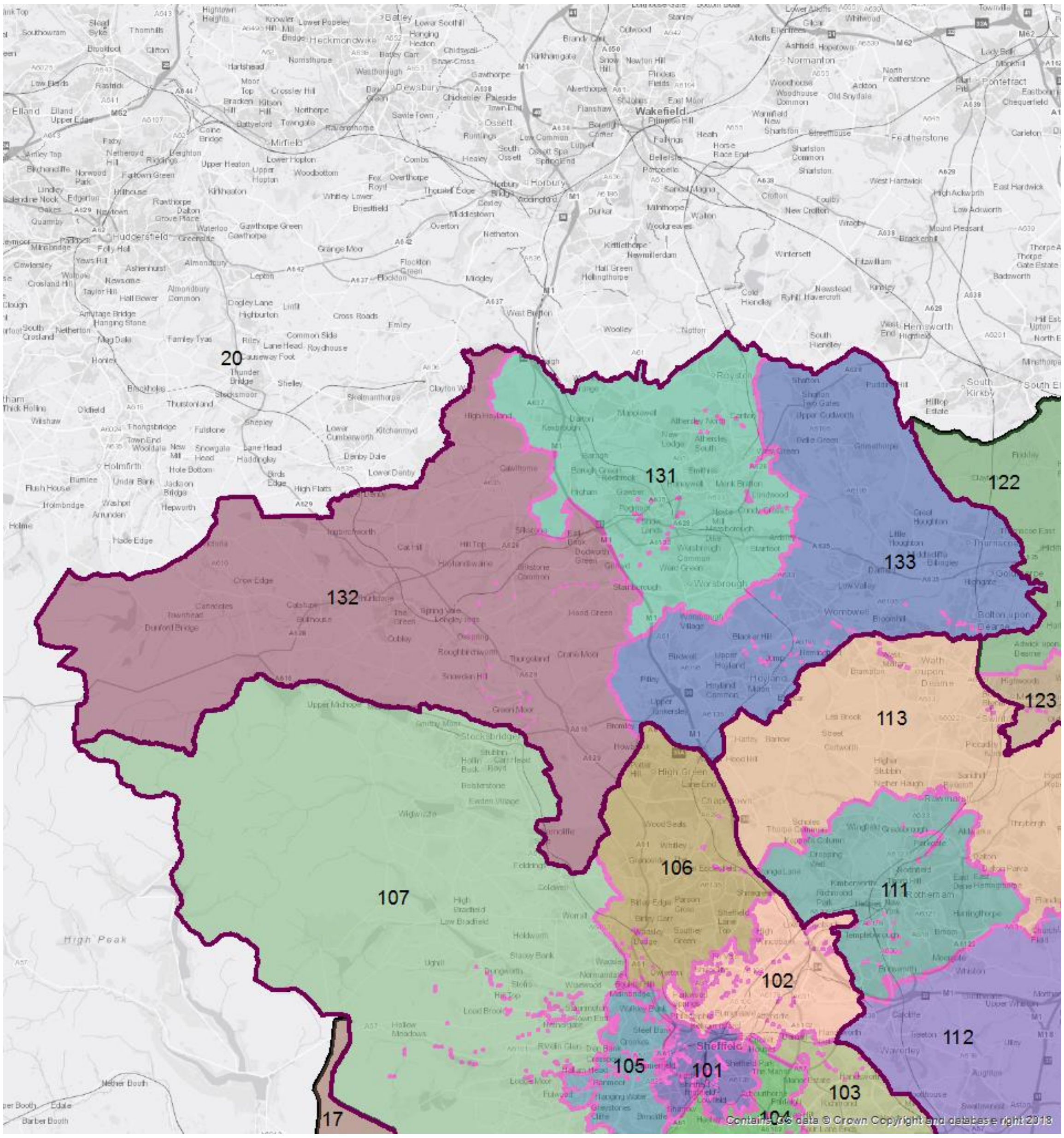


Figure 47. Sector system for Barnsley District

10.3.2.2 Fully Modelled Area versus Whole Model

Results have been presented for the entire model however it is recognised that many of the external movements will not be affected by the estimation process and this could put a positive "spin" on the results. We have therefore also provided results for the Fully Modelled Area.

10.3.2.3 Results for Freight

Due to the lower level of confidence in the freight matrices in general and in the split between MGV and HGV in particular it is considered appropriate to combine the reporting of MGV and HGV classes. LGV are still presented as a separate class.

10.3.2.4 Zonal Cell Values

Using all movements in the model, the results are as follows.

Table 33. Impact of matrix estimation Prior vs First Calibration Run – All Zones

	O-D			Origins			Destinations		
Category	Inter-cept	Slope	R2	Inter-cept	Slope	R2	Inter-cept	Slope	R2
AM_Car	0.00	1.00	1.00	-0.49	1.00	1.00	-0.16	1.00	1.00
AM_LGV	0.00	1.00	1.00	1.80	1.00	1.00	1.79	1.00	1.00
AM_HGV	0.00	1.00	1.00	1.80	1.00	1.00	1.96	1.00	1.00
IP_Car	0.00	1.00	1.00	0.02	1.00	1.00	-0.28	1.00	1.00
IP_LGV	0.00	1.00	1.00	0.97	1.00	1.00	0.97	1.00	1.00
IP_HGV	0.00	1.00	1.00	1.34	1.01	1.00	1.49	1.00	1.00
PM_Car	0.00	1.00	1.00	-0.13	1.00	1.00	0.12	1.00	1.00
PM_LGV	0.00	1.00	1.00	1.61	1.00	1.00	1.63	1.00	1.00
PM_HGV	0.00	1.00	1.00	1.14	1.00	1.00	1.21	1.00	1.00

Source: AECOM analysis

The R2 statistics are 1.00 (2 d.p.) for all of these tests, exceeding the threshold set out in WebTAG. Intercepts are small, particularly for O-D (cell) values. Slope values are easily within the thresholds set out in WebTAG.

As can be seen the model as a whole reaches the values mentioned in WebTAG for the various tests

Table 34. Impact of matrix estimation Prior vs First Calibration Run – Fully Modelled Area

	O-D			Origins			Destinations		
Category	Inter-cept	Slope	R2	Inter--cept	Slope	R2	Inter-cept	Slope	R2
AM_Car	0.00	1.00	0.99	-1.04	1.01	0.99	2.06	0.99	1.00
AM_LGV	0.00	1.00	0.99	1.78	1.00	0.99	1.85	1.00	0.98
AM_HGV	0.00	1.01	0.86	1.90	0.99	0.92	1.68	1.01	0.95
IP_Car	0.00	1.00	0.99	3.08	0.99	0.99	-0.96	1.01	0.99
IP_LGV	0.00	1.00	0.99	1.10	0.99	0.99	1.19	0.99	0.99
IP_HGV	0.00	1.09	0.77	0.61	1.18	0.90	0.83	1.11	0.89
PM_Car	0.00	1.00	1.00	1.49	0.99	0.99	1.25	1.00	0.99
PM_LGV	0.00	1.00	0.99	1.52	1.00	0.99	1.51	1.00	0.99
PM_HGV	0.00	0.95	0. 90	2.06	0.91	0.94	2.08	0.91	0.95

Source: AECOM analysis

All the results for cars and LGVs in Table 34 meet the criteria in WebTAG. The results for HGVs are mixed with some not meeting WebTAG. This is to be expected as we know the prior matrix for HGVs is not as reliable as Car and LGV.

10.3.2.5 Trip Length Distribution

Table 35. Prior vs First Calibration Trip Length Distributions – All Zones

	Prior		Post		Change	
Category	Mean	StdDev	Mean	StdDev	Mean	StdDev
AM_Car	22.3	40.6	22.2	40.4	0%	0%
AM_LGV	22.5	42.2	22.5	42.2	0%	0%
AM_HGV	54.0	87.0	52.9	84.2	-2%	-3%
IP_Car	20.4	41.7	20.2	41.0	-1%	-2%
IP_LGV	21.5	41.1	21.5	41.3	0%	1%
IP_HGV	53.5	88.3	52.7	86.6	-1%	-2%
PM_Car	23.1	44.1	22.9	43.4	-1%	-2%
PM_LGV	22.2	41.6	22.2	41.5	0%	0%
PM_HGV	54.1	88.7	56.7	92.0	5%	4%

Source: AECOM analysis

In all cases the mean and standard deviation changes are within those recommended in WebTAG at the whole model level.

Table 36. Prior vs First Calibration Trip Length Distributions – Fully Modelled Area

	Prior		Post		Change	
Category	Mean	StdDev	Mean	StdDev	Mean	StdDev
AM_Car	16.5	27.4	16.0	26.8	-3%	-2%
AM_LGV	26.8	39.9	25.9	39.1	-3%	-2%
AM_HGV	73.4	76.1	65.8	72.0	-10%	-5%
IP_Car	17.0	35.8	15.7	33.3	-8%	-7%
IP_LGV	25.5	41.9	25.4	42.2	0%	1%
IP_HGV	76.9	79.9	70.5	77.4	-8%	-3%
PM_Car	18.1	32.1	17.2	30.3	-5%	-6%
PM_LGV	25.5	39.1	24.9	38.5	-3%	-2%
PM_HGV	73.6	76.3	74.2	77.4	1%	1%

Source: AECOM analysis

The changes in mean and standard deviation are within WebTAG recommendations in 11 of the 16 comparisons.

10.3.2.6 Sector to sector level matrices – First Stage of Calibration

The sector to sector flows were compared in the prior and post between the 22 sectors including intra-sector movements, by time period and user classes. This results in 4356 comparisons, of these only ten failed to meet the criteria. For the sake of space AECOM have not provided the comparisons within this report, but they can be provided. Table 37 shows the ten movements that did not fall within the criteria, as can be seen many of the movements are intra-sector suggesting an increase in short distance trips for these sectors.

Table 37. First Stage vs Prior sector movements

Category	From Sector	To Sector	Prior Trips	Step 1 Trips	Difference	% Difference
Car_AM	106	106	2824	3312	488	17%
Car_AM	111	111	3443	4001	558	16%

Category	From Sector	To Sector	Prior Trips	Step 1 Trips	Difference	% Difference
Car_AM	113	111	1913	2343	430	22%
Car_IP	106	106	2878	3242	364	13%
Car_IP	111	111	3784	4359	575	15%
Car_IP	121	121	6964	7389	425	6%
Car_IP	131	133	1148	1409	261	23%
Car_PM	102	105	575	262	-313	-54%
Car_PM	106	106	3300	3659	359	11%
Car_PM	111	111	4161	4923	762	18%

Source: AECOM analysis

10.3.3 Conclusion of First Stage of Estimation

After the first stage of estimation the fit of the model against screenline flows has improved considerably for calibration screenlines so that, in most cases, there are over 90% of screenlines meeting the criteria. The performance of validation screenlines has also improved compared with the prior matrix with all but one of the values for cars in the two scheme areas being above 70%.

The changes in the car and LGV matrices are generally within the criteria while it is recognised that larger than recommended changes have occurred in the HGV matrices.

It is considered that the fit against validation data is sufficiently good to allow the second stage of estimation to be applied. The second stage is intended to make further improvements to the validation screenlines without making further significant changes to the matrices.

10.4 Refinement of Prior Matrices by Matrix Estimation – Second Stage of Calibration

A second round of estimation was undertaken where data from all screenlines were used in the estimation process. The purpose of this was to further improve the trip matrix and make the best use of all observed data. This was considered justifiable as the validation results in the previous section were not quite at the WebTAG recommended level. Also after applying this step the additional change between the prior and post estimation matrices is not significantly greater than it was after the first estimation process.

10.4.1 Comparison of Screenline Flows – Second Calibration

Table 38. Calibration Screenlines by Scheme Area within var% for Second Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	88%	82%	96%	94%	94%	92%
Innovation Corridor	91%	85%	100%	100%	95%	91%
Pan Northern Connectivity	97%	97%	90%	90%	87%	87%
Fully modelled Area	94%	92%	97%	97%	96%	94%

Table 39. Validation Screenlines by Scheme Area within var% for Second Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	100%	93%	100%	100%	93%	93%
Innovation Corridor	100%	100%	100%	100%	100%	100%
Pan Northern Connectivity	90%	90%	100%	100%	100%	100%
Fully modelled Area	94%	90%	99%	96%	93%	93%

Table 40. All Screenlines by Scheme Area within var% for Second Calibration

Screenlines -	AM (0800-0900)		IP		PM (1700-1800)	
Within var%	All	Car	All	Car	All	Car
Mass Transit	91%	84%	97%	95%	94%	92%
Innovation Corridor	92%	87%	100%	100%	96%	92%
Pan Northern Connectivity	95%	95%	93%	93%	90%	90%
Fully modelled Area	94%	91%	97%	97%	95%	94%

The number of screenlines within the var% criteria is over 90% across the whole area. Within the scheme areas the values the combined calibration and validation screenlines are also generally over 90% with 100% being achieved for the Innovation Corridor area in the IP period. Where the car value is below 90% the corresponding all vehicle value is above 90%. This suggests that a number of the screenlines which “fail” for the car category are very close to passing.

10.4.2 Impact of Estimation – Second Calibration

The impact of estimation following the second calibration is only reported at the Fully Modelled Area as the statistics for the whole area are virtually identical to those from the first calibration including all R^2 and slope values being 1.00.

10.4.2.1 Zonal Cell Values

Table 41. Impact of matrix estimation First vs Second Calibration Run – Fully modelled Area

	O-D			Origins			Destinations		
Category	Inter-cept	Slope	R2	Inter--cept	Slope	R2	Inter-cept	Slope	R2
AM_Car	0.00	1.00	1.00	0.24	1.00	1.00	0.40	0.99	1.00
AM_LGV	0.00	1.00	0.99	-0.31	1.01	1.00	0.92	1.00	1.00
AM_HGV	0.00	1.13	0.90	-0.29	1.08	0.98	-0.94	1.14	0.97
IP_Car	0.00	1.00	1.00	0.26	1.00	1.00	0.29	1.00	1.00
IP_LGV	0.00	1.00	1.00	0.02	1.00	1.00	0.52	1.00	1.00
IP_HGV	0.00	1.00	0.96	-0.10	1.03	0.98	0.10	1.01	0.99
PM_Car	0.00	1.00	1.00	0.20	1.00	1.00	0.21	1.00	1.00
PM_LGV	0.00	1.00	1.00	1.36	1.00	1.00	0.50	1.00	1.00
PM_HGV	0.00	1.03	0.89	-0.10	1.08	0.97	-0.13	1.09	0.97

Source: AECOM analysis

As expected, these results show that there has only been a slightly change in the matrix compared with the first stage of calibration. In all but one case, the slope and R2 results for car and LGV are very close to 1 (=1.00 to 2dp). This shows that there has been only a very minor change in these matrices as a result of the additional stage of estimation. The change in the HGV matrix is larger as was noted in the first stage.

10.4.2.2 Trip Length Distribution

As with the change in the matrix we have not provided the change in trip length distribution for the whole matrix as this showed no appreciable change. The results for the Fully Modelled Area are set out in Table 42.

Table 42. First vs Second Calibration Trip Length Distributions – Fully Modelled Area

	First		Second		Change	
Category	Mean	StdDev	Mean	StdDev	Mean	StdDev
AM_Car	16.0	26.8	16.0	26.7	0%	0%
AM_LGV	25.9	39.1	25.6	38.8	-1%	-1%
AM_HGV	65.8	72.0	64.7	70.7	-2%	-2%
IP_Car	15.7	33.3	15.5	32.8	-1%	-1%
IP_LGV	25.4	42.2	25.1	41.8	-1%	-1%
IP_HGV	70.5	77.4	69.0	76.3	-2%	-1%
PM_Car	17.2	30.3	17.1	30.3	0%	0%
PM_LGV	24.9	38.5	24.7	38.3	-1%	0%
PM_HGV	74.2	77.4	73.4	76.0	-1%	-2%

Source: AECOM analysis

As with the change in trips, the additional change in trip length distribution is very small. This is true for HGVs as well as cars and LGVs.

10.4.2.3 Sector to sector level matrices – Second Stage of Calibration

As before the 4356 sector to sector comparisons were made, of these only three failed to meet WebTAG criteria. For the sake of space AECOM have not provided the comparisons within this report, but they can be provided. Table 43 shows the three movements that did not meet webtag criteria. All of the IP comparisons passed.

Table 43. Second Stage vs First Stage sector movements

Category	From Sector	To Sector	Step 1 Trips	Step 2 Trips	Difference	% Difference
Car_AM	20	16	2325	2655	330	14%
Car_PM	16	20	2809	3067	258	9%
Car_PM	20	16	2814	3101	287	10%

Source: AECOM analysis

10.5 Conclusion

A two stage process of adjustment of the matrix has been undertaken with all screenline counts being used in the final stage. This has produced an improved fit against observed flows making maximum use of the observed data. This causes a slight additional impact on the matrix but this is considered to be an acceptable compromise in order to achieve better validation.

11. Assignment Calibration and Validation

11.1 Introduction

The assessment of the assignment is undertaken through the following criteria:

- Comparison of observed and modelled flows at individual sites
- Journey Time Validation
- Model Convergence

11.2 Comparison between observed and modelled flows at count sites

Observed and modelled flows have been compared at all three stages of model development; prior, first stage calibration and second stage calibration. These are presented in the following sections.

11.2.1 Prior Model

Table 44. Calibration Count sites within WebTAG criteria for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	67%	73%	69%	73%	62%	63%
Innovation Corridor	69%	80%	70%	77%	64%	66%
Pan Northern Connectivity	72%	70%	74%	67%	74%	67%
Fully modelled Area	64%	69%	69%	73%	62%	63%

Table 45. Validation Count sites within WebTAG criteria for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	69%	76%	63%	71%	63%	65%
Innovation Corridor	71%	71%	90%	83%	71%	71%
Pan Northern Connectivity	79%	71%	93%	86%	73%	70%
Fully modelled Area	64%	63%	67%	70%	62%	60%

Table 46. All Count sites within WebTAG criteria for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	68%	74%	67%	73%	62%	64%
Innovation Corridor	70%	78%	74%	79%	65%	67%
Pan Northern Connectivity	75%	71%	84%	77%	74%	69%
Fully modelled Area	64%	66%	68%	71%	62%	62%

Overall the number of sites falling within WebTAG criteria is relatively good for a prior matrix. Some improvement is required to bring the counts closer to observations but it was considered that this would be achieved through estimation to screenline flows. These results are generally better than the screenlines results for the prior matrix. This is due to the slightly wider tolerances applied to individual counts that are applied at a screenline level.

11.2.2 First Calibration Stage

Table 47. Calibration Count sites within WebTAG criteria for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	88%	88%	89%	91%	84%	87%
Innovation Corridor	88%	90%	93%	96%	88%	89%
Pan Northern Connectivity	93%	89%	96%	89%	78%	78%
Fully modelled Area	82%	83%	87%	90%	81%	82%

Table 48. Validation Count sites within WebTAG criteria for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	67%	76%	73%	80%	80%	82%
Innovation Corridor	76%	83%	93%	95%	74%	79%
Pan Northern Connectivity	80%	80%	89%	95%	73%	70%
Fully modelled Area	63%	67%	74%	78%	66%	67%

Table 49. All Count sites within WebTAG criteria for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	82%	84%	84%	88%	83%	85%
Innovation Corridor	86%	89%	93%	96%	85%	87%
Pan Northern Connectivity	86%	84%	92%	92%	75%	74%
Fully modelled Area	73%	76%	81%	84%	74%	75%

These results show that the first stage estimation process has improved the fit against calibration counts (Table 47 compared with Table 44) with all but one of the values being above 85% for the two scheme areas. The PM all vehicle value for the Mass Transit scheme is only just below the 85% threshold and given that the car value is above then it suggests that some of the individual counts are only just failing.

There is also an improvement in the fit of validation counts with some of the values being above the 85% WebTAG criteria.

11.2.3 Second Calibration Stage

Table 50. Calibration Count sites within WebTAG criteria for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	89%	91%	89%	93%	85%	88%
Innovation Corridor	88%	93%	93%	97%	90%	91%
Pan Northern Connectivity	91%	93%	98%	98%	78%	74%
Fully modelled Area	82%	84%	88%	91%	82%	82%

Table 51. Validation Count sites within WebTAG criteria for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	82%	84%	78%	84%	78%	84%
Innovation Corridor	88%	90%	100%	100%	88%	90%
Pan Northern Connectivity	95%	95%	98%	100%	88%	89%
Fully modelled Area	69%	71%	77%	81%	71%	73%

Table 52. All Count sites within WebTAG criteria for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Passes Either Criteria	All	Car	All	Car	All	Car
Mass Transit	87%	89%	85%	90%	83%	87%
Innovation Corridor	88%	93%	94%	97%	89%	91%
Pan Northern Connectivity	93%	94%	98%	99%	83%	82%
Fully modelled Area	76%	78%	82%	86%	77%	78%

The values in Table 52 show that in most scheme areas and time periods at least 85% of flows meet the WebTAG criteria within the Mass Transit and Innovation Corridor areas. Only the PM all vehicle value within the Mass Transit area is below 85%.

11.3 Journey Time Validation

Table 53. Journey Time Results for Second Calibration Assignment

Scheme Area	No. of JT Routes	JT Pass AM	JT Pass IP	JT Pass PM	%AM	% IP	% PM
Mass Transit	46	37	40	38	80%	87%	83%
Innovation Corridor	54	48	48	46	89%	89%	85%
Pan Northern Connectivity	68	59	63	55	87%	93%	81%
Fully Modelled Area	150	123	138	120	82%	92%	80%
Any Scheme Area	116	98	106	94	84%	91%	81%

The model compares well against journey time observations. This is particularly good for the Interpeak hour where >85% is achieved in all scheme areas and across the whole of the Fully Modelled area as well. The Mass Transit scheme only just misses the 85% threshold in the AM and PM peak hours whereas the 85% threshold is achieved in all 3 time periods for the Innovation Corridor.

Figure 48 to Figure 50 show the geographical spread of the routes which pass the WebTAG criteria along with those that are too fast or too slow.

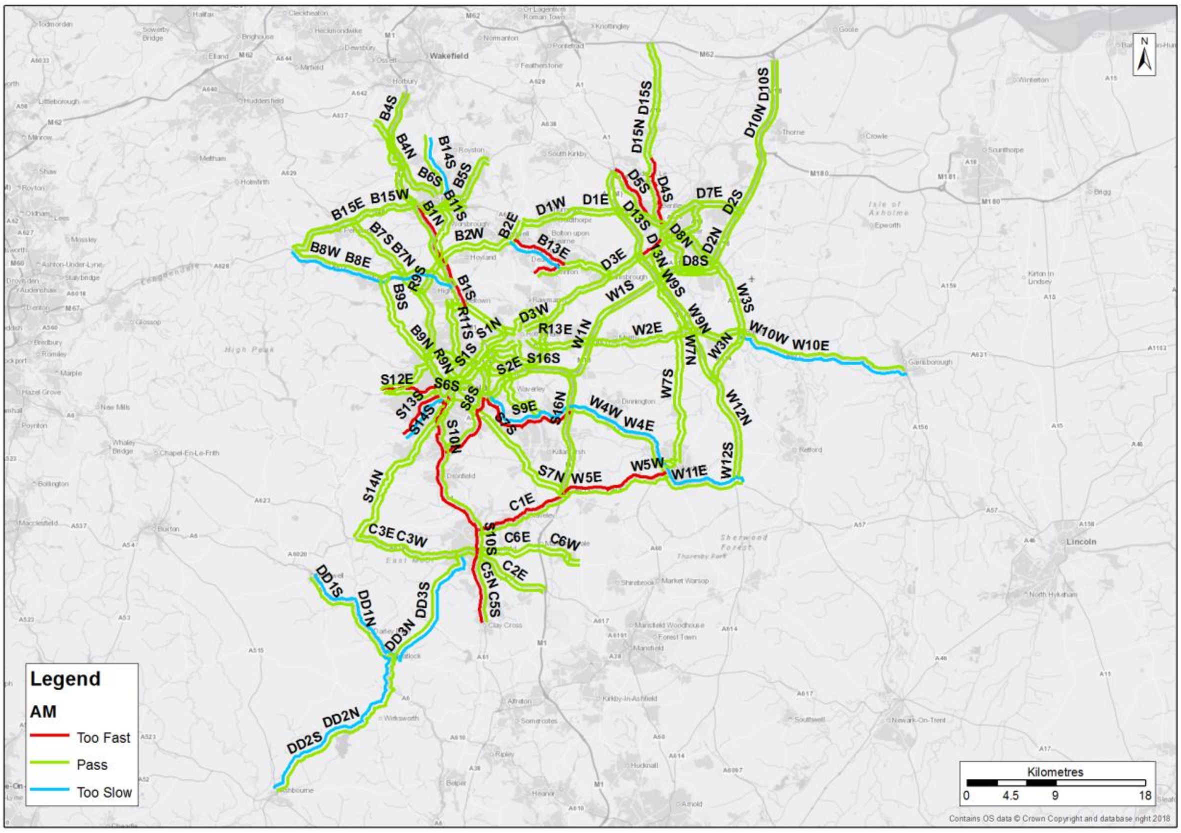


Figure 48. JT results AM

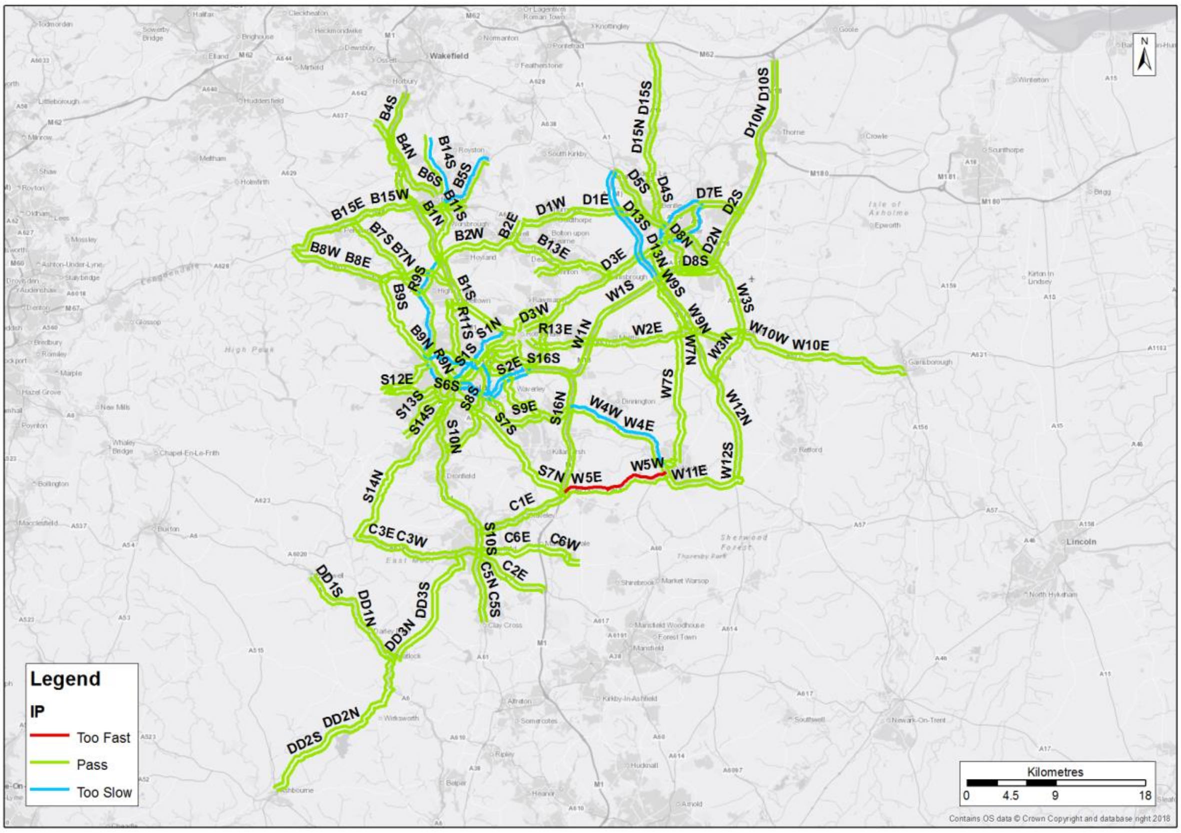


Figure 49. JT results IP

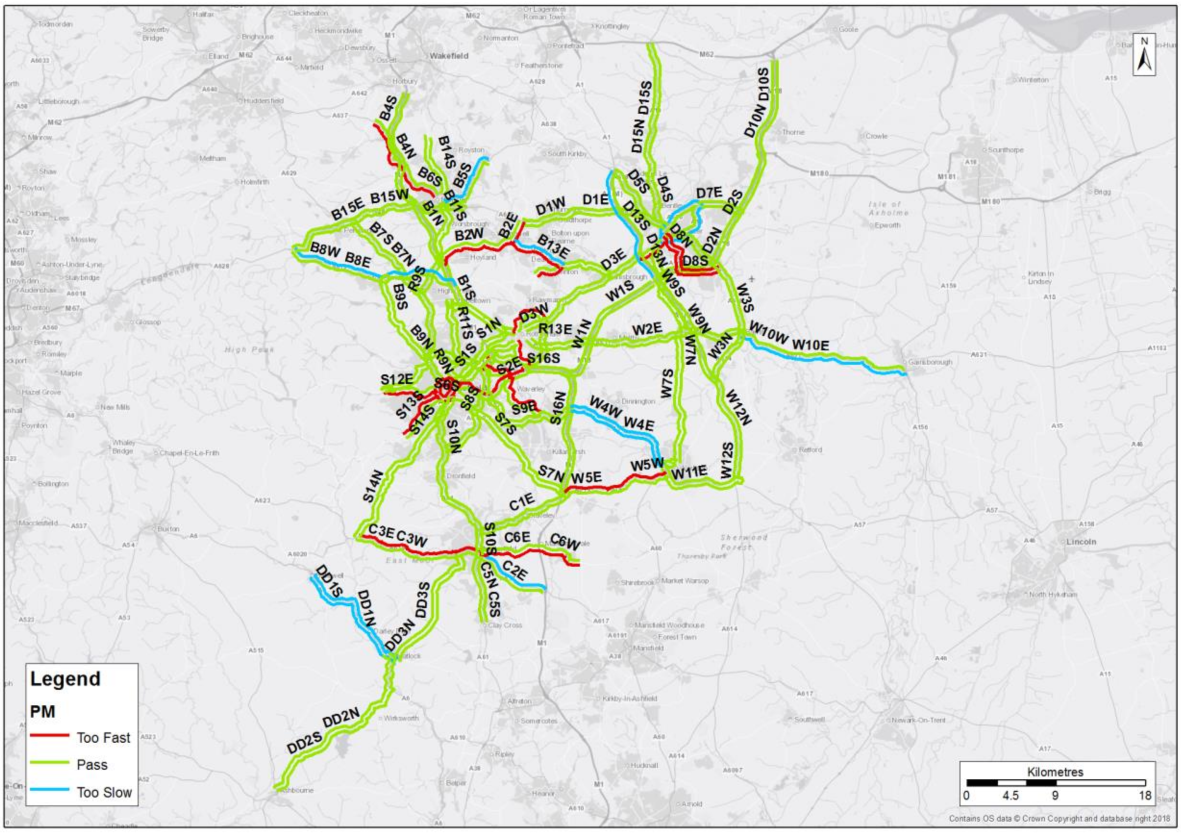


Figure 50. JT results PM

11.4 Model Convergence

The convergence level achieved in the base year model is set out in Table 54.

Table 54. Convergence

Criteria	AM	IP	PM	Target Criteria
SATASS / SATSIM Loops	36	18	27	
%GAP	0.00042%	0.00022%	0.00074%	<0.002%
%Flows (Links changing by less than 1%)	99.2%	99.5%	99.2%	>98%

Source: AECOM – SCRTM1 Model

This shows that the model achieves the criteria that were set out in Table 5.

12. Mass Transit Calibration and Validation

12.1 Introduction

The Sheffield Supertram scheme has been running for over 20 years. Many of the schemes major assets are expected to get to the end of their economic life in the next few years and this is likely to coincide with the end of the current franchise agreement in 2024. A significant programme of track and vehicle replacement will need to be undertaken otherwise the scheme will have to be closed down.

12.2 Highway Network and Zone System

Figure 51 shows an image of the Network in the area around the Mass Transit scheme, and Figure 52 shows the zone system.

Figure 51. Highway Network – Mass Transit Scheme

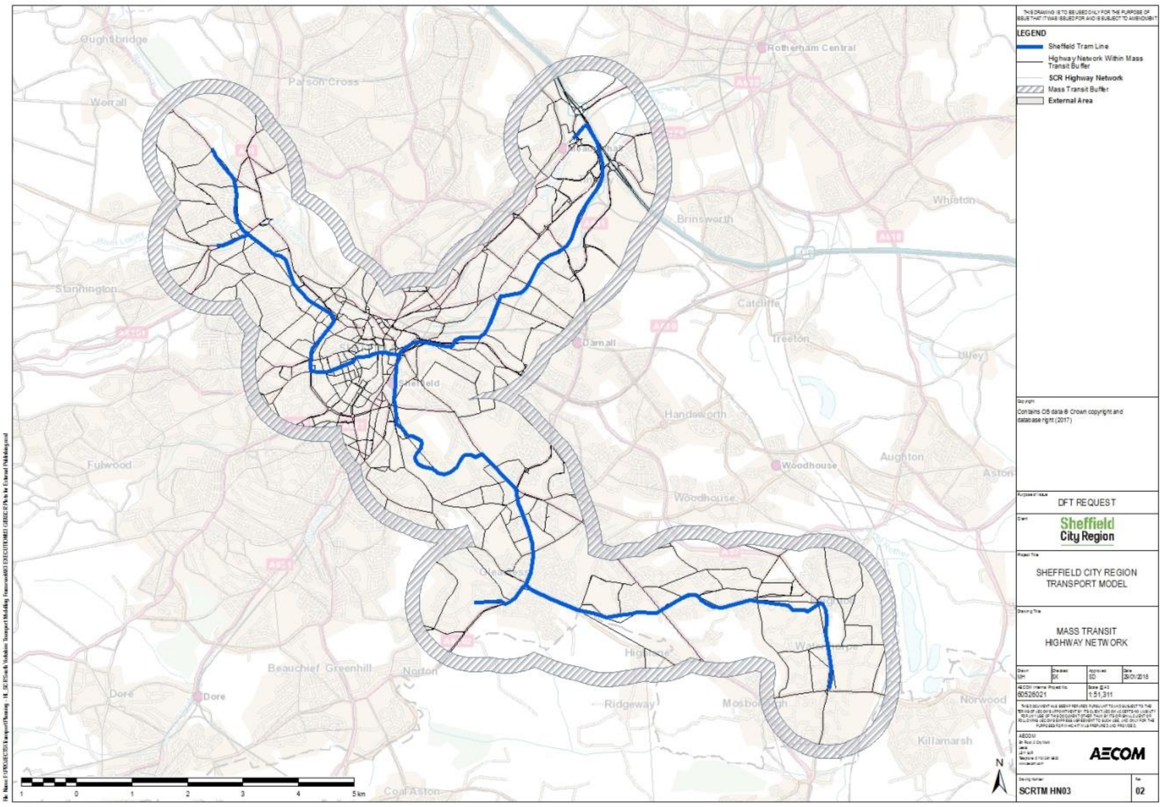
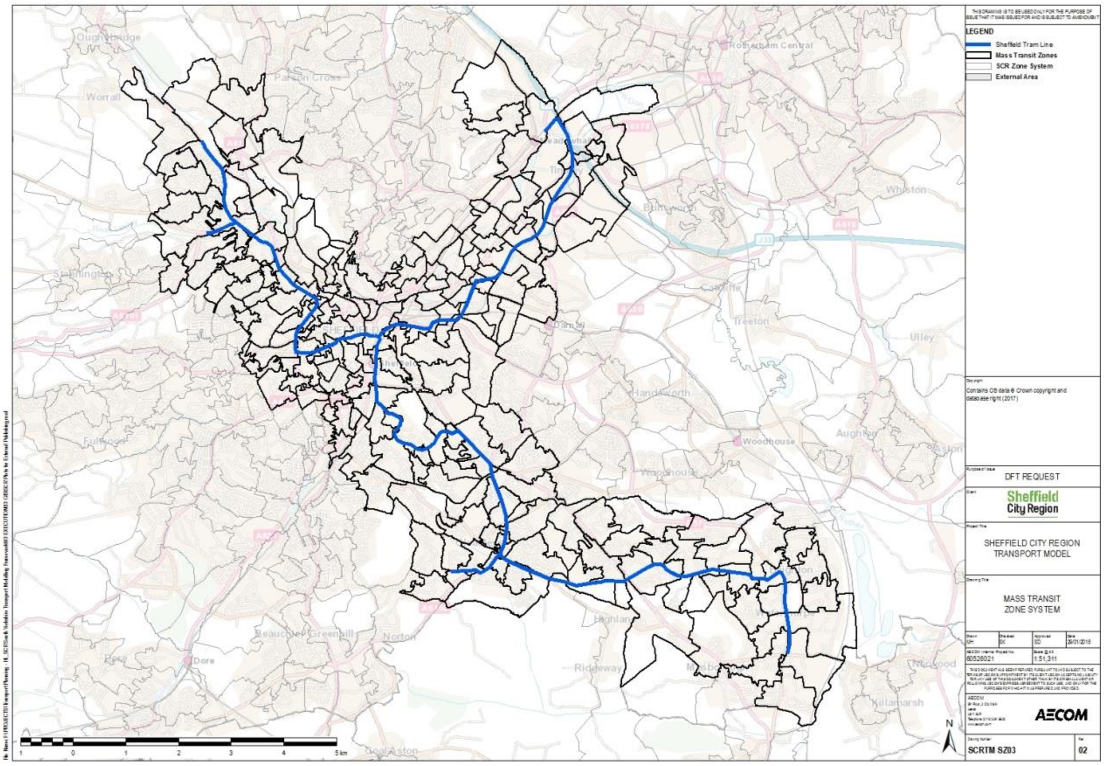


Figure 52. Mass Transit Scheme - Zone system



12.3 Calibration and Validation Data

There are 164 counts sites in the Mass Transit Area; these have been combined in 64 directional screenlines Figure 53, green represents calibration and red is validation, a zoomed in image is shown in Figure 54 to allow nearly all screenlines to be shown. Screenline SLE44 is to the west of SL033.

Of the 150 Journey time routes in SCRTM, 46 were classified as belonging to the Mass Transit Area. The location of these is shown in Figure 55.

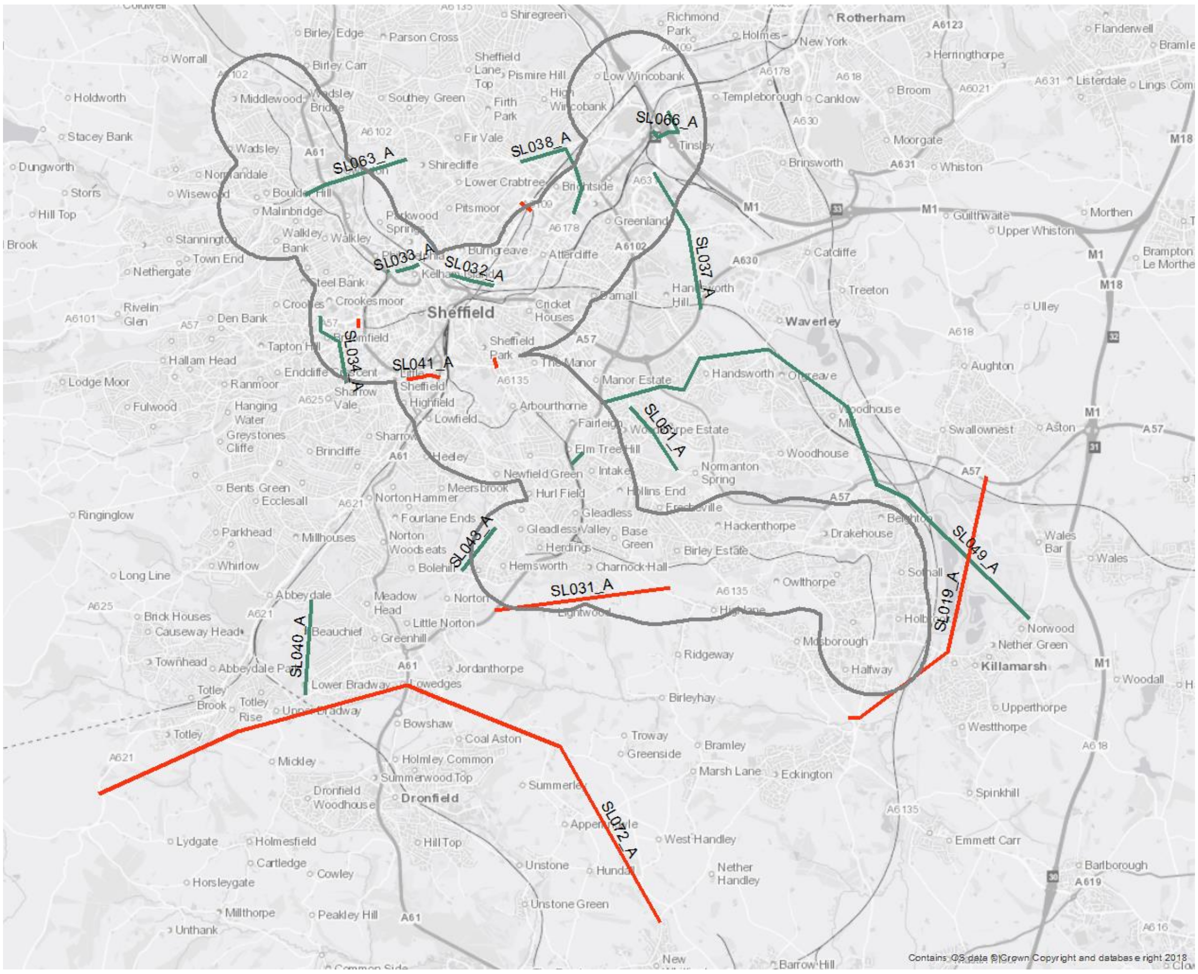


Figure 53. Screenlines in Mass Transit Area

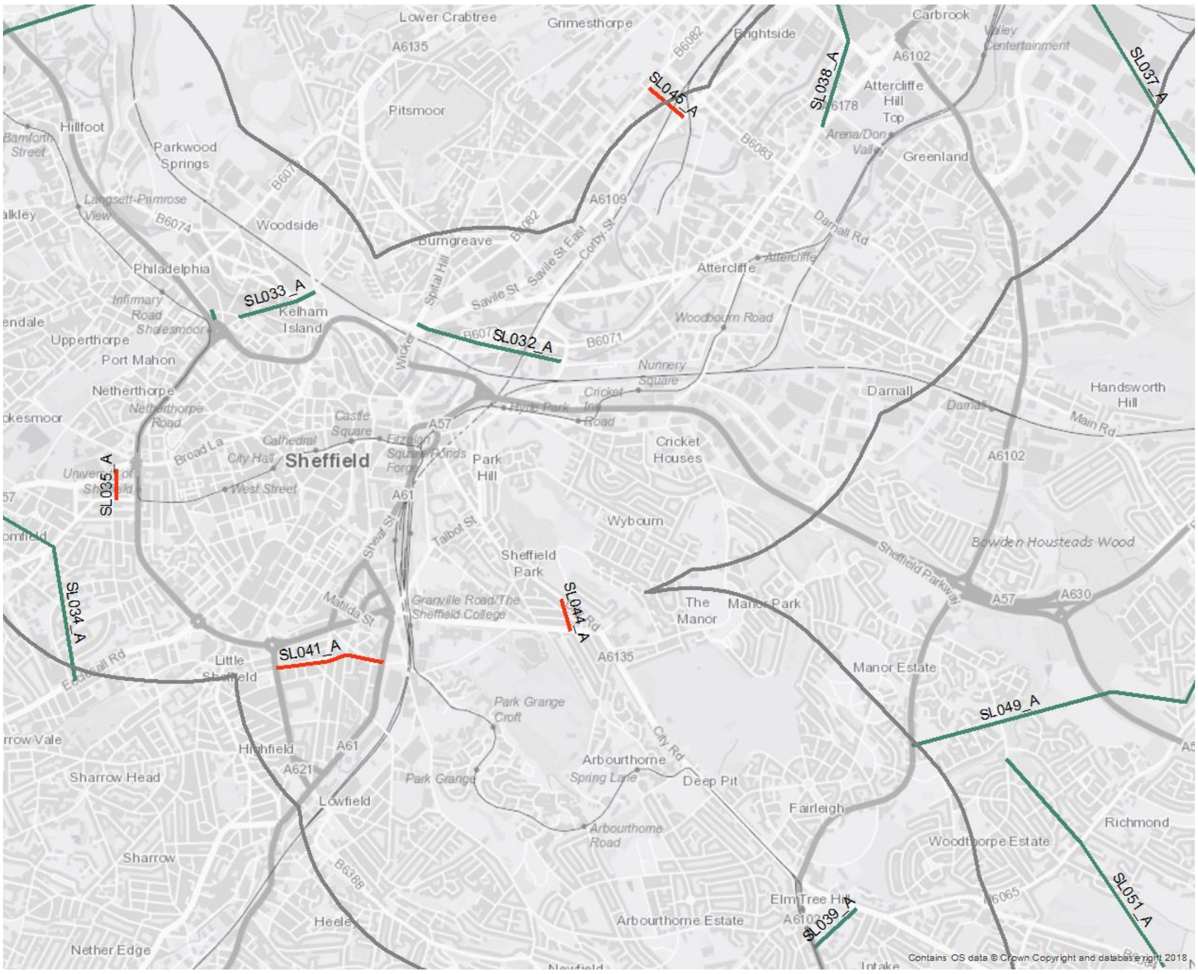


Figure 54. Screenlines in Mass Transit Area (Zoomed In)

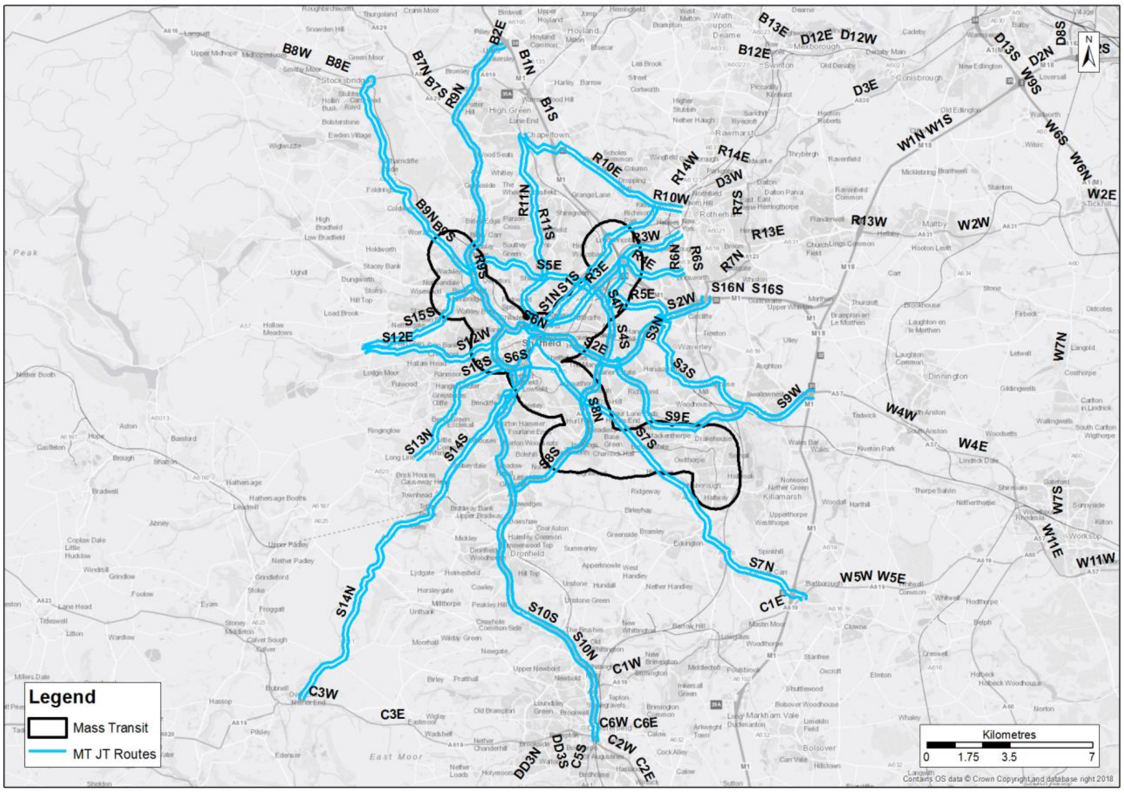


Figure 55. Journey Time Routes in Mass Transit Area

12.4 Signal Data within Sheffield

The Sheffield and Rotherham parts of the model came from the 2008 SRTM3 model. A number of changes to signals have occurred in these areas since then, so it was decided to use the Sheffield AIMSUM model to update the signal settings. This model is kept updated by Sheffield City Council UTMC team and is considered to be the most reliable source of signal data in the local area. Checks and updates to the settings were focused on nodes:

- At critical intersections;
- Where the delay was large or unrealistic;
- Where journey times in the model did not match observed information;
- Where routing issues were identified.

Updates were completed to get the percentage green time for each movement in the model as close as possi

ble to the AIMSUM model. Sometimes this required a change to phases and stages. The resulting coding was checked for reasonableness and making sure it could occur in reality.

Signal data is analysed within SATURN itself, with checks on the signal data entered and reporting errors, such as;

- When the sum of stage lengths doesn't match the cycle time;
- Very long inter-green times; and
- Conflicting movements (without priority markers) but have green time within the same stage.

All occurrences of these errors were checked and rectified where applicable.

12.5 Matrix Development

Full details of the matrix development are provided in the LMVR and associated appendices.

12.6 Model convergence

All assignments reported in this chapter achieved convergence with a percentage gap value less than 0.005% on the final four consecutive loops. Further details are contained in section 11.4.

12.7 Calibration and Validation Results

The validation criteria adopted for this model is based on WebTAG guidance and is shown in Table 55. These are the same as have been used for the main assessment of the model.

Table 55. Validation Criteria and Acceptability Guidelines

Model	Indicator	Criteria	Acceptability Guideline
Highway	Screenline Flows	Differences between modelled and observed values should be less than 5% when at least 5 counts, other criteria (Table 4) applies for screenlines with fewer counts.	All or nearly all of the screenlines
Highway	Link Flows	Individual flows within 100 veh/h of counts for flows less than 700 veh/h	>85% of cases
		Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	>85% of cases
		Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	>85% of cases
Highway	Link Flows	GEH < 5 for individual counts	>85% of cases
Highway	Journey Times	Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of cases

Source: WebTAG / AECOM

As with the main model comparisons we recommend the use of relaxed criteria for screenlines with fewer than 5 count locations. These are set out in Table 56.

Table 56. Acceptability Criteria for Short Screenlines (var%)

Number of counts in screenline	Acceptability Criteria
5	5% (as in WebTAG M3.1)
4	7.5%
3	10%
2	12.5%
1	15%

Source: AECOM

12.7.1 Validation Results

The results presented in this section are from the second stage of the calibration process.

Table 57. Calibration Screenline and Count Statistics for Second Calibration in Mass Transit Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	88%	82%	96%	94%	94%	92%
Counts	89%	91%	89%	93%	85%	88%

Table 58. Validation Screenline and Count Statistics for Second Calibration in Mass Transit Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	100%	93%	100%	100%	93%	93%
Counts	82%	84%	78%	84%	78%	84%

Table 59. All Screenline and Count Statistics for Second Calibration in Mass Transit Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	91%	84%	97%	95%	94%	92%
Counts	87%	89%	85%	90%	83%	87%

Table 60. Journey Time Statistics for Second Calibration in Mass Transit Area

Total Routes	Pass AM	Pass IP	Pass PM	%AM	% IP	% PM
46	37	40	38	80%	87%	83%

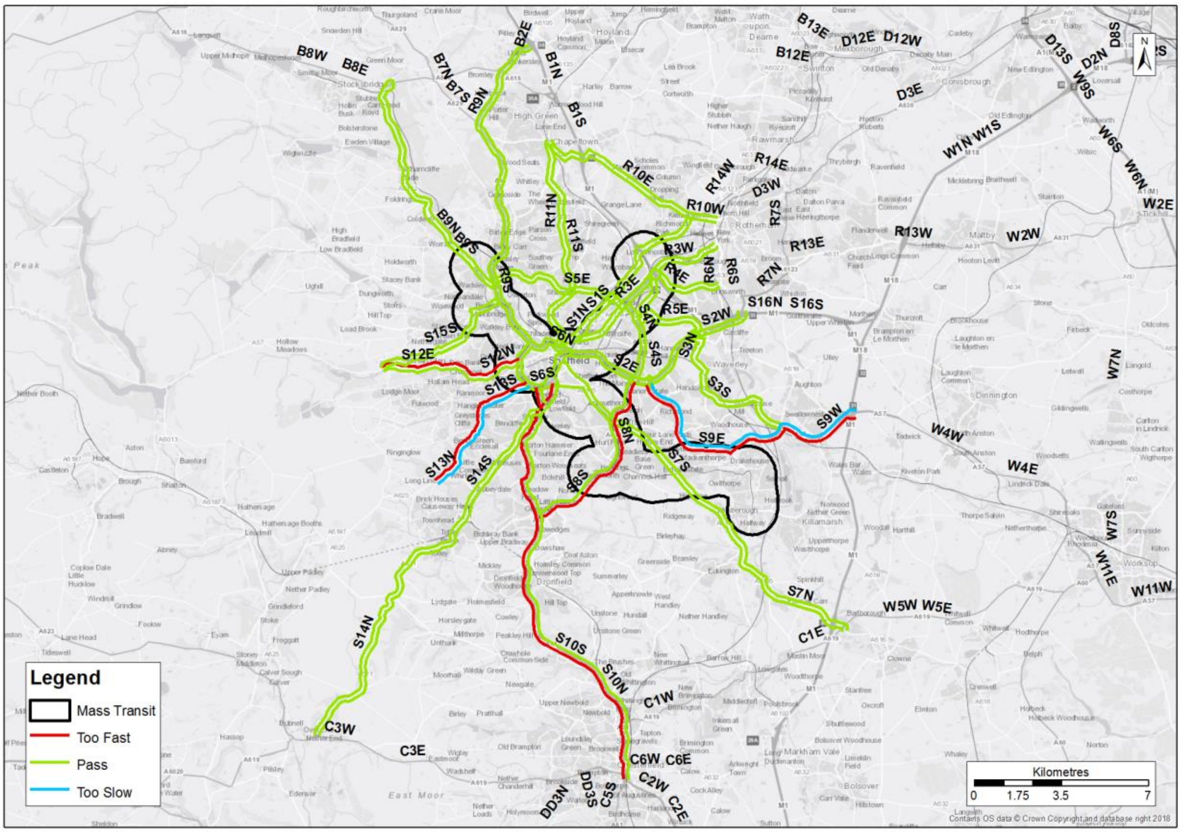


Figure 56. Mass Transit Area JT results AM

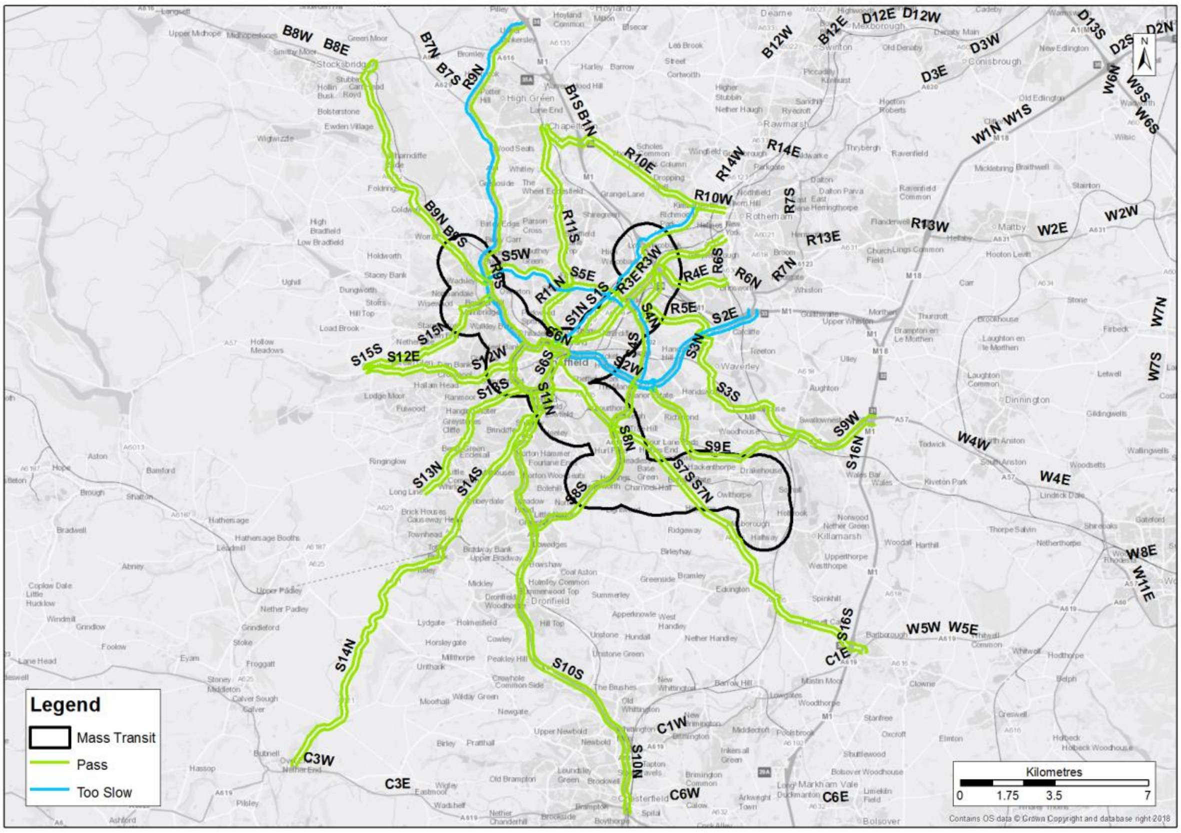


Figure 57. Mass Transit Area JT results IP

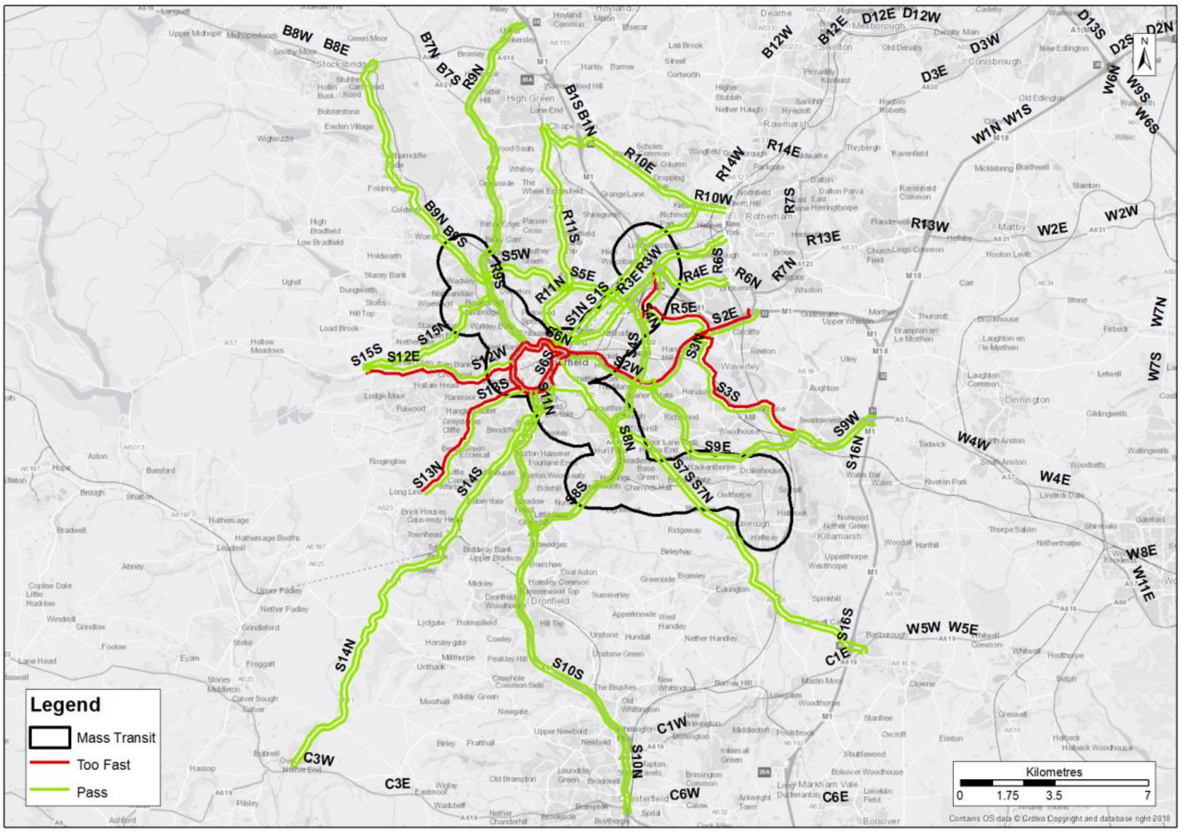


Figure 58. Mass Transit Area JT results PM

These results show that the performance of the model in the Mass Transit scheme area broadly in line with WebTAG criteria for cars. The total vehicle results are less good, indicating a poorer fit of modelled goods vehicles to observed values.

The journey time results in the area are very good for the AM and InterPeak hours although just slightly below the WebTAG standard in the AM and PM.

Overall it is considered that the highway model should provide a suitable basis for assessing the highway impacts of the Mass Transit scheme although results should be always be sense checked and sensitivity testing undertaken to better understand specific outcomes.

13. Innovation Corridor Calibration and Validation

13.1 Introduction

The Innovation Corridor area centres on extensive brownfield sites close to J33 and J34 of the M1 where major employment growth is planned. This is expected to become a world-class international centre of excellence for innovation, recognised as having the potential to be SCR's primary economic driver. Both of these junctions currently experience congestion, and there is poor air quality resulting from this congestion.

The Innovation Corridor Scheme is a major highway improvement scheme providing improved links between these employment sites and the areas of population either side of the M1.

13.2 Highway Network and Zone System

Figure 59 shows an image of the Network in the area around the Innovation Corridor scheme, and Figure 60shows the zone system.

Figure 59. Highway Network – Innovation Corridor Scheme

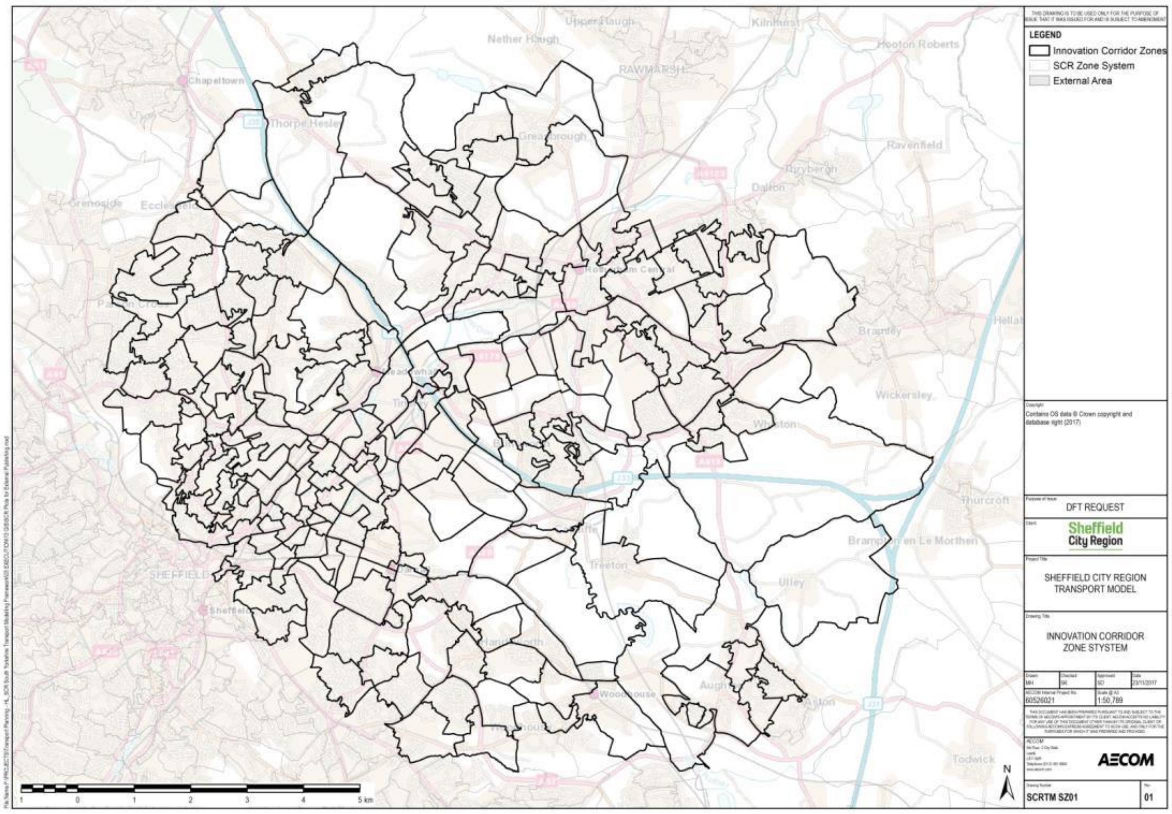


Figure 60. Model Zones in Innovation Corridor Area

13.3 Calibration and Validation Data

There are 214 counts sites in the Innovation Corridor Area; these have been combined in 76 directional screenlines Figure 61, green represents calibration and red is validation, a zoomed in image is shown in Figure 62 to allow all screenlines to be shown.

Of the 150 Journey time routes in SCRTM, 54 were classified as belonging to the Innovation Corridor Area. The location of these is shown in Figure 63.

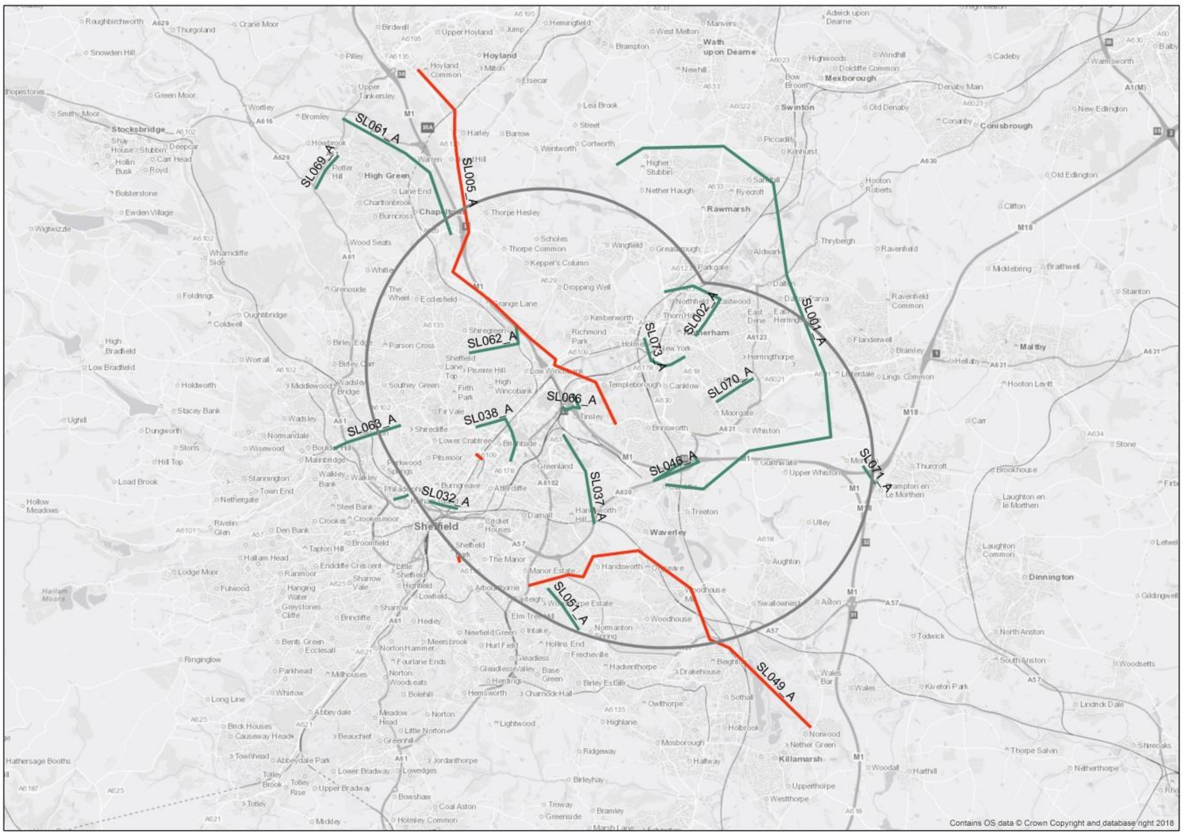


Figure 61. Screenlines in Innovation Corridor Area

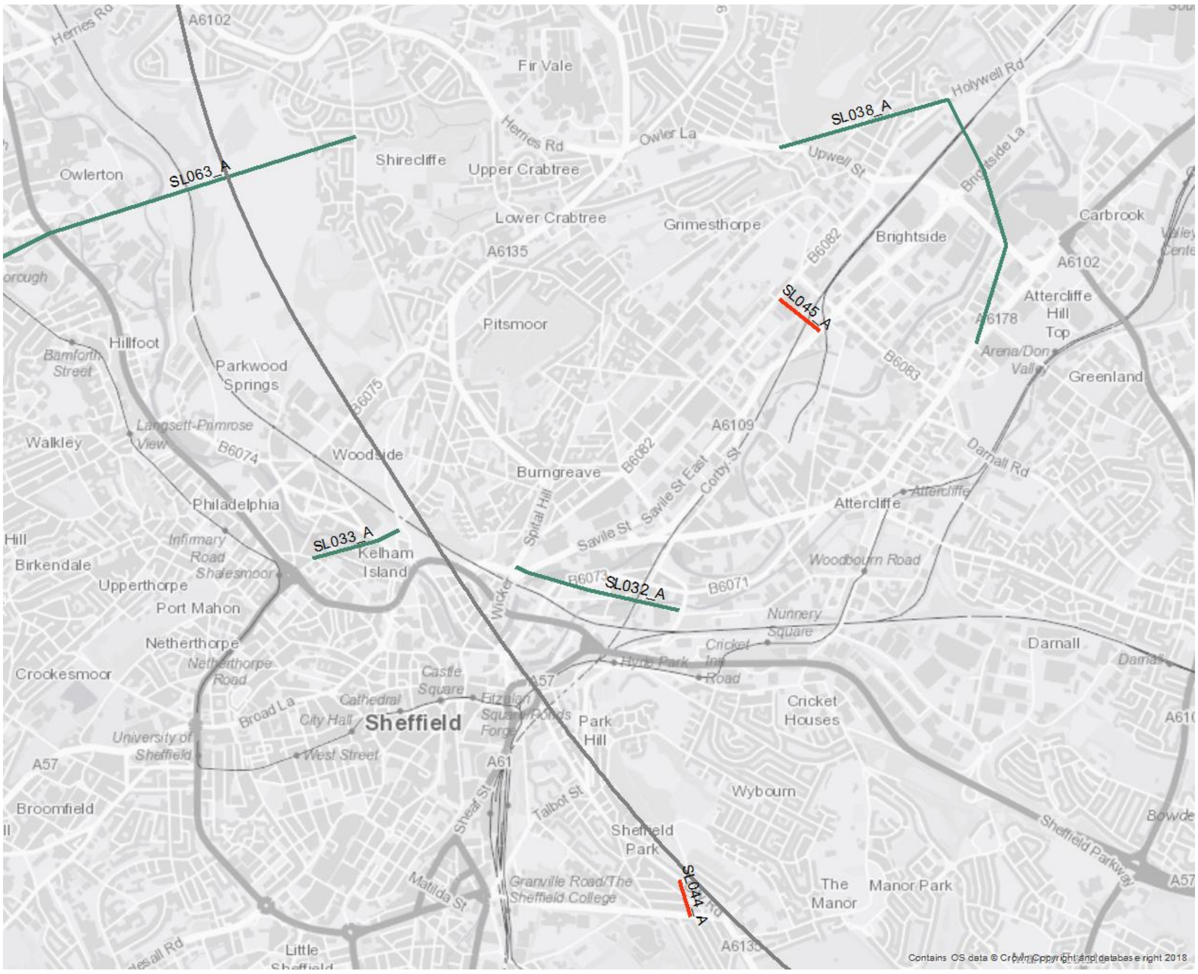


Figure 62. Screenlines in Innovation Corridor Area (Zoomed in)

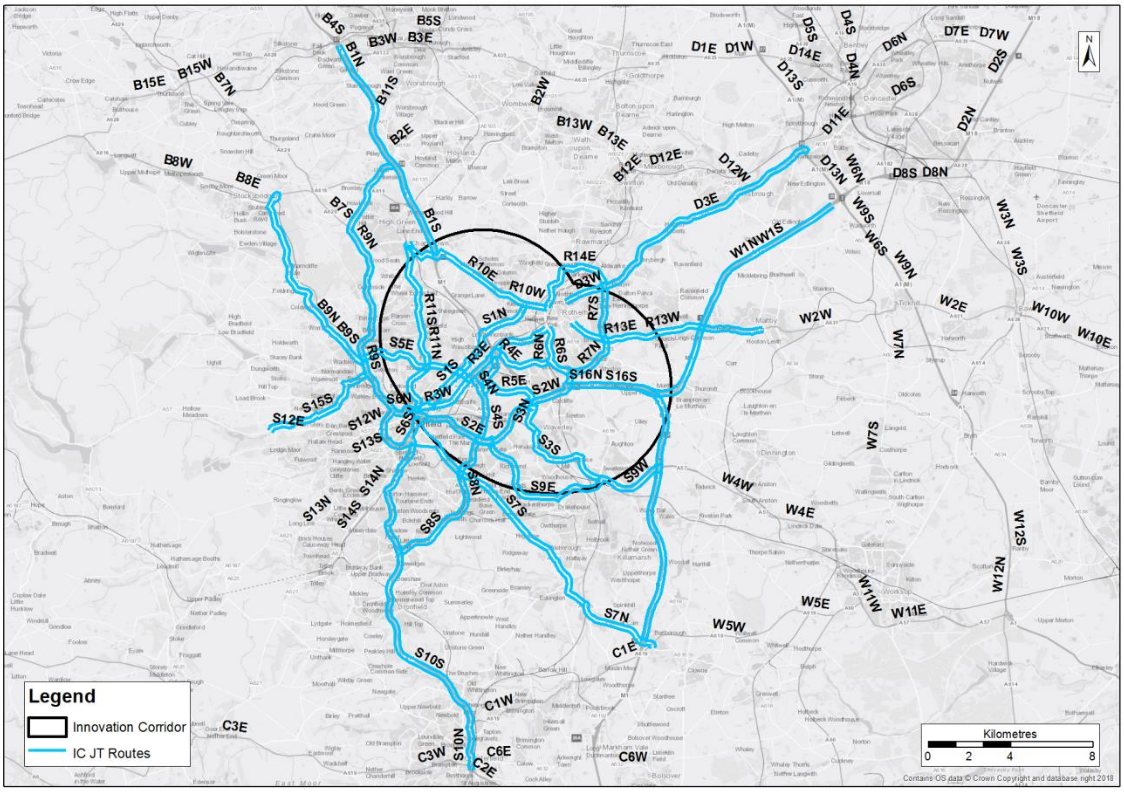


Figure 63. Journey Time Routes in Innovation Corridor Area

13.4 Signal Data within Sheffield

The Sheffield and Rotherham parts of the model came from the 2008 SRTM3 model. A number of changes to signals have occurred in these areas since then, so it was decided to use the Sheffield AIMSUM model to update the signal settings. This model is kept updated by Sheffield City Council UTMC team and is considered to be the most reliable source of signal data in the local area. Checks and updates to the settings were focused on nodes:

- At critical intersections;
- Where the delay was large or unrealistic;
- Where journey times in the model did not match observed information;
- Where routing issues were identified.

Updates were completed to get the percentage green time for each movement in the model as close as possible to the AIMSUM model. Sometimes this required a change to phases and stages. The resulting coding was checked for reasonableness and making sure it could occur in reality.

Signal data is analysed within SATURN itself, with checks on the signal data entered and reporting errors, such as;

- When the sum of stage lengths doesn't match the cycle time;
- Very long inter-green times; and
- Conflicting movements (without priority markers) but have green time within the same stage.

All occurrences of these errors were checked and rectified where applicable.

13.5 Matrix Development

Full details of the matrix development are provided in Chapter 7 and Appendix G.

13.6 Model convergence

All assignments reported in this chapter achieved convergence with a percentage gap value less than 0.005% on the final four consecutive loops. Further details are contained in section 11.4.

13.7 Calibration and Validation Results

The validation criteria adopted for this model is based on WebTAG guidance and is shown in Table 55. These are the same as have been used for the main assessment of the model.

Table 61. Validation Criteria and Acceptability Guidelines

Model	Indicator	Criteria	Acceptability Guideline
Highway	Screenline Flows	Differences between modelled and observed values should be less than 5% when at least 5 counts, other criteria (Table 4) applies for screenlines with fewer counts.	All or nearly all of the screenlines
Highway	Link Flows	Individual flows within 100 veh/h of counts for flows less than 700	>85% of cases

Model	Indicator	Criteria	Acceptability Guideline
		veh/h	
		Individual flows within 15% of counts for flows from 700 to 2,700 veh/h	>85% of cases
		Individual flows within 400 veh/h of counts for flows more than 2,700 veh/h	>85% of cases
Highway	Link Flows	GEH < 5 for individual counts	>85% of cases
Highway	Journey Times	Modelled times along routes should be within 15% of surveyed times (or 1 minute, if higher than 15%)	>85% of cases

Source: WebTAG / AECOM

As with the main model comparisons we recommend the use of relaxed criteria for screenlines with fewer than 5 count locations. These are set out in Table 62.

Table 62. Acceptability Criteria for Short Screenlines (var%)

Number of counts in screenline	Acceptability Criteria
5	5% (as in WebTAG M3.1)
4	7.5%
3	10%
2	12.5%
1	15%

Source: AECOM

13.7.1 Validation Results

The results presented in this section are from the second stage of the calibration process.

Table 63. Calibration Screenline and Count Statistics for Second Calibration in Innovation Corridor Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	91%	85%	100%	100%	95%	91%
Counts	88%	93%	93%	97%	90%	91%

Table 64. Validation Screenline and Count Statistics for Second Calibration in Innovation Corridor Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	100%	100%	100%	100%	100%	100%
Counts	88%	90%	100%	100%	88%	90%

Table 65. All Screenline and Count Statistics for Second Calibration in Innovation Corridor Area

	AM (0800-0900)		IP (1200-1300)		PM (1700-1800)	
Type	All	Car	All	Car	All	Car
Screenlines	92%	87%	100%	100%	96%	92%
Counts	88%	93%	94%	97%	89%	91%

Table 66. Journey Time Statistics for Second Calibration in Innovation Corridor Area

Total Routes	Pass AM	Pass IP	Pass PM	%AM	% IP	% PM
54	48	48	46	89%	89%	85%

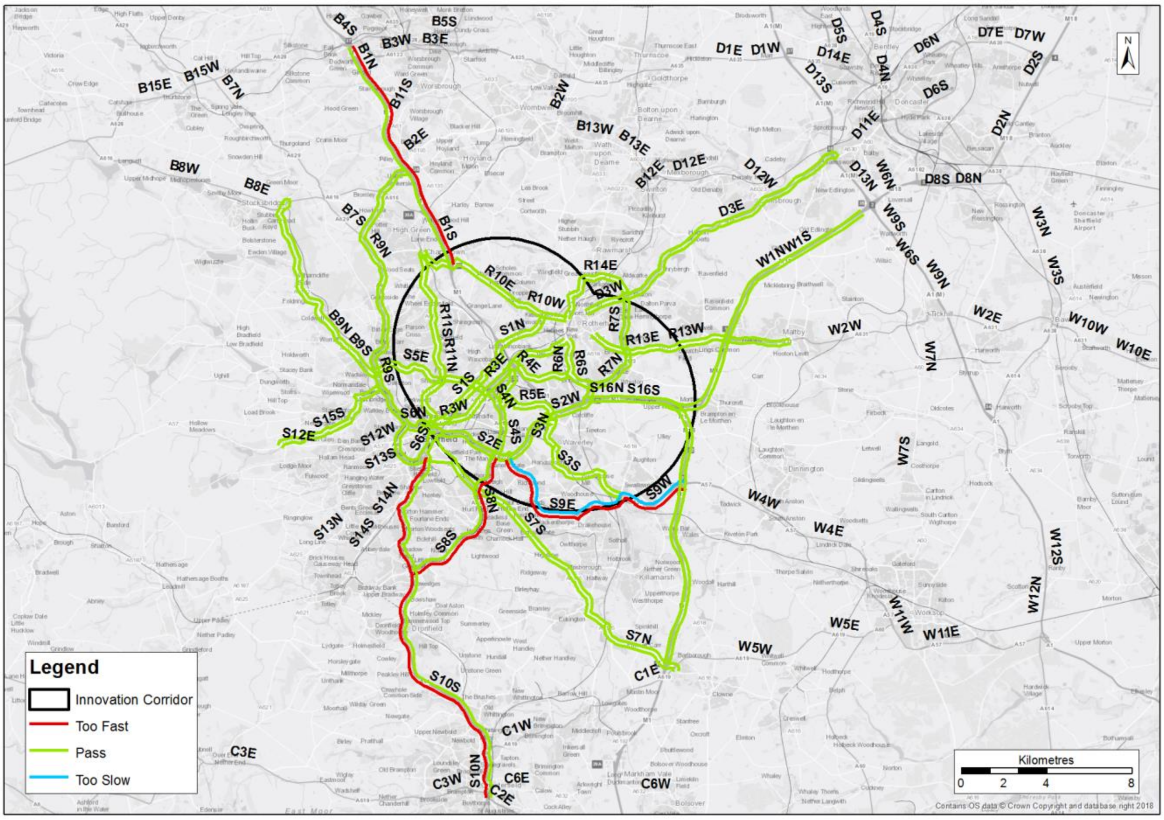


Figure 64. Innovation Corridor Area JT results AM

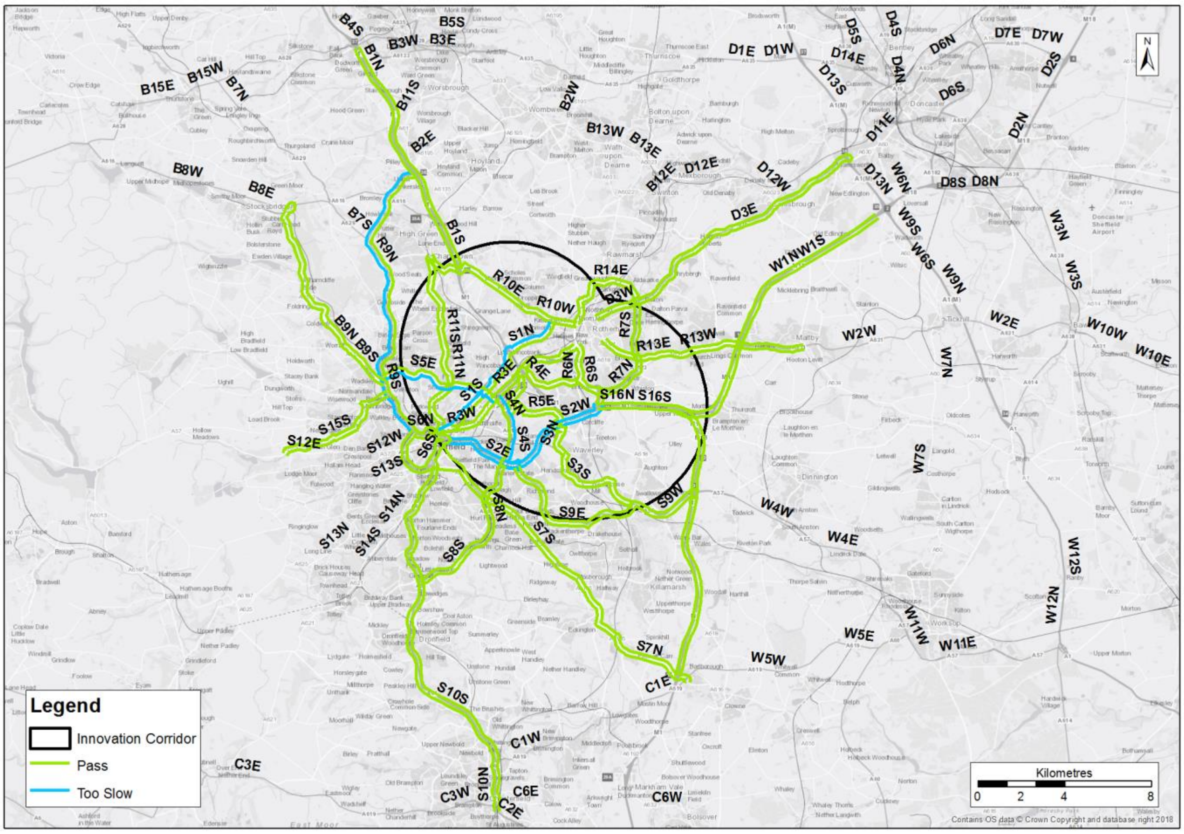


Figure 65. Innovation Corridor Area JT results IP

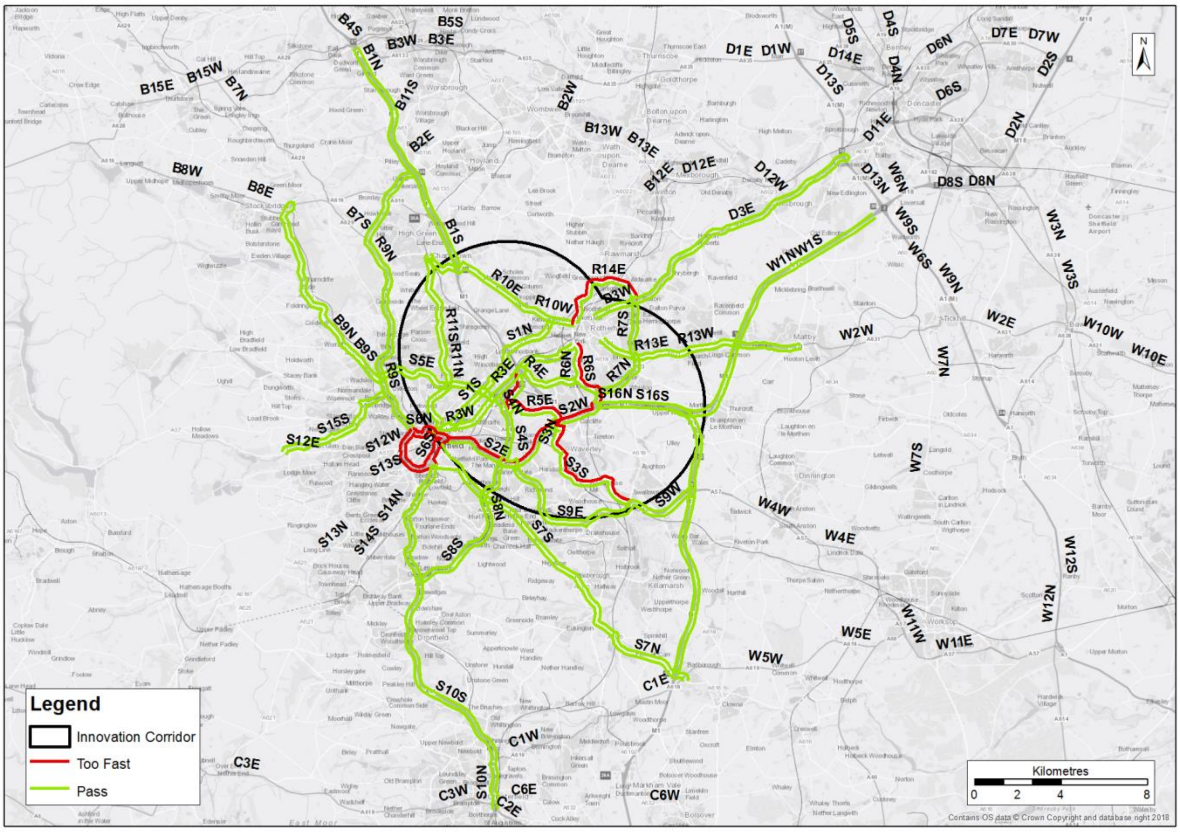


Figure 66. Innovation Corridor Area JT results PM

These results show that the performance of the model for traffic flows in the Innovation Corridor scheme area reaches WebTAG criteria for both cars and all vehicles in all time periods..

The journey time results in the area reach WebTAG standard in all three time periods.

Overall it is considered that the highway model should provide a suitable basis for assessing the highway impacts of the Innovation Corridor scheme although results should always be sense checked and sensitivity testing undertaken to better understand specific outcomes.

14. Summary

14.1 Introduction

The SCRTM1 model has been developed for 4 main purposes:

- Assess the Mass Transit scheme;
- Assess the Innovation corridor Scheme;
- Assess the Pan Northern Connectivity Scheme; and
- Provide a legacy model for assessing other schemes and policies.

The full model suite comprises a highway assignment model, public transport assignment model and a transport demand model.

14.2 Model Development

The highway assignment model is built within the SATURN software version 11.04.07H.

The highway network was developed through merging models from five existing models covering different parts of the SCR area.

The trip matrix was developed from a new set of mobile phone data. This was merged with synthetic data and then adjusted using matrix estimation in order to achieve a reasonable fit against observed traffic flows.

14.3 Standards Achieved

14.3.1 Mass Transit

The comparison against screenline flows in the Mass Transit area shows a good level of compliance with WebTAG standards. The individual counts also have a high level of compliance although full WebTAG standard is not achieved for the “Car” and “All Vehicle” categories in all time periods.

The journey time comparisons show a good level of compliance against WebTAG standards although in the AM and PM peak the values achieved are just below the WebTAG standard.

14.3.2 Innovation Corridor

The comparison against both screenline flows and individual counts shows a very good level of compliance against WebTAG standards with both the “Car” and “All Vehicle” values exceeding the standard.

The journey time comparisons show a good level of compliance against WebTAG standards across all three time periods.

14.3.3 Pan Northern Connectivity

During the development of the model the focus of the model requirements shifted slightly away from the Pan Northern Connectivity scheme area as a result of funding not being currently available to investigate the potential of this scheme. As a result less time was invested in trying to calibrate the model in this area. However, the validation results are similar to those for Mass Transit and Innovation Corridor scheme areas.

The model is considered to be acceptable for the development of options in the Pan Northern Connectivity scheme area. If the model is to be used to progress a preferred scheme to Outline Business Case status then some further calibration work may be required.

14.4 Fitness for Purpose

The model has been built in line with the principles set out in WebTAG. A good level of comparison between modelled and observed flows and journey times have been achieved for both scheme areas. It is therefore considered that the model can be used for assessing the highway impacts of the Mass Transit and Innovation Corridor schemes although results should always be sense checked and sensitivity testing undertaken to better understand specific results.

The model has been set up so that it can form the starting point for various other scheme and policy assessments across the SCR area although prior to each application a review of the calibration of the model in that area should be undertaken. It is expected that in many cases some additional calibration, and perhaps data collection, will be necessary.

Appendix A Glossary

ATC- Automatic Traffic Count; a device at a location that counts the number of vehicles crossing in both directions. Often these counts are not able to distinguish between vehicle types so MCC's are required.

Attraction- The end of a home-based trip that is not the traveller's home.

CSRGT- Continuing Survey of Road Goods Transit.

DMRB – Design Manual for Roads and Bridges

DfT- Department for Transport; government department.HBO- Home-Based Other; non-commuting trips to or from the traveller's own home. In modelling contexts and in the SCR model specifically, this usually excludes travel on employer's time and expense. However the mobile data not identify business travel, so for the purposes of this note, all non-commuting travel is included, including that paid for by an employer.

HBW- Home-Based Work / Home Based Commuting; commuting trips to or from the traveller's own home

HGV- Heavy Goods Vehicle; lorries and vans over 3.5 tonnes

JTW- Journey to work; data from the 2011 census containing individuals home and work locations and their usual mode of travel to work

LA – Local Authority

LGV- Light Goods Vehicle; vans under 3.5 tonnes

MAD- Median Absolute Deviation, a processes used to remove anomalous and outlying data.

MCC- Manually Classified Count; a location where the number of each vehicle type is recorded. Due to expense of processes these are done over a relatively short time period, and are therefore not considered a reliable total number of vehicles. Therefore they are used in conjunctions with ATCs.

ME2- The matrix estimation process used in this project, a built in module within SATURN.

MPD- Mobile Phone Data; travel data derived from tracking movements of mobile phones.

MSOA- Middle Super Output Area; a level of census geography; MSOAs contain around 7,500 people each.

var%- Acceptability criteria for short screenlines used in this report. With the threshold values based on the number of counts on the screenlines. (See Table 4)

NHB- Non-Home-Based; travel neither to nor from the traveller's own home. This includes NHBO and NHBEB.

NHBEB- Non-Home-Based-Other; a trip neither to nor from the traveller's own home, and the purpose of the trip is employer's business.

NHBO- Non-Home-Based-Other; a trip neither to nor from the traveller's own home, and the purpose of the trip is NOT employer's business.

NTEM- National Trip-End Model: a DfT model that forecasts changes in trip making over time by trip-end.

NTS- National Travel Survey; a continuous DfT household survey collecting travel diary data for a week for each individual in households surveyed.

OD / O-D – A particular origin-destination zone pair, can also be in reference to an individual cell / number within a matrix.

OGV- Other Goods Vehicle, these are goods vehicles greater than 3.5 tonnes. In this project OGVs are split into MGV and HGV vehicles.

ONS- Office of National Statistics: government department. Responsible for providing many of the key statistics and data sources used in the project, e.g. JTW.

Production- The end of a home-based trip that is the traveller's home. This may be the origin or the destination depending on whether the trip is outbound or returning.

RSI- Road-side interview; interview carried out with the assistance of the police by stopping vehicles travelling along a stretch of road and asking for journey information (e.g. origin and destination)

RTM- Regional Transport Model. A series of models developed for Highway's England, covering England, the TPS model is an example of a RTM.

SCR- Sheffield City Region

SCRTM1- Sheffield City Region Transport Model

SRN- Strategic Road Network, This consists of all the motorways and key A-roads in England, which are managed by Highways England.

SRTM3- Sheffield and Rotherham Transport Model. Strategic multi-modal transport model covering the whole of Sheffield and Rotherham.

TLD- Trip Length Distribution. A distribution of trips based on distance, which shows the number of trips travelling a particular distance.

TPS- Trans-Pennine South: a Highways England transport model of the area covering Leeds, Bradford, Sheffield, Manchester, Liverpool and Hull.

Trip-End- Total trips from or to a given area, usually a model zone or census geography area.

Trip-Rate- Trips divided by population or households (or occasionally number of jobs depending on context).

UC- User class, a combination of journey purpose and vehicle type. In this model there are 6 user classes, the first three are for cars with different journey purposes (commuting, business and other), with the later three are freight (LGV, MGV and HGV).

Appendix B Model Development Structure

Appendix C Network Coverage

Figure 67. Barnsley - West

Figure 68. Barnsley - East

Figure 69. Doncaster - West

Figure 70. Doncaster - North

Figure 71. Doncaster - South

Figure 72. Doncaster - Central

Figure 73. Rotherham - North

Figure 74. Rotherham - South

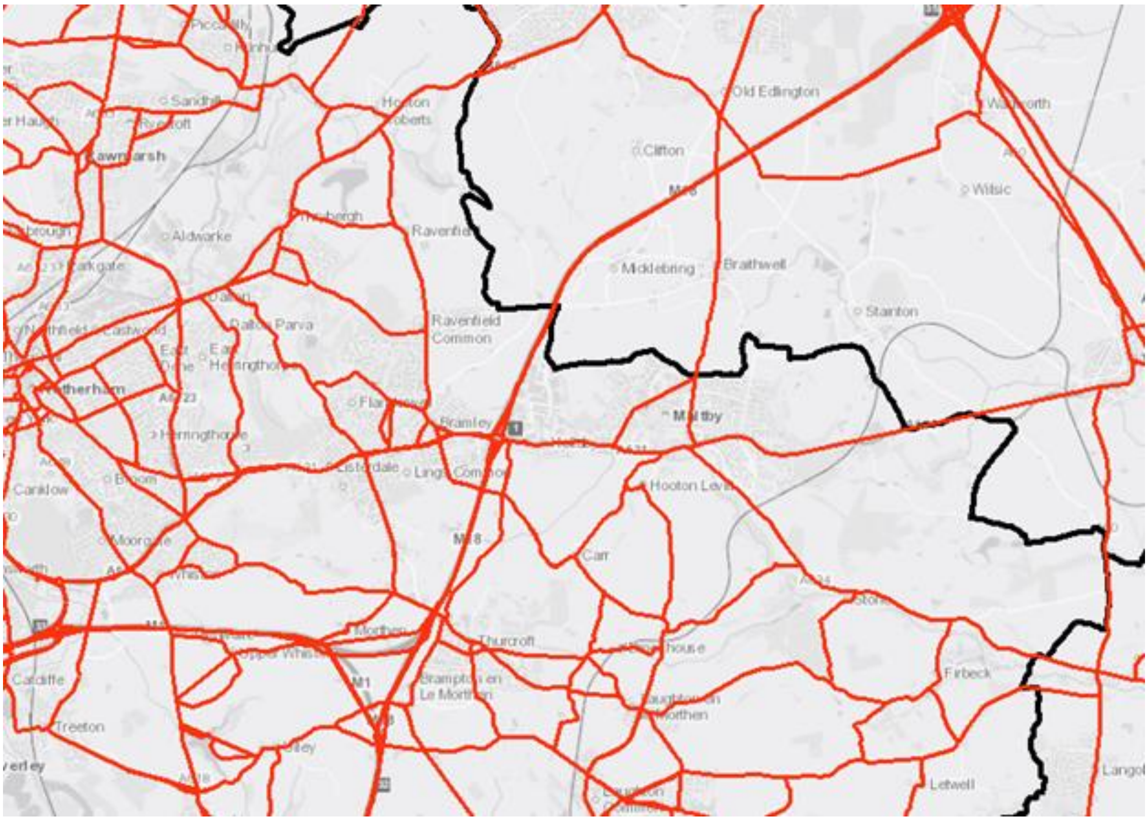


Figure 75. Rotherham - East

Figure 76. Rotherham - Central

Figure 77. Sheffield - South East

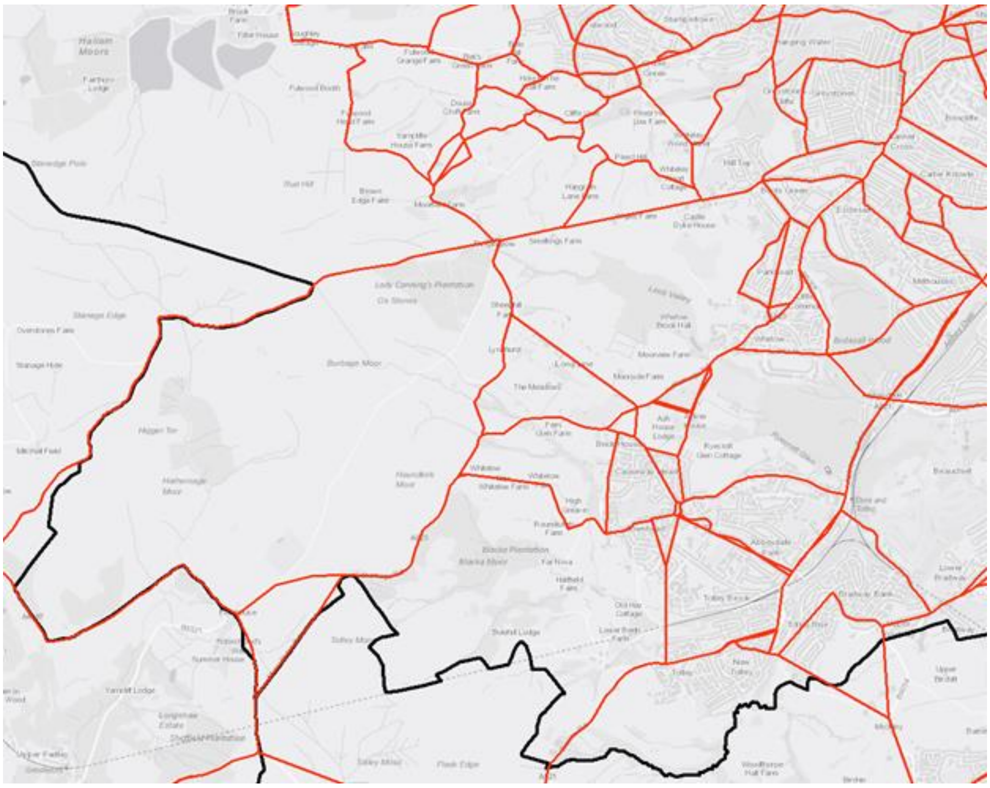


Figure 78. Sheffield - South West

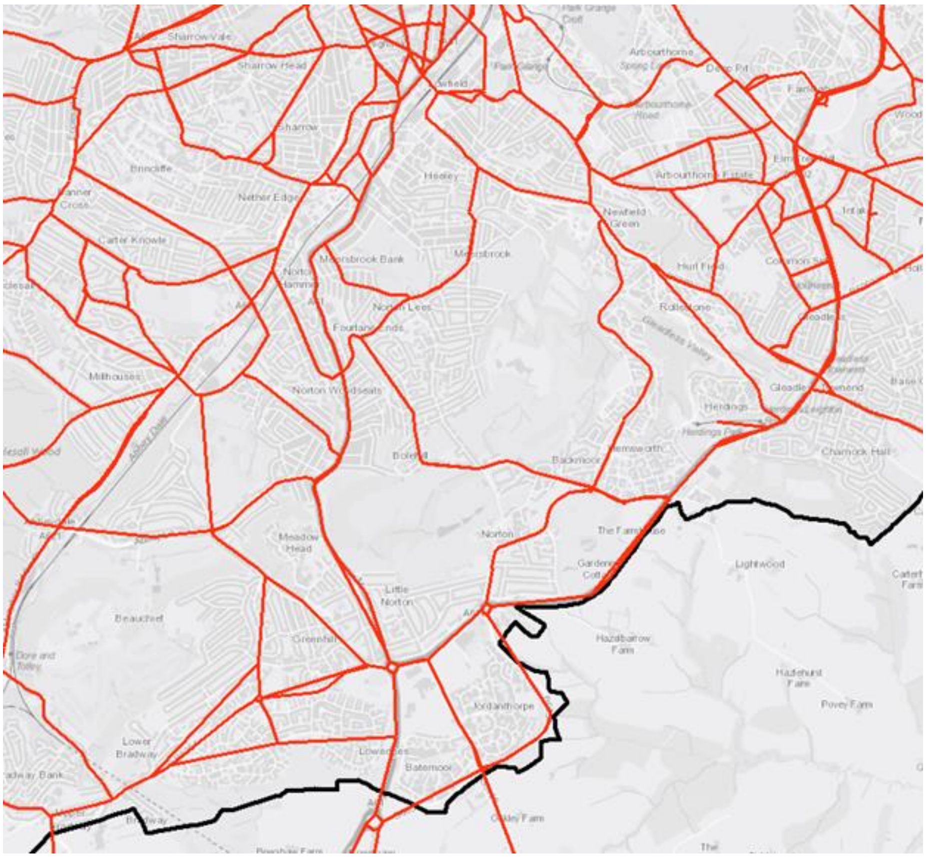


Figure 79. Sheffield - South

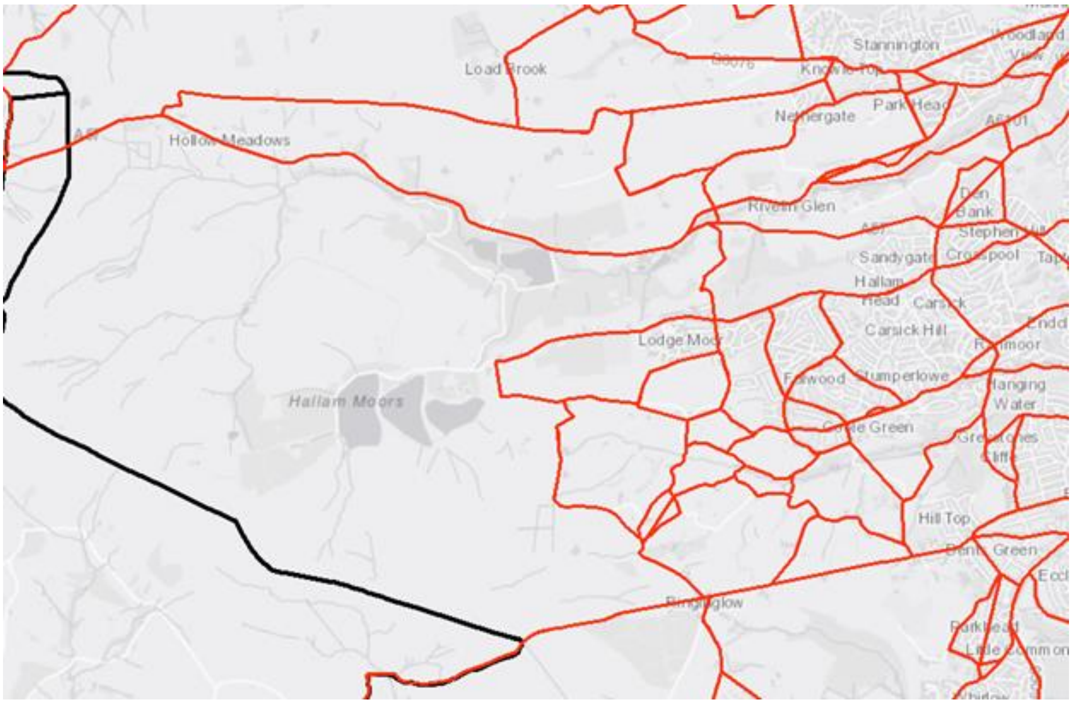


Figure 80. Sheffield - West

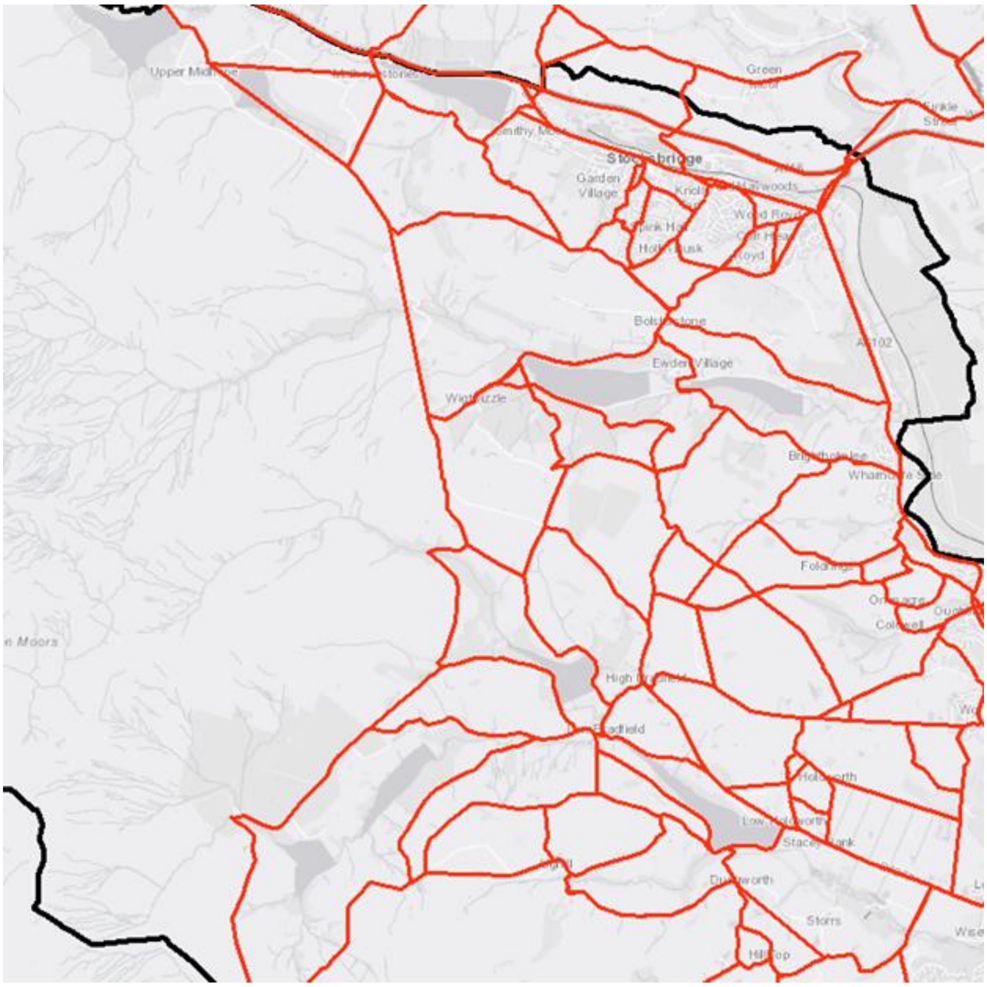


Figure 81. Sheffield - North West

Figure 82. Sheffield - North East

Figure 83. Sheffield - Meadowhall / Don Valley

Figure 84. Sheffield - Parkway

Figure 85. Sheffield - Central

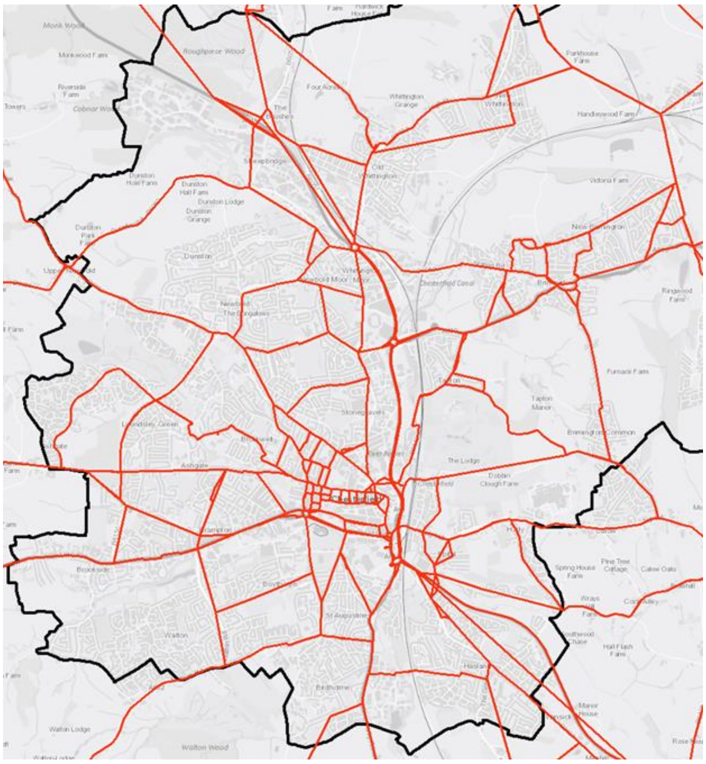


Figure 86. Chesterfield - West

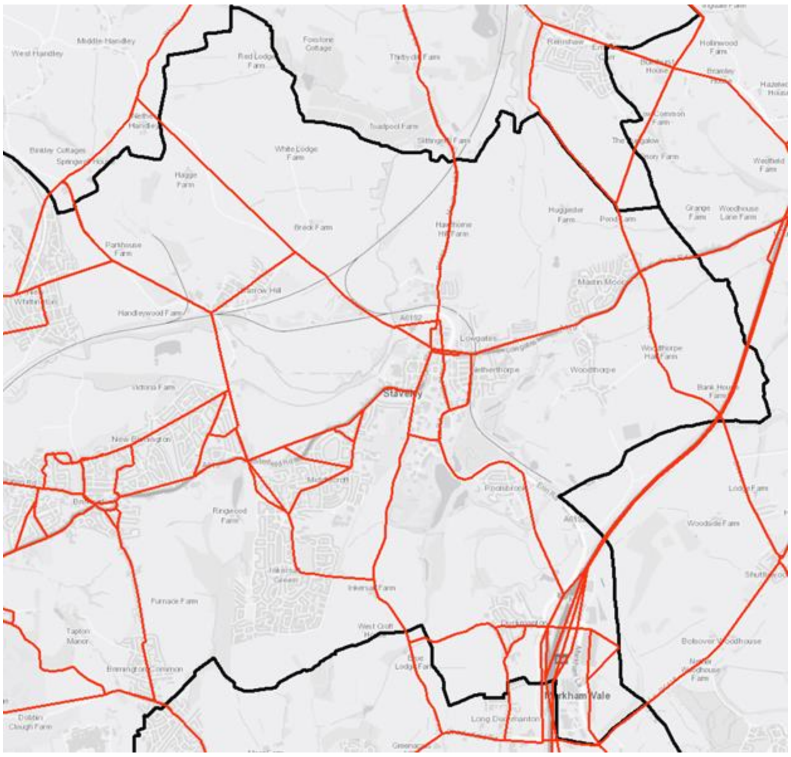


Figure 87. Chesterfield - East

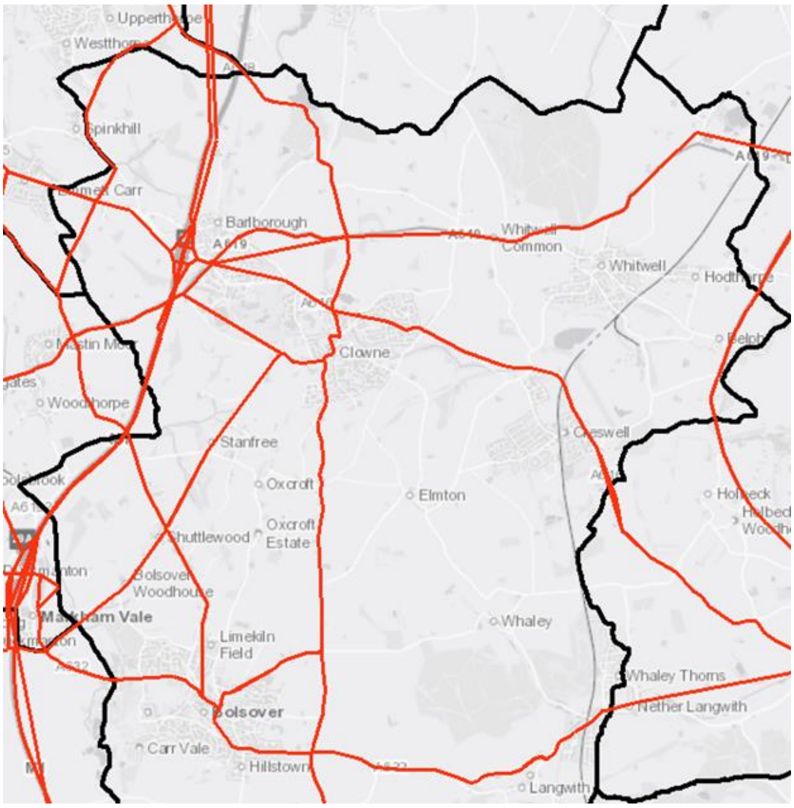


Figure 88. Bolsover - North

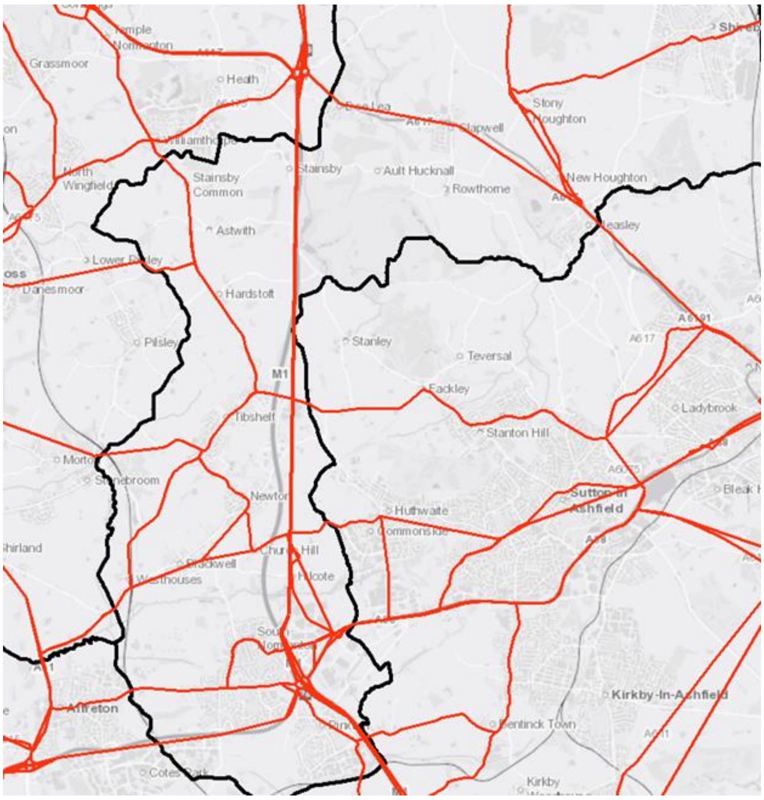


Figure 89. Bolsover - South

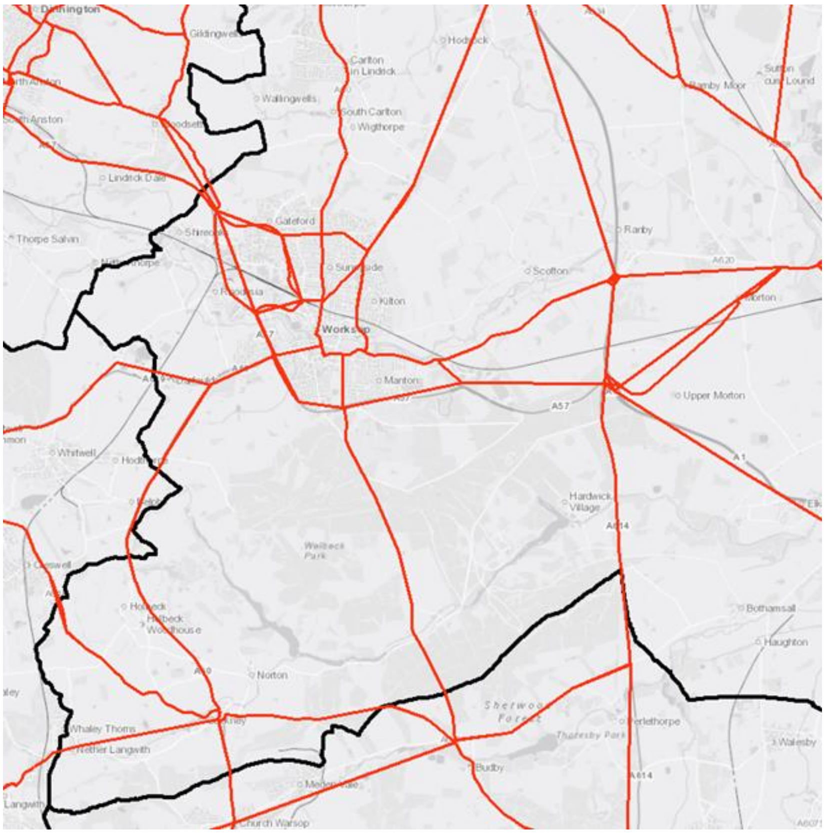


Figure 90. Bassetlaw - South West

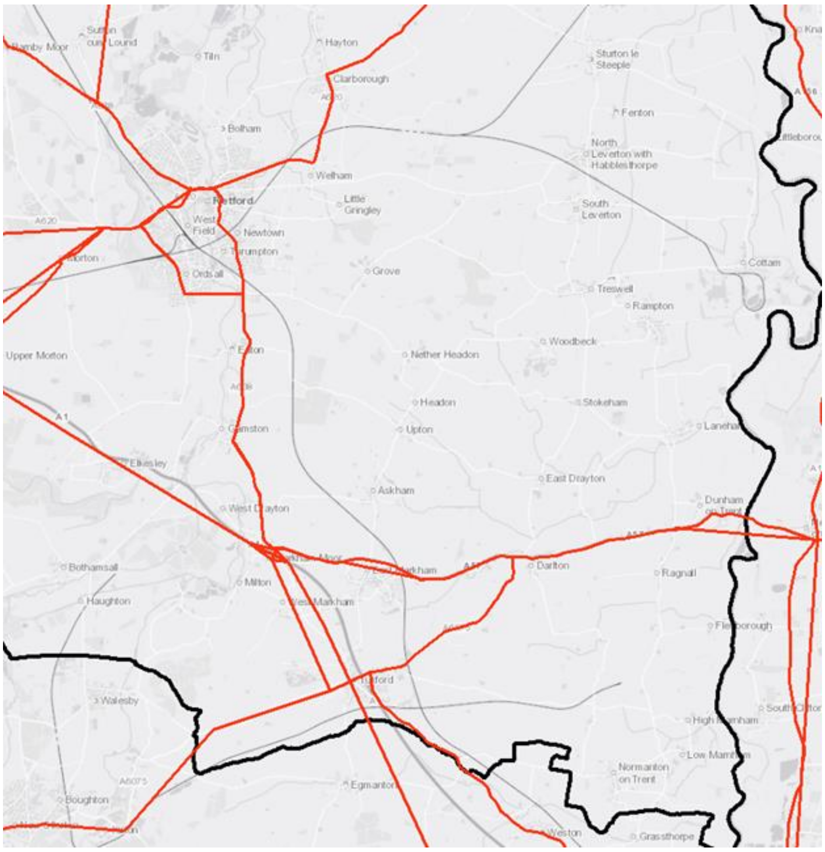


Figure 91. Bassetlaw - South East

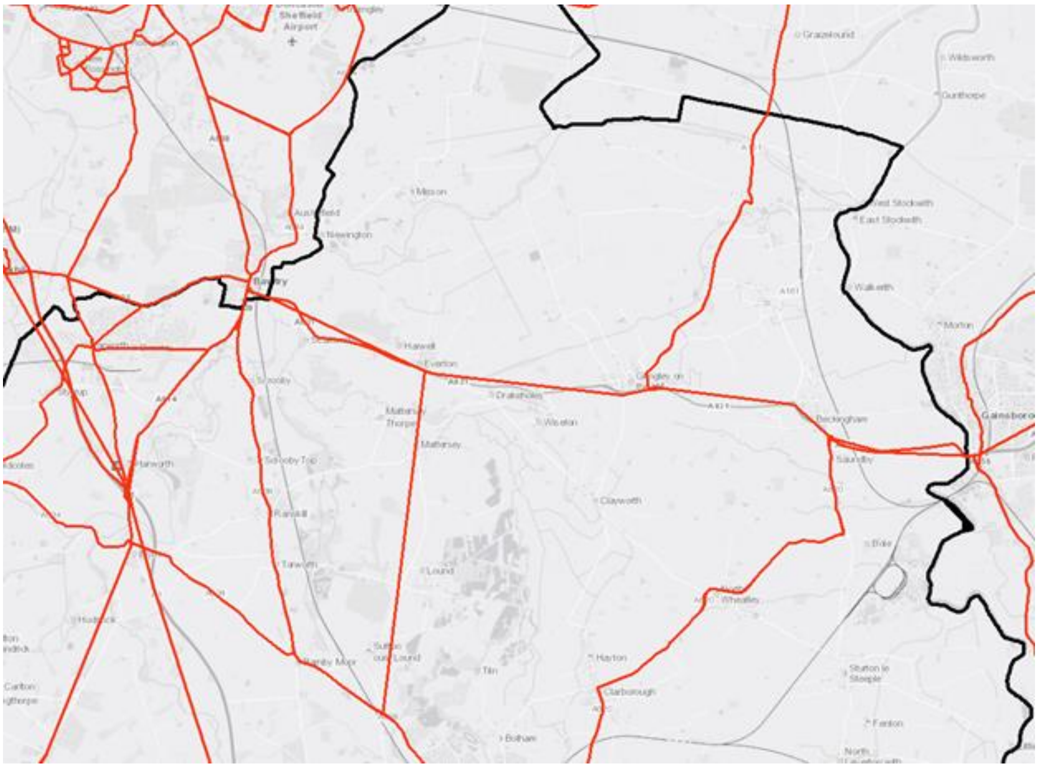


Figure 92. Bassetlaw - North

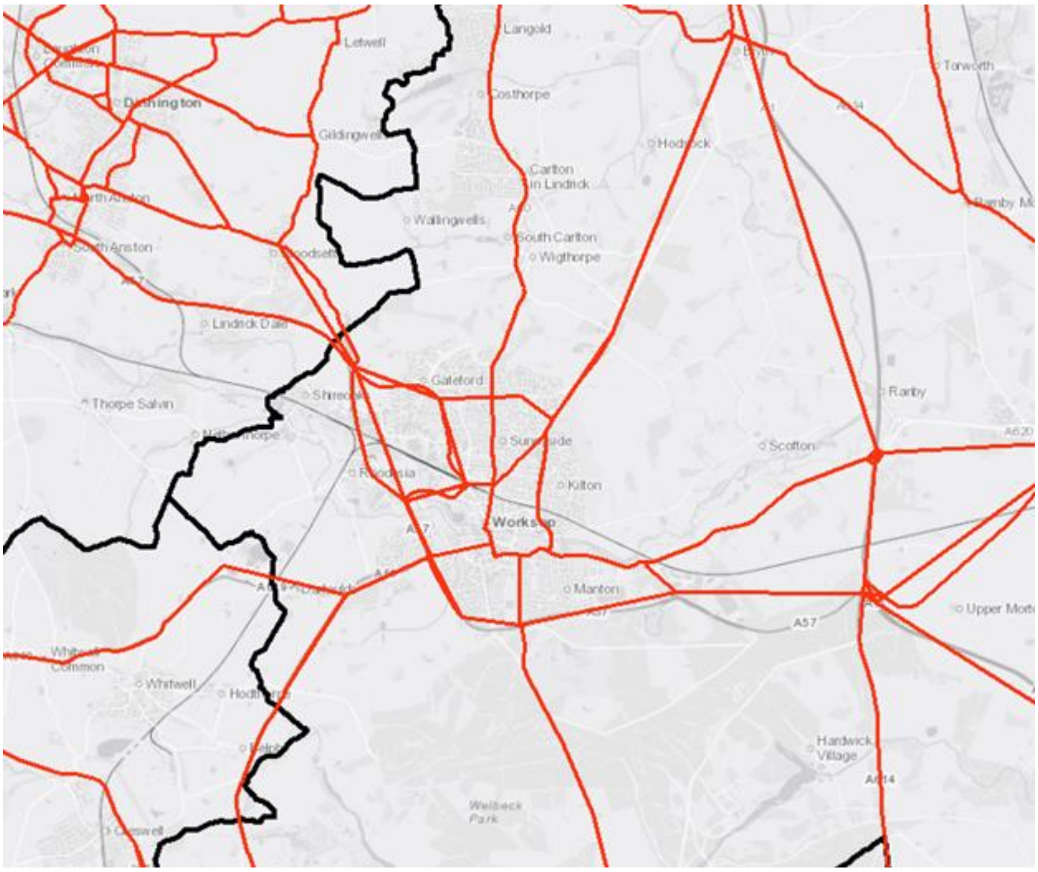


Figure 93. Bassetlaw - West

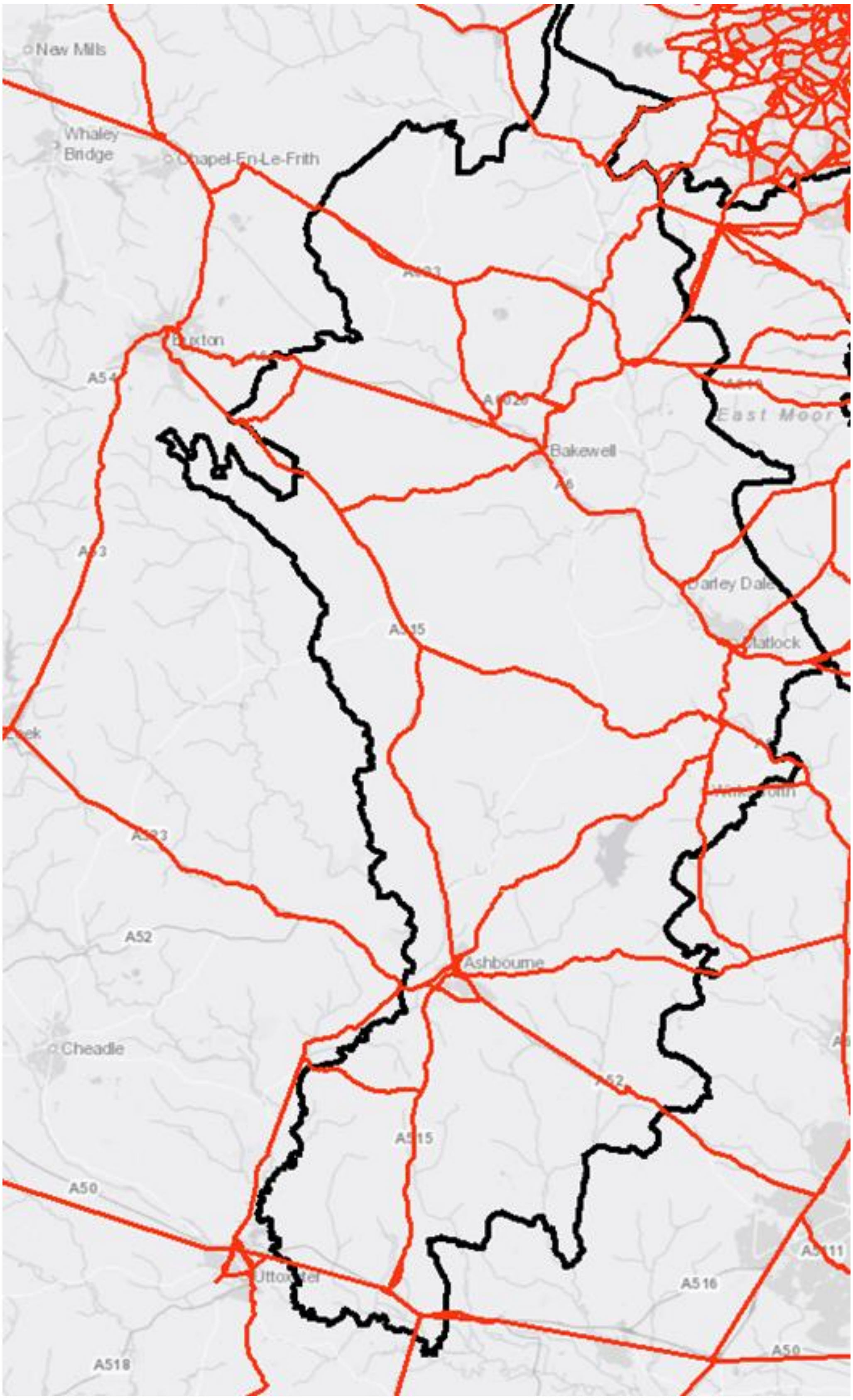


Figure 94. Derbyshire Dales

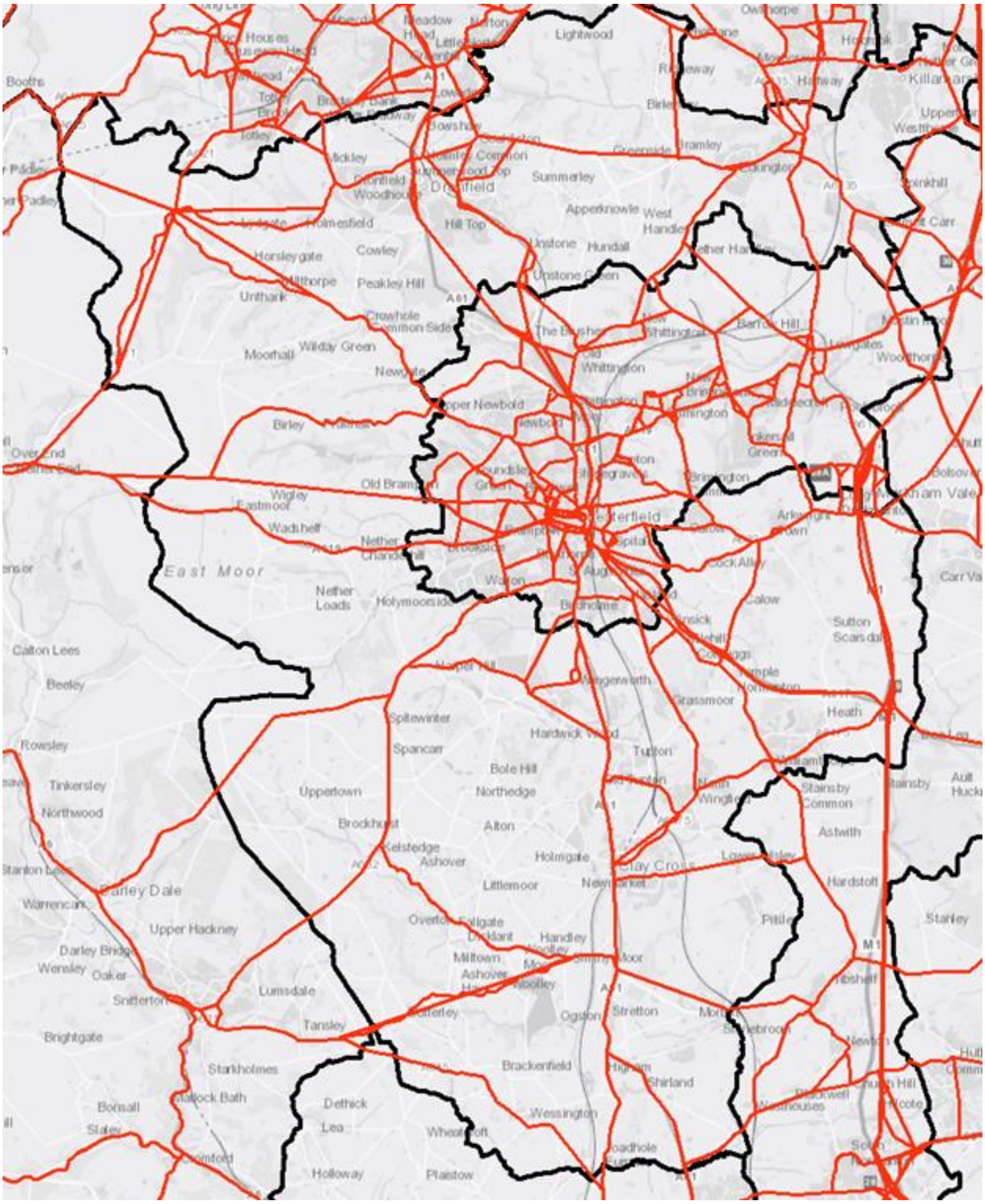


Figure 95. North East Derbyshire

Appendix D Capacity Indices

D.1 Initial Speed Flow Records used in SCRTM1

Below are the speed flow curves used in SCRTM1, as detailed in 6.2.2 (page 51).

Table 67. Initial Capacity Indices used in SCR for Simulation Area

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
1	D5M - Rural	70	5	Motorway		109	104	85	6000	9500	2.87
2	D4M - Rural	70	4	Motorway		109	104	85	4800	7600	2.87
3	D3M - Rural	70	3	Motorway		109	104	85	3600	5700	2.87
4	D2M - Rural	70	2	Motorway		104	98	80	2400	3800	2.64
5	D2 all purpose - Rural	70	2	Rural		97	91	78	2200	3400	2.30
6	D3 all purpose - Rural	70	3	Rural		97	91	78	3300	5100	2.30
7	Slip Road - 1 Lane - 70mph	70	1	Slip		105	82	45	800	2180	1.72
8	Slip Road - 2 Lane - 70mph	70	2	Slip		105	82	45	800	4360	1.24
9	Single (10m) TD9 - Rural	60	1	Rural		92	72	58	1200	1450	2.29
10	Good Single (7.3m) TD9 - Rural	60	1	Rural		88	71	60	800	1150	1.55
11	Typical single (7.3m) - Rural	60	1	Rural		78	61	49	800	1150	1.71
12	Single (6.5m)	60	1	Rural		67	51	45	600	1010	0.99
13	Single (5.5m)	60	1	Rural		58	41	29	200	800	0.81
14	Lightly Developed (20% 30mph) - Small Town	60	1	Small town		63	55	32	0	1200	1.00
15	Typically Developed (50% 30mph) - Small Town	60	1	Small town		57	48	30	0	1200	0.84
16	Heavily Developed (All 30mph) - Small Town	60	1	Small town		47	38	30	0	1200	0.46

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
17	Good - Non-central - Urban - 1 Lane - Curve - 30 mph	30	1	Non Central	Curve	48	39	30	200	800	0.84
18	Good - Non-central - Urban - 1 Lane - Flat - 30 mph	30	1	Non Central	Flat	46	46	45	1300	1300	3.06
19	Typical - Non-central - Urban - 1 Lane - Flat - 30 mph	30	1	Non Central	Flat	43	43	42	1150	1150	3.06
20	Poor - Non-central - Urban - 1 Lane - Flat - 30 mph	30	1	Non Central	Flat	40	40	39	1000	1000	3.07
21	Good - Central - Urban - 1 Lane - Flat - 30 mph	30	1	Central	Flat	43	43	42	1300	1300	3.06
22	Typical - Central - Urban - 1 Lane - Flat - 30 mph	30	1	Central	Flat	40	40	39	1150	1150	3.07
23	Poor - Central - Urban - 1 Lane - Flat - 30 mph	30	1	Central	Flat	34	33	33	1000	1000	3.08
24	Good - Non-central - Urban - 2 Lane - Curve - 30 mph	30	2	Non Central	Curve	48	39	30	400	1900	0.78
25	Good - Non-central - Urban - 2 Lane - Flat - 30 mph	30	2	Non Central	Flat	48	48	47	2600	2600	3.06
26	Typical - Non-central - Urban - 2 Lane - Flat - 30 mph	30	2	Non Central	Flat	45	44	44	2300	2300	3.06
27	Poor - Non-central - Urban - 2 Lane - Flat - 30 mph	30	2	Non Central	Flat	43	43	42	2000	2000	3.06
28	Good - Central - Urban - 2 Lane - Flat - 30 mph	30	2	Central	Flat	46	46	45	2600	2600	3.06
29	Typical - Central - Urban - 2 Lane - Flat - 30 mph	30	2	Central	Flat	43	43	42	2300	2300	3.06
30	Poor - Central - Urban - 2 Lane - Flat - 30 mph	30	2	Central	Flat	40	40	39	2000	2000	3.07

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
31	Good - Non-central - Urban - 3 Lane - Curve - 30 mph	30	3	Non Central	Curve	48	39	30	600	2400	0.84
32	Good - Non-central - Urban - 3 Lane - Fixed - 30 mph	30	3	Non Central	Flat	48	48	47	3900	3900	3.06
33	Typical - Non-central - Urban - 3 Lane - Fixed - 30 mph	30	3	Non Central	Flat	46	46	45	3450	3450	3.06
34	Poor - Non-central - Urban - 3 Lane - Fixed - 30 mph	30	3	Non Central	Flat	43	43	42	3000	3000	3.06
35	Good - Central - Urban - 3 Lane - Fixed - 30 mph	30	3	Central	Flat	48	48	47	3900	3900	3.06
36	Typical - Central - Urban - 3 Lane - Fixed - 30 mph	30	3	Central	Flat	45	44	44	3450	3450	3.06
37	Poor - Central - Urban - 3 Lane - Fixed - 30 mph	30	3	Central	Flat	43	43	42	3000	3000	3.06
38	Good - Non-central - Urban - 1 Lane - Curve - 40 mph	40	1	Non Central	Curve	64	54	47	200	800	0.62
39	Good - Non-central - Urban - 1 Lane - Flat - 40 mph	40	1	Non Central	Flat	62	62	61	1300	1300	3.04
40	Typical - Non-central - Urban - 1 Lane - Flat - 40 mph	40	1	Non Central	Flat	56	56	55	1150	1150	3.05
41	Poor - Non-central - Urban - 1 Lane - Flat - 40 mph	40	1	Non Central	Flat	50	49	49	1000	1000	3.05
42	Good - Central - Urban - 1 Lane - Flat - 40 mph	40	1	Central	Flat	59	59	58	1300	1300	3.05
43	Typical - Central - Urban - 1 Lane - Flat - 40 mph	40	1	Central	Flat	50	49	49	1150	1150	3.05
44	Poor - Central - Urban - 1 Lane - Flat - 40 mph	40	1	Central	Flat	40	40	39	1000	1000	3.07

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
45	Good - Non-central - Urban - 2 Lane - Curve - 40 mph	40	2	Non Central	Curve	64	54	47	400	1900	0.57
46	Good - Non-central - Urban - 2 Lane - Flat - 40 mph	40	2	Non Central	Flat	62	62	61	2600	2600	3.04
47	Typical - Non-central - Urban - 2 Lane - Flat - 40 mph	40	2	Non Central	Flat	59	59	58	2300	2300	3.05
48	Poor - Non-central - Urban - 2 Lane - Flat - 40 mph	40	2	Non Central	Flat	56	56	55	2000	2000	3.05
49	Good - Central - Urban - 2 Lane - Flat - 40 mph	40	2	Central	Flat	61	60	60	2600	2600	3.04
50	Typical - Central - Urban - 2 Lane - Flat - 40 mph	40	2	Central	Flat	56	56	55	2300	2300	3.05
51	Poor - Central - Urban - 2 Lane - Flat - 40 mph	40	2	Central	Flat	50	49	49	2000	2000	3.05
52	Good - Non-central - Urban - 3 Lane - Curve - 40 mph	40	3	Non Central	Curve	64	54	47	600	2400	0.62
53	Good - Non-central - Urban - 3 Lane - Fixed - 40 mph	40	3	Non Central	Flat	64	64	63	3900	3900	3.04
54	Typical - Non-central - Urban - 3 Lane - Fixed - 40 mph	40	3	Non Central	Flat	62	62	61	3450	3450	3.04
55	Poor - Non-central - Urban - 3 Lane - Fixed - 40 mph	40	3	Non Central	Flat	59	59	58	3000	3000	3.05
56	Good - Central - Urban - 3 Lane - Fixed - 40 mph	40	3	Central	Flat	62	62	61	3900	3900	3.04
57	Typical - Central - Urban - 3 Lane - Fixed - 40 mph	40	3	Central	Flat	59	59	58	3450	3450	3.05
58	Poor - Central - Urban - 3 Lane - Fixed - 40 mph	40	3	Central	Flat	56	56	55	3000	3000	3.05

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
59	Good - Non-central - Urban - 1 Lane - Curve - 50 mph	50	1	Non Central	Curve	80	71	63	200	800	0.67
60	Good - Non-central - Urban - 1 Lane - Flat - 50 mph	50	1	Non Central	Flat	75	75	74	1300	1300	3.04
61	Typical - Non-central - Urban - 1 Lane - Flat - 50 mph	50	1	Non Central	Flat	70	70	69	1150	1150	3.04
62	Poor - Non-central - Urban - 1 Lane - Flat - 50 mph	50	1	Non Central	Flat	62	62	61	1000	1000	3.04
63	Good - Non-central - Urban - 2 Lane - Curve - 50 mph	50	2	Non Central	Curve	80	71	63	400	1600	0.67
64	Good - Non-central - Urban - 2 Lane - Flat - 50 mph	50	2	Non Central	Flat	77	76	76	2600	2600	3.04
65	Typical - Non-central - Urban - 2 Lane - Flat - 50 mph	50	2	Non Central	Flat	75	75	74	2300	2300	3.04
66	Poor - Non-central - Urban - 2 Lane - Flat - 50 mph	50	2	Non Central	Flat	70	70	69	2000	2000	3.04
67	Good - Non-central - Urban - 3 Lane - Curve - 50 mph	50	3	Non Central	Curve	80	71	63	600	2400	0.67
68	Good - Non-central - Urban - 3 Lane - Fixed - 50 mph	50	3	Non Central	Flat	78	78	77	3900	3900	3.03
69	Typical - Non-central - Urban - 3 Lane - Fixed - 50 mph	50	3	Non Central	Flat	77	76	76	3450	3450	3.04
70	Poor - Non-central - Urban - 3 Lane - Fixed - 50 mph	50	3	Non Central	Flat	75	75	74	3000	3000	3.04
71	Good - Non-central - Rural - 1 Lane - Fixed - 50 mph	50	1	Rural	Flat	75	75	74	1300	1300	3.04

Index Number	Description	Speed Limit (mph)	Lanes	Road Type	Curved or Flat	Free Flow Speed (kph)	Break Point Speed (kph)	Speed at Capacity (kph)	Flow at which Free-Flow Holds (pcu)	Capacity (vehicles)	n
72	Typical - Non-central - Rural - 1 Lane - Fixed - 50 mph	50	1	Rural	Flat	72	72	71	1150	1150	3.04
73	Poor - Non-central - Rural - 1 Lane - Fixed - 50 mph	50	1	Rural	Flat	67	67	66	1000	1000	3.04
74	Good - Non-central - Rural - 2 Lane - Fixed - 50 mph	50	2	Rural	Flat	77	76	76	2600	2600	3.04
75	Typical - Non-central - Rural - 2 Lane - Fixed - 50 mph	50	2	Rural	Flat	75	75	74	2300	2300	3.04
76	Poor - Non-central - Rural - 2 Lane - Fixed - 50 mph	50	2	Rural	Flat	72	72	71	2000	2000	3.04
77	Good - Non-central - Rural - 3 Lane - Fixed - 50 mph	50	3	Rural	Flat	80	80	79	3900	3900	3.03
78	Typical - Non-central - Rural - 3 Lane - Fixed - 50 mph	50	3	Rural	Flat	78	78	77	3450	3450	3.03
79	Poor - Non-central - Rural - 3 Lane - Fixed - 50 mph	50	3	Rural	Flat	75	75	74	3000	3000	3.04

D.2 Final Capacities Indices used in SCRTM1

Final Capacity indices used in SCRTM1

Following the revision mentioned in 8.2 and introduction of the speed flow curves used for the secondary network. Here is the final set of Speed Flow curves / Capacity index records used in SCRTM1.

Table 68. Final Capacity Indices used in SCR for Simulation Area

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
401	Primary	D5M - Rural	109	85	10311	2.87
402	Primary	D4M - Rural	109	85	8249	2.87
403	Primary	D3M - Rural	109	85	6603	2.87
404	Primary	D2M - Rural	104	80	4069	2.64
405	Primary	D2 all purpose - Rural	97	78	3666	2.3
406	Primary	D3 all purpose - Rural	97	78	5500	2.3
407	Primary	Slip Road - 1 Lane - 70mph	105	45	2180	1.72
408	Primary	Slip Road - 2 Lane - 70mph	105	45	4360	1.24
409	Primary	Primary Single (10m) TD9 - Rural	92	58	1527	2.29
410	Primary	Primary Good Single (7.3m) TD9 - Rural	88	60	1211	1.55
411	Primary	Primary Typical single (7.3m) - Rural	78	49	1211	1.71
412	Primary	Primary Single (6.5m)	67	45	1064	0.99
413	Primary	Primary Single (5.5m)	58	29	843	0.81
414	Primary	Primary Lightly Developed (20% 30mph) - Small Town	63	32	1258	1
415	Primary	Primary Typically Developed (50% 30mph) - Small Town	57	30	1258	0.84
416	Primary	Primary Heavily Developed (All 30mph) - Small Town	47	30	1258	0.46
417	Primary	Primary Good - Non-central - Urban - 1 Lane - Curve - 30 mph	46	29	1350	0.84
418	Primary	Primary Good - Non-central - Urban - 1 Lane - Flat - 30 mph	44	43	1350	3.06
419	Primary	Primary Typical - Non-central - Urban - 1 Lane - Flat - 30 mph	41	40	1194	3.06
420	Primary	Primary Poor - Non-central - Urban - 1 Lane - Flat - 30 mph	38	37	1038	3.07
421	Primary	Primary Good - Central - Urban - 1 Lane - Flat - 30 mph	31	30	1344	3.06
422	Primary	Primary Typical - Central - Urban - 1 Lane - Flat - 30 mph	28	27	1189	3.07
423	Primary	Primary Poor - Central - Urban - 1 Lane - Flat - 30 mph	22	21	1034	3.08
424	Primary	Primary Good - Non-central - Urban - 2 Lane - Curve - 30 mph	46	29	1973	0.78
425	Primary	Primary Good - Non-central - Urban - 2 Lane - Flat - 30 mph	46	45	2700	3.06
426	Primary	Primary Typical - Non-central - Urban - 2 Lane - Flat - 30 mph	43	42	2388	3.06
427	Primary	Primary Poor - Non-central - Urban - 2 Lane - Flat - 30 mph	41	40	2077	3.06
428	Primary	Primary Good - Central - Urban - 2 Lane - Flat - 30 mph	34	33	2688	3.06
429	Primary	Primary Typical - Central - Urban - 2	31	30	2377	3.06

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
		Lane - Flat - 30 mph				
430	Primary	Primary Poor - Central - Urban - 2 Lane - Flat - 30 mph	28	27	2067	3.07
431	Primary	Primary Good - Non-central - Urban - 3 Lane - Curve - 30 mph	46	29	2492	0.84
432	Primary	Primary Good - Non-central - Urban - 3 Lane - Fixed - 30 mph	46	45	4050	3.06
433	Primary	Primary Typical - Non-central - Urban - 3 Lane - Fixed - 30 mph	44	43	3582	3.06
434	Primary	Primary Poor - Non-central - Urban - 3 Lane - Fixed - 30 mph	41	40	3115	3.06
435	Primary	Primary Good - Central - Urban - 3 Lane - Fixed - 30 mph	36	35	4031	3.06
436	Primary	Primary Typical - Central - Urban - 3 Lane - Fixed - 30 mph	33	32	3566	3.06
437	Primary	Primary Poor - Central - Urban - 3 Lane - Fixed - 30 mph	31	30	3101	3.06
438	Primary	Primary Good - Non-central - Urban - 1 Lane - Curve - 40 mph	61	45	1350	0.62
439	Primary	Primary Good - Non-central - Urban - 1 Lane - Flat - 40 mph	59	58	1350	3.04
440	Primary	Primary Typical - Non-central - Urban - 1 Lane - Flat - 40 mph	53	52	1194	3.05
441	Primary	Primary Poor - Non-central - Urban - 1 Lane - Flat - 40 mph	48	47	1038	3.05
442	Primary	Primary Good - Central - Urban - 1 Lane - Flat - 40 mph	46	45	1344	3.05
443	Primary	Primary Typical - Central - Urban - 1 Lane - Flat - 40 mph	38	37	1189	3.05
444	Primary	Primary Poor - Central - Urban - 1 Lane - Flat - 40 mph	28	27	1034	3.07
445	Primary	Primary Good - Non-central - Urban - 2 Lane - Curve - 40 mph	61	45	1973	0.57
446	Primary	Primary Good - Non-central - Urban - 2 Lane - Flat - 40 mph	59	58	2700	3.04
447	Primary	Primary Typical - Non-central - Urban - 2 Lane - Flat - 40 mph	56	55	2388	3.05
448	Primary	Primary Poor - Non-central - Urban - 2 Lane - Flat - 40 mph	53	52	2077	3.05
449	Primary	Primary Good - Central - Urban - 2 Lane - Flat - 40 mph	48	47	2688	3.04
450	Primary	Primary Typical - Central - Urban - 2 Lane - Flat - 40 mph	43	42	2377	3.05
451	Primary	Primary Poor - Central - Urban - 2 Lane - Flat - 40 mph	38	37	2067	3.05
452	Primary	Primary Good - Non-central - Urban - 3 Lane - Curve - 40 mph	61	45	2492	0.62
453	Primary	Primary Good - Non-central - Urban - 3 Lane - Fixed - 40 mph	61	60	4050	3.04
454	Primary	Primary Typical - Non-central - Urban - 3 Lane - Fixed - 40 mph	59	58	3582	3.04
455	Primary	Primary Poor - Non-central - Urban - 3 Lane - Fixed - 40 mph	56	55	3115	3.05
456	Primary	Primary Good - Central - Urban - 3 Lane - Fixed - 40 mph	49	48	4031	3.04

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
457	Primary	Primary Typical - Central - Urban - 3 Lane - Fixed - 40 mph	46	45	3566	3.05
458	Primary	Primary Poor - Central - Urban - 3 Lane - Fixed - 40 mph	43	42	3101	3.05
459	Primary	Primary Good - Non-central - Urban - 1 Lane - Curve - 50 mph	76	60	1350	0.67
460	Primary	Primary Good - Non-central - Urban - 1 Lane - Flat - 50 mph	71	70	1350	3.04
461	Primary	Primary Typical - Non-central - Urban - 1 Lane - Flat - 50 mph	67	66	1194	3.04
462	Primary	Primary Poor - Non-central - Urban - 1 Lane - Flat - 50 mph	59	58	1038	3.04
463	Primary	Primary Good - Non-central - Urban - 2 Lane - Curve - 50 mph	76	60	1661	0.67
464	Primary	Primary Good - Non-central - Urban - 2 Lane - Flat - 50 mph	73	72	2700	3.04
465	Primary	Primary Typical - Non-central - Urban - 2 Lane - Flat - 50 mph	71	70	2388	3.04
466	Primary	Primary Poor - Non-central - Urban - 2 Lane - Flat - 50 mph	67	66	2077	3.04
467	Primary	Primary Good - Non-central - Urban - 3 Lane - Curve - 50 mph	76	60	2492	0.67
468	Primary	Primary Good - Non-central - Urban - 3 Lane - Fixed - 50 mph	74	73	4050	3.03
469	Primary	Primary Typical - Non-central - Urban - 3 Lane - Fixed - 50 mph	73	72	3582	3.04
470	Primary	Primary Poor - Non-central - Urban - 3 Lane - Fixed - 50 mph	71	70	3115	3.04
471	Primary	Primary Good - Non-central - Rural - 1 Lane - Curve - 50 mph	71	49	1369	3.04
472	Primary	Primary Typical - Non-central - Rural - 1 Lane - Curve - 50 mph	68	49	1211	3.04
473	Primary	Primary Poor - Non-central - Rural - 1 Lane - Curve - 50 mph	64	49	1053	3.04
474	Primary	Primary Good - Non-central - Rural - 2 Lane - Curve - 50 mph	73	49	2804	3.04
475	Primary	Primary Typical - Non-central - Rural - 2 Lane - Curve - 50 mph	71	49	2480	3.04
476	Primary	Primary Poor - Non-central - Rural - 2 Lane - Curve - 50 mph	68	49	2157	3.04
477	Primary	Primary Good - Non-central - Rural - 3 Lane - Curve - 50 mph	76	49	4206	3.03
478	Primary	Primary Typical - Non-central - Rural - 3 Lane - Curve - 50 mph	74	49	3720	3.03
479	Primary	Primary Poor - Non-central - Rural - 3 Lane - Curve - 50 mph	71	49	3235	3.04
480	Primary	Primary Typical - Central - Urban - 1 Lane - Flat - 20 mph	20	19	827	3.08
481	Primary	Primary Typical - Non-Central - Urban - 1 Lane - Flat - 20 mph	30	29	935	3.08
482	Primary	Primary Typical - Non-central - Urban - 4 Lane - Fixed - 30 mph	44	43	4776	3.06
483	Primary	Primary Typical - Non-central - Urban - 5 Lane - Fixed - 30 mph	44	43	5970	3.06
484	Primary	Slip Road - 1 Lane - 50mph	76	45	2000	1.72

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
485	Primary	Slip Road - 2 Lane - 50mph	76	45	4000	1.24
488	Primary	Primary Good - Non-central - Urban - 1 Lane - Flat - 40 mph	59	58	1558	3.04
490	Primary	D3 all purpose - Motorway 50mph roadworks	76	61	5908	2.3
491	Primary	D2 all purpose - Parkway only	92	55	3666	2.3
501	Primary	1 Lane Motorway Gyratory	46	45	2000	1
502	Primary	2 Lane Motorway Gyratory	46	45	4000	1
503	Primary	3 Lane Motorway Gyratory	46	45	6000	1
504	Primary	4 Lane Motorway Gyratory	46	45	8000	1
505	Primary	5 Lane Motorway Gyratory	46	45	10000	1
506	Primary	D6M - Rural	104	81	12050	2.87
601	Primary	5 lane (D5M) managed motorway - Rural	97	85	10311	2.87
602	Primary	4 lane (D5M) managed motorway - Rural	97	85	8249	2.87
603	Primary	3 lane (D5M) managed motorway - Rural	97	85	6603	2.87
604	Primary	2 lane (D5M) managed motorway - Rural	97	85	4069	2.64
606	Primary	6 lane (D5M) managed motorway - Rural	97	85	12050	2.87
9	Secondary	Single (10m) TD9 - Rural	64.1	40	1527	2.29
10	Secondary	Good Single (7.3m) TD9 - Rural	61.1	42	1211	1.55
11	Secondary	Typical single (7.3m) - Rural	54.1	34	1211	1.71
12	Secondary	Single (6.5m)	46.1	31	1064	0.99
13	Secondary	Single (5.5m)	40.1	20	843	0.81
14	Secondary	Lightly Developed (20% 30mph) - Small Town	44.1	22	1258	1
15	Secondary	Typically Developed (50% 30mph) - Small Town	39.1	21	1258	0.84
16	Secondary	Heavily Developed (All 30mph) - Small Town	32.1	21	1258	0.46
17	Secondary	Good - Non-central - Urban - 1 Lane - Curve - 30 mph	32.1	20	1350	0.84
18	Secondary	Good - Non-central - Urban - 1 Lane - Flat - 30 mph	30.1	30	1350	3.06
19	Secondary	Typical - Non-central - Urban - 1 Lane - Flat - 30 mph	28.1	28	1194	3.06
20	Secondary	Poor - Non-central - Urban - 1 Lane - Flat - 30 mph	26.1	25	1038	3.07
21	Secondary	Good - Central - Urban - 1 Lane - Flat - 30 mph	21.1	21	1344	3.06
22	Secondary	Typical - Central - Urban - 1 Lane - Flat - 30 mph	19.1	18	1189	3.07
23	Secondary	Poor - Central - Urban - 1 Lane - Flat - 30 mph	15.1	14	1034	3.08
24	Secondary	Good - Non-central - Urban - 2 Lane - Curve - 30 mph	32.1	20	1973	0.78
25	Secondary	Good - Non-central - Urban - 2 Lane - Flat - 30 mph	32.1	31	2700	3.06
26	Secondary	Typical - Non-central - Urban - 2 Lane - Flat - 30 mph	30.1	29	2388	3.06
27	Secondary	Poor - Non-central - Urban - 2 Lane - Flat - 30 mph	28.1	28	2077	3.06
28	Secondary	Good - Central - Urban - 2 Lane - Flat - 30 mph	23.1	23	2688	3.06
29	Secondary	Typical - Central - Urban - 2 Lane - Flat -	21.1	21	2377	3.06

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
		30 mph				
30	Secondary	Poor - Central - Urban - 2 Lane - Flat - 30 mph	19.1	18	2067	3.07
31	Secondary	Good - Non-central - Urban - 3 Lane - Curve - 30 mph	32.1	20	2492	0.84
32	Secondary	Good - Non-central - Urban - 3 Lane - Fixed - 30 mph	32.1	31	4050	3.06
33	Secondary	Typical - Non-central - Urban - 3 Lane - Fixed - 30 mph	30.1	30	3582	3.06
34	Secondary	Poor - Non-central - Urban - 3 Lane - Fixed - 30 mph	28.1	28	3115	3.06
35	Secondary	Good - Central - Urban - 3 Lane - Fixed - 30 mph	25.1	24	4031	3.06
36	Secondary	Typical - Central - Urban - 3 Lane - Fixed - 30 mph	23.1	22	3566	3.06
37	Secondary	Poor - Central - Urban - 3 Lane - Fixed - 30 mph	21.1	21	3101	3.06
38	Secondary	Good - Non-central - Urban - 1 Lane - Curve - 40 mph	42.1	31	1350	0.62
39	Secondary	Good - Non-central - Urban - 1 Lane - Flat - 40 mph	41.1	40	1350	3.04
40	Secondary	Typical - Non-central - Urban - 1 Lane - Flat - 40 mph	37.1	36	1194	3.05
41	Secondary	Poor - Non-central - Urban - 1 Lane - Flat - 40 mph	33.1	32	1038	3.05
42	Secondary	Good - Central - Urban - 1 Lane - Flat - 40 mph	32.1	31	1344	3.05
43	Secondary	Typical - Central - Urban - 1 Lane - Flat - 40 mph	26.1	25	1189	3.05
44	Secondary	Poor - Central - Urban - 1 Lane - Flat - 40 mph	19.1	18	1034	3.07
45	Secondary	Good - Non-central - Urban - 2 Lane - Curve - 40 mph	42.1	31	1973	0.57
46	Secondary	Good - Non-central - Urban - 2 Lane - Flat - 40 mph	41.1	40	2700	3.04
47	Secondary	Typical - Non-central - Urban - 2 Lane - Flat - 40 mph	39.1	38	2388	3.05
48	Secondary	Poor - Non-central - Urban - 2 Lane - Flat - 40 mph	37.1	36	2077	3.05
49	Secondary	Good - Central - Urban - 2 Lane - Flat - 40 mph	33.1	32	2688	3.04
50	Secondary	Typical - Central - Urban - 2 Lane - Flat - 40 mph	30.1	29	2377	3.05
51	Secondary	Poor - Central - Urban - 2 Lane - Flat - 40 mph	26.1	25	2067	3.05
52	Secondary	Good - Non-central - Urban - 3 Lane - Curve - 40 mph	42.1	31	2492	0.62
53	Secondary	Good - Non-central - Urban - 3 Lane - Fixed - 40 mph	42.1	42	4050	3.04
54	Secondary	Typical - Non-central - Urban - 3 Lane - Fixed - 40 mph	41.1	40	3582	3.04
55	Secondary	Poor - Non-central - Urban - 3 Lane - Fixed - 40 mph	39.1	38	3115	3.05
56	Secondary	Good - Central - Urban - 3 Lane - Fixed - 40 mph	34.1	33	4031	3.04

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
57	Secondary	Typical - Central - Urban - 3 Lane - Fixed - 40 mph	32.1	31	3566	3.05
58	Secondary	Poor - Central - Urban - 3 Lane - Fixed - 40 mph	30.1	29	3101	3.05
59	Secondary	Good - Non-central - Urban - 1 Lane - Curve - 50 mph	53.1	42	1350	0.67
60	Secondary	Good - Non-central - Urban - 1 Lane - Flat - 50 mph	49.1	49	1350	3.04
61	Secondary	Typical - Non-central - Urban - 1 Lane - Flat - 50 mph	46.1	46	1194	3.04
62	Secondary	Poor - Non-central - Urban - 1 Lane - Flat - 50 mph	41.1	40	1038	3.04
63	Secondary	Good - Non-central - Urban - 2 Lane - Curve - 50 mph	53.1	42	1661	0.67
64	Secondary	Good - Non-central - Urban - 2 Lane - Flat - 50 mph	51.1	50	2700	3.04
65	Secondary	Typical - Non-central - Urban - 2 Lane - Flat - 50 mph	49.1	49	2388	3.04
66	Secondary	Poor - Non-central - Urban - 2 Lane - Flat - 50 mph	46.1	46	2077	3.04
67	Secondary	Good - Non-central - Urban - 3 Lane - Curve - 50 mph	53.1	42	2492	0.67
68	Secondary	Good - Non-central - Urban - 3 Lane - Fixed - 50 mph	51.1	51	4050	3.03
69	Secondary	Typical - Non-central - Urban - 3 Lane - Fixed - 50 mph	51.1	50	3582	3.04
70	Secondary	Poor - Non-central - Urban - 3 Lane - Fixed - 50 mph	49.1	49	3115	3.04
71	Secondary	Good - Non-central - Rural - 1 Lane - Curve - 50 mph	49.1	34	1369	3.04
72	Secondary	Typical - Non-central - Rural - 1 Lane - Curve - 50 mph	47.1	34	1211	3.04
73	Secondary	Poor - Non-central - Rural - 1 Lane - Curve - 50 mph	44.1	34	1053	3.04
74	Secondary	Good - Non-central - Rural - 2 Lane - Curve - 50 mph	51.1	34	2804	3.04
75	Secondary	Typical - Non-central - Rural - 2 Lane - Curve - 50 mph	49.1	34	2480	3.04
76	Secondary	Poor - Non-central - Rural - 2 Lane - Curve - 50 mph	47.1	34	2157	3.04
77	Secondary	Good - Non-central - Rural - 3 Lane - Curve - 50 mph	53.1	34	4206	3.03
78	Secondary	Typical - Non-central - Rural - 3 Lane - Curve - 50 mph	51.1	34	3720	3.03
79	Secondary	Poor - Non-central - Rural - 3 Lane - Curve - 50 mph	49.1	34	3235	3.04
80	Secondary	Typical - Central - Urban - 1 Lane - Flat - 20 mph	14.1	13	827	3.08
81	Secondary	Typical - Non-Central - Urban - 1 Lane - Flat - 20 mph	21.1	20	935	3.08
82	Secondary	Typical - Non-central - Urban - 4 Lane - Fixed - 30 mph	30.1	30	4776	3.06
83	Secondary	Typical - Non-central - Urban - 5 Lane - Fixed - 30 mph	30.1	30	5970	3.06
88	Secondary	Good - Non-central - Urban - 1 Lane -	41.1	40	1558	3.04

Index Number	Primary or Secondary	Complete Description	Free Flow Speed (kph)	Speed at Capacity (kph)	Capacity (vehicles)	n
		Flat - 40 mph				
89	Secondary	Poor - have to give way to opposing traffic 0.5 Lanes - Flat - 20 mph	21.1	20	468	3.08

Appendix E Sheffield OD from Mobile Phone Data – Project Report (Telefonica)

E.1 Introduction & Project Scope

E.1.1 Introduction

Telefonica are a mobile network operator (O2 in the UK), providing telephony services to over 22 million UK customers in both the public and private sectors. In order to provide this service Telefonica operate a network which provides continuous nationwide coverage to each customer phone (device). In order to provide efficient service to each phone, the network and phone are in frequent communication. Intimate understanding of these networks allows Telefonica to build contextual understanding of the movement of devices in space and time in the real world, with each phone creating events at specific points in time and space which can be chained into ‘breadcrumbs’, demonstrating whether each phone is moving or stationary at any point in time.

The result of Telefonica’s processing creates a huge and valuable dataset which describes the movement and flow of O2 users across the UK. Devices are tracked anonymously and can be associated with attributes derived from the user’s contract (age, gender, contract type and billing address) or their observed behaviour (affluence, lifestyle, home and work location and other points of interest). In aggregate, therefore, mobile phone data provides an effective insight in the movement patterns of the UK population.

Given the nature of mobile phone data, it is able to effectively represent movements on a macro basis across larger areas. The technology is generally better at identifying longer trips and those where the user dwells at their destination for a longer period of time. For this reason, the data should not be used in isolation but should be combined with other data sources prior to application.

Customer privacy is of upmost importance to Telefonica. All events processed are by-products of the core telephony network, and the process does not affect any user’s handset. The records are anonymised prior to being stored in the analysis platform, so all analysis of behaviour is done in a completely anonymous separate environment. Outputs from the analysis are aggregated such that no individual level data will be given to clients.

E.1.2 Scope

Telefonica were requested by AECOM to prepare origin-destination matrices for travel focusing in the Sheffield region.

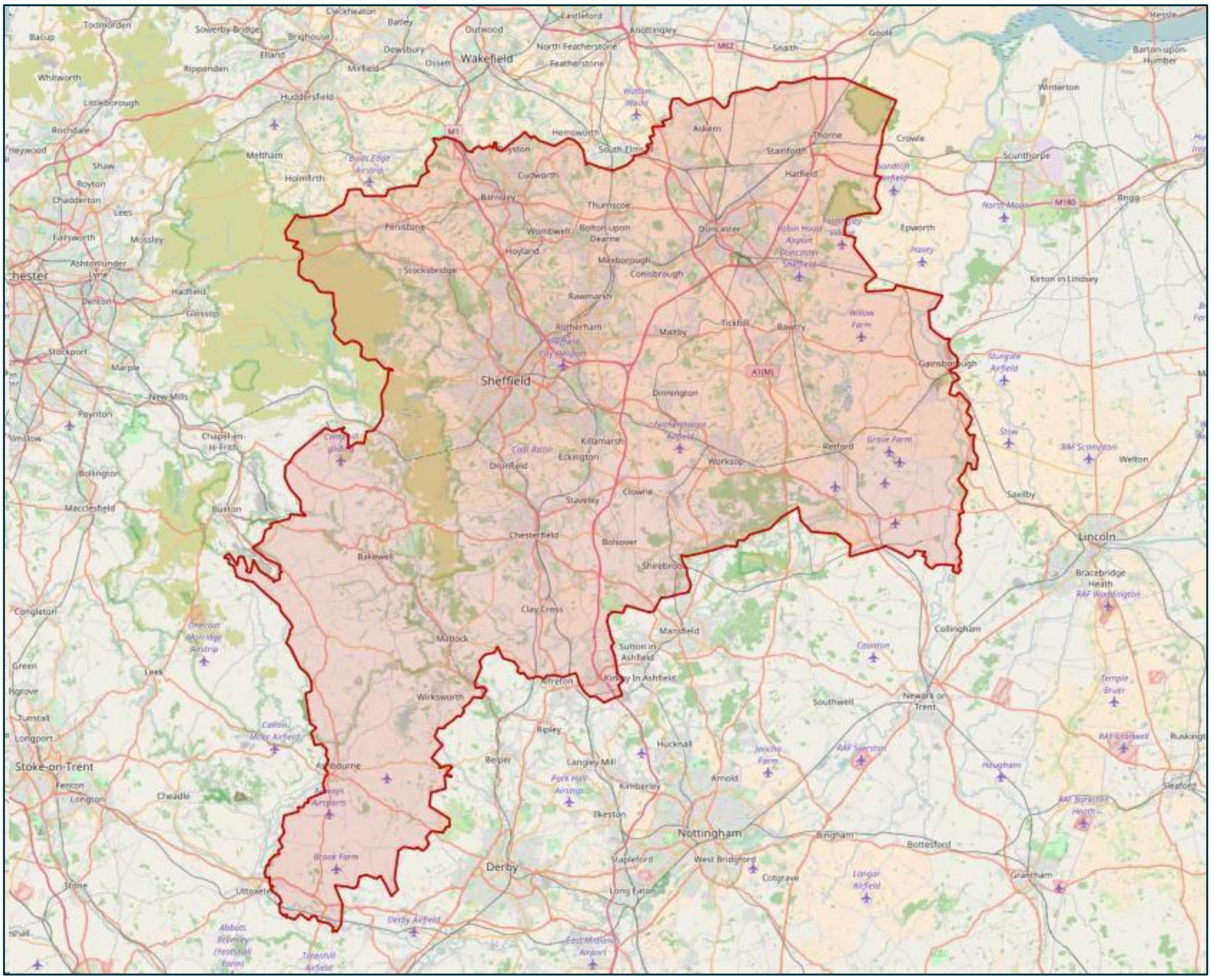


Figure 96. Image showing the extent of the model cordon

The trips were allocated to a start and end zone based on a zone system provided by AECOM. This consisted of, Middle Layer Super Output areas (MSOAs) inside Sheffield City Region (cordon area) and aggregations of MSOA, district, county and region for the rest of Great Britain. There were a total of 432 zones.

All trips within the cordon were included, as well as those which entered or left the cordon and trips between external zones. Therefore, all the journeys were selected except intra-zonal trips for external zones.

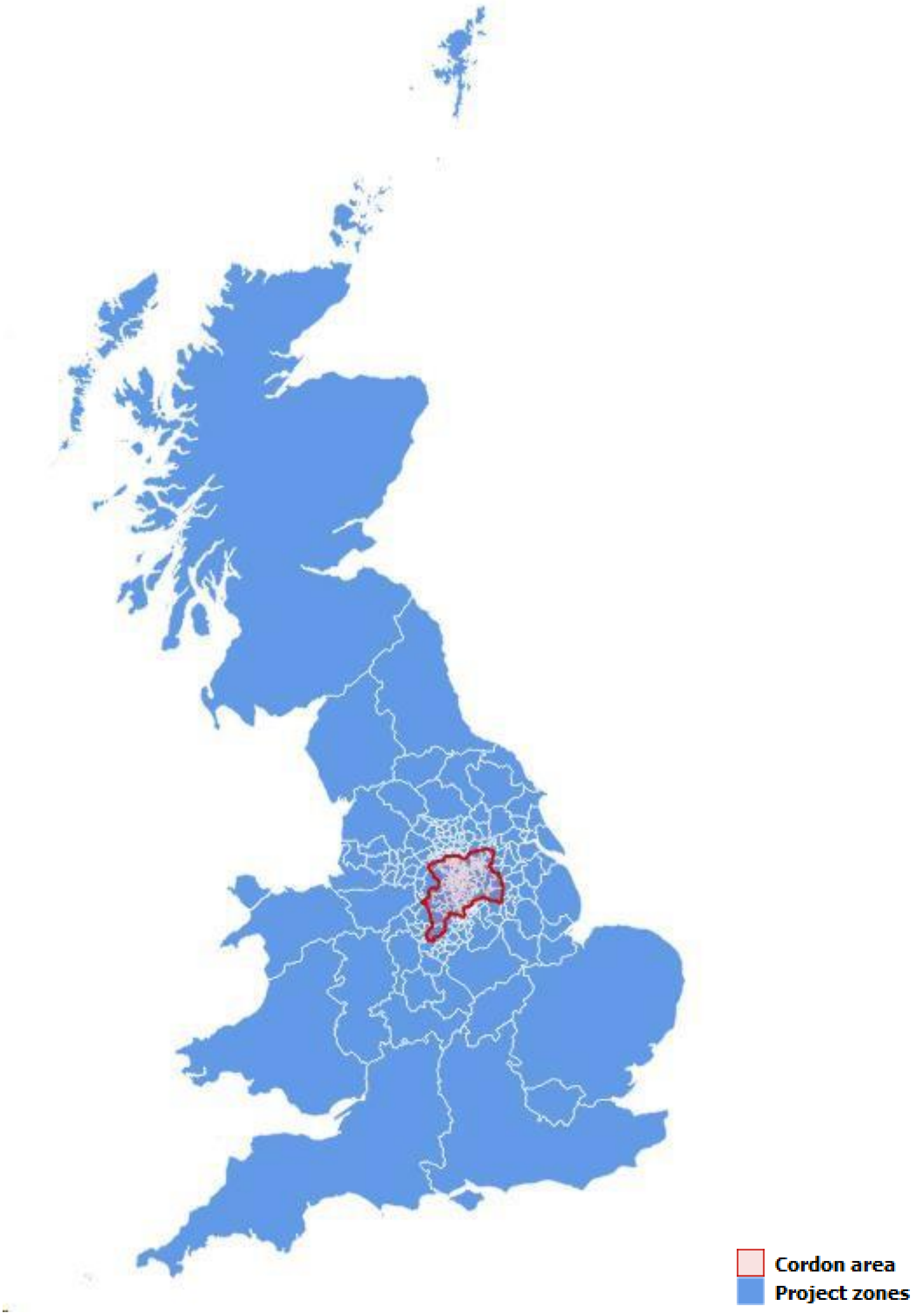


Figure 97. Image showing the zones used to identify trip start and end points

Trips were segmented as follows:

- By mode into road, rail, and HGV, with walk/cycle trips removed
- By purpose into outbound home based commuting (OB_HBW), inbound home based commuting (IB_HBW), outbound home based education (OB_HBE), inbound home based education (IB_HBE), outbound home based other (OB_HBO), inbound home based other (IB_HBO) and non-home based (NHB).
- By time period into:

Early off-peak (00:00-07:00)

AM peak period (07:00-10:00)

AM peak hour (08:00-09:00)

Interpeak (10:00-16:00)

PM peak period (16:00-19:00)

PM peak hour (17:00-18:00)

Late off-peak (19:00-00:00)

Allocation of trips into the previous time period is based on the time at mid-point of travel within the Sheffield City Region. For those journeys between external zones not intersecting the cordon area, the mid-time of the journey was selected.

E.1.3 Study Period

Trips were sampled using 'neutral' days in September and October 2016. These were defined as Mondays- Fridays, excluding bank holidays and school holidays. The following 30 days were included in the final dataset.

2016-09-05	Monday	2016-09-29	Thursday
2016-09-06	Tuesday	2016-09-30	Friday
2016-09-07	Wednesday	2016-10-03	Monday
2016-09-08	Thursday	2016-10-04	Tuesday
2016-09-09	Friday	2016-10-05	Wednesday
2016-09-12	Monday	2016-10-06	Thursday
2016-09-13	Tuesday	2016-10-07	Friday
2016-09-14	Wednesday	2016-10-10	Monday
2016-09-15	Thursday	2016-10-11	Tuesday
2016-09-16	Friday	2016-10-12	Wednesday
2016-09-19	Monday	2016-10-13	Thursday
2016-09-20	Tuesday	2016-10-14	Friday
2016-09-21	Wednesday	2016-10-17	Monday
2016-09-22	Thursday	2016-10-18	Tuesday
2016-09-23	Friday	2016-10-19	Wednesday
2016-09-26	Monday	2016-10-20	Thursday
2016-09-27	Tuesday	2016-10-21	Friday
2016-09-28	Wednesday		

Excluded due to reduced number of network events

E.2 Mobile Phone Technology

E.2.1 Overview of the Cellular Network

A cellular or mobile network is a wireless network distributed over land areas called cells, each served by at least one fixed-location transceiver which is known as a cell site or base station. In a cellular network, each cell uses a different set of frequencies from neighbouring cells to avoid interference and provide guaranteed bandwidth within each cell. When joined together, these cells provide radio coverage over a wide geographic area. This enables a large number of portable transceivers to communicate with each other and with fixed transceivers and telephones anywhere in the network, via base stations, even if some of the transceivers are moving through more than one cell during transmission.

Adjacent cells form groups of cells. The names of these groups depend on the generation of the cells, but for simplicity in this document we will use the 2G grouping which is LAC. LACs overlap and vary in size, depending on the area. Grouping cells into LACs is essential for the collection of event data.

E.2.2 Event Data

O2 mobiles phones generate “events” as they communicate with the national cell network. Telefonica collects these events on an anonymised basis for the purpose of analysis. Each event is linked to a persistent, yet anonymised user ID. Along with each event, Telefonica also stores a timestamp as well as the cell ID of the cell that recorded the event. In this manner, the spatial and temporal distribution of events can be analysed to determine users’ movement patterns. Events can be classified into active and passive events. It is the combination of both of these types of events that allows Telefonica to build a representative, stable dataset. Without the inclusion of passive events, the sample would be biased toward more active users and individual user profiles would be biased towards locations where they made calls.

Active Events

- **Connection events** occur when a user turns their phone on or off, loses or regains connection
- **Call events** occur when a user makes or receives a phone call, or moves between cells when on a call
- **Text events** occur when a user makes or receives a text message

Passive Events

- **Movement events** occur when a user moves from one LAC to another. LACs consist of a number of nearby cells in the same band – so users also create passive events when they transition between 2G/3G/4G coverage. These events ensure that journeys that cover more than one LAC will be recorded by the analysis process. The collection of these events is vital for accurately observing trips and allocating them to the correct mode.
- **Time-based events** occur whenever a user does not create any event for a sustained period of 3 hours. These events ensure that longer dwells are identified even if they are in the same LAC as the previous dwell.

E.3 Methodology

E.3.1 Process Overview

The diagram below summarises the process used to create the OD matrix deliverables. Each step is described in more detail in this chapter.

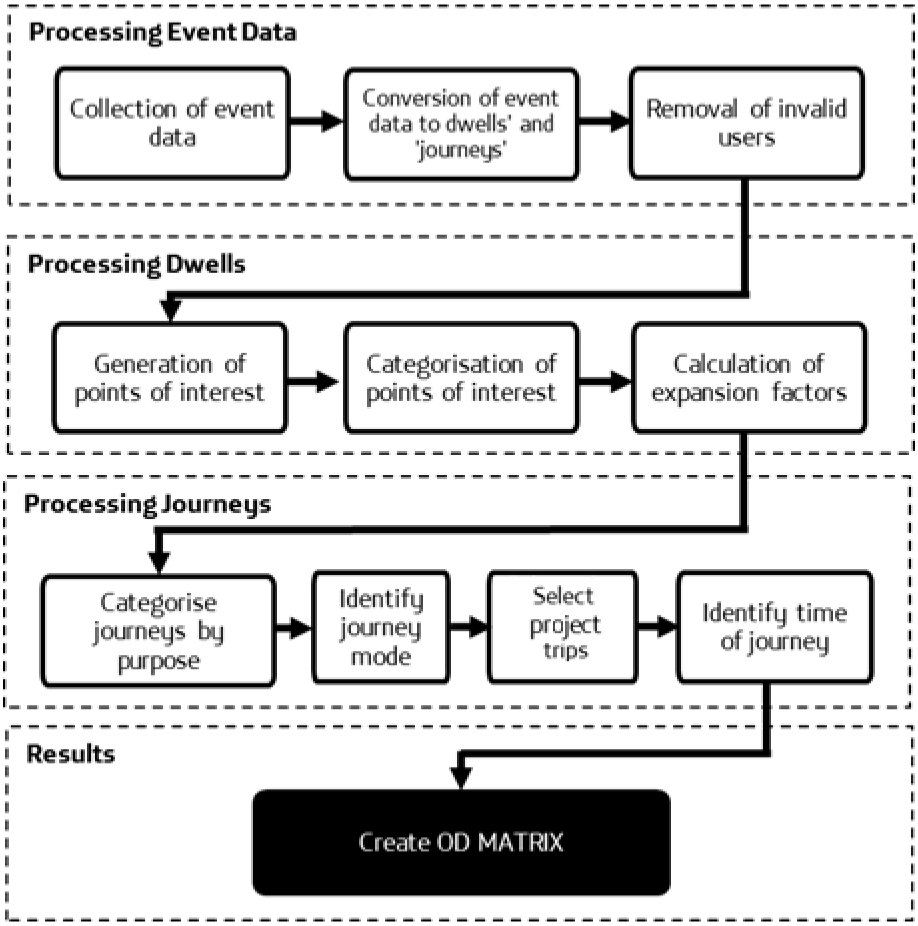


Figure 98. Process diagram of existing methodology

E.3.2 Collection of event data

As described in section two, mobile phones regularly generate events. These are collected ('probed') by Telefonica for network management and billing purposes. To enable analysis of travel data, the events are also stored in a database for further analysis. Telefonica has access to data relating to the whole of the UK for the last two years, but for the purposes of this project data was analysed for 30 specific weekdays as listed above. It should be noted that although only these 30 days were used to create the OD matrix, data from other days was analysed for some specific purposes, e.g. identifying students, valid users and home locations.

E.3.3 Conversion of Event Data to Dwells and Journeys

Telefonica converts the raw event data into 'dwells' (or settles) and 'journeys'. The algorithm that is used for this conversion process takes into account the geographic proximity of events, the propensity for phones to 'flicker' between cells without changing location and the timing of each event. In general, dwells are created whenever a user is assumed to be stationary in one distinct place for at least 30 minutes. The period between two dwells is classified as a journey. The cells of the events which have been combined to make up each settle and each journey are stored as 'via points', which can be interrogated to understand the route of each journey or the location of each settle. Note that journeys represent person trips, and not vehicle trips, due to the nature of mobile phone data.

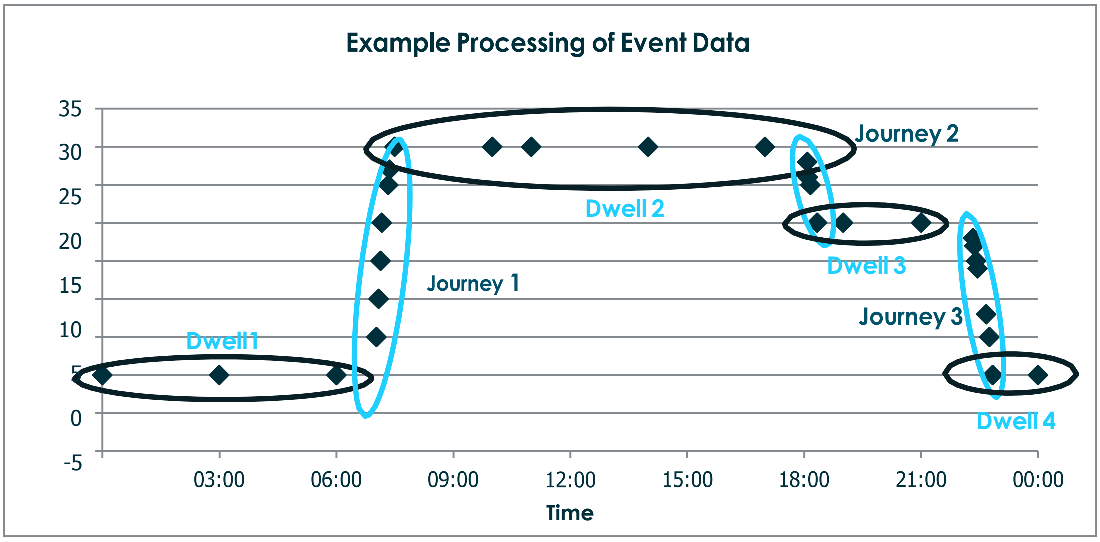


Table 69. Processing event data: dwells and journeys

E.3.4 Removal of invalid users

Events are created by all O2 users, corresponding to about 30% of the UK population or circa 22m connections. Each user is allocated an anonymised user ID, to ensure their records cannot be traced back to a particular user. The anonymous ID is set up to ensure that it is consistent even if a user changes their phone, but if a user leaves O2 their records will cease. To prevent these users from affecting the sample, a filtering process is run to identify a sample of 'stable users' who are consistently present throughout the study period.

Also at this stage a filter is applied to ensure that only mobile devices are included in the sample – machine to machine (M2M) devices, tablets and GPS units are excluded, since they are less likely to be carried by users at all times. Large business contracts are also removed from the sample to reduce the risk of double counting users who carry two phones.

Users who change phones: the anonymous and persistent user ID is based on a user's telephone number, so they will persist in the data if they change phone providing they keep their number and stay on O2.

E.3.5 Generation of Points of Interest

Where a user has multiple dwells which overlap each other, these will be associated with a particular Point of Interest (POI). By analysing all of the dwells associated with a particular POI the position of the POI can be identified with a higher degree of accuracy, because more information will be provided. All of the events associated with a POI will be analysed and the relevant cell geographies will be compared to the zone system supplied by AECOM, so that each POI is associated with a zone. Every time a user visits a cell associated with one of their POIs, this will be recorded as a trip to the associated zone.

E.3.6 Categorisation of Points of Interest

Categorisation of POIs is based on the temporal patterns of a user's dwells at each POI throughout the study period. POIs where users spend a large amount of time overnight are classed as home POIs. All users must have a home POI. POIs where users spend long periods of time during the working day are defined as work POIs. All other POIs are defined as 'other' POIs.

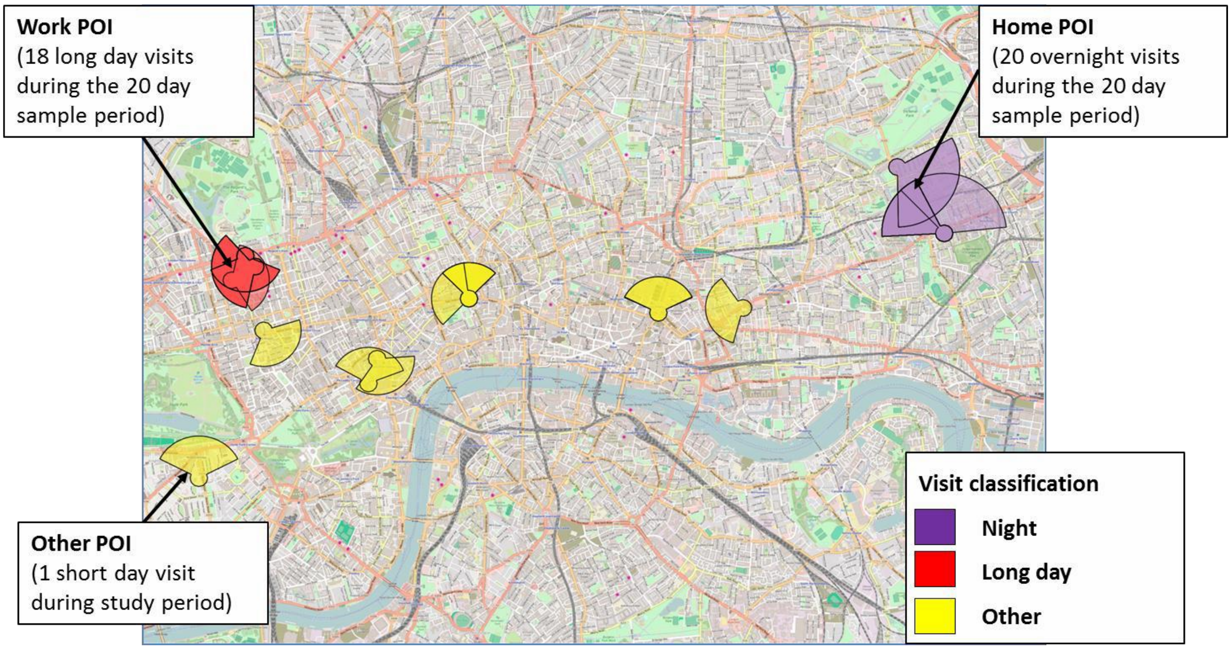


Figure 99. Example POI classification

The POI schematic used is designed to detect regular daytime commuters. As such, it may cause small errors relating to users who behaviour in unusual ways:

Working from home: users who work from home will have a home POI, but no work POI.

No fixed place of work: users who have a moving place of work (e.g. plumbers) will not usually have a work POI, unless they spend most of the study period working at the same site. Their trips to work will usually be included in the home-based-other matrix.

Shift workers: users who work unusual hours, e.g. night shifts, will not usually have a work POI - their trips will also be included in the home-based-other matrix.

E.3.7 Calculation of expansion factors

O2's market share varies across different geographical regions in the UK. To account for this, users are allocated an expansion factor, which relates to how representative they are of the UK population. The process for calculating the expansion is as follows:

- For every valid user (as described in section 3.4), identify their home POI. This is defined as the POI at which they spend the most nights during the study period
- Count the number of primary home POIs in each MSOA region of the UK. Intermediate zones are used in Scotland, LSOAs in Northern Ireland.
- For each MSOA, compare the number of primary home POIs with the total census population from 2011. Each MSOA will become associated with an expansion factor which is equivalent to the census population divided by the number of primary home POIs in that MSOA.
- Each user then inherits the expansion factor associated with the MSOA that their primary home POI is located in. This means that the sum of user weights for all the users in the UK will match the census population.

Any trips made by each user, regardless of origin or destination, will be scaled up according to the weight of the user

E.3.8 Categorising journeys by purpose

Journeys are assigned a purpose based on the categorisation of their start and end POI:

Origin POI	Destination POI	Purpose
Home	Work	Outbound Home-Based-Work (OB_HBW)
Work	Home	Inbound Home-Based-Work (IB_HBW)
Home	Education	Outbound Home-Based-Education (OB_HBE)
Education	Home	Inbound Home-Based-Education (IB_HBE)
Home	Other	Outbound Home-Based-Other (OB_HBO)
Other	Home	Inbound Home-Based-Other (IB_HBO)
Work	Other	Non-Home-Based (NHB)
Other	Work	Non-Home-Based (NHB)
Other	Other	Non-Home-Based (NHB)

Table 70. Trip Purpose Categories

Education trips: Telefonica are not able to specifically identify trips made by users aged under 18, however, pay as you go users are included in the sample as well as users under 18 carrying a phone under an adult's contract.

To infer these trips, the journeys made by all users over the course of several months are evaluated. The distinctive behaviour of users who make a steady number of journeys during the morning peak period during term-time and significantly fewer during school holidays allows the isolation of these trips.

It is recognised that many education trips will not be included in the data, either because they are too short (see validation, trip length distributions for details) or because they are made by users who do not carry phones. It is recommended that alternative datasets are used to supplement information on education trips from the matrices. Note that education escort trips, where observed, will usually be included in home-based-other trips.

Of users living inside the cordon, 12% were found to be making education trips. This compares to a nationwide percentage of 19.3%1 of the population in education from primary school to university.

The following chart show the number of outbound home-based education and outbound home-based work journeys made inside the cordon during the morning peak period. A pronounced reduction in journeys during holiday periods by users identified as making education trips can be observed. An associated smaller decrease is also detected for those users making non-education journeys.

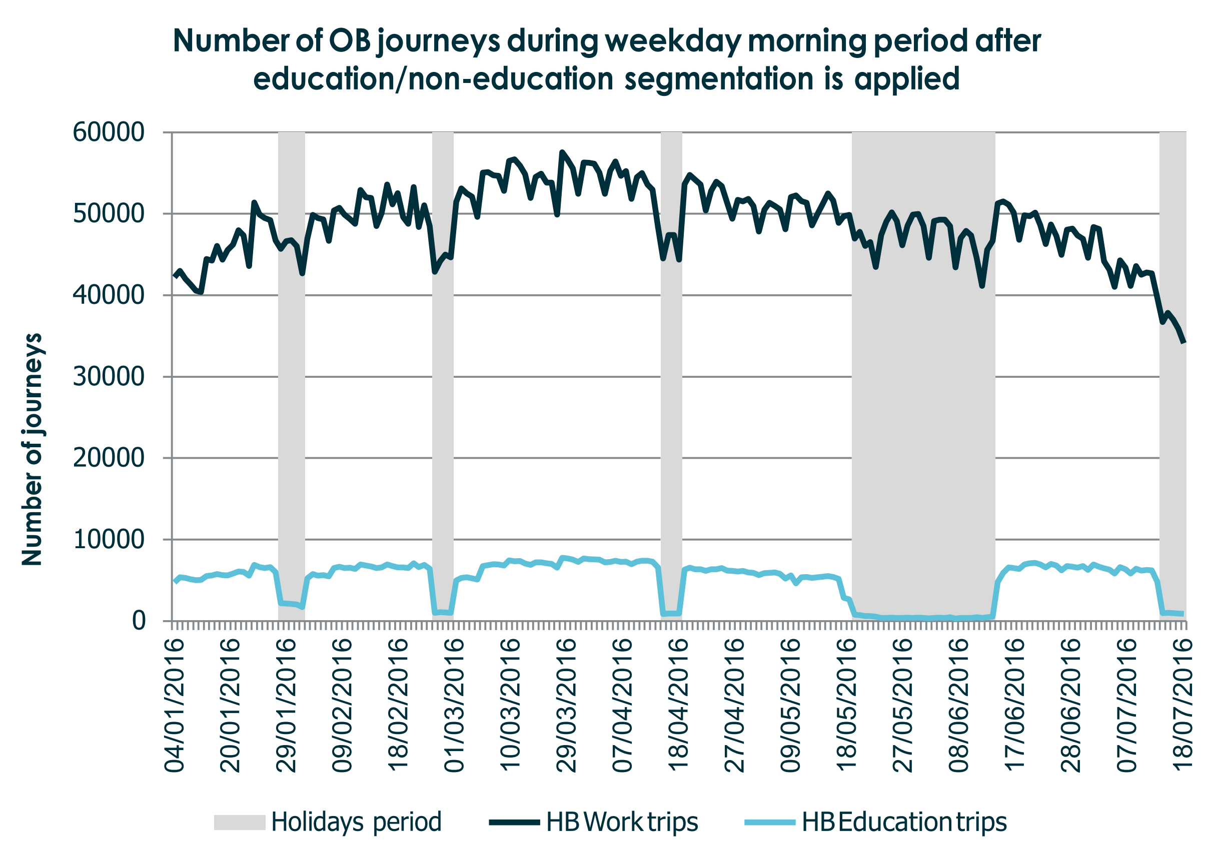


Figure 100. OB morning peak journeys over year post education/non-education segmentation

E.3.9 Identify journey mode

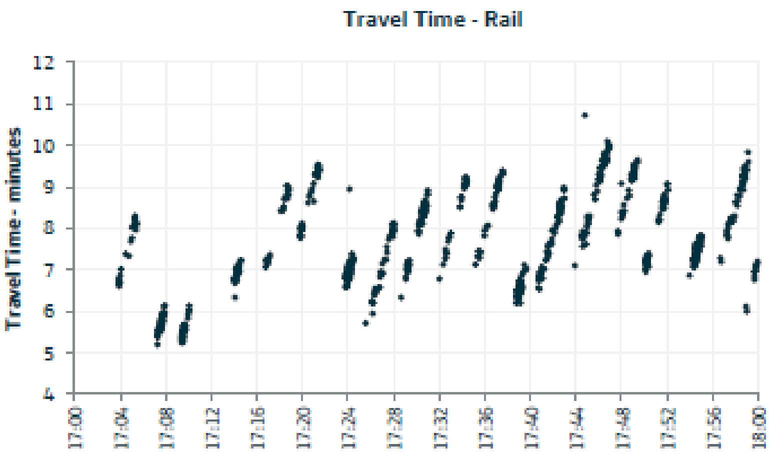
At this stage, the route and characteristics of each journey will be analysed to allocate the journey to one of the following modes:

- Air – journeys with a high speed between two airports. These trips are removed from the final matrix. Note that users will create 'dwells' at the start and end airport of their journey, so access trips to airports will be included in the dataset
- Rail – journeys which follow the rail network and which exhibit 'clustering' (see description below) will be allocated to rail
- HGV – trips made by users who travel regularly at lower speeds (and other factors) on the strategic road network will be allocated to the HGV matrix.
- Walk/cycle – short and slow trips will be allocated to walk/cycle and removed from the matrix. Most walk and some cycle trips will be too short to detect using mobile data. Some longer, faster cycle trips may be indistinguishable from road trips and so will be included in the road matrix.
- Road – any remaining trips will be allocated to the road matrix – note that this includes coach, bus and LGV trips as well as car trips.

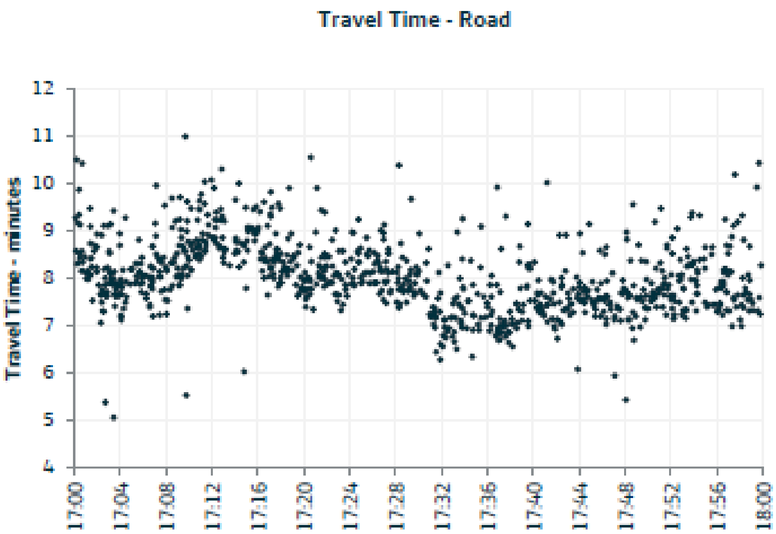
Park and ride: it is usual practice when processing mobile data to identify trips based on their true origin and destination, defined as points where the user has dwelled for more than 30 minutes. This means that park and ride trips, where the user drives to a station and then travels by train, will not usually be split into two distinct trips but will instead be represented as a single trip in the rail matrix. It is recommended that adjustments are made to the rail matrix if park and ride trips are thought to be a significant component of travel in any part of the model.

Clustering: the distinction between road and rail journeys is accomplished by identifying cell pairs that show characteristic travel time patterns for either of the two modes. When a train crosses the boundary of a LAC, the phone of every O2 customer on board will generate a passive event. These events will occur within very quick succession (depending on the length and speed of the train, as well as the device type and the current state of the mobile network), which will result in the clearly identifiable clustering patterns. When these patterns become apparent for a specific pair of cells, these cell pairs can be classified as “rail”. However, when a pattern with no clusters is observed this is indicative of a road pair. On a road, a continuous flow of cars is usually observed and events (i.e., movements from one LAC to another) also occur continually. An algorithm examines the clustering patterns of all the journeys in the system to identify rail and road journeys.

HGV: detection of HGV journeys is based on a set of considered parameters. The algorithm filters journeys on average speed percentile, motorway use, speed, and distance (average weekly and number of long distance journeys), and returns a list of users who are likely to be HGV drivers based on their observed behaviour – user who make many long journeys and generally travel slower on motorways than the other traffic are identified as HGV drivers, and their road trips are converted to HGV trips.



Characteristic clustering pattern of a rail cell pair



The lack of any identifiable clusters indicates a road cell pair

E.3.10 Select trips that penetrate cordon

Once every journey is associated with a mode, it is mapped to a route based on the events (via points) generated during the journey. These routes are compared against the cordon and zoning system provided by AECOM, any trip starting or finishing inside the cordon and inter-zonal trips are selected.

E.3.11 Identify time of journey

Journeys are allocated to a time band based on the mid-point of travel within the cordon. For those journeys between external zones not intersecting the cordon area, the mid-time of the journey is selected.

E.3.12 Create OD matrix split by mode

Once all journeys have been allocated a time, purpose and mode it is straightforward to create the OD matrix outputs. Trips are allocated to a time period, mode and purpose and included in the relevant part of the matrix. Note that trips in the AM peak hour (8-9am) and PM peak hour (5-6pm) will be included twice - once the in peak hour matrix and once in the peak period matrix.

Stochastic rounding: to preserve personal data, Telefonica does not provide outputs relating to the movement of individuals. In the context of an origin-destination matrix, this is achieved by creating an average result representing multiple days of observations, and by rounding results to integer values.

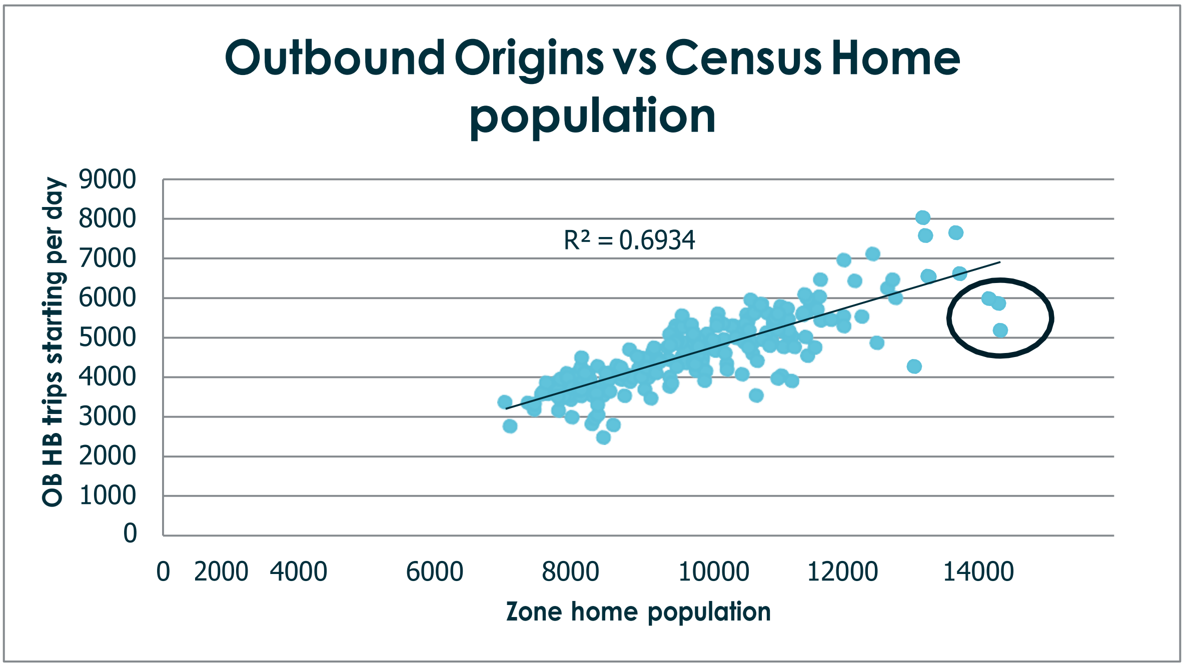
Applying standard rounding methods would cause errors in the outputs because they would cause many cells in the matrix to be rounded to zero, reducing the volume of trips in the data. To avoid this, stochastic rounding is used whereby the probability of a value being rounded up or down depends on fractional part – so a value of 0.1 has a 90% probability of being rounded down to zero and a 10% probability of being rounded up to one. This method of rounding preserves the overall volumes of the matrix (and the size of any part of the matrix large enough for the rounding interval to be negligible) while also preventing the disclosure of individual level data.

E.4 Validation

Prior to releasing the data Telefonica carries out a range of validation checks to ensure internal consistency and check against relevant alternative data sources.

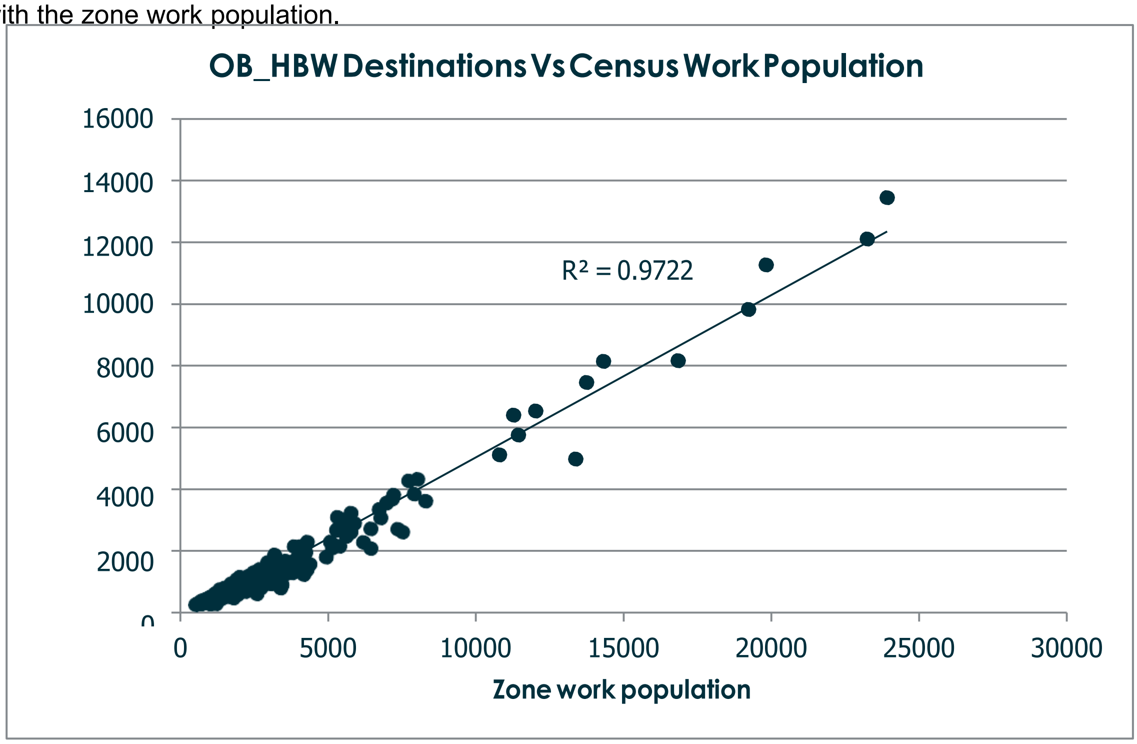
E.4.1 Comparison of home based origins with zone home population

The scatter graph below shows the number of home based outbound trips starting in each zone within the cordon on an average day in the study period against that zone's home population, based on the 2011 census. As is to be expected, zones with a higher population tend to have more home trip ends per day, with an R2 of 0.6934 indicating a good correlation between the two variables, allowing for some variation due to the diversity of the large study area. A similar result was found when checking the number of inbound home based trips ending in each zone against the home population. It is noted that some MSOA's containing higher census populations behave as leverage points and disrupt the overall correlation (i.e. excluding them gives an r2 of 0.733) – using the more outlier-robust spearman correlation gives a coefficient of 0.847.



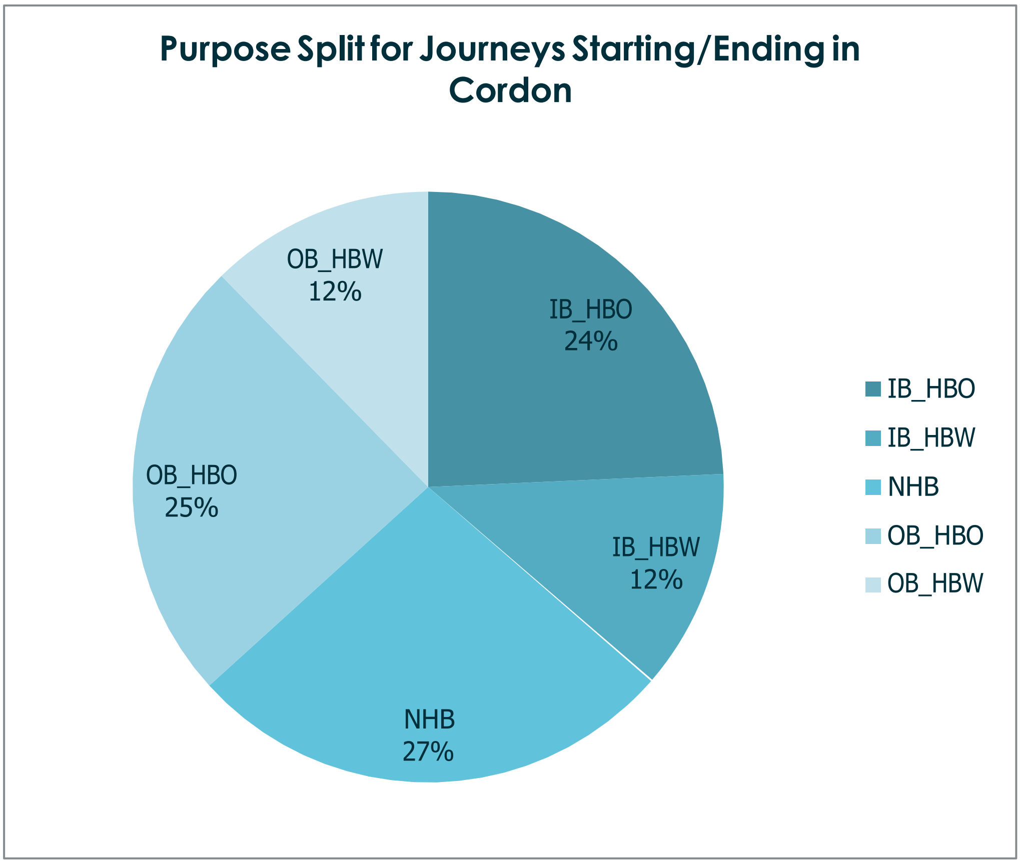
E.4.2 Comparison of work based origins with zone work population

The following graph shows the number of outbound home based work trips arriving at each zone within the cordon, during a typical day in the study period, against the work population of each zone (based on census workplace statistics). A strong correlation is found with an R2 of 0.9722. A similar result was found when comparing the number of inbound home based work trips starting in each zone with the zone work population.



E.4.3 Trip purpose split

The following graph shows the trips starting or ending in zones fully within the cordon, split by purpose:



A direct comparison of this data with secondary data is difficult because there are no publicly available datasets showing trips split by purpose for particular areas of the country. A high level comparison with the DfT's TEMPRO data suggests that the number of non-home-based trips in the mobile phone data is high. This could be due to limitations in the TEMPRO data, although there two other reasons why NHB trips may be over- represented in the mobile phone data:

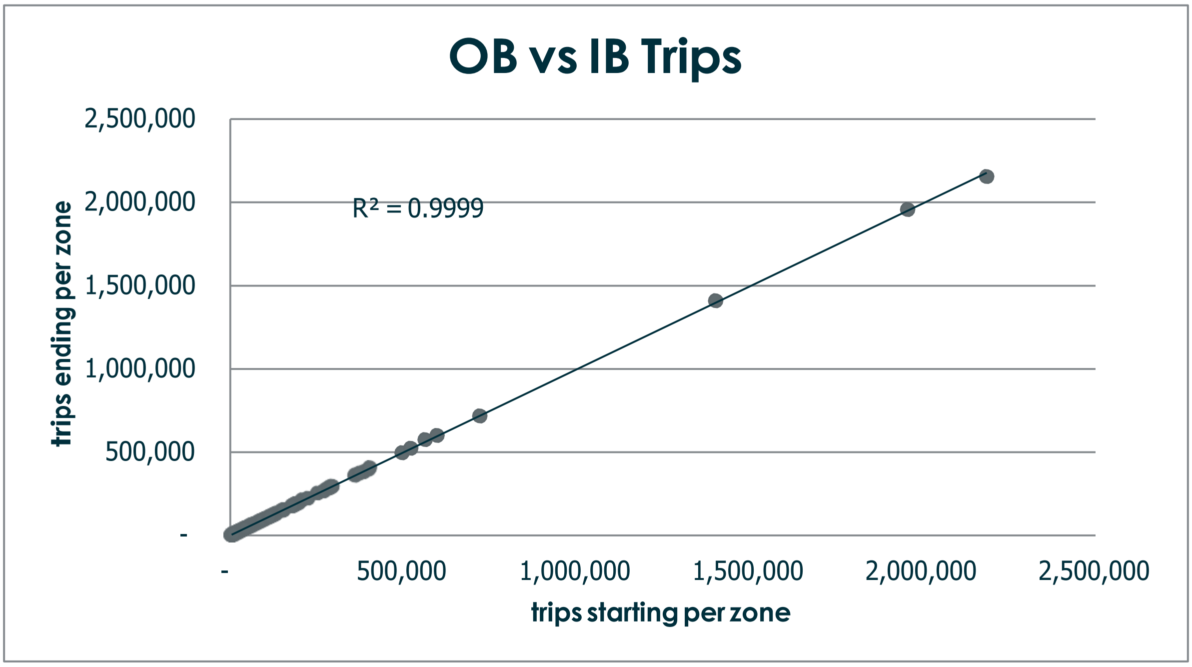
- Home based trips may tend to be shorter than non-home based trips, and so more likely to be missing in the mobile phone data
- Education trips are more likely to be home based, and are also more likely to be missing from the mobile phone data.

It is recommended that secondary data sets are used to complement the mobile phone data to correct for the biases described above and increase the proportion of home based trips.

E.4.4 Trip symmetry

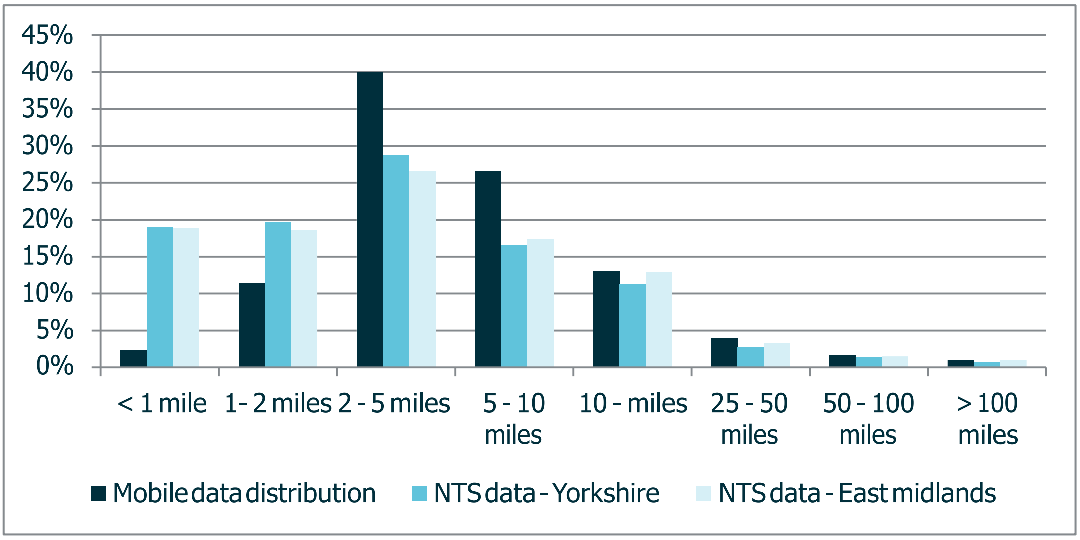
The graph below shows a comparison of the number of trips starting (by all modes and purposes) with the number of trips ending in each zone. As expected a very strong correlation is found, with an R2 of close to

1. A similar result was found when analysing the symmetry of HBW trips only, HBO trips only, and when trips were segmented by mode

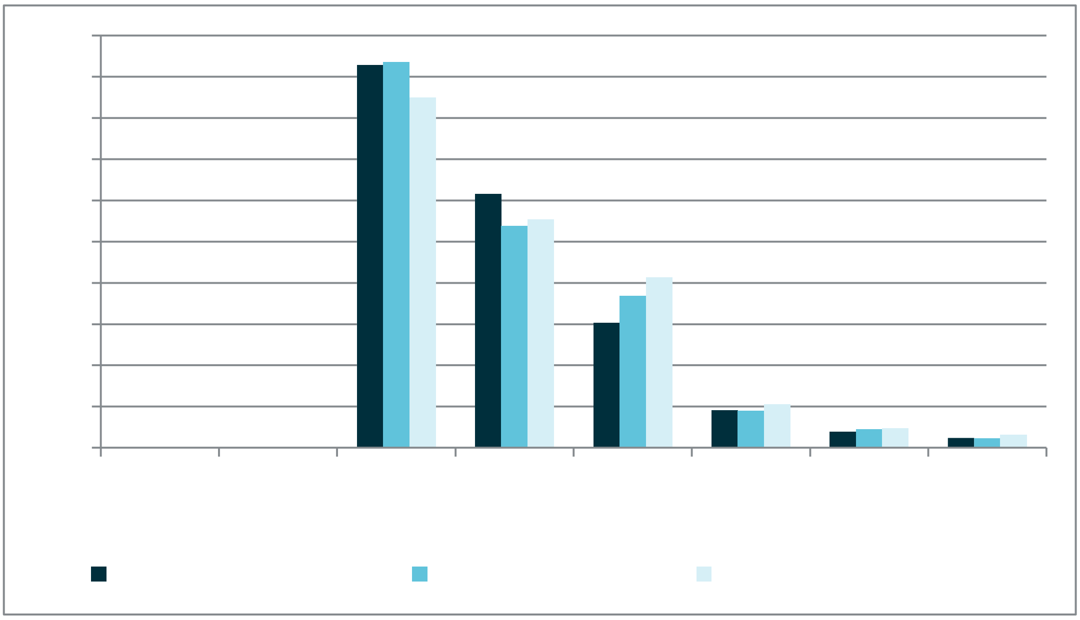


E.4.5 Trip length distribution compared to National Travel Survey

The graph below shows a comparison of the trip length distribution for trips starting in the cordon (by all modes and purposes and excluding round trips) with the trip length distribution reported in the National Travel Survey for Yorkshire and the Humber and East Midlands (NTS9911) as the cordon area falls between these two regions.

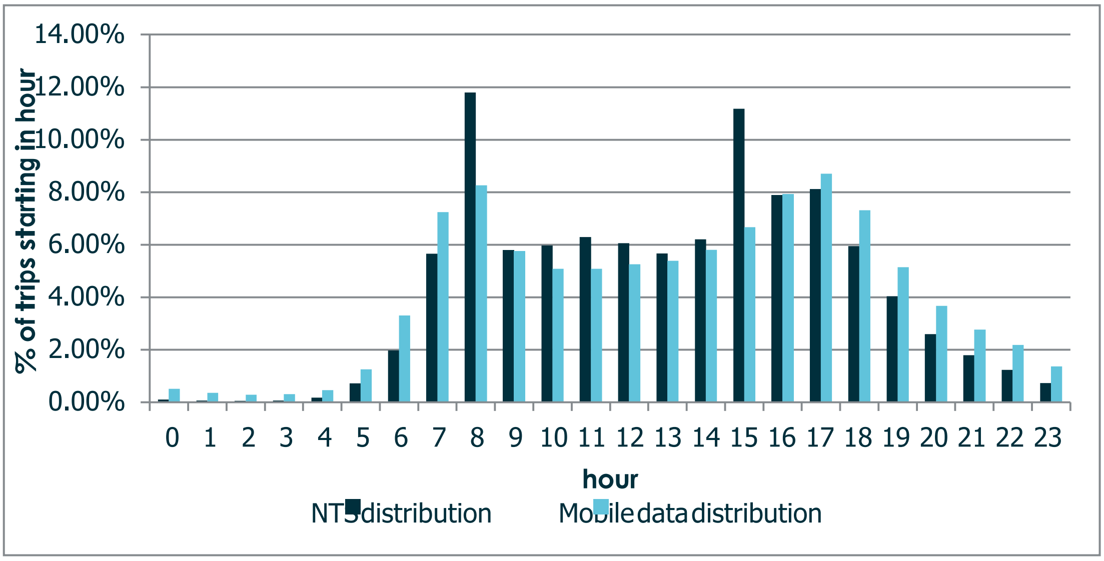


At first glance the match between the two datasets is poor, with the NTS containing more trips below two miles and the mobile data containing more trips above two miles. However, a better match is found when comparing only trips above two miles in length:



E.4.6 Comparison of trip start time with National Travel Survey

The graph below shows the percentage of trips starting in each hour in the study against the percentage indicated by the National Travel Survey (NTS0503). This is not a direct comparison since the NTS result includes trips across the UK, whereas the mobile data results only include trips starting or finishing inside the cordon or intra-zonal trips.



This comparison shows a good match between the two datasets, except for trips starting between 8am and 9am and between 3pm and 4pm. Further analysis indicates that this difference could be attributed to education and education escort trips, suggesting that these trips are poorly represented in the mobile data. This may be due to the trips being particularly short, and due to some education trips being made by users without phones. It is recommended that secondary data be used to correct for this bias.

The NTS also shows more trips starting between 11am and 12pm, while the mobile phone data shows more trips starting before 8am and ending after 7pm – this may be due to the fact that the study area is more dominated by longer commuting flows compared to the average across England.

E.4.7 Comparison of mode with census journey to work data

Analysis of census journey to work data for the study area indicates that 3% of commute trips starting in the cordon were by rail (excluding walk/cycle trips). By comparison, the mobile phone data indicated 1% of OB HBW trips were rail trips.

Similar analysis was carried out for commuting trips ending in the study area. The 2011 census suggested 3% of commute trips ending in the cordon were by rail, while the mobile data suggested 1% of trips ending in the cordon were by rail.

For trips to work, the census data indicated a slightly higher proportion by rail than found in the mobile data. This is likely to be due to a small proportion of shorter rail trips being attributed to road. The impact on the road matrix is likely to be small but the impact on the rail matrix may be more significant, and it is recommended that where local rail trips are important secondary data is used to complement the mobile phone data.

E.4.8 Summary

The data for this project has been collected based on a 30 day sample using established and proven methodologies for the application of mobile phone data to transport modelling. Internal validation checks above have shown that the mobile data provided is internally consistent and compares well to the secondary data it is compared to. The checks described are limited to publicly available datasets and are not intended to be exhaustive, further comparisons with appropriate local datasets are advised prior to applying the matrices to a transport model.

The methodology and validation sections have highlighted a number of biases, all of which are recognised limitation of mobile phone data. It is recommended that secondary data sources are used to enhance them mobile phone data to correct for them:

- Park and ride trips are represented in the mobile data as rail trips from the initial origin to the final destination.
- Comparisons with trip length distributions from NTS indicate that trips below two miles are likely to be under-represented in the mobile phone data. However, this will depend on the cell resolution – in urban areas (e.g. north London) short distance trips are more likely to be represented, while in rural areas the threshold may be slightly higher.
- Comparisons with trip start time indicate that education trips are likely to be under-represented in the mobile phone data. This will partly be a natural consequence of the short-trip bias (since many education trips are short), but may also be due to some education trips being made by people who do not carry phones. Where education trips are included in the mobile phone data, they are likely to be counted as home-based-work trips.

Appendix F Mobile Data Verification Report Mobile Data Verification Report

F.1 Introduction

The Sheffield City Region Transport Model (SCRTM1) includes a highway traffic model to estimate traffic flow and congestion in forecast scenarios. This model requires estimates of current car travel patterns to use as a base from which to forecast.

The primary source of data for generating these current travel patterns is mobile phone data (MPD) received from Telefonica concerning the movement of mobile devices on their network.

Telefonica provided AECOM with data gained from mobile phone movements across Great Britain. In Telefonica's report (AECOM Sheffield Report v1.0 20170221.pdf) of the data processing, Telefonica detailed how the data was collected and processed. This note is summarised in section 1.2.

This note discusses the tests carried out by AECOM to analyse and check the mobile data received from Telefonica against other data sources to ensure we are making the best use of all the data we have available. All data sources have strengths and weaknesses and it is important to make use of each source's strengths while compensating for their weaknesses.

The tests are summarised in the table at the end of this chapter. This is not a matrix development report; the actual process followed in building the matrices for the SCR model is documented elsewhere.

References to "Trips" in this report refer to person trips, not vehicle trips.

F.1.1 Telefonica Data

Data were collected over 30 days between September 5th and October 21st 2016, comprising Mondays to Fridays only. Bank holidays, school holidays and five days when there were mobile network issues affecting data availability were excluded.

Telefonica use the movement patterns of mobile phones to generate "trips". A trip is considered to start and end anywhere the phone is at rest for more than 30 minutes. Trips are allocated to a start and end zone based on the following zone system:

- MSOAs within Sheffield City Region (SCR), and
- Model zones outside SCR.

In addition, phones are allocated to a "home", and, where possible a "work" zone based on where they generally spend the night or most of the day. Although in principle Telefonica have access to users' registered home addresses, these are not used in this allocation.

Trips are expanded to 2011 census population based on allocated home zone by multiplying all trips by the ratio of total population to number of phones allocated to this home zone.

Trips are allocated to a model time period based on the midpoint of the trip within the SCR, as we requested, for consistency with our model.

Telefonica have undertaken several steps to anonymise the data, including but not limited to stochastic rounding.

Both mode and purpose are estimated by the data. Very fast trips are excluded as air. Trips with high levels of "clustering" (very large numbers of phone simultaneously switching cells) are allocated to rail. Trips made by users who make large number of long, slow, strategic road trips are allocated to HGV. Purpose is estimated using home and work locations.

Telefonica acknowledge a number of weaknesses in the data, all of which are confirmed by AECOM's analysis in this note:

- The data are very poor at estimating very short trips (under 2 miles). Mobile “cells” are not large enough to detect many trips of this length. This means that walk trips cannot be observed from the data, generally.
- There are too many non-home-based trips in the data relative to other sources such as NTEM. We believe this is largely due to inclusion of light goods vehicle (LGV) trips in the mobile data.
- The mobile data understates rail trip-making; it allocates many rail trips incorrectly to “road”. Telefonica do not offer any explanation for the reason for this.
- There are relatively too few trips in the education travel peaks (8am to 9am and 3pm to 4pm) in the mobile data. This is because education trips tend to be very short, and are thus often missing from the mobile data due to cell size, as noted above.

F.1.2 Summary of Tests

As historically AECOM have found that MPD struggles to distinguish between road and rail for the mode of travel. It was decided to compare the percentage rail mode share between MPD and the 2011 Census for HBW trips. The analysis was completed for movements that began and finished close to a railway station within the SCR.

Trips assigned to HBW were also checked against the 2011 Census Journey To Work dataset, at both the home / production and work / attraction ends. This was done for each MSOA within the SCR.

NTEM was analysed to see how many trips were produced within SCR for each journey purpose. This was compared to the productions within the MPD data, to check the splits between the different journey purposes. To check for spatial accuracy the number of trips produced for each MSOA by journey purpose was compared against NTEM, this was done as a regression analysis / scatter plot.

Over a 24 hour period it would be expected that the number of trips travelling between Zone A and Zone B, should match the number of trips travelling in the reverse direction. This is tested within A5-7, using regression analysis / scatter plots.

Using the HGV base year matrices from the Transpennine South (TPS) regional transport model (see F.2.3), and identified HGV trips within the MPD the trip length distribution was compared to see if the MPD had correctly identified HGV trips.

The tests are summarised in the table below. These tests were taken from those used in the regional transport models (RTM), however using the knowledge gained from building the RTM matrices and other models the tests have been applied more holistically. For example from the outset it was likely that short distance trips would be under-reported and there would be inaccuracy in mode choice of a given trip.

A summary of the findings and suggestions resulting from the tests is provided in Section F.3.10.

Table 71. Tests Carried Out

Test Section	Test Code	Name	Validation Data	Data Check / Comparison	Geographical Level	Indicative Criteria	Purpose of Test / Problems to Identify
A	A1	Road vs. Rail	2011 Census Journey to Work	All day commuting trips for selected corridors with high rail share.	MSOA	No criteria, look for outliers	Check split of mobile trips into rail and road
	A2	Trip-ends- JTW	2011 Census Journey to Work	All day commuting productions and attractions.	MSOA	$R^2 \geq 0.90$	Check spatial accuracy of allocation of mobile trips to zones.
	A3	Trip-ends- NTEM	National Trip End Model	All day productions and attractions by purpose.	MSOA	$R^2 \geq 0.90$	Check spatial accuracy of allocation of mobile trips to zones.
	A4	Symmetry	Mobile Data	From-home vs. to-home and origins vs. destinations.	MSOA	$R^2 \geq 0.90$	Validate split of demand into outbound and returning trips
	A5	HGV Split	Trans-Pennine Model	Trip length distribution between the two models for HGV trips	MSOA	No criteria, look for outliers	Verify HGV trips have been correctly identified
	A6	Trip End Spread and Desire Lines	N/A	All day, all purposes, by car, with short distance trips removed.	SCRTM1 Model Zones	No criteria look ofr outliers	Check that spread of trips ends is consistent with expectations, and the large movements are logical.
B	B1	Trip Rates- NTS	National Travel Survey	From-home trip rates	SCR	No criteria, look for material differences	Verify expansion of data
	B2	Trip Rates- Consistency	Mobile Data	From-home trip rates; look for outliers at an MSOA level.	MSOA	No criteria, look for outliers	Identify any localised expansion issue, identify outliers
C	C1	Trip Distribution	2011 Census Journey to Work	Number of all day commuting trips between and within SCR districts	District within SCR	No criteria, look for outliers	Identify any large discrepancies between trip patterns across the region.

D	D1	Trip Length Profile-JTW	2011 Census Journey to Work	Trips by distance band	SCR	No criteria, look for material differences	Verify trip length distribution
	D2	Trip Length Profile-NTS	National Travel Survey	Trips by distance band	SCR	No criteria, look for material differences	Verify trip length distribution
E	E1	Trip Purpose	National Travel Survey	Split into commuting, home-based, non-home-based.	SCR	No criteria, look for material differences	Verify purpose split
	E2	Time Period	National Travel Survey	Split into model periods	SCR	No criteria, look for material differences	Verify period split

F.2 Data Sources for checking and verification

Four sources of data were primarily used to check the mobile phone data, these were the 2011 Census Journey To Work data, Version 7.2 of the National Trip End Model (NTEM), the National Travel Survey (NTS), and the Trans-Pennine South (TPS) model.

The processing undertaken for each of these datasets are described below. It should be noted that NTEM trip-rates are based on applying knowledge of systematic variations in trip rates to spatially disaggregate planning data therefore the NTEM is not independent from other data sources.

F.2.1 Census Journey To Work

The 2011 Census in England & Wales collected data on all worker's usual workplaces and usual modes of travel to work: the census "journey to work" data. The unadjusted JTW data overstate average weekday trips by ~35%, because they represent workers and jobs, not trips; and most people do not travel to work every day (holiday, sick leave, part-time working, shift working, occasional working from home etc.). Adjustment factors have been estimated by AECOM to correct for this at a disaggregate (MSOA) level, and vary by mode – these are based on various sources including the Census, NTEM/NTS, ONS, etc. They include adjustments for the following:

- Allowance for annual leave;
- Allowance for sick leave;
- Allowance for weekday/weekend commute;
- Trip production growth between 2011 and 2015; and
- Proportion of full-time vs part-time working.

Despite these adjustments, it should of course be noted that the census data remain estimates of commuting trips; they are not perfect.

During the analysis it was brought to AECOM's attention that there is a known issue in the JTW data with trips between Sheffield and Barnsley having been coded as occurring between Sheffield and Bury. This was investigated and found to be the case within our data. However, the number of trips is small (less than a thousand) and we are not using the JTW census directly in in our matrix adjustments.

F.2.2 NTEM

A trip-end model was developed for SCRTM1, based on: i) household, population, employment and car ownership data derived from planning data that will form the basis of a land use model (FLUTE18) being developed by David Simmonds Consultancy and ii) the model structure and trip rates from version 7.2 of the National Trip-End Model (NTEM). The model produces estimates of zonal trip-ends by purpose based on the above assumptions.

The trip ends from the above described model are used as inputs to generate Synthetic Matrices. The Synthetic Matrices are sequentially used to complement (infill short distance trips up to 4 miles), disaggregate (the mobile matrices are considered geographically precise only to the MSOA level) and assist in the verification of the Prior Mobile Phone Matrices after all the adjustments undertaken in the context of the Matrix Development Process.

F.2.3 Trans-pennine South (TPS) Model

The Trans-pennine South (TPS) regional model is one of Highways England's five regional strategic traffic models of England, and covers the Sheffield City Region area. It is of interest to the SCR modelling because estimates of freight travel are likely to be derived from it.

Heavy Goods Vehicle demand in the TPS model comes from the Base Year Freight Model (BYFM) which is in turn derived from the Continuing Survey of Road Goods Transport (CSRGT); the approximate equivalent of NTS for goods travel.

Light Goods Vehicle demand in the TPS model is derived from TrafficMaster GPS records.

F.2.4 National Travel Survey (NTS)

The National Travel Survey (NTS) is a household survey of personal travel by residents of England travelling within Great Britain, from data collected via interviews and a one week travel diary.[i] The data used in this report represents the records of people that lived in Yorkshire and Humber and the East Midlands, and for trips occurring between 2011 and 2015. Trips which occur in heavy goods vehicles are not included in the NTS and there is limited coverage of LGVs.

It is worth noting that the area selected, Yorkshire and Humber and the East Midlands, covers a wider geography that the SCR.

F.2.5 University Students

As the census was collected on the 27th March 2011, it is not clear what proportion of university students it will have captured. During term time university students represent around 10% of the population of Sheffield, though we would expect that car mode shares will be low and car occupancies relatively high for students at university (relative to the general population). It is also likely that university students will often travel outside the peaks and the journeys will tend to be relatively short.

As described in 7.3 the mobile phone data collection occurred between September 5th and October 21st 2016. This means around half the data was collected outside university term time, and half inside. However for the reasons explained above it is unlikely to make much impact to the car traffic.

Regarding student populations recommendations are made in Section F.3.10 - Summary and Conclusions of this report.

F.2.6 Trip Lengths by using Distance Skims

Some of the tests required using trip lengths, as no trip length was provided by Telefonica the following methodology was used.

- When a trip end was an MSOA within SCR then one of the zones within the MSOA was taken as the respective trip end.
- A distance skim was taken from the latest (interim) version of the highway model for each origin-destination (zone) pair.

Where the skimmed distance between two zones (say Zone A and Zone B) was zero, then the lowest positive distance from Zone A to all other zones was calculated. This was divided by two to give a distance. This distance was used for Zone A to B. Intra-zonal distances were calculated following the same method.

F.3 Verification Results

It should be noted that all the tests are undertaken on the adjusted provisional data matrices (referred to as MPD in this note) prior to any synthetic adjustment or merging with other data sources. Other data sources were used in addition to the MPD data in the development of demand estimates for SCRTM1; this verification work helped to understand where other data sources were required.

The selection criteria vary by tests, with further details provided in the text.

F.3.1 Test A1 – Rail share

Five stations, Barnsley, Chesterfield, Doncaster, Rotherham Central and Sheffield Midland[ii] were chosen for analysis. The closest MSOAs surrounding each of these stations were combined into station groups. This allowed AECOM to 'assign' a MSOA-MSOA movement by rail to a station to station movement.

In selecting the MSOAs to including in the station 'group', a decision was made to keep the group as small as possible. For example Rotherham only has two MSOAs (E02001593 and E02001594) these means that a relatively small number of Production – Attraction pairs contribute to each of the Station-Station movements.

We excluded trips which began and finished in the same MSOA group, as these could not logically occur by train[iii].

This gave twenty movements; a double filter was applied keeping only movements for which the adjusted Journey-to-Work (JTW) Census dataset (see F.2.1) recorded at least 10% of the trips occurring by rail, and at least fifty trips across all modes. This left four movements, which are shown in Table 73 along with the totals across all twenty movements.

Table 72. Criteria for selection of percentage rail share analysis

Geography	Data Type	Mode	Trip Purpose	Time Period
Movements between MSOAs around selected stations. Filtered as described in the main text, for both datasets.	Mobile Phone Data	Road, and rail included with HGV excluded.	OB_HBW and IB_HBW, converted to Production – Attraction format then divided by two to avoid double counting.	All - 24 hours (Peak hour was excluded as trips are counted in Peak Period)
	Adjusted JTW	Bus, Car and Rail combined to give 'All' modes.	From Home (FH) only to avoid double counting.	All - 24 hours

Table 73. Percentage rail share of HBW / JTW for movements near stations

Station-Station	Number of MSOA – MSOA Movements	MPD Rail Trips	JTW Rail Trips	MPD All Modes	JTW All Modes	MPD % Rail	JTW % Rail
Barnsley to Sheffield Midland	16	18	68	120	181	15%	37%
Chesterfield to Sheffield Midland	12	36	59	143	162	25%	37%
Rotherham Central to Sheffield Midland	8	2	24	167	123	1%	20%
Sheffield Midland to Rotherham Central	8	1	13	143	92	1%	14%
All-All	**225**	**73**	**228**	**901**	**977**	**8%**	**23%**

Source: Telefonica with AECOM analysis

As can be seen the overall number of trips (901 vs 977) heading between these MSOA groups is broadly similar in the mobile data compared with the JTW data. However the rail shares are much lower (8% vs 23%) than the Census suggests; overall there are about a third of the number of rail trips.

Telefonica describe in Section 3.9 of their report how they have split trips that use rail from other modes. This is done though monitoring Clustering patterns of mobile events.

As Telefonica acknowledge in their report, the rail mode share appears to be understated. Between Sheffield and Rotherham in particular there are essentially no rail trips at all in the MPD data, while the true mode share (note, this is for movements with trip-ends close to the stations, not the whole of the respective urban areas) is probably around 17% (the average of 14% and 20%).

The other two movements (Barnsley and Chesterfield to Sheffield) also exhibit a notably low rail mode share in the MPD, but the difference is not as extreme as the Sheffield-Rotherham movements. This suggests that the understatement is not consistent across movements; it cannot be corrected by simply factoring up rail trips.

As is to be expected, there are greater differences between the total number of HBW and JTW trips when considering station to station movements. This could be due to sample sizes being smaller, more reliance on assumptions (both within the MPD and JTW), and the impact of stochastic rounding that has been applied to fewer values.

Our conclusion is that the rail mode share from mobile data cannot usefully be used, and that the rail and road trips should be combined and another method used to remove rail trips.

F.3.2 Tests A2 and A3 – Trip Ends

Comparisons of mobile data against JTW and NTEM data have been completed for both the home and work end of trips for each MSOA within the SCR.

Table 74. Criteria for HBW vs JTW comparisons – Test A2

Geography	Mode	Trip Purpose	Time Period
For Home Location comparison (Test A2) then Home end within SCR. For Work Location comparison (Test A3) then Work end within SCR.	Road, and rail included with HGV excluded.	OB_HBW and IB_HBW, with the result divided by two to avoid double counting.	All - 24 hours

Test A2- Home Locations/ Productions

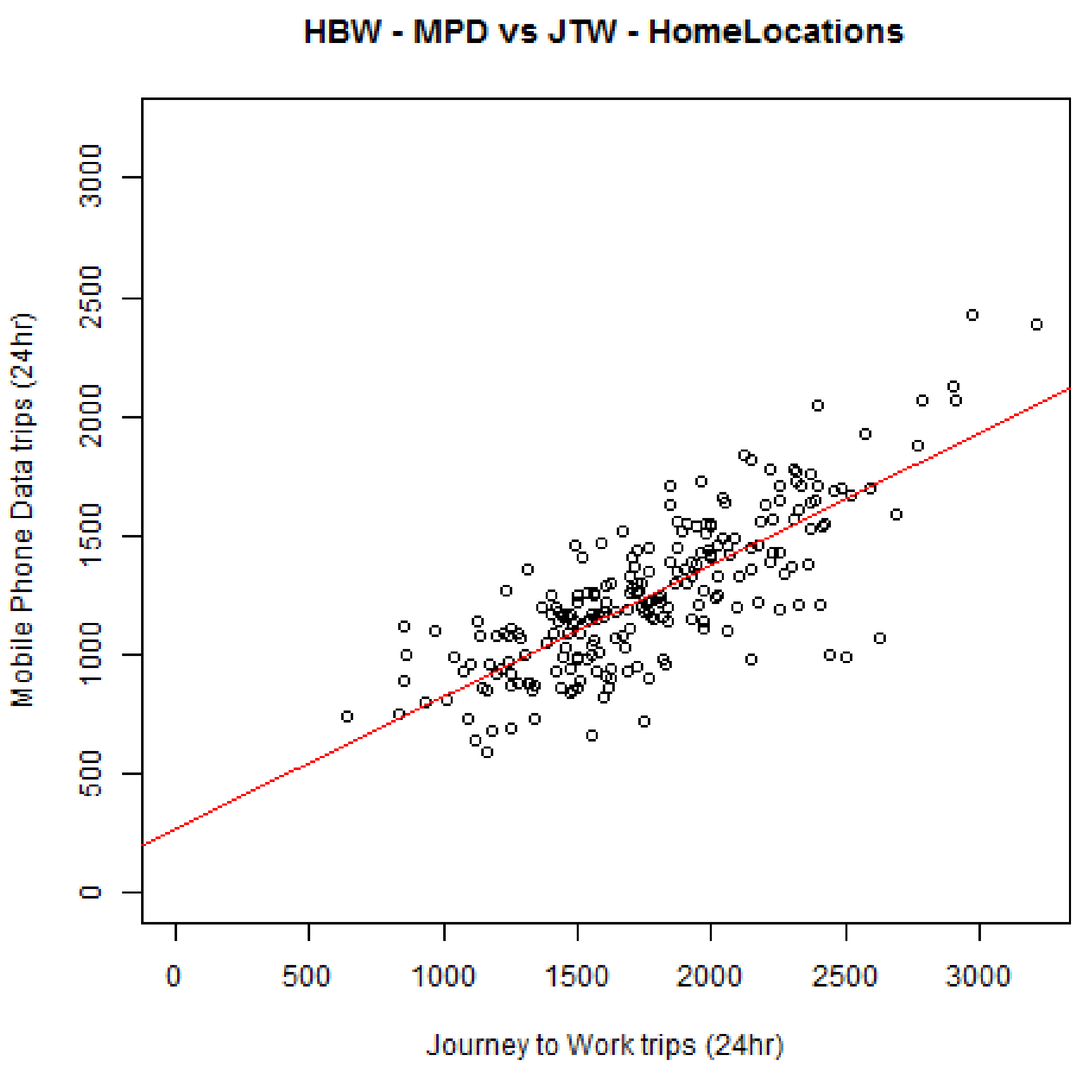


Figure 101. HBW vs JTW – Home Locations

Journey Purpose	Trip End	Intercept	Slope	R^2	Total number of Journeys JTW	Total number of Journeys MPD
HBW	Home	274	0.553	0.610	409,930	290,069

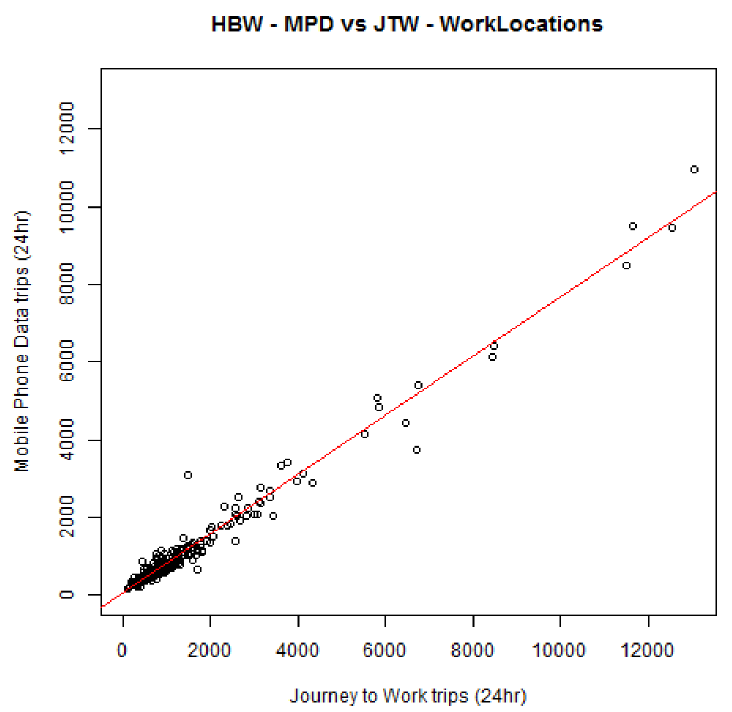
The number of trips leaving each MSOA is relatively similar, which makes sense as MSOA aim to contain a similar population. This will make a good correlation harder to achieve as there is less variation by MSOA. Despite this, there is a reasonable correlation between the Journey to Work and mobile data; however, the MPD is about 30% lower overall in the SCR.

As historically we know that short distance trips have been under represented in the mobile phone data it was decided to split the movements into those shorter than 4 miles, and those longer. Trip lengths were estimated using the method described in Section F.2.6.

Distance Band	Journey Purpose	Trip End	Intercept	Slope	R^2	Total number of Journeys JTW	Total number of Journeys MPD
All	HBW	Home	274	0.553	0.610	409,930	290,069
Less than 4 miles	HBW	Home	-106	0.688	0.664	168,830	91,588
More than 4 miles	HBW	Home	158	0.672	0.804	241,100	198,482

Above 4 miles, the R-squared is much improved. It is also evident that the understatement of total trips is worst in the shortest band. In the upper band, the understatement is only ~10%, within reasonable uncertainty in the census total (which has to be adjusted to approximate trips).

Test A2- Work Locations/ Attractions



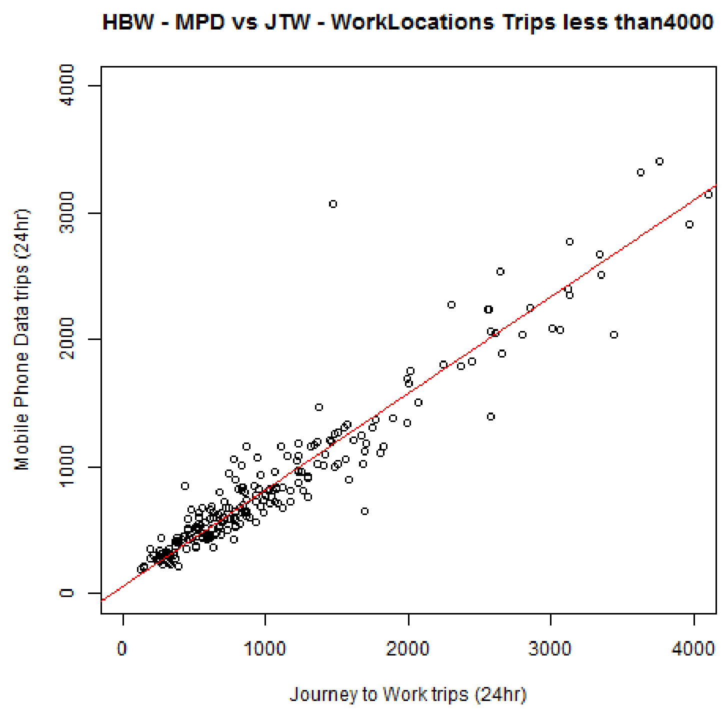


Figure 102. HBW vs JTW – Work Locations

Journey Purpose	Trip End	Intercept	Slope	R^2	Total number of Journeys JTW	Total number of Journeys MPD
HBW	Work	67	0.759	0.973	344,783	277,452

When considering the 'work end' of the trip, the data have a more diverse spread. The majority of the MSOAs have fewer than 2,000 trips (in both MPD and JTW), but some MSOAs exceed 10,000 trips. The second chart within Figure 102 shows MSOAs where the number of trips is fewer than 4,000 for both MPD and JTW. This larger spread contributes to a much better R2 and correlation for work location than home locations.

There is one notable outlier around (1500, 3000), which is the MSOA E02004054 which covers area surrounding Junction 28 of the M1. The area includes East Midland Designer Outlet, and the Castlewood Business Park. The business park has developed since the 2011 Census, so this accounts for the difference in trip end totals.

As with the home locations, the MPD appears low compared to the JTW data, although with work locations the discrepancy is smaller. Again, we attribute this primarily to short-distance trips being largely absent from the MPD.

One potential area where the MPD may have introduced error is in misallocating a trip end to a neighbouring MSOA. It was therefore decided to see if combining MSOAs into groups would significantly improve the fit between the two datasets.

The 232 MSOAs were combined into 184 groups. With each group consisting of up to 4 MSOAs, while most MSOAs remained in their own 'group'. The scatter plots of these new groups are shown in Figure 103 and Figure 104.

As might be expected there is a greater improvement for the statistics at the home trip ends than the work trip end. However from looking at the scatter plots it appears that much of this improvement arises from a few zones with very large number of trip ends. The zoomed in plots showing grouped trip ends up to 4000 trips, show a similar spread to the original ungrouped MSOA charts in Figure101 and Figure 102.

In light of the above analysis we do not suggest combining the MSOAs, instead further analysis should be undertaken on the trip lengths, with possible synthetic infilling for short distance trips. This will be discussed more in Section F.3.10.

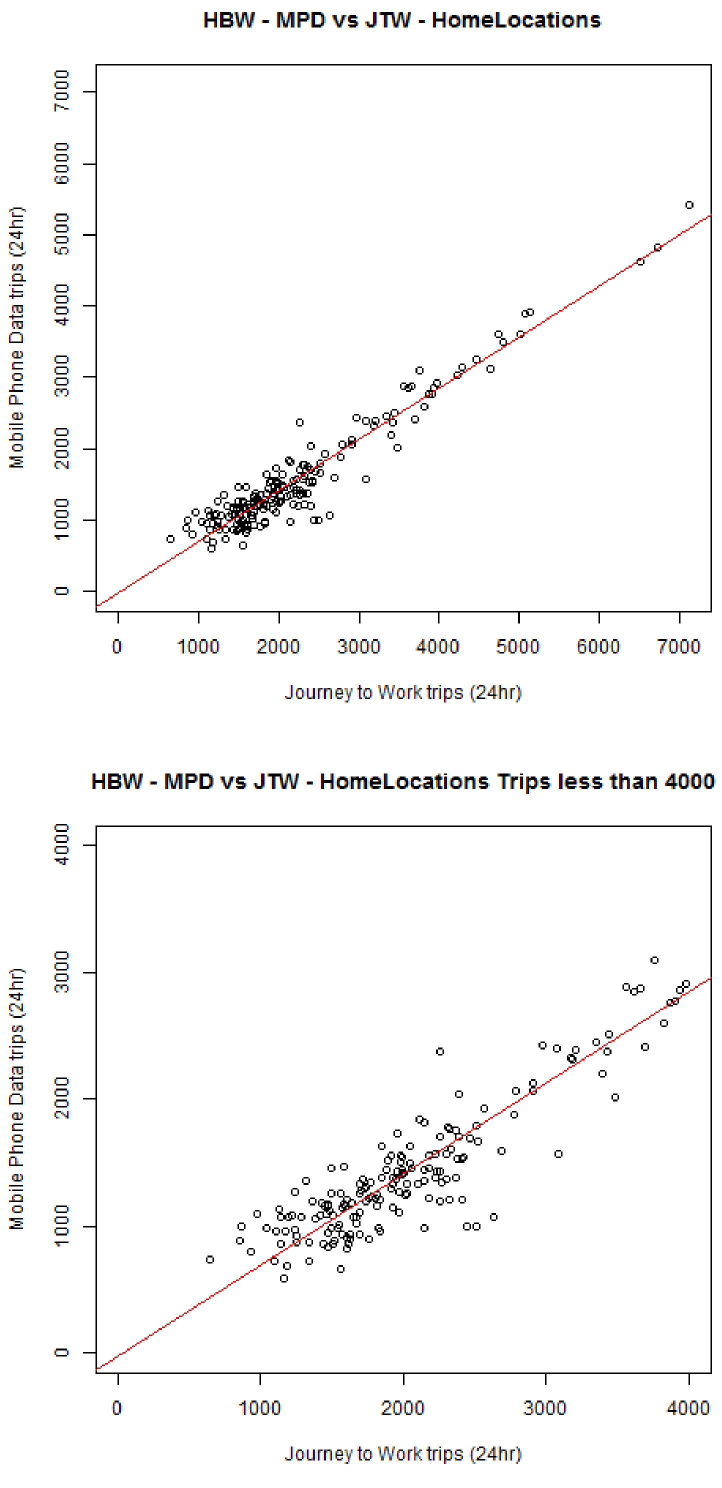
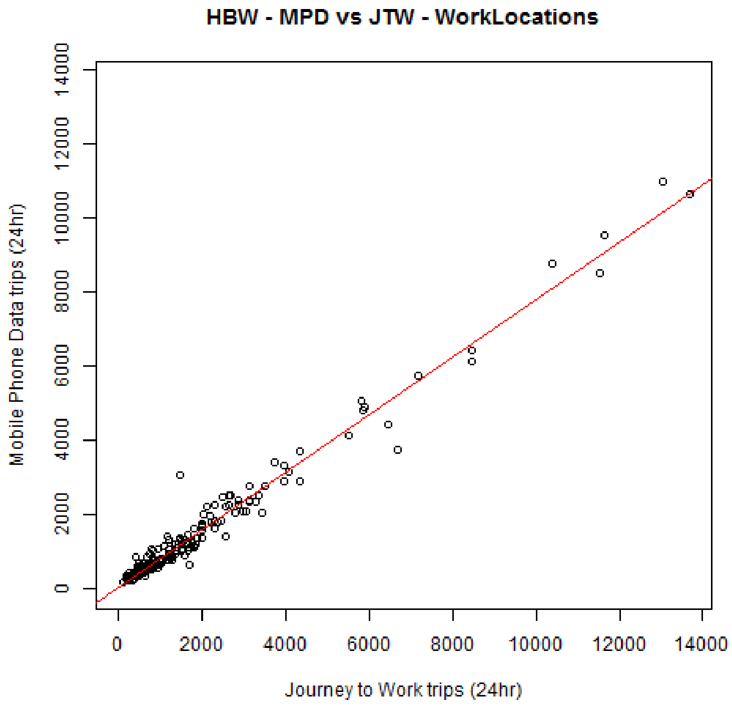


Figure 103. HBW vs JTW – Home Locations



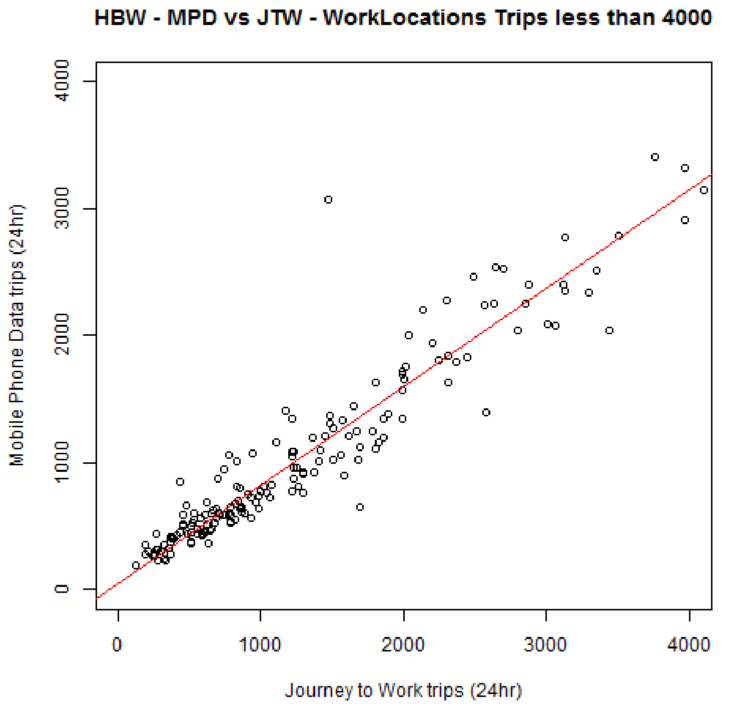


Figure 104. HBW vs JTW – Work Locations

Journey Purpose	Trip End	Intercept	Slope	R^2	Total number of Journeys JTW	Total number of Journeys MPD
HBW	Home	-18	0.716	0.915	409,930	290,069
HBW	Work	57	0.774	0.974	344,783	277,452

Test A3

The total person trips from Mobile Data and NTEM are compared by trip purpose in Table 76 for trips produced in the internal SCR area. Overall the number of trips from the MPD is low compared to NTEM figures; this is likely to be due to the missing short trips as discussed earlier.

The results also suggest a significant overstatement of non-home-based (NHB) trips and moderate understatement of home-based other (HBO) trips in Mobile Data compared to NTEM-based trip-ends.

All trips made in Light Good Vehicles are included in trips within MPD, but is excluded from NTEM, as we shall see in F.3.4 we have reason to believe some trips made in Heavy Good Vehicles are also (wrongly) included within the 'light' vehicle MPD matrix. These goods trips will generally be NHB, so this accounts for much of the NHB overstatement.

Table 75. Criteria for comparison of total number of trips between MPD and NTEM

	Geography	Mode	Trip Purpose	Time Period
MPD for SCR	Production / Home end within SCR	Road and rail combined HGV trips removed (of which there are 104,767 which originate in SCR)	IB_HBW, OB_HBW combined to HBW HBO, OB_HBE, IB_HBE, OB_HBO and IB_HBO combined to HBO NHB is just NHB	All - 24 hours
NTEM	Production / Home end within SCR	Car and Public Transport (Bus, Rail)-Active Modes excluded (No freight trip ends in NTEM)	5 Purposes-HBW, HBEB, HBO, NHBEB, NHBO	All-24hours (average weekday-weekends excluded)

Trip Purpose	Trip ends			
	Mobile Data	NTEM	Difference	Diff%
Home Based Work	580,138	772,581	-192,443	-25%
Home Based Other	1,571,893	2,175,212	-603,319	-28%
Non-Home Based*	648,969*	382,052	266,917	70%
All Purposes	2,801,000*	3,329,845	-528,845	-16%

Table 76. Comparison of total number of trips (SCR production area)

*These figures include LGV Trips from the MPD

The number of trips given in the MPD and the NTEM were compared. This was done for both the production and attraction end of the trip, for each MSOA within Sheffield City Region. The data have been plotted for each of the three journey purposes: HBW (Figure 105), HBO (Figure 106) and NHB (Figure 107) excluding Telefonica identified HGV trips.

Table 77. Criteria for comparison of trips totals between MPD and NTEM (A4)

	Geography	Mode	Trip Purpose	Time Period
MPD for SCR	MSOAs within SCR	Road and rail combined HGV trips removed	IB_HBW, OB_HBW combined to HBW HBO, OB_HBE, IB_HBE, OB_HBO and IB_HBO combined to HBO NHB is just NHB	All - 24 hours
NTEM	MSOAs within SCR	Car and Public Transport (Bus, Rail)-Active Modes excluded (No freight trip ends in NTEM)	5 Purposes-HBW, HBEB, HBO, NHBEB, NHBO HBW left as HBW HBEB and HBO combined into HBO NHBEB and NHBO combined into HBO	All-24hours (average weekday-weekends excluded)

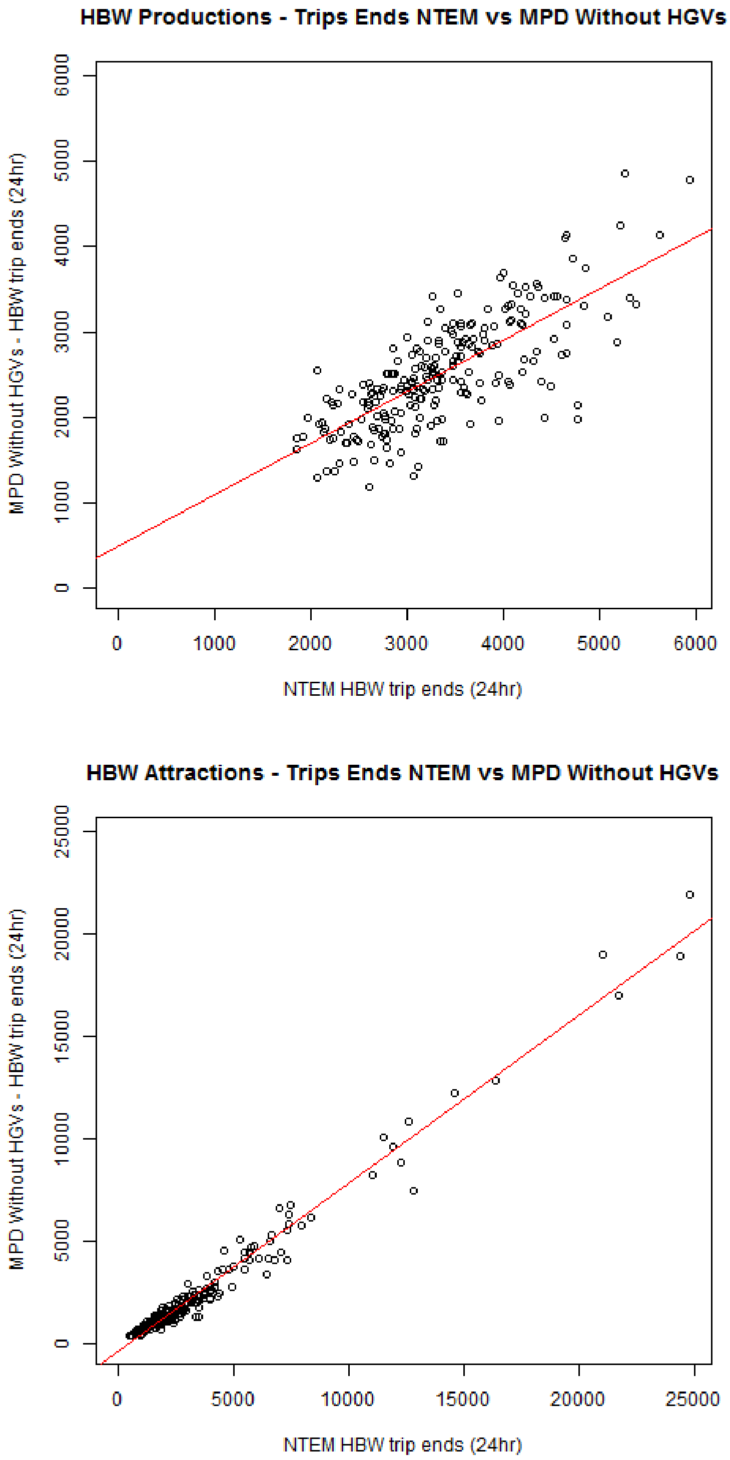
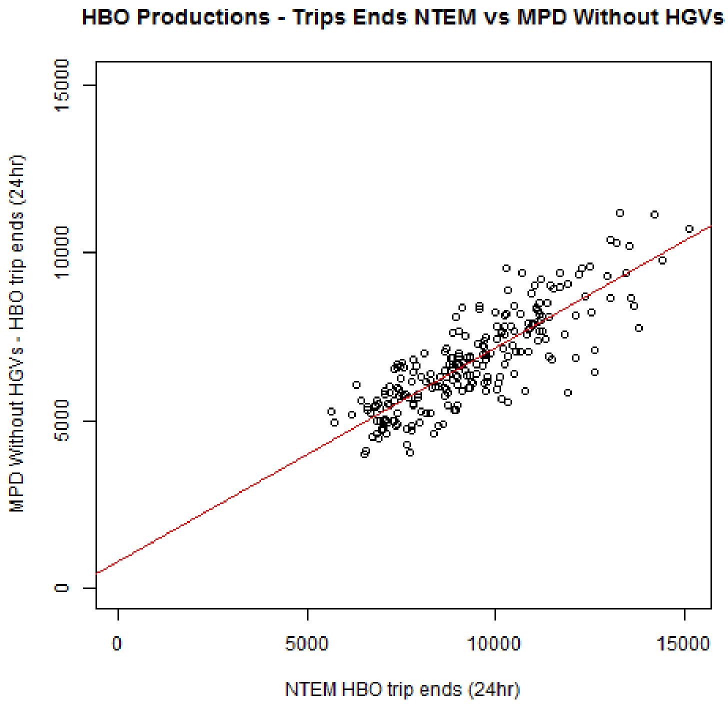


Figure 105. NTEM vs MPD Trip Ends HBW



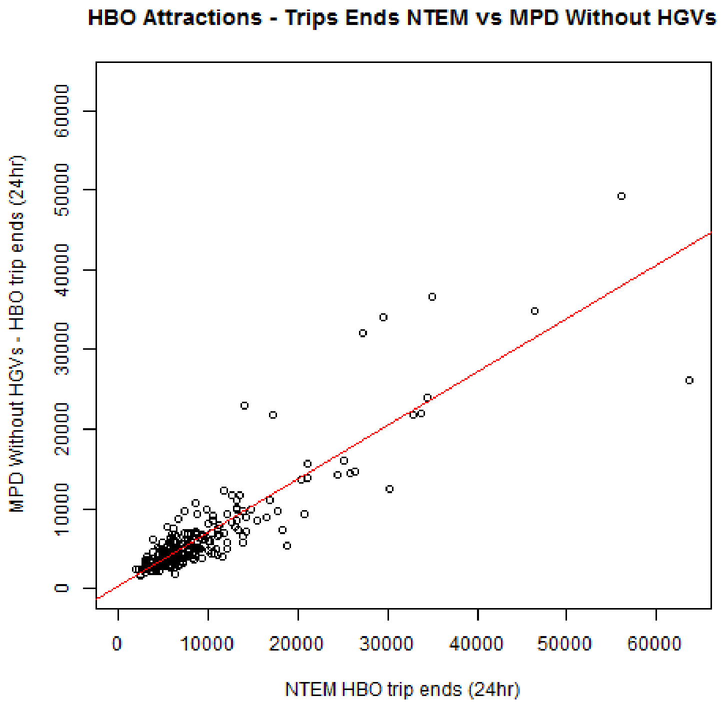
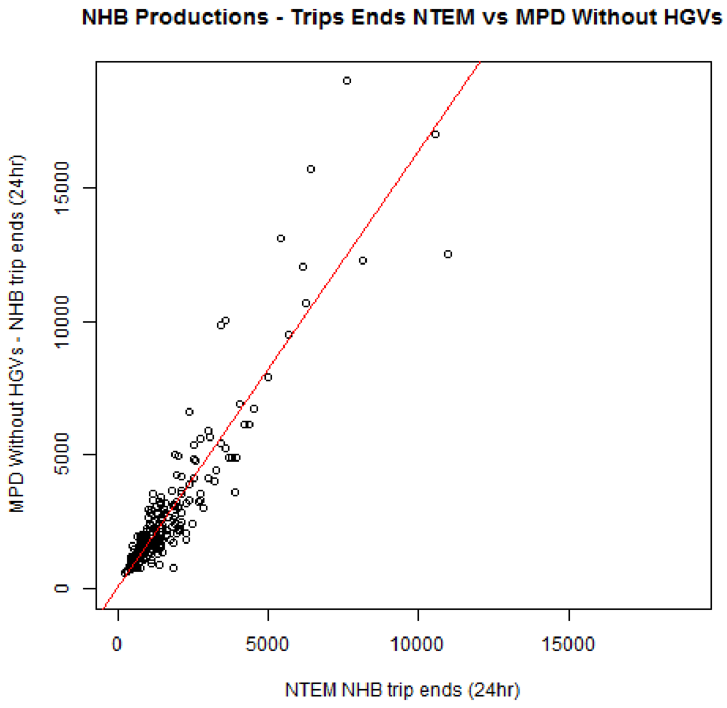


Figure 106. NTEM vs MPD Trip Ends HBO



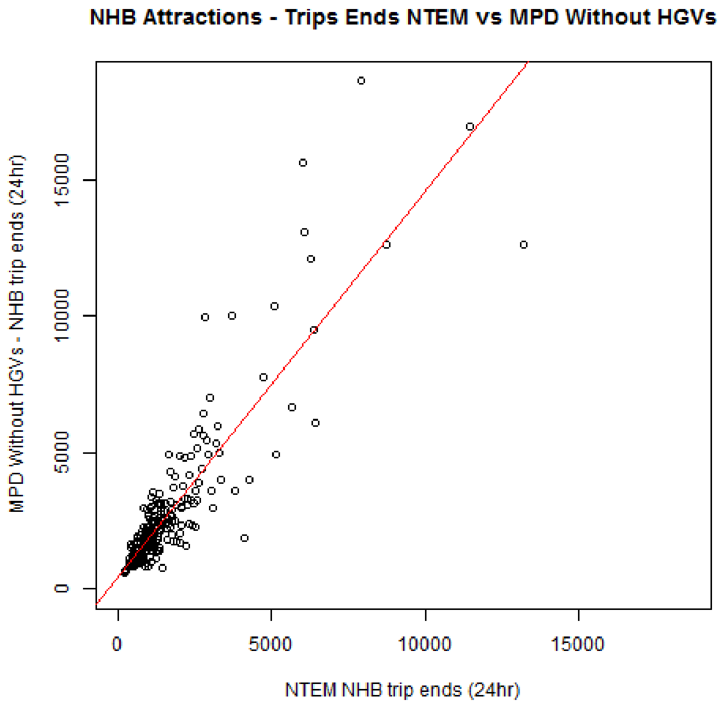


Figure 107. NTEM vs MPD Trip Ends NHB without HGVs

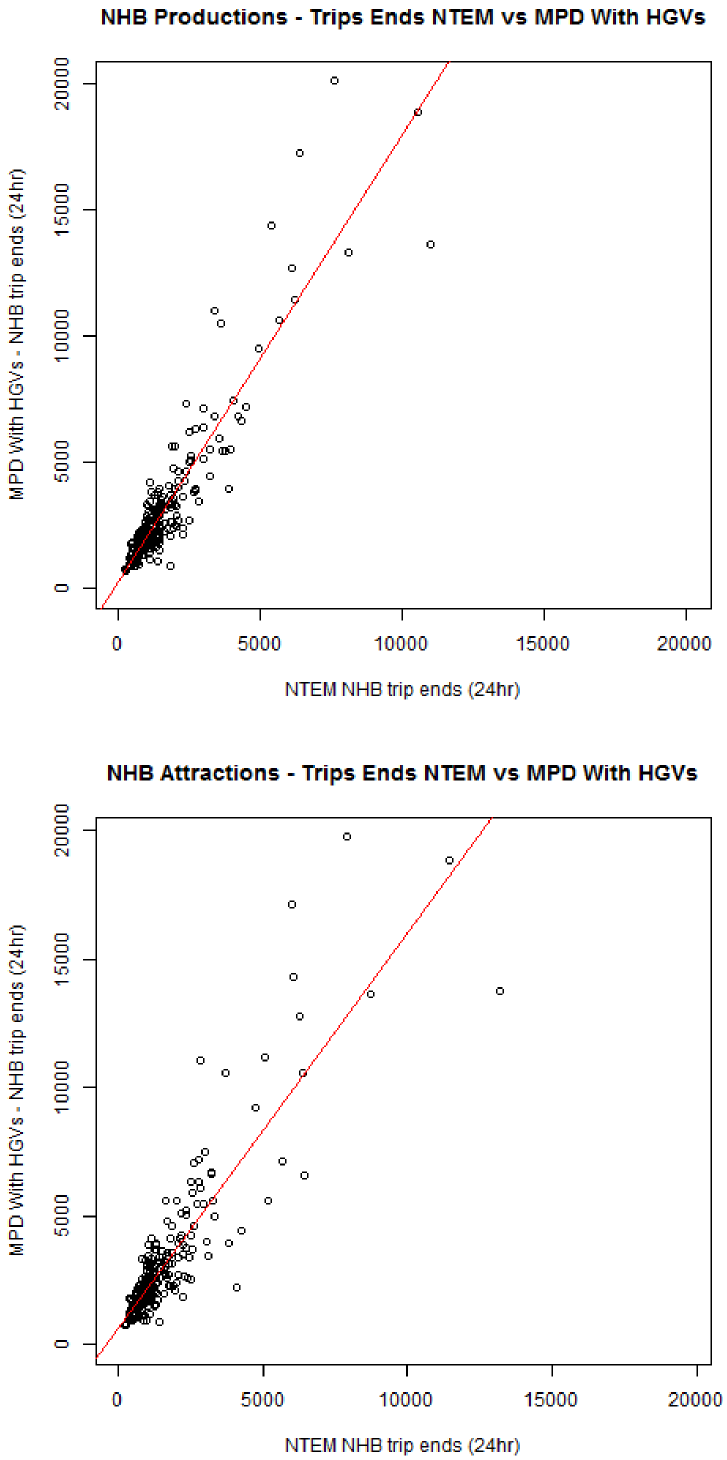


Figure 108. NTEM vs MPD Trip Ends NHB with HGVs

The NHB analysis was repeated including the HGV trips, as identified by Telefonica; however very similar plots (Figure 108) were produced.

A regression analysis was also performed separately for each of the three journey purposes, at the production and attraction end. It was also decided to test the comparison including and excluding HGV trips (identified by Telefonica). This is shown in Table 78.

Table 78. Regression Analysis between MPD and NTEM Trip Ends by Purpose

Journey Purpose	Production or Attraction	With or Without HGVs	Intercept	Slope	R^2	Total number of Journeys NTEM	Total number of Journeys MPD
HBW	Productions	Without HGVs	496	0.602	0.571	772,584	580,138
HBW	Attractions	Without HGVs	-333	0.820	0.975	771,141	554,903
HBO	Productions	Without HGVs	804	0.637	0.696	2,175,218	1,571,893
HBO	Attractions	Without HGVs	340	0.670	0.778	2,161,390	1,526,337
NHB	Productions	Without HGVs	114	1.629	0.840	382,058	648,969
NHB	Attractions	Without HGVs	485	1.413	0.772	379,627	648,945
NHB	Productions	With HGVs	282	1.769	0.843	382,058	741,336
NHB	Attractions	With HGVs	685	1.534	0.774	379,627	741,337

Source: Analysis by AECOM on data provided by Telefonica (MPD) and NTEM

Comparing the production and attraction end of the trips, the R-squared values are slightly higher on the attraction side for the home based trips and slightly lower for the non-home based trips.

The slopes are closer to one for attractions than productions for each journey purpose and when considering all journey purposes together. For the home based trips there is a greater variation in attraction trip end totals than production trip ends. This is reasonable as we may expect households to be more evenly distributed than workplaces.

Here it is clear that in general the mobile data are low compared with NTEM for home based trips (but comparable and with a fairly good correlation and the discrepancy is probably due to short trips), but there is a substantial overstatement of non-home-based trips, probably largely due to inclusion of many freight trips in the mobile data.

F.3.3 Tests A4 – Symmetry tests

It would be expected that in the majority of cases people leaving home would return within the same day. Furthermore it is likely that the journey purposes would match e.g. each *'outbound home based work'* trip would correspond with an *'inbound home based work'* (likewise for home based other trips). This is a reasonable test as we would expect a large majority of both HBO and HBW work trip to be two legged tours[iv].

This has been analysed both on an O-D basis and the production / home end. Table 80 shows a summary of the statistics tests, with Figure 109, Figure 110, Figure 111, and Figure 112 showing the graphs.

The intercepts are reported to the nearest integer, with slope and r-squared figures rounded to three decimal places.

As Table 80 shows in each case the r-squared exceeds 0.985, and the intercepts are less than one hundred trips. The total number of outbound trips is slightly larger than the number of inbound trips for both Home based other, and Home based work[v].

Non-home based trips of course do not have a direction so no symmetry test can be applied.

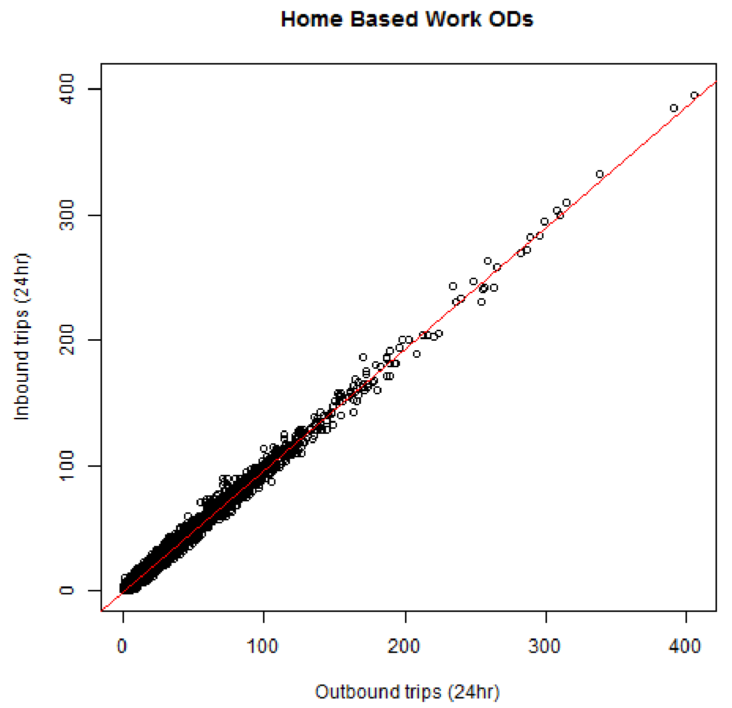
Table 79. Criteria for HBW and HBO symmetry tests (A5, A6, A7)

Geography	Mode	Trip Purpose	Time Period
At least one trip end within SCR. I.e. excluding External to External trips.	Road, and rail, as HGV trips are assigned to NHB trip purpose.	OB_HBW and IB_HBW, and OB_HBO and IB_HBO, for the respective tests. Trips assigned to HBO with no direction were excluded.	All - 24 hours

Table 80. Regression Analysis on IB vs OB for HBO and HBW

Journey Purpose	Comparison Type	Intercept	Slope	R^2	Total number of Journeys Outbound	Total number of Journeys Inbound
HBW	Origins vs Destinations	0	0.965	0.989	324217	313139
HBW	Productions	39	0.935	0.989	292323	282238
HBW	Attractions	0	0.964	1.000	280501	270596
HBO	Origins vs Destinations	0	1.005	0.999	993456	1009696
HBO	Productions	32	1.011	0.994	907045	924662
HBO	Attractions	41	1.011	0.999	885209	904754

Source: Telefonica Data with analysis by AECOM



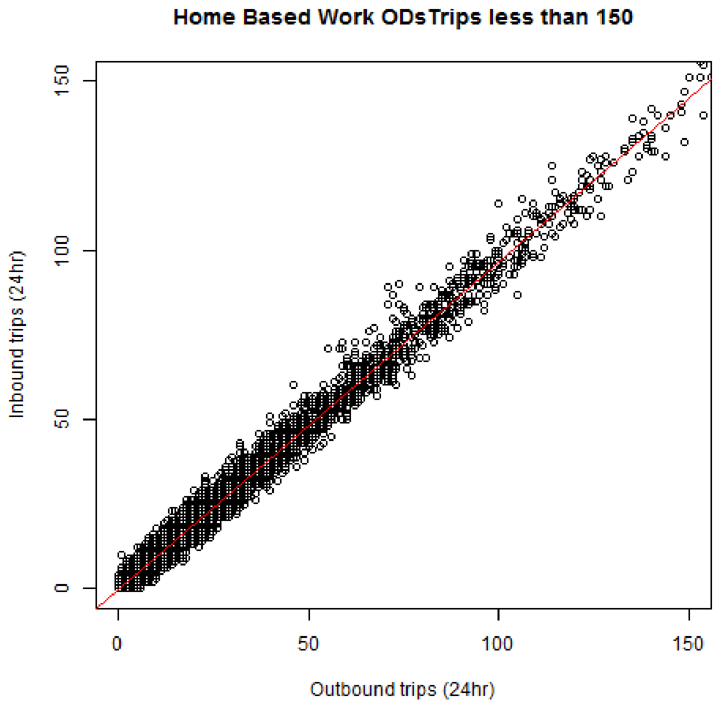
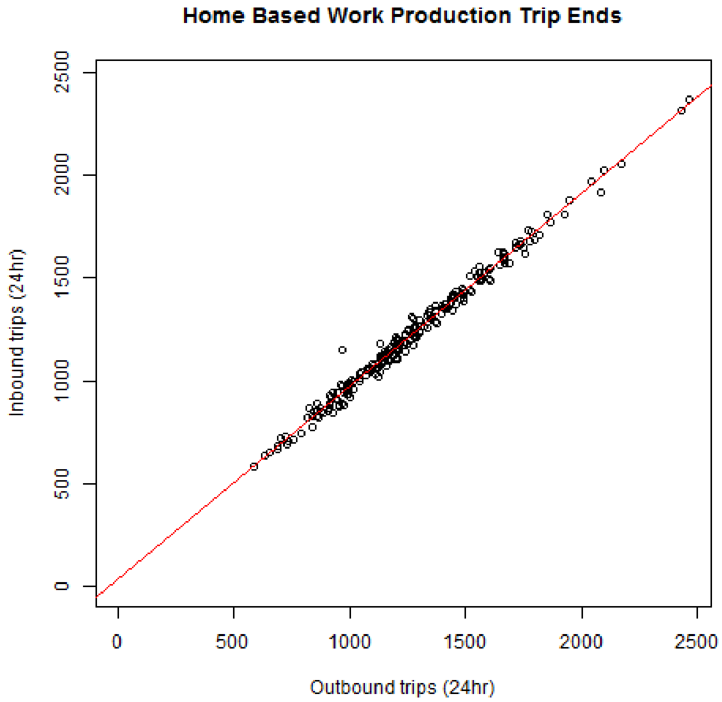


Figure 109. IB vs OB HBW ODs



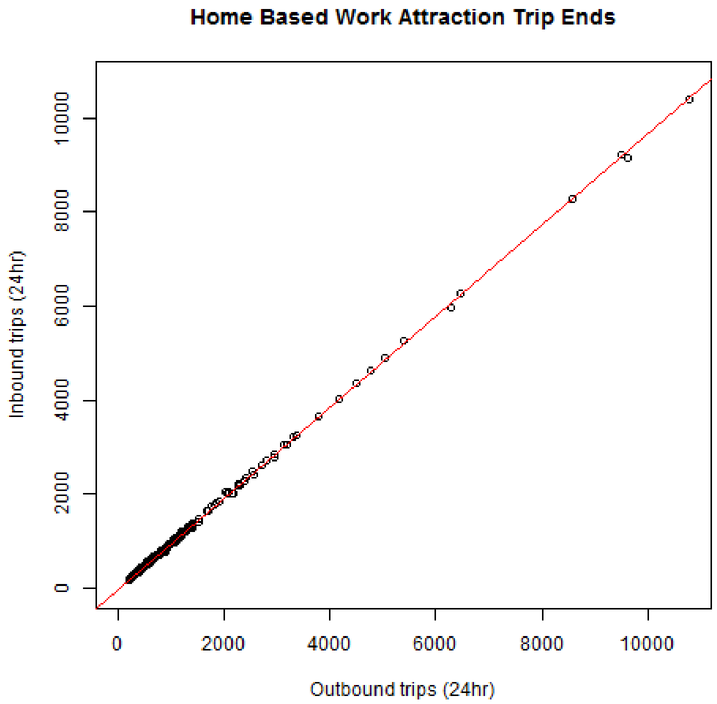
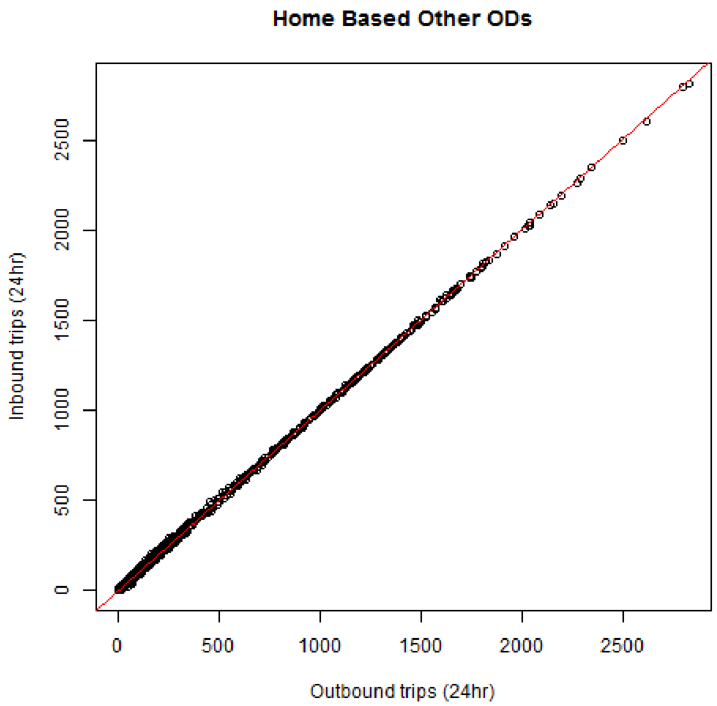


Figure 110. IB vs OB HBW Trip Ends (Productions and Attractions)

Test A7 Home Based Other symmetry tests



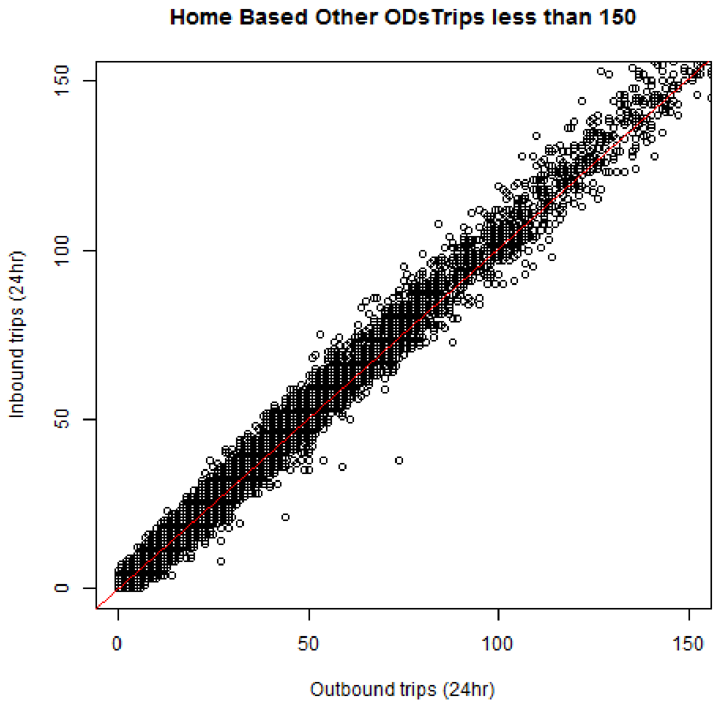
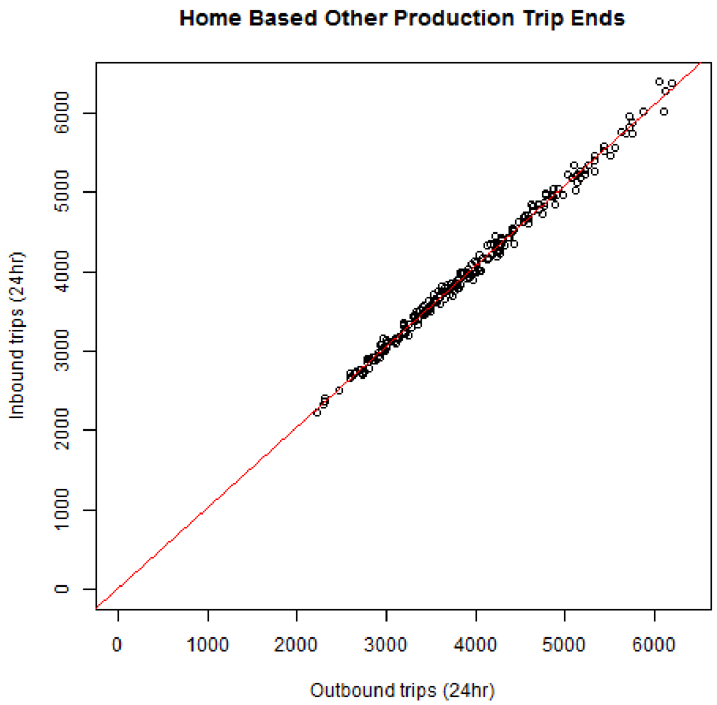


Figure 111. IB vs OB HBO ODs



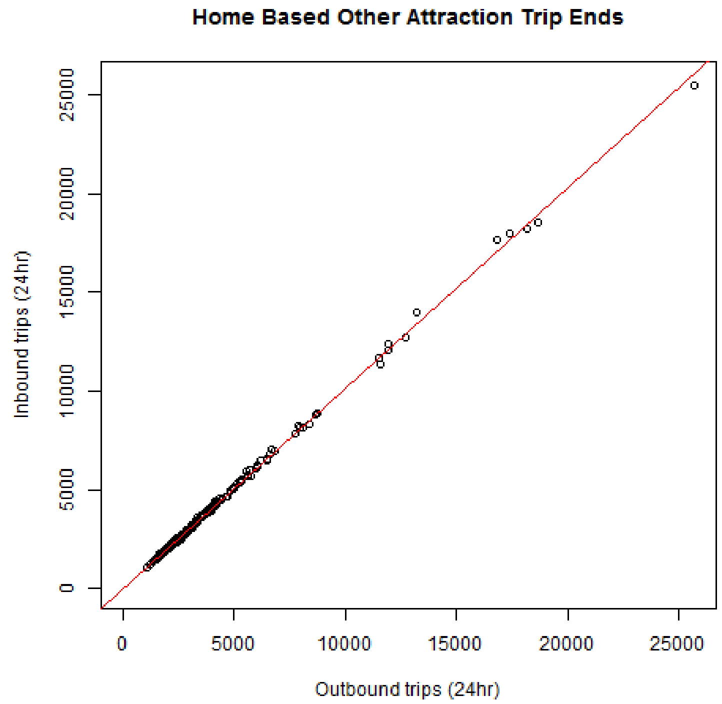


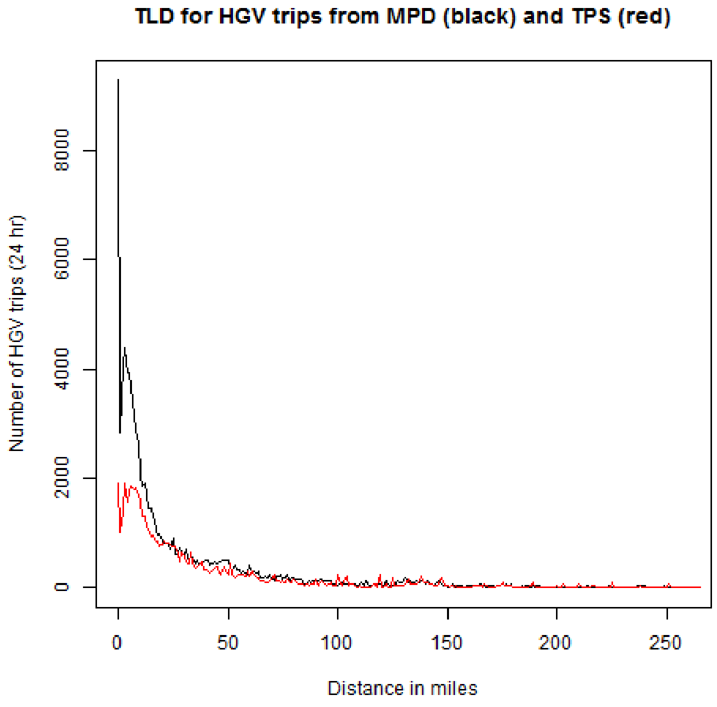
Figure 112. IB vs OB HBO Trip Ends (Productions and Attractions)

A comparison between the total number of outbound and inbound trips for each MSOA area shows a tight clustering around the regression line. As there are no obvious outliers, this suggests a good symmetry between inbound and outbound HBO trips.

F.3.4 Test A5 - Mode Split between Road and HGV

The MPD was filtered by AECOM to only leave trips which were reported by Telefonica to occur in a HGV, with the origin within SCR.

Table 81. Criteria for TLD HGV analysis



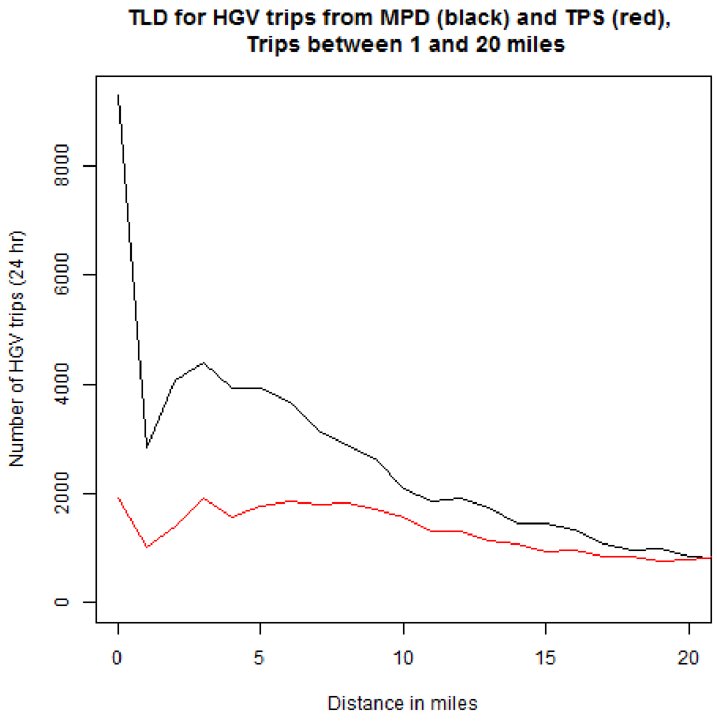


Figure 113. TLD for HGVs MPD vs TPS

As described in F.2.6, a trip length distribution was produced comparing the HGV MPD to the HGV distribution from the Highways England's Trans Pennine model, which in turn derived freight distribution from the Base Year Freight Model (BYFM). BYFM is based partly on an old version of the Continuing Survey of Road Goods Transit (CSRGT), a still-current DfT survey broadly equivalent to the NTS but for HGV travel. BYFM also makes use of the TRICS trip-rate database. Unfortunately direct use of CSRGT is difficult as non-government access to CSRGT is restricted for commercial reasons and sample sizes would preclude its use at an MSOA or model zone level in any case.

Only trips which began within SCR were included. An interesting result occurred which is shown in Figure 113. Above twenty miles, the two lines correspond very well, showing a similar number of trips for these mid to long distances. However, there is a large difference for the trips less than twenty miles, with a great many shorter distance trips in the MPD than suggested by the TPS. We suggest that it is likely that at least some of these shorter distance trips should be assigned to a different vehicle class (probably car).

It is notable that Telefonica, having identified a phone as belonging to an HGV driver, allocated *all* travel by that person/phone as HGV. This is would result in personal travel by lorry drivers being incorrectly allocated to an HGV mode. It may also be that some regular business travellers, whose travel characteristics may be similar to that of HGVs, may have been incorrectly assigned to HGV.

To try to understand this better, it was decided to see how many HGV trips were estimated to finish in each MSOA for both the MPD and the TPS model. This analysis is shown in Figure 114, the area of the circles is proportionate to the number of destination trips, with MPD shown in green and TPS shown in purple.

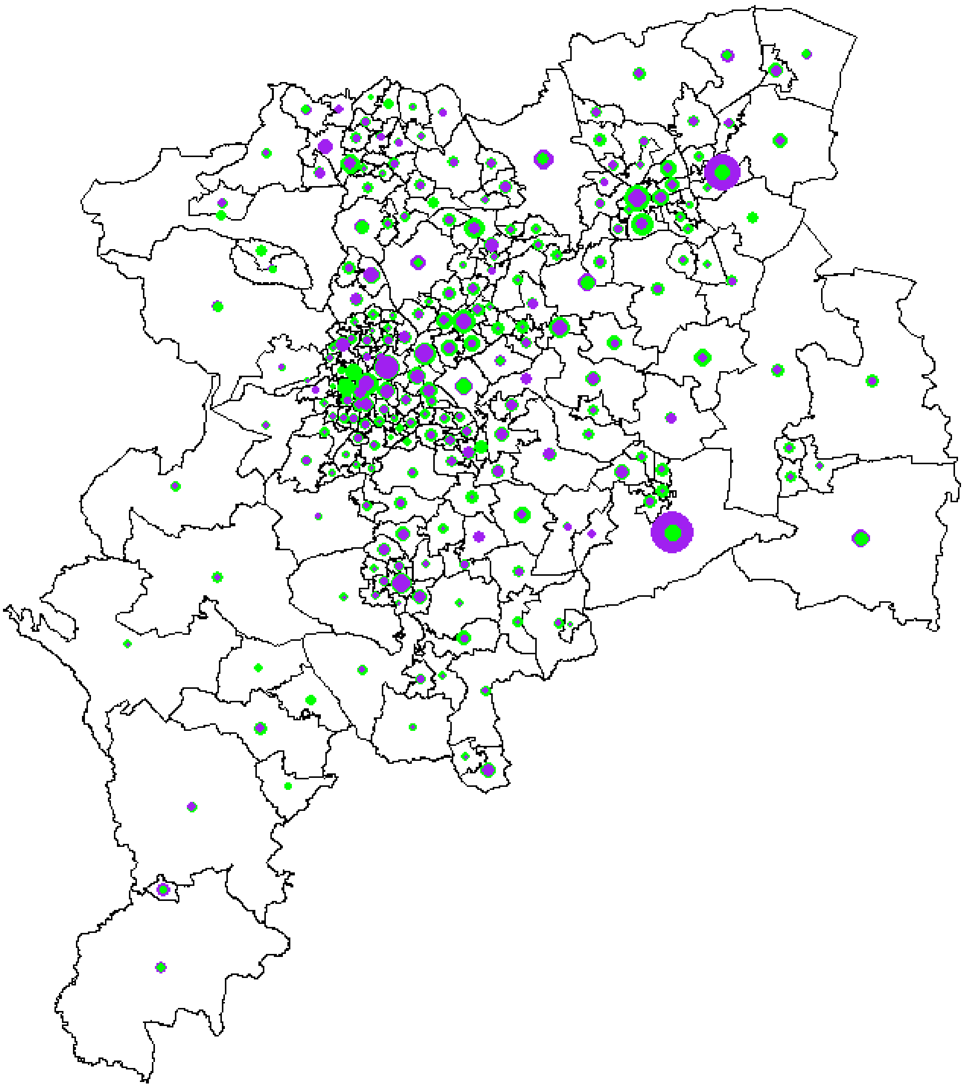


Figure 114. Trip Destinations for HGVs MPD (green) vs TPS (purple)

As can be seen in Figure 114, there are a number of MSOAs where the total number of destination HGVs trips are much higher in the TPS model (see F.2.3) than the MPD. From the scatterplot shown in Figure 115, there are three notable MSOAs which are: E02005848, E02001552 and E02004076. These MOSAs are located in Asbourne (North East Derbyshire), North Doncaster (M18 J4) and just to the south of Worksop.

The MSOA around Asbourne includes 'Airfield Industrial Estate'; the area around Junction 4 of the M18 (North Doncaster) has a number of distribution centres (Ikea, Next,); and south of Worksop there is a quarry and number of distribution centres.

This suggests that the mobile data processing by Telefonica has been poor at identifying areas with unusually high industrial activity and thus very high HGV proportions.

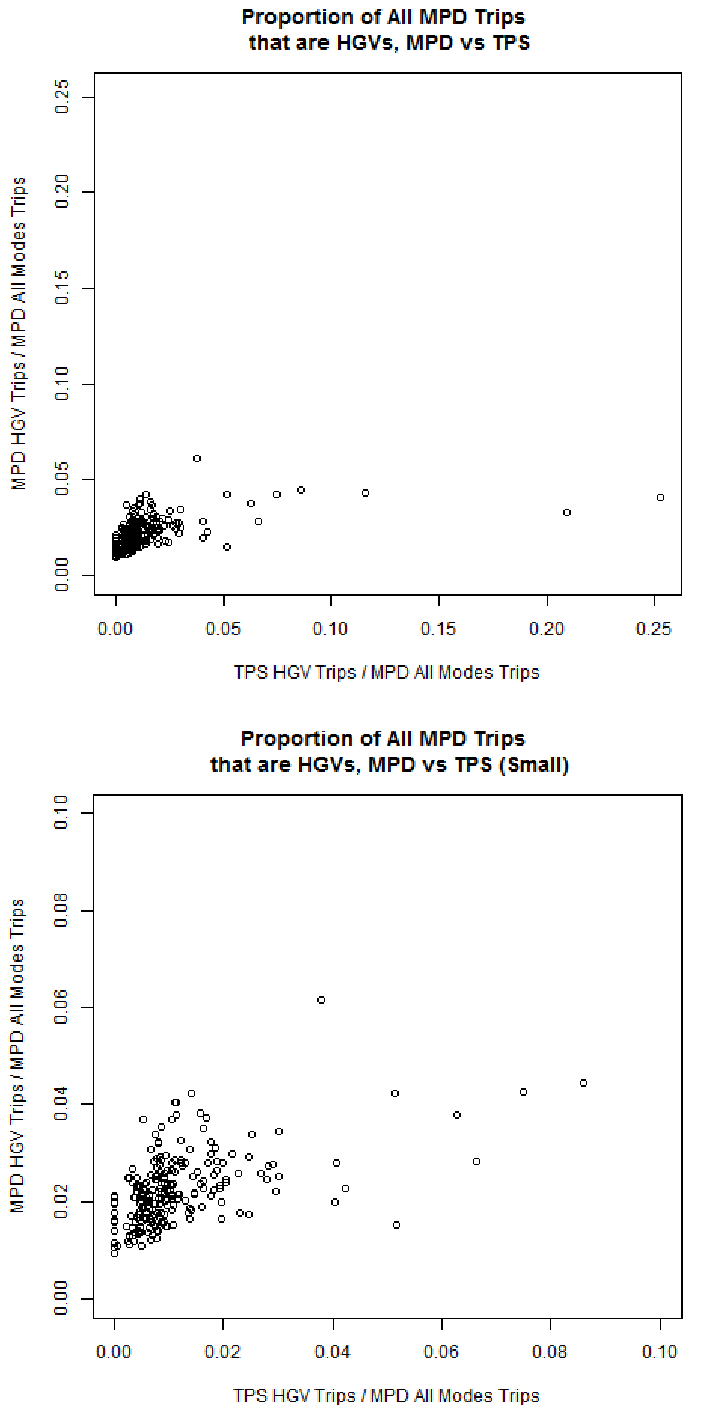


Figure 115. HGV proportion of MPD Trips, in the TPS and SCRTM1 datasets (Internal MSOAs)

Due to the difference in TLD and the distribution of number of destination trip ends across the MSOAs, we do not trust that the split of vehicle classes between non HGV and HGV is sufficiently accurate to use.

An average trip length for HGVs was estimated, for trips with the origin within SCR. The MPD gives an average of 29 miles, with the TPS matrix at 37. We can compare these figures to Road Freight Statistics from the DfT[vi], which gives an average distance for all HGV within 2016 as 56 miles. We would expect trips which start in SCR to be shorter in length as it necessarily excludes the longest distance trips e.g. Scotland to the South East of England. Furthermore the average distance for the whole TPS HGV matrix was calculated to be 55 miles, which compares very favourably with the figure from DfT. As the freight matrices are derived from the same datasource (CSRGT) then this is to be expected.

Even for longer distance trips the evidence from the trip-end analysis by zone is that the MPD data is likely to be significantly in error even for longer trips

We propose that we shall use the TPS HGV matrix for our model, (split into MGV and HGV purposes). We shall therefore not split HGV and Road within the MPD, and instead combine them, removing the HGV demand, using the TPS matrix, at a later stage.

F.3.5 Test A6 – Spread of trip ends and desire line plots

The aim of this test is to check the distribution/spread of trips across the matrix, the level of matrix symmetry and the main movements between Sheffield City Region and the rest of the country as well as within the study area.

For that purpose, desire line plots were produced separately for: i) Internal to External OD trips, ii) External to Internal OD Trips and iii) Inter-zonal OD trips within Sheffield City Region (excluding intra-zonal trips). The desire line plots refer to Origin-Destination people trips (car only) aggregated across all journey purposes (home-based work, home-based other and non-home based) and all time periods of the day. Thus, the desire lines represent the total number of OD car people trips that have at least one trip end within the study area on an average weekday.

The matrices used to produce the plots are based on Telefonica's Mobile Phone Data matrices (all modes combined) after a few adjustments:

- Disaggregation from mobile phone data sectors to actual SCR zones by purpose and time period based on the Synthetic Matrices
- Removal of external intra-zonal and short distance trips up to 6 kms (4 miles). These two trip categories were found to be significantly understated in the Provisional MPD matrices and will, thus, sequentially be infilled by the Synthetic Matrices. For consistency with the Mobile Phone Data matrices, the same trip categories were also removed from SYSTRA's public transport matrices and from Highways England TPS Regional Model freight matrices (LGV, OGV).
- Removal of public transport trips using the bus and rail public transport matrices developed by SYSTRA and
- Removal of freight (LGV, OGV) trips from the non-home based demand using the freight (LGV, OGV) matrices derived from Highways England Trans-Pennine Regional Model (TPS)

For the sake of clarity, OD movements with less than 20 trips are not shown on the figures below. The thickness of the desire lines on the plots is proportional to the size of the movement (number of trips for the specific OD zonal pair).

Figures 4-14 and 4-15 compare inbound trips to Sheffield City Region with outbound trips originating from the study area. It is observed that almost every inbound movement in the plot has a respective outbound one, a finding that verifies the symmetry of this part of the matrix.

Figure 4-14 shows a large part of the UK (including the whole of England and Wales) so that all major long distance movements between the internal area and the rest of the country are depicted (more than 20 trips).

A significant number of trips are shown between Sheffield City Region and most of the large cities in the adjacent North East and North West government regions, as well as in the rest of Yorkshire and Humber and East Midlands (external area). Amongst all, we could distinguish the movements between SCR and Newcastle, Liverpool, Manchester, Chester, York, Kingston upon Hull, Grimsby, Birmingham, Leicester and East Lincolnshire.

A considerable number of trips are also depicted from/to London and the rest of the South East and from/to the South West. However, because of the large size of the zones for these regions, the precise origin/destination of the trips are not distinguished in the plots.

The plots do not show any trips between the study area and Scotland as the demand for that particular movement is less than 20 trips on an average weekday. The low number of trips is reasonable considering the distance between Scotland and Sheffield City Region (more than 300kms/ 200miles).

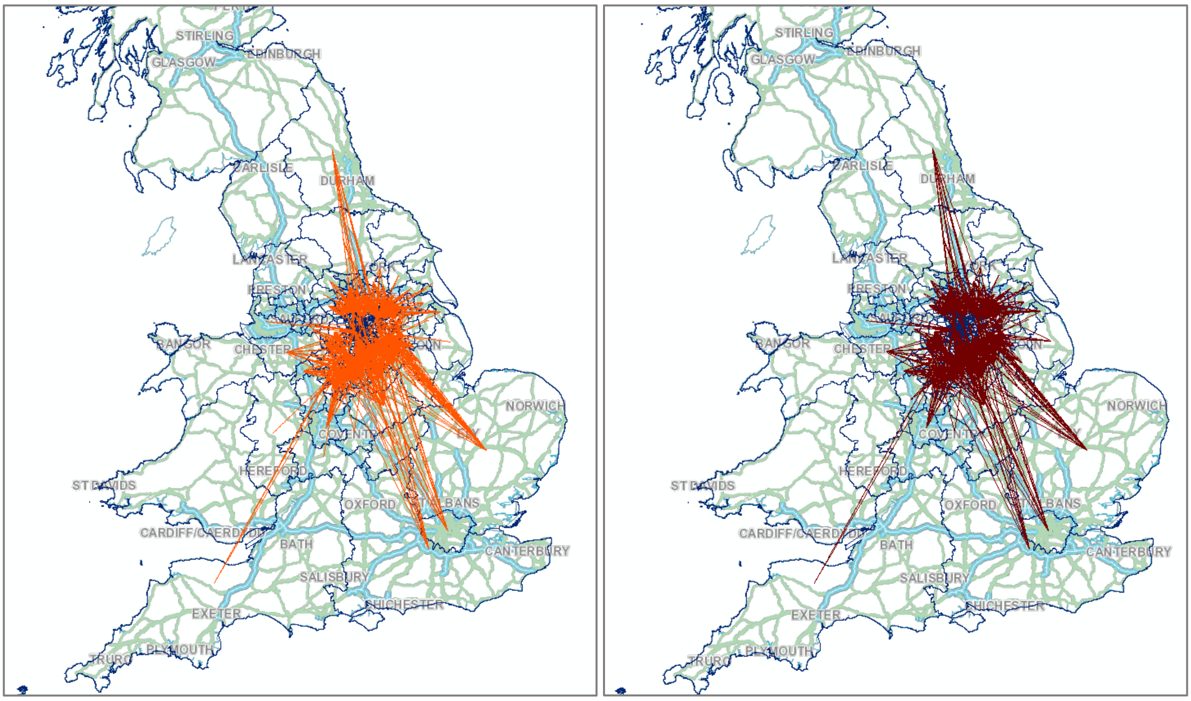


Figure 116. External to Internal (on the left) versus Internal to External (on the right)

Figure 116 mainly focuses on trips between the internal area and the external zones in proximity to the borders of Sheffield City Region.

As expected, the thickest desire lines and therefore, the major movements are spotted between the study area and Leeds, Wakefield, Bradford, Goole, Scunthorpe, Derby, Nottingham, Stoke upon Trent and Lincoln. A large number of trips are also shown from/to many other smaller towns and urban areas around Sheffield City Region borders.

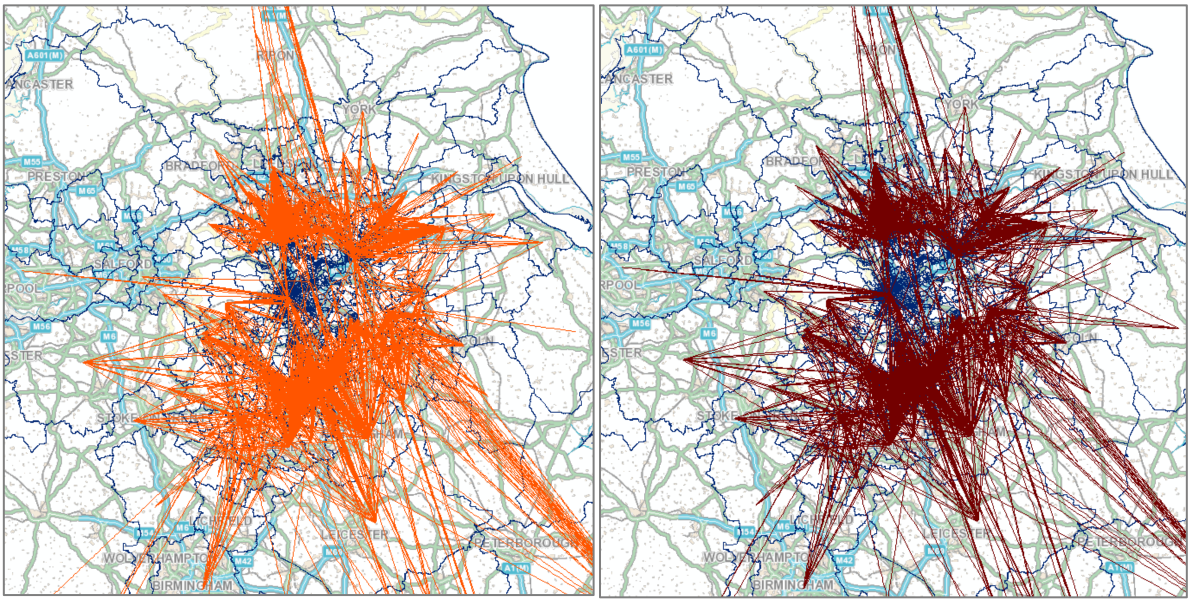


Figure 117. External to Internal (on the left) versus Internal to External (on the right) study area)

Comparing the size of movements between each of the nine districts of Sheffield City Region, as depicted in Figure 117, and the external area, there is an apparent lower level of "activity" in Sheffield than in most of the rest of the internal districts. This is expected, as the sizes of the zones within the Sheffield district are slightly smaller compared to the rest of the internal districts. This was required as a result of the need to use the model to support Supertram schemes where the walking access to existing and potential tram stops needs to be modelled in slightly more detail. The total number of trips per zone in Sheffield is therefore slightly lower than in other districts with fewer movements triggering the 20 trip cut off.

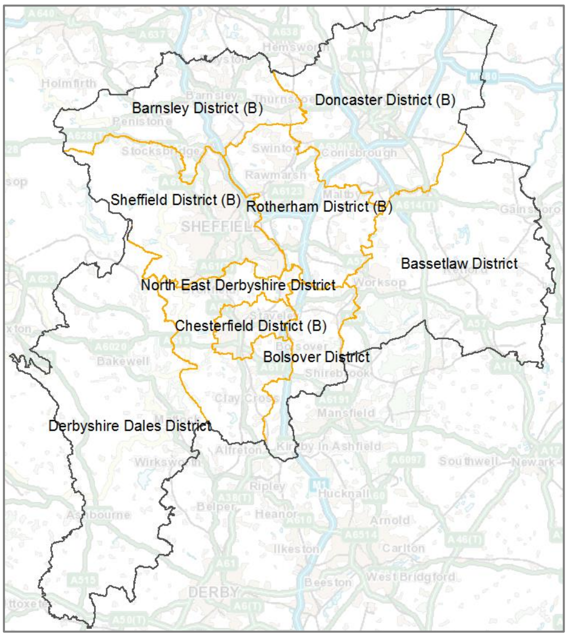


Figure 118. The nine internal districts within Sheffield City Region Study Area

Movements within Sheffield City Region study area are presented in Figure 118. It is remarked that inter-district trips are, in general, evenly spread across all nine different internal districts. When examining each internal district on its own, it is clear that the majority of inter-zonal movements are between residential areas and the main urban centres of the district. Amongst all internal districts, Derbyshire Dales is the one with the fewest trips. This is expected as the Peak District National Park counts for the largest part of the district and although there are some small urban areas in the district (Ashbourne, Matlock, Bakewell and Wirksworth), they do not constitute areas with significant employment/economic activity.

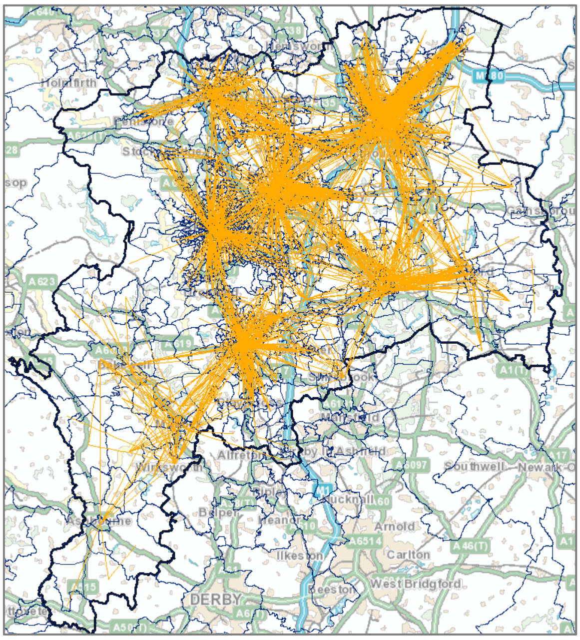


Figure 119. OD movements within the study area

Overall, as it can be deduced from all the above plots, the Mobile Phone Data matrices appear to have a satisfactory level of symmetry and trips seem to reflect sensible and expected patterns across the study area and country. There are, of course, some differences in the actual number of outbound and inbound trips for particular movements but the majority of them are within an acceptable range (up to 10% absolute difference).

F.3.6 Test B – Trip Rates

Average trip rates (i.e. productions per resident), for a weekday, were estimated from MPD and NTS data, separately for each of HBW, HBO and NHB purposes. The summary results for car and rail trips are shown in Figure 120.

While HB car trip rates are approximately 30% higher in NTS data than in the MPD, the situation is reversed for NHB trips where the trip rate is approximately 18% higher in mobile phone data than in NTS. NHB trips within the MPD will include some freight trips.

These results are similar to the findings comparing MPD against NTEM in the previous section.

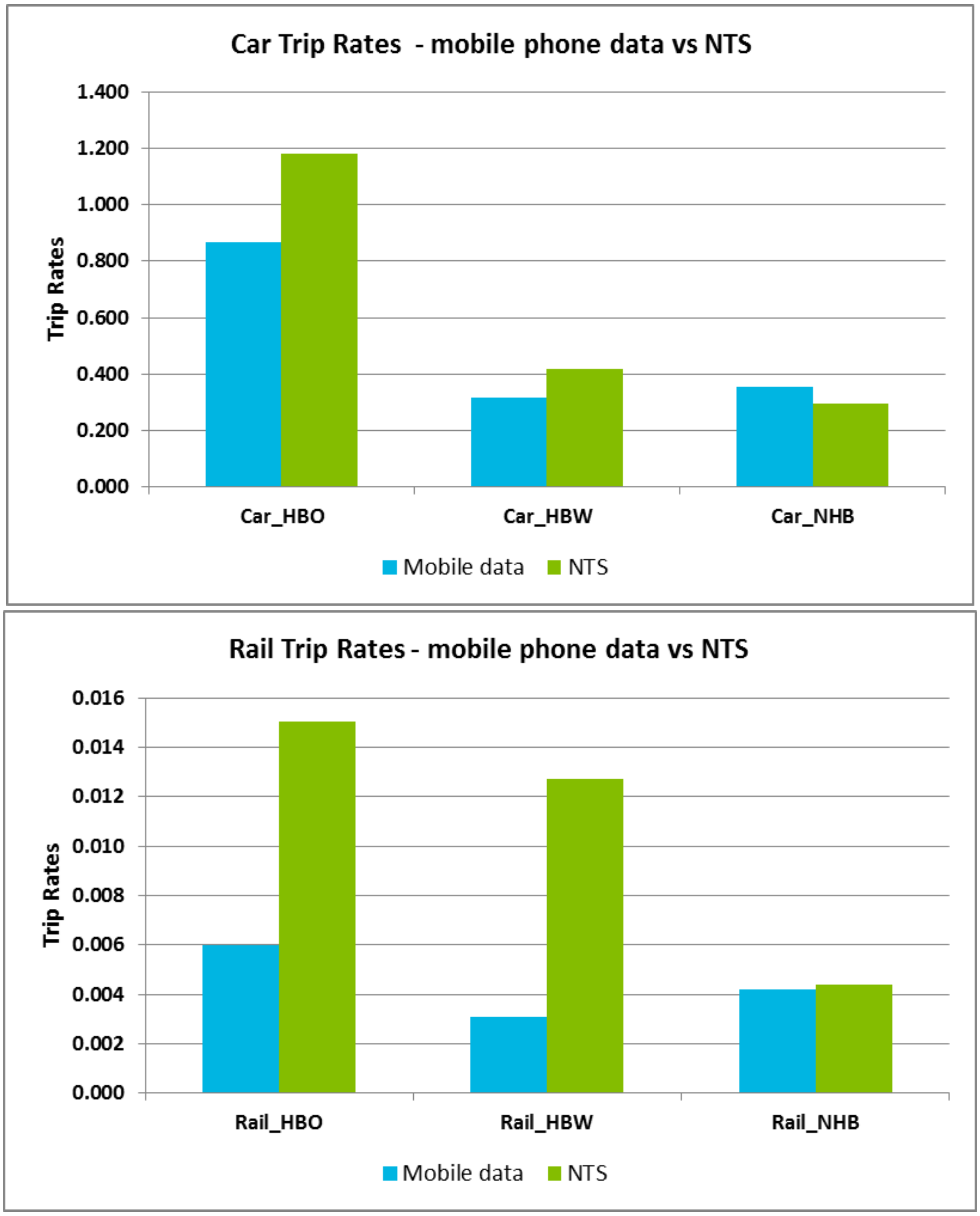


Figure 120. Car and Rail splits by purpose – MPD vs NTS

For rail trips, NTS trips rates are significantly higher than mobile phone trip rates overall; this is consistent with the findings of test A1.

The second test of trip rates was carried out by dividing trip productions by populations. First the residential populations for each MSOA within Sheffield City Region were taken from MSOA. Then the number of outbound home based trips was calculated from the mobile phone data for each MSOA. Finally a trip rate was obtained for each MSOA by dividing the number of outbound home based trips by the residential population.

In order to identify any outlying trip rates or distinct groups of MSOAs, the MSOAs were ordered by trip rate (smallest to largest). A plot of this data is shown in Figure 121.

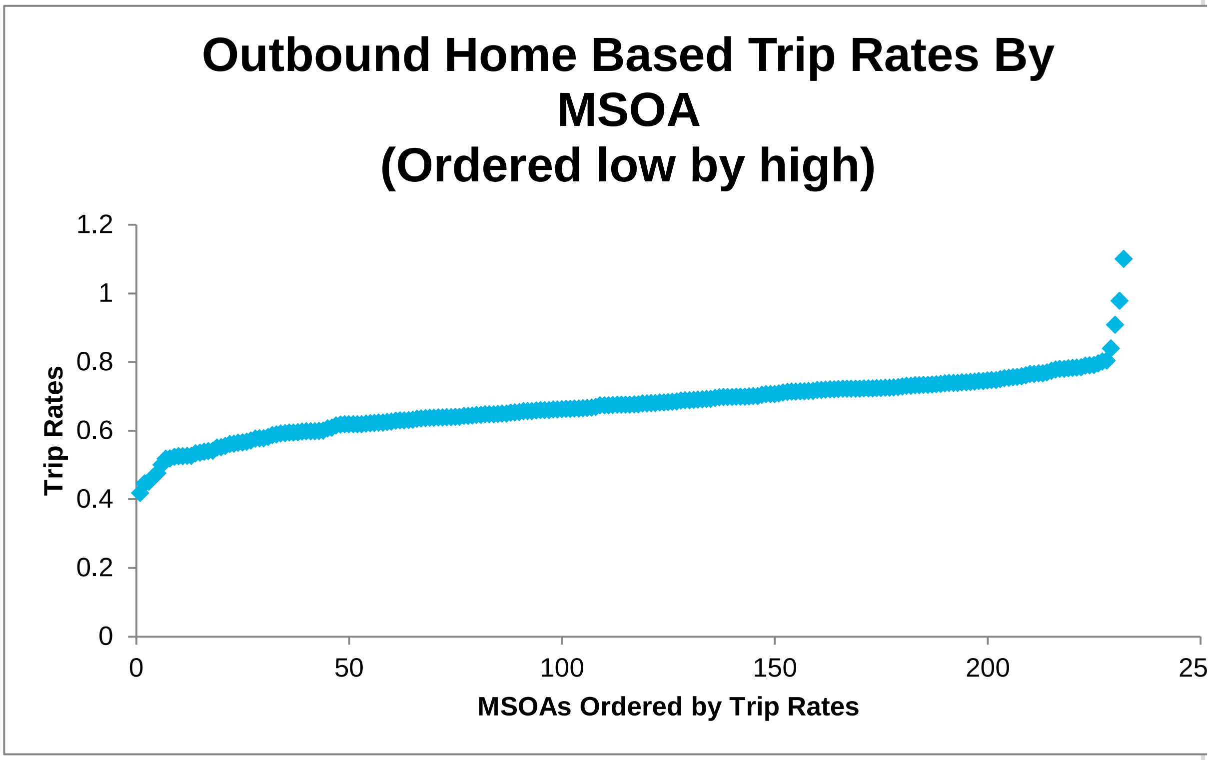


Figure 121. HB Trip Rates (by Population) for MSOAs within SCR

The trip rates split the 232 MSOAs into three rough groups. The vast majority (223) have a trip rate between 0.49 and 0.81, with an average of 0.61.

Of the remaining nine MSOAs, five have a trip rate between 0.81 and 1.10. The remaining four have a small trip rate between 0.41 and 0.49.

Trip rates were plotted geographically; the four MSOAs with the highest rate lie between Sheffield City Centre and Doncaster City Centre. The five MSOAs with trip rates less than 0.49 are towards the edge of the SCR.

The outlining MSOA are indicated in Figure 122, with the MSOAs with low rates in blue and high rates in red. It is notable that:

- The low zones are generally rural; the high ones urban, so some or all of the effect may be genuine.
- All zones are relatively small, so Telefonica's precision in allocating trips to a single zone might be lower.

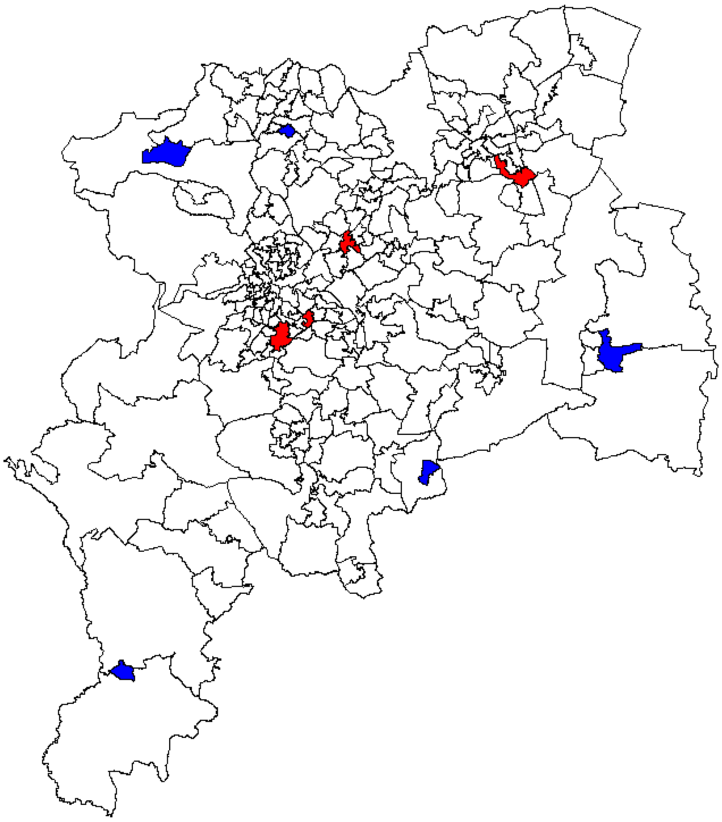


Figure 122. Trip rates by MSOA, outliers are indicated (high in red, low in blue)

In conclusion, the trip rates, comparing residential populations and home based trip productions; suggest a reasonable level of consistency. There are very few significant outliers.

F.3.7 Test C – Trip Distribution

In addition to the tests in Section A. It was decided to compare the number of trips recorded as travelling between each district to district (within SCR). This is shown below.

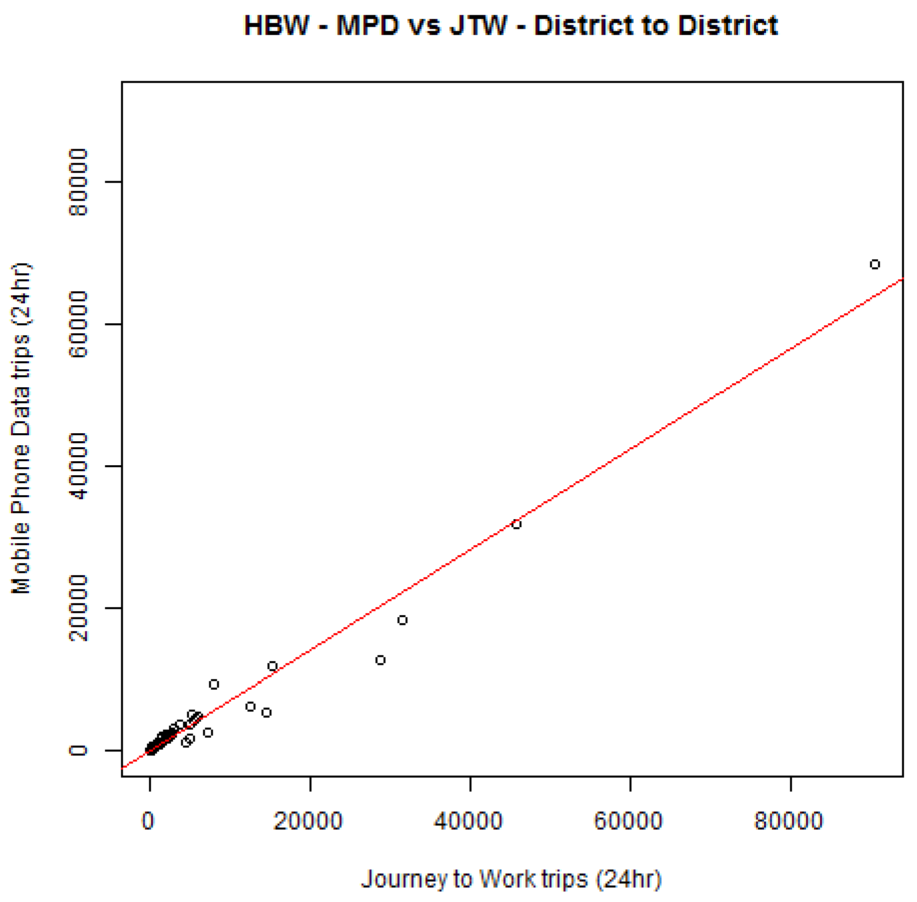


Figure 123. HBW vs JTW – District to District
Internal movements only

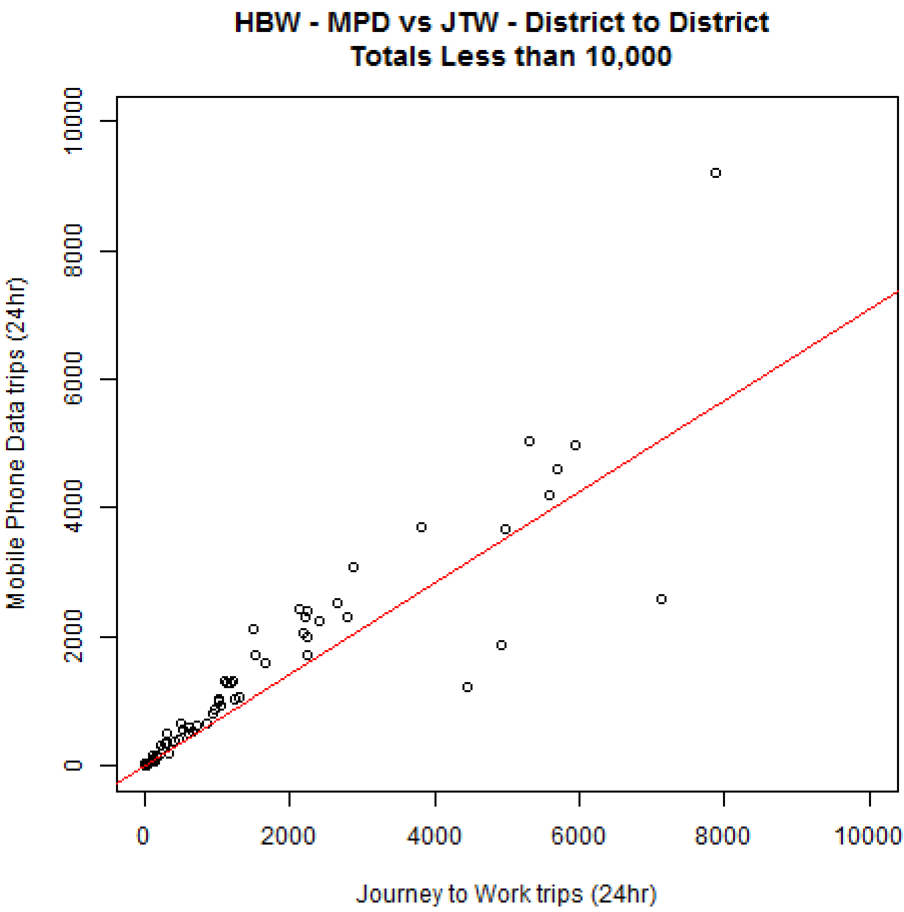


Figure 124. HBW vs JTW – District to District "Zoomed-in"

Journey Purpose	Geography	Intercept	Slope	R^2	Total number of Journeys JTW	Total number of Journeys MPD
HBW	District to District	22	0.706	0.973	344,783	245,265

There is a small intercept and a large R-squared value. Though this is likely to be highly influenced by the Sheffield-Sheffield movement at (90502, 68520). The slope is a similar value to the Home Productions MPD vs JTW tests by distance bands discussed in 0 and 0. Again suggesting that we are missing trips from the MPD compared to the JTW data.

F.3.8 Test D – Trip Length Distribution

Figure 125 compares trip length distributions for car, bus and rail trips obtained from NTS and mobile phone data, as well as census journey-to-work (JTW) data for home-based work trips. As we know MPD trips are unreliable for short distance trips, further analysis is provided for trips greater than 4 miles.

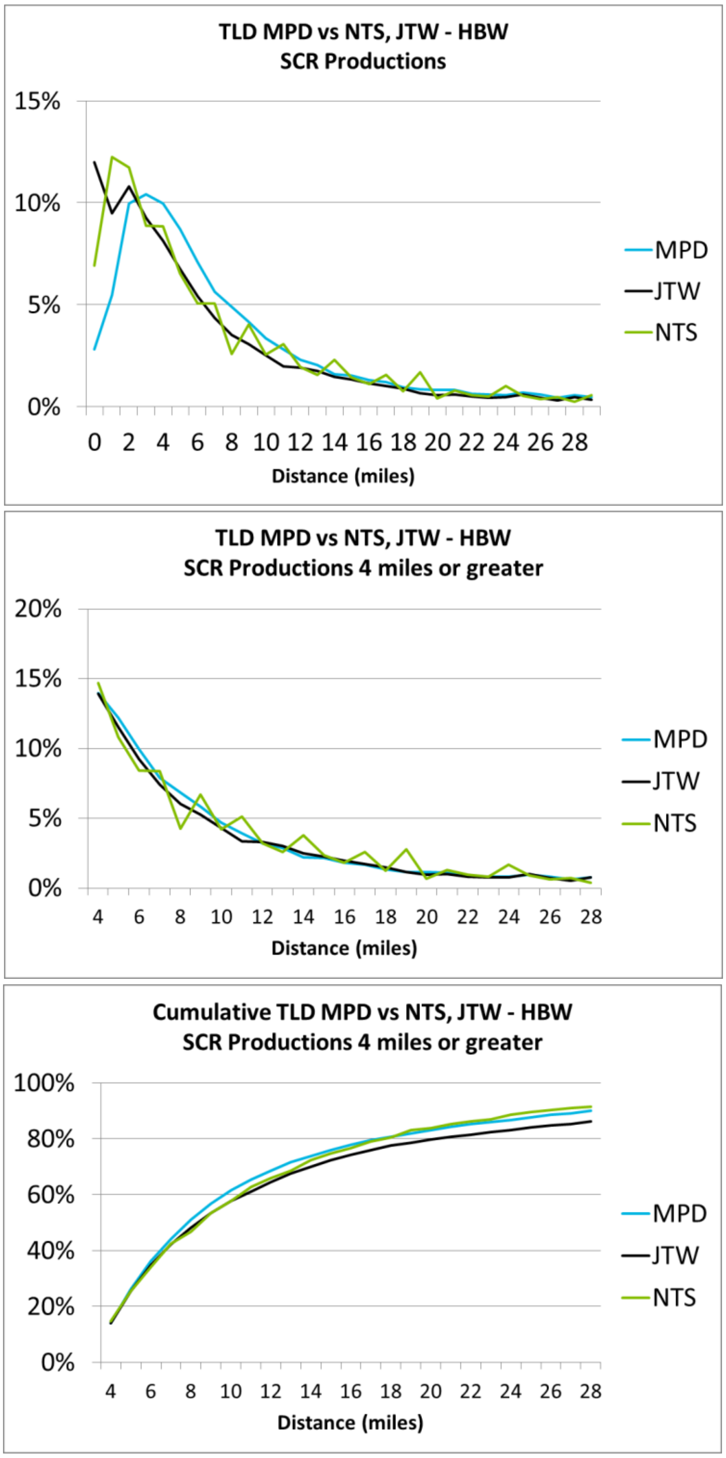


Figure 125. Comparison of trip length distributions, HBW, between MPD & NTS data.

Figure 126, Figure 127 and Figure 128 compares trip length distributions for car, bus and rail trips obtained from NTS and mobile phone data for different journey purposes. Again further analysis is provided for trips 4 miles or greater.

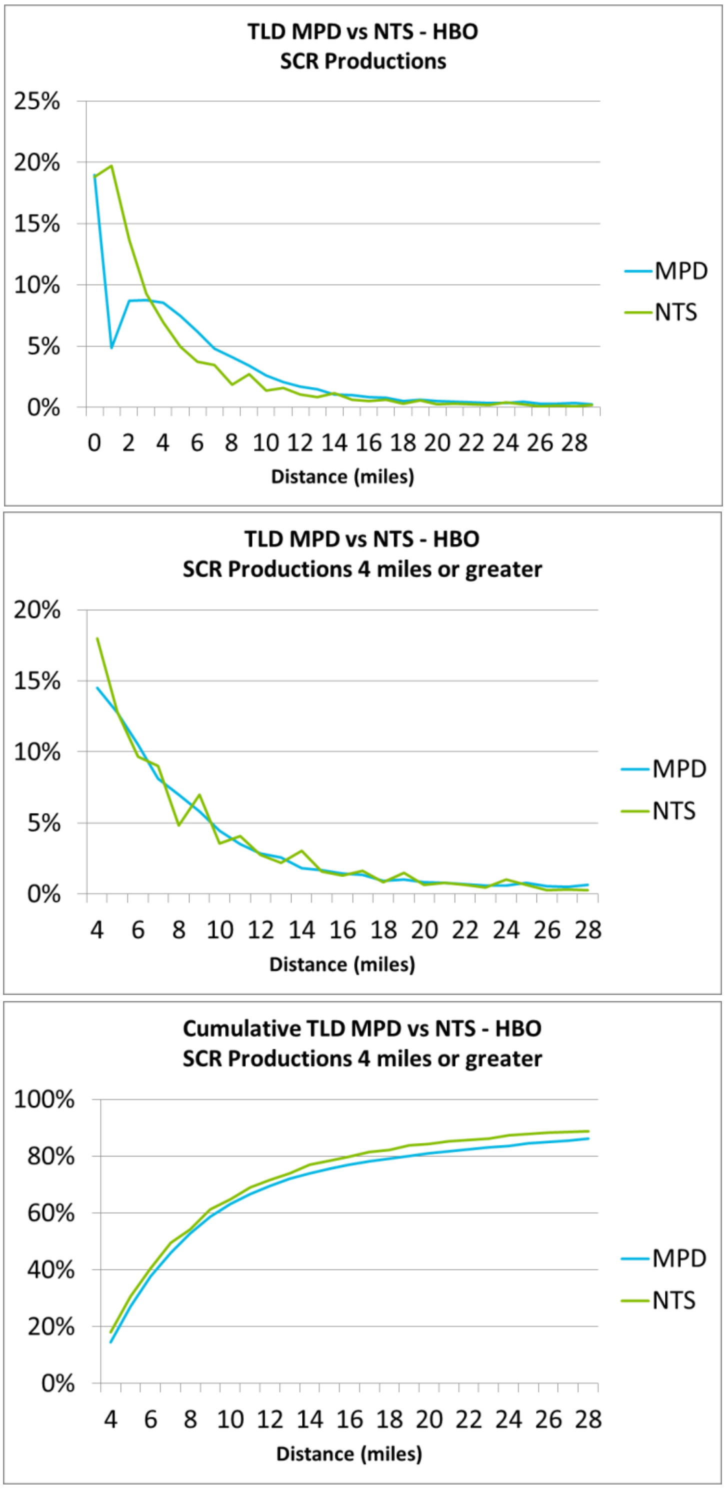


Figure 126. Comparison of trip length distributions, HBO, between MPD & NTS data.

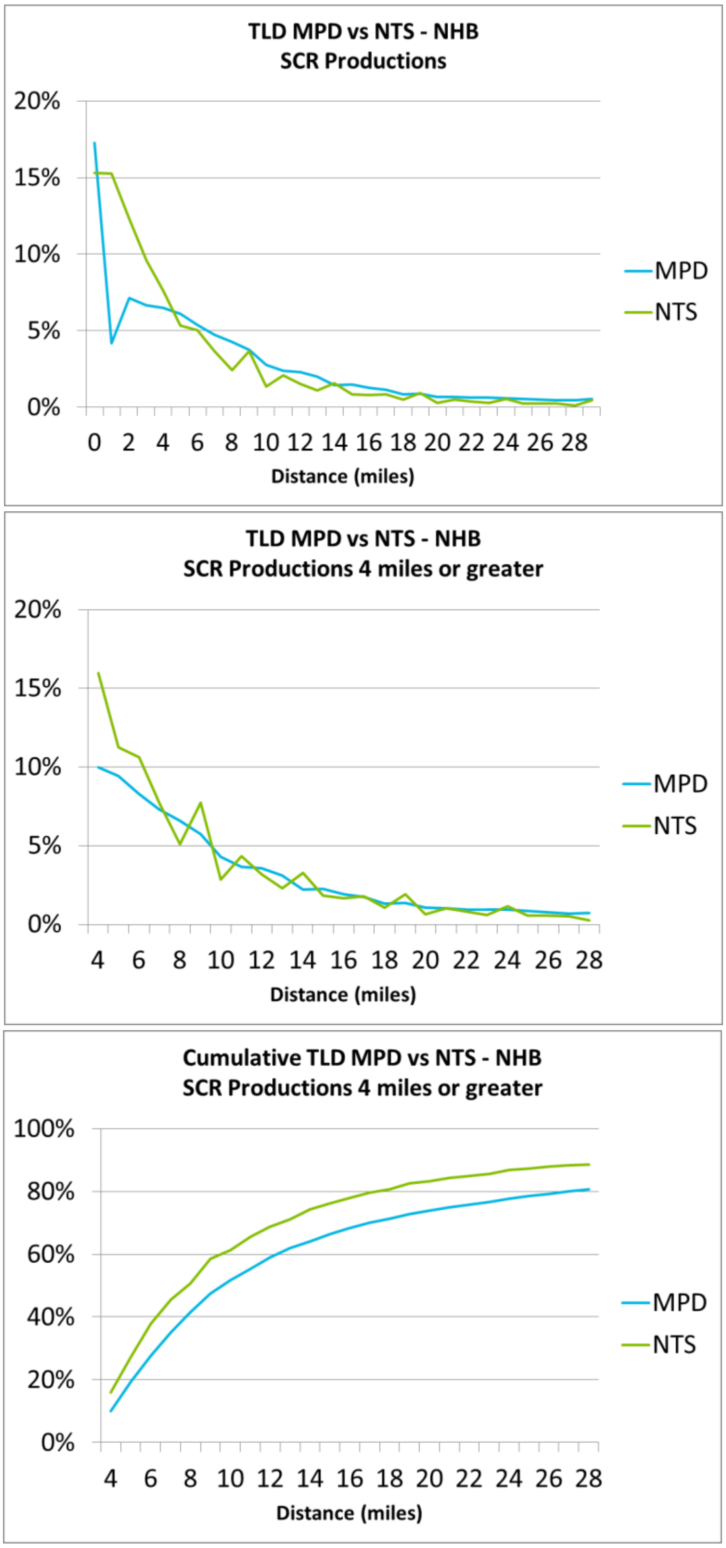


Figure 127. Comparison of trip length distributions, NHB, between MPD & NTS data.

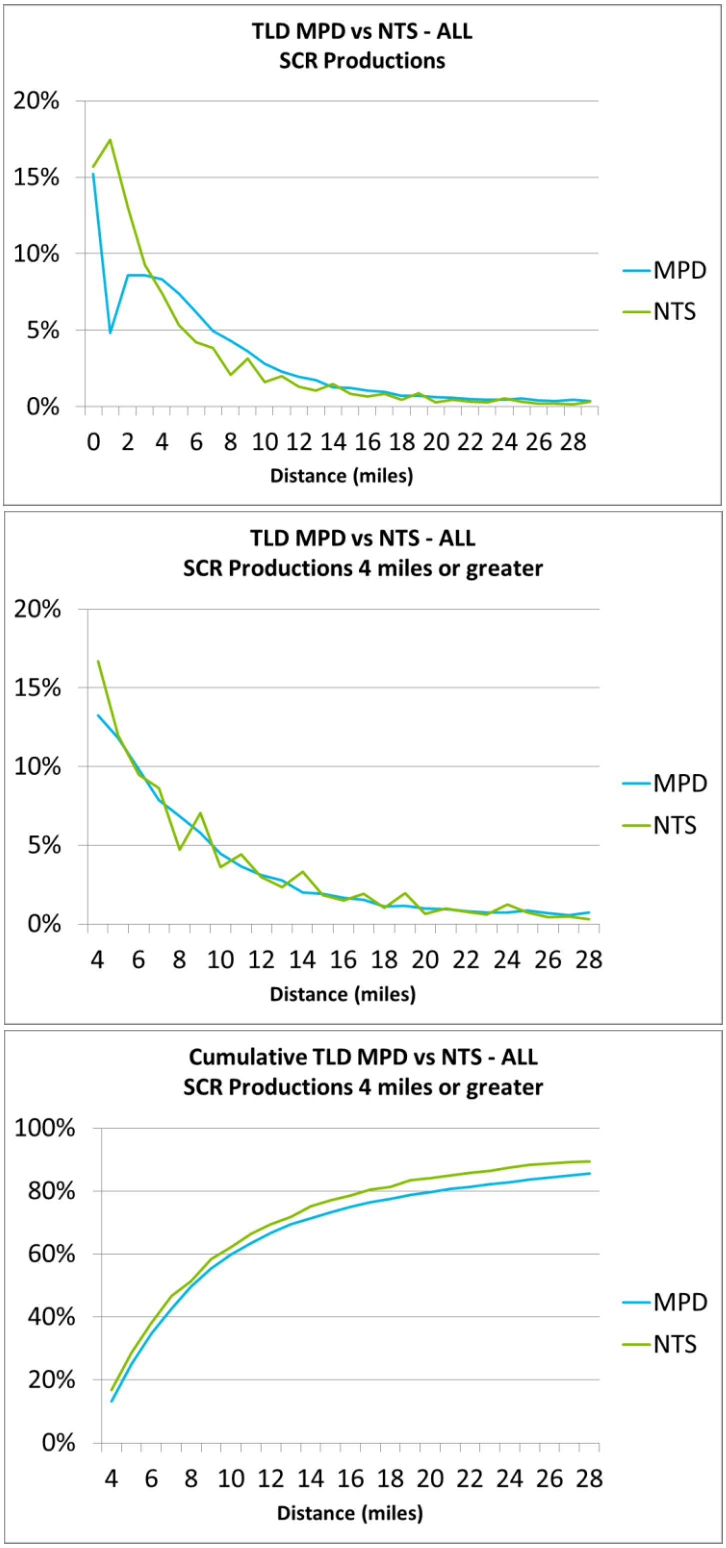


Figure 128. Comparison of trip length distributions, All, between MPD & NTS data.

Overall, the graphs show that the number of short trips (i.e. trips less than four miles) is significantly underestimated in MPD for all purposes. For home-based work trips the JTW and NTS data compare fairly well, which is reassuring evidence that our validation trip-length are themselves good observations. The mobile data compare less well with the other two, although for longer trips (over 12 miles) the match is fairly good.

It is noticeable how the NHB distribution (Figure 127) only has 80-90% of trips less than 30 miles. With the MPD data trips tending to be longer than the NTS trips. This is understandable as NHB includes all freight trips in the MPD, which are not covered to the same extent in the NTS.

Both of these points correspond with the analysis of average trip lengths shown in Figure 129 Figure 125 which shows that trips in MPD tend to be longer overall than those from NTS data. However, when trips up to four miles are excluded (which accounts for approximately 37% of all MPD trips), with the exception of NHB trips average trip lengths in MPD are actually very close to those from NTS.

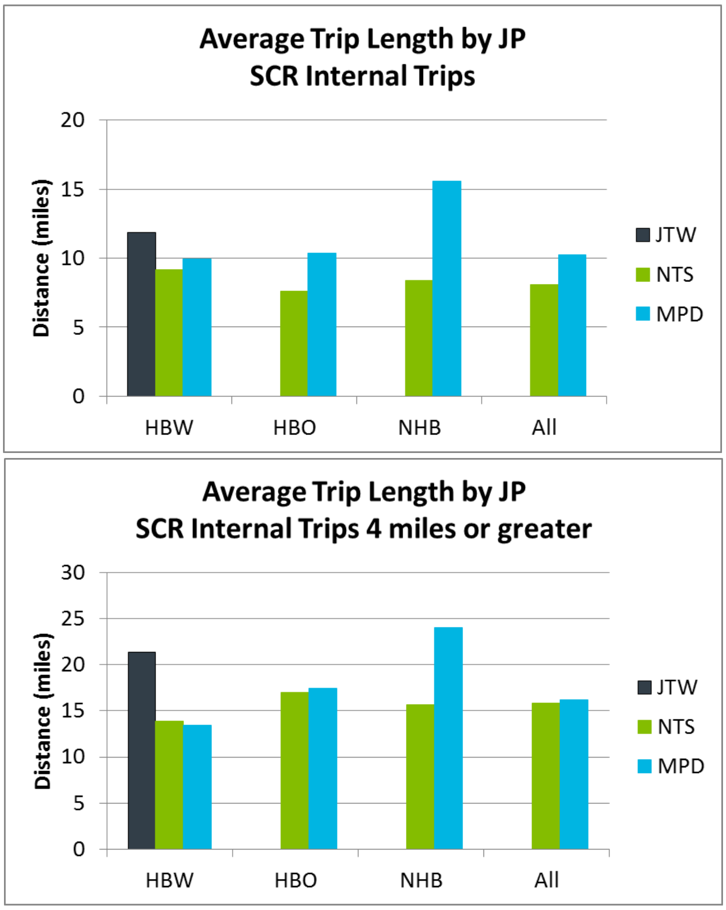


Figure 129. Average trip lengths – NTS vs MPD vs JTW

F.3.9 Test E – Trip Purpose Split

In the analysis of purpose splits, significant but not extreme differences between Mobile Data and NTS data were identified. Figure 130 compares purpose splits derived from mobile phone and NTS data. MPD clearly over allocates non-home-based trips, as mentioned above in 0.

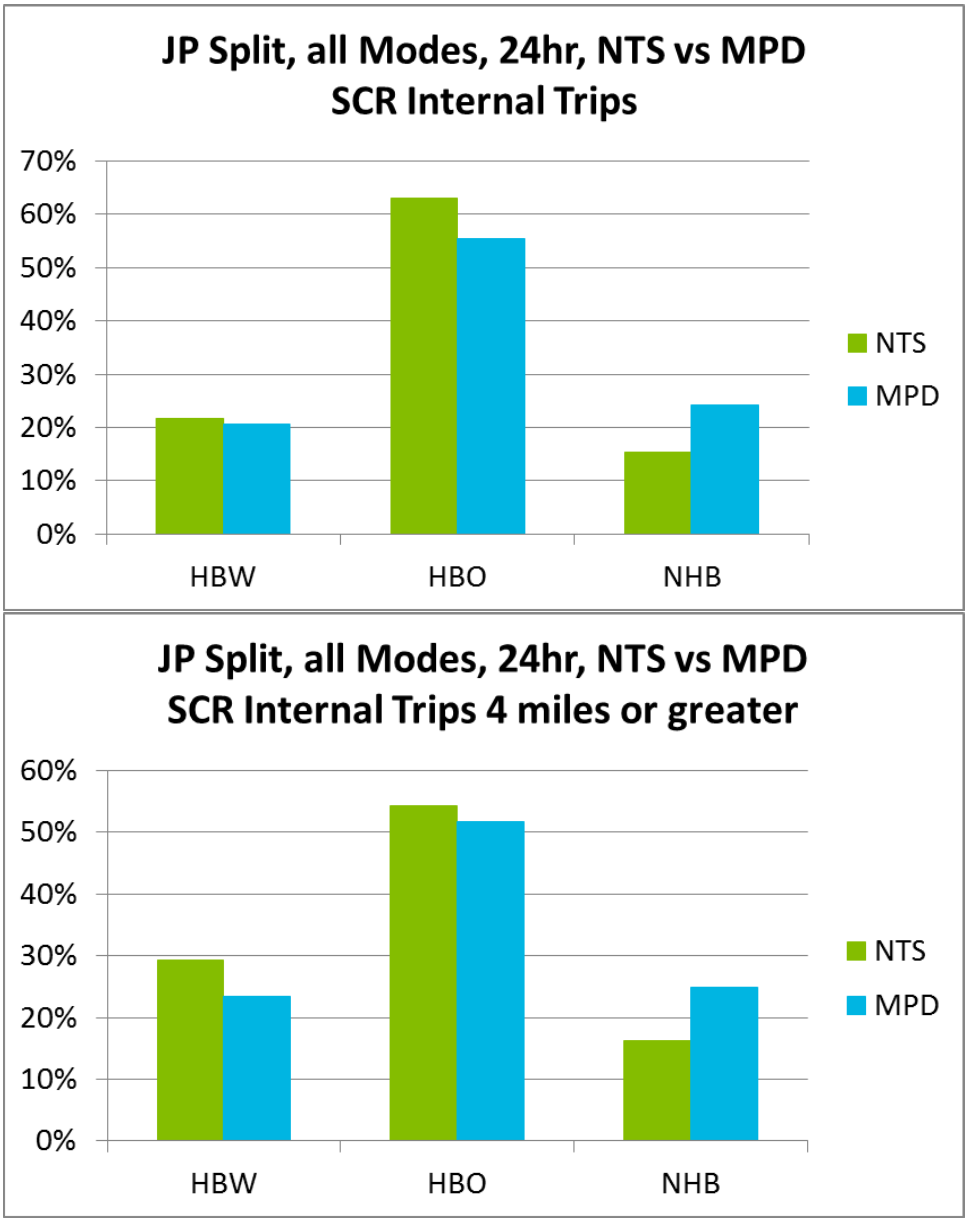
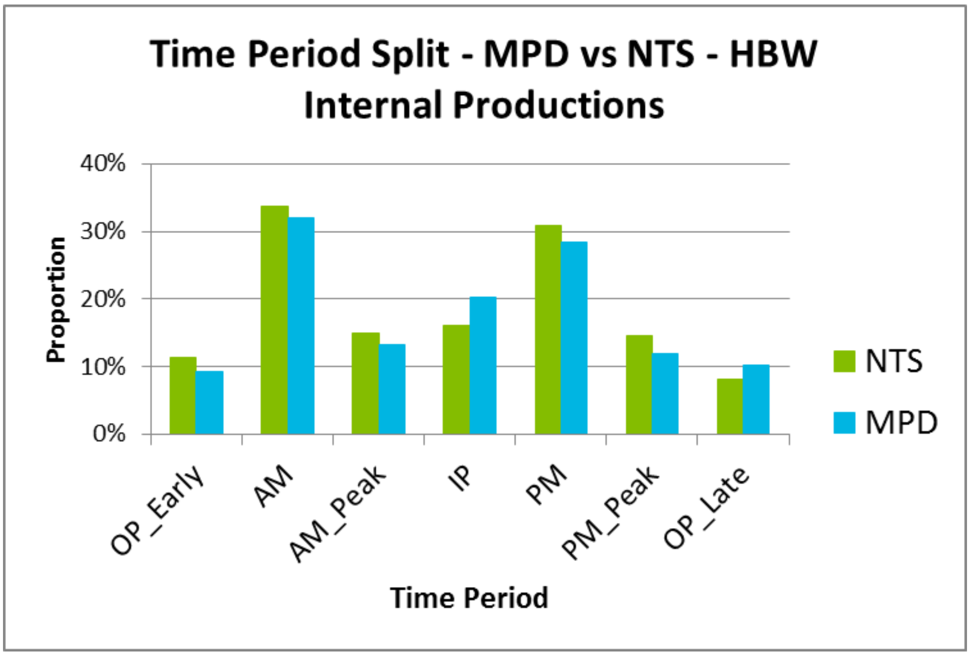
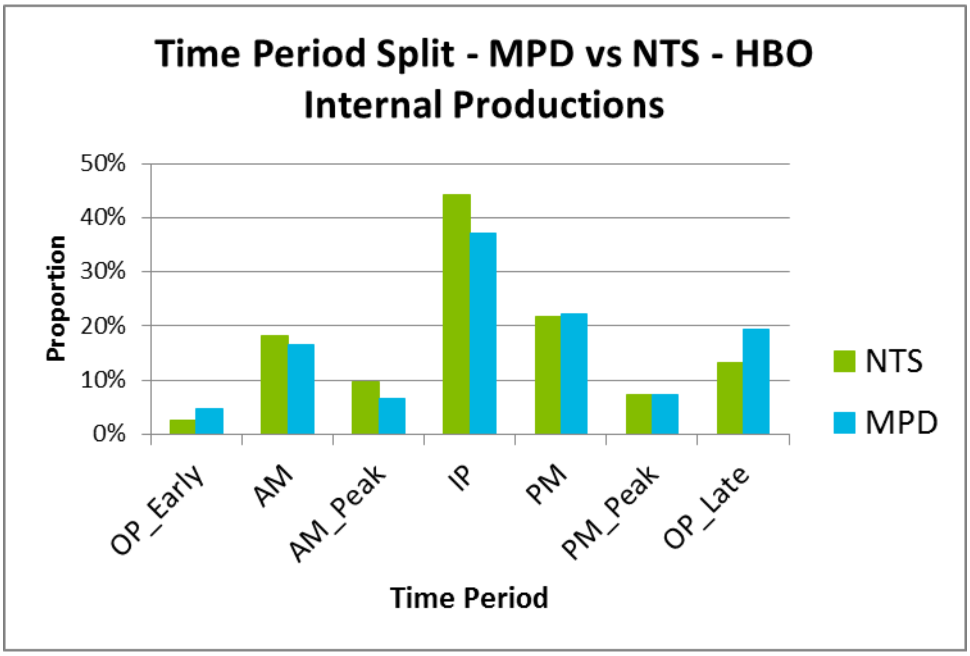
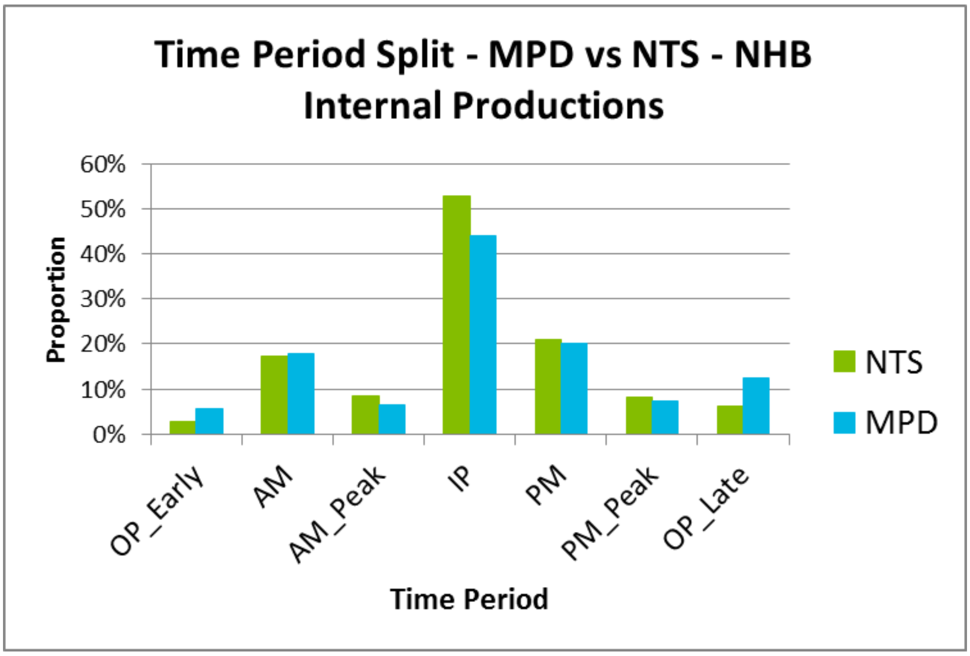


Figure 130. Purpose splits – MPD vs NTS

In order to better understand the extent to which trip purposes were misallocated, purpose split were analysed within time periods. As shown in Figure 131, trips appear to be misallocated in the off-peak periods (there is too much non-home-based and other demand and not enough commuting).


Time Period Split - MPD vs NTS - HBW Internal Productions
Proportion
40%
30%
20%
10%
0%
OP_Early
AM
AM_Peak
IP
PM
PM_Peak
OP_Late
Time Period
NTS
MPD


Time Period Split - MPD vs NTS - HBO Internal Productions
Proportion
50%
40%
30%
20%
10%
0%
OP_Early
AM
AM_Peak
IP
PM
PM_Peak
OP_Late
Time Period
NTS
MPD



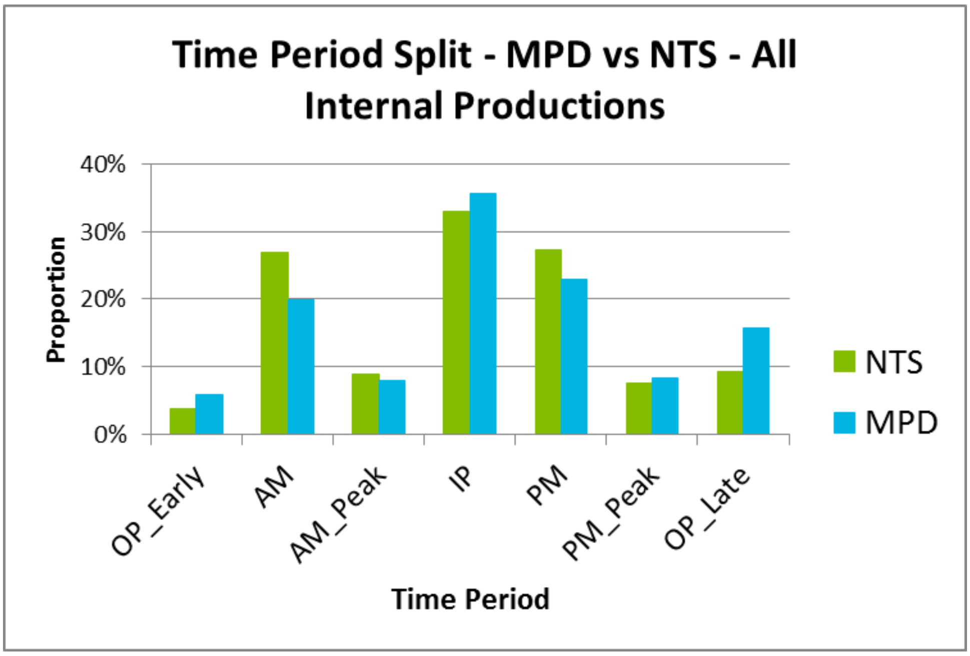


Figure 131. Purpose splits by time periods – MPD vs NTS

F.3.10 Summary and Conclusions

Our view remains, as it was from previous work with mobile data, that mobile data are a valuable source of information about patterns of longer distance travel movements across the model area. Furthermore, they are able to identify times of travel, and reasonably allocate demand to different travel purposes within the categories used. However, they do have weaknesses, as follows:

- The MPD split between rail and road is not yet reliable and therefore, the majority of rail trips are expected to have been incorrectly allocated to road trips (Test A1).
- The MPD split between vehicle classes and in particular between non- freight and freight trips is not considered to be accurate enough to rely on (Test A5).

- Mobile Phone Data underestimate short distance trips up to 6kms (4 miles) (Test D - Trip Length Distribution), severely so for very short trips (under 2 miles). In general, mobile phone data cannot be relied upon for patterns of short-distance travel.
- An overstatement in the allocation of off peak demand is observed in the MPD matrices for home based other and non-home based trips compared to the NTS time period allocation (Test E). However, taking into account the low levels of demand in the off peak period, the differences are not large. The high level of non-home-based demand in the off peak period is also explained by the inclusion of freight trips in Mobile Phone Data.

To address the above mentioned limitations and inaccuracies of Mobile Phone Data, the Matrix Development Process is implementing a series of adjustments using other reliable sources of data. In particular, synthetic data derived from the DfT’s National Trip-End Model (NTEM), as well as National Travel Survey (NTS) data are used.

The synthetic OD matrices were developed using a gravity trip distribution model and as they are based on observed data (NTS trip length distribution), they were used to:

- Disaggregate the Provisional Mobile Phone Data from Mobile Data Sectors to the actual SCR model zones by purpose and time period.
- Infill short distance trips up to 6kms (4 miles) that are missing from Mobile Phone Data according to the verification tests.

Disaggregate the Provisional Mobile Phone “home based and non-home based other” trip matrices to “home based and non-home based Employers Business and Other” trip categories based on the relevant purpose split derived from the Synthetic Matrices.

Infilling short distance trips will considerably increase the number of trips across all purposes, but the effect will be more prevalent in the home based other demand segment that mainly consists of short distance trips.

The initial inputs of the Mobile Phone Matrix Development Process will be the combined Rail, Road and freight matrices.

Rail and bus trips will then be removed by purpose and time period of travel using the public transport matrices that SYSTRA is currently developing

Freight trips will sequentially be removed from the non-home based demand segment using the freight matrices (LGVs/HGVs) derived from the Trans Pennine Regional model (TPS). Freight removal will have a significant effect in reducing the overstated non-home based demand of the provisional mobile phone data.

The trip length distribution of MPD trips originating from Sheffield City Region will then be compared against the relevant NTS trip length profiles by purpose of travel and if needed, distance-based adjustment factors will be applied based on the NTS observed data for the internal area by trip purpose, at an all-day level.

The implementation of trip length adjustments will also ensure a better alignment between the MPD and NTS trip rates.

At the end of the Mobile Phone Data Matrix Build Process, the allocation of demand between time periods will be checked again and if any significant misallocations are observed, further adjustments will be considered to the provisional matrices.

A detailed description of the all the steps and adjustments of the Prior Mobile Phone Development Process will be available at a later stage in the relevant Matrix Development Report.

F.4 Glossary

Attraction- The end of a home-based trip that is not the traveller's home.

CSRGT- Continuing Survey of Road Goods Transit.

DfT- Department for Transport; government department

HBO- Home-Based Other; non-commuting trips to or from the traveller's own home. In modelling contexts and in the SCR model specifically, this usually excludes travel on employer's time and expense. However the mobile data not identify business travel, so for the purposes of this note, all non-commuting travel is included, including that paid for by an employer.

HBW- Home-Based Work; commuting trips to or from the traveller's own home

HGV- Heavy Goods Vehicle; lorries and vans over 3.5 tonnes

JTW- Journey to work; data from the 2011 census containing individuals home and work locations and their usual mode of travel to work

LGV- Light Goods Vehicle; vans under 3.5 tonnes

MPD- Mobile Phone Data; travel data derived from tracking movements of mobile phones.

MSOA- Middle Super Output Area; a level of census geography; MSOAs contain around 7,500 people each.

NHB- Non-Home-Based; travel neither to nor from the traveller's own home.

NTEM- National Trip-End Model: a DfT model that forecasts changes in trip making over time by trip-end.

NTS- National Travel Survey; a continuous DfT household survey collecting travel diary data for a week for each individual in households surveyed.

Production- The end of a home-based trip that is the traveller's home. This may be the origin or the destination depending on whether the trip is outbound or returning.

RSI- Road-side interview; interview carried out with the assistance of the police by stopping vehicles travelling along a stretch of road and asking for journey information (e.g. origin and destination)

RTM- Regional Transport Model. A series of models developed for Highway's England, covering England, the TPS model is an example of a RTM.

SCR- Sheffield City Region

SCRTM1- Sheffield City Region Transport Model

TPS- Trans-Pennine South: a Highways England transport model of the area covering Leeds, Bradford, Sheffield, Manchester, Liverpool and Hull.

Trip-End- Total trips from or to a given area, usually a model zone or census geography area.

Trip-Rate- Trips divided by population or households (or occasionally number of jobs depending on context).

https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/633077/national-travel-survey-2016.pdf
Sheffield Midland is the main station in Sheffield City Centre.
Two such trips occurred in the MPD, and 159 in the JTW data. It is probable that some transcribing error occurred.
I.e. a journey from home to work, and from work to home with no intermediate location is a two legged tour.
A possible reason for this is people may be more likely to stop at an intermediate location, on the way back home, e.g. Home-Work-Shop-Home tour, occurring more often than Home-Shop-Work-Home. Though we have not investigated this any further.
Table RFS0105

Appendix G Highway Demand (or Prior) Matrix Development

G.1 Highway Demand (Prior) Matrix Development

G.1.1 Introduction

This chapter describes the methodology used for the development of the base year (2016) Highway Matrices for Sheffield City Region Transport Model (SCRTM). The Highway OD trip matrices are sourced primarily from Mobile Phone Data, provided by Telefonica (O2) UK. The mobile phone data were received as Origin Destination (OD) trip matrices focusing on Sheffield City Region. As Telefonica's mode share counts for an approximate 30% of UK's total population, Census 2011 population data were used to expand the mobile phone data to the whole UK population.

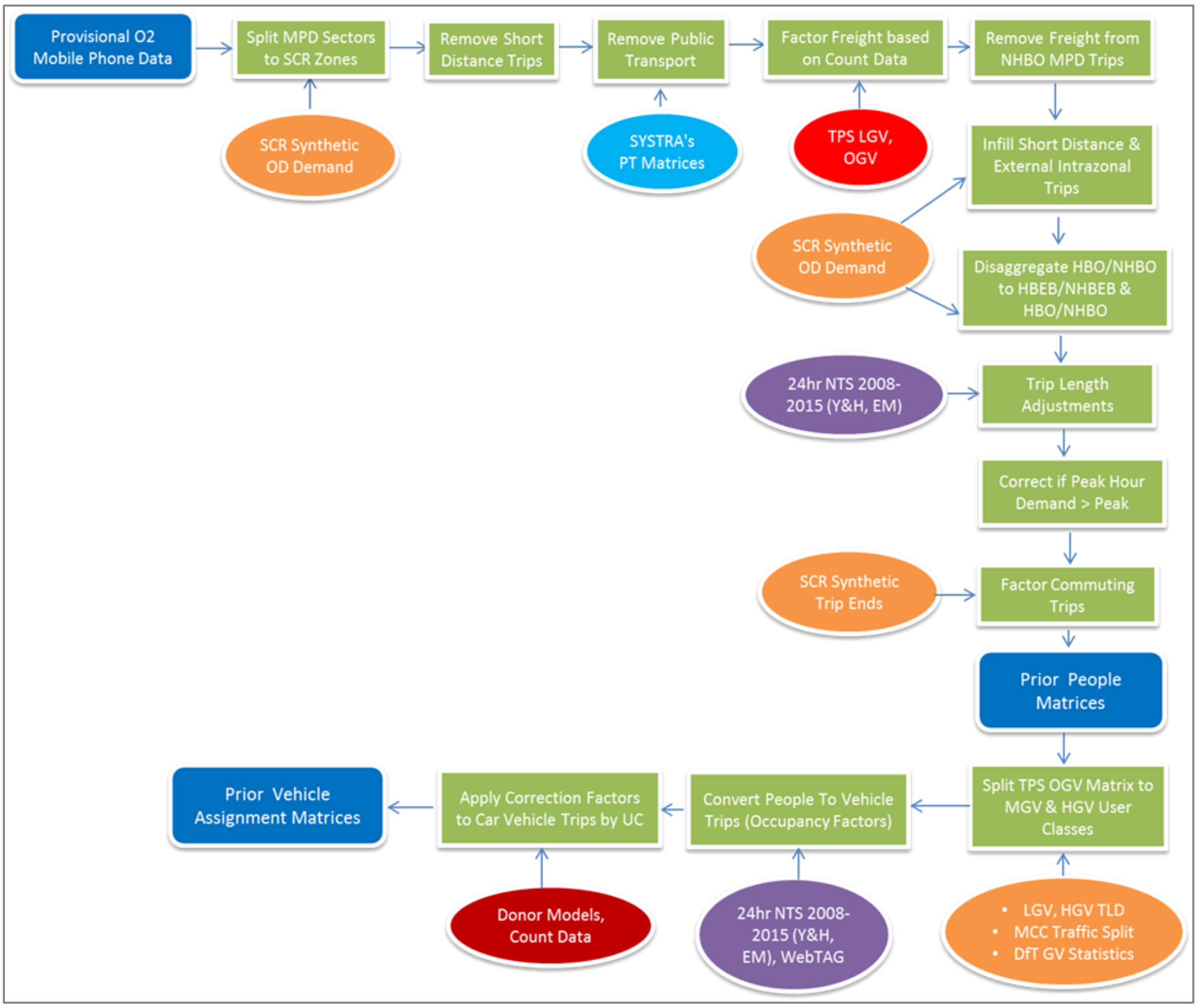
Other secondary data sources such as demand estimates from local land-use planning data combined with the National Trip End Model (NTEM72), National Travel Survey (NTS) Data, 2011 Census Adjusted Journey To Work Data, various traffic count data (Automatic Traffic Counts, Manual Classified Counts, Roadside Interviews) and existing donor transport models developed for the SCR study area (SYSTM+, Sheffield - Rotherham and Barnsley Transport Model) were used to augment, disaggregate, verify and address the various limitations of the Provisional Mobile Phone Data.

A thorough description of the data used and the approach adopted to develop the highway prior matrices at each stage is provided in the following sections.

G.1.2 Highway Matrix Build Specification

The highway Matrix Build Process involved a number of adjustments to process the Provisional Mobile Phone Data into Prior matrices. The adjustments implemented were based on the outcome of the verification tests and on comparison against the aforementioned secondary sources of data. Figure 132 outlines the methodology followed in the Matrix Build Process.

Figure 132. Outline of SCR Matrix Build Methodology - Flow Chart



The key steps involved in the Matrix Development Process are the following:

- Combine road, rail and HGV Provisional Mobile Phone Data into a single dataset.
- Import all other inputs: i) SCR Synthetic OD Highway Matrices, ii) OD Public Transport Matrices by mode (Rail, Bus and Tram) developed by SYSTRA & iii) Freight LGV and OGV Hourly Matrices (in PCUs) derived from the 2015 Highways' England TransPennine South Regional Transport Model (TPS).
- Geographically disaggregate the Provisional Mobile Phone Data within Sheffield City Region from the 232 existing Mobile Phone Sectors, identical to Middle Layer Super Output Areas (MSOAs), to the actual 1232 model zones within Sheffield City Region. The split from Mobile Phone sectors to SCR model zones was based on the SCR Synthetic Matrices.
- Remove short distance trips (0 to 6 kms) and external intra-zonal trips from the Provisional Mobile Phone Data, Public Transport and Freight Matrices.
- Remove Public Transport trips from Mobile Phone Data by purpose and time period using SYSTRA's OD Public Transport Matrices.
- Apply global factors to freight trips by user class (LGV, OGV) and time period based on comparisons against count data and TRICs trip ends. Sequentially remove the factored freight trips from non-home based Other Mobile Phone matrices.
- Infill short distance (0-6 kms) and external intra-zonal trips using the SCR Synthetic OD Matrices by purpose and time period.

- Disaggregate “Other” Trips to “Employer’s Business” and “Other” trip categories for home based and non-home based segments based on the relevant purpose split of the synthetic matrices.
- Apply trip length adjustment factors to MPD trips that have at least one trip end within Sheffield City Region. The factors were calculated based on 2008 to 2015 24hr NTS trip length profile by trip purpose for Yorkshire and Humber and East Midlands.
- Correct OD records where peak hour demand is greater than time period demand.
- Adjust MPD Commuting Trips to the SCR Synthetic HBW Trip Ends (developed by SCR Planning Data and DfT’s CTripEnd Model) at a production, SCR district level. The outcome of the process at this stage is the development of the Prior People Car Matrices.
- Split the TPS OGV matrix to MGV and HGV trips based on the Manual Classified Count (MCC) data traffic split and the TPS LGV and OGV trip length profiles taking into consideration DfT’s statistics for Good Vehicles.
- Apply occupancy factors to convert the Prior Mobile Phone Data People matrices to Prior Vehicle matrices segmented by assignment user class.
- Apply correction factors to Prior Car Vehicle Matrices by User Class for specific intra-district movements within SCR based on comparisons against existing donor models for Sheffield City Region and the count data.

The Prior People Car Matrices were disaggregated to the following eight demand segments based on trip purpose and direction of travel:

- Home based work related trips “from home” (outbound trips);
- Home based work related trips “to home” (inbound trips);
- Home based employer’s business trips “from home” (outbound trips);
- Home based employer’s business trips “to home” (inbound trips);
- Home based other trips “from home” (outbound trips);
- Home based other trips “to home” (inbound trips);
- Non home based employer’s business trips;
- Non home based other trips.

The Prior Vehicle Matrices were segmented into the following six user classes as required for their assignment onto the highway network:

- Car Commuting (home based trips);
- Car Employer’s Business (including home based and non-home based trips);
- Car Other (including home based and non-home based trips);
- LGV;
- MGV;
- HGV.

Both the Prior People and Vehicle matrices were developed for:

i) the four full time periods: AM peak period (07:00-10:00), Interpeak period (10:00-16:00), and PM peak period (16:00-19:00) and Off Peak period (19:00-07:00) and

ii) at a peak hour level as required for the assignment: AM Peak Hour (08:00-09:00), Interpeak Average Hour and PM Peak Hour (17:00-18:00)

For trips with one or both trip ends within Sheffield City Region, their allocation into the above mentioned periods was based on the time at mid-point of travel within the internal area. External trips that did not intersect the cordon were allocated based on the mid time of the journey.

Although the off peak period is not validated, matrices are produced for the off-peak in order to provide 24hr data for the Variable Demand Model.

The final Sheffield City Region matrices were required in SCRTM zoning. In total, 1412 zones have been produced for Sheffield City Region, which consist of 1232 internal zones and 180 external zones. Another 30 “empty” zones in terms of base year trips were added to account for future development zones; these contain no trips either to or from the zone.

G.1.3 Data Characteristics and Sources

Provisional Mobile Phone Data

The OD trip matrices, representing highway demand in Sheffield City Region Transport Model, are sourced primarily from mobile phone data, provided by Telefonica (O2) UK.

The Provisional Mobile Phone Data include all trips within Sheffield City Region, as well as trips leaving or entering the internal area. The mobile phone dataset also includes trips between external zones (external inter-zonal trips) but excludes external intra-zonal trips. The next section describes the specification of Provisional Data and the SCR matrix requirements in detail.

The Provisional Data, as received from Telefonica, were segmented by mode into:

- All Road based trips (car, light goods vehicle (LGV), bus and coach);
- Rail trips;
- Heavy goods vehicle (HGV) trips.

All trips made by active modes (walk, cycle) were in principle identified and excluded.

In terms of trip purposes, the following matrices were provided separately, based on Telefonica’s interpretative algorithms:

- Home Based Work Outbound (HBW_OB): work related trips starting from home;
- Home Based Work Inbound (HBW_IB): work related trips ending at home;
- Home Based Education Outbound (HBE_OB): education trips starting from home;
- Home Based Education Inbound (HBE_IB): education trips ending at home;
- Home Based Other Outbound (HBO_OB): non-work related trips starting from home;
- Home Based Other Inbound (HBO_IB): non-work related trips ending at home;
- Non home based trips (NHB): trips that do not start nor end at home.

The Provisional Data relate to person trips between every MSOA in England, Scotland (equivalent thereof) and Wales. The data were provided in the form of a sectoring system which consists of Middle Layer Super Output Areas (MSOAs) within Sheffield City Region (Internal Area) and aggregations of MSOAs for the rest of Great Britain (External Area). In particular, Mobile Phone Data were received in a sectoring system comprising of 432 zones; 232 internal zones (equivalent to MSOAs - bigger than the actual SCR zones in the internal area) and 200 external zones (aggregations of MSOAs - smaller than the SCR external zones).

Matrices represented Monday to Friday weekday averages (based on trips made between the 5th of September and the 21st of October 2016 inclusive) for each hour of the day. Trips were segmented by time period into:

- Early Off-Peak (00:00 - 07:00)
- AM Peak Period (07:00 - 10:00)
- AM Peak Hour (08:00 - 09:00)
- InterPeak Period (10:00 - 16:00)

- PM Peak Period (16:00 - 19:00)
- PM Peak Hour (17:00 - 18:00)
- Late Off-Peak (19:00 - 00:00)

AM and PM Peak Hour trips are also included in AM/ PM Peak Period respectively.

As Telefonica's market share varies across the UK and counts for a third of total UK population, an expansion factor had to be applied so that the OD trip matrices are representative of the UK as a whole. Thus, the expansion factor applied was based on the ratio of MSOA population, as derived from 2011 Census Residential Population Data, to the number of phones registered by Telefonica's algorithm with a home location in that MSOA.

Freight Data

LGV and OGV freight matrices derived from Highway's England TransPennine Regional Model (2015) were used to inform freight demand. TPS LGV trips were drawn from Trafficmaster data with expansion factors applied at an aggregate level.

TPS OGV data were developed from DfT's 2006 Continuing Survey of Roads Good Transit (CSRGT) data provided at 24hr, county to county level. The conversion from 2006 to 2015 was done using growth factors varying by region; for the whole Yorkshire and Humber a factor of 0.89 was applied to the 2006 CSRGT OGV data (reduction of 11% in freight HGV trips). The disaggregation from county to the actual TPS model zones was based on employment places within each zone.

The TPS LGV and OGV data, as received, had to be converted to the actual SCR Zoning system. However, the OGV user class in the TPS model included both MGV and HGV, while in our case MGV should form a separate assignment class. Thus, the OGV TPS matrix had to be further split into MGV and HGV user classes.

Table 82 and Table 83 present the LGV and OGV TPS matrices respectively at an SCR district, all day level. OGV matrices are shown after the conversion from the TPS PCU factor of 2.5 to the SCR PCU factor of 2.3.

Table 82. Total LGV vehicle trips between SCR districts, TPS 24hr Data

LGVs TPS 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	North East Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	31,397	2,854	707	1,334	543	1,020	260	180	276	4,566	43,137
Rotherham	2,933	12,259	1,345	1,371	231	309	220	39	564	3,731	23,003
Doncaster	698	1,409	16,938	657	65	99	88	16	721	5,907	26,598
Barnsley	1,315	1,391	683	14,503	55	58	55	10	113	4,817	23,000
Chesterfield	511	243	73	62	11,115	2,059	750	337	134	2,062	17,346
North East Derbyshire	910	289	89	55	2,107	6,136	790	341	142	2,288	13,146
Bolsover	221	204	102	44	774	780	3,908	89	340	4,520	10,981
Derbyshire Dales	161	52	19	11	316	326	123	6,420	14	3,314	10,756
Bassetlaw	300	589	667	110	124	127	369	17	9,704	4,443	16,449
External	4,505	3,592	5,824	4,744	2,048	2,341	4,679	3,418	4,175	7,830,351	7,865,679
Total	42,950	22,881	26,446	22,892	17,379	13,256	11,243	10,866	16,182	7,866,000	**8,050,095**

Table 83. Total OGV trips in PCUs after conversion to the SCR PCU factor, TPS 24hr Data

HGVs TPS 24hr (in PCUs)	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	North East Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	7,945	4,799	3,017	1,436	282	139	191	437	1,099	12,013	31,359
Rotherham	4,235	3,738	1,464	865	55	419	72	6	479	4,612	15,944
Doncaster	2,075	1,008	8,743	773	44	71	82	249	552	15,792	29,388
Barnsley	1,349	620	662	4,066	40	14	31	8	157	5,802	12,751
Chesterfield	259	126	55	78	2,078	343	394	383	59	1,456	5,232
North East Derbyshire	74	45	78	19	200	542	144	77	61	1,643	2,882
Bolsover	207	104	118	44	397	110	287	53	652	2,045	4,018
Derbyshire Dales	895	9	729	14	701	128	91	588	409	3,808	7,372
Bassetlaw	612	903	688	251	79	73	546	184	6,384	7,669	17,391
External	13,500	5,373	16,307	5,326	1,712	1,962	2,278	3,498	7,737	4,718,465	4,776,159
Total	31,152	16,726	31,861	12,871	5,590	3,802	4,116	5,483	17,589	4,773,306	**4,902,495**

Public Transport Matrices (Rail, Bus, Supertram)

SYSTRA developed Public Transport Matrices by mode (bus, rail and supertram), modelled purpose and time period. The matrices were developed from observed data sources as follows:

- Bus - fare stage to fare stage matrices derived from Electronic Ticket Machine (ETM) data (September 2016). Matrices required disaggregating from fare stages, via bus stops, to zonal trip end.
- Rail – station to station matrices derived from MOIRA database, required disaggregating to modelled time periods using a comprehensive set of station entry/exit counts and Furness procedure. Matrices disaggregated further to zonal trip ends, using access/egress modal and trip length distributions derived from on-platform surveys undertaken at Sheffield and Meadowhall rail stations specifically for this study.
- Supertram – stop to stop matrices derived from ETM data (September 2016). Matrices disaggregated further to zonal trip ends, using access/egress proportions by mode and distance derived for each stop from a comprehensive on-board Supertram survey.

Further adjustments were made to the bus matrices to reflect multi-leg journeys using Smartcard information contained in the ETM data. Checks have been made on levels of interchange between sub-mode options, with relationships derived from rail and Supertram survey data.

Secondary Data Sources

Various sources of secondary data were used to augment, disaggregate and verify the Provisional Data. These mainly include the following:

- Trip End Estimates based on local land-use planning data (population, household data, employment, level of car ownership), NTS trip rates (National Trip-End Model version 7.2) and model structure from DfT's CTripEnd Model were used to develop the Sheffield City Region Synthetic Matrices by trip purpose, time period and direction of travel (see *Section 1.4*).
- 2011 Census Adjusted Journey to Work data were used to validate the Prior Commuting Mobile Phone Matrices by internal SCR district.
- National Travel Survey (NTS) Data for the years 2008 to 2015 for people that live within Yorkshire and Humber or East Midlands (as Sheffield City Region overlaps the two regions) were used to correct the Mobile Phone Data trip length profile and to validate the time period split of the Prior matrix. The same source of data was also used as an input to the Synthetic Matrix Build Process that is explained in detail in the following section.
- Various Traffic Count Data within the internal area; Manual Classified Counts (MCCs), Automatic Traffic Counts (ATCs) and Roadside Interviews (RSIs). Manual Classified Counts were used to segment the Automatic Traffic Counts into vehicle class (car, LGV, MGV, HGV), while Road Side Interviews were used to validate the trip length profile of the Prior Matrices.
- Existing donor transport models previously developed for the whole or part of Sheffield City Region (SYSTM+, SRTM3, Barnsley Transport Model) were used to validate the base year demand at a district to district level.

G.1.4 Synthetic Matrix Build Process

As it was mentioned earlier in this report, synthetic matrices were required to infill, segment, verify and generally support the Mobile Phone Data at various stages of the Matrix Development Process.

In particular, the Synthetic data were used to:

i) Geographically disaggregate the Provisional Matrices from Mobile Phone Data sectors into the actual Sheffield City Region model zones,

ii) Infill short distance trips up to 6 kms (4 miles equivalent) that were found to be missing from the mobile phone data,

iii) Further segment the Mobile Phone Data “Other” user class into Employer’s Business and Other demand segments separately for home and non-home based trips and

iv) Adjust mobile phone commuting trips at a production, district level.

The SCR Synthetic matrices were also used post adjustments to validate the Prior Matrix in terms of purpose split and OD trip ends by SCR district.

SCR Synthetic Car Matrices – Application of Methodology

For consistency with the Prior Mobile Phone Matrices, the car synthetic people matrices were segmented into the purposes listed below:

- Home-Based Work (HBW); disaggregated into from and to home trips
- Home-Based Employers Business (HBEB); disaggregated into from and to home trips
- Home-Based Other (HBO); disaggregated into from and to home trips
- Non Home-Based Employers Business (NHBEB); and
- Non-Home-Based Other (HBO).

The SCR Synthetic matrices are based on:

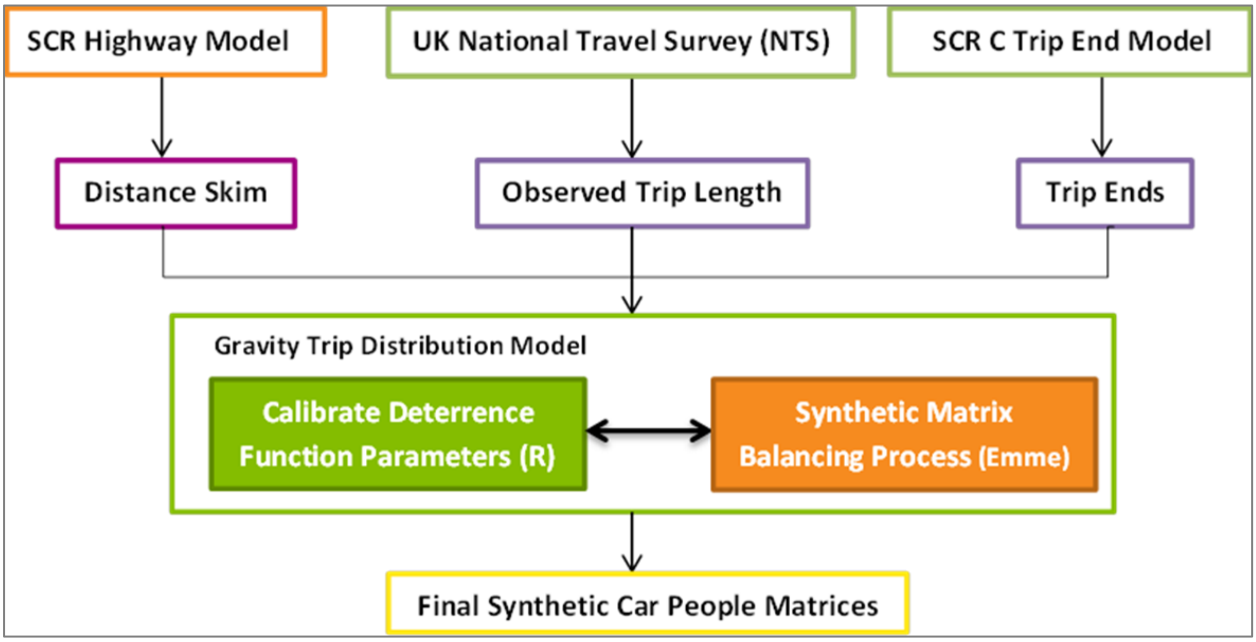
i) UK National Travel Survey (NTS) Household Data 2008-2015 for Yorkshire and Humber and East Midlands that constitute the primary source of data for individuals trip making behaviour in the UK and

ii) local planning data (population, households, employment, car ownership by SCR zone) derived from a local land use model developed by David Simmonds Consultancy for Sheffield City Region (FLUTE).

Thus, the synthetic data are used to estimate likely trip patterns in the modelled area. However, the synthetic demand is based on reliable data but is not itself directly observed.

Figure 133. below provides an overview of the Synthetic Matrix Build Process for Sheffield City Region Transport Model.

Figure 133. Overview of the SCR Synthetic Matrix Development Process



As shown in Figure 133 the Synthetic Process requires a set of inputs to the distribution model. These inputs are:

- **Trip Ends:** Trip Ends were calculated using the local planning data mentioned above in combination with CTripEnd model. CTripEnd is a trip-end model, based on version 7.2 of DfT's National Trip-End Model (NTEM7.2), that makes use of: i) land-use planning data at an MSOA level, ii) NTS trip rates by area type, iii) the NTEM72 model structure and segmentation into population, employment and car ownership categories and produces production-attraction (PA) trip end estimates at an average weekday, zonal level by mode, time period and purpose of travel.

  In the context of the SCRTM, the SCR CTripEnd Model was adapted to use the FLUTE zoning system instead and was sequentially converted to the SCR zoning system. Trip ends were calculated at both a Production-Attraction (PA) and Origin-Destination (OD) level by SCR zone, trip purpose (HBW, HBEB, HBO, NHBEB, NHBO), time period and direction of travel for OD home based trips (Outbound or "From Home"/ Inbound or "To Home"). Trip ends were derived for car and public transport (in people) at an all-day level.

  The trip-end estimates produced, having taken into consideration the land use (housing and employment) developments and socio-demographic / socio-economic characteristics (household types, level of car ownership) that are specific to Sheffield City Region, are considered to be more accurate and reliable for the fully modelled, internal area compared to the respective NTEM72 trip ends based solely on Census 2011 employment and population data.
- **Cost Skim** for the modelled area: a distance skim derived from the highway model network was used.
- **Observed Cost Profile**: The UK National Travel Survey (NTS) trip length profile was used to calibrate the synthetic matrices by purpose of travel (*HBW, HBEB, HBO, NHBEB, NHBO*). The extracted NTS trip length profile is relevant to Yorkshire and Humber and East Midlands Regions, so that it is representative of our internal area that overlaps the two regions. The NTS sample size covers all years from 2008 to 2015.

The synthetic approach makes use of a gravity distribution model, according to which the number of trips between each OD zone pair is inversely proportional to a function of the distance between them.

The gravity model makes use of a deterrence function that represents the disincentive to travel with increasing travel cost (distance in our case). The deterrence function applied was a log-normal distribution density function.

This specific functional form has been evaluated in similar projects using Mobile Phone Data and it was found to provide a good fit with observed data.

The mean and standard deviation (μ and σ) of the deterrence cost function, namely the calibration parameters, were initially estimated by fitting a log-normal distribution (density function) to the observed NTS trip length profile. Sequentially, the estimated deterrence function parameters were used to generate the synthetic matrices and the matrix balancing factors.

This calibration process was an iterative process, as the deterrence function parameters were updated several times, using each time the log-normal parameters estimated in the previous iteration, until the best possible fit to the observed NTS trip length profile was achieved. The calibration process was executed in the R statistical package and the calibration area included only internal productions, hence internal to internal and internal to external trips.

The calibrated parameters mentioned above are outputs of the Synthetic Matrix Build Process run at a Production - Attraction 24hr level for 10 iterations. It was observed that, across all purposes of travel, the log-normal parameters were stable after iteration 6 of the R calibration process.

The calibrated lognormal parameters by purpose of travel, as derived from the calibration process ran in R, after 10 iterations, are illustrated in Table 84 below:

Table 84: Calibrated lognormal parameters by purpose - (PA, 24hr, 10 iterations)

Lognormal Parameters	HBO 24hr	HBEB 24hr	HBW 24hr	NHBEB 24hr	NHBO 24hr
μ	0.67	1.54	1.43	1.50	1.04
σ	1.06	1.19	1.03	1.14	1.09

The matrix balancing process (Furness) implemented was doubly constrained to total origins and destinations and was applied to the whole matrix. *Emme* software was used for the matrix balancing process.

Therefore, the final Synthetic matrices by purpose should match the total SCR origin and destination trip ends (inputs) as derived from the SCR CTripEnd Model, as well as the NTS trip length distribution. It should be mentioned that no sector constraints were applied in the calibration process.

Synthetic matrices for the SCR model were initially developed at a 24hour Production - Attraction level by purpose (HBW, HBEB, HBO, NHBEB, NHBO) following the procedure explained above. Then, the final calibrated log-normal parameters from that run were used to generate synthetic matrices at an Origin-Destination level, by purpose (HBW, HBEB, HBO, NHBEB, NHBO), time period (AM, IP, PM, OP) and direction of travel for the three home based purposes (outbound or from home trips and inbound or to home trips). The outputs of the second run were 32 car vehicle synthetic matrices, with their trip length profiles being consistent with the NTS trip length distribution and their origin and destination totals matching the SCR trip end estimates. Table 82 below compares the average trip length of the SCR Synthetic matrices by demand segment and time period for trips produced within Sheffield City Region (2016) against the NTS data (2008-2015) for Yorkshire and Humber and East Midlands.

The average trip length of the SCR synthetic matrices and the NTS by time period and trip purpose are generally quite close. There are certain discrepancies amongst them, but we should first consider some of the existing limitations in the NTS data used:

a) The annual sample size of the NTS data is quite small and thus to make use a representative sample, we had to consider and process data for all years between 2008 and 2015, although SCR trip ends are based on planning data for the model's base year 2016.

b) The NTS data used cover the whole of East Midlands and Yorkshire and Humber. However, the model's focus area, Sheffield City Region, does not cover the whole of Yorkshire and Humber area, while only a small part of it falls within East Midlands. Therefore, although the NTS profile used is the most reliable source of travel making behaviour available for the model's study area, we shouldn't expect it to be 100% representative of it.

Table 85: 24hr Average Trip Length of the Synthetic matrices, by trip purpose, compared to NTS

NTS Purpose 24 hr	NTS Average Trip Length	Synthetic Purpose 24hr	Synthetic Ave Trip Length	% Diff NTS vs SCR TE
HBW	14.84	HBW FH	16.2	9%
		HBW TH	16.1	8%
HBEB	30.55	HBEB FH	25.2	-18%
		HBEB TH	24.1	-21%
HBO	9.85	HBO FH	8.5	-13%
		HBO TH	8.8	-11%
NHBEB	22.0	NHBEB	20.5	-7%
NHBO	11.30	NHBO	12.0	6%

Figure 134. to Figure 138. below compare the trip length profile of the 24hr SCR Synthetic matrices with the 24hr NTS trip length distribution by trip purpose. The figures show that the trip length distribution of the synthetic trips is a smooth log-normal curve that follows the respective NTS trip length profile. Thus, the figures reflect the consistency amongst the two data sources in terms of trip length profile.

The graphs below present the TLD profile of the NTS data and the Synthetic matrix by distance bands of 1km. The NTS TLD graphs appear to have various spikes that are mainly observed because of:

i) the fact that the distance travelled per trip is not directly measured but reported from individuals that take part in the National Travel Survey (NTS) and thus, tend to round their responses to the nearest integer number (in miles),

ii) following each individual's answer in miles, the distance travelled per trip will then be converted to actual kms that will be introducing some further round off error in the reported results.

Figure 134. Comparison between 24hr NTS and Synthetic Trip Length Distribution (HBW)

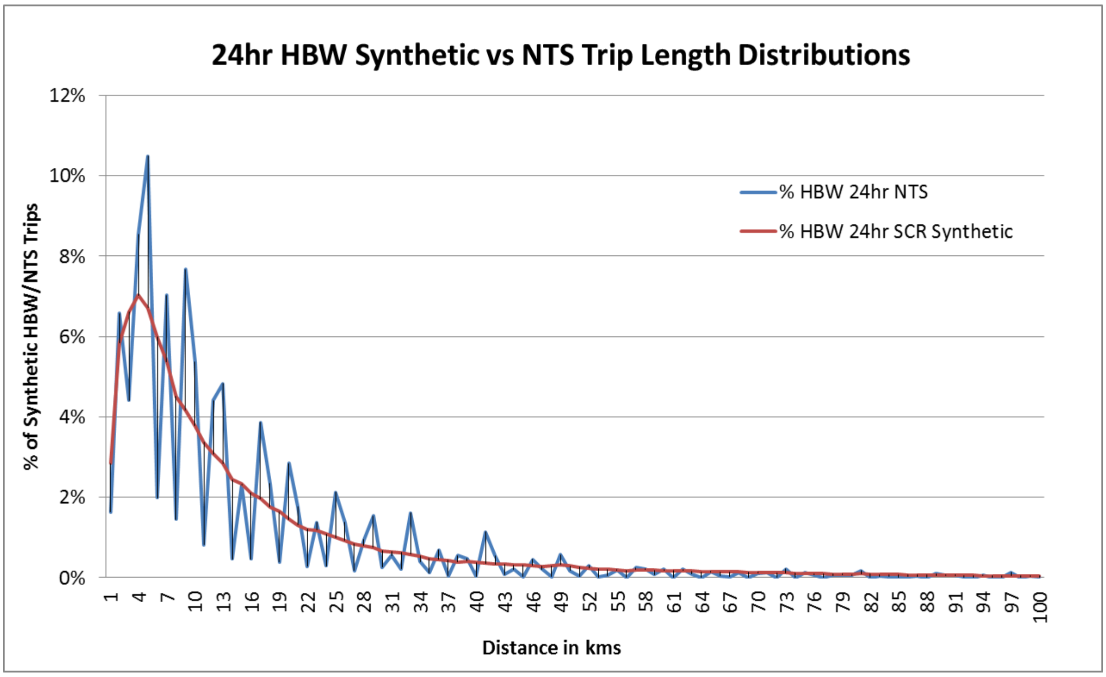


Figure 135. Comparison between 24hr NTS and Synthetic Trip Length Distribution (HBEB)

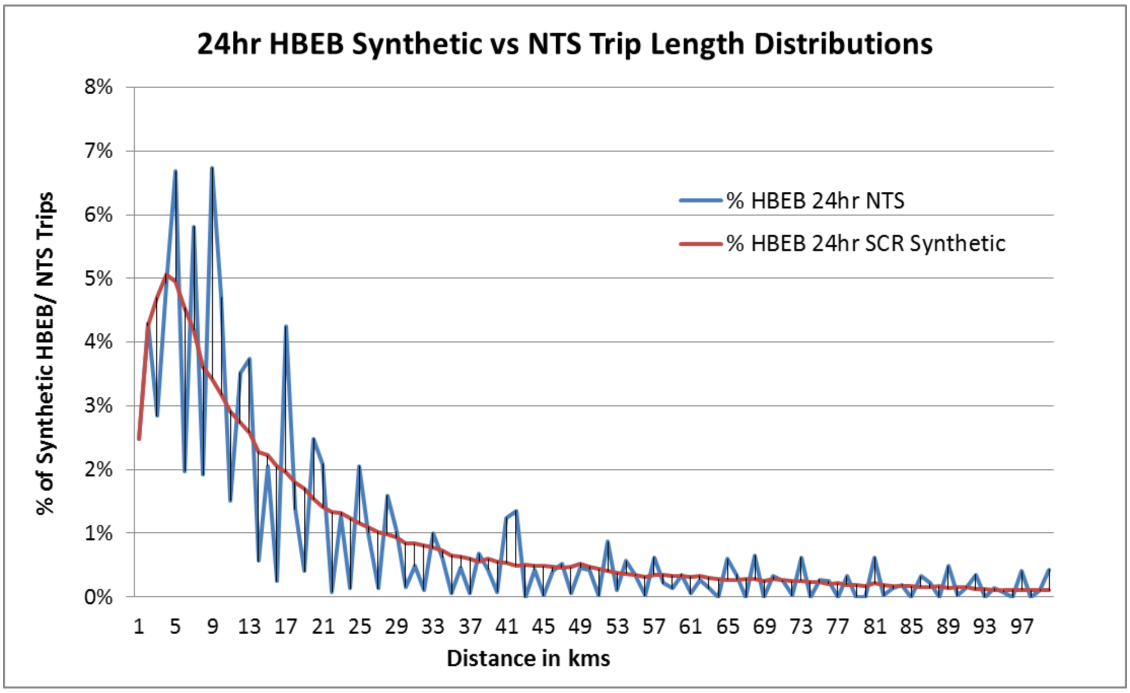


Figure 136. Comparison between 24hr NTS and Synthetic Trip Length Distribution (HBO)

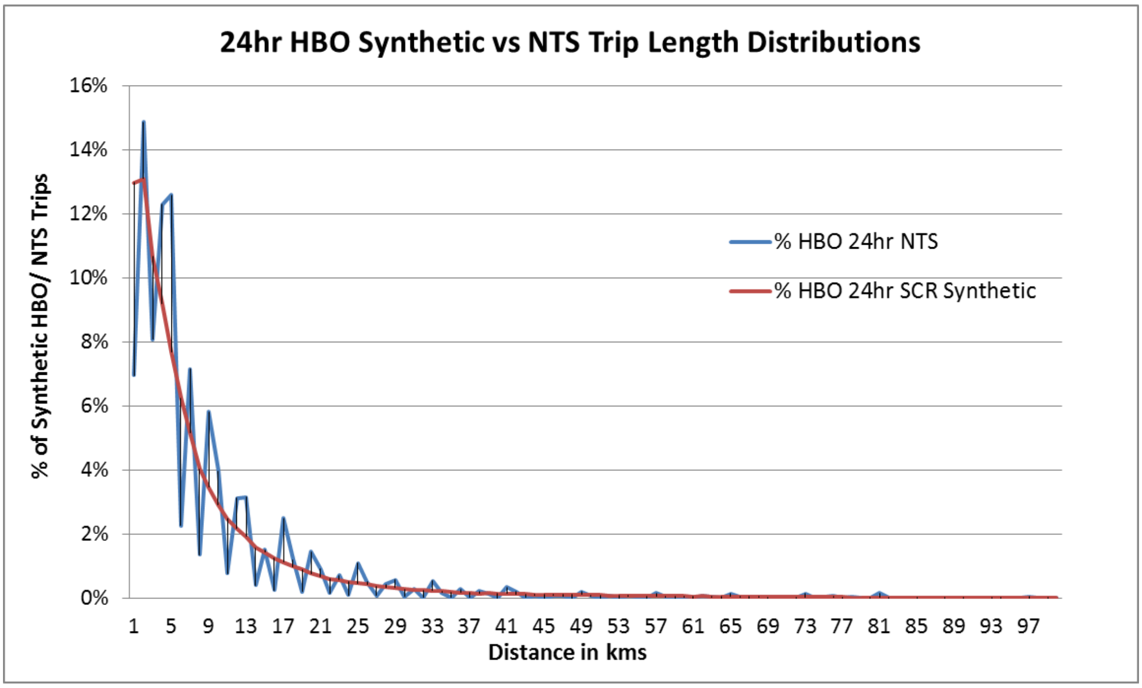


Figure 137. Comparison between 24hr NTS and Synthetic Trip Length Distribution (NHBEB)

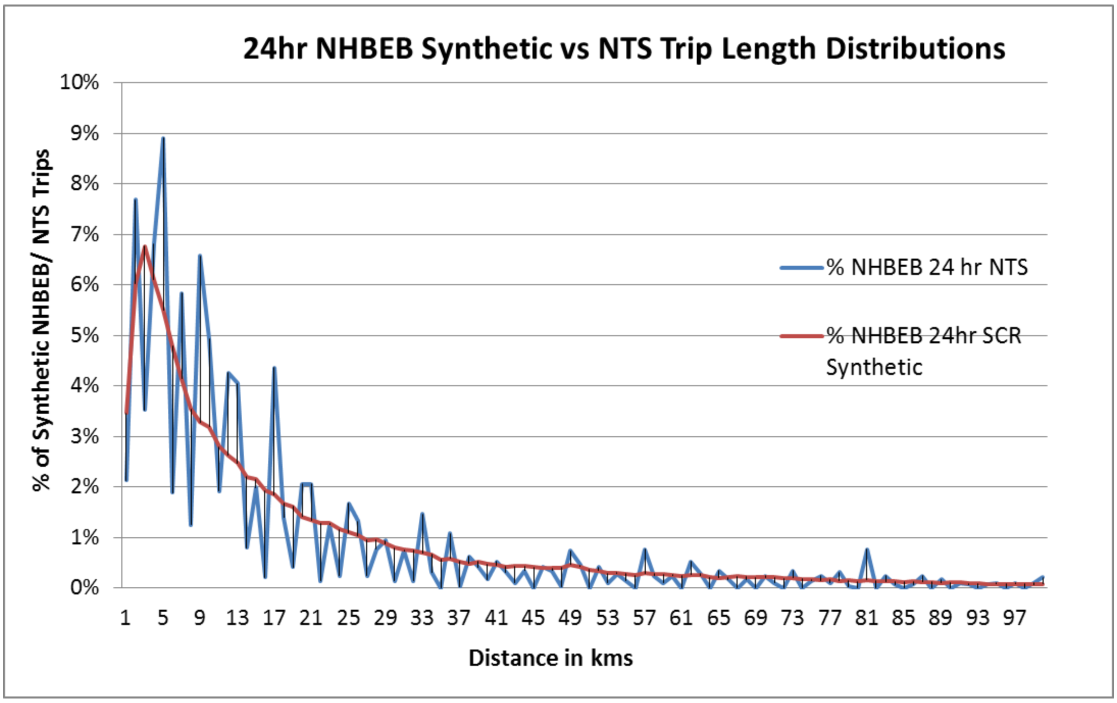
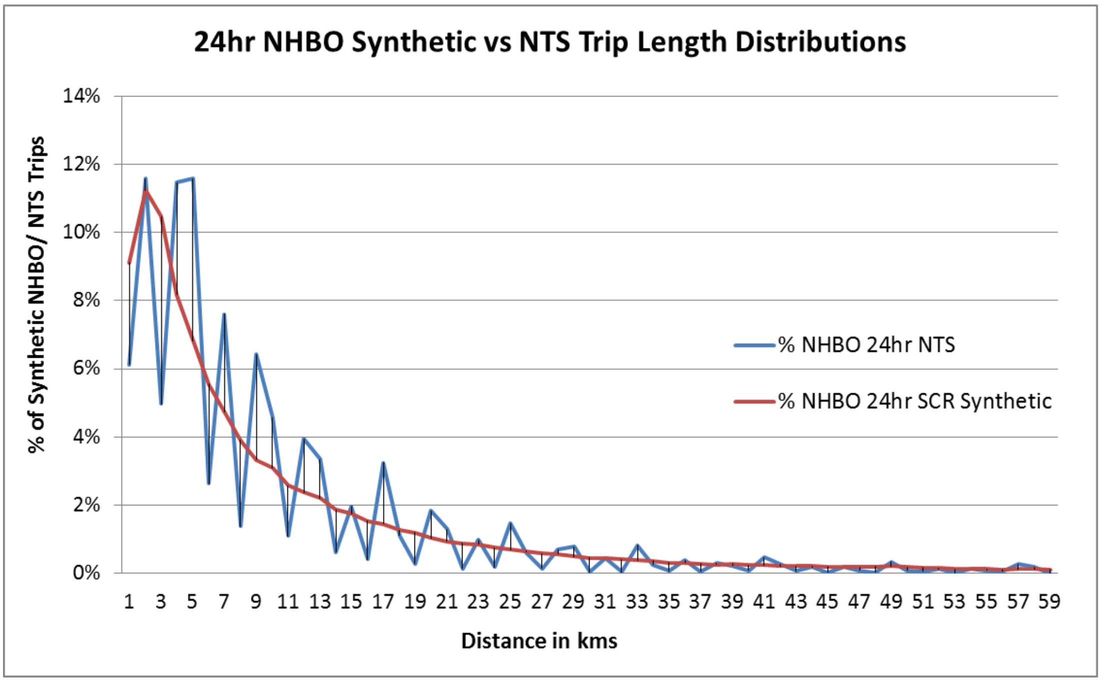


Figure 138. Comparison between 24hr NTS and Synthetic Trip Length Distribution (NHBO)



G.1.5 Prior Matrix Development – Adjustments

The following adjustments were undertaken as part of the Matrix Build Process, to convert the Provisional Mobile Phone Matrices into Prior Matrices:

Step 1: Import all Required Inputs

Combined Provisional Mobile Phone Data (MPD) from Telefonica

Telefonica's Provisional Mobile Phone OD matrices, initially segmented by mode into road, rail and HGV, were all aggregated into one combined matrix as the verification tests indicated that both rail and HGV trips are significantly understated by Mobile Phone Data and thus, neither the road-rail nor the freight-non freight split could be trusted.

The combined MPD Data were imported in our database by purpose (HBW, HBO, NHBO), time period (AM Peak Period, AM Peak Hour, Interpeak, PM Peak Period, PM Peak Hour, Off Peak Period) and direction of travel for home based purposes (Outbound or From Home and Inbound or To Home), forming a total of 30 input matrices. The matrices were imported at a mobile sector level equivalent to MSOAs in the internal area (Sheffield City Region) and aggregation of MSOAs outside of Sheffield City Region.

Table 86 shows the total number of person trips in the Provisional Data between Sheffield City Region districts and the external area. The total number of people trips, across all vehicles types and modes (car, LGV, HGV, bus, and rail) is about 22.5 million on an average weekday, excluding all intra-zonal trips in the external area.

Table 86: Combined Road, Rail and Freight MPD People Trips between Districts, pre-adjustments

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	576,933	89,747	14,427	33,338	19,666	26,661	6,230	7,072	6,635	72,754	853,462
Rotherham	90,560	178,111	33,415	31,649	3,294	5,097	3,815	586	15,735	37,256	399,518
Doncaster	14,271	33,117	267,038	14,577	818	765	815	230	15,408	81,714	428,753
Barnsley	32,658	31,178	14,498	130,145	542	567	385	186	918	64,770	275,847
Chesterfield	19,498	3,228	846	565	60,406	32,245	13,284	8,047	1,893	22,500	162,512
NE Derbyshire	26,682	5,045	885	612	32,244	19,085	8,146	5,298	1,841	23,626	123,464
Bolsover	6,236	3,726	868	414	13,270	8,111	13,955	1,302	6,964	42,905	97,751
Derbyshire Dales	6,924	576	216	179	8,201	5,371	1,283	27,778	322	49,119	99,969
Bassetlaw	6,536	15,754	15,537	918	1,879	1,829	7,023	302	52,437	44,863	147,078
External	71,077	36,902	80,953	64,883	22,404	23,827	42,912	49,696	44,647	19,466,363	19,903,665
Total	851,376	397,384	428,682	277,280	162,724	123,558	97,848	100,497	146,800	19,905,871	**22,492,020**

Freight Matrices (LGV, OGV):

LGV and OGV matrices (in PCUs) by time period and purpose of travel were derived from 2015 Highways England TransPennine Regional Model (TPS) and converted to the Sheffield City Region zoning system (1412 zones). A factor of 0.92 was applied to the OGV matrices to convert from the TPS to the SCR PCU factor (2.5 against 2.3).

Public Transport Matrices:

Bus, Rail and Tram matrices by time period and purpose of travel were provided from SYSTRA and imported at the SCR zoning system. Sequentially, time period to peak hour factors were used to convert them to peak hour matrices. Fixed global factors were applied to tram and bus separately for the AM and the PM peak hours, whilst in the case of rail, different factors were applied by origin zone in the AM peak hour and by destination zone in the PM peak hour.

SCR Synthetic Matrices:

The SCR Synthetic OD matrices were imported by trip purpose, direction of travel and time period.

The SCR Synthetic Matrix Build process is described in detail in section 1.4 above.

Distance Matrix (in kms):

The network skimmed distance was used to provide a complete distance matrix for all the origin destination zone pairs of the Sheffield City Region Transport Model. Inter-zonal OD pairs with zero distance were infilled with the minimum non-zero distance of their origin zone. In the case of intra-zonal movements where no distance could be provided, the matrix was infilled by half the minimum non-zero row distance capped to a maximum acceptable distance of 10 kms. Tests were made to verify / check the symmetry of the distance matrix.

Step 2: Converting Mobile Phone Data from Mobile Data Sectors (MSOAs) to Sheffield City Region Actual Zones

Within the internal area of the model, the Sheffield City Region zones were more disaggregated than the 232 Mobile Phone Data Sectors that were identical to the *Middle Layer Super Output Areas* (MSOAs).

Thus, to estimate the percentage of MSOA demand that should be allocated to each internal SCR zone within it, the respective proportion of car synthetic demand was used. After finding a correspondence between every SCR zone and a mobile phone sector, the next step was to calculate the proportion of car synthetic demand in each SCR OD zone pair over the total synthetic demand of the relevant mobile phone sector pair where this OD movement belongs to.

This proportion was sequentially implemented to the Mobile Phone data by mobile phone sector OD pair respectively. In the external area, the SCR zones were equivalent to MPD sectors (aggregation of MSOAs) and therefore, no conversion was required.

Step 3: Removing Short Distance (0 to 6kms) and intra-zonal trips from Provisional Mobile Phone Data, Public Transport and Freight Matrices

Short distance trips (between 0 and 6 kms) were found to be significantly understated in the Mobile Phone Data according to the results of the Verification tests and thus, were removed at this stage (they were later infilled- see step 5). Intra-zonal trips had also to be removed as they represent very short trips within our internal area.

Table 87 shows the total number of combined road, rail and freight mobile phone trips amongst the Sheffield City Region Districts and the external area after removing short distance and intra-zonal trips.

It should be mentioned that the Provisional Matrices exclude external intra-zonal trips that would often be much longer than 6 kms and haven't been infilled at this stage. This along with the fact that external intra-zonal trips count for a very high percentage of the total demand in the external area (because of the large size of the external zones) justifies the lower than expected number of external to external trips shown in the table below.

Table 87: Combined Road, Rail and Freight MPD People Trips between Districts, non-short trips

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	253,186	80,454	14,427	32,356	19,647	21,117	6,230	6,960	6,635	72,753	513,764
Rotherham	81,327	84,504	29,939	28,643	3,294	4,757	3,815	586	14,823	37,270	288,957
Doncaster	14,271	29,693	159,912	13,796	818	765	815	230	15,018	80,947	316,264
Barnsley	31,721	28,230	13,712	67,758	542	567	385	186	918	63,469	207,488
Chesterfield	19,477	3,228	846	565	14,516	22,916	12,596	8,047	1,893	22,501	106,585
NE Derbyshire	21,238	4,722	885	612	23,001	7,409	7,181	4,919	1,841	23,138	94,946
Bolsover	6,236	3,726	868	414	12,592	7,157	4,892	1,302	5,636	40,875	83,699
Derbyshire Dales	6,816	576	216	179	8,201	4,994	1,283	13,335	322	47,166	83,087
Bassetlaw	6,536	14,820	15,135	918	1,879	1,829	5,661	302	28,726	43,322	119,129
External	71,105	36,913	80,203	63,594	22,402	23,330	40,872	47,748	43,118	19,052,134	19,481,419
Total	511,914	286,865	316,143	208,834	106,892	94,840	83,730	83,614	118,930	19,483,576	**21,295,338**

The overall impact of removing short trips was a reduction of 5% in total volume of trips (full matrix), while the effect was more profound on movements within the internal area that decreased by approximately 36%, as short distance trips comprise a high proportion of the internal to internal overall demand.

Only 3% of trips between the internal and the external area were removed at that stage, as they mainly consist of longer distance trips.

In reference to external intra-zonal trips, they are not included in the Provisional Matrices and therefore, this justifies the negligible 2% reduction in short distance, external to external trips.

Step 4: Remove Public Transport trips from Provisional Mobile Phone Data

Telefonica provided AECOM with rail provisional matrices, separately from the road matrices. However, the relevant verification tests (see "Mobile Data Verification Report") suggested that the road matrices are likely to include a large number of rail trips as a result of misallocation. Bus trips were also included in the road mobile phone matrices.

Hence, combined road and rail matrices were obtained as part of the Provisional MPD so that rail and bus trips were removed at the same time, using the methodology described below.

SYSTRA provided us with rail, bus and tram matrices by purpose, direction and time period. Thus, public transport trips were removed across all purposes and time periods. As Mobile Phone Data significantly understate short distance trips (0 - 6kms) and completely exclude external intra-zonal movements, these two categories had to be removed from the bus, rail and tram matrices as it is very important that both matrices represent the same type of movements.

According to Test A1 of the Verification tests (see "*Mobile Phone Data Verification Report*"), the maximum rail share in MPD was found to be equal to 25% (between Chesterfield and Sheffield train stations), so this percentage was used by assumption as a cap, namely as the maximum percentage of MPD demand that could be removed at an OD zone pair level from the Provisional data to represent public transport demand.

The methodology applied is the following one:

- The first step was to aggregate bus, rail and tram by purpose, direction of travel and time period so that they can be removed from the relevant demand segment of Mobile Phone Data.
- Initially, public transport demand was removed at an OD zone pair level with the constraint that only a proportion lower or equal to 25% of total MPD demand by OD pair can be removed. Thus, if for a particular movement, the sum of bus and rail demand is higher than the 25% of MPD demand for that origin-destination pair, only the 25% of mobile phone trips will actually be removed at a zonal level.
- The remaining public transport demand will be, sequentially, aggregated and removed at an MSOA level while the same condition has still to be satisfied.
- If after MSOA removal, there is still public transport demand that hasn't been removed, it will be aggregated and removed at a district level.
- Finally, the remaining demand, if any, will be removed at a global, full matrix level.

Applying the methodology described above, we make sure that no car trips are lost while attempting to remove public transport from the combined road and rail Provisional MPD Matrices. The level of MPD demand removed at each stage of the process is shown in detail in Table 88: and Table 89**Error! Reference source not found.** below. It is remarked that the highest number of public transport trips are removed at an OD zone and district level.

It is clear from the tables below that the use of a cap was necessary to avoid removing, in some cases, the entire mobile phone data demand for specific trip purpose and time period combinations. In particular, it is observed that the public transport demand for HBW "to home" trips in the AM and HBW "from home" trips in the PM are higher than the actual MPD demand. However, the specific movements are not dominant and they only constitute a minor percentage of the total commuting demand in the respective time periods.

In total, 8% of demand was removed to account for public transport rail, bus and tram trips (1,646,231 trips), with the majority of the trips being home based, either "commuting" or "other".

SYSTRA's Public Transport demand was found to be significantly lower for non-home based trips. In reference to time of the day, Interpeak comes first with the highest number of rail and bus trips with the two peak periods (AM, PM) to follow and the off peak to come at the end with the lowest number of public transport trips, as expected.

Table 88: Change in trip totals at each stage from removing Public Transport

MPD Demand Segment	Initial MPD Demand	Total PT Demand to Remove	PT Removed at an OD zone pair level	% Change in MPD After OD Zone Removal	PT Still To Remove	PT Removed at an MSOA level	% Change in MPD After MSOA Removal	PT Still To Remove	PT Removed at a District level	% Change in MPD After District Removal	PT Still To Remove	PT Removed at a Fulll Matrix level	% Change in MPD After Full Matrix Removal	PT Still To Remove	% Change After PT Removal vs Initial MPD Demand
HBW FH AM	1,709,557	186,318	94,283	-5.5%	92,035	3,146	-0.2%	88,889	85,219	-5.3%	3,670	3,670	-0.2%	0	-10.9%
HBW TH AM	27,986	37,287	1,232	-4.4%	36,056	67	-0.2%	35,989	5,440	-20.4%	30,549	1,430	-6.7%	29,119	-29.2%
HBO FH AM	1,464,098	131,282	63,194	-4.3%	68,088	2,395	-0.2%	65,694	63,953	-4.6%	1,740	1,740	-0.1%	- 0	-9.0%
HBO TH AM	271,066	24,841	8,863	-3.3%	15,978	535	-0.2%	15,443	14,278	-5.5%	1,165	1,165	-0.5%	0	-9.2%
NHBO AM	1,193,814	19,080	14,279	-1.2%	4,801	280	0.0%	4,521	4,521	-0.4%	- 0	-	0.0%	- 0	-1.6%
HBW FH IP	281,964	122,093	15,906	-5.6%	106,186	695	-0.3%	105,491	49,993	-18.8%	55,498	20,052	-9.3%	35,445	-30.7%
HBW TH IP	451,625	95,878	19,064	-4.2%	76,814	896	-0.2%	75,918	73,799	-17.1%	2,119	2,119	-0.6%	- 0	-21.2%
HBO FH IP	1,776,667	214,321	108,743	-6.1%	105,578	4,065	-0.2%	101,513	95,645	-5.7%	5,867	5,867	-0.4%	- 0	-12.1%
HBO TH IP	1,695,664	163,311	82,696	-4.9%	80,615	4,147	-0.3%	76,468	69,054	-4.3%	7,413	7,413	-0.5%	- 0	-9.6%
NHBO IP	2,729,310	53,313	46,438	-1.7%	6,875	1,848	-0.1%	5,027	5,027	-0.2%	- 0	-	0.0%	- 0	-2.0%
HBW FH PM	44,376	66,290	2,128	-4.8%	64,162	119	-0.3%	64,043	8,301	-19.7%	55,742	2,824	-8.3%	52,918	-30.1%
HBW TH PM	1,447,363	169,407	76,562	-5.3%	92,845	2,630	-0.2%	90,215	86,093	-6.3%	4,123	4,123	-0.3%	0	-11.7%
HBO FH PM	742,709	74,179	33,254	-4.5%	40,925	768	-0.1%	40,157	39,804	-5.6%	353	353	-0.1%	0	-10.0%
HBO TH PM	1,439,152	144,132	78,132	-5.4%	66,000	2,453	-0.2%	63,547	61,227	-4.5%	2,320	2,320	-0.2%	- 0	-10.0%
NHBO PM	1,471,501	41,451	36,301	-2.5%	5,150	945	-0.1%	4,205	4,205	-0.3%	0	-	0.0%	0	-2.8%
HBW FH OP	472,270	53,329	18,414	-3.9%	34,915	542	-0.1%	34,373	33,821	-7.5%	552	552	-0.1%	- 0	-11.3%
HBW TH OP	425,629	51,040	21,274	-5.0%	29,766	832	-0.2%	28,934	27,473	-6.8%	1,461	1,461	-0.4%	0	-12.0%
HBO FH OP	944,539	34,338	26,074	-2.8%	8,264	549	-0.1%	7,715	7,715	-0.8%	- 0	-	0.0%	- 0	-3.6%
HBO TH OP	1,475,061	68,045	47,489	-3.2%	20,556	1,490	-0.1%	19,065	18,964	-1.3%	101	101	0.0%	- 0	-4.6%
NHBO OP	1,230,851	13,780	13,099	-1.1%	681	325	0.0%	355	355	0.0%	0	-	0.0%	0	-1.1%
24hr All Purposes	**21,295,201**	**1,763,714**	**807,424**	**-3.8%**	**956,290**	**28,725**	**-0.1%**	**927,564**	**754,890**	**-3.7%**	**172,674**	**55,192**	**-0.3%**	**117,482**	**-7.7%**

Table 89 shows the total number of person trips between different Sheffield City Region districts and the external area after removing public transport (bus, rail, tram). Total number of trips across road and freight is around 19.6 million trips on an average weekday excluding all short distance trips (up to 6 kms) and external intra-zonal movements.

Table 89: Combined Road and Freight MPD People Trips between Districts, after PT removal

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	202,563	72,846	12,713	29,094	17,478	19,069	6,066	6,376	6,069	62,251	434,525
Rotherham	75,219	74,801	27,991	26,546	3,211	4,638	3,709	576	14,080	36,248	267,020
Doncaster	12,476	27,845	138,556	12,883	780	751	801	226	14,304	74,812	283,434
Barnsley	28,955	25,763	12,768	55,930	510	553	381	184	906	60,471	186,420
Chesterfield	17,539	3,154	810	536	11,983	20,500	11,597	7,825	1,828	20,514	96,287
NE Derbyshire	19,389	4,607	862	596	20,510	6,969	6,917	4,749	1,788	22,157	88,543
Bolsover	6,055	3,631	857	411	11,497	6,849	4,560	1,271	5,095	39,429	79,654
Derbyshire Dales	6,297	566	209	177	8,029	4,897	1,270	12,755	318	45,646	80,165
Bassetlaw	5,986	14,291	14,487	903	1,812	1,797	5,275	301	26,773	41,599	113,224
External	59,718	35,869	74,517	60,802	20,415	22,446	39,527	46,170	41,356	17,619,327	18,020,148
Total	434,197	263,374	283,770	187,879	96,226	88,469	80,104	80,432	112,517	18,022,453	19,649,420

Table 90 shows the percentage change in MPD trips as a result of public transport removal. It is inferred that trips originating from or ending in Sheffield have the highest public transport share with Barnsley, Chesterfield, Doncaster and Rotherham to follow.

This makes sense as the aforementioned areas are the biggest urban areas in Sheffield City Region and thus, they are better served by public transport compared to the rest of the model's internal area.

20% of trips within Sheffield and 17% of trips within Barnsley and Chesterfield are considered to represent public transport trips. The intra-district public transport share is higher than the inter-district one across all SCR districts, a fact that can be explained by the considerable number of short distance bus trips.

Referring to trips with one trip end outside of Sheffield City Region, the highest share of public transport demand (~15%) is observed for trips between Sheffield and the external area

Table 90: Percentage change in People Trips between District following PT removal

% Change in Full MPD Matrix	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	-20%	-9%	-12%	-10%	-11%	-10%	-3%	-8%	-9%	-14%	-15%
Rotherham	-8%	-11%	-7%	-7%	-3%	-2%	-3%	-2%	-5%	-3%	-8%
Doncaster	-13%	-6%	-13%	-7%	-5%	-2%	-2%	-2%	-5%	-8%	-10%
Barnsley	-9%	-9%	-7%	-17%	-6%	-3%	-1%	-1%	-1%	-5%	-10%
Chesterfield	-10%	-2%	-4%	-5%	-17%	-11%	-8%	-3%	-3%	-9%	-10%
NE Derbyshire	-9%	-2%	-3%	-3%	-11%	-6%	-4%	-3%	-3%	-4%	-7%
Bolsover	-3%	-3%	-1%	-1%	-9%	-4%	-7%	-2%	-10%	-4%	-5%
Derbyshire Dales	-8%	-2%	-3%	-1%	-2%	-2%	-1%	-4%	-1%	-3%	-4%
Bassetlaw	-8%	-4%	-4%	-2%	-4%	-2%	-7%	0%	-7%	-4%	-5%
External	-16%	-3%	-7%	-4%	-9%	-4%	-3%	-3%	-4%	-8%	-8%
Total	-15%	-8%	-10%	-10%	-10%	-7%	-4%	-4%	-5%	-7%	-8%

Step 5: Factor TPS Freight trips (LGV, OGV) based on comparisons against the Count data

As detailed in Appendix F tests within the Mobile Phone Verification process suggests, the mobile phone data mode split between road and HGV trips is not considered to be correct, as HGV trips are significantly understated and many of them are likely to have been misallocated to non-home based road trips.

LGV trips are also included in the road matrix and have to be removed to obtain a car highway matrix. Highways England TransPennine Regional Model freight matrices (LGV, OGV) were used to represent the correct freight demand that should be removed from the Provisional Mobile Phone Data combined road and freight matrix.

Meanwhile, comparison of the TPS freight data against the count data indicated that LGV trips were 30% lower on average across all time periods. This finding was also supported by comparison against TRICs trip end data (at an employee level), as TPS LGVs were found to be 32% lower than TRICs. Therefore, a global factor of 1.3 was applied to TPS LGV trips just before being removed from the combined MPD road-freight matrix.

On the other hand, compared against the count data, the TPS matrices were found to: significantly overstate OGV trips in the PM peak (~55%), moderately overstate OGV trips in the AM peak (~ 7%), while slightly underestimating OGV demand in the Interpeak (~ 4%).

Thus, appropriate factors were applied to OGV trips by time period to factor down the AM and PM peak OGV demand and slightly augment the number of OGV trips in the Interpeak.

It should be noted that before applying the factors mentioned above we sought for supplementary evidence in other available sources of UK freight data.

Thus, we obtained 2016 freight data derived from the *Continuing Survey of Road Goods Transport* (CSRGT) to compare them against the existing TPS freight data. However, there was a number of limitations in that source of data and thus, we decided that it was not fit for purpose.

The main reason was that, in the CSRGT survey, for trips with more than 5 stops, only the origin and final destination of the trip were reported from the driver with the locations of all the intermediate stops remaining unknown. The implication of this was that all freight trips with more than 5 stops per day that have both trip ends outside Sheffield City Region but pass through and stop within the model's internal area are not part of the dataset. Therefore, the use of this source of data is inappropriate, as it would create a bias in the process.

Table 91 and Table 92 below show the factored TPS matrices at a 24hr, district to district level that were sequentially removed from the combined road-freight MPD matrix.

Table 91: LGV TPS Matrices factored to match counts 24hr trips between Districts

LGVs TPS 24hr Factored	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total Origins
Sheffield	40,816	3,710	919	1,735	706	1,326	339	234	359	5,935	56,078
Rotherham	3,812	15,937	1,749	1,783	301	402	286	50	733	4,851	29,903
Doncaster	907	1,832	22,020	854	84	128	114	20	938	7,679	34,578
Barnsley	1,710	1,808	888	18,854	71	76	71	13	147	6,263	29,900
Chesterfield	664	315	95	81	14,450	2,677	975	437	174	2,681	22,550
NE Derbyshire	1,183	375	115	71	2,739	7,977	1,027	443	184	2,975	17,089
Bolsover	287	265	132	57	1,007	1,014	5,081	115	442	5,876	14,276
Derbyshire Dales	209	68	24	14	410	424	160	8,346	18	4,309	13,983
Bassetlaw	390	765	867	143	161	165	480	22	12,615	5,776	21,384
External	5,857	4,670	7,571	6,167	2,663	3,044	6,083	4,444	5,428	10,179,456	10,225,382
Total Destinations	55,835	29,745	34,380	29,759	22,592	17,233	14,616	14,126	21,037	10,225,800	10,465,123

Table 92: OGV TPS Matrices factored to match counts 24hr trips between Districts

OGVs TPS 24hr Factored	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total Origins
Sheffield	7,241	4,241	2,692	1,244	267	127	180	424	974	11,171	28,560
Rotherham	3,853	3,446	1,365	774	54	394	70	5	445	4,347	14,754
Doncaster	1,877	916	8,197	717	43	65	79	224	523	14,730	27,371
Barnsley	1,269	586	634	3,761	38	13	30	8	147	5,545	12,030
Chesterfield	245	120	54	69	1,949	324	369	359	57	1,382	4,928
NE Derbyshire	68	42	74	17	188	512	135	72	58	1,558	2,726
Bolsover	197	99	112	41	372	104	269	50	628	1,938	3,808
Derbyshire Dales	867	9	667	13	658	122	85	554	393	3,652	7,020
Bassetlaw	574	844	653	234	77	71	529	178	6,020	7,333	16,513
External	12,629	4,995	15,265	4,931	1,619	1,858	2,163	3,368	7,309	4,382,023	4,436,161
Total Destinations	28,820	15,297	29,712	11,800	5,265	3,591	3,910	5,242	16,554	4,433,679	4,553,870

Step 6: Remove Freight trips from Non Home Based Other Mobile Phone Trips

The next step after factoring the TPS freight matrices was to remove them from the Mobile Phone Data.

The methodology implemented is the same as the one used for public transport removal, with the exception that freight demand is removed from just one purpose: Non Home Based Other trips by time period and peak hour.

As the Provisional matrices are in people units, the LGV TPS matrices were converted from vehicles to people assuming an average LGV occupancy of 1.23 people per vehicle. The initial TPS OGV matrices were in PCUs and were divided by 2.3 (SCR PCU factor) so that they are converted to vehicles (equivalent to people) before the removal process. Short distance trips (up to 6 kms) and external intra-zonal trips had to be removed from LGV and OGV TPS matrices so that they are consistent with the Mobile Phone Data matrix.

Freight was removed from the combined Mobile Phone road / freight matrix initially at an OD zone pair level and sequentially, at an MSOA, district and full matrix level until the entire freight demand was removed, following a very similar process to the public transport removal mentioned in Step 4. The cap applied in the process, namely the maximum percentage of NHB MPD demand that could be removed at an OD zone pair level to account for freight, was assumed to be equal to 50% for all time periods apart from the off peak. In the case of the off-peak, a higher, 75% cap was applied as most of the long distance freight trips occur late at night or early in the morning (late/ early off peak).

Table 93 summarises the results of the freight removal process in terms of percentage changes brought about in non-home based MPD trips at each stage of the process. It is observed that freight accounts for 63% of total non-home based demand in the off peak period, while a high freight share (51%) is also evident in the morning peak. Interpeak and evening peak periods follow with freight shares of 40% and 35% respectively, while overall, freight demand counts for a 45% of the total non-home based mobile phone data demand.

Table 93: Percentage Difference in NHBO at each stage from Freight Removal by time period

MPD Demand Segment	Initial Demand	% Change Zone Removal	% Change MSOA Removal	% Change District Removal	% Change Full Matrix Removal	% After Freight Removal
NHBO AM	1,174,734	-42%	-0.6%	-14%	-1.0%	-51%
NHBO IP	2,675,997	-35%	-0.4%	-8%	-0.3%	-40%
NHBO PM	1,430,050	-31%	-0.4%	-5%	-0.4%	-35%
NHBO OP	1,217,071	-50%	-0.7%	-24%	-1.2%	-63%
Total 24hr NHB Trips	6,497,852	-38%	0%	-11%	-1%	-45%

Table 94 shows the total number of person trips at a district level after removing the factored TPS matrices. Total number of car trips appears to be about 16.7 million trips on an average weekday excluding all short distance trips (up to 6 kms) and external intra-zonal movements.

Table 94: 24hr Car People Trips between Districts post Freight removal

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	187,137	67,154	10,532	26,472	16,417	17,810	5,557	5,929	5,208	50,073	392,289
Rotherham	69,559	68,832	25,426	24,280	2,812	4,039	3,320	511	12,989	28,393	240,161
Doncaster	10,563	25,403	126,582	11,557	661	619	634	172	13,056	59,557	248,804
Barnsley	26,332	23,553	11,445	49,169	407	460	291	165	709	50,523	163,053
Chesterfield	16,544	2,712	668	423	10,582	18,313	10,418	7,138	1,586	16,726	85,110
NE Derbyshire	18,279	4,153	703	501	18,326	6,147	6,106	4,205	1,550	18,208	78,179
Bolsover	5,601	3,258	682	323	10,302	6,042	3,951	1,112	4,495	32,694	68,460
Derbyshire Dales	5,867	496	155	156	7,238	4,349	1,083	10,667	264	38,964	69,238
Bassetlaw	5,256	13,012	13,236	701	1,577	1,570	4,677	251	23,695	32,525	96,500
External	47,228	27,987	58,997	51,317	16,436	18,209	32,879	39,555	33,014	14,944,977	15,270,599
Total	392,367	236,560	248,425	164,900	84,759	77,558	68,916	69,705	96,566	15,272,638	16,712,394

Table 92 below indicates that a 15% of total MPD demand at an all-day level was removed as it was considered to constitute freight trips.

Movements between Doncaster and Derbyshire Dales, Doncaster and Bolsover, Barnsley and Bolsover and Bassetlaw and Barnsley appear to be amongst the ones with the highest freight share within Sheffield City Region. Regarding longer distance trips starting or ending outside the model's internal area, the freight share by SCR district appears within a range of 14% and 22%, while a 15% of external inter-zonal trips were removed as freight trips.

Table 95: Percentage Change in People Trips between districts post Freight removal

% Change in Full MPD Matrix	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	-8%	-8%	-17%	-9%	-6%	-7%	-8%	-7%	-14%	-20%	-10%
Rotherham	-8%	-8%	-9%	-9%	-12%	-13%	-11%	-11%	-8%	-22%	-10%
Doncaster	-15%	-9%	-9%	-10%	-15%	-18%	-21%	-24%	-9%	-20%	-12%
Barnsley	-9%	-9%	-10%	-12%	-20%	-17%	-23%	-10%	-22%	-16%	-13%
Chesterfield	-6%	-14%	-18%	-21%	-12%	-11%	-10%	-9%	-13%	-18%	-12%
NE Derbyshire	-6%	-10%	-18%	-16%	-11%	-12%	-12%	-11%	-13%	-18%	-12%
Bolsover	-7%	-10%	-20%	-21%	-10%	-12%	-13%	-13%	-12%	-17%	-14%
Derbyshire Dales	-7%	-12%	-26%	-12%	-10%	-11%	-15%	-16%	-17%	-15%	-14%
Bassetlaw	-12%	-9%	-9%	-22%	-13%	-13%	-11%	-17%	-11%	-22%	-15%
External	-21%	-22%	-21%	-16%	-19%	-19%	-17%	-14%	-20%	-15%	-15%
Total	-10%	-10%	-12%	-12%	-12%	-12%	-14%	-13%	-14%	-15%	-15%

Step 7: Infilling Short Distance (up to 6 kms), Internal and External Intra-zonal Trips with the Synthetic Matrix

The outcome of the *Verification Test D* showed that, as Telefonica had explicitly stated in the relevant report ("*Sheffield OD from Mobile Phone Data*"), the derivation of short trips in the Provisional data are unreliable. Mobile Phone Data are not able to capture and identify very short distance intra-zonal / intra-MSOA trips, whilst they exclude external intra-zonal trips. This was corrected by synthesising and replacing short trips, derived from the developed SCR Synthetic matrices.

The infilling was undertaken using 6 kms as the distance threshold used to define a short trip. Thus, all trips up to 6 kms, as well as all internal and external trips that originate from and end in the same SCR zone were replaced from the Synthetic Car matrices by purpose, time period and direction of travel.

Table 96 shows the total number of car person trips between different Sheffield City Region districts and the external area after infilling short distance and intra-zonal trips from the synthetic car matrices. Total number of car people trips is about 106.4 million on an average weekday.

Table 96: 24hr Car People trips between Districts after Infilling Short Distance Trips

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	632,028	82,989	10,532	28,669	16,441	30,740	5,557	6,106	5,208	50,094	868,365
Rotherham	85,448	229,527	32,415	31,472	2,812	4,950	3,320	511	14,293	28,393	433,140
Doncaster	10,563	32,288	366,102	13,030	661	619	634	172	15,843	62,992	502,905
Barnsley	28,497	30,635	12,916	200,459	407	460	291	165	709	55,295	329,834
Chesterfield	16,566	2,712	668	423	111,843	31,502	12,046	7,138	1,586	16,726	201,211
NE Derbyshire	31,158	5,052	703	501	31,625	42,942	8,571	4,817	1,550	20,094	147,014
Bolsover	5,601	3,258	682	323	11,926	8,532	44,305	1,112	5,831	43,000	124,569
Derbyshire Dales	6,043	496	155	156	7,238	4,951	1,083	84,151	264	44,697	149,234
Bassetlaw	5,256	14,311	16,034	701	1,577	1,570	6,020	251	127,328	37,039	210,087
External	47,249	27,987	62,399	56,076	16,436	20,088	42,981	45,332	37,485	103,070,148	103,426,180
Total	868,411	429,255	502,605	331,811	200,965	146,354	124,807	149,755	210,098	103,428,479	**106,392,539**

Table 97 shows the percentage of short distance trips over the total number of MPD trips after infilling from the Synthetic. The infilling had a profound effect on the number of intra-district trips, as well as on the level of demand between adjacent districts. Chesterfield and Bolsover appear to have the highest proportion of short distance intra-district trips, whereas, at a full matrix level, short distance trips count for 84% of the total volume of trips.

Table 97: Percentage of Car People trips between districts that are infilled Short Distance Trips

% of Infilled Short Dist Trips (0-6kms) over total no of Trips	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	70%	19%	0%	8%	0%	42%	0%	3%	0%	0%	55%
Rotherham	19%	70%	22%	23%	0%	18%	0%	0%	9%	0%	45%
Doncaster	0%	21%	65%	11%	0%	0%	0%	0%	18%	5%	51%
Barnsley	8%	23%	11%	75%	0%	0%	0%	0%	0%	9%	51%
Chesterfield	0%	0%	0%	0%	91%	42%	14%	0%	0%	0%	58%
NE Derbyshire	41%	18%	0%	0%	42%	86%	29%	13%	0%	9%	47%
Bolsover	0%	0%	0%	0%	14%	29%	91%	0%	23%	24%	45%
Derbyshire Dales	3%	0%	0%	0%	0%	12%	0%	87%	0%	13%	54%
Bassetlaw	0%	9%	17%	0%	0%	0%	22%	0%	81%	12%	54%
External	0%	0%	5%	8%	0%	9%	24%	13%	12%	86%	85%
Total	55%	45%	51%	50%	58%	47%	45%	53%	54%	85%	84%

Step 8: Purpose Split; Disaggregate "Other" into Employer's Business and "Other" trip categories

Telefonica's Provisional MPD Matrices were segmented into five purposes: Home Based Work Outbound, Home Based Work Inbound, Home Based Other Outbound (Including Home Based Education Outbound), Home Based Other Inbound (Including Home Based Education Inbound) and Non Home Based Other trips.

For the requirements of the assignment and the Variable Demand Model, the "Other" demand segment had to be further split into "Employer's Business" and "Other" both for home and non-home based trips.

The purpose split of the Synthetic car matrices was used to calculate the proportion of HBEB / NHBEB trips over the entire HBO / NHBO demand by time period and direction of travel.

After the purpose split, the total number of car people mobile phone trips on an average weekday and by time period remains the same; it's only a redistribution of trips that occurs amongst purposes other than commuting.

Step 9: Trip Length Adjustments applied to MPD trips with at least one trip end within Sheffield City Region based on NTS

As thoroughly discussed in the Mobile Phone Data Verification report, all the tests indicated that the Provisional Mobile Phone Data were generally biased towards longer distance trips, while significantly understating short distance trips.

At this stage of the Matrix Build Process, the trip length profile of MPD trips originating within Sheffield City Region was extracted at a trip purpose (HBW, HBEB, HBO, NHBEB, NHBO), all-day level and compared against the relevant 24hr NTS profile.

The NTS profile used in the process was derived from 2008-2015 National Travel Survey (NTS) Household Data for Yorkshire and Humber and East Midlands regions that are both relevant to the model's Internal Area (SCR).

A number of supplementary tests were also undertaken to compare and verify the level of MPD demand in each demand segment against secondary sources of data.

In particular, PA and OD MPD trip ends by Sheffield City Region district were compared against the relevant trip ends derived from the SCR Synthetic matrix and the National Trip End Model (NTEM v72). For commuting trips, the total number of production tours by SCR district was also compared against Adjusted 2011 Census Journey to Work Data.

Thus, a set of distance based, trip length adjustment factors were calculated by purpose of travel considering the performance of Mobile Phone Data against all of the above mentioned sources of data.

In particular, the selection of the TLD factors implemented was the outcome of an iterative process aiming to correct for all the inconsistencies amongst the data sources and to satisfy all of the following conditions:

- Produce a smooth TLD profile for the Mobile Phone matrices similar to NTS at a trip purpose, all day level
- End up with trip ends consistent with TEMPRO v72 and the SCR Synthetic trip ends across all trip purposes and
- Result in the least possible change in the matrix totals (total volume of MPD trips) by demand segment.

Different factors were calculated for different distance bands depending on the shape of the distribution and the divergence from the NTS profile. The factors were estimated based on the trip length distribution of the MPD average weekday (24hr) trips that have their origin within Sheffield City Region (Internal to Internal and Internal to External trips). However, the same factors were implemented to trips that originate outside of our study area but have their destination within Sheffield City Region, as their trip length profile should be similar to that of the outbound (internal to external) trips to ensure the symmetry of the matrix.

Short distance trips between 0 and 6 kms have been already infilled from the Synthetic Matrix and thus, no trip length adjustment factors were applied to them.

The factors implemented to home based “from home” and “to home” trips by purpose are similar but not identical, as they were calculated separately by direction of travel.

Table 98*:* summarises the trip length adjustment factors calculated by purpose and direction of travel and the relevant distance bands to which they were applied. The factors were calculated at a 24hr level but implemented by time period with the same factors being applied across all time periods.

Table 98: Trip Length Adjustment Factors by Distance Band for Car People Matrices

Trip Purpose	Distance Band (kms)	Adjustment Factor
HBW FH	6 to 10	1.29
	10 to 999	1.07
HBW TH	6 to 10	1.16
	10 to 999	1.08
HBEB FH	6 to 11	1.00
	11 to 999	0.82
HBEB TH	6 to 11	1.00
	11 to 999	0.87
HBO FH	6 to 999	1.00
HBO TH	6 to 999	1.00
NHBEB	6 to 10	0.82
	10 to 999	0.75
NHBO	6 to 999	0.87

It is remarkable that, with the exception of home based work and other trips, in the rest of the purposes (HBEB, NHBEB, NHBO), trip length adjustment factors lower than unity were applied, aiming to significantly reduce longer distance trips.

This is supported by the fact that the NTS TLD profile, as well as comparisons against NTEM v72, SCR Synthetic trip ends and adjusted Census 2011 Journey to Work data all indicated that Mobile Phone Data were slightly understating commuting trips, while significantly overstating employer’s business and non-home based trips.

To be more specific, MPD commuting trips appeared to be particularly short of trips within the distance band of 6 to 10 kms, while also slightly lacking longer distance trips.

No trip length adjustments were undertaken in the case of HBO trips, as the specific trip category was considered to include the right level of demand based on comparisons against NTEMv72 and SCR Synthetic trip ends, while the trip length profile of the MPD HBO trips was found to be indistinguishable from what NTS suggests. This is key if it is taken into account that home based other trips count for 60% of the total number of mobile phone car trips.

Regarding HBEB trips, it occurred that the mobile phone data included a number of business trips with a trip length greater than 280 kms. If we consider that the distance from Sheffield to London is approximately 270 kms, we wouldn't expect to observe many business trips longer than that on an average weekday. Thus, we decided to remove these trips from Mobile Phone Data just before applying the trip length adjustment factors, as these probably constitute long distance freight trips (of the OGV band) incorrectly allocated to home-based travel.

It should be mentioned that, before removing freight from non-home based mobile phone matrices (see Step 4), the TPS HGV matrices were first factored down by the percentage of HBEB trips above 280 kms over the total number of OGV trips (~3%), to avoid removing twice the specific part of the freight matrix.

Table 99 below summarises the changes in trip totals and average trip length by purpose and direction of travel, on an average weekday for all trips originating within Sheffield City Region pre and post TLD adjustments.

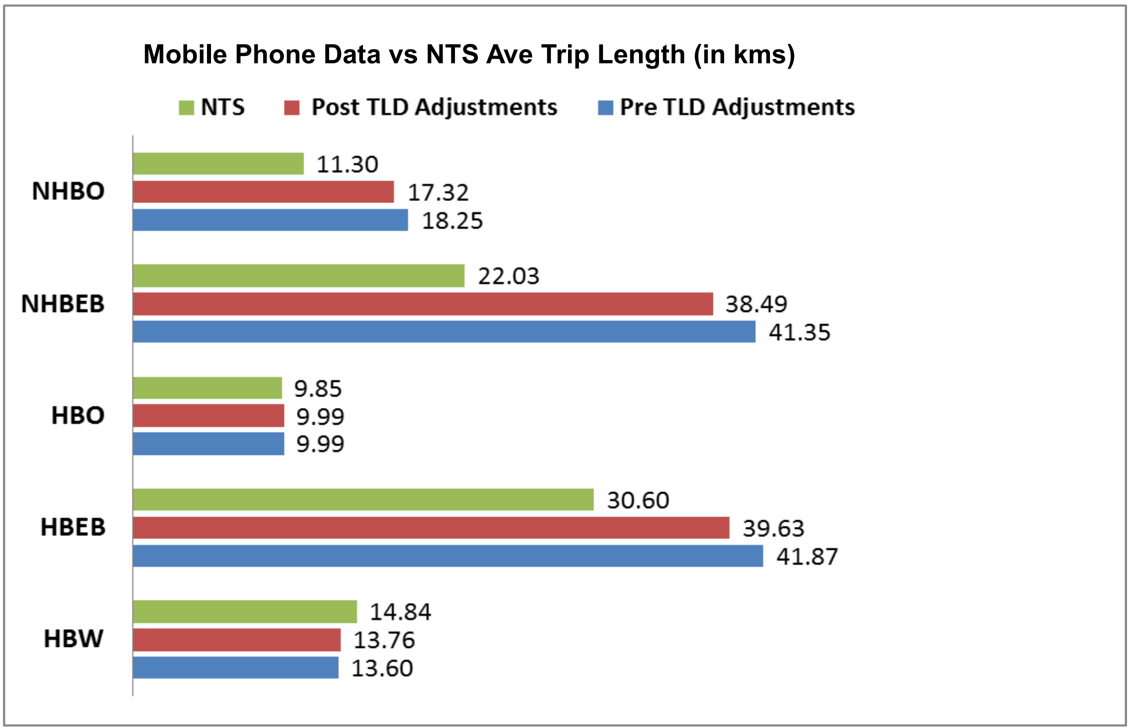
Table 99: Impact of Trip Length Adjustments on 24hr trip totals and average trip length

MPD People Matrices By Purpose 24hr	Trip Totals (Internal Origins) 24hr			Average Trip Length		
	Pre TLD Adjustments	Post TLD Adjustments	% Change	Pre TLD Adjustments	Post TLD Adjustments	NTS
HBW FH	293,184	316,038	8%	14.25	14.33	14.84
HBW TH	283,790	301,677	6%	12.94	13.16	14.84
HBW	576,974	617,715	7%	13.60	13.76	14.84
HBEB FH	58,828	51,714	-12%	44.01	41.43	30.60
HBEB TH	55,630	51,021	-8%	39.60	37.81	30.60
HBEB	114,458	102,735	-10%	41.87	39.63	30.60
HBO FH	910,201	910,201	0%	11.06	11.06	9.85
HBO TH	908,691	908,691	0%	8.92	8.92	9.85
HBO	1,818,892	1,818,892	0%	9.99	9.99	9.85
NHBEB	98,257	80,005	-19%	41.35	38.49	22.03
NHBO	354,354	327,380	-8%	18.25	17.32	11.30

Regarding trip totals, a reduction in the number of Employer's Business trips (both home and non-home based) and non-home based other trips is remarked. On the other hand, commuting trips with an SCR trip end have been increased post adjustments.

Figure 139 shows the average trip lengths pre and post trip length adjustments for MPD people matrices (only trips originating within SCR) and NTS data by trip purpose at an all-day level.

Figure 139: Impact of TLD Adjustments on 24hr Average Trip Length with an SCR origin



It is observed that, post adjustments, the average trip length across all purposes is closer to the relevant NTS one. For commuting trips and home based other trips, the average trip lengths of mobile phone data matrices are consistent with what NTS suggests.

In reference to employer's business and non-home based other trips, it is obvious that, even post adjustments, they still have an average trip length significantly longer than the NTS trip length.

However, it should be taken into consideration the small sample size of the NTS data along with the fact that Employer's Business trip purpose is the demand segment with the lowest number of trips. Hence, even a small percentage of very long distance employer's business trips (outliers) in the MPD trip matrix does have an impact on the average trip length.

In particular, it was identified that only a 5% of the adjusted 24hr HBEB MPD trips originating from Sheffield City Region have a trip length greater than 180 kms. The average trip length for HBEB trips up to 180 kms was estimated to be equal to 29 kms and therefore, very close to the NTS equivalent (30.6 kms).

The results were similar for the adjusted NHBEB trips where the 95% of trips originating from the model's internal area are shorter than 180 kms and have an average trip length of about 26kms. This is not far from what NTS suggests; 22kms.

In reference to the NHBO trips post trip length adjustments, it was remarked that only a 3% of trips of that demand segment are actually longer than 100 kms. The average trip length for non-home based other trips up to 100kms was found to be equal to 12.7 kms and thus, close enough to the NTS estimate of 11.3 kms.

Table 100 below shows the total number of car person trips between different Sheffield City Region districts and the external area post TLD adjustments. Total number of car people trips is about 106 million on an average weekday.

Table 100: 24hr Car People trips between SCR Districts post TLD adjustments

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	636,830	81,786	10,236	27,903	15,877	30,565	5,443	5,926	5,053	45,536	865,156
Rotherham	84,583	230,312	31,913	31,138	2,717	4,903	3,260	490	14,075	26,001	429,392
Doncaster	10,270	31,804	368,470	12,841	630	608	607	162	15,515	59,399	500,307
Barnsley	27,828	30,295	12,737	201,127	388	449	280	155	684	53,011	326,953
Chesterfield	16,021	2,630	637	409	112,248	31,840	12,050	6,982	1,536	15,628	199,981
NE Derbyshire	31,037	4,976	686	482	32,027	43,030	8,596	4,781	1,519	19,244	146,378
Bolsover	5,465	3,205	653	305	11,958	8,565	44,342	1,088	5,820	42,322	123,723
Derbyshire Dales	5,877	476	145	146	7,075	4,903	1,058	84,160	252	42,913	147,006
Bassetlaw	5,086	14,144	15,721	676	1,526	1,544	6,043	240	127,451	35,416	207,846
External	43,113	25,615	59,093	53,798	15,484	19,348	42,339	43,624	35,778	102,771,604	103,109,796
Total	866,108	425,244	500,292	328,824	199,931	145,757	124,019	147,607	207,682	103,111,074	106,056,539

Table 101 presents the percentage change in mobile phone car people trips by district to district movement and in total, at an all-day level, as a consequence of applying the trip length adjustments.

Table 101: Percentage Change in Car People trip totals at a district level Post TLD adjustments

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	1%	-1%	-3%	-3%	-3%	-1%	-2%	-3%	-3%	-7%	0%
Rotherham	-1%	0%	-2%	-1%	-3%	-1%	-2%	-4%	-2%	-7%	-1%
Doncaster	-3%	-1%	1%	-1%	-5%	-2%	-4%	-6%	-2%	-5%	0%
Barnsley	-2%	-1%	-1%	0%	-4%	-2%	-4%	-6%	-4%	-3%	-1%
Chesterfield	-3%	-3%	-5%	-3%	0%	1%	0%	-2%	-3%	-6%	-1%
NE Derbyshire	0%	-2%	-2%	-4%	1%	0%	0%	-1%	-2%	-4%	0%
Bolsover	-2%	-2%	-4%	-6%	0%	0%	0%	-2%	0%	-1%	-1%
Derbyshire Dales	-3%	-4%	-6%	-6%	-2%	-1%	-2%	0%	-5%	-4%	-1%
Bassetlaw	-3%	-1%	-2%	-4%	-3%	-2%	0%	-5%	0%	-4%	-1%
External	-7%	-7%	-4%	-3%	-5%	-3%	-1%	-3%	-4%	0%	0%
Total	0%	-1%	0%	-1%	0%	0%	-1%	-1%	-1%	0%	-0.03%

At a full matrix level, the impact was not significant, as total MPD all-day demand was reduced by less than 0.05%. The adjustments mostly affected trips with one trip end outside of the study area, as they mainly constitute medium to longer distance trips, decreasing them by no more than 7% across all SCR districts.

Figure 140 to Figure 144. below compare the trip length distributions at an all-day level by purpose of travel (HBW, HBEB, HBO, NHBEB, NHBO) between:

i) the MPD matrices pre TLD adjustments (just following the purpose split from 5 into 8 demand segments),

ii) the relevant NTS trip length profile (2008-2015 data for Yorkshire & Humber and East Midlands) and

iii) the “Adjusted” Mobile Phone matrices after applying the trip length adjustment factors.

The comparison applies to trips that have an origin trip end within Sheffield City Region.

Figure 140 demonstrates that mobile phone data tend to understate short to medium distance commuting trips of a distance range between 6 and 10 kms, while they are also lacking some longer distance commuting trips.

According to Figure 141., Mobile Phone data seem to understate home based employer’s business trips between 6 and 11 kms, while being severely biased towards longer distance business trips.

On the other hand, as it is shown in Figure 142., the trip length profile of home based other trips appears to be identical to the NTS trip length distribution.

As depicted in Figure 143 and Figure 144., the trip length profiles of non-home based employer’s business and other trips, before the adjustments, are both found to be significantly biased towards longer trips with short trips being significantly underrepresented.

However, all the graphs below indicate that after the trip length adjustments, Mobile Phone Data across all purposes are consistent with the National Travel Survey (NTS) trip length profile and are no longer biased towards longer distance trips.

Figure 140. Impact of TLD Adjustment on 24hr Trip Length Distribution (HBW)

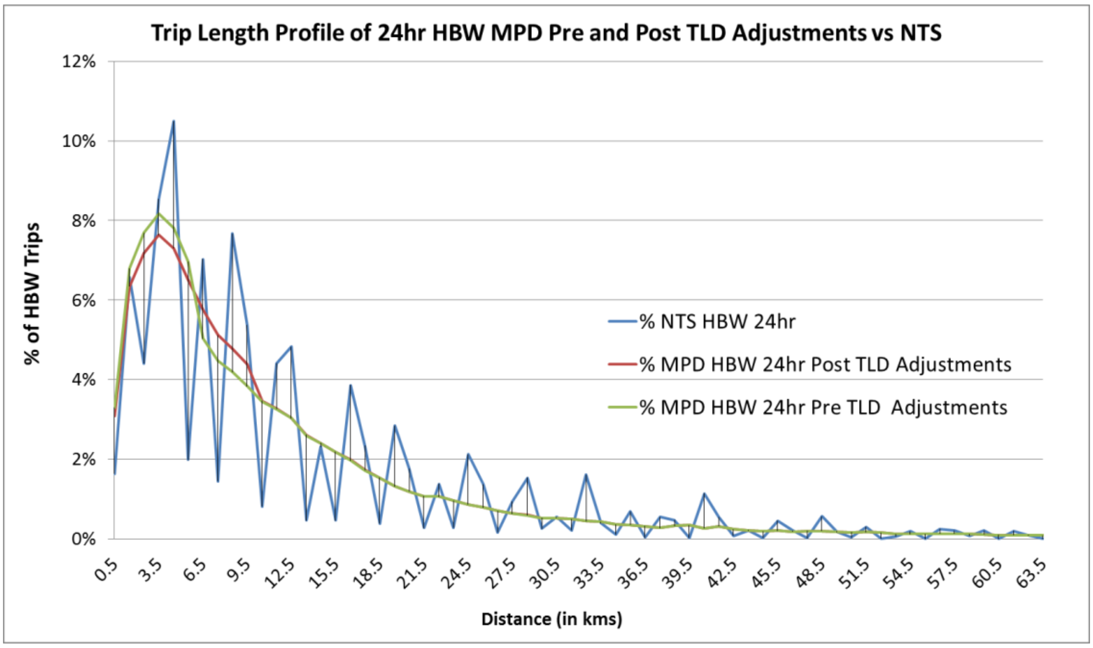


Figure 141. Impact of TLD Adjustment on 24hr Trip Length Distribution (HBEB)

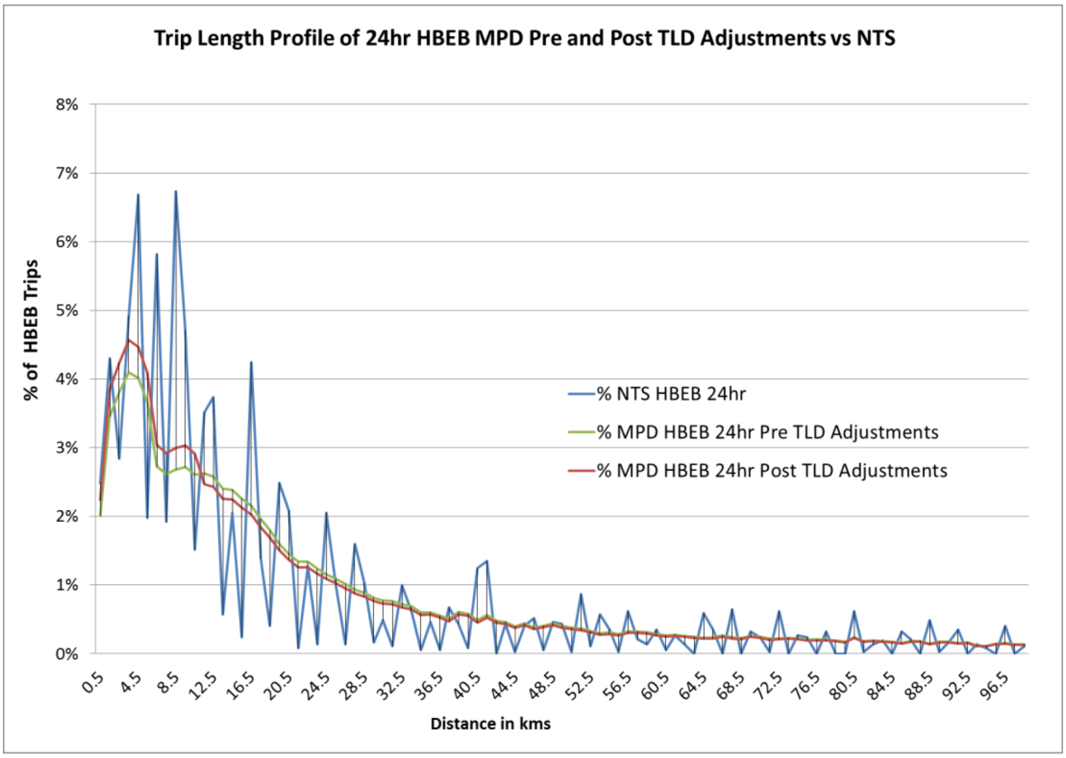


Figure 142. Impact of TLD Adjustment on 24hr Trip Length Distribution (HBO)

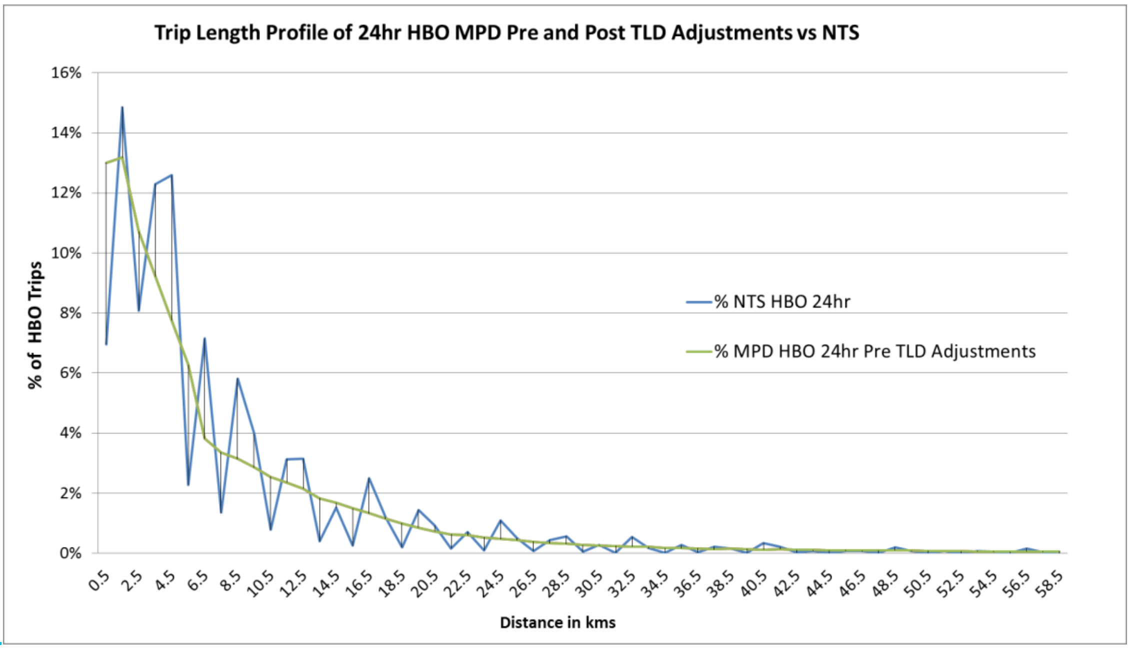


Figure 143. Impact of TLD Adjustment on 24hr Trip Length Distribution (NHBEB)

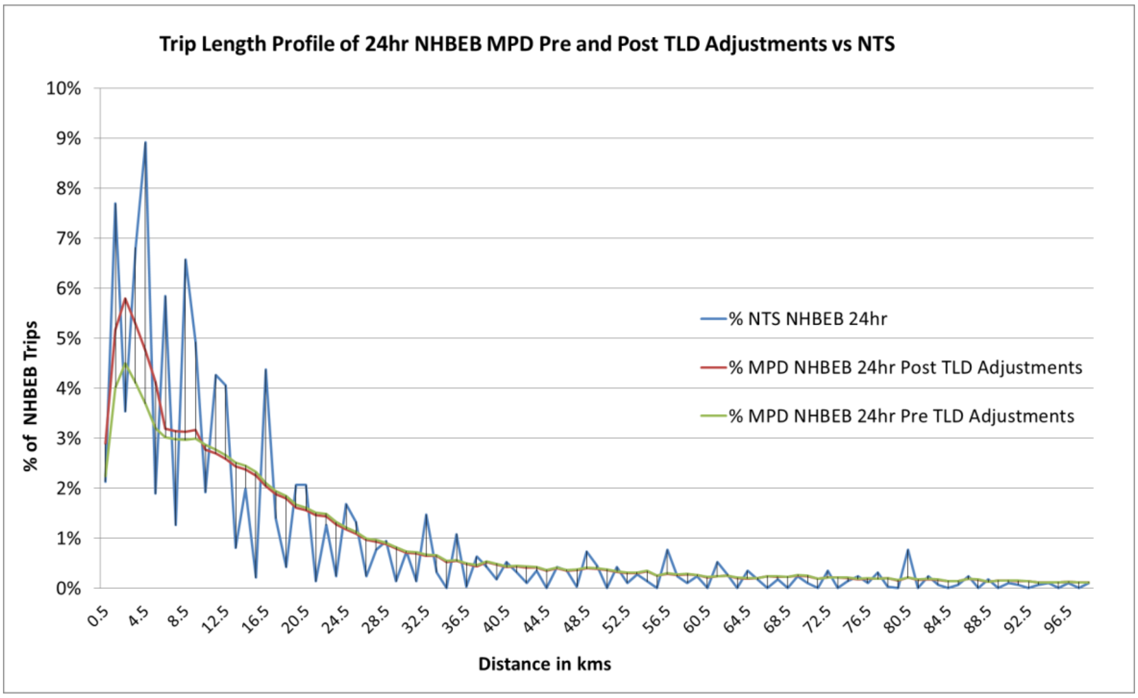


Figure 144. Impact of TLD Adjustment on 24hr Trip Length Distribution (NHBO)

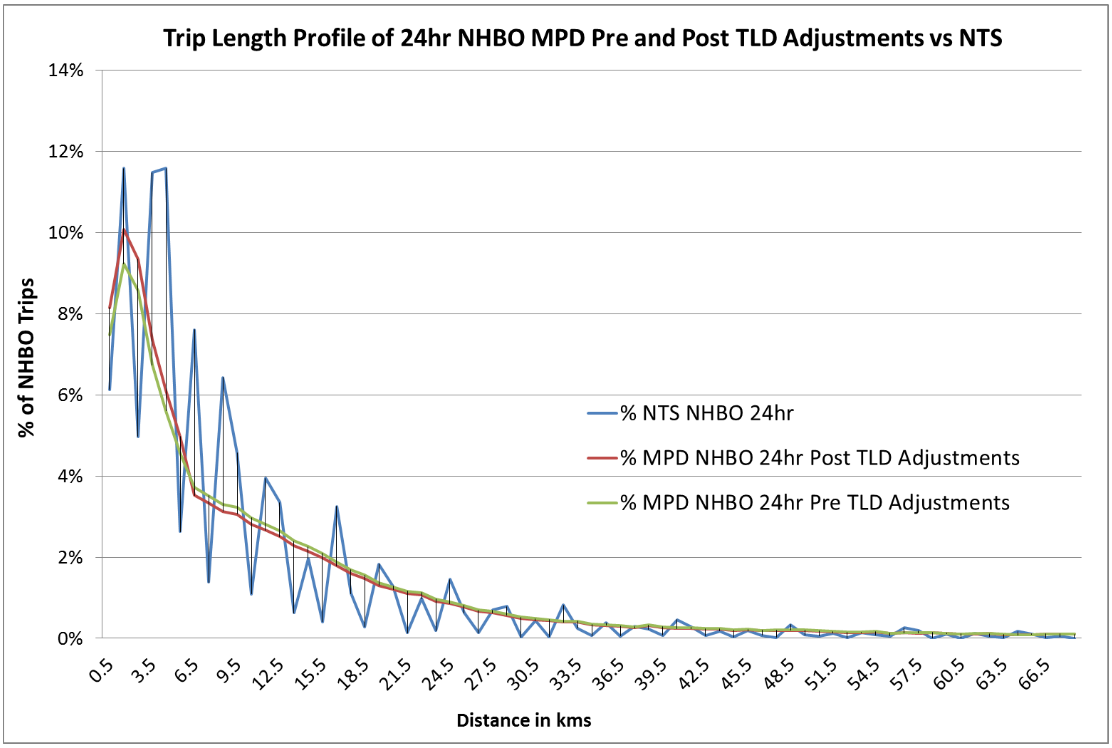


Table 102 below compares the ratio of all day MPD production trip ends to 24hr SCR Synthetic trip ends pre and post TLD adjustments by trip purpose for all trips produced within the Internal Area. The HBO and NHBO trip categories also include HBEB and NHBEB trips respectively. In the case of the HBO trip ends the changes observed post estimation are only attributed to employers business trips, as home based other trips were not subject to any TLD adjustment.

It is obvious that, post TLD adjustments, all ratios are much closer to unity. Overall, on an average weekday, the adjusted MPD trip ends produced within Sheffield City Region are only about 1% higher than the SCR Synthetic trip ends.

The results summarised in Table 102 provide evidence that the implementation of the trip length adjustments improved the consistency of the MPD matrix with both the NTS data in terms of trip length profile and the SCR Synthetic data in terms of actual level of trip making.

Table 102: Impact of TLD Adjustments on Production Trip End totals by District

Pre TLD Adjustments

Home Based Work		MPD vs Synthetic Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	174,344	193,302	0.90
Rotherham	all	84,834	95,549	0.89
Doncaster	all	101,321	111,566	0.91
Barnsley	all	67,856	89,638	0.76
Chesterfield	all	37,696	39,832	0.95
NE Derbyshire	all	34,466	39,137	0.88
Bolsover	all	26,594	29,589	0.90
Derbyshire Dales	all	22,878	28,909	0.79
Bassetlaw	all	37,544	45,100	0.83
Total		587,533	672,621	0.87

Home Based Other		MPD vs Synthetic Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	538,099	541,403	0.99
Rotherham	all	280,530	276,574	1.01
Doncaster	all	330,530	317,458	1.04
Barnsley	all	238,233	255,135	0.93
Chesterfield	all	120,166	111,582	1.08
NE Derbyshire	all	112,040	113,966	0.98
Bolsover	all	93,677	86,115	1.09
Derbyshire Dales	all	98,724	85,089	1.16
Bassetlaw	all	142,096	129,032	1.10
Total		1,954,095	1,916,353	1.02

Non-Home Based Other		MPD vs Synthetic Origin Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	142,896	109,890	1.30
Rotherham	all	70,037	47,574	1.47
Doncaster	all	73,234	59,866	1.22
Barnsley	all	46,678	38,983	1.20
Chesterfield	all	30,215	24,110	1.25
NE Derbyshire	all	18,247	14,523	1.26
Bolsover	all	15,762	13,550	1.16
Derbyshire Dales	all	25,785	22,800	1.13
Bassetlaw	all	29,757	25,020	1.19
Total		452,611	356,316	1.27

All Purposes 24hr		MPD vs Synthetic Internal Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	855,339	844,594	1.01
Rotherham	all	435,401	419,697	1.04
Doncaster	all	505,086	488,889	1.03
Barnsley	all	352,767	383,756	0.92
Chesterfield	all	188,077	175,525	1.07
NE Derbyshire	all	164,752	167,626	0.98
Bolsover	all	136,033	129,254	1.05
Derbyshire Dales	all	147,386	136,797	1.08
Bassetlaw	all	209,397	199,152	1.05
Total		2,994,239	2,945,290	1.02

Post TLD Adjustments

Home Based Work		Prior MPD vs Synthetic Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	187,819	193,302	0.97
Rotherham	all	91,299	95,549	0.96
Doncaster	all	108,561	111,566	0.97
Barnsley	all	72,361	89,638	0.81
Chesterfield	all	39,966	39,832	1.00
NE Derbyshire	all	37,140	39,137	0.95
Bolsover	all	28,492	29,589	0.96
Derbyshire Dales	all	24,081	28,909	0.83
Bassetlaw	all	39,447	45,100	0.87
Total		629,166	672,621	0.94

Home Based Other		MPD vs Synthetic Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	535,463	541,403	0.99
Rotherham	all	278,957	276,574	1.01
Doncaster	all	328,411	317,458	1.03
Barnsley	all	236,934	255,135	0.93
Chesterfield	all	119,403	111,582	1.07
NE Derbyshire	all	111,255	113,966	0.98
Bolsover	all	92,986	86,115	1.08
Derbyshire Dales	all	97,529	85,089	1.15
Bassetlaw	all	140,878	129,032	1.09
Total		1,941,815	1,916,353	1.01

Non-Home Based Other		MPD vs Synthetic Origin Trip Ends By District 24hr		
From	To	MPD	;ynthetic SC	MPD/Synthetic SCR
Sheffield	all	129,511	109,890	1.18
Rotherham	all	61,960	47,574	1.30
Doncaster	all	66,218	59,866	1.11
Barnsley	all	41,716	38,983	1.07
Chesterfield	all	27,506	24,110	1.14
NE Derbyshire	all	16,167	14,523	1.11
Bolsover	all	14,004	13,550	1.03
Derbyshire Dales	all	23,395	22,800	1.03
Bassetlaw	all	26,909	25,020	1.08
Total		407,386	356,316	1.14

All Purposes 24hr		MPD vs Synthetic Internal Production Trip Ends By District 24hr		
From	To	MPD	Synthetic SCR	MPD/Synthetic SCR
Sheffield	all	852,793	844,594	1.01
Rotherham	all	432,216	419,697	1.03
Doncaster	all	503,190	488,889	1.03
Barnsley	all	351,010	383,756	0.91
Chesterfield	all	186,875	175,525	1.06
NE Derbyshire	all	164,562	167,626	0.98
Bolsover	all	135,482	129,254	1.05
Derbyshire Dales	all	145,004	136,797	1.06
Bassetlaw	all	207,234	199,152	1.04
Total		2,978,367	2,945,290	1.01

Step 10: Correct peak hour demand when it is greater than the peak period one for each OD pair

In the case of OD pairs where the peak hour demand was found to be greater than the respective peak period demand, the peak hour demand was set equal to the peak period demand to correct for error in the data. This occurred in about 3% of the OD pairs for both the AM and PM peak hour demand.

Step 11: Apply Factors to MPD Commuting Trips to adjust to SCR Synthetic Trip Ends

As inferred from Table 91 above, although trip length adjustments have increased commuting trips produced within Sheffield City Region by about 7%, commuting trips were still found to be slightly understated in Mobile Phone Data based on comparisons against Census 2011 Adjusted Journey to Work Data and the SCR Synthetic trip ends.

Commuting trips comprise more than 20% of total number of Mobile Phone trips and thus, it is important that they represent the right level of demand.

Thus, further tests were undertaken to compare the Mobile Phone commuting trip ends by SCR district against the SCR Synthetic trip ends at a time period level, separately for origin and destination trip ends. The results of that comparison are summarised in **Table 103** below.

Table 103: HBW OD Trip Ends against Synthetic data, production level by district and time period

AM		HBW FH (Origin Trip Ends)		Factors Applied	AM		HBW TH (Destination Trip Ends)		Factors Applied
From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD	From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD
Sheffield	all	65,385	66,586	1.02	all	Sheffield	2,109	3,802	1.80
Rotherham	all	31,696	33,295	1.05	all	Rotherham	834	1,856	2.23
Doncaster	all	34,234	37,738	1.10	all	Doncaster	1,214	2,205	1.82
Barnsley	all	23,665	30,499	1.29	all	Barnsley	735	1,758	2.39
Chesterfield	all	13,756	13,326	0.97	all	Chesterfield	404	783	1.94
NE Derbyshire	all	13,269	13,702	1.03	all	NE Derbyshire	250	756	3.02
Bolsover	all	9,692	10,314	1.06	all	Bolsover	167	575	3.44
Derbyshire Dales	all	8,820	10,348	1.17	all	Derbyshire Dales	184	547	2.98
Bassetlaw	all	13,192	15,625	1.18	all	Bassetlaw	380	875	2.30
External	all	8,353,795	7,703,570	0.92	all	External	402,568	426,704	1.06

IP		HBW FH (Origin Trip Ends)		Factors Applied	IP		HBW TH (Destination Trip Ends)		Factors Applied
From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD	From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD
Sheffield	all	10,896	12,110	1.11	all	Sheffield	18,879	18,347	0.97
Rotherham	all	3,546	6,067	1.71	all	Rotherham	10,410	9,042	0.87
Doncaster	all	3,768	7,370	1.96	all	Doncaster	13,219	10,625	0.80
Barnsley	all	2,563	5,918	2.31	all	Barnsley	8,634	8,516	0.99
Chesterfield	all	1,507	2,715	1.80	all	Chesterfield	4,315	3,781	0.88
NE Derbyshire	all	1,227	2,558	2.09	all	NE Derbyshire	4,119	3,704	0.90
Bolsover	all	575	1,911	3.32	all	Bolsover	3,565	2,802	0.79
Derbyshire Dales	all	644	1,894	2.94	all	Derbyshire Dales	2,344	2,717	1.16
Bassetlaw	all	1,405	2,968	2.11	all	Bassetlaw	4,441	4,266	0.96
External	all	1,453,154	1,410,708	0.97	all	External	2,191,017	2,083,567	0.95

PM		HBW FH (Origin Trip Ends)		Factors Applied	PM		HBW TH (Destination Trip Ends)		Factors Applied
From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD	From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD
Sheffield	all	3,469	5,722	1.65	all	Sheffield	52,402	52,977	1.01
Rotherham	all	1,195	2,693	2.25	all	Rotherham	25,765	26,333	1.02
Doncaster	all	1,948	3,432	1.76	all	Doncaster	30,610	30,377	0.99
Barnsley	all	1,204	2,739	2.27	all	Barnsley	20,277	24,461	1.21
Chesterfield	all	651	1,328	2.04	all	Chesterfield	11,750	10,798	0.92
NE Derbyshire	all	368	1,023	2.78	all	NE Derbyshire	10,926	10,806	0.99
Bolsover	all	222	807	3.64	all	Bolsover	8,239	8,154	0.99
Derbyshire Dales	all	243	696	2.86	all	Derbyshire Dales	7,638	8,059	1.06
Bassetlaw	all	557	1,280	2.30	all	Bassetlaw	11,394	12,397	1.09
External	all	577,086	618,394	1.07	all	External	6,653,453	6,077,880	0.91

OP		HBW FH (Origin Trip Ends)		Factors Applied	OP		HBW TH (Destination Trip Ends)		Factor Calculation
From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD	From	To	MPD Post TLD Adjust	Synthetic SCR	Synthetic SCR/MPD
Sheffield	all	17,507	15,921	0.91	all	Sheffield	17,170	17,837	1.04
Rotherham	all	9,750	7,495	0.77	all	Rotherham	8,104	8,767	1.08
Doncaster	all	13,274	9,364	0.71	all	Doncaster	10,294	10,455	1.02
Barnsley	all	8,340	7,373	0.88	all	Barnsley	6,942	8,374	1.21
Chesterfield	all	4,099	3,322	0.81	all	Chesterfield	3,484	3,779	1.08
NE Derbyshire	all	3,712	3,008	0.81	all	NE Derbyshire	3,269	3,579	1.09
Bolsover	all	3,224	2,311	0.72	all	Bolsover	2,808	2,715	0.97
Derbyshire Dales	all	2,098	2,040	0.97	all	Derbyshire Dales	2,110	2,609	1.24
Bassetlaw	all	4,336	3,526	0.81	all	Bassetlaw	3,743	4,164	1.11
External	all	1,926,291	1,721,375	0.89	all	External	2,159,776	2,021,036	0.94

It is inferred from Table 103 that, as far as the main commuting flows are concerned; namely the HBW “from home” trips in the AM and the HBW “to home” trips in the PM, MPD origin and destination trip ends respectively seem to be close enough to the SCR Synthetic trip ends, as the difference amongst them is, across all SCR districts, within plus/minus 10%. This is quite important as approximately 70% of commuting “from home” trips on an average weekday occur in the AM peak period, whereas 60% of work related “to home” trips occur in the PM.

Meanwhile, it is remarked that the Mobile Phone matrices are lacking counter-peak flow trips; HBW “to home” trips in the AM peak period and HBW “from home” trips in the PM period appear to be significantly understated in Mobile Phone Data compared against the SCR Synthetic trip ends. Although only a 3% of the daily commuting “from home” trips occur in the PM and a 2% of HBW “to home” trips occur in the AM, it is important to fix the tidality issue identified in our model. Interpeak commuting “from home” trips also seem to be underrepresented in the adjusted MPD matrix.

Hence, a set of factors were applied to MPD commuting trips to adjust them to the SCR Synthetic trip ends estimates. The factors were calculated based on the ratio of the SCR Synthetic to MPD trip ends by time period at a production level; namely by origin for home based work “from home” trips and by destination for home based work “to home” trips.

The factors were applied at a district level for all trips produced within Sheffield City Region. For reasons of consistency and matrix symmetry, factors were also applied on trips produced outside of the model’s area of focus. Table 103 shows in detail all the factors applied by production, direction of travel and time period.

In reference to the main commuting flows, apart from Barnsley where the highest factor was applied in both cases (1.3 for HBW FH AM and 1.2 for HBW TH PM), the factors applied to the rest of the SCR districts were within the range of 0.9 to 1.1.

It is clear that some significant factors had to be implemented in the case of HBW “from home” trips in the IP and the PM, as well as for the HBW “to home” AM trips to correct for the lack of counter-peak demand.

“From home” commuting trips originating from Derbyshire Dales and Bassetlaw in the AM were increased by 20%, but in actual trip numbers they constitute by far the lowest commuting flows within Sheffield City Region.

Table 104 and Table 105 below summarise the total number and the percentage change in the number of trips (full matrix) as a result of adjusting MPD commuting trips to the SCR Synthetic trip ends.

Table 104: 24hr Car People trips between Districts after adjusting HBW

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	643,401	82,640	10,263	28,820	15,997	31,018	5,429	6,097	5,142	45,217	874,024
Rotherham	86,232	234,169	32,014	32,312	2,729	4,959	3,244	502	14,225	25,614	436,002
Doncaster	10,530	32,285	374,179	13,320	637	613	608	169	15,764	58,515	506,621
Barnsley	29,455	31,698	13,157	211,577	406	466	284	159	716	54,006	341,924
Chesterfield	16,194	2,634	631	427	113,719	32,195	12,004	7,041	1,536	15,345	201,725
NE Derbyshire	31,882	5,024	685	497	32,662	43,833	8,622	4,856	1,529	19,086	148,676
Bolsover	5,479	3,225	651	315	12,324	8,706	45,377	1,115	5,916	42,247	125,357
Derbyshire Dales	6,043	487	148	150	7,195	5,023	1,068	87,624	259	43,248	151,245
Bassetlaw	5,265	14,395	16,118	705	1,556	1,575	6,151	247	131,558	35,465	213,036
External	42,928	25,666	58,760	55,185	15,425	19,439	41,857	44,121	35,902	101,169,394	101,508,677
Total	877,410	432,224	506,606	343,308	202,651	147,829	124,645	151,930	212,547	101,508,138	104,507,287

Table 105: 24hr % Change in Car People trips between Districts after adjusting HBW

All Purposes 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	1.0%	1.0%	0.3%	3.3%	0.8%	1.5%	-0.3%	2.9%	1.8%	-0.7%	1.0%
Rotherham	1.9%	1.7%	0.3%	3.8%	0.5%	1.1%	-0.5%	2.4%	1.1%	-1.5%	1.5%
Doncaster	2.5%	1.5%	1.5%	3.7%	1.1%	0.8%	0.1%	4.0%	1.6%	-1.5%	1.3%
Barnsley	5.8%	4.6%	3.3%	5.2%	4.4%	3.9%	1.8%	2.6%	4.7%	1.9%	4.6%
Chesterfield	1.1%	0.1%	-0.9%	4.6%	1.3%	1.1%	-0.4%	0.8%	0.0%	-1.8%	0.9%
NE Derbyshire	2.7%	1.0%	-0.3%	3.0%	2.0%	1.9%	0.3%	1.6%	0.6%	-0.8%	1.6%
Bolsover	0.3%	0.6%	-0.2%	3.2%	3.1%	1.6%	2.3%	2.5%	1.7%	-0.2%	1.3%
Derbyshire Dales	2.8%	2.2%	2.1%	2.7%	1.7%	2.4%	0.9%	4.1%	2.7%	0.8%	2.9%
Bassetlaw	3.5%	1.8%	2.5%	4.3%	1.9%	2.0%	1.8%	3.2%	3.2%	0.1%	2.5%
External	-0.3%	0.2%	-0.6%	2.6%	-0.4%	0.5%	-1.1%	1.1%	0.3%	-1.6%	-1.6%
Total	1.3%	1.6%	1.3%	4.4%	1.4%	1.4%	0.5%	2.9%	2.3%	-1.6%	-1.5%

Overall, a 1.5% decrease is shown at a full matrix level, that is mainly driven by the slight decrease in the number of trips outside Sheffield City Region (both trip ends in the external area) that comprise that biggest part of the matrix.

Meanwhile, it is noted that the number of trips with both trip ends within Sheffield City Region increased as a result of the adjustments with the percentage change across all SCR district to district movements being within 5%.

G.1.6 Prior People Matrix Validation – Post Adjustments Verification Tests

The outcome of all the adjustments described in detail in steps 1 to 10 above was the development of the ***Prior People Matrix***. The term "***Prior***" refers to the adjusted MPD matrix, namely the output of the Matrix Development Process.

The next step involved the validation of the Prior against other reliable, secondary data sources relevant to Sheffield City Region to ensure that it is indeed appropriate for use in the context of Sheffield City Region Transport Model (SCRTM).

For that reason, a number of validation tests were undertaken to prove that: a) the adjustments implemented have actually improved the quality of the Provisional Mobile Phone Data and b) to verify the consistency of the Prior with other datasets relevant to Sheffield City Region.

Most of the validation tests had been previously conducted on the Provisional Mobile Phone Data at an MSOA level and are thoroughly reported in the *Mobile Phone Data Verification report*.

Prior People Matrices were used instead of vehicle matrices as the tests were conducted at a demand segment, trip purpose level disaggregated to home based and non-home based trips and direction of travel.

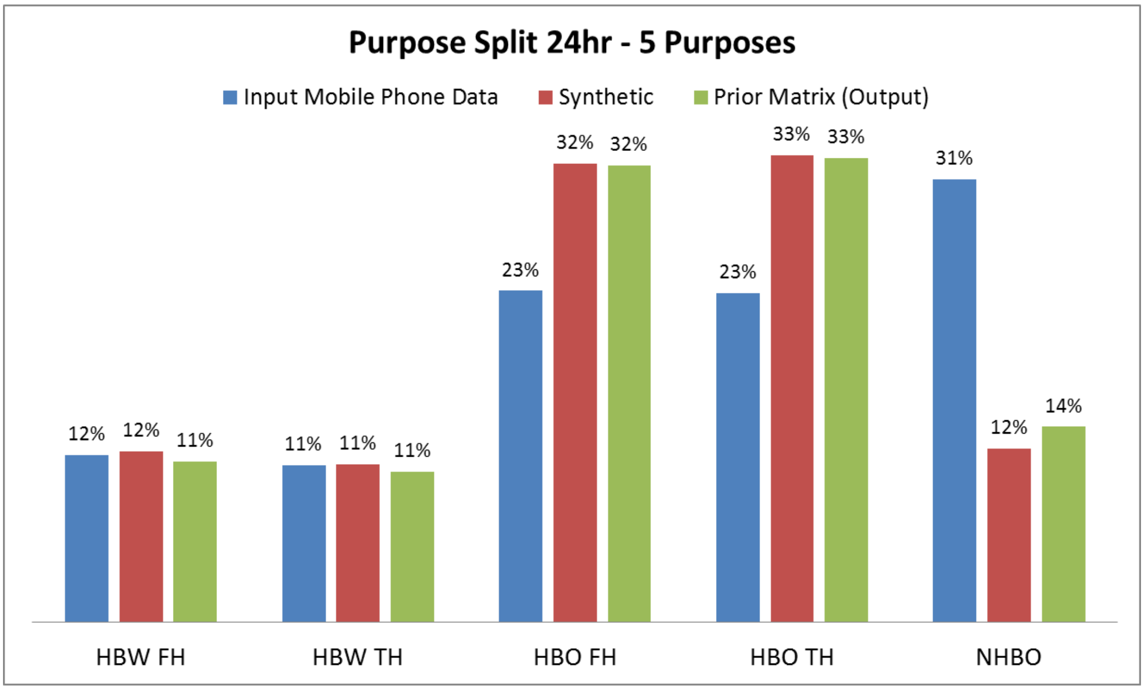
This section discusses the main findings and results of the validation tests performed.

Purpose Split; 24hr Prior People Matrix against SCR Synthetic Data:

This validation test compares the purpose split of the 24hr Prior Matrix against that of the Provisional Mobile Phone Data and the SCR Synthetic car trip matrices.

Figure 145 below shows the split of all day demand across three trip purposes (by direction of travel) for: i) the Provisional Mobile Phone Data, ii) the Prior Matrix and iii) the SCR Synthetic Car Matrix.

Figure 145. Adjustment impact on 24hr Purpose Split, by direction of travel



The graph depicts the significant change in purpose split between the original Provisional Mobile Phone Data and the final, Prior Matrix after all the adjustments undertaken as part of the Matrix Development Process.

A significant reduction is observed in non-home based trips, as their share has dropped by 17 percentage points, a fact mainly attributed to the removal of freight trips and the trip length adjustments undertaken.

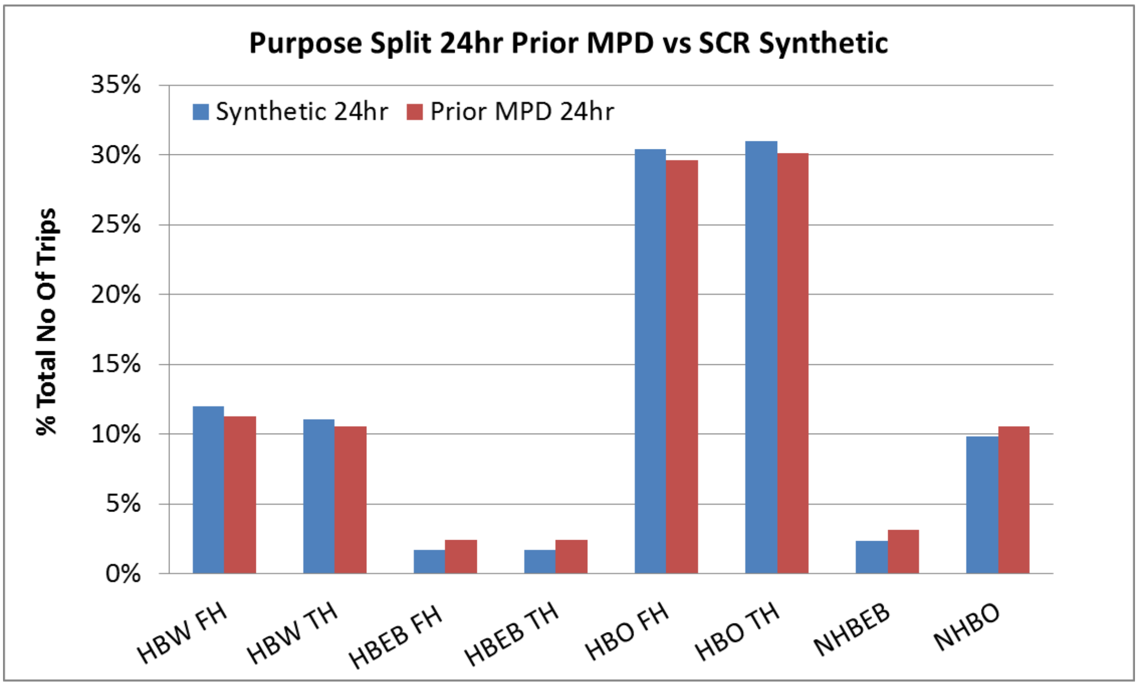
The split of HBO trips has increased by about 10% in both directions of travel (outbound, inbound), as a result of infilling short distance and intra-zonal trips from the Synthetic matrix, because of the short distance nature of this travel purpose. The purpose share of HBO trips appears to be spot on, as it is absolutely consistent with the Synthetic split.

Commuting is the only trip purpose with approximately the same split in the Provisional (input MPD matrix) and the Prior Matrices (output) although a number of adjustments had been applied to that specific journey category: trip length adjustments, as well as adjustment to the SCR Synthetic commuting trip ends at a production, SCR district level.

It is obvious that the Prior Matrix purpose split is very similar to the SCR synthetic purpose split with a small divergence of 2% in the case of NHBO trips.

Figure 146 below compares the split across all five modelled purposes (by direction of travel) for the Prior and the Synthetic Car Matrix on an average weekday.

Figure 146. Adjustment impact on Purpose Split, by direction of travel, HBEB, NHBEB separate



It suggests that, as a result of the various adjustments, the purpose split of the Prior Mobile Phone Matrix is consistent with the Synthetic matrix split even when looking at a more disaggregate purpose level.

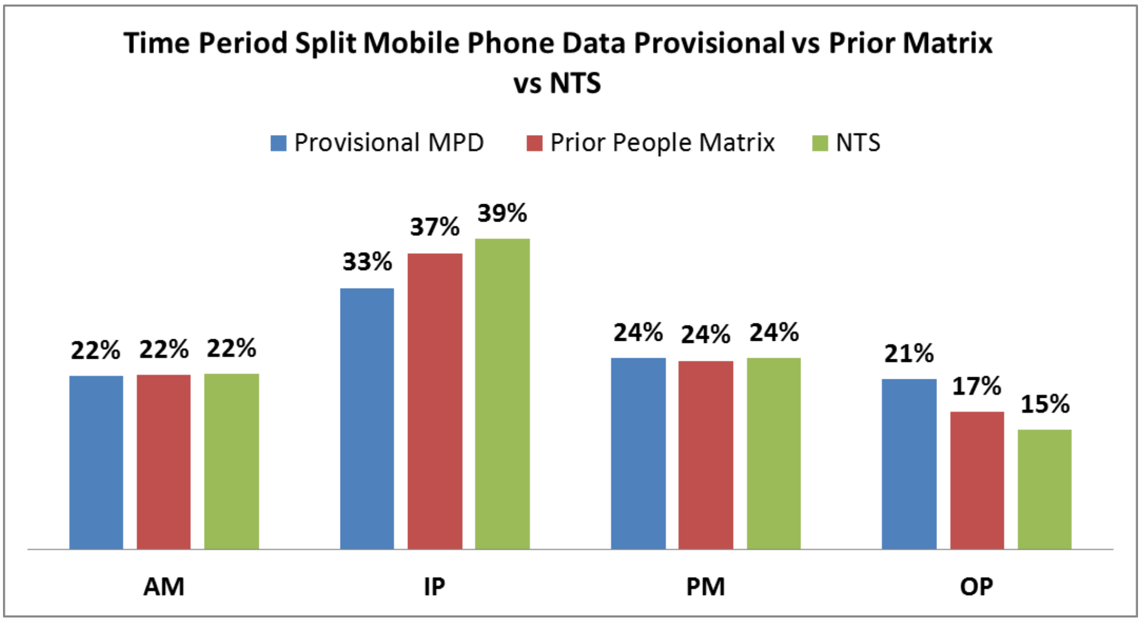
Across all trip purposes the difference amongst the adjusted Mobile Phone Data and the synthetic matrix is less than 1%.Thus, it is inferred that the purpose split of the Prior is compliant with the split of the SCR Synthetic 24hr matrices.

Time Period Split: 24hr Prior Matrix against NTS Data (2008-2015)

As the results of the Provisional MPD verification tests indicated, the off peak demand in the provisional matrices was overstated especially in the case of home based other and non-home based trips compared against NTS.

Figure 147. compares the distribution of the 24hr Prior MPD demand across the time periods of the day against the time period allocation of the Provisional MPD data and National Travel Survey Data for Yorkshire and Humber and East Midlands for the years 2008-2015.

Figure 147. Adjustment impact on Time Period Split



It is remarkable that, even without making any explicit adjustment to alter the allocation of MPD demand in the different time periods of the day, the time period split of the Prior Matrix is very close to the NTS evidence, as a result of the overall Matrix Development Process and the adjustments implemented.

The share of AM and PM peak period demand over the total all day Prior demand is identical with the time period split that NTS suggests. In particular, the morning and evening peak period count for a 22% and a 24% respectively of the total 24hr Prior demand.

The share of the Interpeak period, that was found to be rather low in the Provisional Matrices (33% against 39% in NTS), has increased by 4% as a result of the adjustments, reaching 37% of the total all day Prior demand.

On the contrary, the off peak period split, considered to be too high in the Provisional Data, was dropped by 4% post adjustments, resulting in being only 2% higher than the NTS off peak period split. This is considered a negligible difference, taking into consideration the low level of demand in the off peak and the fact that the off peak demand is not assigned onto the network.

Comparison of All Day Prior Trip Ends by SCR District with the SCR Synthetic Trip Ends by trip purpose

The Prior Matrix trip ends on an average weekday were validated by trip purpose against the SCR Synthetic trip ends as estimated by David Simmonds planning data and the SCR CTripEnd Model. **Figure 148.** to **Figure 157.** show the Prior trip ends at an all day, Origin – Destination, SCR district level compared against the respective SCR Synthetic trip ends.

The scatter plots indicate that there is a very good correlation between the Provisional Mobile Phone Data and the SCR Synthetic matrices (R squared is greater than 0.98 for all purposes) both at an origin and at a destination level.

The R squared for commuting and home based other trips is greater than 0.99. The slopes of the linear curves are between 0.95 and 1.05 for all home based purposes. Higher slopes are observed in the case of non-home based trips, as they are consistently higher than the SCR Synthetic trip ends across all SCR districts. For commuting trips, the slope of the linear regression line (almost equal to one) suggests that both sources of data have the same level of demand.

Figure 148. 24hr HBW Origins by SCR District Prior vs Synthetic

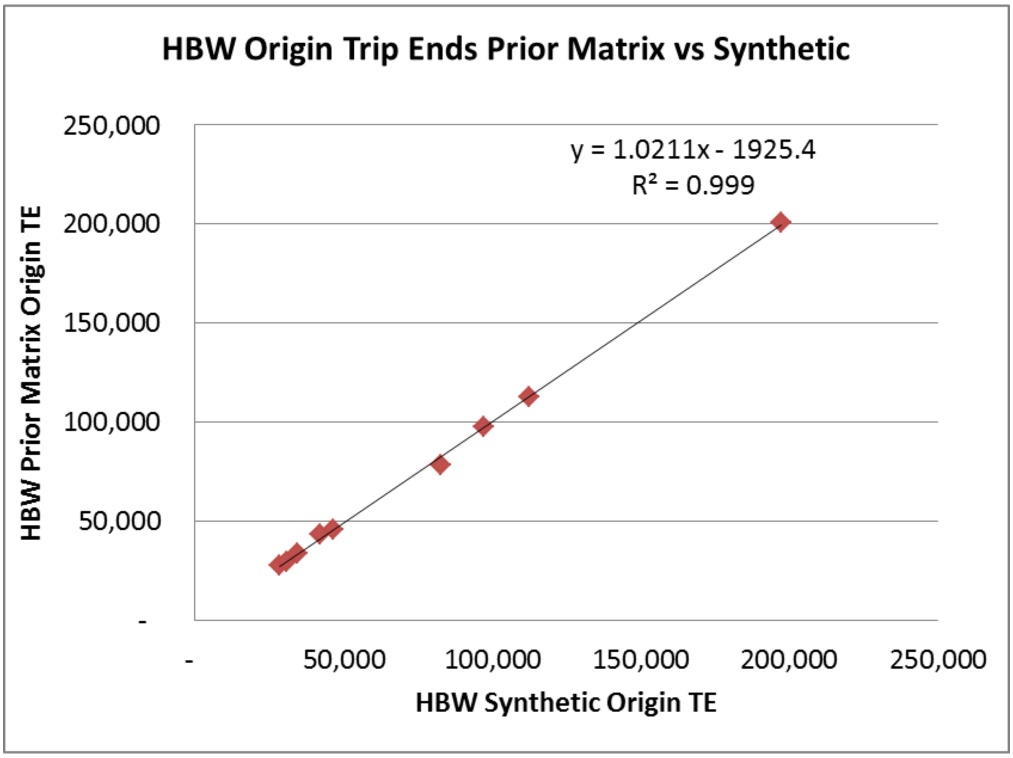


Figure 149. 24hr HBW Destinations by SCR District Prior vs Synthetic

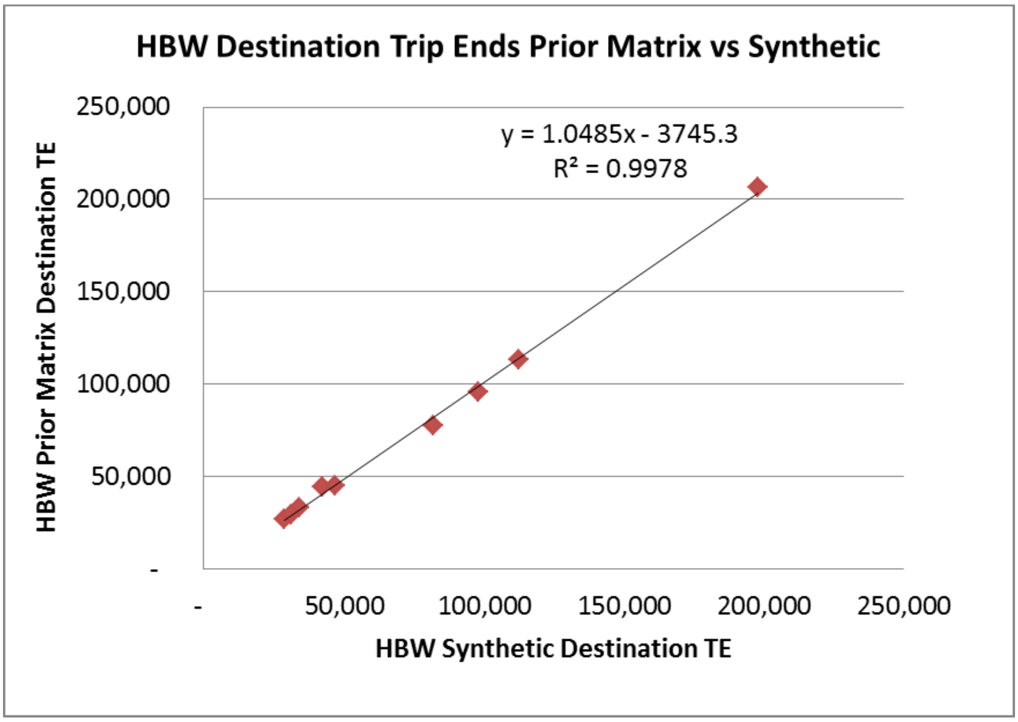


Figure 150. 24hr HBEB Origins by SCR District Prior vs Synthetic

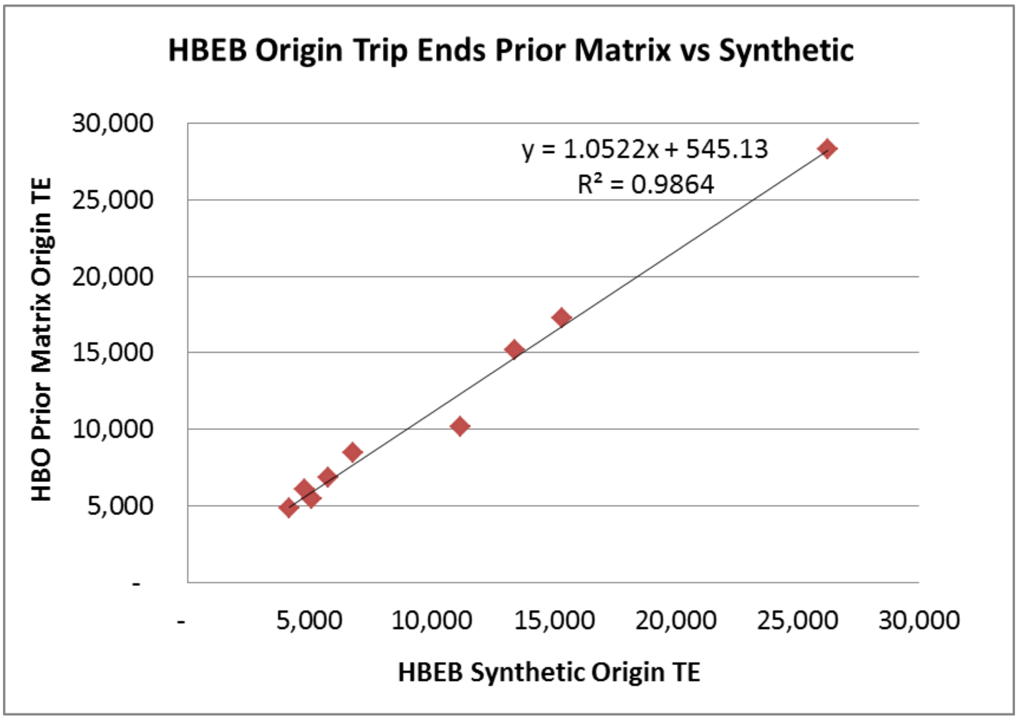


Figure 151. 24hr HBEB Destinations by SCR District Prior vs Synthetic

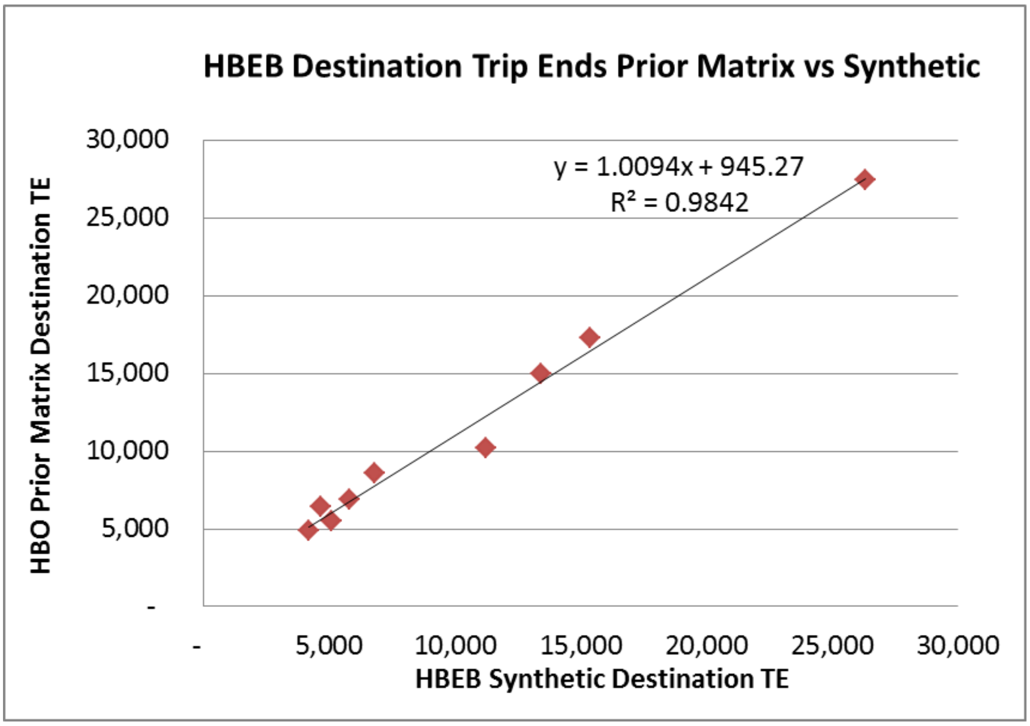


Figure 152. 24hr HBO Origins by SCR District Prior vs Synthetic

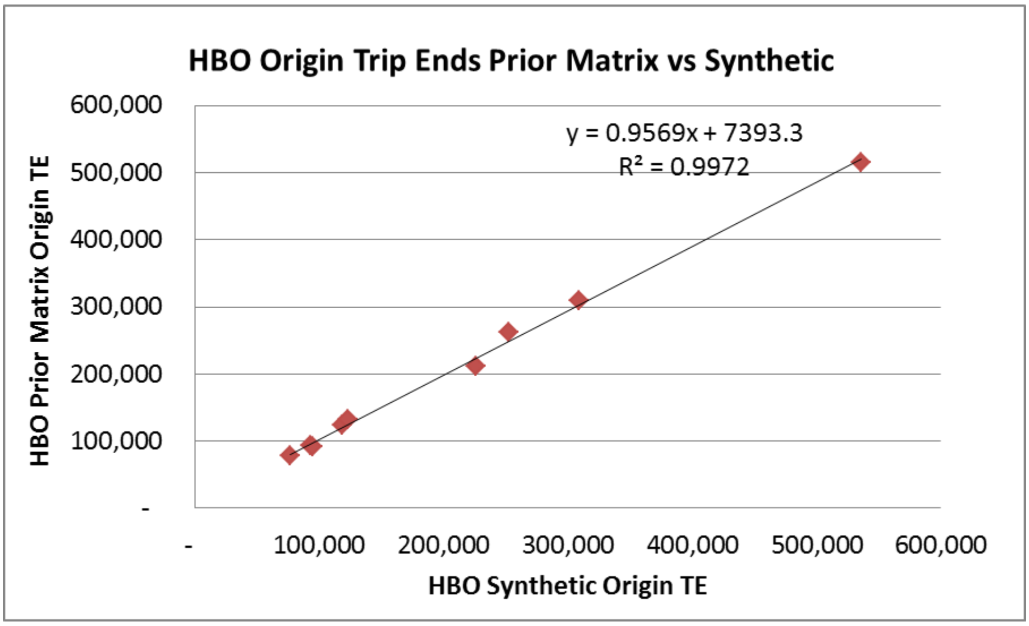


Figure 153. 24hr HBO Destinations by SCR District Prior vs Synthetic

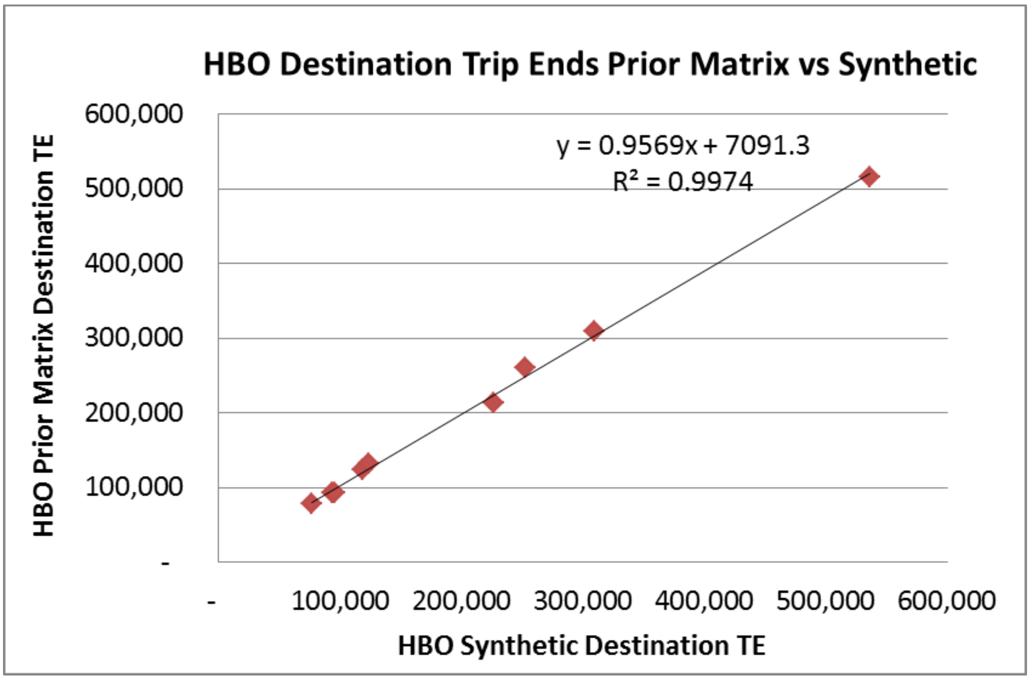


Figure 154. 24hr NHBEB Origins by SCR District Prior vs Synthetic

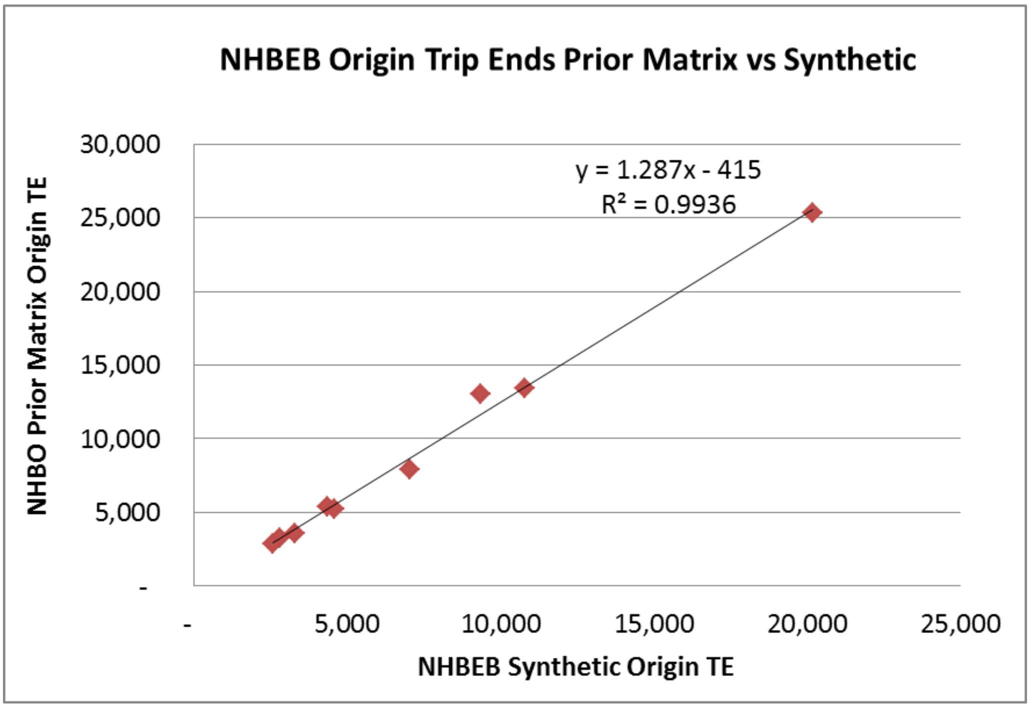


Figure 155. 24hr NHBEB Destinations by SCR District Prior vs Synthetic

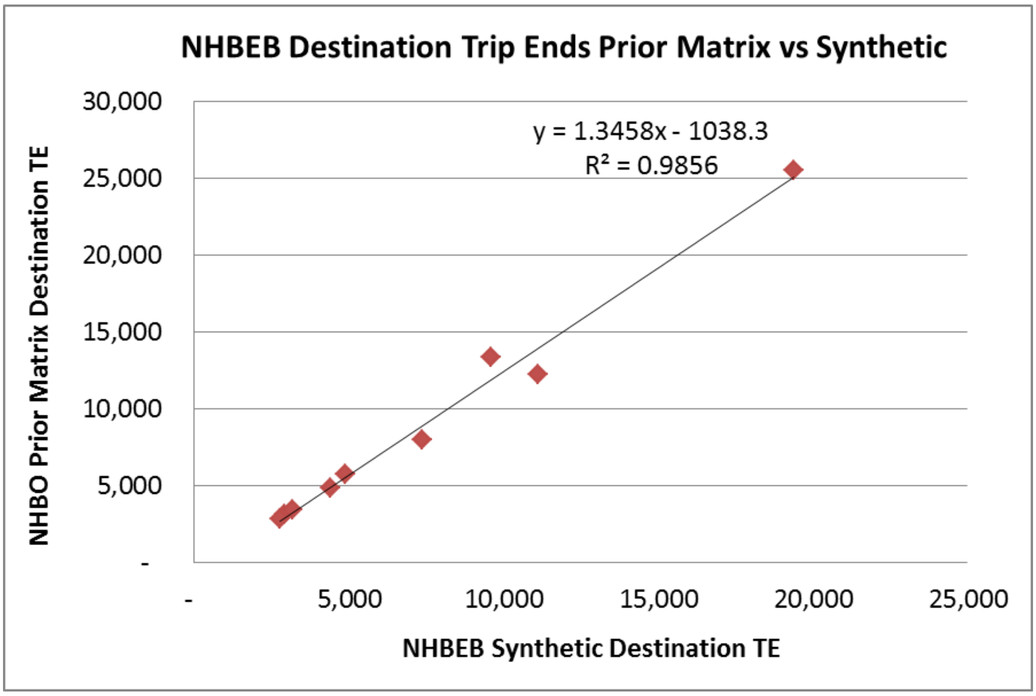


Figure 156. 24hr NHBO Origins by SCR District Prior vs Synthetic

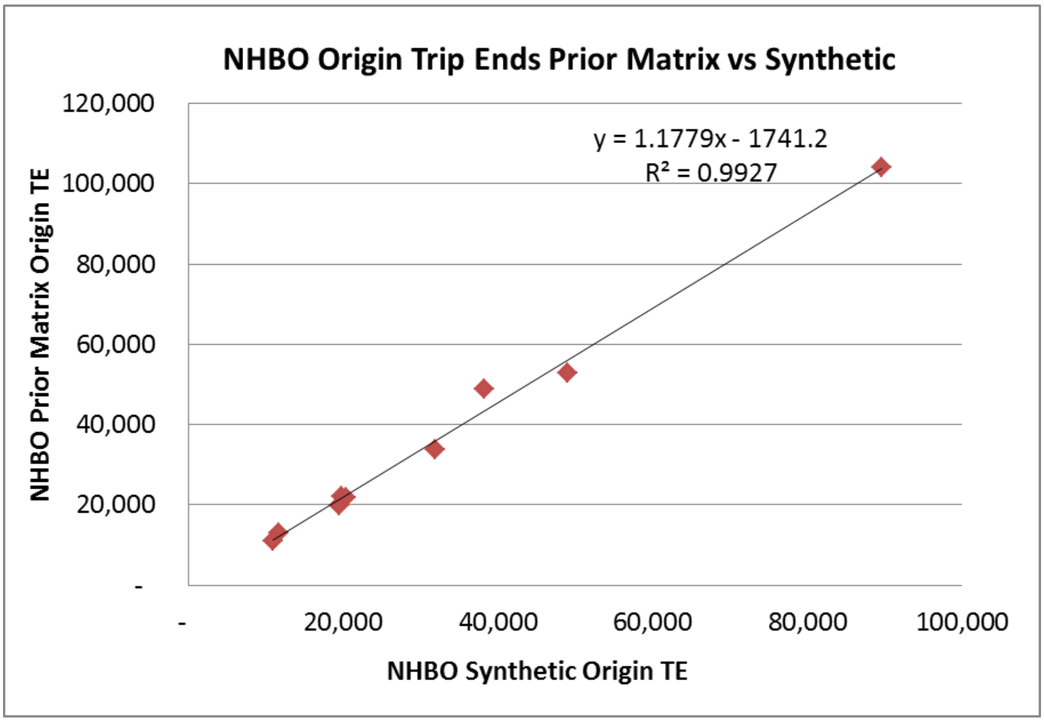


Figure 157. 24hr NHBO Destinations by SCR District Prior vs Synthetic

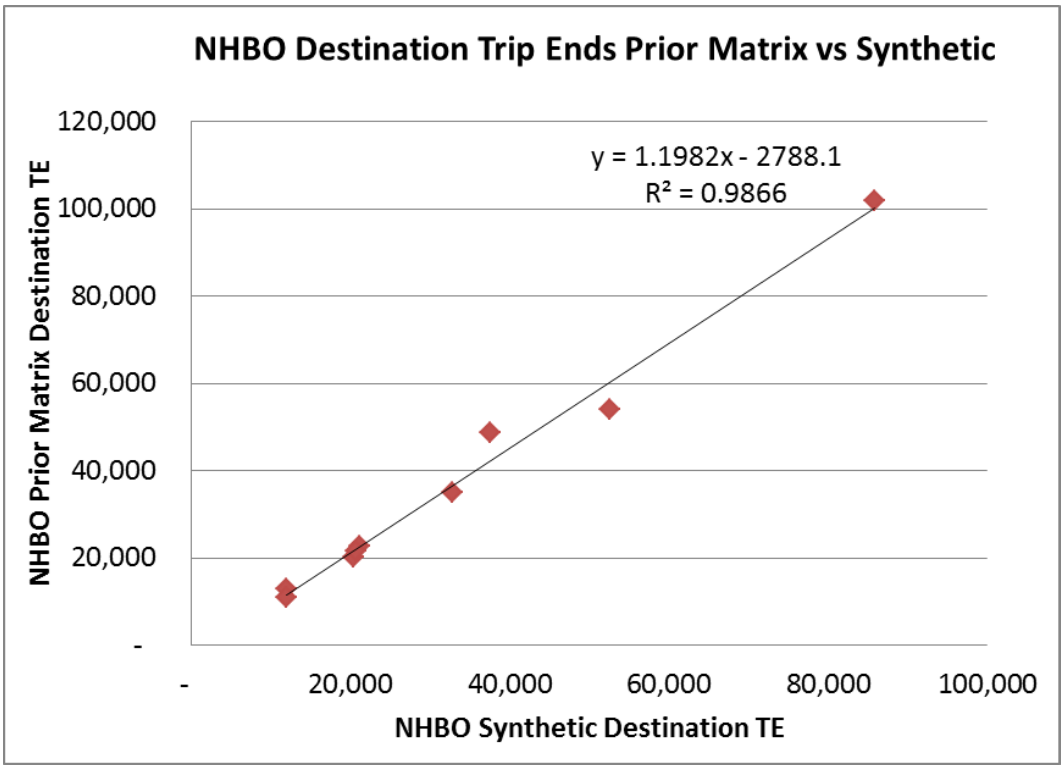


Table 95 compares the Prior with the SCR Synthetic OD trip ends by SCR internal district on an average weekday. Total SCR Origin and Destination trip ends across all internal districts are also presented; as well OD trip ends from/ to the rest of the country outside Sheffield City Region.

As inferred from the table, commuting and home based other trips are the two categories that perform best in comparisons against the synthetic data. The total number of the Prior HBW and HBO Origin trip ends across all internal SCR districts differ by less than 0.7% from the Synthetic Matrix. This is noteworthy as the two trip purposes together count for 82% of total Prior demand.

In reference to HBEB trips, the total number of Prior SCR Origin and Destination trip ends at a 24hr level is 10% higher than the respective Synthetic trip ends. NHBEB trip ends derived from the Prior differ by about 20% from the Synthetic, whereas NHBO trips are higher by roughly 11% compared against the Synthetic.

The 20% difference of the NHBEB trip ends from the Synthetic is remarkable but it only affects a 3% of total number of trips. The same applies to the HBEB category that counts for a 4% of total number of trips.

In the case of NHBO trips, it should be noted that freight has already been removed and that the trip length adjustments have further decreased the number of NHBO trips by 8%.

Meanwhile, rather than just independently examine these results, it is key to consider the changes brought about in MPD trip ends as a result of the Matrix Build adjustments.

To be more specific, before the trip length adjustments, the MPD trip ends compared against the synthetic were as described below:

- Commuting Origin and Destination trip ends 14% lower
- Home Based Employer's Business OD trip ends about 23% higher
- Home Based Other trip ends as good as in the Prior as no TLD adjustments were applied
- Non Home Based Employers Business trips roughly 50% higher
- Non Home Based Other trips about 22% higher

The difference in these numbers reflects the impact of solely the trip length adjustments for all trip purposes apart from commuting.

For work related trips, the difference is attributed to the combined effect of the trip length adjustments and the adjustment to Synthetic SCR trip ends. In particular, post TLD adjustments, the HBW MPD SCR OD trip ends increased by 6%, and then, as a result of the trip end adjustments, they further increased by 8% to finally reach the SCR Synthetic trip ends.

Table 106: 24hr Comparison in Trip Totals between Prior and Synthetic by Purpose and District

HBW		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	200,880	197,436	1.02
Rotherham	all	97,405	97,284	1.00
Doncaster	all	112,971	112,535	1.00
Barnsley	all	78,054	82,629	0.94
Chesterfield	all	43,150	42,190	1.02
NE Derbyshire	all	33,898	34,403	0.99
Bolsover	all	27,766	28,558	0.97
Derbyshire Dales	all	29,501	31,071	0.95
Bassetlaw	all	45,978	46,631	0.99
External	all	22,127,701	22,063,111	1.00
Total Internal Origins	all	669,601	672,738	1.00

HBW		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	206,791	197,720	1.05
all	Rotherham	95,422	97,953	0.97
all	Doncaster	113,016	112,593	1.00
all	Barnsley	77,665	81,987	0.95
all	Chesterfield	44,066	42,235	1.04
all	NE Derbyshire	33,374	34,070	0.98
all	Bolsover	27,107	28,565	0.95
all	Derbyshire Dales	29,442	31,059	0.95
all	Bassetlaw	45,149	46,901	0.96
all	External	22,125,270	22,062,770	1.00
All	All Internal Destinations	672,033	673,083	1.00

HBEB		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	28,282	26,275	1.08
Rotherham	all	15,225	13,433	1.13
Doncaster	all	17,272	15,391	1.12
Barnsley	all	10,156	11,202	0.91
Chesterfield	all	6,867	5,784	1.19
NE Derbyshire	all	5,503	5,129	1.07
Bolsover	all	4,877	4,164	1.17
Derbyshire Dales	all	6,079	4,793	1.27
Bassetlaw	all	8,475	6,803	1.25
External	all	4,879,083	3,260,678	1.50
Total Internal Origins	all	102,735	92,973	1.10

HBEB		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	27,463	26,316	1.04
all	Rotherham	14,966	13,442	1.11
all	Doncaster	17,285	15,356	1.13
all	Barnsley	10,179	11,209	0.91
all	Chesterfield	6,915	5,798	1.19
all	NE Derbyshire	5,476	5,095	1.07
all	Bolsover	4,908	4,161	1.18
all	Derbyshire Dales	6,445	4,665	1.38
all	Bassetlaw	8,568	6,785	1.26
all	External	4,879,614	3,260,825	1.50
All	All Internal Destinations	102,205	92,826	1.10

HBO		Prior vs Synthetic OrigTrip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	515,357	535,935	0.96
Rotherham	all	261,412	252,685	1.03
Doncaster	all	310,161	309,320	1.00
Barnsley	all	211,998	226,073	0.94
Chesterfield	all	124,202	118,758	1.05
NE Derbyshire	all	93,108	93,186	1.00
Bolsover	all	78,710	76,708	1.03
Derbyshire Dales	all	92,270	95,088	0.97
Bassetlaw	all	131,674	123,599	1.07
External	all	60,602,918	58,809,046	1.03
Total Internal Origins	all	1,818,892	1,831,351	0.99

HBO		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	515,773	536,288	0.96
all	Rotherham	259,805	252,203	1.03
all	Doncaster	309,901	309,438	1.00
all	Barnsley	212,382	226,744	0.94
all	Chesterfield	124,053	118,805	1.04
all	NE Derbyshire	92,748	93,531	0.99
all	Bolsover	78,876	76,654	1.03
all	Derbyshire Dales	92,367	95,400	0.97
all	Bassetlaw	131,380	123,419	1.06
all	External	60,604,520	58,807,928	1.03
All	All Internal Destinations	1,817,286	1,832,481	0.99

NHBEB		Prior vs Synthetic Orig Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	25,318	20,213	1.25
Rotherham	all	13,004	9,356	1.39
Doncaster	all	13,424	10,805	1.24
Barnsley	all	7,880	7,041	1.12
Chesterfield	all	5,405	4,370	1.24
NE Derbyshire	all	3,283	2,797	1.17
Bolsover	all	2,872	2,583	1.11
Derbyshire Dales	all	3,616	3,296	1.10
Bassetlaw	all	5,204	4,605	1.13
External	all	3,182,286	2,234,701	1.42
Total Internal Origins	all	80,005	65,065	1.23

NHBEB		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	25,504	19,370	1.32
all	Rotherham	13,331	9,572	1.39
all	Doncaster	12,210	11,108	1.10
all	Barnsley	7,988	7,381	1.08
all	Chesterfield	4,853	4,397	1.10
all	NE Derbyshire	3,115	2,918	1.07
all	Bolsover	2,781	2,754	1.01
all	Derbyshire Dales	3,399	3,164	1.07
all	Bassetlaw	5,698	4,889	1.17
all	External	3,183,413	2,234,212	1.42
All	All Internal Destinations	78,878	65,554	1.20

NHBO		Prior vs Synthetic Orig Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
Sheffield	all	104,193	89,677	1.16
Rotherham	all	48,956	38,219	1.28
Doncaster	all	52,794	49,061	1.08
Barnsley	all	33,836	31,941	1.06
Chesterfield	all	22,101	19,740	1.12
NE Derbyshire	all	12,884	11,726	1.10
Bolsover	all	11,132	10,966	1.02
Derbyshire Dales	all	19,779	19,503	1.01
Bassetlaw	all	21,705	20,416	1.06
External	all	**10,719,225**	**9,405,762**	1.14
Total Internal Origins	all	327,380	291,251	1.12

NHBO		Prior vs Synthetic Dest Trip Ends By District 24hr		
From	To	Prior	Synthetic SCR TE	Prior/Synthetic SCR
all	Sheffield	101,885	85,928	1.19
all	Rotherham	48,699	37,595	1.30
all	Doncaster	54,194	52,667	1.03
all	Barnsley	35,095	32,839	1.07
all	Chesterfield	22,763	21,151	1.08
all	NE Derbyshire	13,115	12,033	1.09
all	Bolsover	10,973	11,964	0.92
all	Derbyshire Dales	20,277	20,388	0.99
all	Bassetlaw	21,752	20,758	1.05
all	External	10,717,853	9,401,689	1.14
All	All Internal Destinations	328,753	295,323	1.11

Therefore, it is concluded that, overall, post adjustments, the differences have been more than halved and the mobile phone data matrices have been significantly improved. Further reduction of Prior matrix trips could not be justified as we would then risk removing too many trips from our matrices.

Overall, the total number of SCR all-day origin trip ends across all trip purposes is only 1.5% higher compared to the SCR Synthetic data. A similar difference (about 1.3%) is also observed in the destination trip ends.

Trip Length Distribution Profile of the 24hr Prior People Matrices

Step 9 above presented the trip length distribution profiles, as well as the average trip length in kms for the 24hr Mobile Phone Data matrices post TLD adjustments by trip purpose.

For all trip purposes apart from commuting, the trip length adjustments were the final step of the Prior People Matrices development process and thus, the trip length profiles for home and non-home based employers business and other trips are the ones shown in Step 9, **Figure 141.** to **Figure 144.**.

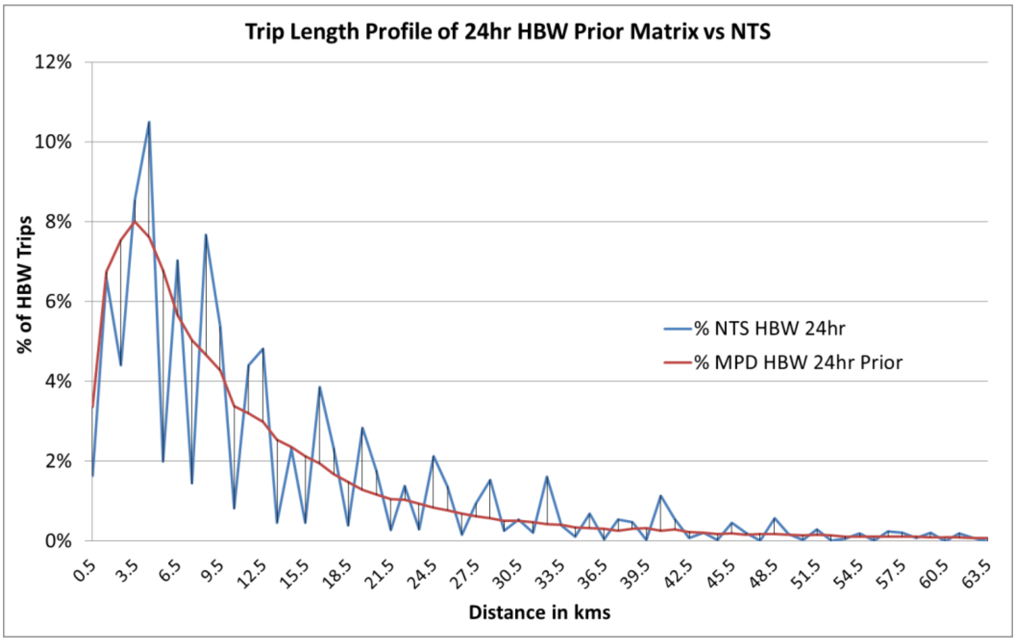
However, commuting trip ends were adjusted to the SCR Synthetic trip ends at a production level following the TLD adjustments.

Figure 158 below shows the trip length profile of the Prior 24hr Commuting trips compared against the National Travel Survey Data for Yorkshire and Humber and East Midlands for the years 2008 to 2015. The figure suggests that the number of short to medium distance commuting trips has slightly increased as result of the trip end adjustments.

It is clear that the trip length profile of the prior commuting trips is consistent with the relevant NTS trip length distribution.

Overall, as a result of the trip end adjustments, commuting trips originating in Sheffield City Region increased in total by 8.4%.

Figure 158. 24hr HBW Trip Length Profile of the Prior Matrix vs NTS Data (SCR Productions)



14.4.1 Inter-District Symmetry of the Prior MPD Matrix (Total People Demand – 24hrs)

A symmetry test was also undertaken as part of the Prior Matrix Validation, to examine the relation between the Prior Matrix all day outbound and inbound trips at a district level and to verify the symmetry of the Prior Matrix. The test was undertaken by calculating the percentage difference between outbound and inbound trips for each district to district combination in the Internal Area.

Table 107 below presents the results of the symmetry test. The percentages depicted represent the percentage difference of each outbound district to district movement from the average of the specific outbound and the symmetric inbound movement.

The Prior Matrix appears to be satisfactorily symmetric, as no outbound district to district movement differs more than 6% than the respective symmetric inbound one. The symmetry is quite good for movements between the internal districts and the external area as no difference greater than 3% was observed.

Table 107: Inter-District Symmetry for Prior MPD 24hr People Trips

24hr Prior Matrix Symmetry	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External
Sheffield		-2%	-1%	-1%	-1%	-1%	0%	0%	-1%	3%
Rotherham			0%	1%	2%	-1%	0%	2%	-1%	0%
Doncaster				1%	1%	-5%	-3%	6%	-1%	0%
Barnsley					-3%	-3%	-5%	3%	1%	-1%
Chesterfield						-1%	-1%	-1%	-1%	0%
NE Derbyshire							0%	-2%	-1%	-1%
Bolsover								2%	-2%	0%
Derbyshire Dales									2%	-1%
Bassetlaw										-1%
External										

G.1.7 Conversion from Prior People to Vehicle Assignment Matrices

Step 12: Conversion of Adjusted Mobile Phone Data from People to Vehicle Matrices

The Provisional Mobile Phone Data received from Telefonica represented people trips and thus, all the adjustments mentioned above as part of the Matrix Development Process are implemented on people matrices. However, conversion of people to actual vehicle trip matrices is necessary so that the modelled demand can be assigned onto the highway network.

For that purpose, National Travel Survey (NTS) Household Data relevant to Sheffield City Region (Yorkshire and Humber and East Midlands) were extracted by purpose of travel (HBW, HBEB, HBO, NHBEB, NHBO) and distance band (for every 1 km) separately for drivers and passengers.

For each distance band and journey purpose, total number of NTS driver and passenger trips were calculated. Adding passenger trips to driver trips and dividing the sum by the number of driver trips, provided an occupancy factor by distance band for each purpose. These data were sequentially used to develop continuous linear functions, where for each journey purpose occupancy (number of people per vehicle) is dependent on the distance travelled in kms.

In the case of Employer's Business trips, both home and non-home based, not much variation of occupancy with the distance travelled was observed. For that reason, a demand weighted average of occupancy was calculated by the relevant NTS Data and applied to Prior People matrices. For HBEB the weighted average occupancy was estimated to be equal to 1.10 people per vehicle, while for non-home based trips of the same user class a slightly lower occupancy of 1.08 was calculated.

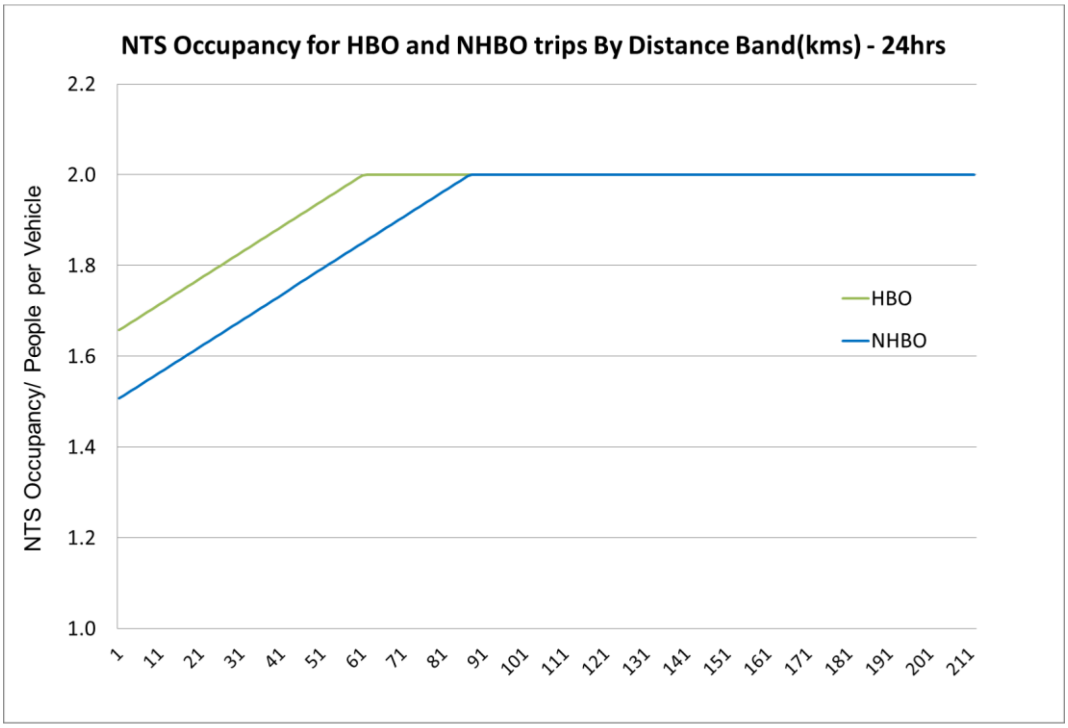
For HBW trips, the occupancy range was found to be between 1 to 1.2 people per vehicle with the occupancy value decreasing as the distance travelled increases. Our approach was that, although there is some variation of occupancy with distance for commuting trips, it is not that significant to necessitate the use of a linear function and therefore, the weighted average occupancy as derived from NTS data (1.17 persons per vehicle) would be adequate.

However, it was considered more appropriate to introduce an element of variation of commuting occupancy with the time of the day and thus, the recommended WebTAG vehicle occupancies at a time period level were used instead(*TAG Unit 3.5.6 Values of Time and Vehicle Operating Costs, Section 2.5, Table 4).* The occupancy values applied to commuting trips were the following: a fixed occupancy factor of 1.16 for the AM period, 1.14 for the IP and PM peak period and 1.13 for the off peak.

For home and non-home based other trips, a significant fluctuation of occupancy with distance was remarked and hence, instead of applying a single occupancy factor, an occupancy function that varies with distance was used.

Figure 159 shows occupancy as a linear function of distance for HBO and NHBO trips based on National Travel Survey Data (NTS). The range of observed occupancies for HBO trips is between 1.5 to 2 persons per vehicle, while for NHBO trips it appears to be between 1.65 to 2.00 people per vehicle. It is remarkable that the occupancy value reaches a maximum of 2 peoples per vehicle for trip lengths above 60 and 87 kms for HBO and NHBO trips respectively.

Figure 159. Distance based occupancy function used for HBO and NHBO trips (NTS data)



Hence, the following linear distance-based occupancy functions were applied to home and non-home based other trips to convert the Prior Phone People to Vehicle matrices :

i ***Home-Based Other trips***:

7. Occupancy (OD matrix) = 1.666 + 0.00414 * "Distance"

ii ***Non-Home Based Other trips***:

8. Occupancy (OD matrix) = 1.510 + 0.00569 * "Distance”

The two functions above were applied to home and non-home based trips up to 40 kms. For longer trips, a fixed occupancy was calculated, equivalent to the occupancy value in the distance of 40kms (cap), as derived from the linear functions for home and non-home based trips respectively. The reason for capping off at 40kms was that there were too few NTS observations in distance bands greater than 40kms.

The output of the process was the generation of an Origin Destination (OD) Occupancy Matrix based on the skimmed distance of each OD Zone Pair.

Step 13: MGV Assignment User Class

As discussed earlier in this report, the freight demand in Sheffield City Region Transport Model was derived from the factored freight matrices of Highway’s England TransPennine Regional Model.

However, the OGV user class in the TPS model includes both MGV and HGV trips while in our case, MGVs should form a separate assignment class. Thus, the OGV TPS matrix has to be further split into the two different vehicle types/user classes.

The type of vehicle classified as MGV in SCRTM is a rigid commercial vehicle of the OGV1 category with two axles, twin rear wheels and with reflective plate that weighs more than 3.5 tonnes but less than 7.5 tonnes. HGV is defined as a rigid vehicle with 3 axles that weigh more than 7.5 tonnes.

To estimate the proportion of MGV over OGV trips, observed data/evidence was required. Traffic data were available from Manual Classified Counts (MCCs) that were undertaken in the model's internal area (Sheffield City Region). According to the count data, the proportion of MGV traffic over the total OGV traffic for Sheffield City Region is, on average, equal to 25% in the morning peak period, 24% in the Interpeak and 19% during the evening peak period.

The MGV over OGV traffic split derived from MCC count data was also validated against DfT statistics for "*Heavy goods vehicle traffic by axle configuration and road category in Great Britain, 2016*" (*Table TRA3105*). According to that source of data, rigid vehicles with 2 axles comprise about 32% of total OGV vehicle-kms across all road types for the whole of Great Britain, a percentage close enough to the split that the MCC counts suggest for Sheffield City Region.

To convert the proportion of MGV traffic to actual number of MGV trips, total OGV vehicle-kms were calculated from the model matrices. Then, the total number of MGV vehicle-kms was calculated by multiplying the total TPS OGV vehicle-kms with the relevant proportion of MGV over OGV traffic.

Using the above number of total MGV vehicle-kms as a constraint, a calibration process was developed to generate a smooth trip length distribution for MGV trips. It was assumed that the trip length profile of MGV trips is similar to the LGV trip length profile but also includes some longer distance trips. The average MGV trip length is expected to be higher than the LGV but lower than the average HGV trip length.

Overall, the process was largely based on the assumption that MGV trips originating in Sheffield City Region broadly follow the trip length profile of the LGV trips, while satisfying at the same time the following constraints:

i) the level of MGV demand by distance band cannot be greater than the relevant number of total TPS OGV trips;

ii) the total MGV vehicle-kms by time period should be equal to the product of total OGV vehicle-kms and the average proportion of MGV over OGV traffic, as estimated by MCC count data.

The LGV curve was shifted gradually via a single adjustment factor towards longer trips, until it was possible that these two constraints were satisfied; this occurred when MGV average trip length was roughly twice that of LGV.

A number of MGV trips are still expected in longer distance bands, as well as a number of HGV trips in the short distance bands.

The output of the process was the calculation of a smooth MGV proportion curve across distance separately for each time period, where the MGV demand % for each Origin Destination Zone pair is described by a power function of the distance between these zones (trip length).

Thus, the Mobile Phone Data MGV OD matrix was generated by applying this power function of distance to the OGV user class. The remaining TPS OGV demand was assigned to the HGV user class.

The MGV curve was calculated based only on freight trips that are generated in Sheffield City Region, as the process makes use of the LGV trip length distribution for internal productions only. However, it was applied also to inbound trips that have as destination Sheffield City Region, as they are expected to have a similar trip length profile with the outbound trips originating from Sheffield City Region.

For external to external trips, that have a completely different trip length distribution compared to the rest of the matrix, the average proportion of MGV over OGV traffic was used to split the total external OGV demand to MGV and HGV trips.

It should be mentioned that the PCU factor applied to MGV trips was 1.5, whilst 2.3 was used for HGV trips.

Figure 160. to *Figure 162.* show the trip length distributions of all three freight user classes (LGV, MGV, OGV) by time period only for trips that originate in the internal area.

Figure 160. AM Peak TLD of LGV, MGV and HGV (Internal Productions, Distance in kms)

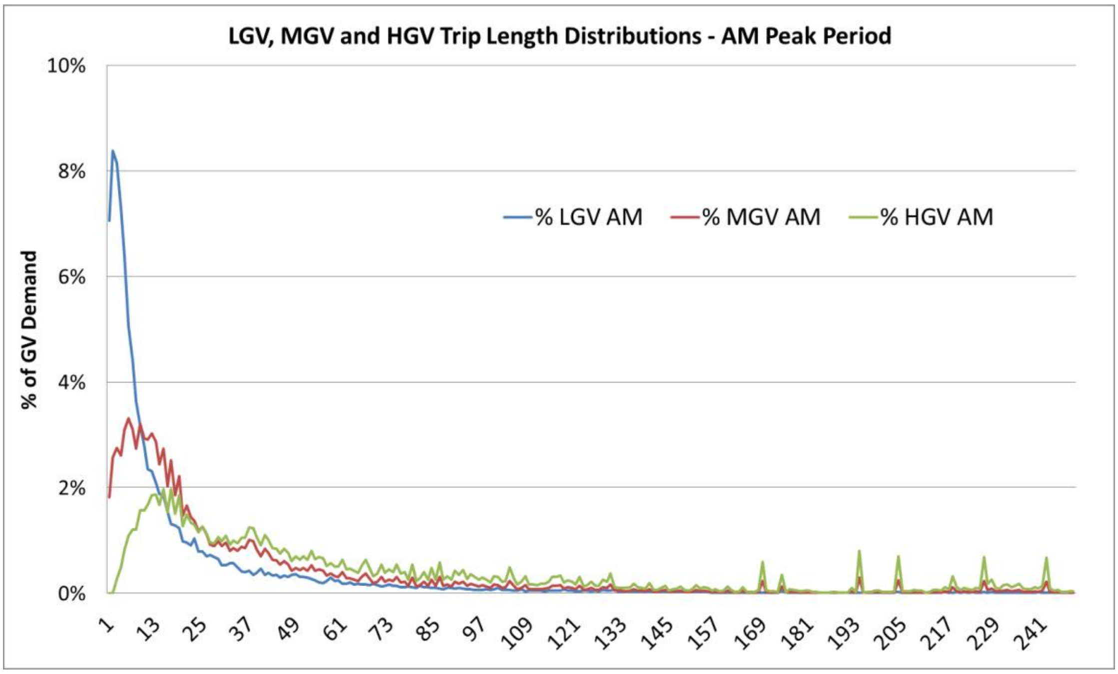


Figure 161. IP TLD of LGV, MGV and HGV (Internal Productions, Distance in kms)

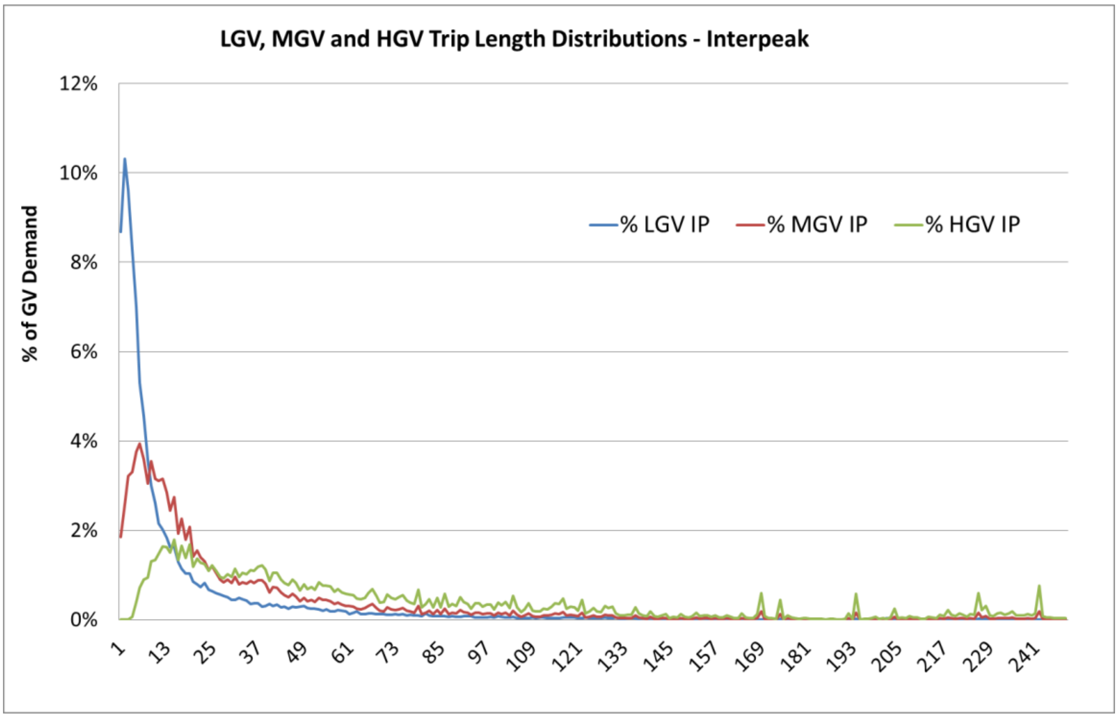


Figure 162. PM Peak TLD of LGV, MGV and HGV (Internal Productions, Distance in kms)

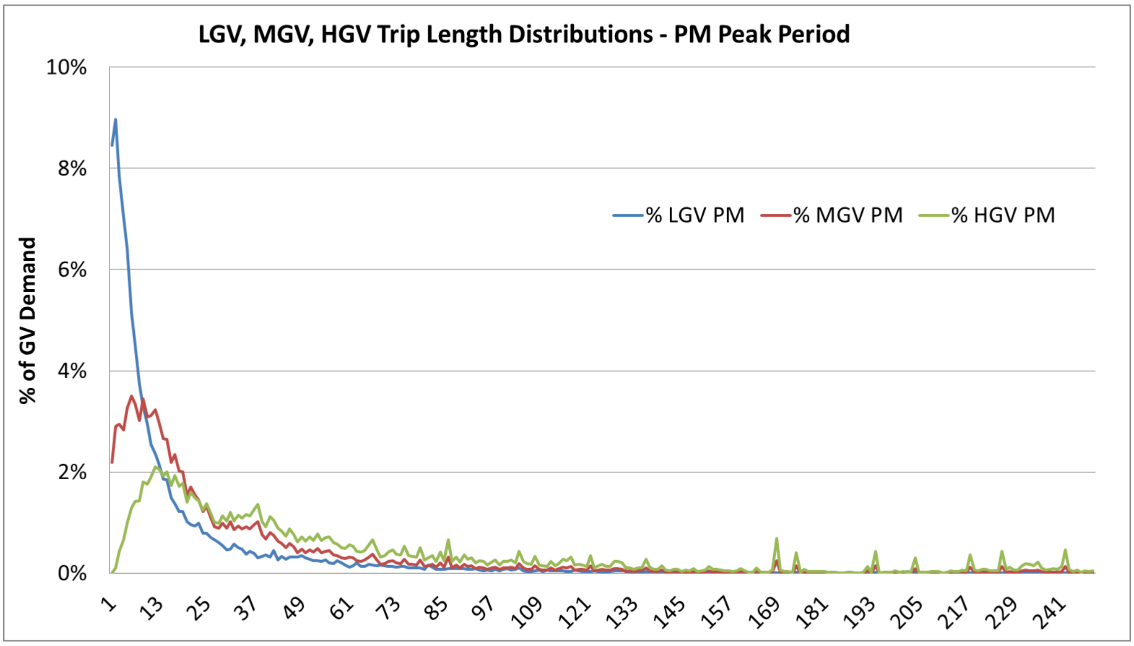


Table 108 summarises the results of the OGV splitting process by comparing the actual freight demand and average trip length by user class (LGV, MGV, HGV) and time period (AM, IP, PM) for trips that originate within Sheffield City Region.

It is observed that MGV trips, despite comprising a 19% to 25% of total OGV traffic (vehicle-kms), count for a significantly higher proportion of total OGV trips across all time periods (between 30% and 41%) because of their average trip length being shorter than that of the HGV trips.

In particular, MGV average trip length varies from a minimum of 34 kms in the PM peak period to a maximum of 38 kms in the AM peak period.

Table 108. LGV, MGV and HGV Statistics by time period after TPS split (SCR Productions)

AM Peak Period	LGV	HGV	MGV	Total OGV
Trips	38,903	12,551	7,687	20,238
% OGV Trips		62%	38%	
VehKms	823,854	905,645	295,420	1,201,066
% OGV Vehkms		75%	25%	
Average Trip Length (kms)	**21**	**72**	**38**	**59**
InterPeak	**LGV**	**HGV**	**MGV**	**Total OGV**
Trips	71,998	22,928	15,806	38,734
% OGV Trips	-	59%	41%	100%
VehKms	1,346,696	1,767,890	550,780	2,318,670
% OGV Vehkms		76%	24%	100%
Average Trip Length (kms)	**19**	**77**	**35**	**60**
PM Peak Period	**LGV**	**HGV**	**MGV**	**Total OGV**
Trips	36,074	10,641	4,658	15,300
% OGV Trips	-	70%	30%	100%
VehKms	695,440	679,615	156,829	836,444
% OGV Vehkms		81%	19%	100%
Average Trip Length (kms)	**19**	**64**	**34**	**55**

Step 14: Apply factors to Vehicle Prior Trips by Car User Class based on existing Donor Models and Count Data

After the conversion of the Prior People matrices to the six vehicle user classes (Commuting, Employer's Business, Other, LGV, MGV & MGV) by time period at a peak hour level, the matrix was assigned onto the highway network.

This allowed the validation / comparison of the modelled flows against the count data and the model's journey time routes against the observed TrafficMaster data. Both comparisons indicated that the Prior Matrix demand was lower in actual volume of trips compared against the counts (about 20% overall), whilst the model's journey times on the primary routes within Sheffield City Region were generally shorter than what TrafficMaster data were suggesting.

The Prior Matrix was also validated against existing donor models for Sheffield City Region (SYSTM+, SRTM and the Barnsley Transport Model) and a matrix estimation run was undertaken to enable us quantify the impact of estimation on our matrices and the matrix changes brought about.

The comparison against the donor models also suggested that, although the Prior Matrix had the right level of demand for movements between Sheffield City Region and the external area, it was found to be lacking shorter distance, intra-district trips.

This was the case, in particular, for intra-district movements within Sheffield, Rotherham, Doncaster, Barnsley and Bolsover. This finding was also supported by the results of matrix estimation, where the specific movements were factored up resulting in a significant increase in the total number of trips.

Therefore, after taking into consideration the comparison against the count data, the TrafficMaster data and the results of matrix estimation, we came to the conclusion that, although the Prior Matrix passed all of the validation tests and found to be consistent with other secondary reliable sources of data, it still had a few weaknesses that should be addressed before actually being used in our model. Thus, some further factoring had to be applied at a vehicle, user class level by time period.

The selected set of factors, summarised in **Table 109** below, were based on:

- Comparison of district to district movements between the Prior Vehicle Matrices and the respective donor models (SYSTM+, SRTM and Barnsley Transport Model)
- Comparison against the count data and
- The actual change observed amongst the Prior Matrix (Pre estimation) and the Post Matrix Estimation Matrix in terms of trip totals at an SCR district to district level.

The highest factors were applied to intra-district trips within Barnsley across all time periods and to trips within Rotherham during the Interpeak.

Table 109. Factors applied to car vehicle intra-district trips by user class at a time period level

From	To	AM	IP	PM
Sheffield	Sheffield	1.00	1.54	1.21
Rotherham	Rotherham	1.25	1.74	1.35
Doncaster	Doncaster	1.21	1.28	1.31
Barnsley	Barnsley	1.70	1.68	1.75
Bolsover	Bolsover	1.30	1.30	1.30

Further analysis was undertaken to understand the trip length profile and the proportion of short distance trips over the total number trips for the specific factored intra-district movements.

Table 99 below shows the proportion of short distance trips (0 - 6 kms) over the total number of intra-district trips for the matrix movements mentioned above by time period.

It is observed that, in all cases, short distance trips count for the majority of intra-district trips. The lowest percentage of short distance trips is equal to 55% for trips within Doncaster in the AM peak hour and the highest reaches 89% for Bolsover intra-district trips in the PM peak hour.

Table 110. The proportion of factor intra-districts that is short distance trips (0-6kms)

Intra- district trips with both trip ends within:	Percentage of Short Distance (0 - 6kms) trips		
	AM Peak Hour	IP Ave Hour	PM Peak Hour
Sheffield	59%	67%	64%
Rotherham	60%	65%	65%
Doncaster	55%	61%	59%
Barnsley	68%	69%	71%
Bolsover	85%	84%	89%

It should be raised that, in the Prior Matrix, the short distance trips are not derived from the Provisional Mobile Phone Data but are instead infilled from the SCR synthetic matrices (see *Step 5 for infilling short distance trips, Section 1.4 for Synthetic Matrices*).

Synthetic matrices have been built using DfT's CTripEnd Model structure and are based on NTS trip rates that vary based on area type. NTEM v72 includes eight different levels of area classification based on population. However, each level covers a wide range of population bands and Sheffield, for example, is included in the same category with other less populated areas such as Stockport, Tameside or Salford.

Therefore, NTS trip rates, although providing us with accurate information about the demand for trips at a whole country level, they tend to underestimate the trip rates for model areas of a smaller size, such as Sheffield City Region, in our case. This finding explains why we are lacking trips in the short distance bands.

Table 111below summarises the total number of district to district movements between Sheffield City Region and the External Area after factoring the Prior Vehicle Matrix.

Table 111: 24hr Car Vehicle trips between Districts post factoring

All Purposes Car Vehicles 24hr	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	Derbyshire Dales	Bassetlaw	External	Total
Sheffield	434,996	56,890	7,297	19,812	11,144	21,138	3,761	4,158	3,622	32,279	595,096
Rotherham	59,916	156,117	21,794	22,214	1,910	3,432	2,218	344	9,696	18,112	295,754
Doncaster	7,559	22,157	250,792	9,207	460	446	432	120	10,771	40,652	342,595
Barnsley	20,513	21,775	9,023	140,998	299	341	206	106	517	36,945	230,722
Chesterfield	11,357	1,849	445	316	75,362	21,950	8,195	4,816	1,080	10,924	136,296
NE Derbyshire	21,866	3,478	493	359	22,294	28,597	5,844	3,329	1,070	13,194	100,524
Bolsover	3,812	2,218	454	224	8,474	5,930	29,290	784	4,038	29,301	84,525
Derbyshire Dales	4,102	337	103	102	4,920	3,459	749	57,644	180	29,608	101,204
Bassetlaw	3,729	9,868	11,004	500	1,096	1,109	4,239	172	87,477	24,574	143,769
External	30,870	18,425	41,013	38,009	11,013	13,535	29,050	30,247	25,088	68,705,410	68,942,660
Total	598,719	293,114	342,418	231,743	136,972	99,937	83,982	101,721	143,539	68,941,000	**70,973,146**

G.1.8 Conclusion

Following the adjustments undertaken, the Prior Matrix is considered to adequately reflect/ to be representative of the trip making behaviour and the main travel patterns observed in the model's area of focus (Sheffield City Region), and thus is regarded appropriate for use in the context of the SCRTM model.

Appendix H Motorway Coding

H.1 Coding schematic for motorway sections within SCR

Table 112. Merge and Diverge Descriptions

Merge		Diverge	
Letter	**Description**	**Letter**	**Description**
A	Taper Merge	A	Taper Diverge
B	Parallel Merge	B (opt 1)	Ghost Island diverge (preferred)
C	Ghost Island Merge	B (opt 2)	Parallel Diverge (not preferred)
D	2 Lane Urban Merge	C	Lane Drop at Taper Diverge
D2	-----	D (opt 1)	Ghost Island diverge for Lane Drop (preferred)
E	Lane Gain	D (opt 2)	Lane Drop at Parallel Diverge (not preferred)
F	Lane Gain with Ghost Island Merge (preferred)	E	2 Lane Drop
F2	Lane Gain with Ghost Island Merge (alternative)		
G	2 Lane Gain with Ghost Island		
H	Alternative Ghost Island Merge with Auxiliary Lane		

Source: DMRB Volume 6 / section 2 / td2206 (Chapter 2)

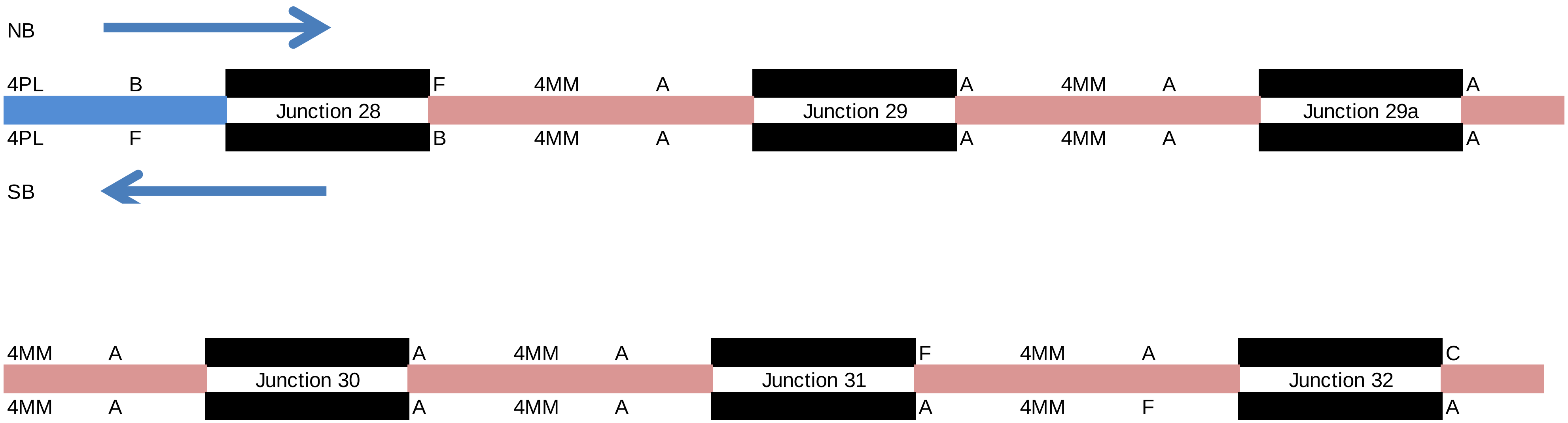
Table 113. Motorway Mainline Descriptions

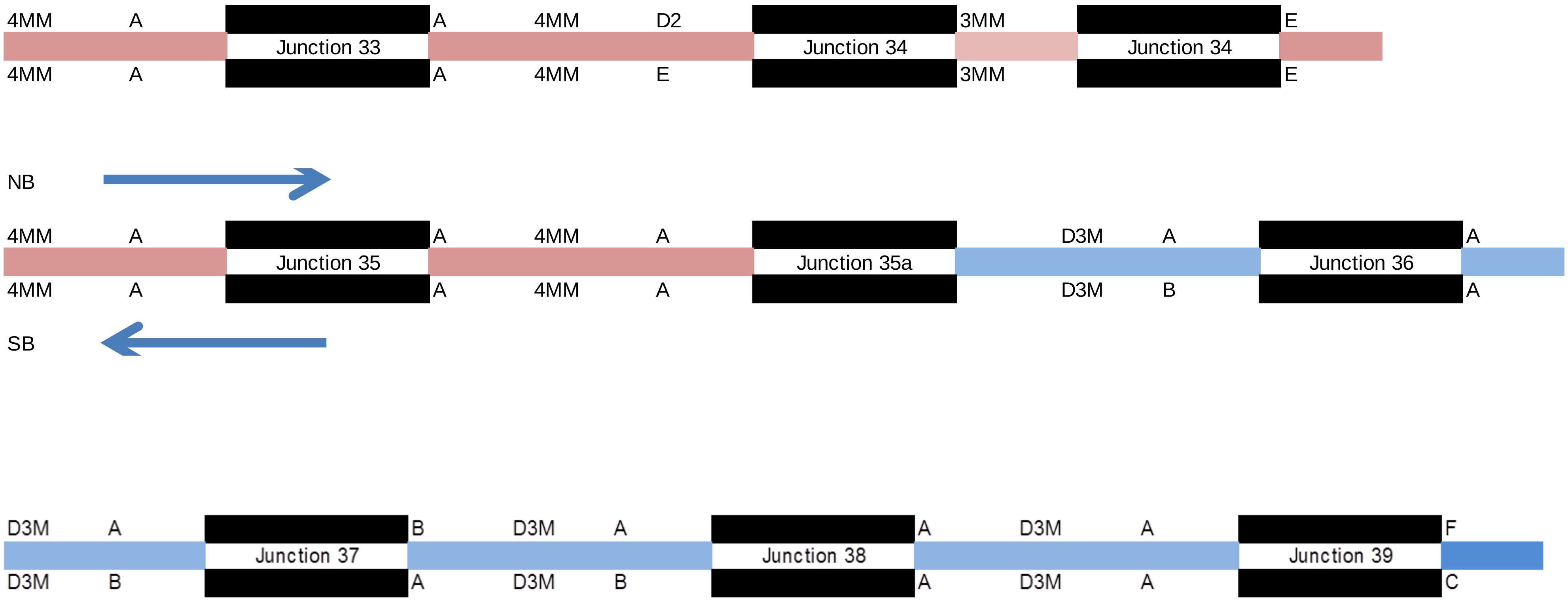
Code	Description
D5M	5 lanes traditional motorway standard
5PL	5 lanes with variable speed limit
D4M	4 lanes traditional motorway standard
4MM / 4PL	4 lanes with variable speed limit
D3M	3 lanes traditional motorway standard

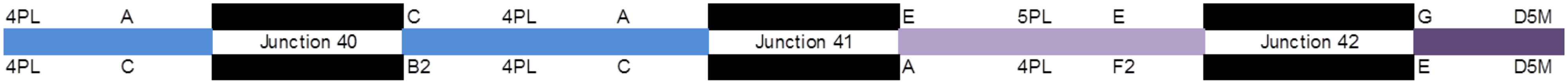
Code	Description
3MM	3 lanes all the time with variable speed limit
D2M	2 lanes traditional motorway standard

Source: Various

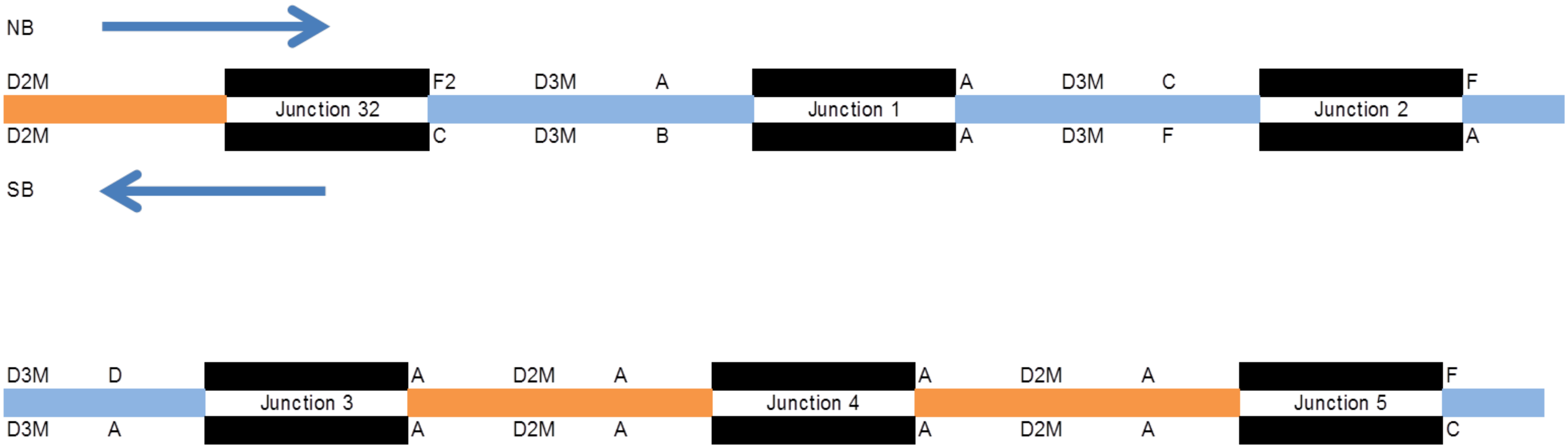
M1




4MM
A
Junction 33
A
4MM
D2
Junction 34
3MM
Junction 34
E
4MM
A
A
4MM
E
3MM
E
NB
4MM
A
Junction 35
A
4MM
A
Junction 35a
D3M
A
Junction 36
A
4MM
A
A
4MM
A
D3M
B
A
SB
D3M
A
Junction 37
B
D3M
A
Junction 38
A
D3M
A
Junction 39
F
D3M
B
A
D3M
B
A
D3M
A
C

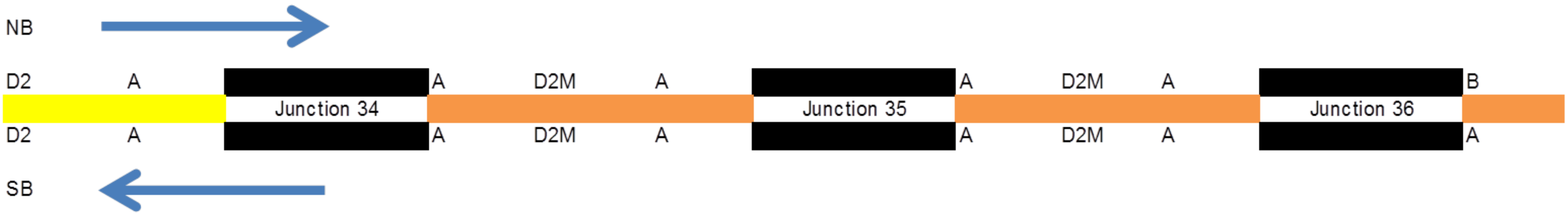

4PL
A
C
4PL
A
E
5PL
E
G
D5M
Junction 40
Junction 41
Junction 42
4PL
C
B2
4PL
C
A
4PL
F2
E
D5M

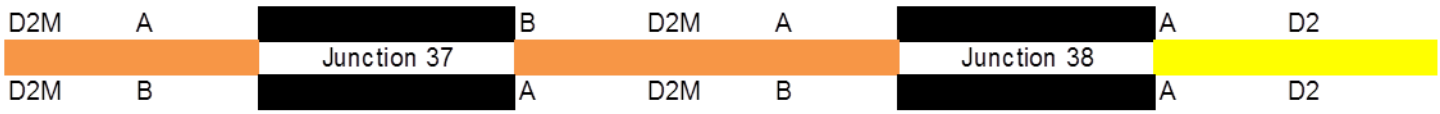
M18


NB
D2M
F2
D3M
A
A
D3M
C
F
Junction 32
Junction 1
Junction 2
D2M
C
D3M
B
A
D3M
F
A
SB
D3M
D
A
D2M
A
A
D2M
A
F
Junction 3
Junction 4
Junction 5
D3M
A
A
D2M
A
A
D2M
A
C


D3M
A
A
D3M
D2
Junction 6
Junction 35
D3M
A
A
D3M
F

A1M


NB
D2
A
A
D2M
A
A
D2M
A
B
Junction 34
Junction 35
Junction 36
D2
A
A
D2M
A
A
D2M
A
A
SB



M180

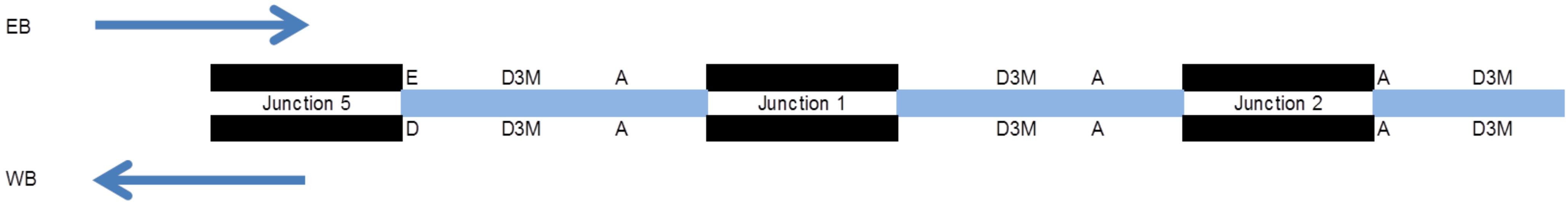


Figure 163: Schematic Diagram of the SCR Motorway Network

Appendix I Network Checks

I.1 Network Error Checks

Table 114. Network Error Checks

SATURN ERROR NUMBER	Description	Total at time of check	Comment	Comment Date
1	Rather high or low speed relative to SPMIN / SPMAX	2	No action taken to date	31.03.17
2	Turn saturation flow less than the minimum MINSAT	0	Reviewed and set all 5 instances to MINSAT of 500	31.03.17
3	Some but not all turns coded as G from a single link	19	Reviewed and no action taken to date	31.03.17
5	An X marker has 2 or more opposing major flows	0	Corrected node coding	31.03.17
6	A priority junction has no minor but multiple major arms	8	Reviewed and only one node changed	31.03.17
8	Priority marker X has appeared for 2 or more turns on 1 link	4	Reviewed and no action taken to date	31.03.17
12	More than one give-way turn sharing a single lane; Priority	1145		
14	Roundabout turn sat flow less than circulation sat flow	9	Checked and changed where appropriate	31.03.17
15	Maximum roundabout turn sat flow exceeds circulation sat flo	4	Checked and changed where appropriate	31.03.17
16	Rather long intergreen time for a stage (> 20 seconds)	135		
19	Total stage plus intergreen times not equal input cycle time	44		
20	Turn coded F - Filter at signals - included in stage defs	36		
21	Very short red phase	68		
22	Very short red phasse - less than 1 time unit in duration	1	All removed barring 7539 and 7401 due to bus gates	31.03.17
23	Total upstream sat flow inconsistent with lanes downstream	426		
24	Input link time/speed out of range from speed-flow record	524		
28	A zone CC goes to an external sim link joint with buffer	0	Corrected zone connection	05.04.17
30	Calculated speed outside the expected min/max range	13		
31	A buffer link 1-way in opposite direction in simulation	0	Corrected node coding	31.03.17
32	Simulation link distances	692		

SATURN ERROR NUMBER	Description	Total at time of check	Comment	Comment Date
	and/or times differ in reverse			
43	A turn is coded as an X turn but is not the last	26		
45	Total intergreen time exceeds the total stage time	57		
49	A buffer link has both A and B-node in the simulation	25		
50	The saturation flow per lane is less than MINLSF	0	Checked and changed where appropriate	31.03.17
51	The saturation flow per lane is greater than MAXLSF	869		
52	External simulation node with 2 arms - unusual	0	Checked and changed where appropriate	31.03.17
53	Two priority turns share the same exit; should one give way?	62		
54	Duplicate and different capacity indices	0		
65	Low (chain) stacking capacity per lane (1.0 < 3.0 PCU)	135		
68	A priority marker G looks suspiciously like a merge! (M)	10		
72	Dummy node with 3 or more arms - not a good idea!	0	Changed node coding for priority junction	05.04.17
82	Cycle time is very high - > 999 Seconds	0	Changed node coding	05.04.17
84	Redundant intergreen stage time - all turns continuous green	61		
91	Two+ turns with same lanes at signals but different stages	3	Reviewed and no action taken to date	05.04.17
92	A zone coded under 33333 would be better coded under 22222	0	Changed both zone connections	05.04.17
96	Give-ways have both shared and unshared lanes	7	Checked and changed where appropriate	05.04.17
98	Possible opportunity for a Clear Exit Priority Modifier?	680		
106	No green movements defined for a stage	5	Checked and changed where appropriate	05.04.17
111	No opposing turns found for a turn with a Priority Marker	1	Checked and changed where appropriate	05.04.17
113	Input simulation arms not in (counter-)clockwise order	0	Changed node coding	05.04.17
124	A nearside turn is all-green but not coded as a filter F	1	Checked and changed where appropriate	05.04.17
126	Total intergreen stage times equal zero	4	Reviewed and no action taken to date	05.04.17

SATURN ERROR NUMBER	Description	Total at time of check	Comment	Comment Date
128	Zero sat flow for a turn which is green during a stage	2	Changes made	05.04.17
135	2+ give-way turns in a single lane: Major arm priority jcn.	745		
137	Turn saturation flows per lane differ widely. See 6.4.6.3	1834		
138	Saturation flows differ widely between roundabout arms	28		
147	A positive intergreen separates two identical stages	14		
148	The rules for green during intergreen differ in 10.6	31		
150	A nearside merge into a turn not in its inside lane	2	Reviewed and no action taken to date	05.04.17
152	A single lane arm at signals which includes an X-marked turn	107		
154	X-Turn shares lanes with a turn which could use inside lanes	14		
156	The exit link for a merge has GE lanes than the 2 entries	24		
157	The mid-link capacity is either >> or << stop-line sat flow	110		
160	Merge turns enter a link which has significantly fewer lanes	21		
161	An X-turn at a priority junction has no major turns opposing	0	Reviewed and no action taken to date	05.04.17
162	Multiple turns sharing multiple lanes: leads to weaving	1	Checked and changed where appropriate	05.04.17
167	Buffer zones to stub links: different directionalities;5.5.4	0	Checked and changed zone connection	05.04.17
168	A roundabout turn is banned but other turns use that exit	6	Reviewed and no action taken to date	05.04.17
175	Flare length exceeds link distance and/or 100 metres	0	Changed node coding	05.04.17
178	Strange stage sequencing for an X-turn at signals	21		
183	LCY for a node differs from its neighbours	261		
186	Intergreen equals zero but	11		
187	Mixture of late cut-offs and opposed stages for sig. X-turns	1	Reviewed and no action taken to date	05.04.17
188	(Chain) stacking capacity per lane less than 1 PCU	8	Reviewed and no action taken to date	05.04.17

Source: Saturn / AECOM

Appendix J Routeing Analysis

J.1 Routes taken in model - Figures

As mentioned in the report (Chapter 9) 40 O-D routes in each direction were taken from each of the three time periods. These were done as a percentage tree (based on UFO files), and links assigned to one of 7 categories based on what proportion of the movement takes this link.

For links not used in any of the iterations for that time period, the link will not have any proportion so will not be shown in the images. For any given O-D pair nearly all links will fall into this category.

Links which are used in at least one iteration have colours and widths based on the key shown in Figure 165.

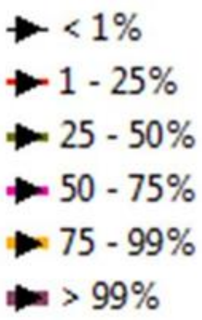


Figure 164. Key to Routing Images

After the flow images there is a table examining:

- The consistency of the routes chosen between time periods;
- For each time period has one or two routes been chosen or many;
- Are the routes chosen logical, in terms of time (from Google traffic) and distance.

Figure 165. Manchester to Birmingham (on above, reverse direction below)

Figure 166. Manchester to Nottingham (on above, reverse direction below)

Figure 167. Manchester to Lincoln (on above, reverse direction below)

Figure 168. Leeds to Birmingham (on above, reverse direction below)

Figure 169. Leeds to Nottingham (on above, reverse direction below)

Figure 170. Leeds to Lincoln (on above, reverse direction below)

Figure 171. Hull to Birmingham (on above, reverse direction below)

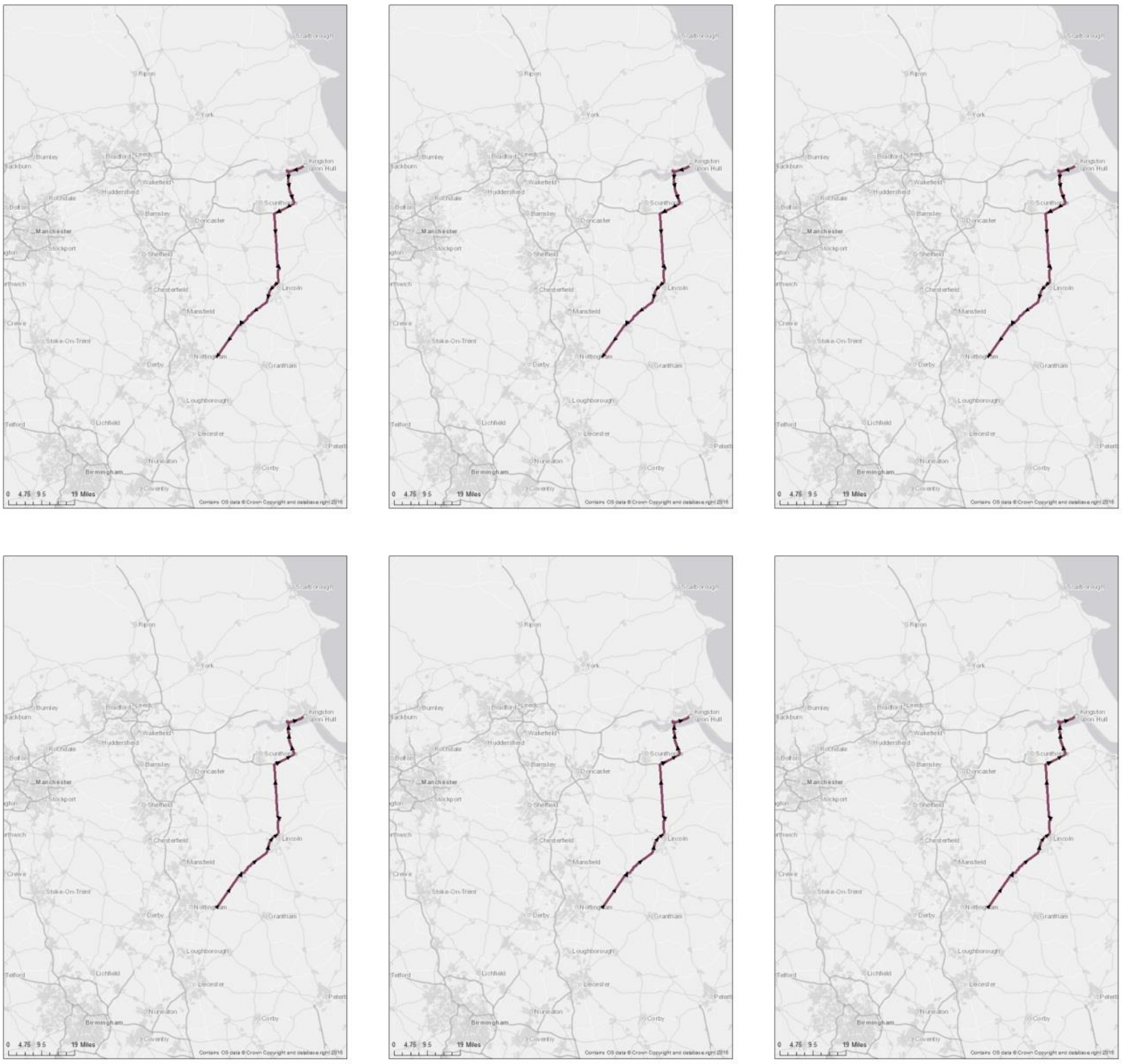


Figure 172. Hull to Nottingham (on above. Reverse direction below)

Figure 173. Hull to Lincoln (on above, reverse direction below)

Figure 174. Derby to Newcastle (on above, reverse direction below)

Figure 175. Rotherham to Chesterfield (on above, reverse direction below)

Figure 176. Rotherham to Doncaster (on above, reverse direction below)

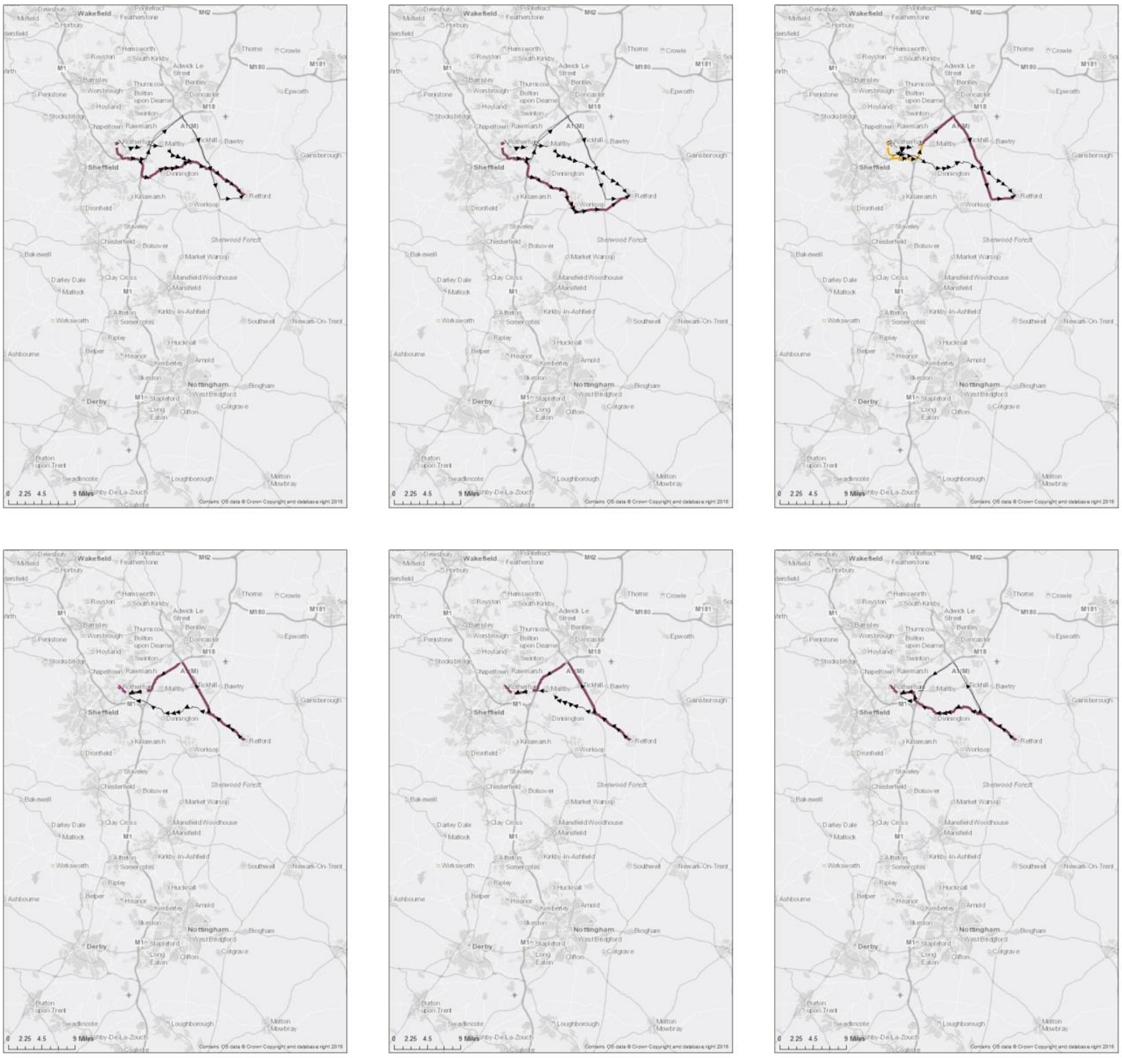


Figure 177. Rotherham to Retford (on above, reverse direction below)

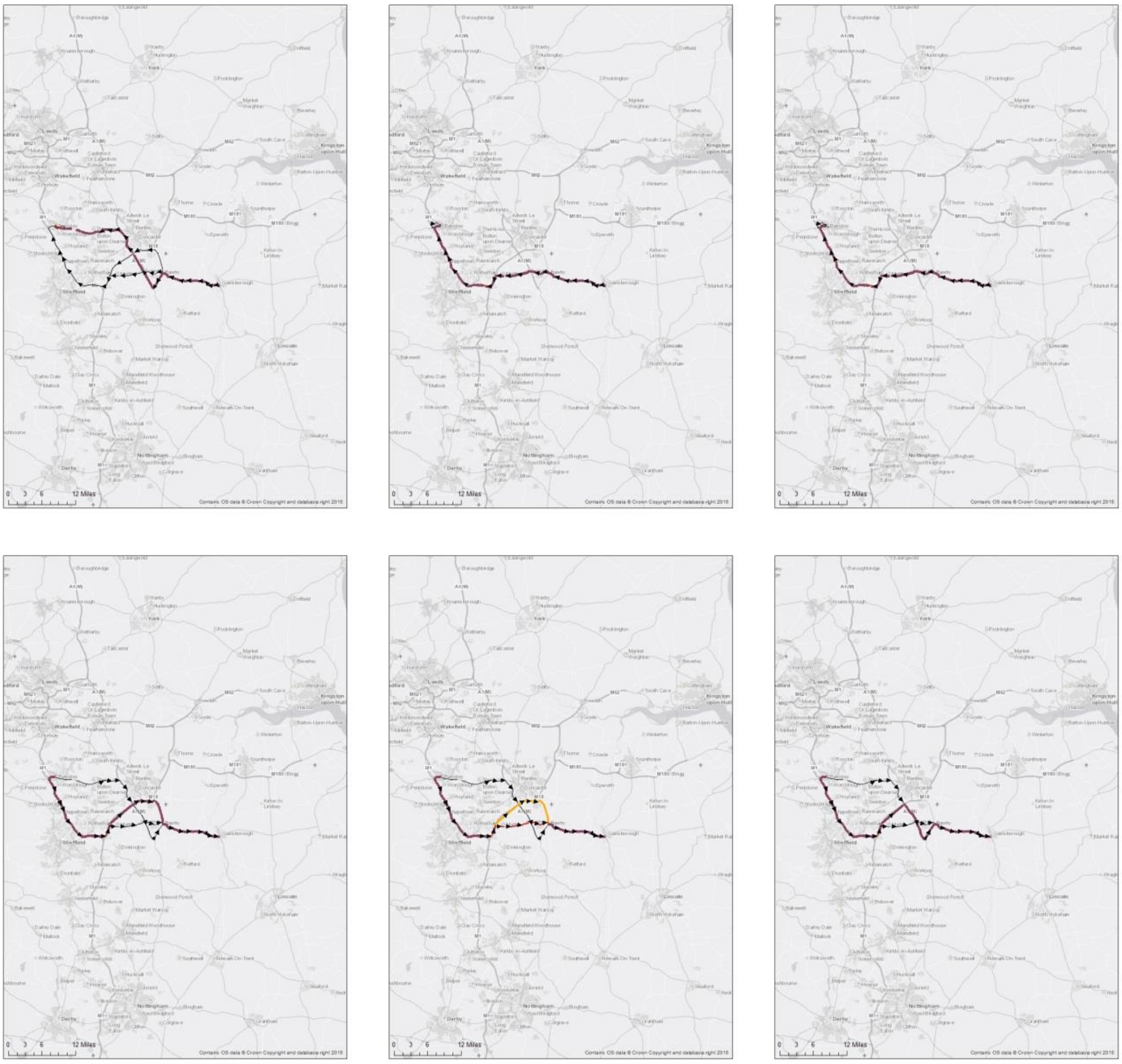


Figure 178. Gainsborough to Barnsley (on above, reverse direction below)

Figure 179. Everton to Swindon (on above, reverse direction below)

Figure 180. Conisborough to Tankersley (on above, reverse direction below)

Figure 181. Worksop to Robin Hood Airport (on above, reverse direction below)

Figure 182. Barnsley to Robin Hood Airport (on above, reverse direction below)

Figure 183. Dronfield to Chapeltown (on above, reverse direction below)

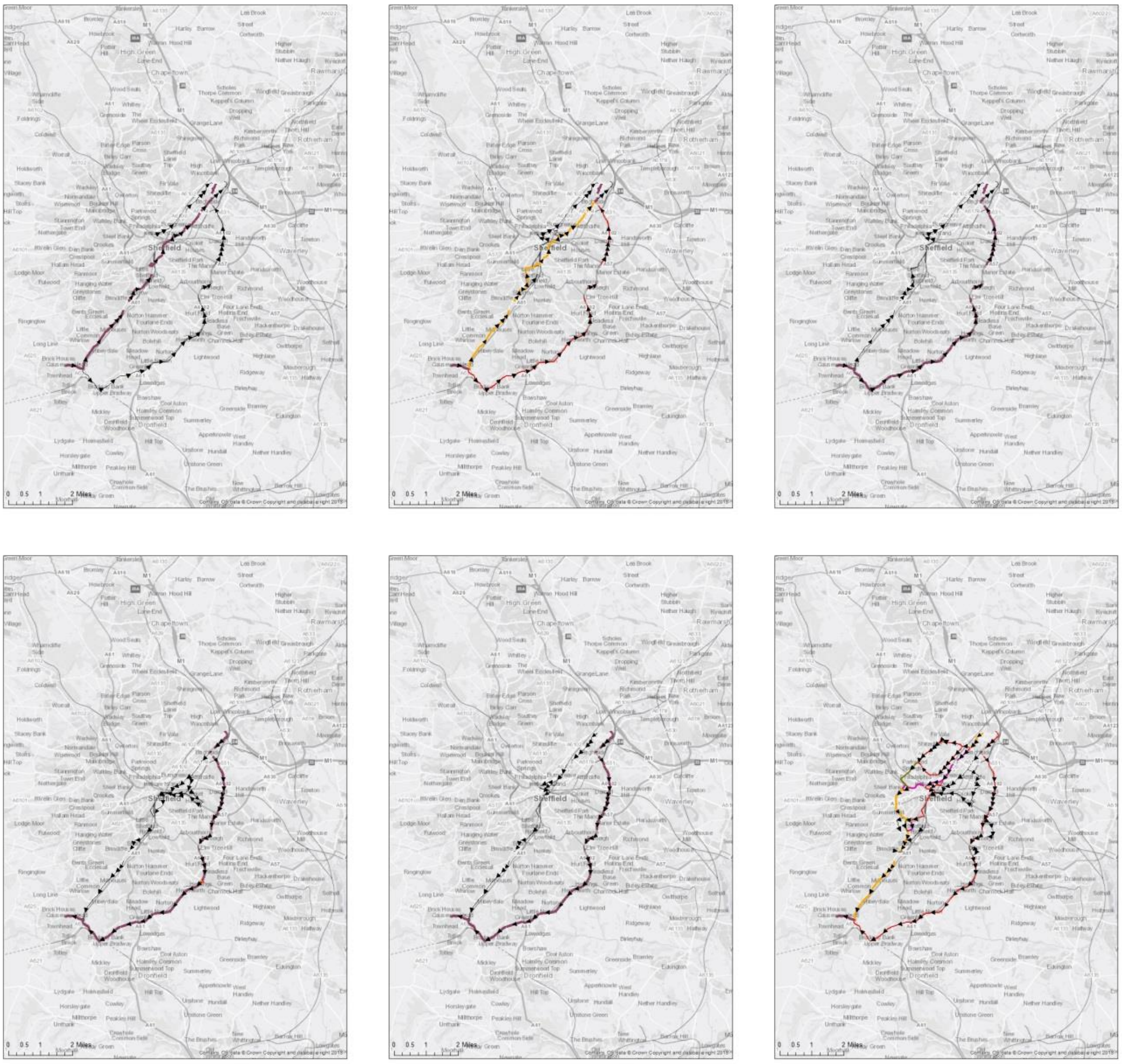


Figure 184. Sheffield to Rotherham (on above, reverse direction below)

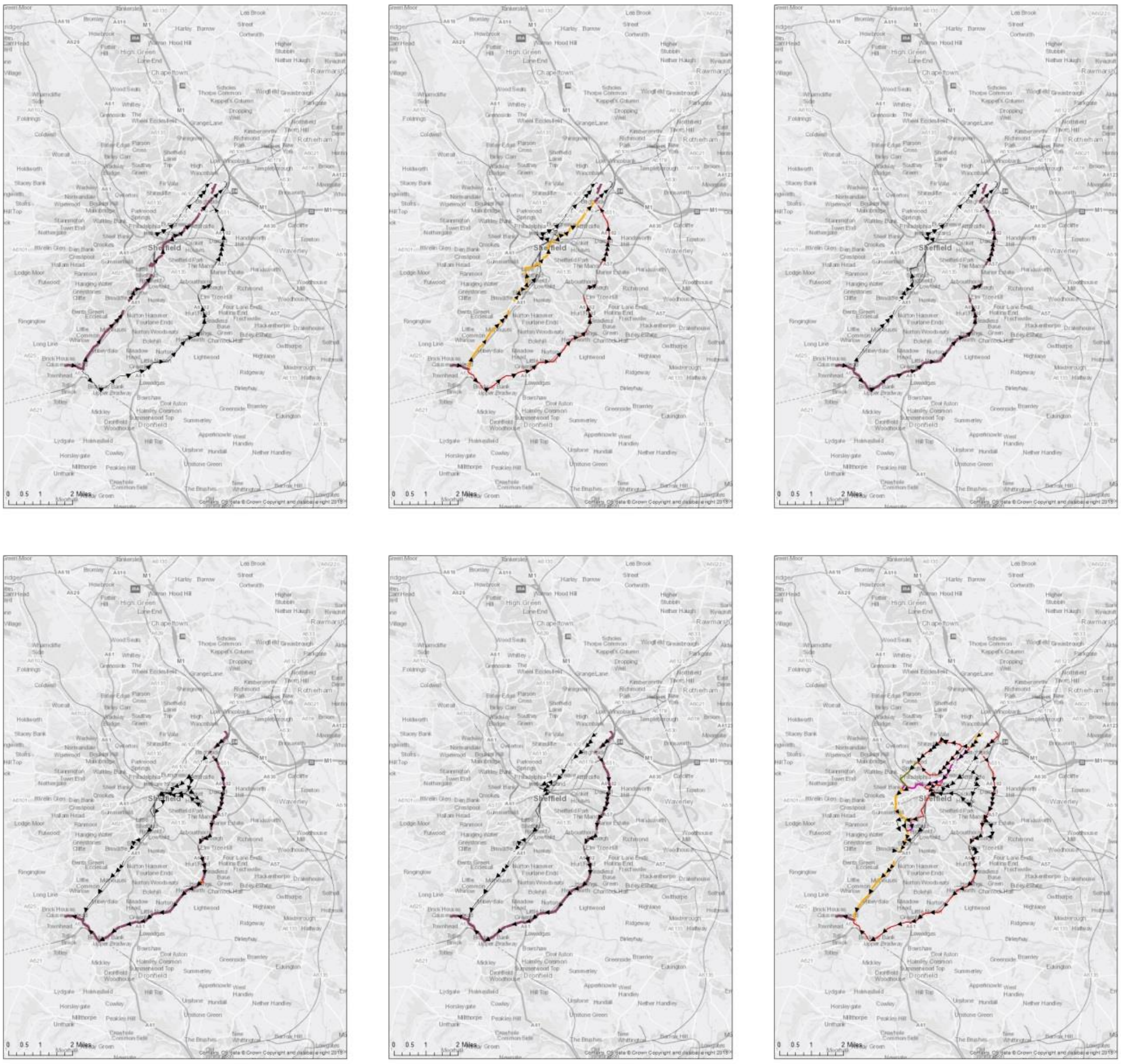


Figure 185. Dore to Meadowhall (on above, reverse direction below)

Figure 186. Maltby to Meadowhall (on above, reverse direction below)

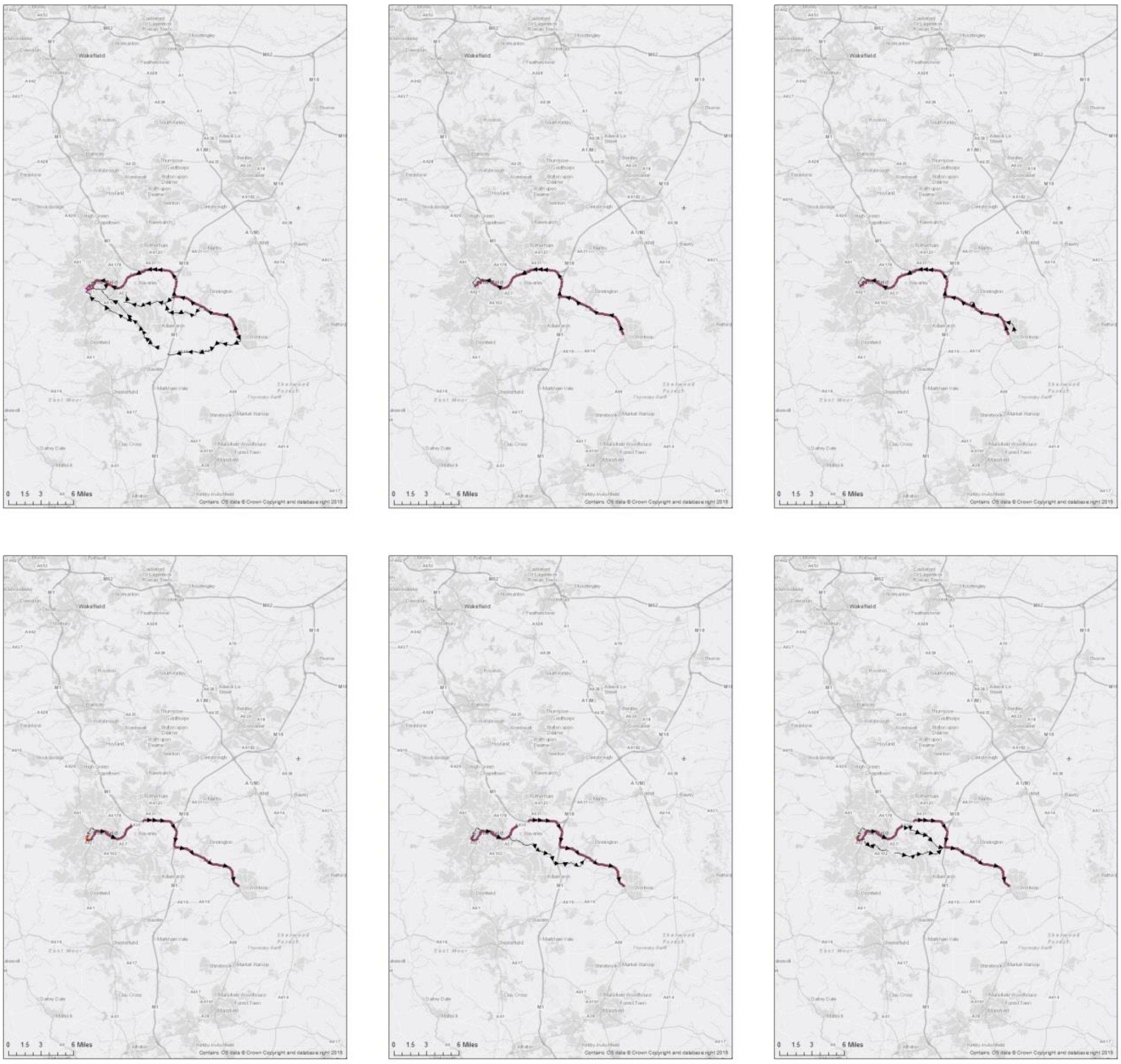


Figure 187. Worksop to Sheffield (on above, reverse direction below)

Figure 188. Barnsley to Sheffield (on above, reverse direction below)

Figure 189. Barnsley to Rotherham (on above, reverse direction below)

Figure 190. Chesterfield to Meadowhall (on above, reverse direction below)

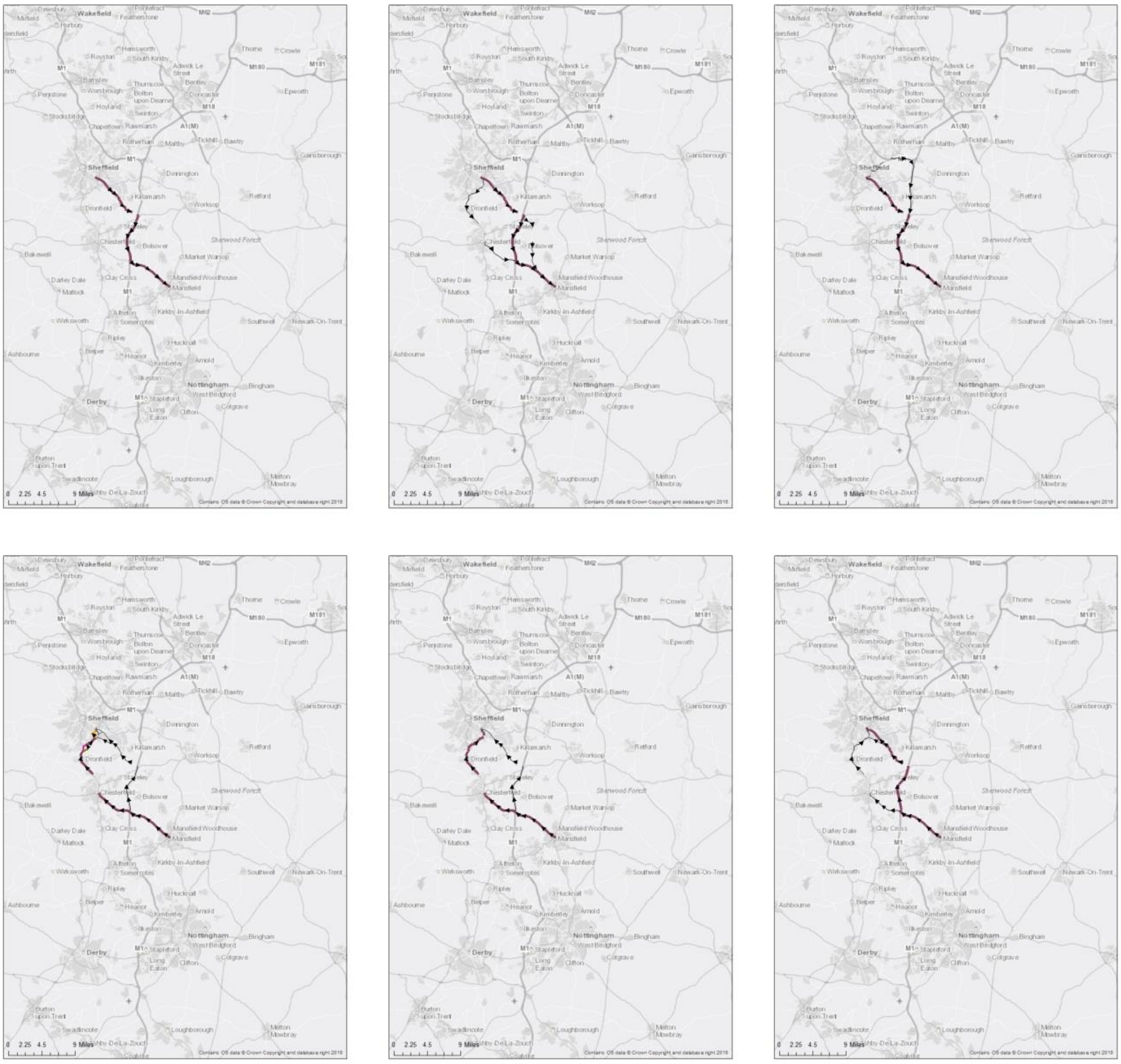


Figure 191. Sheffield to Mansfield (on above, reverse direction below)

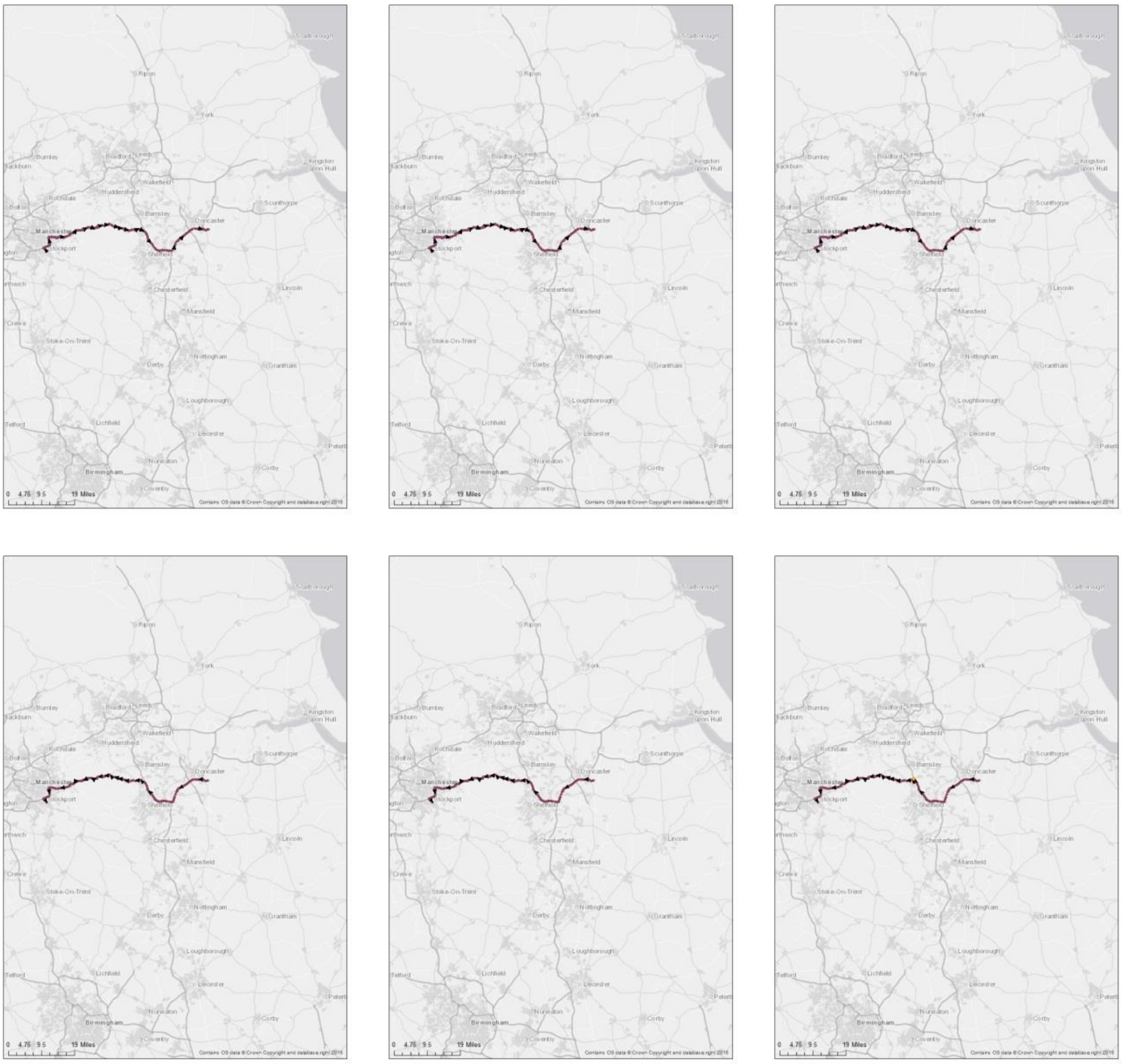


Figure 192. Cheadle to Robin Hood Airport (on above, reverse direction below)

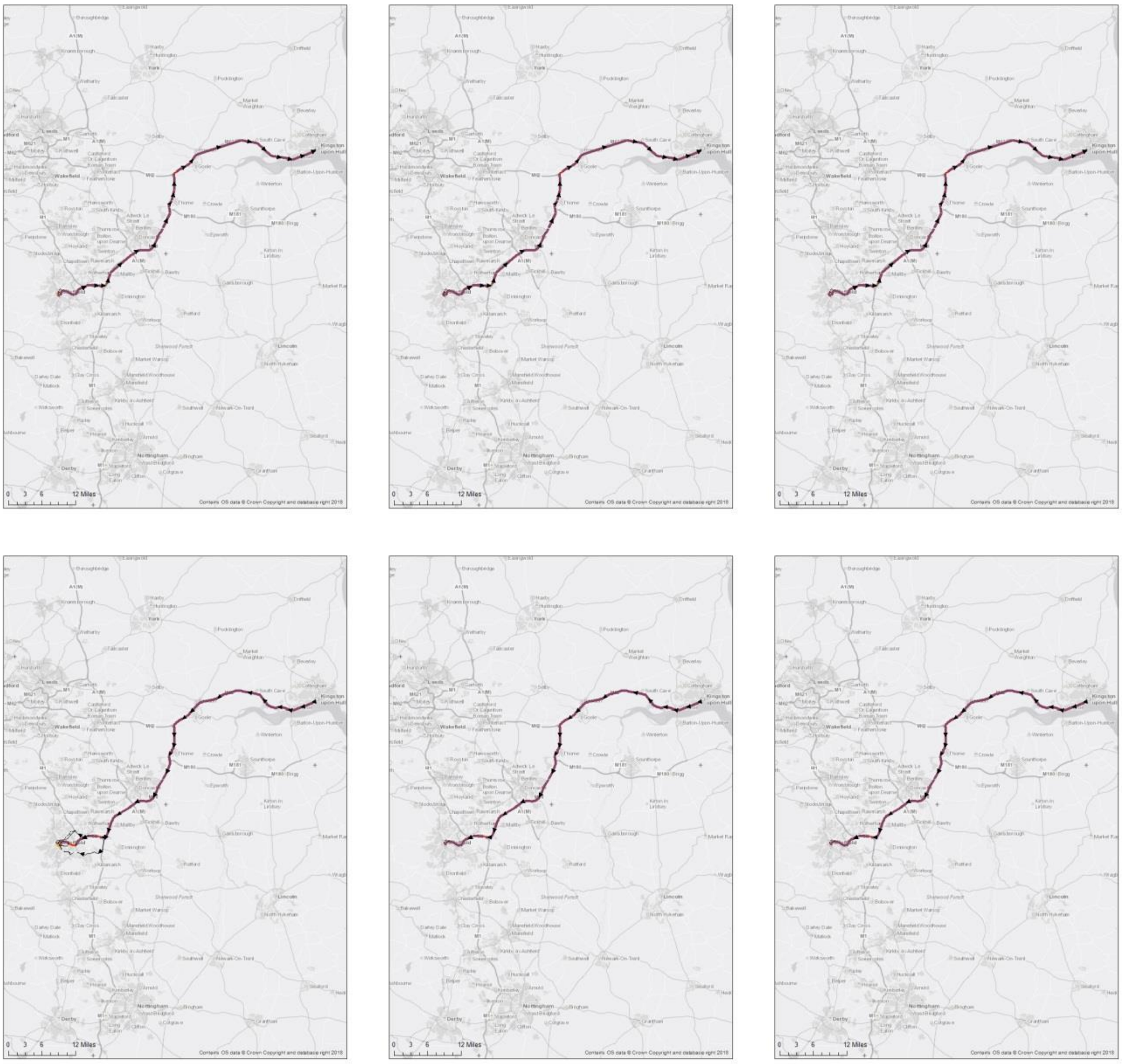


Figure 193. Sheffield to Hull (on above, reverse direction below)

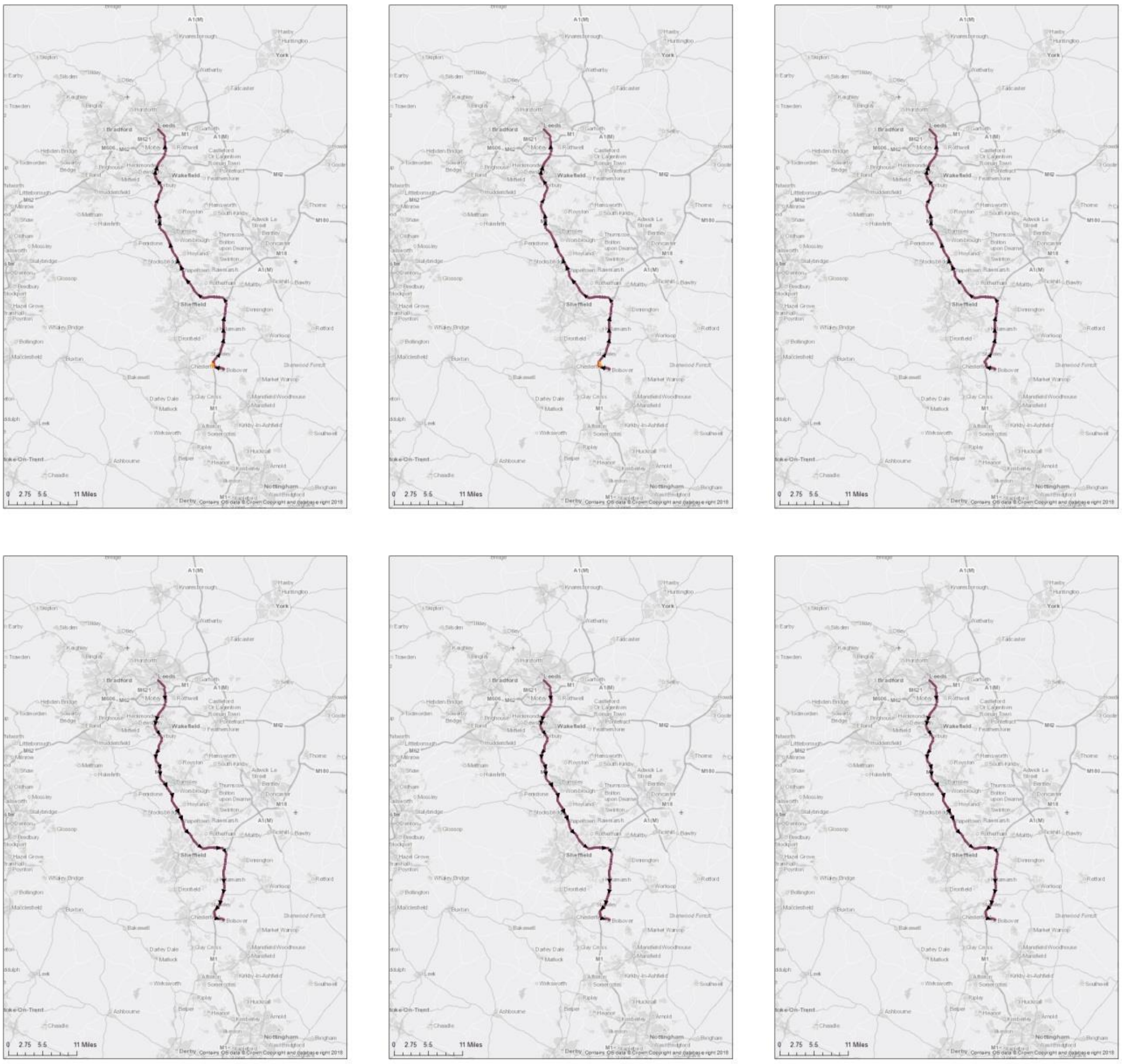


Figure 194. Bolsover to Leeds (on above, reverse direction below)

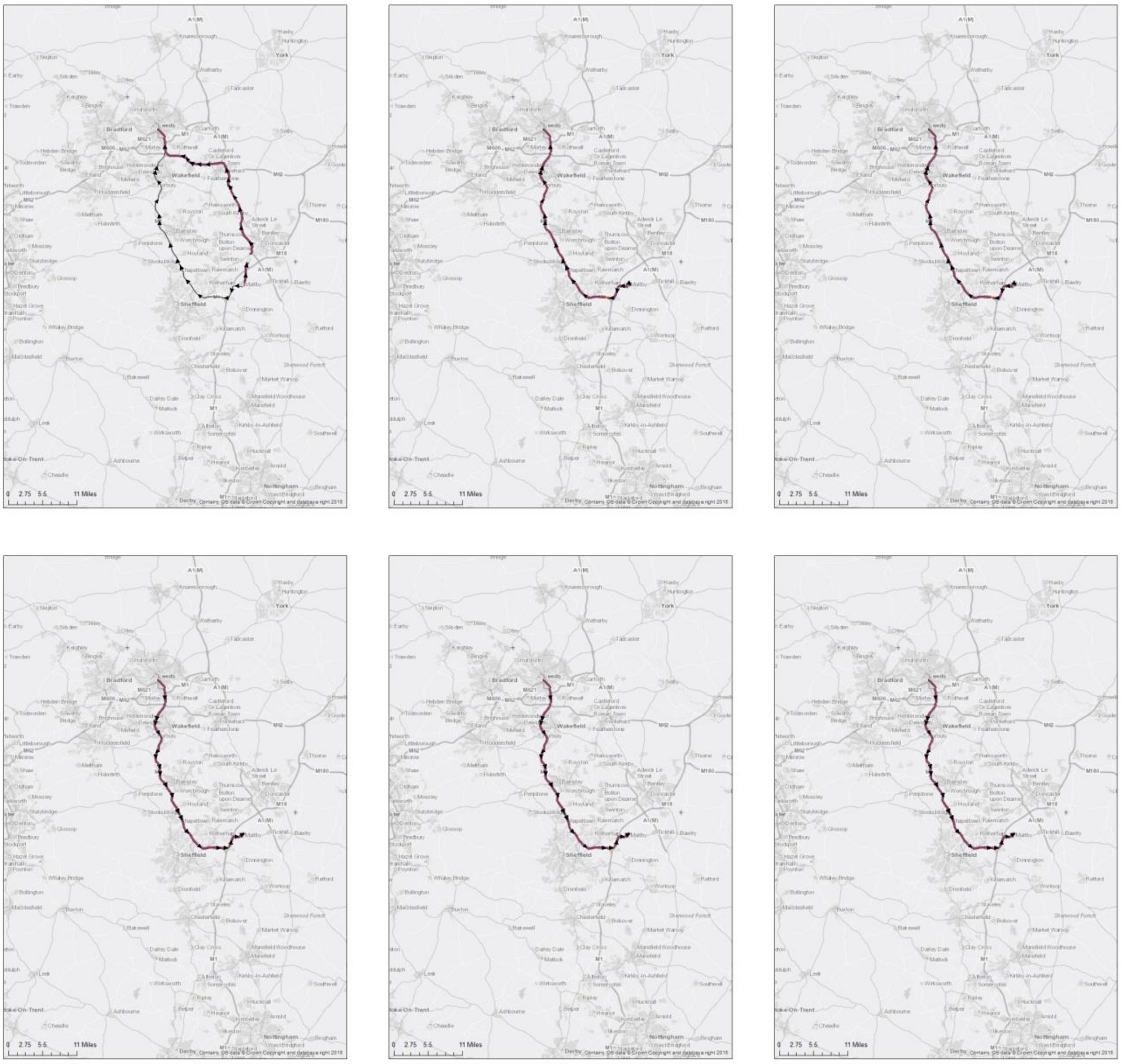


Figure 195. Maltby to Leeds (on above, reverse direction below)

Figure 196. Barnsley to Doncaster (on above, reverse direction below)

Figure 197. Sheffield to Doncaster (on above, reverse direction below)

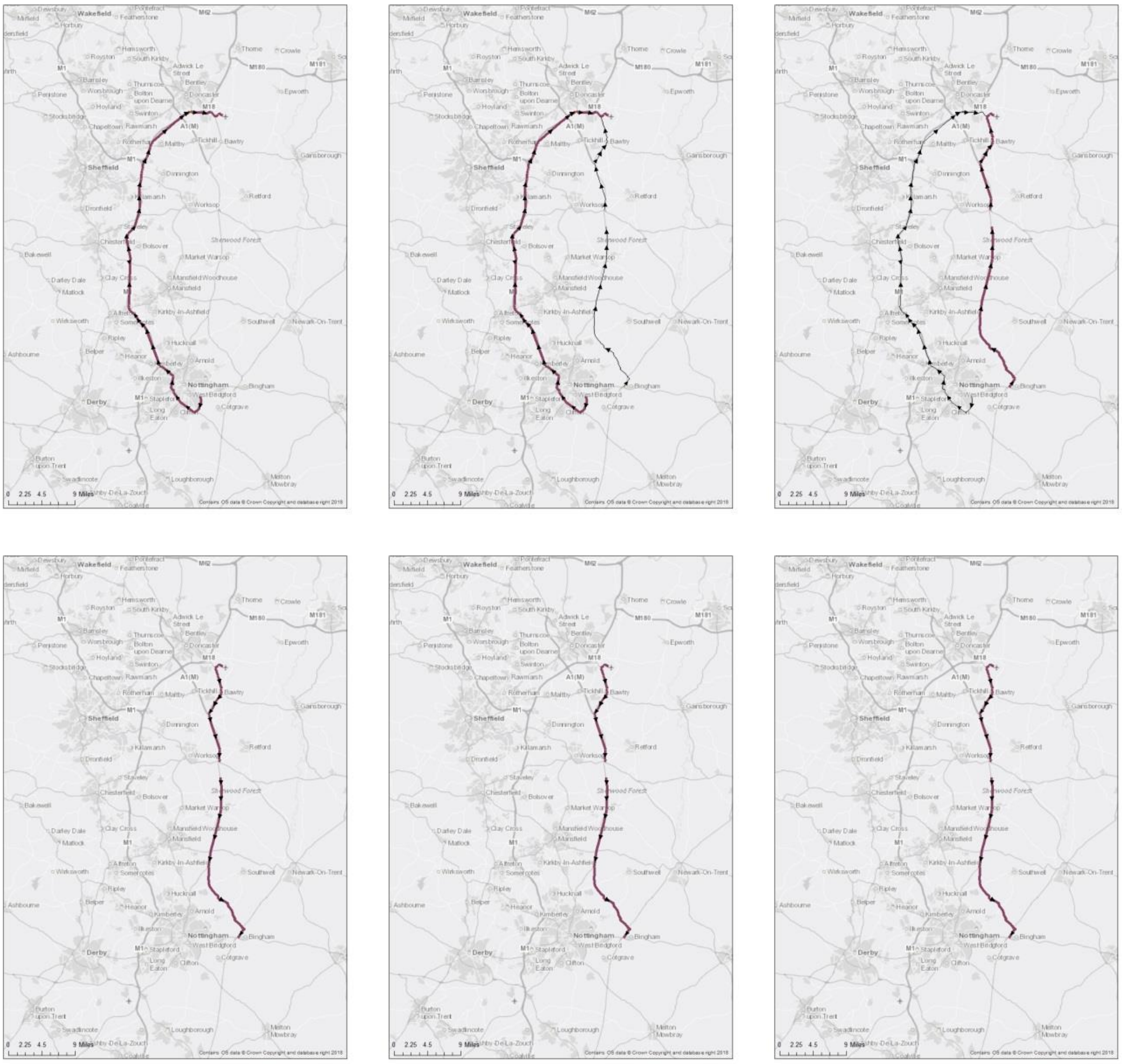


Figure 198. Nottingham to Robin Hood Airport (on above, reverse direction below)

Figure 199. Southwell to Doncaster (on above, reverse direction below)

Figure 200. Stocksbridge to Killamarsh (on above, reverse direction below)

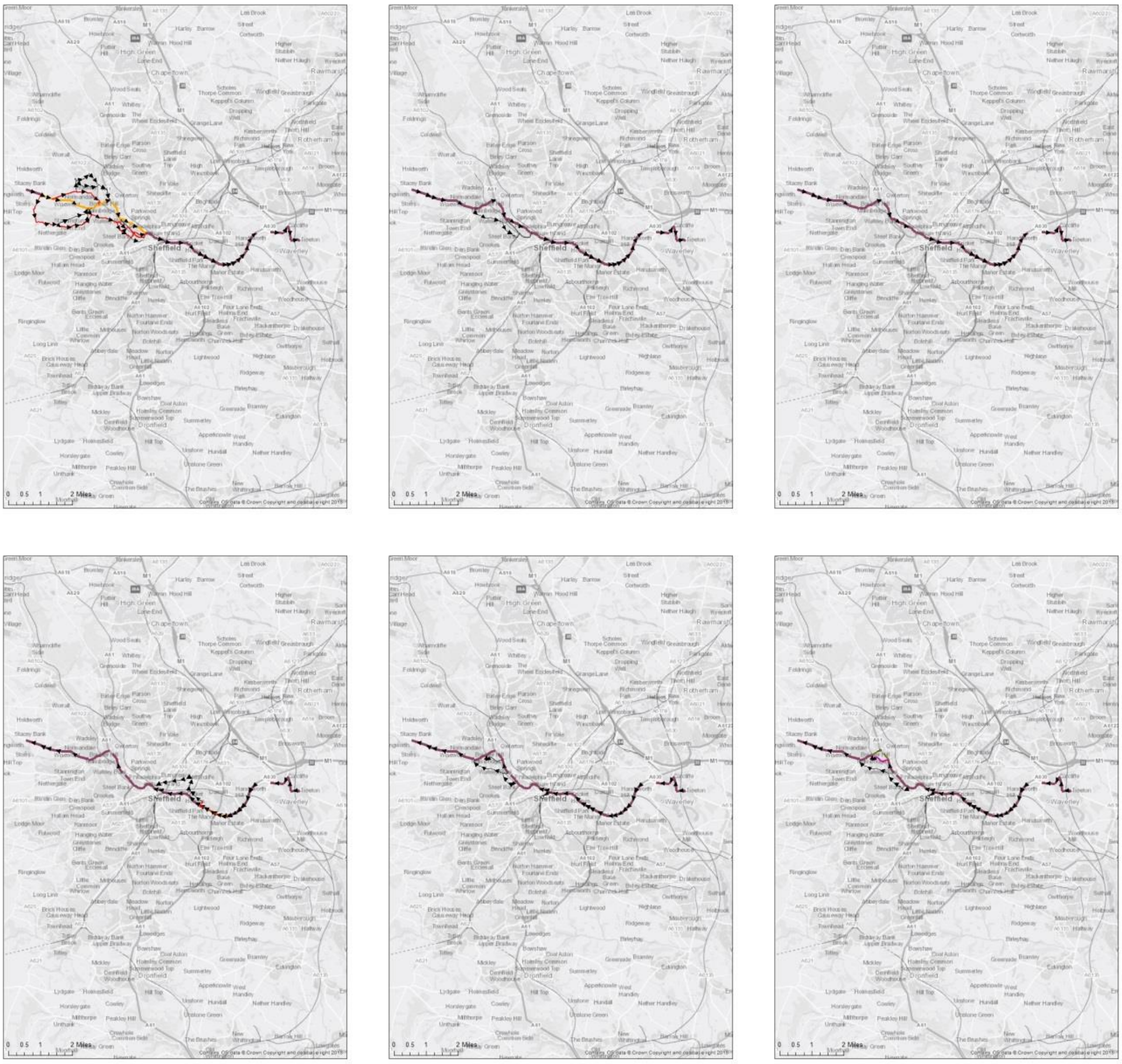


Figure 201. Dungworth to Treeton (on above, reverse direction below)

Figure 202. Wath-Upon-Dearne to Catcliffe (on above, reverse direction below)

Figure 203. Ponds Forge to Conisborough (on above, reverse direction below)

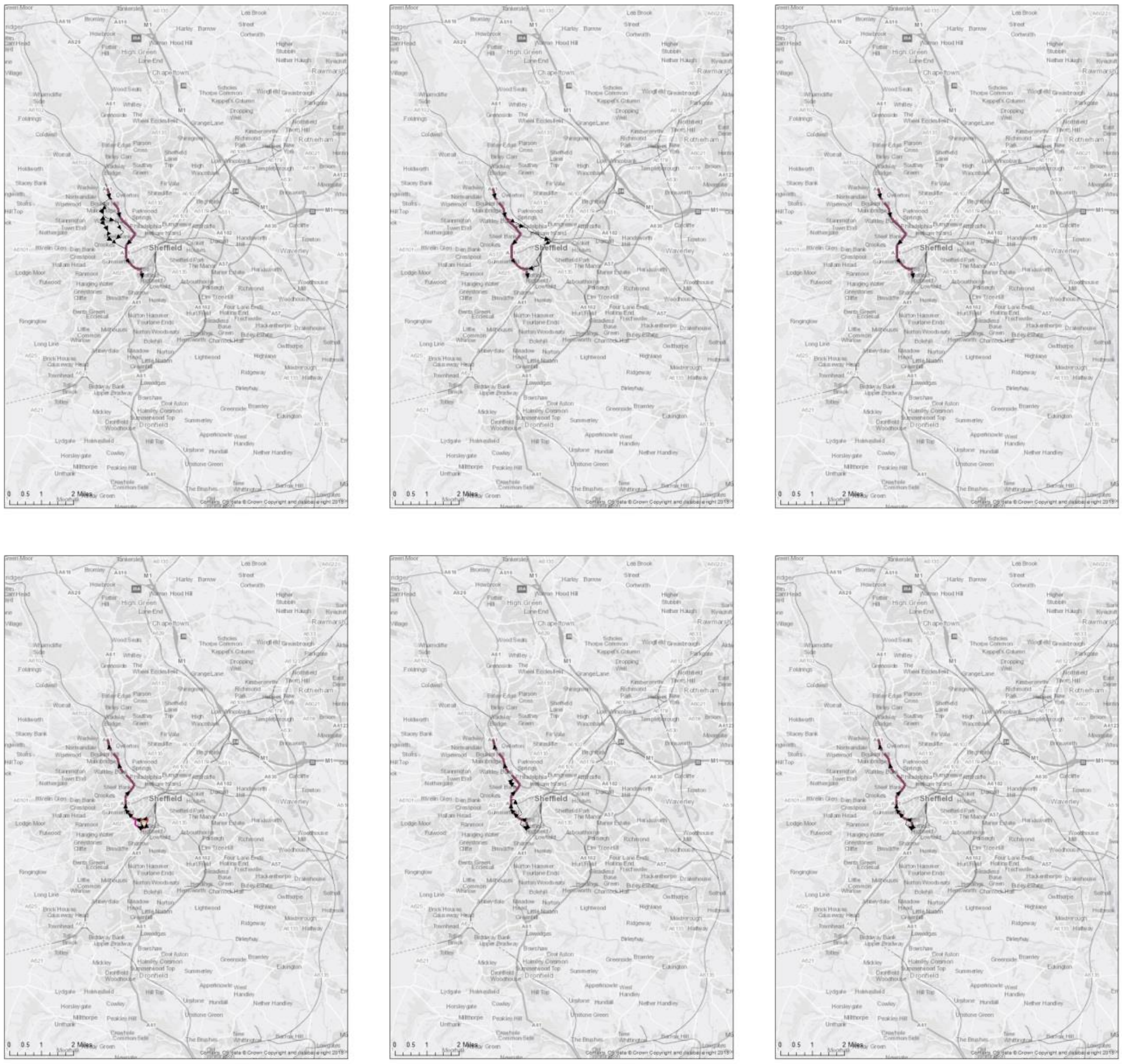


Figure 204. Hillsborough to Bramall Lane (on above, reverse direction below)

J.2 Routes taken in model - Analysis

Table 115. Routing Analysis

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
1	Manchester	Birmingham	20151	20176	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time and distance.	Yes they are the quickest route by travel time and distance.	Yes they are the quickest route by travel time and distance.	N/A
1	Birmingham	Manchester	20176	20151	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time and distance.	Yes they are the quickest route by travel time and distance.	Yes they are the quickest route by travel time and distance.	N/A
2	Manchester	Nottingham	20151	20125	All time periods follow the same route although AM and PM split into two routes	Yes, depending on the congestion rate.	1 main route but split into two traffic flows of 75-99% and 1-24%, google also suggests a 3rd route	1 single main route on the drawings but 3 suggested routes via google	1 main route but split into two traffic flows of 75-99% and 1-24%, google also suggests a 3rd route	Yes both diversions have the roughly same travel time although the route taken by 1-24% of the	Yes they are the quickest route by travel time and distance.	Yes both diversions have the roughly same travel time although the route taken by 1-24% of	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
										traffic flow is a longer distance by16.1 miles longer.		the traffic flow is a longer distance by16.1 miles longer.	
2	Nottingham	Manchester	20125	20151	IP and AM follow the same route as suggested by google although PM follows an alternate route.	Yes	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings although it is not show on google but 3 alternative routes are suggested.	Yes they are the quickest route by travel time and distance.	Yes they are the quickest route by travel time and distance.	Yes it is the shortest distance although it does increase the travel time by roughly 10 minutes	N/A
3	Manchester	Lincoln	20151	20118	IP follows google secondary route, PM and AM follow and alternative route with AM also spliting off in to two routes	No	1 main route but split into two traffic flows of 75-99% and 1-24%, google also suggests 3 further routes	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but further 3 suggested routes via google	Perhaps as at this time period both traffic flows follow routes that may be shorter but are also slower	Yes the route follows the suggestion by google for the fastest route for the time period.	Perhaps as several routes of similar time and distance are available for this route.	N/A
3	Lincoln	Manchester	20118	20151	IP and AM both follow the same route but AM is split into 2	No there are quicker routes for all time periods and shorter routes	1 single main route that is split into 2 routes with traffic flows of	1 single main route on the drawings but 3	1 single main route on the drawings but further 3 suggested	Two routes are chosen by the model to leave Lincoln and reach the A57.	The route taken is logical and direct using the key main	Distance wise this route is fairly long, taking the M62.	Does not use the A1 / A1(m)

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					routes at the first leg, PM takes an alternative route using the M62.	for PM.	75-99% and 1-24% for the first leg of the route on the drawings but 3 suggested routes via google	suggested routes via google	routes via google	The more direct route has the higher proportion. The route taken is the shortest from this point.	roads.	However this could be a logical route, particularly to avoid any congestion on the M1 around Sheffield.	
4	Leeds	Birmingham	20112	20176	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
4	Birmingham	Leeds	20176	20112	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
5	Leeds	Nottingham	20112	20125	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via	1 single main route on the drawings but 2	1 single main route on the drawings but 2 suggested routes via	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
							google	suggested routes via google	google				
5	Nottingham	Leeds	20125	20112	All time periods follow the same main route	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
6	Leeds	Lincoln	20112	20118	All time periods follow same route.	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	This is a logical route. Though alternatives exist such as using the A1.	This is a logical route. Though alternatives exist such as using the A1.	This is a logical route. Though alternatives exist such as using the A1.	Does not use the A1 / A1(m)
6	Lincoln	Leeds	20118	20112	All time periods follow same route.	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	This is a logical route. Though alternatives exist such as using the A1.	This is a logical route. Though alternatives exist such as using the A1.	This is a logical route. Though alternatives exist such as using the A1.	Does not use the A1 / A1(m)
7	Hull	Birmingham	20164	20176	All time periods follow same	N/A	1 single main route on the drawings but	1 single main route on the	1 single main route on the drawings but 2	Yes they are the quickest route by travel	Yes they are the quickest route by	Yes they are the quickest route by	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					route.		2 suggested routes via google	drawings but 2 suggested routes via google	suggested routes via google	time.	travel time.	travel time.	
7	Birmingham	Hull	20176	20164	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
8	Hull	Nottingham	20164	20125	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is estimated to be a longer travel time.	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is estimated to be a longer travel time.	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is estimated to be a longer travel time.	N/A
8	Nottingham	Hull	20125	20164	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via	1 single main route on the drawings but 2 suggested routes via google	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is	Yes although it crosses the Humber toll bride and even though it is a shorter distance it is	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
								google		estimated to be a longer travel time.	estimated to be a longer travel time.	estimated to be a longer travel time.	
9	Hull	Lincoln	20164	20118	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time although it crosses the Humber toll bride	Yes they are the quickest route by travel time although it crosses the Humber toll bride	Yes they are the quickest route by travel time although it crosses the Humber toll bride	N/A
9	Lincoln	Hull	20118	20164	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time although it crosses the Humber toll bride	Yes they are the quickest route by travel time although it crosses the Humber toll bride	Yes they are the quickest route by travel time although it crosses the Humber toll bride	N/A
10	Derby	Newcastle	20111	20193	All time periods follow same route.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes the route is one of the quickest time wise although the route is increased by 4 miles.	Yes although the route is increased by 4 miles and 10 minutes	Yes although the route is increased by 4 miles and 10 minutes	N/A
10	Newcastle	Derby	20193	20111	All time periods follow same	N/A	1 single main route on the drawings but	1 single main route on the	1 single main route on the drawings but 2	The A1 / M1 route is an option that	The A1 / M1 route is an option that	The A1 / M1 route is an option that	Does not use the A1 / A1(m)

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					route.		2 suggested routes via google	drawings but 2 suggested routes via google	suggested routes via google	some people will take in reality. However it is longer than the A1 / M18 / M1 alternative.	some people will take in reality. However it is longer than the A1 / M18 / M1 alternative.	some people will take in reality. However it is longer than the A1 / M18 / M1 alternative.	
11	Rotherham	Chesterfield	11063	14020	No. AM and PM take different routes. With IP taking a combination of the AM and PM routes.	The differences are plausible, with routes sensible.	Yes one route	Yes one route	Yes one route	The route from Rotherham to the M1 is sensible; however the route leaves at J29 rather than J29a.	The route from Rotherham to the M1 is sensible; however the majority route leaves at J29 rather than J29a.	The full route matches the suggested route from Google maps.	N/A
11	Chesterfield	Rotherham	14020	11063	The route is different in all time periods.	The differences are plausible, with routes sensible.	Yes one main route	Yes one main route	No there are three routes	Google suggests joining the motorway at J29 however the route in the model joins at J29a.	Yes, route chosen matches suggested route from Google.	No, as main route from Google is not chosen as one of the three.	N/A
12	Rotherham	Doncaster	11063	12024	Main route is the same in all time periods.	The PM difference is plausible.	Yes one main route	Yes one main route	Yes one main route with a secondary minor route	Yes	Yes	Yes	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					There is a slight difference in the PM.								
12	Doncaster	Rotherham	12024	11063	IP and AM follow the same route. PM takes an alternate route.	Similar distance. Though slightly odd PM avoids M18.	Yes one main route	Yes one main route	Yes one main route	Yes the route chosen is the one suggested by Google traffic.	Yes the route has roughly the same travel time and is shorter in distance by 3 miles.	Yes the route has roughly the same travel time and is shorter in distance by 6.4 miles	N/A
13	Rotherham	Retford	11063	18005	A different route is used in each time period.	Unknown	Yes one main route	Yes one main route	2 routes taken	Route chosen matches of the alternative suggestion from Google traffic	Route chosen matches suggestion from Google traffic.	Route chosen matches suggestion from Google traffic.	N/A
13	Retford	Rotherham	18005	11063	IP and AM follow the same route, PM takes an alternate route.	Possibly due to congestion.	Yes one main route	Yes one main route	Yes one main route	Nearly all the route is the suggested route in Google. The difference being getting from the motorway to Rotherham. Route is still sensible.	The route taken in the model is one of the suggested routes in Google traffic and is the shortest in distance.	Nearly all the route is an alternative suggested route in Google. The difference being getting from the motorway to Rotherham. Route is still sensible.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
14	Gainsborough	Barnsley	20048	13096	IP and PM follow the same route, AM follows an alternate route.	Possibly due to congestion	Yes one main route	Yes one main route	Yes one main route	Route chosen matches suggestion from Google traffic.	Similar time to the route suggested in Google, though slightly longer in distance 3km.	Similar time to the route suggested in Google, though slightly longer in distance 3km.	N/A
14	Barnsley	Gainsborough	13096	20048	All time periods route use the M1 as far as M18 J1. After this point differences occur until they join again near Bawtry.	Possibly due to congestion	Yes one main route	Two routes used, one travelling further on the M18 but less direct.	Yes one main route	Yes this is a sensible option using the SRN.	Two sensible routes are chosen, one option involves leaving the SRN at M18 J1 and heading east to join A631.	Yes this is a sensible option using the SRN.	N/A
15	Everton	Swinton	18058	11133	AM and PM the same route which is a secondary suggestion on google whereas IP follows the suggested route?	Yes	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes although it is not the suggested route by google it is estimated to have the same travel time.	Yes it is both the quickest and shortest route for this time period.	Yes although it is not the suggested route by google it is estimated to have the same travel time.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
15	Swinton	Everton	11133	18058	All time periods follow the same route with IP also following a second route.	No, there is no obvious reason for vehicles to take different routes in the IP.	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes this is logical, though there is a slightly shorter route avoiding the A1 (M)	Yes both of the routes are logical.	Yes this is logical, though there is a slightly shorter route avoiding the A1 (M)	N/A
16	Conisborough	Tankersley	12137	13118	All time periods follow the same route which is a secondary route suggestion via google	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes this is a logical route.	Yes this is a logical route.	Yes this is a logical route.	N/A
16	Tankersley	Conisborough	13118	12137	All time periods follow the same route although the route is only the suggest route by google at IP time period and a secondary route at AM	Yes	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes this is a logical route.	Yes it is the quickest route for the time period	Yes this is a logical route.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					and PM								
17	Worksop	Robin Hood Airport	18055	12173	All time periods follow the same route	N/A	Yes one main route	Yes one main route	Yes one main route	Yes this route is the one suggested by Google.	Yes this route is the one suggested by Google.	Yes this route is the one suggested by Google.	N/A
17	Robin Hood Airport	Worksop	12173	18055	AM and PM follow the same route. The IP has a secondary minor alternative.	Possibly	Yes one main route	2 routes taken	Yes one main route	Yes this route is the one suggested by Google.	Yes this major route is the one suggested by Google.	Yes this route is the one suggested by Google.	Alternative route in the IP is close, both in terms of distance and time.
18	Barnsley	Robin Hood Airport	13096	12173	All time periods follow the same route in the drawings although google suggests an alternate route for AM time period.	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes the route on the drawing is the most sensible route although google disagrees for the time period.	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	N/A
18	Barnsley	Robin Hood Airport	13096	12173	All time periods follow the same route in the drawings	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested	1 single main route on the drawings but 2 suggested routes via google	Yes the route on the drawing is the most sensible route although google	Yes it is a longer route distance wise but the travel time is quicker than	Yes it is a longer route distance wise but the travel time is quicker than the	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					although google suggests an alternate route for AM time period.			routes via google		disagrees for the time period.	the alternate routes	alternate routes	
19	Dronfield	Chapeltown	15038	10248	For the vast majority of the route the traffic uses the same route.	N/A	Yes	Yes	Yes	Yes this is a logical route using the main roads.	Yes this is a logical route using the main roads.	Yes this is a logical route using the main roads.	Route uses banned link in Sheffield residential area. This will need correcting.
19	Chapeltown	Dronfield	10248	15038	All time periods route down the M1 to J34. However each time period takes a different route from here to the A61.	Congestion in Sheffield may cause the different routes.	Yes	Yes	There are multiple route options between J34 and the A6102	Yes this is a logical route, even if it avoids the Parkway and uses the A631 instead.	Yes this is a logical route using the main roads.	Many routes chosen, though none of the routes appear too absurd.	N/A
20	Sheffield	Rotherham	10402	11063	IP and PM follow the same route, AM follows a different route.	Delay on the Parkway and J33 may make the route through J34 more	Yes one main route	Yes one main route	Yes one main route	The route chosen is the one suggested by Google.	The route chosen is the one suggested by Google.	The route chosen is an alternative route suggested by Google.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
						attractive in the AM peak.							
20	Rotherham	Sheffield	11063	10402	All time periods follow the same main route	N/A	Yes one main route	Yes one main route	Yes one main route	The route chosen is the one suggested by Google.	The route chosen is the one suggested by Google.	The route chosen is the one suggested by Google.	N/A
21	Dore	Meadowhall	10211	10285	AM and PM take different routes, with the IP split between these two.	Possibly due to congestion.	Yes one main route.	Two main routes.	Yes one main route.	The route chosen is an alternative route suggested by Google.	The routes chosen are similar in distance, and one is the suggested route by Google.	The route chosen is an alternative route suggested by Google.	N/A
21	Meadowhall	Dore	10285	10211	AM and IP take the same route, but PM takes many routes.	No	Yes one main route.	Yes one main route.	No, many routes are suggested.	The route chosen is the one suggested by Google.	The route chosen is an alternative route suggested by Google.	Too many routes selected by the model.	N/A
22	Maltby	Meadowhall	11076	10285	All time periods follow the same route as suggested by google	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
22	Meadowhall	Maltby	10285	11076	All time periods follow the same route as suggested by google	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	Yes it is a longer route distance wise but the travel time is quicker than the alternate routes	N/A
23	Worksop	Sheffield	18055	10402	All time periods follow the same route as suggested by google although 1-24% of AM traffic flow follow an alternate route	Yes	1 single main route	1 single main route	1 single main route	The main route yes but the alternate route is not recommended by google.	Yes it is the only route available by google.	Yes it is the only route available by google.	N/A
23	Sheffield	Worksop	10402	18055	All time periods follow the same route as suggested by google	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes it is the only route available by google.	Yes it is the only route available by google.	Yes it is the only route available by google.	N/A
24	Barnsley	Sheffield	13096	10402	All time periods	N/A	1 single main route on the	1 single main route	1 single main route on the	Yes although distance varies	Yes although distance	Yes although distance varies	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					follow the same route for approx. the 90% of the route but IP and PM split into 2 routes with traffic flows of 1-24% and 75-99% while AM splits into 4 routes 2 with traffic flows of 1-24% and 2 with traffic flows of 25-49%		drawings but 3 suggested routes via google	on the drawings but 3 suggested routes via google	drawings but 3 suggested routes via google	the travel time is roughly the same for all route diversions	varies the travel time is roughly the same for all route diversions	the travel time is roughly the same for all route diversions	
24	Sheffield	Barnsley	10402	13096	All time periods follow the same main route	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
25	Barnsley	Rotherham	13096	11063	AM and PM follow the same route,	Yes	1 single main route on the drawings but	1 single main route on the	1 single main route on the drawings but 3	Yes they are the quickest route by travel	Yes they are the quickest route by	Yes they are the quickest route by travel	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					IP follows the same route for the first 80% of the route but takes an alternate detour from the M1 to the end point.		3 suggested routes via google	drawings but 3 suggested routes via google	suggested routes via google	time.	travel time.	time.	
25	Rotherham	Barnsley	11063	13096	All time periods follow the same main route with the beginning of the route being split between two diversions of 75-99% and 1-24% of the traffic flow.	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
26	Chesterfield	Meadowhall	14020	10285	AM and IP take different routes. With the PM a combination of the two.	Routeing differences could be down to congestion.	Yes one main route.	Yes one main route.	Two routes chosen.	The route taken is longer than the suggestion from Google however the	The route taken is an alternative route suggested by Google.	The minor route is the one suggested by Google, with the major route an	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
										route is still logical.		alternative suggestion.	
26	Meadowhall	Chesterfield	10285	14020	A different route is taken in all three periods.	Routeing differences could be down to congestion.	Yes one main route.	Yes one main route.	Yes one main route.	The route chosen is similar to the suggested route from Google.	The route chosen is an alternative route suggested by Google.	The route chosen is the one suggested by Google.	N/A
27	Sheffield	Mansfield	10420	20007	Same route in all time periods.	N/A	Yes one main route.	Yes one main route.	Yes one main route.	The route chosen is an alternative route suggested by Google.	The route chosen is an alternative route suggested by Google.	The route chosen is an alternative route suggested by Google.	Routeing issues between M1 and Mansfield.
27	Mansfield	Sheffield	20007	10420	IP and AM follow the same route, PM follows an alternative route	Possibly	Yes one main route.	Yes one main route.	Yes one main route.	Route chosen is one taken from Google.	Route chosen is one taken from Google.	Route chosen is one taken from Google.	N/A
28	Cheadle	Robin Hood Airport	20137	12173	All time periods follow the same main route	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
28	Robin Hood Airport	Cheadle	12173	20137	All time periods follow the same main route	N/A	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes it is both the quickest and shortest route for this time period	Yes it's the shortest route with a difference of 26.1 miles compared to googles suggested route although the travel time is increased by 10 minutes	Yes it is the quickest route as suggested by google	N/A
29	Sheffield	Hull	10402	20164	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
29	Hull	Sheffield	20164	10402	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
30	Bolsover	Leeds	1600	2011	All time	N/A	1 single main	1 single	1 single main	Only one route	Only one	Only one route	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
			4	2	periods follow the same main route		route	main route	route	suggested via google.	route suggested via google.	suggested via google.	
30	Leeds	Bolsover	20112	16004	All time periods follow the same main route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
31	Maltby	Leeds	11076	20112	AM uses the A1 whereas the IP and PM use the M1.	Yes	1 single main route	1 single main route	1 single main route	Route taken is an alternative route suggested by Google.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	N/A
31	Leeds	Maltby	20112	11076	All time periods follow the same main route	N/A	1 single main route	1 single main route	1 single main route	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	N/A
32	Barnsley	Doncaster	13096	12024	The three time periods use different routes.	Routes are similar with differences minor.	1 single main route	2 routes are chosen	1 single main route	Route taken is an alternative route suggested by Google.	Both routes taken are alternative route suggested by Google.	Route taken is the one suggested by Google.	N/A
32	Doncaster	Barnsley	1202	1309	AM and PM	The PM using	1 single main	2 routes are	1 single main	Route taken is	Route taken	Route taken is	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
			4	6	use different routes, with the IP using a similar route to the AM.	the M18 / M1does make sense.	route	chosen	route	the one suggested by Google.	is longer than Google suggests but is still logical.	similar in time to suggested route from Google.	
33	Sheffield	Doncaster	1040 2	1202 4	All time periods follow the same main route	N/A	1 single main route.	1 single main route.	1 single main route.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
33	Doncaster	Sheffield	1202 4	1040 2	All time periods follow the same main route with AM having roughly three minor diversions (1%) towards the end of the route	Yes	1 single main route.	1 single main route.	1 single main route.	Yes, excluding the minor diversions from 1% of the traffic flow	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
34	Nottingham	Robin Hood Airport	2012 5	1217 3	IP and AM follow the same route, PM follows an alternative.	Yes, congestion could be an explanation for the different route choices.	1 single main route.	1 single main route.	1 single main route.	Route taken is the one suggested by Google.	Route taken is an alternative route suggested by Google.	Route taken is an alternative route suggested by Google.	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
34	Robin Hood Airport	Nottingham	12173	20125	All time periods follow same route.	N/A	1 single main route.	1 single main route.	1 single main route.	Route taken is an alternative route suggested by Google.	Route taken is an alternative route suggested by Google.	Route taken is an alternative route suggested by Google.	N/A
35	Southwell	Doncaster	20083	12024	All time periods follow the same main route with AM having a minor diversion (1%)	The AM diversion makes no difference time wise but adds 0.2 mile to the route.	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes excluding the 1% traffic flow diversion	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
35	Doncaster	Southwell	12024	20083	All time periods follow the same route except a minor difference at the start of PM.	Yes	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
36	Stocksbridge	Killamarsh	15061	10253	All time periods follow the same main route	N/A	1 single main route.	1 single main route.	1 single main route.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	N/A
36	Killamarsh	Stocksbridg	1025	1506	All time	N/A	1 single main	1 single	1 single main	Yes they are	Yes they are	Yes they are	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
		e	3	1	periods follow the same main route		route.	main route.	route.	the quickest route by travel time.	the quickest route by travel time.	the quickest route by travel time.	
37	Dungworth	Treeton	1000 1	1105 0	IP and PM same, AM route diverting from A road to B road	Google journey planner does suggest one alternate route but it has a longer travel time although the AM route difference is NOT a suggested route.	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	1 single main route on the drawings but 3 suggested routes via google	Yes, the diversion seems a logical route	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	
37	Treeton	Dungworth	1105 0	1000 1	IP and AM same route, PM has a minor diversion (1%) along a bus route.	Google journey planner does suggest one alternate route but it has a longer travel time.	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	PM diversion may be a logical route for drop offs/ pick-ups along the route
38	Wath upon Derne	Catcliffe	1115 7	1107 0	AM and IP take the same route,	Possibly, the routes are similar	1 single main route.	1 single main route.	1 single main route.	Route taken is the one suggested by	Route taken is the one suggested by	Route taken is an alternative route	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
					PM takes a parallel route.	distance.				Google.	Google.	suggested by Google.	
38	Catcliffe	Wath upon Derne	11070	11157	All time periods follow the same route.	N/A	1 single main route.	1 single main route.	1 single main route.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	N/A
39	Ponds Forge	Conisborough	10148	12137	Same route in all three periods.	N/A	1 single main route.	1 single main route.	1 single main route.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	Route taken is the one suggested by Google.	
39	Conisborough	Ponds Forge	12137	10148	IP and PM take different routes, AM takes combination of the two.	Possibly	2 main routes	1 single main route.	1 single main route.	The minor route is the route suggested by Google. The major route is the same time.	Route taken is the one suggested by Google.	Route chosen in similar in time to the one suggested by Google.	N/A
40	Hillsbrough	Bramall Lane	10039	10153	AM, PM and IP all follow the same route. Google journey planner offers no alternate route	N/A	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	1 single main route on the drawings but 2 suggested routes via google	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	Yes they are the quickest route by travel time.	AM shows several diversions although the flow count is minor
40	Bramall	Hillsborough	1015	1003	Yes although	N/A	1 single main	1 single	1 single main	Yes they are	Yes they are	Yes they are	N/A

#	From	To	From Zone	To Zone	Are the same routes chosen in all time periods?	Do the routing differences by time period make sense?	AM – Are there 1-2 main routes?	IP – Are there 1-2 main routes?	PM – Are there 1-2 main routes?	AM -Are the routes chosen sensible? If no, why?	IP -Are the routes chosen sensible? If no, why?	PM -Are the routes chosen sensible? If no, why?	Any Comments
	Lane		3	9	Google shows a different main route for PM and the chosen only as a secondary route		route on the drawings but 3 suggested routes via google	main route on the drawings but 3 suggested routes via google	route on the drawings but 3 suggested routes via google	the quickest route by travel time.	the quickest route by travel time.	the quickest route by travel time.	

Appendix K RSI Comparisons

K.1 RSI Record Processing

Intro

This appendix discusses the process that compared assignments with the prior and post estimated matrices against data obtained from RSIs. This is done at a screenline level, for each modelled time period. Checks are done separately for Cars and Freight for trip length distributions and district to district proportions. Additionally the journey purposes between the three types of Car trips are compared.

Background

Prior matrices were built from various data sources including mobile phone data (MPD) and freight matrices from the TransPennie South (TPS) model. To check the reliability of the prior matrices, AECOM decided to use data collected from RSI sites. There were 13 RSI sites, which were combined into 4 screenlines, across the study area. The sites and screenlines are shown in Figure 205 below. Whilst traditionally these would have been used to make the highway demand matrix, for movements between sectors; for this model they would be used to check the prior matrix built from mobile phone, TPS, and synthetic sources.

This was due to the programme constraints and not being able to wait for the RSIs before commencing the matrix build.

Sites were chosen to represent different types of movements across SCR. Following discussions with the Police and client we agreed on the following 13 sites across South Yorkshire and Derbyshire:

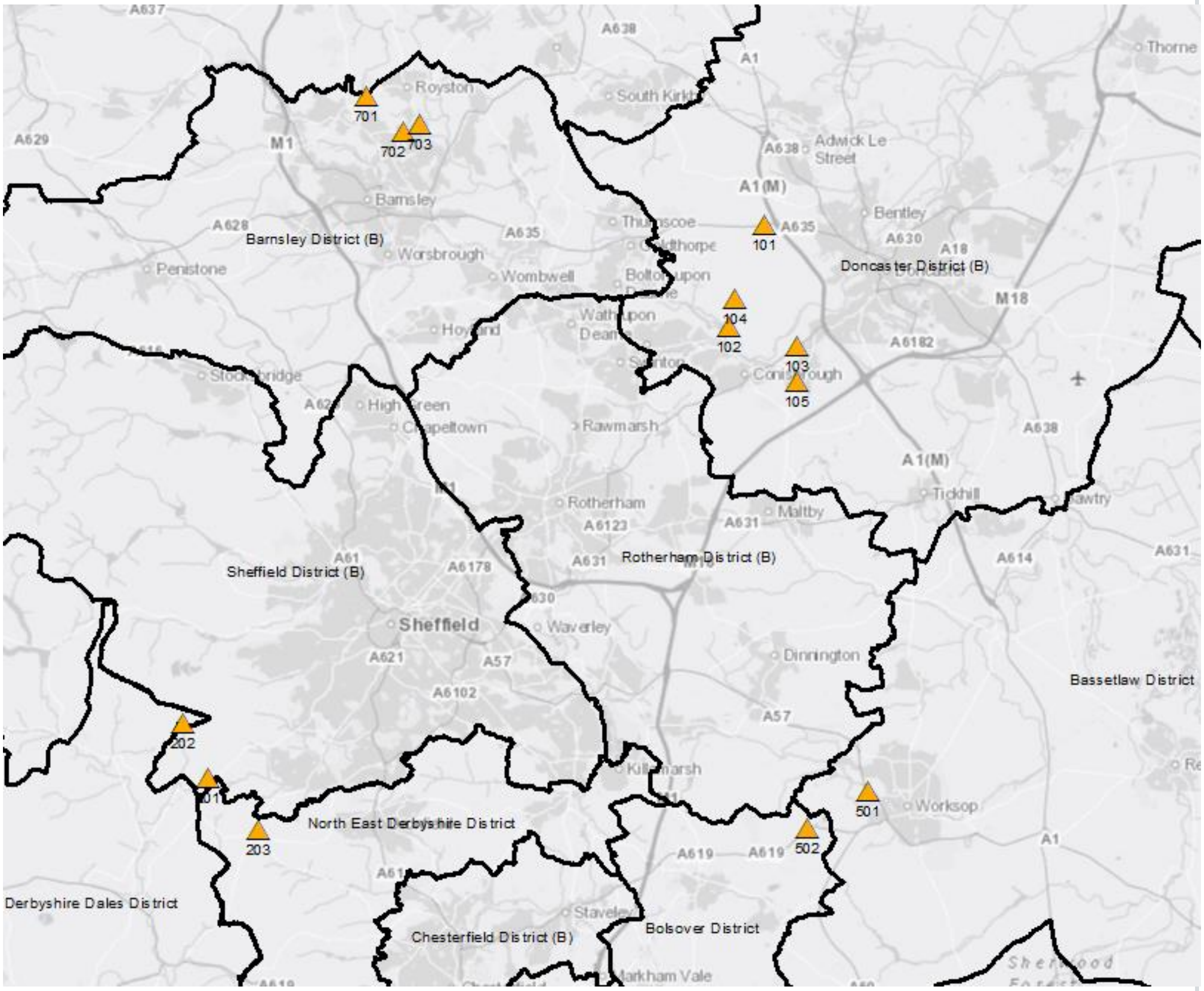


Figure 205. RSI All Screenlines locations

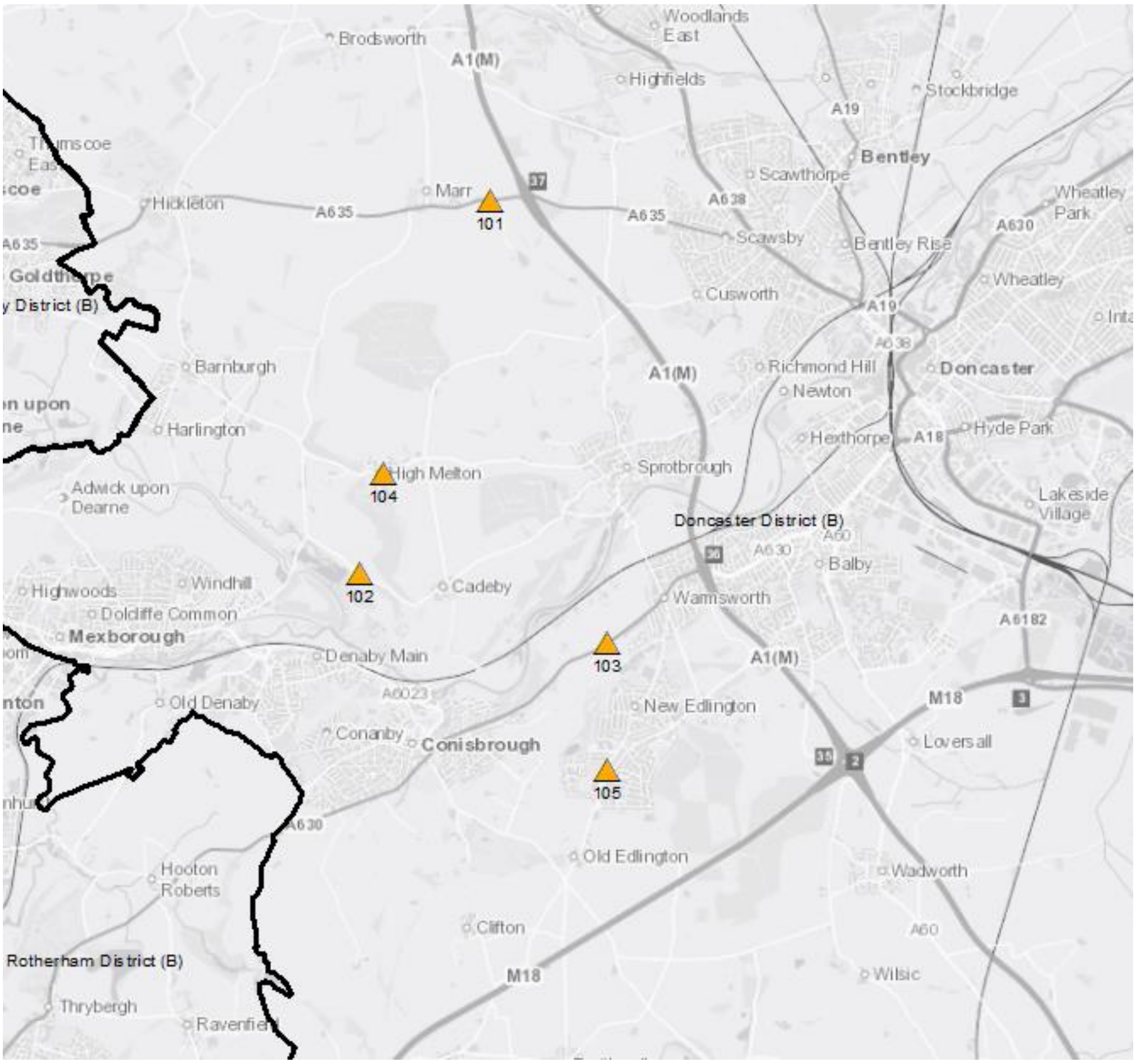


Figure 206. RSI Screenline 1 count site locations

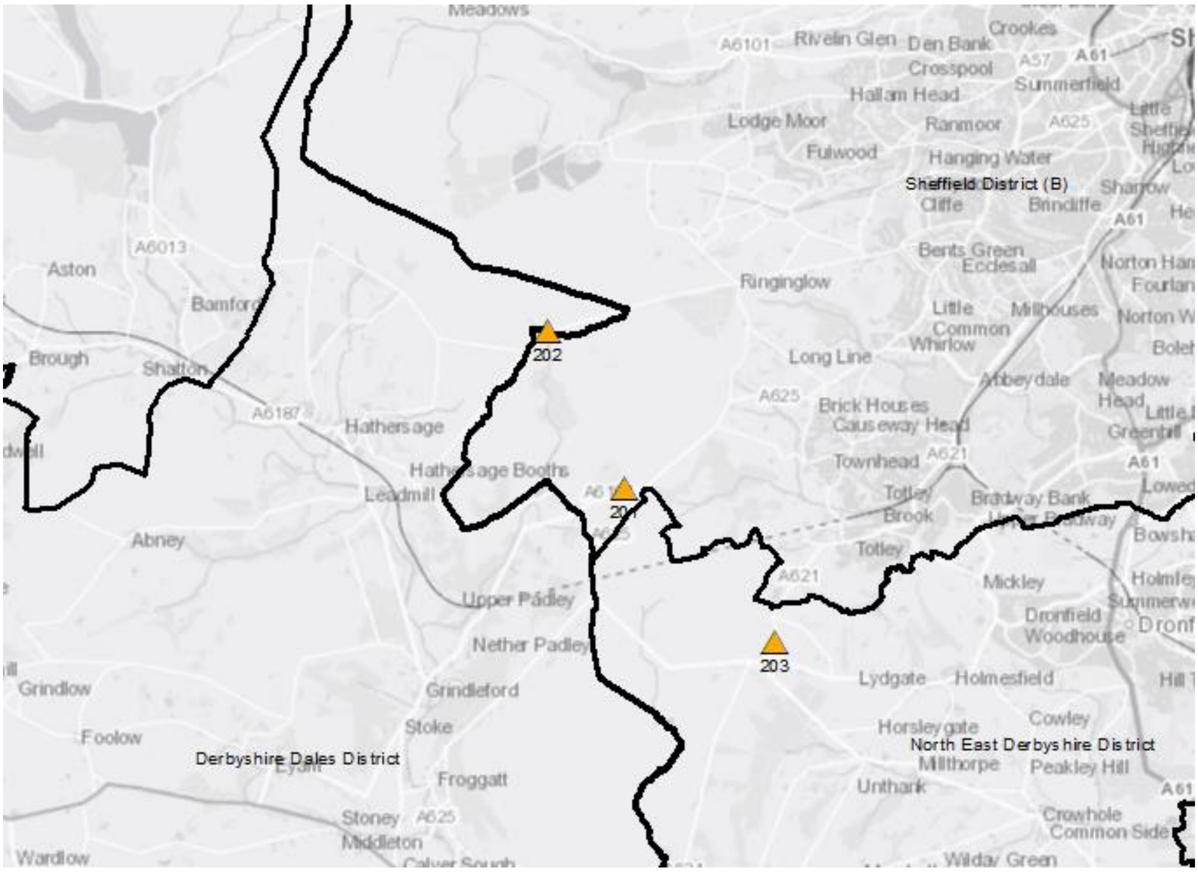


Figure 207. RSI Screenline 2 count site locations

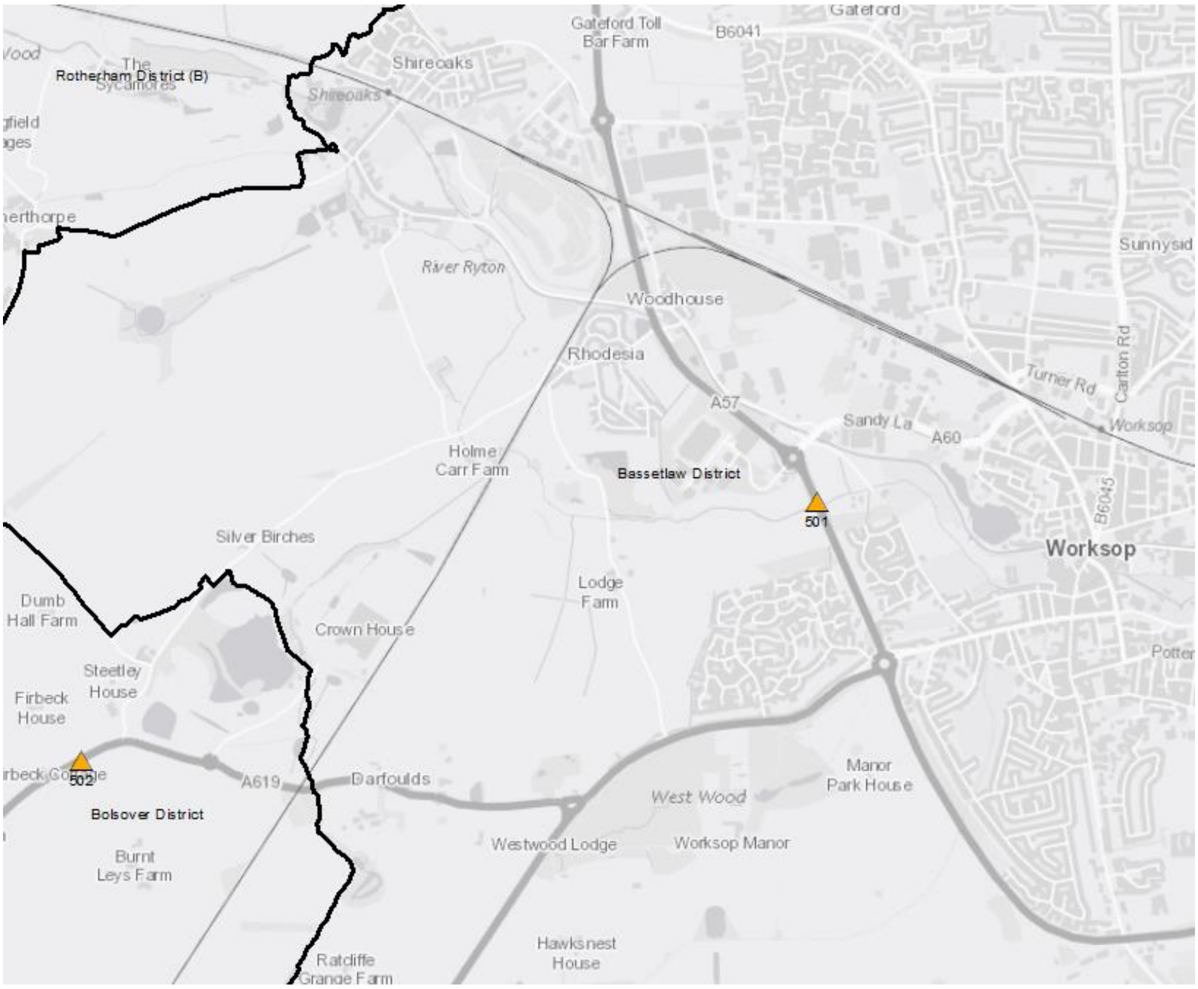


Figure 208. RSI Screenline 5 count site locations

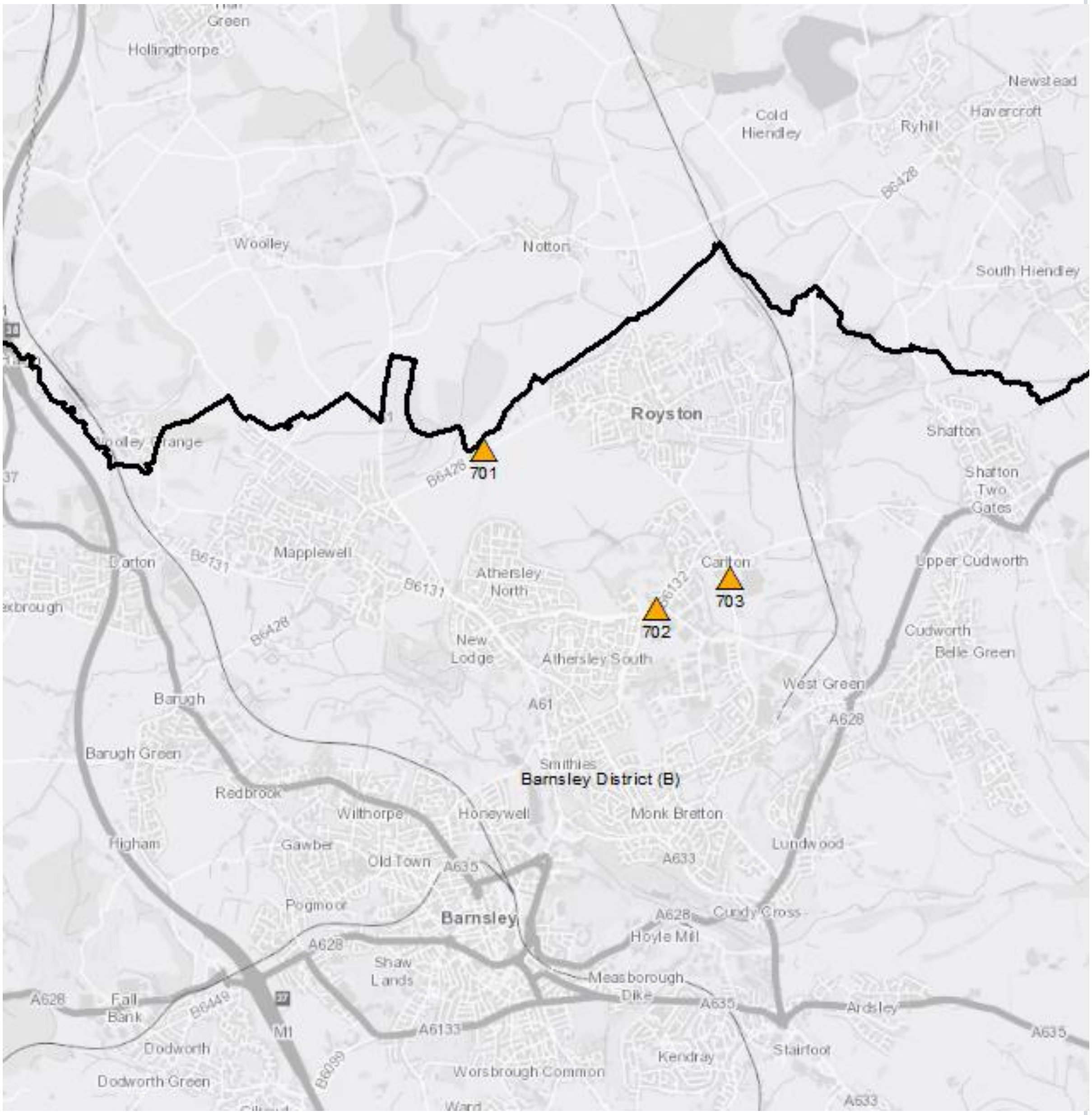


Figure 209. RSI Screenline 7 count site locations

The 13 sites were combined into 4 screenlines, 1, 2, 4 and 7; where possible the sites interview direction matched that of the screenline. Unfortunately this was not possible at sites 101 and 702. Separate steps would need to be taken at these sites and these are detailed below. Note that site 501 had to be moved from its preferred position; this was due to police safety concerns with the original site being in an accident management area. Unfortunately the new site location was on the A57 within South Anston to the west of Royton Road junction so screenline 5 contains a small gap.

At site 105, it was discovered on the day, that emergency roadworks were taking place which prevented interviews occurring. Therefore this became an all postcard site.

At all sites full ATC counts were taken for a two week period during 2017 including the RSI interview day, in both directions. On the interview day a MCC was conducted by hourly period of all traffic passing the site in both directions.

Initial sifting

As Nationwide processed the record they attempted to identify seemingly illogical and reversed trips by plotting information on a map base. Whilst this is somewhat subjective the definitions for illogical and reversed were as follows:

Void – the record is missing a key piece of data such as the origin or destination postcode or origin – destination journey purpose not allowing the record to be usefully used.

Illogical – the trip appears to make no sense in relation to the site location and direction of interview e.g. both the origin and destination are located on the same side of the site.

Reversed – the origin and destination appears to be the wrong way round, which can sometimes happens with postal returns as people occasionally can't remember which direction they were travelling in when they received the postcard.

Logical – complete records which could reasonably pass through the site in the interview direction.

Following this initial sifting AECOM were provided with the remaining 7506 records across all 12 sites, and over the 12 hours.

Further sifting

After receiving the Roadside Interviews (RSIs) from Nationwide Data Collection (NDC), AECOM undertook a further series of checks to assess their validity. It is worth noting that this data had already undergone a series of checks before being issued to AECOM.

Of the 7506 records received, 85 were deemed to be invalid c1.1% of the data received.

Journey Purpose

For each interview, and postcard response the purpose for being at the origin and destination of the trip was recorded, using the following categories:

- Permanent Home
- Holiday Home
- Work
- Employers Business
- Education
- Shopping
- Personal Business
- Visit Friends
- Recreation / Leisure
- Other

Additionally the vehicle type, be that Car/Taxi, LGV, MGV or HGV was recorded. All freight trips were assumed to be Non-Home Based Other trips, so the purpose response was not used.

For trips in a Car/Taxi, these were split into the following three categories in line with the 'levels' of the Prior Matrix: Commuting, Business, and Other.

For analysing the RSI records Commuting was defined to consist of trips travelling either Permanent Home to Work or Work to Permanent Home. Business was made out of trips which had either end being Employers Business. The remaining combinations were all mapped to Other. This mapping has the advantage of being symmetric so it did not matter if the trip was heading from home or to home as the purpose would be the same regardless.

Mapping to Zones

All the origin and destination postcodes were converted to a coordinate, which in turn was mapped to a SCRTM1 zone. This turned all the records to an origin destination zonal pair.

At this stage some alterations and duplication of records was needed, to allow the best possible set of records through the screenline before expansion factors were calculated and applied.

Reversed Records at all sites

For the trips that appear to have their origin and destination the wrong way around, the origin and destination zone were switched. The journey purpose was left as the mapping is symmetric.

Mapping interview time to a model time period for Cars at sites other than 101 and 702

Sites were run for 12 hours between 7 am and 7 pm. These were mapped into the three modelled time periods shown in the table below.

Interview Period	Model Time Period
7 am – 10 am	AM Peak Hour (7 am – 8 am)
10 am – 4 pm	IP average Hour (10 am – 4 pm)
4 pm – 7 pm	PM Peak Hour (5 pm – 6 pm)

The reason for the IP mapping is self-evident. For the two peak hours, it was judged that the movements by journey purpose between the corresponding three hour period and middle single hour would be very similar. Of course there may be some difference between the volume of trips within the three hours, though this would be managed through expansion factors, which is discussed later.

Expansion Factors for car trips at sites other than 101 and 702

Using the ATC and MCC at each count site, in the screenline direction, it was possible to calculate an estimate for the number of cars passing each site during 7 – 8 am, 5 – 6 pm and average Interpeak hour on a typical day, such as when the interview was not taking place.

Appropriate expansion factors were then calculated and applied.

Expansion Factors for Car trips at reversed sites (101 and 702)

As mentioned previously two sites, 101 and 702, had the interviews conducted in the opposite direction to the screenline direction. For the records at these two sites, the following assumptions were used:

- The reverse part of the journey would occur and would pass the site in the reverse direction either earlier or later that day. This would be in the same direction as the screenline.
- The recorded journey would be part of a two legged trip, if for example the journey was Commuting from Zone A to Zone B then the reversed trip would also be Commuting from Zone B to Zone A.
- Trips passing through each screenline would have the same journey purpose split by time of day. I.e. the JP split at site 102 would be broadly the same as site 103.

Each of the records at site 101 was copied into all three model time periods with the origin and destination zone of the trip switched. The journey purpose was kept the same.

From processing the ATC count in the opposite direction to site 101, there was a target count for cars by model time period. This was split into a count by journey purpose by time period using the split obtained from the expanded records at sites 102 and 103. The same process was repeated for site 702 using the journey purpose information from 701 and 703.

Trips were then expanded to give the count car totals observed in each time period at site 101 and 702 in the same direction as the screenline.

Freight trips

For sites 101 and 702, the origin and destination zones were switched.

As freight interview samples were very low, then it was decided to copy each freight record into every model time period (AM, IP and PM) and ignore the time that the interview occurred.

As all freight was mapped to the same journey purpose, non-home based, and then no correction was required for journey purposes.

An expansion factor was applied to give the target number of LGV, MGV and HGVs by model time period for the reversed 101 and 702.

Screenline combination

At this stage the records were combined by screenline to give an estimate of the observed movements over the screenline by model time period. The individual site that the record passed through was kept to allow routing checks later if required.

Comparison between RSI and Prior Matrix

All analysis took place at the model hour, screenline level. Some differences would be expected as the two sets of data have been built using different sources

K.2 Extracting Records from the Assignment models

Extracting trips from Prior Matrix Assignment Model

The un-factored prior matrices were assigned to the highway networks, to create a prior highway model for each modelled time period. Trips passing through each screenline in each of the three models were extracted, by user class to give the vehicle and journey purpose of each trip.

Extracting trips from Post ME2 Matrix Assignment Model

The same process was repeated for the matrices after they had been estimated.

Both sets of results are shown below.

K.3 Prior Matrix Comparisons to RSI Records

Checks on Journey Purpose Splits

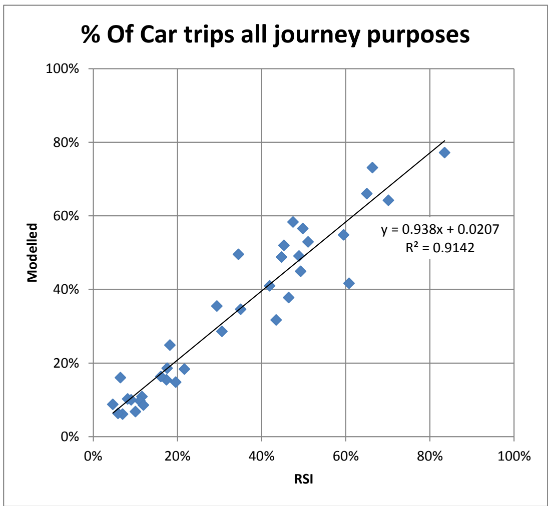
One of the purposes of using the RSI data is to see how close the split between the three journey purposes for car trips in the prior matrix is to the observed. The percentage of car trips for each journey purpose by screenline and time period is shown below.

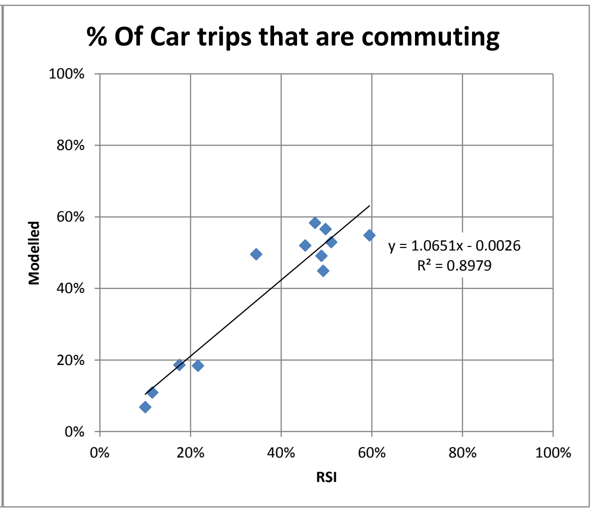
Table 116. Journey Purpose Split comparison Prior vs RSI

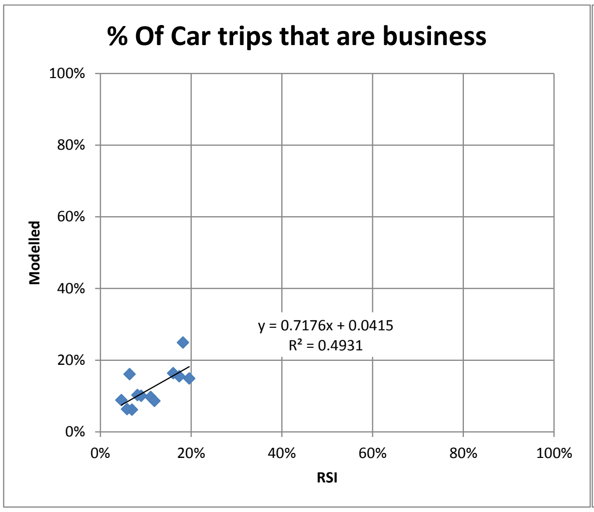
		RSI			Prior Assignment			Post Assignment		
Screenline		Commuting	Business	Other	Commuting	Business	Other	Commuting	Business	Other
1	AM	59%	11%	29%	55%	10%	35%	5%	1%	-6%
1	IP	18%	17%	65%	19%	15%	66%	-1%	2%	-1%
1	PM	45%	8%	46%	52%	10%	38%	-7%	-2%	9%
2	AM	47%	9%	44%	58%	10%	32%	-11%	-1%	12%
2	IP	10%	6%	84%	7%	16%	77%	3%	-10%	6%
2	PM	35%	5%	61%	50%	9%	42%	-15%	-4%	19%
5	AM	50%	20%	31%	57%	15%	29%	-7%	5%	2%
5	IP	12%	18%	70%	11%	25%	64%	1%	-7%	6%
5	PM	49%	16%	35%	49%	16%	35%	0%	0%	0%
7	AM	51%	7%	42%	53%	6%	41%	-2%	1%	1%
7	IP	22%	12%	66%	18%	9%	73%	3%	3%	-7%
7	PM	49%	6%	45%	45%	6%	49%	4%	0%	-4%

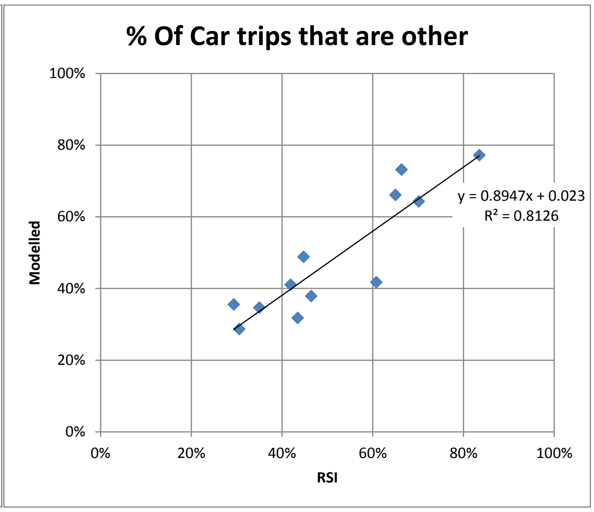
Source: AECOM analysis

The average percentage point difference is 5%. Screenline 2 seems to be the worst matching, which lies south west of Sheffield at the edge of the SCR. Below scatter plots are shown comparing the percentage splits from the model and the RSI information. The correspondence between the two datasets is good for all proposes together (R2 = 0.91), for commuting (R2 = 0.90) and other (R2 = 0.81). Business is the weakest (R2 = 0.49), but this contributes the smallest number of trips so total differences may be small.









Checks on Sector to Sector Movements

This analysis was completed by screenline, by model time period first for Car, and then for Freight combined, comparing the RSI expanded records to the Prior Matrix.

Screenline	Vehicle	TimePeriod	Model
1	Car	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	3	4	0	0	0	0	0	7
Rotherham	0	1	3	12	0	0	0	0	0	15
Doncaster	40	424	556	333	2	1	3	0	19	1378
Barnsley	0	0	3	0	0	0	0	0	0	3
Chesterfield	0	1	0	1	0	0	0	0	0	2
NE Derbyshire	0	0	0	1	0	0	0	0	0	1
Bolsover	0	0	0	3	0	0	0	0	0	3
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	14	8	19	0	0	0	0	0	41
All	**40**	**440**	**573**	**373**	**2**	**1**	**3**	**0**	**19**	**1451**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	16	4	0	0	0	0	0	19
Rotherham	0	0	24	24	0	0	0	0	0	49
Doncaster	23	437	574	256	0	0	0	0	0	1291
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	3	0	0	0	0	0	0	3
NE Derbyshire	0	0	1	1	0	0	0	0	0	2
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	23	15	16	0	0	0	0	0	53
All	**23**	**459**	**634**	**301**	**0**	**0**	**0**	**0**	**0**	**1419**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Doncaster	3%	29%	38%	23%	0%	0%	0%	0%	1%	95%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	3%
All	**3%**	**30%**	**39%**	**26%**	**0%**	**0%**	**0%**	**0%**	**1%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%
Rotherham	0%	0%	2%	2%	0%	0%	0%	0%	0%	3%
Doncaster	2%	31%	40%	18%	0%	0%	0%	0%	0%	91%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	2%	1%	1%	0%	0%	0%	0%	0%	4%
All	**2%**	**32%**	**45%**	**21%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Car	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	2	2	0	0	0	0	0	4
Rotherham	0	0	2	6	0	0	0	0	0	8
Doncaster	18	215	471	191	1	0	5	0	0	900
Barnsley	0	0	4	0	0	0	0	0	0	4
Chesterfield	0	0	1	0	0	0	0	0	0	2
NE Derbyshire	0	0	2	1	0	0	0	0	0	4
Bolsover	0	0	0	2	0	0	0	0	0	2
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	8	6	9	0	0	0	0	0	23
All	**18**	**224**	**489**	**211**	**1**	**0**	**5**	**0**	**0**	**947**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	2	0	0	0	0	0	0	2
Rotherham	0	0	5	11	0	0	0	0	0	15
Doncaster	13	321	522	268	0	0	0	0	1	1125
Barnsley	0	1	2	0	0	0	0	0	0	3
Chesterfield	0	0	1	1	0	0	0	0	0	1
NE Derbyshire	0	0	1	1	0	0	0	0	0	1
Bolsover	0	0	1	1	0	0	0	0	0	2
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	7	11	12	0	0	0	0	0	30
All	**13**	**329**	**544**	**294**	**0**	**0**	**0**	**0**	**1**	**1180**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Doncaster	2%	23%	50%	20%	0%	0%	1%	0%	0%	95%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	2%
All	**2%**	**24%**	**52%**	**22%**	**0%**	**0%**	**1%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Doncaster	1%	27%	44%	23%	0%	0%	0%	0%	0%	95%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	3%
All	**1%**	**28%**	**46%**	**25%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Car	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0	0	5	4	0	0	0	0	0	**9**
Rotherham	0	0	2	10	0	0	0	0	0	**11**
Doncaster	35	328	701	347	0	0	0	0	3	**1413**
Barnsley	0	0	1	0	0	0	0	0	0	**1**
Chesterfield	0	1	0	1	0	0	0	0	0	**2**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	1	3	0	0	0	0	0	**4**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	15	16	19	0	0	0	0	0	**50**
All	**35**	**345**	**725**	**385**	**0**	**0**	**0**	**0**	**3**	**1492**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0	0	2	3	0	0	0	0	0	**5**
Rotherham	0	0	7	22	0	0	0	0	0	**29**
Doncaster	13	516	844	435	0	0	0	0	1	**1810**
Barnsley	0	5	8	0	0	0	0	0	0	**13**
Chesterfield	0	0	1	2	0	0	0	0	0	**3**
NE Derbyshire	0	0	1	1	0	0	0	0	0	**2**
Bolsover	0	0	2	1	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	9	20	15	0	0	0	0	0	**44**
All	**13**	**530**	**885**	**480**	**0**	**0**	**0**	**0**	**1**	**1909**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	2%	22%	47%	23%	0%	0%	0%	0%	0%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**3%**
All	**2%**	**23%**	**49%**	**26%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**2%**
Doncaster	1%	27%	44%	23%	0%	0%	0%	0%	0%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	1%	1%	0%	0%	0%	0%	0%	**2%**
All	**1%**	**28%**	**46%**	**25%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Car	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	10	0	0	0	12	7	0	144	0	**173**
Rotherham	2	0	0	0	0	0	0	6	0	**8**
Doncaster	1	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	1	0	**1**
Chesterfield	0	0	0	0	0	0	0	0	0	**1**
NE Derbyshire	1	0	0	0	0	0	0	2	0	**3**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**13**	**0**	**0**	**0**	**12**	**7**	**0**	**155**	**0**	**188**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	104	37	2	138	0	**281**
Rotherham	0	0	0	0	0	0	0	6	0	**6**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	1	0	**1**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	1	1	0	12	0	**14**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	1	0	**1**
All	**0**	**0**	**0**	**0**	**106**	**38**	**2**	**158**	**0**	**304**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	5%	0%	0%	0%	7%	3%	0%	77%	0%	**92%**
Rotherham	1%	0%	0%	0%	0%	0%	0%	3%	0%	**4%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	1%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**7%**	**0%**	**0%**	**0%**	**7%**	**4%**	**0%**	**82%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	34%	12%	1%	45%	0%	**93%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	4%	0%	**5%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**0%**	**0%**	**0%**	**35%**	**12%**	**1%**	**52%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
	2 Car	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	14	0	0	0	7	22	0	167	0	**210**
Rotherham	1	0	0	0	0	0	0	6	0	**7**
Doncaster	0	0	0	0	0	0	0	2	0	**2**
Barnsley	0	0	0	0	0	0	0	1	0	**1**
Chesterfield	0	0	0	0	0	0	0	1	0	**1**
NE Derbyshire	1	0	0	0	0	1	0	2	0	**4**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**16**	**0**	**0**	**0**	**7**	**23**	**0**	**179**	**0**	**226**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	7	16	0	94	0	**117**
Rotherham	0	0	0	0	0	0	0	8	0	**8**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	1	0	**1**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	3	0	**3**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**0**	**0**	**0**	**7**	**16**	**0**	**108**	**0**	**131**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	6%	0%	0%	0%	3%	10%	0%	74%	0%	**93%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	3%	0%	**3%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	1%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**7%**	**0%**	**0%**	**0%**	**3%**	**10%**	**0%**	**79%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	5%	12%	0%	72%	0%	**89%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	6%	0%	**6%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**0%**	**0%**	**0%**	**5%**	**12%**	**0%**	**83%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Car	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	26	0	0	0	18	53	0	255	0	353
Rotherham	0	0	0	0	1	0	0	11	0	11
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	1	0	0	0	0	1
Chesterfield	1	0	0	0	0	1	0	0	0	1
NE Derbyshire	1	0	0	0	0	0	0	2	0	2
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	1	0	1
Bassetlaw	1	0	0	0	0	0	0	0	0	1
All	**28**	**0**	**0**	**0**	**19**	**54**	**0**	**269**	**0**	**371**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	38	34	0	154	0	227
Rotherham	0	0	0	0	0	0	0	14	0	14
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	1	0	1	0	2
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	2	0	2
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**0**	**0**	**0**	**38**	**35**	**0**	**172**	**0**	**245**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7%	0%	0%	0%	5%	14%	0%	69%	0%	95%
Rotherham	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**8%**	**0%**	**0%**	**0%**	**5%**	**15%**	**0%**	**73%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	16%	14%	0%	63%	0%	92%
Rotherham	0%	0%	0%	0%	0%	0%	0%	6%	0%	6%
Doncaster	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**0%**	**0%**	**0%**	**16%**	**14%**	**0%**	**70%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Car	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	12	0	0	0	0	0	0	178	**190**
Rotherham	0	15	0	0	0	0	5	0	189	**209**
Doncaster	0	0	0	0	0	0	0	0	7	**7**
Barnsley	0	5	0	0	0	0	0	0	17	**22**
Chesterfield	0	2	0	0	0	0	0	0	54	**56**
NE Derbyshire	0	0	2	0	0	0	2	0	48	**51**
Bolsover	0	0	0	0	0	0	0	0	99	**99**
D. Dales	0	0	0	0	0	0	0	0	5	**5**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**33**	**2**	**0**	**0**	**0**	**7**	**0**	**596**	**638**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	29	0	0	0	0	3	0	172	**204**
Rotherham	0	65	0	0	0	0	4	0	184	**253**
Doncaster	0	4	0	0	0	0	0	0	11	**15**
Barnsley	0	2	0	0	0	0	0	0	9	**12**
Chesterfield	0	2	0	0	0	0	5	0	79	**86**
NE Derbyshire	0	13	0	0	0	0	2	0	109	**124**
Bolsover	0	12	0	0	0	0	6	0	234	**253**
D. Dales	0	0	0	0	0	0	0	0	7	**7**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**128**	**0**	**0**	**0**	**0**	**21**	**0**	**804**	**954**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	2%	0%	0%	0%	0%	0%	0%	28%	**30%**
Rotherham	0%	2%	0%	0%	0%	0%	1%	0%	30%	**33%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Barnsley	0%	1%	0%	0%	0%	0%	0%	0%	3%	**3%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	9%	**9%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	7%	**8%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	15%	**15%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**5%**	**0%**	**0%**	**0%**	**0%**	**1%**	**0%**	**93%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	3%	0%	0%	0%	0%	0%	0%	18%	**21%**
Rotherham	0%	7%	0%	0%	0%	0%	0%	0%	19%	**27%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	**2%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	8%	**9%**
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	11%	**13%**
Bolsover	0%	1%	0%	0%	0%	0%	1%	0%	25%	**26%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**13%**	**0%**	**0%**	**0%**	**0%**	**2%**	**0%**	**84%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Car	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	45	0	0	0	0	1	0	139	**184**
Rotherham	0	42	0	0	3	0	3	0	94	**141**
Doncaster	0	4	0	0	0	0	0	0	3	**6**
Barnsley	0	3	0	0	0	0	0	0	4	**6**
Chesterfield	0	1	0	0	0	0	0	0	40	**41**
NE Derbyshire	0	1	0	0	0	0	1	0	26	**28**
Bolsover	0	7	3	0	0	0	1	0	105	**117**
D. Dales	0	0	0	0	0	0	0	0	6	**6**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**102**	**3**	**0**	**3**	**0**	**5**	**0**	**417**	**530**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	36	0	0	0	0	3	0	107	**146**
Rotherham	0	24	0	0	0	0	1	0	83	**109**
Doncaster	0	3	0	0	0	0	0	0	4	**8**
Barnsley	0	2	0	0	0	0	0	0	7	**9**
Chesterfield	0	4	0	0	0	0	4	0	46	**53**
NE Derbyshire	0	4	0	0	0	0	2	0	33	**39**
Bolsover	0	7	0	0	0	0	4	0	101	**112**
D. Dales	0	1	0	0	0	0	0	0	5	**6**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**81**	**0**	**0**	**0**	**0**	**15**	**0**	**386**	**482**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	8%	0%	0%	0%	0%	0%	0%	26%	**35%**
Rotherham	0%	8%	0%	0%	0%	0%	0%	0%	18%	**27%**
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	7%	**8%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	5%	**5%**
Bolsover	0%	1%	1%	0%	0%	0%	0%	0%	20%	**22%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**19%**	**1%**	**0%**	**0%**	**0%**	**1%**	**0%**	**79%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	7%	0%	0%	0%	0%	1%	0%	22%	**30%**
Rotherham	0%	5%	0%	0%	0%	0%	0%	0%	17%	**23%**
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	1%	**2%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	**2%**
Chesterfield	0%	1%	0%	0%	0%	0%	1%	0%	9%	**11%**
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	7%	**8%**
Bolsover	0%	1%	0%	0%	0%	0%	1%	0%	21%	**23%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**17%**	**0%**	**0%**	**0%**	**0%**	**3%**	**0%**	**80%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Car	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	76	0	0	0	0	0	0	280	356
Rotherham	0	37	0	0	0	0	0	0	119	157
Doncaster	0	8	0	0	0	0	0	0	0	8
Barnsley	0	4	0	0	0	0	0	0	0	4
Chesterfield	0	0	2	0	0	0	0	0	82	84
NE Derbyshire	0	0	2	0	0	0	0	0	37	39
Bolsover	0	2	2	0	0	0	2	0	137	141
D. Dales	0	0	0	0	0	0	0	0	11	11
Bassetlaw	0	2	0	0	0	0	0	0	2	3
All	**0**	**129**	**5**	**0**	**0**	**0**	**2**	**0**	**668**	**803**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	43	0	0	0	0	6	0	245	294
Rotherham	0	24	0	0	0	0	2	0	138	164
Doncaster	0	3	0	0	0	0	0	0	3	6
Barnsley	0	2	0	0	0	0	0	0	13	15
Chesterfield	0	6	0	0	0	0	6	0	78	89
NE Derbyshire	0	7	0	0	0	0	4	0	61	71
Bolsover	0	9	0	0	0	0	5	0	148	163
D. Dales	0	0	0	0	0	0	0	0	9	9
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**94**	**0**	**0**	**0**	**0**	**23**	**0**	**694**	**811**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	9%	0%	0%	0%	0%	0%	0%	35%	44%
Rotherham	0%	5%	0%	0%	0%	0%	0%	0%	15%	19%
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%
Barnsley	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	10%	10%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	5%	5%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	17%	18%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**16%**	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**83%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	5%	0%	0%	0%	0%	1%	0%	30%	36%
Rotherham	0%	3%	0%	0%	0%	0%	0%	0%	17%	20%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%
Chesterfield	0%	1%	0%	0%	0%	0%	1%	0%	10%	11%
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	7%	9%
Bolsover	0%	1%	0%	0%	0%	0%	1%	0%	18%	20%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**12%**	**0%**	**0%**	**0%**	**0%**	**3%**	**0%**	**86%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Car	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	22	0	0	0	0	0	**22**
Rotherham	0	0	0	16	0	0	0	0	0	**16**
Doncaster	0	0	0	2	0	0	0	0	0	**2**
Barnsley	0	10	9	819	0	0	0	0	0	**838**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	2	0	0	0	0	0	**2**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**10**	**9**	**862**	**0**	**0**	**0**	**0**	**0**	**881**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	22	0	0	0	0	0	**22**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	40	28	422	0	0	0	0	1	**491**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**40**	**28**	**448**	**0**	**0**	**0**	**0**	**1**	**517**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	1%	1%	93%	0%	0%	0%	0%	0%	**95%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**1%**	**1%**	**98%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	8%	5%	82%	0%	0%	0%	0%	0%	**95%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**8%**	**5%**	**87%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Car	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	18	0	0	0	0	0	18
Rotherham	0	0	0	7	0	0	0	0	0	7
Doncaster	0	0	0	2	0	0	0	0	0	2
Barnsley	1	3	4	567	0	0	0	0	0	574
Chesterfield	0	0	0	1	0	0	0	0	0	1
NE Derbyshire	0	0	0	0	0	0	0	0	0	0
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**1**	**3**	**4**	**595**	**0**	**0**	**0**	**0**	**0**	**602**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	19	0	0	0	0	0	19
Rotherham	0	0	0	3	0	0	0	0	0	3
Doncaster	0	0	0	0	0	0	0	0	0	0
Barnsley	0	16	13	336	0	0	0	0	1	365
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	0	0	0
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**16**	**13**	**359**	**0**	**0**	**0**	**0**	**1**	**388**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	3%	0%	0%	0%	0%	0%	3%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	1%	94%	0%	0%	0%	0%	0%	95%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**0%**	**1%**	**99%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	5%	0%	0%	0%	0%	0%	5%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	4%	3%	86%	0%	0%	0%	0%	0%	94%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**4%**	**3%**	**92%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Car	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	51	0	0	0	0	0	**51**
Rotherham	0	0	0	13	0	0	0	0	0	**13**
Doncaster	0	0	0	3	0	0	0	0	0	**3**
Barnsley	0	8	6	722	0	0	0	0	0	**736**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	4	0	0	0	0	0	**4**
Bassetlaw	0	0	0	1	0	0	0	0	0	**1**
All	**0**	**8**	**6**	**793**	**0**	**0**	**0**	**0**	**0**	**807**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	40	0	0	0	0	0	**40**
Rotherham	0	0	0	5	0	0	0	0	0	**5**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	22	21	524	0	0	0	0	0	**567**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**22**	**21**	**571**	**0**	**0**	**0**	**0**	**0**	**614**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	**6%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	1%	1%	89%	0%	0%	0%	0%	0%	**91%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**1%**	**1%**	**98%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	7%	0%	0%	0%	0%	0%	**7%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	4%	3%	85%	0%	0%	0%	0%	0%	**92%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**4%**	**3%**	**93%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	5	0	0	0	0	0	**5**
Rotherham	0	0	1	7	0	0	0	0	0	**9**
Doncaster	7	97	112	108	0	0	0	0	0	**324**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	1	0	0	0	0	0	**1**
Bassetlaw	5	7	11	6	0	0	0	0	0	**29**
All	**12**	**105**	**126**	**129**	**0**	**0**	**0**	**0**	**0**	**371**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	7	1	0	0	0	0	0	**8**
Rotherham	0	0	5	3	0	0	0	0	0	**8**
Doncaster	15	47	69	51	0	0	0	0	0	**182**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	1	2	0	0	0	0	0	**2**
NE Derbyshire	0	0	1	1	0	0	0	0	0	**1**
Bolsover	0	0	1	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	7	8	8	0	0	0	0	0	**24**
All	**15**	**54**	**92**	**66**	**0**	**0**	**0**	**0**	**0**	**226**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	2%	26%	30%	29%	0%	0%	0%	0%	0%	**87%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	1%	2%	3%	2%	0%	0%	0%	0%	0%	**8%**
All	**3%**	**28%**	**34%**	**35%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	3%	0%	0%	0%	0%	0%	0%	**4%**
Rotherham	0%	0%	2%	1%	0%	0%	0%	0%	0%	**3%**
Doncaster	7%	21%	30%	23%	0%	0%	0%	0%	0%	**80%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	3%	4%	4%	0%	0%	0%	0%	0%	**10%**
All	**7%**	**24%**	**40%**	**29%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	5	0	0	0	0	0	5
Rotherham	0	0	2	7	0	0	0	0	0	8
Doncaster	6	99	123	108	0	0	0	0	0	336
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	1	0	0	0	0	0	1
NE Derbyshire	0	0	0	1	0	0	0	0	0	1
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	1	0	0	0	0	0	1
Bassetlaw	5	9	9	4	0	0	0	0	0	27
All	**10**	**108**	**135**	**127**	**0**	**0**	**0**	**0**	**0**	**380**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	10	0	0	0	0	0	0	10
Rotherham	0	0	4	2	0	0	0	0	0	6
Doncaster	7	31	68	48	0	0	0	0	0	155
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	1	0	0	0	0	0	0	1
NE Derbyshire	0	0	1	0	0	0	0	0	0	1
Bolsover	0	0	1	0	0	0	0	0	0	1
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	3	7	8	0	0	0	0	0	19
All	**7**	**35**	**91**	**59**	**0**	**0**	**0**	**0**	**0**	**193**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
Doncaster	1%	26%	32%	28%	0%	0%	0%	0%	0%	88%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	1%	2%	2%	1%	0%	0%	0%	0%	0%	7%
All	**3%**	**28%**	**36%**	**33%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	5%	0%	0%	0%	0%	0%	0%	5%
Rotherham	0%	0%	2%	1%	0%	0%	0%	0%	0%	3%
Doncaster	4%	16%	35%	25%	0%	0%	0%	0%	0%	80%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	2%	4%	4%	0%	0%	0%	0%	0%	10%
All	**4%**	**18%**	**47%**	**31%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	1	3	0	0	0	0	0	4
Rotherham	0	0	1	5	0	0	0	0	0	7
Doncaster	5	96	124	100	0	0	0	0	0	326
Barnsley	0	0	1	0	0	0	0	0	0	1
Chesterfield	0	0	0	1	0	0	0	0	0	1
NE Derbyshire	0	0	0	1	0	0	0	0	0	1
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	1	0	0	0	0	0	1
Bassetlaw	4	7	12	4	0	0	0	0	0	27
All	**9**	**103**	**139**	**115**	**0**	**0**	**0**	**0**	**0**	**367**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	3	0	0	0	0	0	0	3
Rotherham	0	0	2	2	0	0	0	0	0	4
Doncaster	5	35	56	46	0	0	0	0	0	142
Barnsley	0	0	1	0	0	0	0	0	0	2
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	1	0	0	0	0	0	0	1
Bolsover	0	0	0	0	0	0	0	0	0	1
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	2	3	7	0	0	0	0	0	13
All	**5**	**37**	**67**	**57**	**0**	**0**	**0**	**0**	**0**	**166**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	2%
Doncaster	1%	26%	34%	27%	0%	0%	0%	0%	0%	89%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	1%	2%	3%	1%	0%	0%	0%	0%	0%	7%
All	**2%**	**28%**	**38%**	**31%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	2%	0%	0%	0%	0%	0%	0%	2%
Rotherham	0%	0%	1%	1%	0%	0%	0%	0%	0%	3%
Doncaster	3%	21%	33%	28%	0%	0%	0%	0%	0%	85%
Barnsley	0%	0%	1%	0%	0%	0%	0%	0%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	1%	2%	4%	0%	0%	0%	0%	0%	8%
All	**3%**	**22%**	**40%**	**34%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	1	0	0	0	1	3	0	29	0	**34**
Rotherham	0	0	0	0	0	0	0	4	0	**4**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	1	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**2**	**0**	**0**	**0**	**1**	**3**	**0**	**35**	**0**	**40**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	1	1	0	8	0	**10**
Rotherham	0	0	0	0	0	0	0	4	0	**4**
Doncaster	0	0	0	0	0	0	0	3	0	**3**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	1	0	1	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	1	0	**1**
All	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**16**	**0**	**19**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	0%	0%	0%	2%	7%	0%	72%	0%	**84%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	9%	0%	**10%**
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	3%	0%	**3%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**0%**	**0%**	**0%**	**2%**	**7%**	**0%**	**86%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	6%	7%	0%	41%	0%	**54%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	19%	0%	**19%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	16%	0%	**16%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	1%	3%	0%	3%	0%	**8%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	3%	0%	**3%**
All	**0%**	**0%**	**0%**	**0%**	**7%**	**10%**	**0%**	**83%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	1	0	0	0	1	3	0	30	0	36
Rotherham	0	0	0	0	0	0	0	5	0	6
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	1	0	1
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**2**	**0**	**0**	**0**	**1**	**3**	**0**	**38**	**0**	**44**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	0	1	0	6	0	7
Rotherham	0	0	0	0	0	0	0	1	0	1
Doncaster	0	0	0	0	0	0	0	4	0	4
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	1	0	1	0	2
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**13**	**0**	**15**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	0%	0%	0%	2%	8%	0%	69%	0%	**82%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	12%	0%	**13%**
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	**3%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**0%**	**0%**	**0%**	**2%**	**8%**	**0%**	**86%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	1%	8%	0%	39%	0%	**48%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	6%	0%	**6%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	28%	0%	**28%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	8%	0%	7%	0%	**15%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
All	**0%**	**0%**	**0%**	**0%**	**1%**	**16%**	**0%**	**83%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	2	0	0	0	1	5	0	29	0	38
Rotherham	0	0	0	0	0	0	0	3	0	3
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	1	0	1
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**2**	**0**	**0**	**0**	**1**	**5**	**0**	**33**	**0**	**42**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	1	2	0	7	0	10
Rotherham	0	0	0	0	0	0	0	1	0	1
Doncaster	0	0	0	0	0	0	0	4	0	4
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	0	0	0
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**0**	**0**	**0**	**1**	**2**	**0**	**13**	**0**	**15**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	0%	0%	0%	3%	13%	1%	68%	0%	89%
Rotherham	0%	0%	0%	0%	0%	0%	0%	6%	0%	7%
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	3%
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	2%	0%	2%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**5%**	**0%**	**0%**	**0%**	**3%**	**13%**	**1%**	**78%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	5%	13%	0%	49%	0%	66%
Rotherham	0%	0%	0%	0%	0%	0%	0%	8%	0%	8%
Doncaster	0%	0%	0%	0%	0%	0%	0%	25%	0%	25%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**0%**	**0%**	**0%**	**5%**	**13%**	**0%**	**82%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7	4	0	0	0	0	8	0	67	87
Rotherham	0	8	0	0	0	0	4	0	29	41
Doncaster	0	0	0	0	0	0	0	0	0	0
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	1	0	0	0	1	0	11	13
NE Derbyshire	0	0	0	0	0	0	1	0	11	12
Bolsover	0	1	0	0	0	0	1	0	22	24
D. Dales	0	0	0	0	0	0	0	0	6	6
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**7**	**13**	**1**	**0**	**0**	**0**	**16**	**0**	**147**	**184**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	4	0	0	0	0	0	0	58	62
Rotherham	0	4	0	0	0	0	0	0	25	29
Doncaster	0	1	0	0	0	0	0	0	2	2
Barnsley	0	1	0	0	0	0	0	0	10	10
Chesterfield	0	0	0	0	0	0	2	0	12	15
NE Derbyshire	0	1	0	0	0	0	1	0	18	19
Bolsover	0	1	0	0	0	0	3	0	44	48
D. Dales	0	0	0	0	0	0	0	0	14	14
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**11**	**0**	**0**	**0**	**0**	**6**	**0**	**183**	**200**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	2%	0%	0%	0%	0%	5%	0%	37%	**47%**
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	16%	**22%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	12%	**13%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	4%	**4%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**7%**	**1%**	**0%**	**0%**	**0%**	**8%**	**0%**	**80%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	2%	0%	0%	0%	0%	0%	0%	29%	**31%**
Rotherham	0%	2%	0%	0%	0%	0%	0%	0%	12%	**15%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	5%	**5%**
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	9%	**10%**
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	22%	**24%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	7%	**7%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**5%**	**0%**	**0%**	**0%**	**0%**	**3%**	**0%**	**91%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7	3	0	0	0	0	8	0	57	75
Rotherham	0	6	0	0	0	0	3	0	23	32
Doncaster	0	0	0	0	0	0	0	0	0	0
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	1	0	0	0	1	0	10	12
NE Derbyshire	0	0	0	0	0	0	1	0	13	14
Bolsover	0	1	0	0	0	0	3	0	28	32
D. Dales	0	0	0	0	0	0	0	0	9	9
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**7**	**10**	**1**	**0**	**0**	**0**	**15**	**0**	**140**	**173**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	4	0	0	0	0	1	0	74	79
Rotherham	0	3	0	0	0	0	0	0	29	32
Doncaster	0	1	0	0	0	0	0	0	1	2
Barnsley	0	1	0	0	0	0	0	0	8	9
Chesterfield	0	0	0	0	0	0	1	0	12	14
NE Derbyshire	0	0	0	0	0	0	1	0	11	12
Bolsover	0	1	0	0	0	0	2	0	38	42
D. Dales	0	0	0	0	0	0	0	0	15	15
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**10**	**0**	**0**	**0**	**0**	**6**	**0**	**189**	**205**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	2%	0%	0%	0%	0%	4%	0%	33%	43%
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	13%	19%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	7%
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	7%	8%
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	16%	18%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	5%	5%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**4%**	**6%**	**1%**	**0%**	**0%**	**0%**	**9%**	**0%**	**81%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	2%	0%	0%	0%	0%	0%	0%	36%	38%
Rotherham	0%	2%	0%	0%	0%	0%	0%	0%	14%	16%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	7%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	5%	6%
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	19%	20%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	7%	7%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**5%**	**0%**	**0%**	**0%**	**0%**	**3%**	**0%**	**92%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	5	3	0	0	0	0	6	0	48	62
Rotherham	0	6	0	0	0	0	3	0	21	30
Doncaster	0	0	0	0	0	0	0	0	0	0
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	1	0	0	0	1	0	12	13
NE Derbyshire	0	0	0	0	0	0	1	0	12	13
Bolsover	0	1	0	0	0	0	2	0	26	29
D. Dales	0	0	0	0	0	0	0	0	7	7
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**5**	**9**	**2**	**0**	**0**	**0**	**12**	**0**	**126**	**154**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	4	0	0	0	0	1	0	40	45
Rotherham	0	3	0	0	0	0	0	0	20	23
Doncaster	0	0	0	0	0	0	0	0	1	2
Barnsley	0	0	0	0	0	0	0	0	3	3
Chesterfield	0	1	0	0	0	0	3	0	16	19
NE Derbyshire	0	1	0	0	0	0	1	0	8	10
Bolsover	0	1	0	0	0	0	3	0	18	22
D. Dales	0	0	0	0	0	0	0	0	4	4
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**10**	**0**	**0**	**0**	**0**	**7**	**0**	**110**	**127**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	2%	0%	0%	0%	0%	4%	0%	32%	40%
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	14%	19%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	1%	0%	0%	0%	0%	0%	7%	9%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	8%	8%
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	17%	19%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**3%**	**6%**	**1%**	**0%**	**0%**	**0%**	**8%**	**0%**	**82%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	3%	0%	0%	0%	0%	1%	0%	32%	35%
Rotherham	0%	2%	0%	0%	0%	0%	0%	0%	16%	18%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	2%	2%
Chesterfield	0%	1%	0%	0%	0%	0%	2%	0%	12%	15%
NE Derbyshire	0%	1%	0%	0%	0%	0%	1%	0%	6%	8%
Bolsover	0%	1%	0%	0%	0%	0%	2%	0%	14%	17%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	3%	3%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**7%**	**0%**	**0%**	**0%**	**0%**	**6%**	**0%**	**87%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Freight	AM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	**12**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	4	0	0	0	0	0	**4**
Barnsley	0	1	5	150	0	0	0	0	0	**156**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	3	0	0	0	0	0	**3**
Bolsover	0	0	0	3	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	8	0	0	0	0	0	**8**
All	**0**	**2**	**5**	**181**	**0**	**0**	**0**	**0**	**0**	**188**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	8	0	0	0	0	0	**8**
Rotherham	0	0	0	2	0	0	0	0	0	**2**
Doncaster	0	0	0	1	0	0	0	0	0	**1**
Barnsley	0	2	4	41	0	0	0	0	0	**47**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**2**	**4**	**53**	**0**	**0**	**0**	**0**	**0**	**60**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	**6%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Barnsley	0%	1%	3%	79%	0%	0%	0%	0%	0%	**83%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
All	**0%**	**1%**	**3%**	**96%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	14%	0%	0%	0%	0%	0%	**14%**
Rotherham	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	4%	6%	68%	0%	0%	0%	0%	0%	**79%**
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
All	**0%**	**4%**	**6%**	**89%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Freight	IP	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	**12**
Rotherham	0	0	0	5	0	0	0	0	0	**5**
Doncaster	0	0	0	3	0	0	0	0	0	**3**
Barnsley	0	5	4	163	0	0	0	0	0	**171**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	3	0	0	0	0	0	**3**
Bolsover	0	0	0	3	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	5	0	0	0	0	0	**5**
All	**0**	**5**	**4**	**193**	**0**	**0**	**0**	**0**	**0**	**203**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	8	0	0	0	0	0	**8**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	1	0	0	0	0	0	**1**
Barnsley	0	2	4	39	0	0	0	0	0	**44**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**2**	**4**	**52**	**0**	**0**	**0**	**0**	**0**	**58**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	**6%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Barnsley	0%	2%	2%	80%	0%	0%	0%	0%	0%	**85%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
All	**0%**	**3%**	**2%**	**95%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	15%	0%	0%	0%	0%	0%	**15%**
Rotherham	0%	0%	0%	5%	0%	0%	0%	0%	0%	**5%**
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	3%	7%	67%	0%	0%	0%	0%	0%	**76%**
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
All	**0%**	**3%**	**7%**	**91%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Freight	PM	Prior

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	**12**
Rotherham	0	0	0	5	0	0	0	0	0	**5**
Doncaster	0	0	0	3	0	0	0	0	0	**3**
Barnsley	0	1	4	137	0	0	0	0	0	**142**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	4	0	0	0	0	0	**4**
All	**0**	**1**	**4**	**163**	**0**	**0**	**0**	**0**	**0**	**169**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	8	0	0	0	0	0	**8**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	2	3	33	0	0	0	0	0	**38**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**2**	**3**	**46**	**0**	**0**	**0**	**0**	**0**	**51**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	7%	0%	0%	0%	0%	0%	**7%**
Rotherham	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Barnsley	0%	1%	2%	81%	0%	0%	0%	0%	0%	**84%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
All	**0%**	**1%**	**2%**	**97%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	17%	0%	0%	0%	0%	0%	**17%**
Rotherham	0%	0%	0%	5%	0%	0%	0%	0%	0%	**5%**
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	3%	6%	65%	0%	0%	0%	0%	0%	**75%**
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
All	**0%**	**3%**	**6%**	**91%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Table 117. Summary of Sector to Sector Comparisons (Prior)

Screenline	Time Period	Cars (UC1 + UC2 + UC3)	Freight (UC4 + UC5 + UC6)
1	AM	Looks good	Overall low trips but proportions broadly correct. Doncaster to Sheffield is higher in the model than observed.
	IP	Looks good	Overall low trips but proportions broadly correct. Doncaster to Rotherham is lower in model than RSIs.
	PM	Looks good	Overall low trips but proportions broadly correct
2	AM	No trips to Sheffield in model but there are in RSI records? Sheffield to Chesterfield much higher in the model than in observations.	Overall low trips but proportions broadly correct
	IP	No trips to Sheffield in model but there are in RSI records?	Overall low trips but proportions broadly correct
	PM	No trips to Sheffield in model but there are in RSI records?	Overall low trips but proportions broadly correct
5	AM	NE Derbyshire + Bolsover to Bassetlaw about twice as high in the model as RSI would suggest. Rotherham to Rotherham is a little high.	Looks good
	IP	Looks good	Looks good
	PM	Looks good	Looks good
7	AM	Looks good	Looks good
	IP	Looks good	Looks good
	PM	Looks good	Overall low trips but proportions broadly correct

Source: AECOM analysis

The screenlines with comments mentioned above are discussed below along with any adjustments to the prior matrix that may be required.

Car comparison - Screenline 2

For this screenline in the RSI records there were a number of trips finishing in Sheffield across all three time periods. On further investigation it was found that most of these trips were heading to The Norfolk Arms pub which does lie in Sheffield. However the zone (10091) that encompasses this postcode loads to the east of the RSI site. If we were intending to build the prior matrix from RSI records then adjustments would be needed, however as we are just using this for checks then no adjustment is needed.

Sheffield to Chesterfield is much higher in the model than in observations, though routeing appears to be logical, therefore the number of trips in this part of the matrix may be too high.

Car comparison - Screenline 5

In the AM Car trips routing between NE Derbyshire and Bolsover to Bassetlaw is higher in the model than the RSI records would suggest. A few of the routes passes through this screenline in the model were checked and it was logical routing. Therefore either the trips were missed during the RSI interview or there are too many trips between these two sectors in the matrix.

Also in the AM time period Rotherham to Rotherham is a little high in the model compared to the RSI records. There are 65 records in the model compared to 15 observed. Most of the trips through this screenline in the model have a origin and destination close to Anston, where RSI Site 501was moved to. Therefore whether the trip routes through the RSI link or not is very sensitive to coding, including where centroids are loaded.

Freight comparisons

At Screenline 1 during the IP period Doncaster to Rotherham is low in the model compared to RSIs. However the number of PCUs is relatively low, and we are aware expansion factors at RSI sites for freight are high. The freight matrix also came from another data source so will contain additional discrepancies.

Trip Length Distributions

This analysis was also completed by screenline, by model time period first for Car, and then for Freight combined.

A distance skim for all origin destination pairs was taken using the first user class (Commuting) of the AM model. This allowed the expanded RSI records and model trips to be mapped to distances in 1 kilometre bands, up to 50 km. These were compared to each other, using cumulative graphs. These are shown on the following pages.

The plots show a strong correlation between the RSI and model data for car trips. The freight distributions are poorer for distances greater than 20 kilometres. There could be a number of reasons for this: freight sample rates being low (so expansion factors high); the freight matrix coming from another data source.

Conclusion

Using the RSI matrices to check the prior matrices has not raised any new concerns. There are some discrepancies between the observed and model data, particularly for freight movements; which make a relatively small volume. Further calibration will look into the few instances where incorrect routing has been discovered.

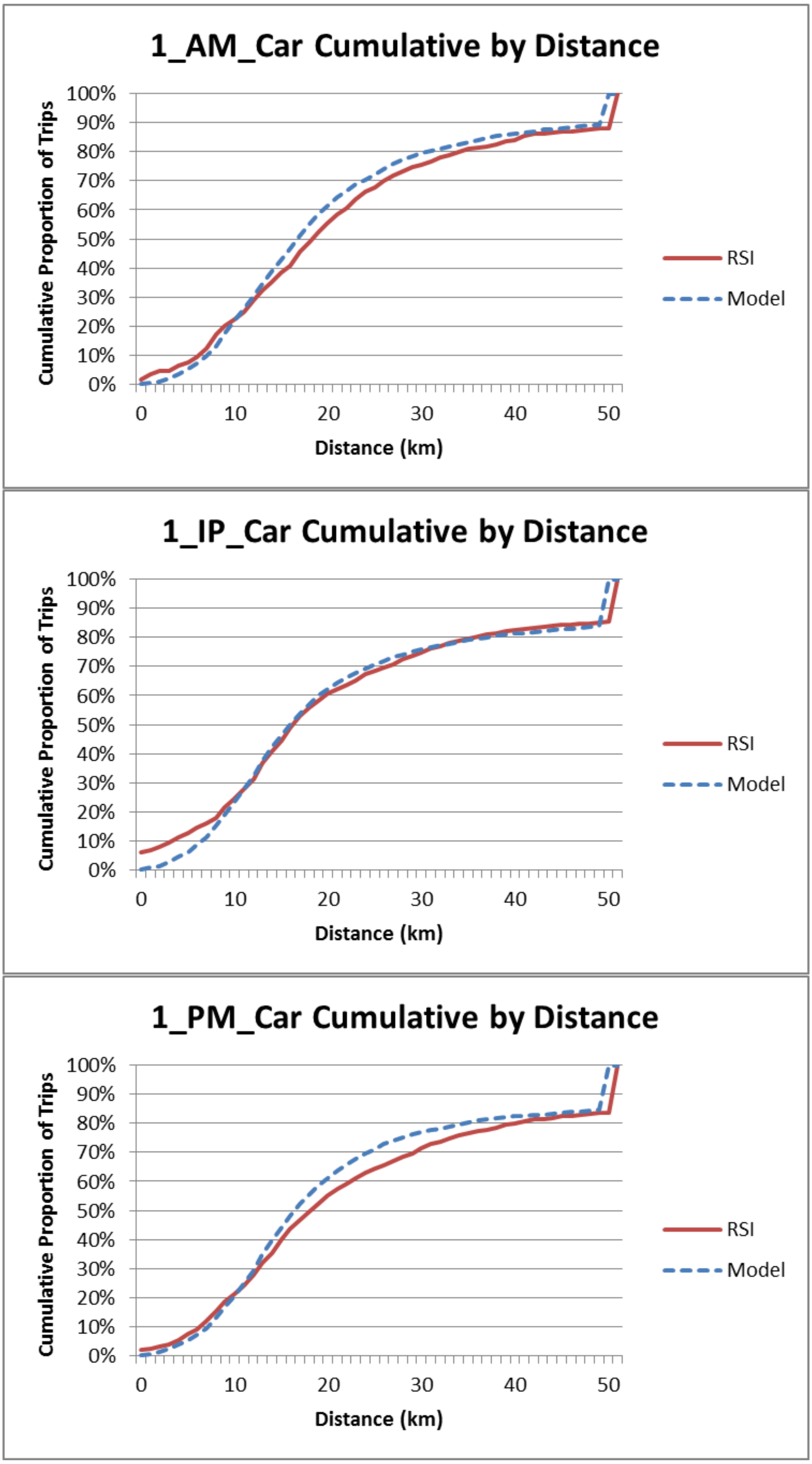


Figure 210. Car TLD at Screenline 1, Observed (Solid Red) vs Prior Model (Dotted Blue)

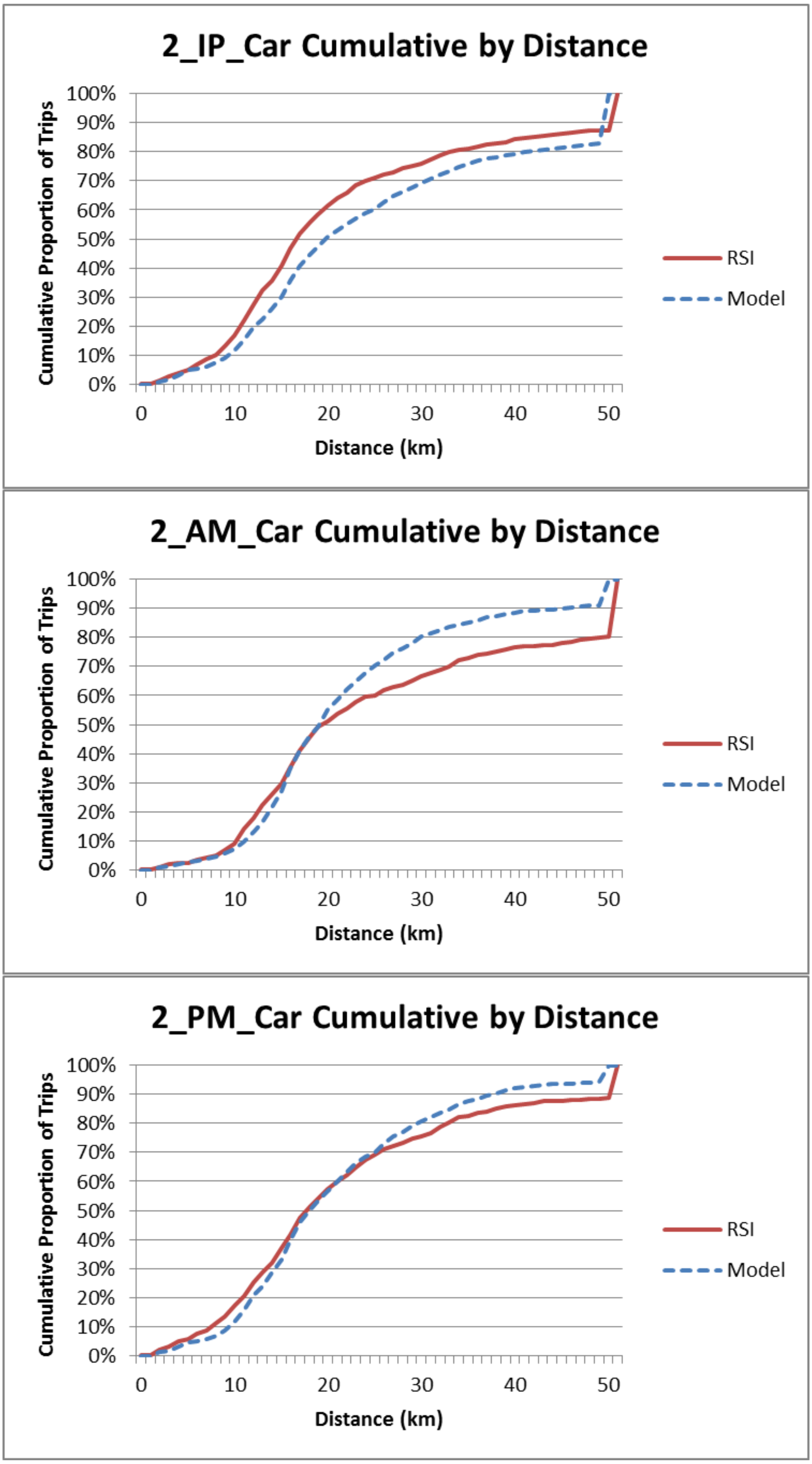


Figure 211. Car TLD at Screenline 2, Observed (Solid Red) vs Prior Model (Dotted Blue)

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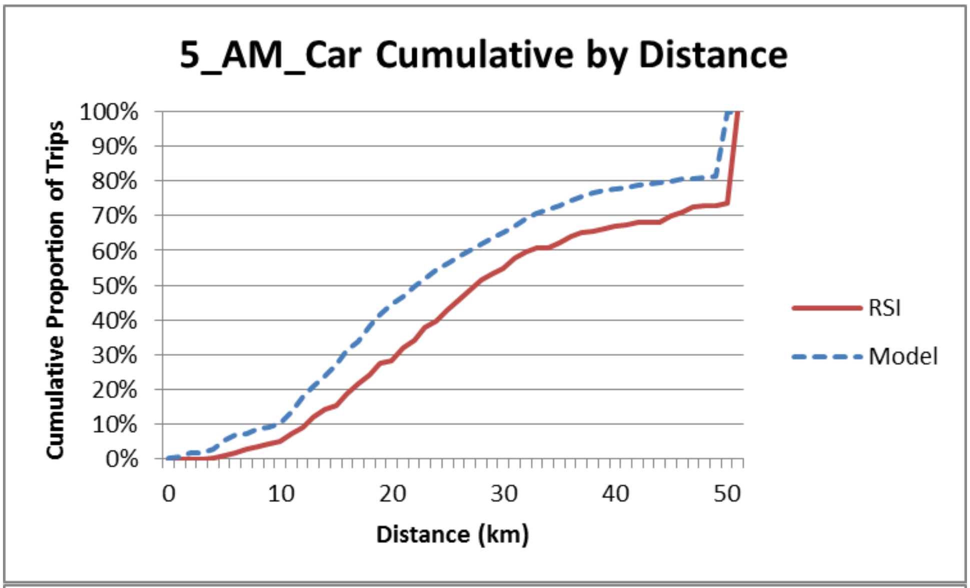
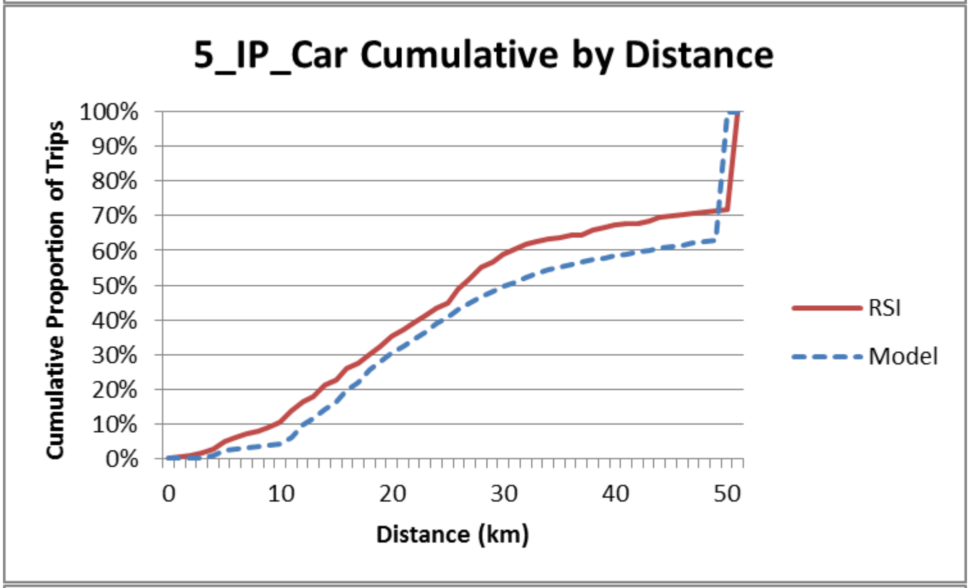




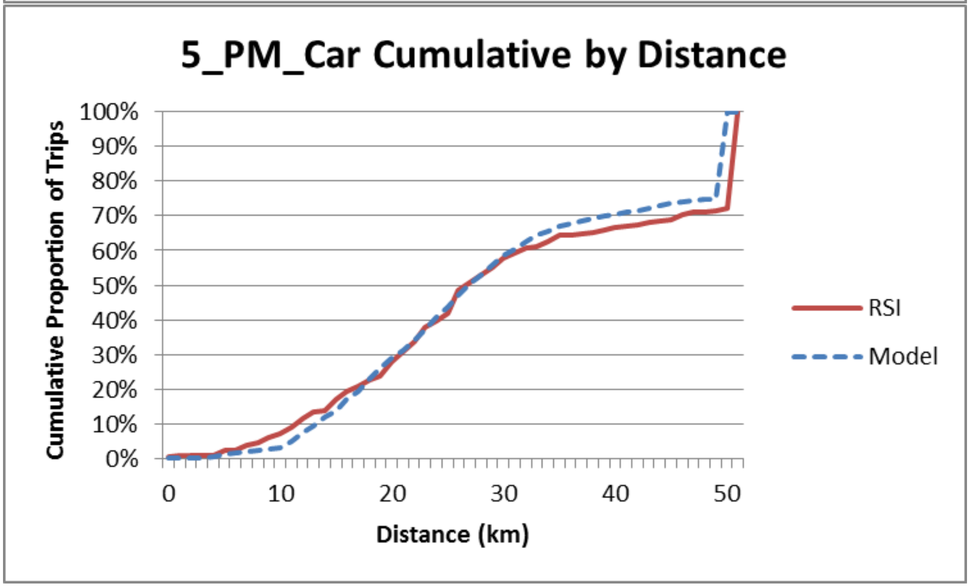


Figure 212. Car TLD at Screenline 5, Observed (Solid Red) vs Prior Model (Dotted Blue)

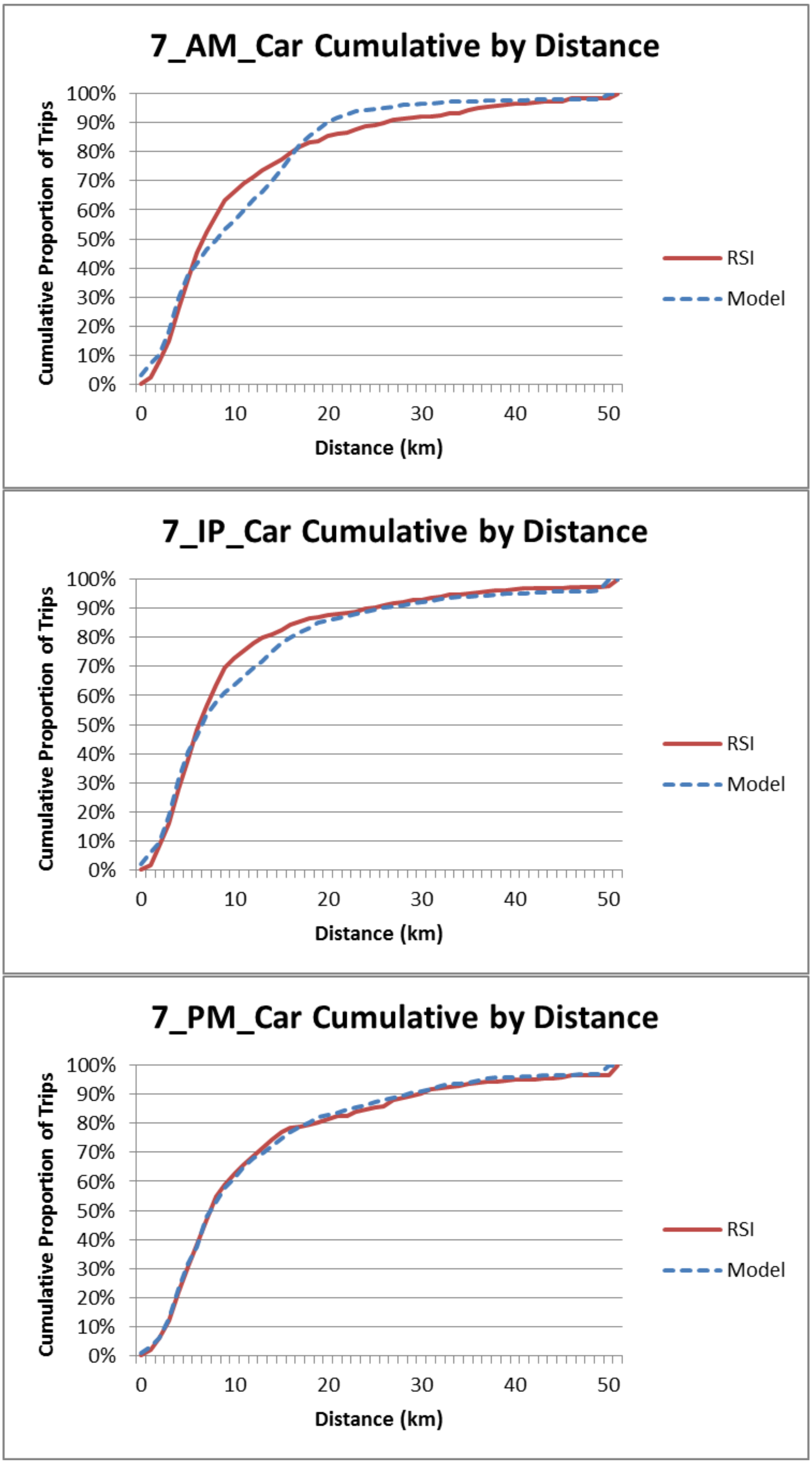


Figure 213. Car TLD at Screenline 7, Observed (Solid Red) vs Prior Model (Dotted Blue)

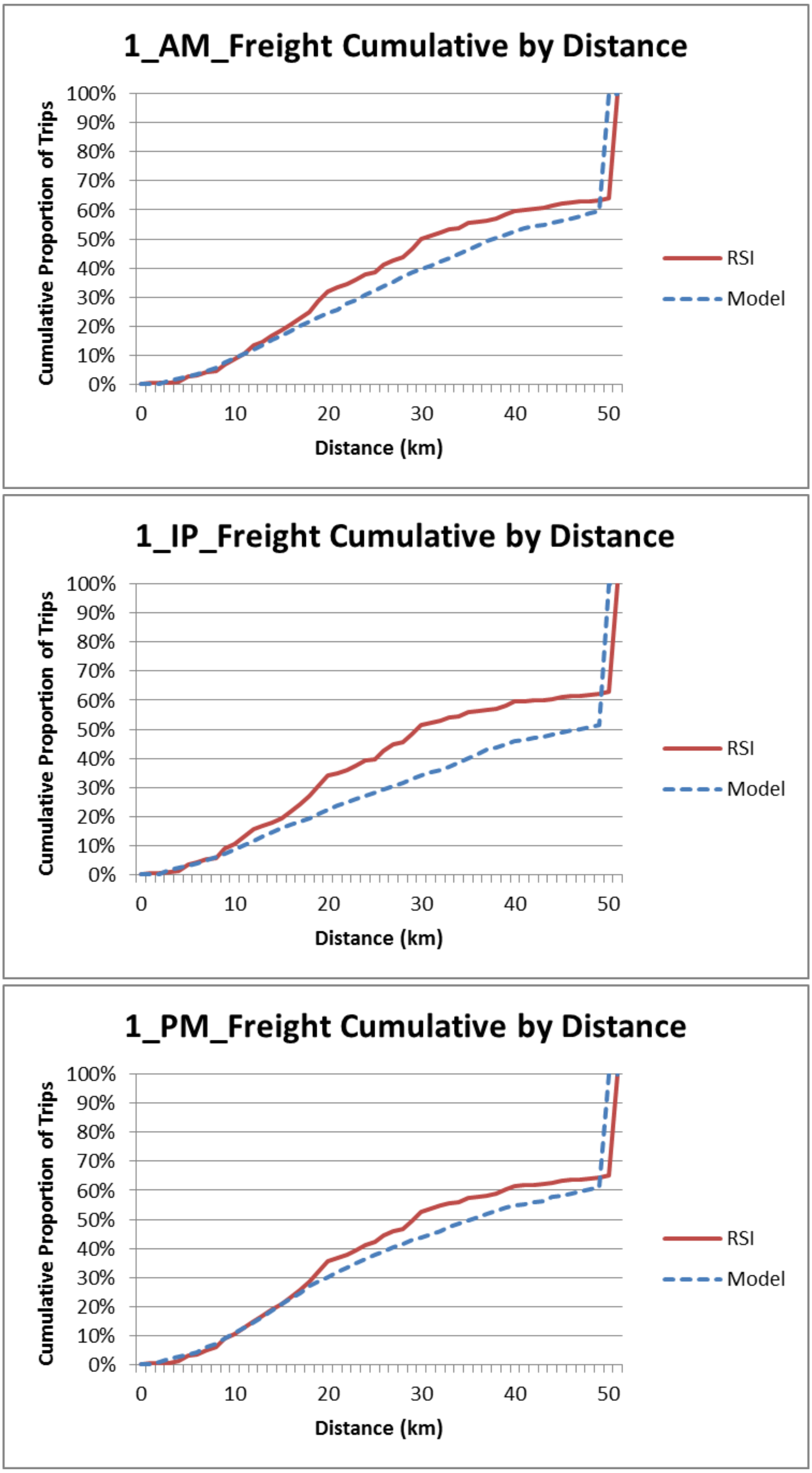


Figure 214. Freight TLD at Screenline 1, Observed (Solid Red) vs Prior Model (Dotted Blue)

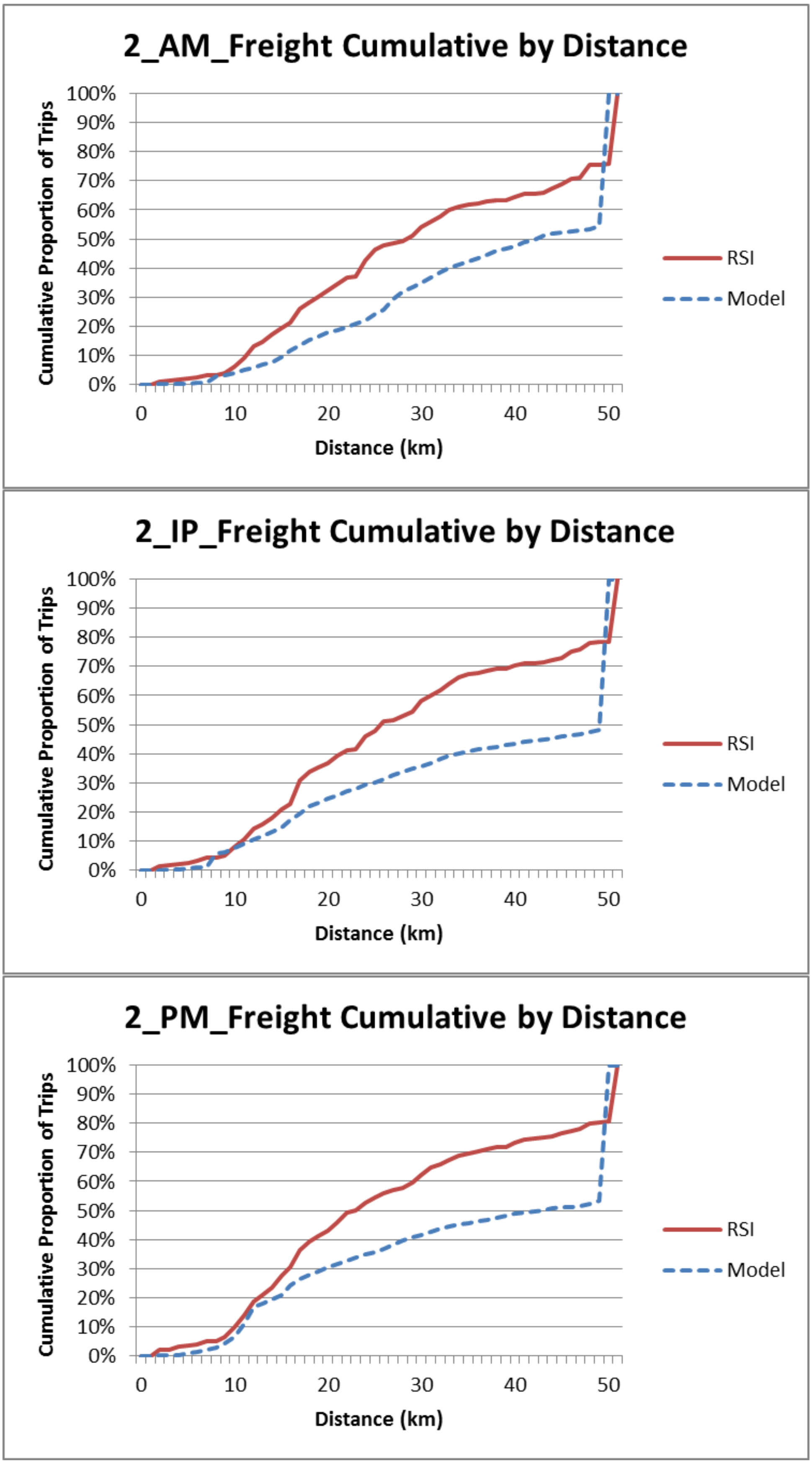


Figure 15. Freight TLD at Screenline 2, Observed (Solid Red) vs Prior Model (Dotted Blue)

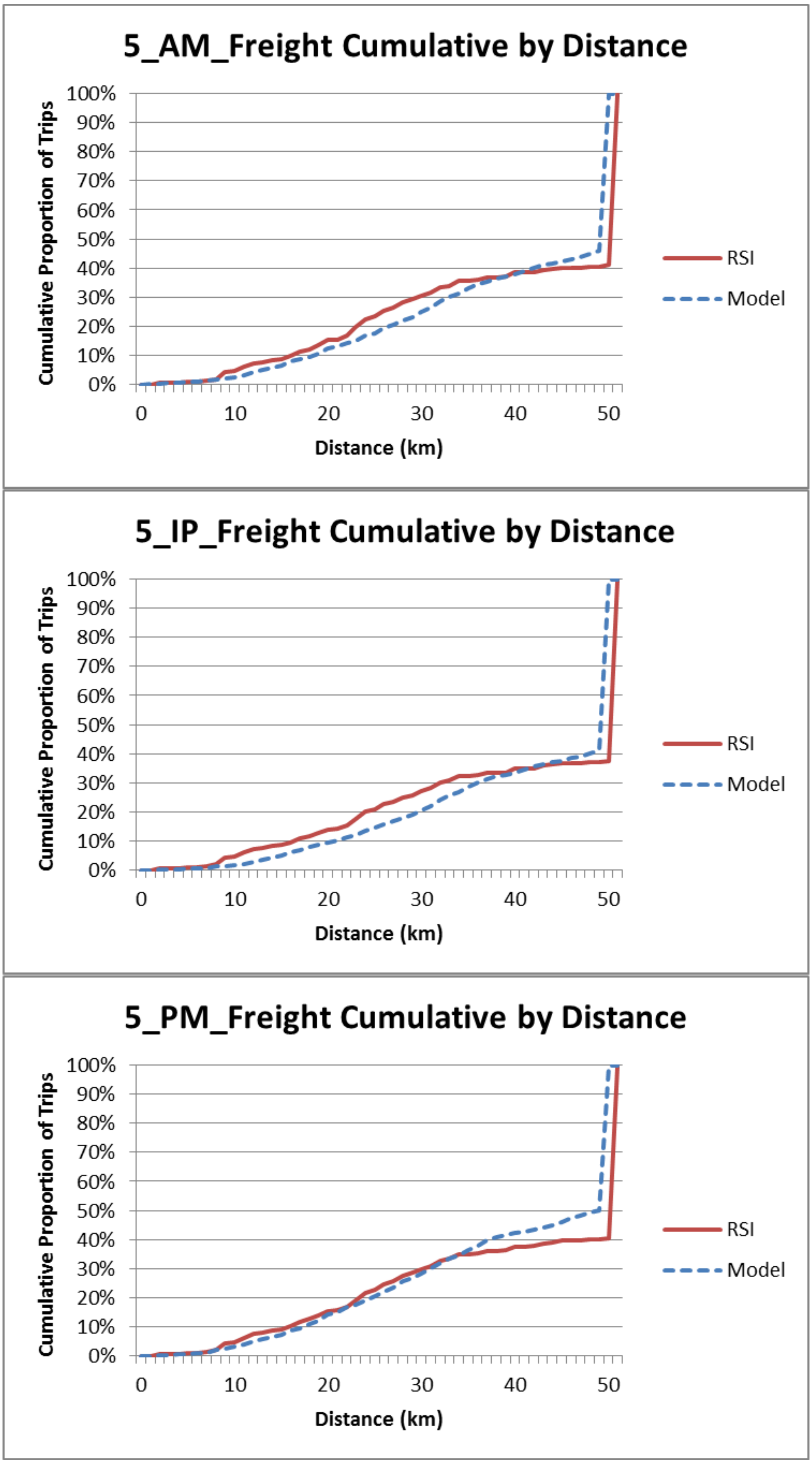
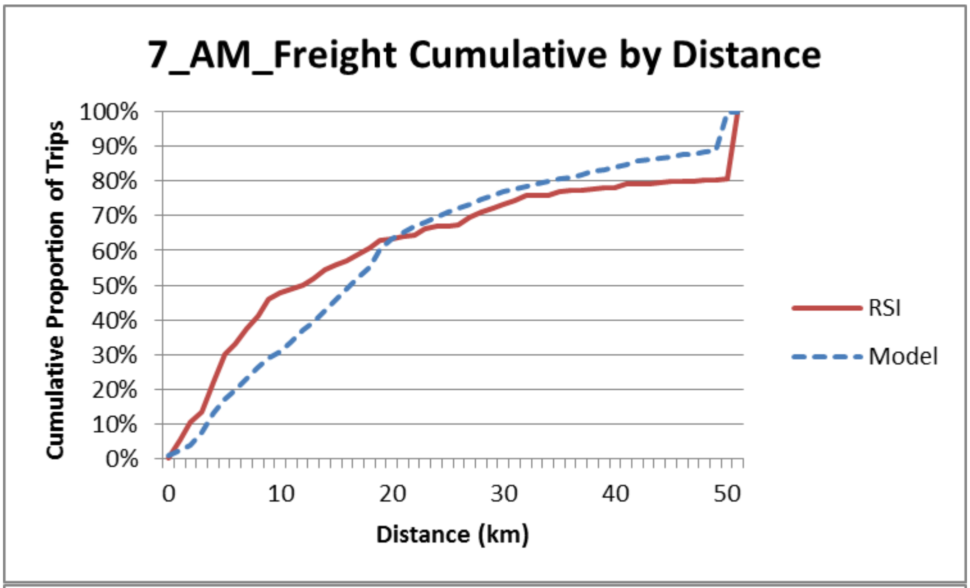
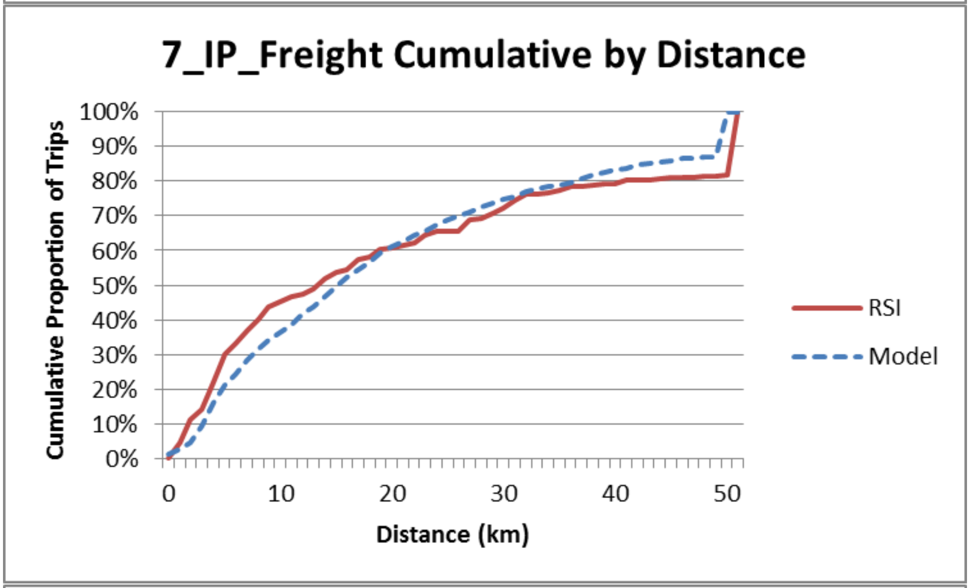


Figure 15. Freight TLD at Screenline 5, Observed (Solid Red) vs Prior Model (Dotted Blue)





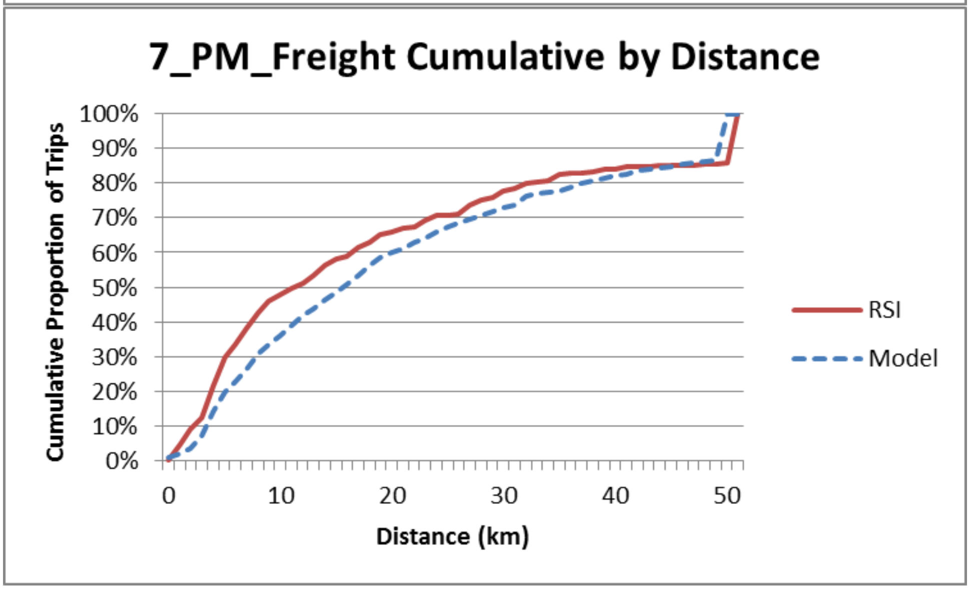


Figure 15. Freight TLD at Screenline 7, Observed (Solid Red) vs Prior Model (Dotted Blue)

K.4 Post Matrix Comparisons to RSI Records

Checks on Journey Purpose Splits

One of the purposes of using the RSI data is to see how close the split between the three journey purposes for car trips in the post matrix is to the observed. The percentage of car trips for each journey purpose by screenline and time period is shown below.

Table 118. Journey Purpose Split comparison Post vs RSI

		RSI			Prior Assignment			Post Assignment		
Screenline		Commuting	Business	Other	Commuting	Business	Other	Commuting	Business	Other
1	AM	59%	11%	29%	55%	10%	35%	4%	1%	-6%
1	IP	18%	17%	65%	18%	16%	66%	-1%	2%	-1%
1	PM	45%	8%	46%	51%	11%	38%	-6%	-2%	8%
2	AM	47%	9%	44%	58%	10%	33%	-10%	-1%	11%
2	IP	10%	6%	84%	7%	15%	78%	3%	-9%	6%
2	PM	35%	5%	61%	42%	9%	49%	-8%	-4%	12%
5	AM	50%	20%	31%	55%	16%	29%	-5%	4%	1%
5	IP	12%	18%	70%	12%	24%	65%	0%	-5%	6%
5	PM	49%	16%	35%	53%	15%	33%	-4%	1%	2%
7	AM	51%	7%	42%	52%	6%	42%	-1%	1%	0%
7	IP	22%	12%	66%	19%	8%	73%	3%	4%	-7%
7	PM	49%	6%	45%	45%	6%	49%	4%	0%	-4%

Source: AECOM analysis

The average percentage point difference is slightly less than in the Prior Comparison and now stands at 4%. Screenline 2 seems to remain as the worst matching, which lies south west of Sheffield at the edge of the SCR. Below scatter plots are shown comparing the percentage splits from the model and the RSI information. The correspondence between the two datasets is good for all proposes together (R2 = 0.94), for commuting (R2 = 0.94) and other (R2 = 0.88). Business is the weakest (R2 = 0.53), but this contributes the smallest number of trips so total differences may be small. R2 has increased from the Prior Comparison in all instances.

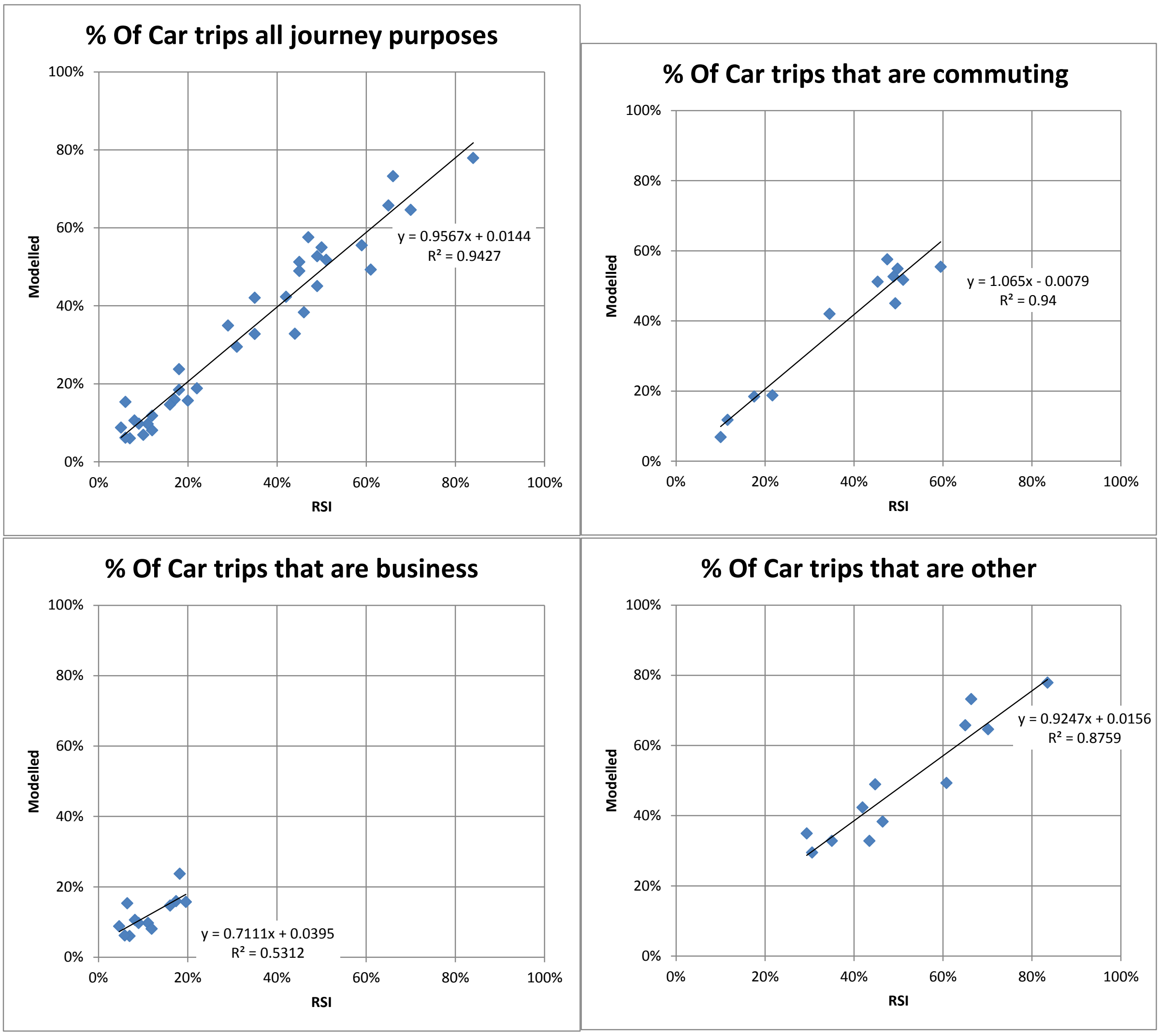


Figure 15 Percentage split at RSI Screenlines

Checks on Sector to Sector Movements

This analysis was completed by screenline, by model time period first for Car, and then for Freight combined.

Screenline	Vehicle	TimePeriod	Model
	1 Car	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	3	4	0	0	0	0	0	**7**
Rotherham	0	1	3	12	0	0	0	0	0	**15**
Doncaster	40	424	556	333	2	1	3	0	19	**1378**
Barnsley	0	0	3	0	0	0	0	0	0	**3**
Chesterfield	0	1	0	1	0	0	0	0	0	**2**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	3	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	14	8	19	0	0	0	0	0	**41**
All	**40**	**440**	**573**	**373**	**2**	**1**	**3**	**0**	**19**	**1451**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	17	5	0	0	0	0	0	**22**
Rotherham	0	0	25	18	0	0	0	0	0	**43**
Doncaster	39	345	557	238	0	0	0	0	0	**1180**
Barnsley	0	4	3	0	0	0	0	0	0	**7**
Chesterfield	0	0	5	0	0	0	0	0	0	**5**
NE Derbyshire	0	0	1	2	0	0	0	0	0	**3**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	11	9	15	0	0	0	0	0	**36**
All	**39**	**360**	**618**	**278**	**0**	**0**	**0**	**0**	**0**	**1295**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	3%	29%	38%	23%	0%	0%	0%	0%	1%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**3%**
All	**3%**	**30%**	**39%**	**26%**	**0%**	**0%**	**0%**	**0%**	**1%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	1%	0%	0%	0%	0%	0%	0%	**2%**
Rotherham	0%	0%	2%	1%	0%	0%	0%	0%	0%	**3%**
Doncaster	3%	27%	43%	18%	0%	0%	0%	0%	0%	**91%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**3%**
All	**3%**	**28%**	**48%**	**21%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Car	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	2	2	0	0	0	0	0	**4**
Rotherham	0	0	2	6	0	0	0	0	0	**8**
Doncaster	18	215	471	191	1	0	5	0	0	**900**
Barnsley	0	0	4	0	0	0	0	0	0	**4**
Chesterfield	0	0	1	0	0	0	0	0	0	**2**
NE Derbyshire	0	0	2	1	0	0	0	0	0	**4**
Bolsover	0	0	0	2	0	0	0	0	0	**2**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	8	6	9	0	0	0	0	0	**23**
All	**18**	**224**	**489**	**211**	**1**	**0**	**5**	**0**	**0**	**947**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	2	1	0	0	0	0	0	**4**
Rotherham	0	0	4	8	0	0	0	0	0	**12**
Doncaster	8	192	402	179	0	0	0	0	1	**782**
Barnsley	0	0	1	0	0	0	0	0	0	**1**
Chesterfield	0	0	1	0	0	0	0	0	0	**1**
NE Derbyshire	0	0	1	0	0	0	0	0	0	**1**
Bolsover	0	0	1	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	4	8	8	0	0	0	0	0	**21**
All	**8**	**196**	**419**	**199**	**0**	**0**	**0**	**0**	**1**	**823**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	2%	23%	50%	20%	0%	0%	1%	0%	0%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**2%**
All	**2%**	**24%**	**52%**	**22%**	**0%**	**0%**	**1%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Rotherham	0%	0%	1%	1%	0%	0%	0%	0%	0%	**2%**
Doncaster	1%	23%	49%	22%	0%	0%	0%	0%	0%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**2%**
All	**1%**	**24%**	**51%**	**24%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Car	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	5	4	0	0	0	0	0	**9**
Rotherham	0	0	2	10	0	0	0	0	0	**11**
Doncaster	35	328	701	347	0	0	0	0	3	**1413**
Barnsley	0	0	1	0	0	0	0	0	0	**1**
Chesterfield	0	1	0	1	0	0	0	0	0	**2**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	1	3	0	0	0	0	0	**4**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	15	16	19	0	0	0	0	0	**50**
All	**35**	**345**	**725**	**385**	**0**	**0**	**0**	**0**	**3**	**1492**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	6	7	0	0	0	0	0	**13**
Rotherham	0	0	11	22	0	0	0	0	0	**33**
Doncaster	19	384	785	357	0	0	0	0	1	**1547**
Barnsley	0	6	5	0	0	0	0	0	0	**11**
Chesterfield	0	0	1	2	0	0	0	0	0	**3**
NE Derbyshire	0	0	2	1	0	0	0	0	0	**3**
Bolsover	0	0	5	1	0	0	0	0	0	**7**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	11	15	17	0	0	0	0	0	**44**
All	**19**	**401**	**831**	**408**	**0**	**0**	**0**	**0**	**1**	**1661**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	2%	22%	47%	23%	0%	0%	0%	0%	0%	**95%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**3%**
All	**2%**	**23%**	**49%**	**26%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	1%	1%	0%	0%	0%	0%	0%	**2%**
Doncaster	1%	23%	47%	21%	0%	0%	0%	0%	0%	**93%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	1%	1%	0%	0%	0%	0%	0%	**3%**
All	**1%**	**24%**	**50%**	**25%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Car	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	10	0	0	0	12	7	0	144	0	**173**
Rotherham	2	0	0	0	0	0	0	6	0	**8**
Doncaster	1	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	1	0	**1**
Chesterfield	0	0	0	0	0	0	0	0	0	**1**
NE Derbyshire	1	0	0	0	0	0	0	2	0	**3**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**13**	**0**	**0**	**0**	**12**	**7**	**0**	**155**	**0**	**188**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	65	33	0	171	0	**269**
Rotherham	0	0	0	0	0	0	0	5	0	**5**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	1	0	0	16	0	**18**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**0**	**0**	**0**	**66**	**33**	**0**	**193**	**0**	**293**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	5%	0%	0%	0%	7%	3%	0%	77%	0%	**92%**
Rotherham	1%	0%	0%	0%	0%	0%	0%	3%	0%	**4%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	1%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**7%**	**0%**	**0%**	**0%**	**7%**	**4%**	**0%**	**82%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	22%	11%	0%	58%	0%	**92%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	6%	0%	**6%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**0%**	**0%**	**0%**	**23%**	**11%**	**0%**	**66%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
	2 Car	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	14	0	0	0	7	22	0	167	0	210
Rotherham	1	0	0	0	0	0	0	6	0	7
Doncaster	0	0	0	0	0	0	0	2	0	2
Barnsley	0	0	0	0	0	0	0	1	0	1
Chesterfield	0	0	0	0	0	0	0	1	0	1
NE Derbyshire	1	0	0	0	0	1	0	2	0	4
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**16**	**0**	**0**	**0**	**7**	**23**	**0**	**179**	**0**	**226**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	7	17	0	115	0	138
Rotherham	0	0	0	0	0	0	0	5	0	5
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	0	0	1	0	1
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	6	0	6
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**0**	**0**	**0**	**7**	**17**	**0**	**129**	**0**	**153**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	6%	0%	0%	0%	3%	10%	0%	74%	0%	93%
Rotherham	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
Doncaster	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	1%	0%	2%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**7%**	**0%**	**0%**	**0%**	**3%**	**10%**	**0%**	**79%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	4%	11%	0%	75%	0%	90%
Rotherham	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
Doncaster	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	4%	0%	4%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**0%**	**0%**	**0%**	**4%**	**11%**	**0%**	**85%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
	2 Car	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	26	0	0	0	18	53	0	255	0	353
Rotherham	0	0	0	0	1	0	0	11	0	11
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	1	0	0	0	0	1
Chesterfield	1	0	0	0	0	1	0	0	0	1
NE Derbyshire	1	0	0	0	0	0	0	2	0	2
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	1	0	1
Bassetlaw	1	0	0	0	0	0	0	0	0	1
All	28	0	0	0	19	54	0	269	0	371

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	11	27	0	191	0	230
Rotherham	0	0	0	0	0	0	0	10	0	10
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	0	0	1	0	1
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	12	0	12
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	0	0	0	0	12	27	0	215	0	254

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7%	0%	0%	0%	5%	14%	0%	69%	0%	95%
Rotherham	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	8%	0%	0%	0%	5%	15%	0%	73%	0%	100%

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	5%	11%	0%	75%	0%	91%
Rotherham	0%	0%	0%	0%	0%	0%	0%	4%	0%	4%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	5%	0%	5%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	0%	0%	0%	0%	5%	11%	0%	85%	0%	100%

Screenline	Vehicle	TimePeriod	Model
5	Car	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	12	0	0	0	0	0	0	178	190
Rotherham	0	15	0	0	0	0	5	0	189	209
Doncaster	0	0	0	0	0	0	0	0	7	7
Barnsley	0	5	0	0	0	0	0	0	17	22
Chesterfield	0	2	0	0	0	0	0	0	54	56
NE Derbyshire	0	0	2	0	0	0	2	0	48	51
Bolsover	0	0	0	0	0	0	0	0	99	99
D. Dales	0	0	0	0	0	0	0	0	5	5
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**33**	**2**	**0**	**0**	**0**	**7**	**0**	**596**	**638**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	24	0	0	0	0	1	0	135	161
Rotherham	0	68	0	0	0	0	5	0	185	258
Doncaster	0	2	0	0	0	0	0	0	6	8
Barnsley	0	1	0	0	0	0	0	0	5	6
Chesterfield	0	2	0	0	0	0	4	0	87	93
NE Derbyshire	0	8	0	0	0	0	2	0	97	107
Bolsover	0	8	0	0	0	0	5	0	188	201
D. Dales	0	0	0	0	0	0	0	0	6	6
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**113**	**0**	**0**	**0**	**0**	**17**	**0**	**709**	**839**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	2%	0%	0%	0%	0%	0%	0%	28%	30%
Rotherham	0%	2%	0%	0%	0%	0%	1%	0%	30%	33%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Barnsley	0%	1%	0%	0%	0%	0%	0%	0%	3%	3%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	9%	9%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	7%	8%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	15%	15%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**5%**	**0%**	**0%**	**0%**	**0%**	**1%**	**0%**	**93%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	3%	0%	0%	0%	0%	0%	0%	16%	19%
Rotherham	0%	8%	0%	0%	0%	0%	1%	0%	22%	31%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	10%	11%
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	12%	13%
Bolsover	0%	1%	0%	0%	0%	0%	1%	0%	22%	24%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**13%**	**0%**	**0%**	**0%**	**0%**	**2%**	**0%**	**84%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Car	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	45	0	0	0	0	1	0	139	**184**
Rotherham	0	42	0	0	3	0	3	0	94	**141**
Doncaster	0	4	0	0	0	0	0	0	3	**6**
Barnsley	0	3	0	0	0	0	0	0	4	**6**
Chesterfield	0	1	0	0	0	0	0	0	40	**41**
NE Derbyshire	0	1	0	0	0	0	1	0	26	**28**
Bolsover	0	7	3	0	0	0	1	0	105	**117**
D. Dales	0	0	0	0	0	0	0	0	6	**6**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**102**	**3**	**0**	**3**	**0**	**5**	**0**	**417**	**530**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	48	0	0	0	0	2	0	148	**197**
Rotherham	0	31	0	0	0	0	1	0	71	**102**
Doncaster	0	4	0	0	0	0	0	0	5	**9**
Barnsley	0	1	0	0	0	0	0	0	6	**8**
Chesterfield	0	3	0	0	0	0	2	0	44	**49**
NE Derbyshire	0	4	0	0	0	0	1	0	33	**38**
Bolsover	0	5	0	0	0	0	3	0	84	**93**
D. Dales	0	1	0	0	0	0	0	0	6	**7**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**98**	**0**	**0**	**0**	**0**	**10**	**0**	**397**	**505**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	8%	0%	0%	0%	0%	0%	0%	26%	**35%**
Rotherham	0%	8%	0%	0%	0%	0%	0%	0%	18%	**27%**
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	7%	**8%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	5%	**5%**
Bolsover	0%	1%	1%	0%	0%	0%	0%	0%	20%	**22%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**19%**	**1%**	**0%**	**0%**	**0%**	**1%**	**0%**	**79%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	9%	0%	0%	0%	0%	0%	0%	29%	**39%**
Rotherham	0%	6%	0%	0%	0%	0%	0%	0%	14%	**20%**
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	1%	**2%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	**2%**
Chesterfield	0%	1%	0%	0%	0%	0%	0%	0%	9%	**10%**
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	7%	**8%**
Bolsover	0%	1%	0%	0%	0%	0%	1%	0%	17%	**18%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	**1%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**19%**	**0%**	**0%**	**0%**	**0%**	**2%**	**0%**	**79%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Car	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	76	0	0	0	0	0	0	280	356
Rotherham	0	37	0	0	0	0	0	0	119	157
Doncaster	0	8	0	0	0	0	0	0	0	8
Barnsley	0	4	0	0	0	0	0	0	0	4
Chesterfield	0	0	2	0	0	0	0	0	82	84
NE Derbyshire	0	0	2	0	0	0	0	0	37	39
Bolsover	0	2	2	0	0	0	2	0	137	141
D. Dales	0	0	0	0	0	0	0	0	11	11
Bassetlaw	0	2	0	0	0	0	0	0	2	3
All	**0**	**129**	**5**	**0**	**0**	**0**	**2**	**0**	**668**	**803**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	91	0	0	0	0	4	0	286	381
Rotherham	0	32	0	0	0	0	1	0	132	166
Doncaster	0	9	0	0	0	0	0	0	3	12
Barnsley	0	2	0	0	0	0	0	0	10	12
Chesterfield	0	10	0	0	0	0	6	0	120	136
NE Derbyshire	0	13	0	0	0	0	4	0	78	94
Bolsover	0	11	0	0	0	0	5	0	145	161
D. Dales	0	0	0	0	0	0	0	0	13	13
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**167**	**0**	**0**	**0**	**0**	**21**	**0**	**786**	**974**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	9%	0%	0%	0%	0%	0%	0%	35%	44%
Rotherham	0%	5%	0%	0%	0%	0%	0%	0%	15%	19%
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%
Barnsley	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	10%	10%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	5%	5%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	17%	18%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**16%**	**1%**	**0%**	**0%**	**0%**	**0%**	**0%**	**83%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	9%	0%	0%	0%	0%	0%	0%	29%	39%
Rotherham	0%	3%	0%	0%	0%	0%	0%	0%	14%	17%
Doncaster	0%	1%	0%	0%	0%	0%	0%	0%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Chesterfield	0%	1%	0%	0%	0%	0%	1%	0%	12%	14%
NE Derbyshire	0%	1%	0%	0%	0%	0%	0%	0%	8%	10%
Bolsover	0%	1%	0%	0%	0%	0%	0%	0%	15%	17%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	1%	1%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**17%**	**0%**	**0%**	**0%**	**0%**	**2%**	**0%**	**81%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Car	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	22	0	0	0	0	0	**22**
Rotherham	0	0	0	16	0	0	0	0	0	**16**
Doncaster	0	0	0	2	0	0	0	0	0	**2**
Barnsley	0	10	9	819	0	0	0	0	0	**838**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	2	0	0	0	0	0	**2**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**10**	**9**	**862**	**0**	**0**	**0**	**0**	**0**	**881**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	19	0	0	0	0	0	**19**
Rotherham	0	0	0	1	0	0	0	0	0	**1**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	39	21	651	0	0	0	0	1	**711**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	2	0	0	0	0	0	**2**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**39**	**21**	**673**	**0**	**0**	**0**	**0**	**1**	**734**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	1%	1%	93%	0%	0%	0%	0%	0%	**95%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**1%**	**1%**	**98%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	5%	3%	89%	0%	0%	0%	0%	0%	**97%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**5%**	**3%**	**92%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Car	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	18	0	0	0	0	0	**18**
Rotherham	0	0	0	7	0	0	0	0	0	**7**
Doncaster	0	0	0	2	0	0	0	0	0	**2**
Barnsley	1	3	4	567	0	0	0	0	0	**574**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**1**	**3**	**4**	**595**	**0**	**0**	**0**	**0**	**0**	**602**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	20	0	0	0	0	0	**20**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	14	8	528	0	0	0	0	0	**550**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**14**	**8**	**552**	**0**	**0**	**0**	**0**	**0**	**575**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	3%	0%	0%	0%	0%	0%	**3%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	1%	94%	0%	0%	0%	0%	0%	**95%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**0%**	**1%**	**99%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	2%	1%	92%	0%	0%	0%	0%	0%	**96%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**2%**	**1%**	**96%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
	7 Car	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	51	0	0	0	0	0	**51**
Rotherham	0	0	0	13	0	0	0	0	0	**13**
Doncaster	0	0	0	3	0	0	0	0	0	**3**
Barnsley	0	8	6	722	0	0	0	0	0	**736**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	4	0	0	0	0	0	**4**
Bassetlaw	0	0	0	1	0	0	0	0	0	**1**
All	**0**	**8**	**6**	**793**	**0**	**0**	**0**	**0**	**0**	**807**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	44	0	0	0	0	0	**44**
Rotherham	0	0	0	5	0	0	0	0	0	**5**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	22	12	844	0	0	0	0	0	**877**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**22**	**12**	**894**	**0**	**0**	**0**	**0**	**0**	**927**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	**6%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	1%	1%	89%	0%	0%	0%	0%	0%	**91%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**1%**	**1%**	**98%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	5%	0%	0%	0%	0%	0%	**5%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	2%	1%	91%	0%	0%	0%	0%	0%	**95%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**2%**	**1%**	**96%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0	0	0	5	0	0	0	0	0	**5**
Rotherham	0	0	1	7	0	0	0	0	0	**9**
Doncaster	7	97	112	108	0	0	0	0	0	**324**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	1	0	0	0	0	0	**1**
Bassetlaw	5	7	11	6	0	0	0	0	0	**29**
All	**12**	**105**	**126**	**129**	**0**	**0**	**0**	**0**	**0**	**371**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0	0	16	1	0	0	0	0	0	**18**
Rotherham	0	0	15	5	0	0	0	0	0	**20**
Doncaster	54	96	158	75	0	0	0	0	1	**384**
Barnsley	0	0	0	0	0	0	0	0	0	**1**
Chesterfield	0	0	2	2	0	0	0	0	0	**4**
NE Derbyshire	0	0	2	1	0	0	0	0	0	**3**
Bolsover	0	0	2	1	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	4	12	9	0	0	0	0	0	**25**
All	**54**	**101**	**207**	**94**	**0**	**0**	**0**	**0**	**1**	**458**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	2%	26%	30%	29%	0%	0%	0%	0%	0%	**87%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	1%	2%	3%	2%	0%	0%	0%	0%	0%	**8%**
All	**3%**	**28%**	**34%**	**35%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	**All**
Sheffield	0%	0%	4%	0%	0%	0%	0%	0%	0%	**4%**
Rotherham	0%	0%	3%	1%	0%	0%	0%	0%	0%	**4%**
Doncaster	12%	21%	34%	16%	0%	0%	0%	0%	0%	**84%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	1%	0%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	3%	2%	0%	0%	0%	0%	0%	**5%**
All	**12%**	**22%**	**45%**	**21%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	5	0	0	0	0	0	**5**
Rotherham	0	0	2	7	0	0	0	0	0	**8**
Doncaster	6	99	123	108	0	0	0	0	0	**336**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	1	0	0	0	0	0	**1**
Bassetlaw	5	9	9	4	0	0	0	0	0	**27**
All	**10**	**108**	**135**	**127**	**0**	**0**	**0**	**0**	**0**	**380**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	31	1	0	0	0	0	0	**32**
Rotherham	0	0	16	4	0	0	0	0	0	**20**
Doncaster	18	69	139	85	0	0	0	0	1	**312**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	2	1	0	0	0	0	0	**3**
NE Derbyshire	0	0	2	0	0	0	0	0	0	**3**
Bolsover	0	0	2	1	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	3	11	10	0	0	0	0	0	**24**
All	**18**	**72**	**203**	**102**	**0**	**0**	**0**	**0**	**1**	**397**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	1%	26%	32%	28%	0%	0%	0%	0%	0%	**88%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	1%	2%	2%	1%	0%	0%	0%	0%	0%	**7%**
All	**3%**	**28%**	**36%**	**33%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	8%	0%	0%	0%	0%	0%	0%	**8%**
Rotherham	0%	0%	4%	1%	0%	0%	0%	0%	0%	**5%**
Doncaster	5%	17%	35%	21%	0%	0%	0%	0%	0%	**79%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	1%	0%	0%	0%	0%	0%	0%	**1%**
NE Derbyshire	0%	0%	1%	0%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	1%	3%	3%	0%	0%	0%	0%	0%	**6%**
All	**5%**	**18%**	**51%**	**26%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
1	Freight	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	1	3	0	0	0	0	0	**4**
Rotherham	0	0	1	5	0	0	0	0	0	**7**
Doncaster	5	96	124	100	0	0	0	0	0	**326**
Barnsley	0	0	1	0	0	0	0	0	0	**1**
Chesterfield	0	0	0	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	0	1	0	0	0	0	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	1	0	0	0	0	0	**1**
Bassetlaw	4	7	12	4	0	0	0	0	0	**27**
All	**9**	**103**	**139**	**115**	**0**	**0**	**0**	**0**	**0**	**367**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	13	1	0	0	0	0	0	**13**
Rotherham	0	0	12	4	0	0	0	0	0	**16**
Doncaster	12	69	107	72	0	0	0	0	1	**261**
Barnsley	0	0	1	0	0	0	0	0	0	**1**
Chesterfield	0	0	1	1	0	0	0	0	0	**1**
NE Derbyshire	0	0	2	1	0	0	0	0	0	**2**
Bolsover	0	0	2	1	0	0	0	0	0	**2**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	5	7	10	0	0	0	0	0	**22**
All	**12**	**75**	**144**	**89**	**0**	**0**	**0**	**0**	**1**	**320**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Rotherham	0%	0%	0%	1%	0%	0%	0%	0%	0%	**2%**
Doncaster	1%	26%	34%	27%	0%	0%	0%	0%	0%	**89%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	1%	2%	3%	1%	0%	0%	0%	0%	0%	**7%**
All	**2%**	**28%**	**38%**	**31%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	4%	0%	0%	0%	0%	0%	0%	**4%**
Rotherham	0%	0%	4%	1%	0%	0%	0%	0%	0%	**5%**
Doncaster	4%	22%	33%	23%	0%	0%	0%	0%	0%	**82%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	1%	0%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	1%	0%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	2%	2%	3%	0%	0%	0%	0%	0%	**7%**
All	**4%**	**23%**	**45%**	**28%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	1	0	0	0	1	3	0	29	0	**34**
Rotherham	0	0	0	0	0	0	0	4	0	**4**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	1	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**2**	**0**	**0**	**0**	**1**	**3**	**0**	**35**	**0**	**40**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	1	1	0	25	0	**27**
Rotherham	0	0	0	0	0	0	0	6	0	**6**
Doncaster	0	0	0	0	0	0	0	2	0	**2**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	1	0	2	0	**3**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	1	0	**1**
All	**0**	**0**	**0**	**0**	**1**	**3**	**0**	**36**	**0**	**39**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	0%	0%	0%	2%	7%	0%	72%	0%	**84%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	9%	0%	**10%**
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	3%	0%	**3%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**0%**	**0%**	**0%**	**2%**	**7%**	**0%**	**86%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	2%	3%	0%	65%	0%	**70%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	15%	0%	**15%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	5%	0%	**5%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	3%	0%	4%	0%	**7%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
All	**0%**	**0%**	**0%**	**0%**	**2%**	**7%**	**0%**	**92%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	1	0	0	0	1	3	0	30	0	36
Rotherham	0	0	0	0	0	0	0	5	0	6
Doncaster	0	0	0	0	0	0	0	1	0	1
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	0	0	1	0	1
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**2**	**0**	**0**	**0**	**1**	**3**	**0**	**38**	**0**	**44**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	0	1	0	15	0	17
Rotherham	0	0	0	0	0	0	0	3	0	3
Doncaster	0	0	0	0	0	0	0	5	0	5
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	0	0	2	0	2	0	4
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	0	0	0	0	1	0	1
All	**0**	**0**	**0**	**0**	**0**	**3**	**0**	**27**	**0**	**30**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	0%	0%	0%	2%	8%	0%	69%	0%	82%
Rotherham	0%	0%	0%	0%	0%	0%	0%	12%	0%	13%
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	3%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	2%	0%	2%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**4%**	**0%**	**0%**	**0%**	**2%**	**8%**	**0%**	**86%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	0%	5%	0%	50%	0%	56%
Rotherham	0%	0%	0%	0%	0%	0%	0%	11%	0%	11%
Doncaster	0%	0%	0%	0%	0%	0%	0%	16%	0%	16%
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	0%	0%	6%	0%	6%	0%	12%
Bolsover	0%	0%	0%	0%	0%	0%	0%	1%	0%	1%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	3%	0%	3%
All	**0%**	**0%**	**0%**	**0%**	**0%**	**11%**	**0%**	**88%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
2	Freight	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	2	0	0	0	1	5	0	29	0	**38**
Rotherham	0	0	0	0	0	0	0	3	0	**3**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	1	0	**1**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**2**	**0**	**0**	**0**	**1**	**5**	**0**	**33**	**0**	**42**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	0	0	2	0	17	0	**20**
Rotherham	0	0	0	0	0	0	0	1	0	**1**
Doncaster	0	0	0	0	0	0	0	1	0	**1**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	0	0	0	0	0	0	**0**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**0**	**0**	**0**	**0**	**2**	**0**	**19**	**0**	**21**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	0%	0%	0%	3%	13%	1%	68%	0%	**89%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	6%	0%	**7%**
Doncaster	1%	0%	0%	0%	0%	0%	0%	2%	0%	**3%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	1%	0%	**1%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	2%	0%	**2%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**5%**	**0%**	**0%**	**0%**	**3%**	**13%**	**1%**	**78%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	0%	2%	9%	0%	82%	0%	**92%**
Rotherham	0%	0%	0%	0%	0%	0%	0%	4%	0%	**4%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	4%	0%	**4%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**0%**	**0%**	**0%**	**2%**	**9%**	**0%**	**89%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7	4	0	0	0	0	8	0	67	**87**
Rotherham	0	8	0	0	0	0	4	0	29	**41**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	1	0	0	0	1	0	11	**13**
NE Derbyshire	0	0	0	0	0	0	1	0	11	**12**
Bolsover	0	1	0	0	0	0	1	0	22	**24**
D. Dales	0	0	0	0	0	0	0	0	6	**6**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**7**	**13**	**1**	**0**	**0**	**0**	**16**	**0**	**147**	**184**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	3	0	0	0	0	4	0	50	**56**
Rotherham	0	5	0	0	0	0	1	0	33	**38**
Doncaster	0	1	0	0	0	0	0	0	1	**1**
Barnsley	0	1	0	0	0	0	0	0	10	**11**
Chesterfield	0	0	0	0	0	0	7	0	15	**23**
NE Derbyshire	0	1	0	0	0	0	3	0	18	**22**
Bolsover	0	1	0	0	0	0	5	0	60	**67**
D. Dales	0	0	0	0	0	0	1	0	37	**38**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**10**	**1**	**0**	**0**	**0**	**22**	**0**	**223**	**256**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	2%	0%	0%	0%	0%	5%	0%	37%	**47%**
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	16%	**22%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	12%	**13%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	4%	**4%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**7%**	**1%**	**0%**	**0%**	**0%**	**8%**	**0%**	**80%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	1%	0%	0%	0%	0%	2%	0%	19%	**22%**
Rotherham	0%	2%	0%	0%	0%	0%	0%	0%	13%	**15%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	4%	**4%**
Chesterfield	0%	0%	0%	0%	0%	0%	3%	0%	6%	**9%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	7%	**9%**
Bolsover	0%	0%	0%	0%	0%	0%	2%	0%	24%	**26%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	14%	**15%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**4%**	**0%**	**0%**	**0%**	**0%**	**8%**	**0%**	**87%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	7	3	0	0	0	0	8	0	57	**75**
Rotherham	0	6	0	0	0	0	3	0	23	**32**
Doncaster	0	0	0	0	0	0	0	0	0	**0**
Barnsley	0	0	0	0	0	0	0	0	0	**0**
Chesterfield	0	0	1	0	0	0	1	0	10	**12**
NE Derbyshire	0	0	0	0	0	0	1	0	13	**14**
Bolsover	0	1	0	0	0	0	3	0	28	**32**
D. Dales	0	0	0	0	0	0	0	0	9	**9**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**7**	**10**	**1**	**0**	**0**	**0**	**15**	**0**	**140**	**173**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	6	0	0	0	0	4	0	93	**104**
Rotherham	0	4	0	0	0	0	1	0	37	**42**
Doncaster	0	1	0	0	0	0	0	0	1	**2**
Barnsley	0	1	0	0	0	0	0	0	14	**15**
Chesterfield	0	0	0	0	0	0	9	0	17	**26**
NE Derbyshire	0	1	0	0	0	0	4	0	16	**20**
Bolsover	0	1	0	0	0	0	6	0	59	**67**
D. Dales	0	0	0	0	0	0	1	0	21	**22**
Bassetlaw	0	0	0	0	0	0	0	0	0	**0**
All	**0**	**15**	**0**	**0**	**0**	**0**	**24**	**0**	**257**	**297**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	4%	2%	0%	0%	0%	0%	4%	0%	33%	**43%**
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	13%	**19%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Chesterfield	0%	0%	0%	0%	0%	0%	1%	0%	6%	**7%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	7%	**8%**
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	16%	**18%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	5%	**5%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**4%**	**6%**	**1%**	**0%**	**0%**	**0%**	**9%**	**0%**	**81%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	2%	0%	0%	0%	0%	1%	0%	31%	**35%**
Rotherham	0%	1%	0%	0%	0%	0%	0%	0%	12%	**14%**
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	5%	**5%**
Chesterfield	0%	0%	0%	0%	0%	0%	3%	0%	6%	**9%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	1%	0%	5%	**7%**
Bolsover	0%	0%	0%	0%	0%	0%	2%	0%	20%	**22%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	7%	**7%**
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
All	**0%**	**5%**	**0%**	**0%**	**0%**	**0%**	**8%**	**0%**	**87%**	**100%**

Screenline	Vehicle	TimePeriod	Model
5	Freight	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	5	3	0	0	0	0	6	0	48	62
Rotherham	0	6	0	0	0	0	3	0	21	30
Doncaster	0	0	0	0	0	0	0	0	0	0
Barnsley	0	0	0	0	0	0	0	0	0	0
Chesterfield	0	0	1	0	0	0	1	0	12	13
NE Derbyshire	0	0	0	0	0	0	1	0	12	13
Bolsover	0	1	0	0	0	0	2	0	26	29
D. Dales	0	0	0	0	0	0	0	0	7	7
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**5**	**9**	**2**	**0**	**0**	**0**	**12**	**0**	**126**	**154**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	3	0	0	0	0	1	0	23	28
Rotherham	0	3	0	0	0	0	0	0	22	26
Doncaster	0	0	0	0	0	0	0	0	1	1
Barnsley	0	0	0	0	0	0	0	0	4	5
Chesterfield	0	1	0	0	0	0	6	0	18	25
NE Derbyshire	0	1	0	0	0	0	2	0	10	13
Bolsover	0	1	0	0	0	0	3	0	25	29
D. Dales	0	0	0	0	0	0	1	0	9	10
Bassetlaw	0	0	0	0	0	0	0	0	0	0
All	**0**	**10**	**0**	**0**	**0**	**0**	**13**	**0**	**112**	**136**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	3%	2%	0%	0%	0%	0%	4%	0%	32%	40%
Rotherham	0%	4%	0%	0%	0%	0%	2%	0%	14%	19%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Chesterfield	0%	0%	1%	0%	0%	0%	0%	0%	7%	9%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	8%	8%
Bolsover	0%	0%	0%	0%	0%	0%	1%	0%	17%	19%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	4%	4%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**3%**	**6%**	**1%**	**0%**	**0%**	**0%**	**8%**	**0%**	**82%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	3%	0%	0%	0%	0%	1%	0%	17%	21%
Rotherham	0%	2%	0%	0%	0%	0%	0%	0%	16%	19%
Doncaster	0%	0%	0%	0%	0%	0%	0%	0%	0%	1%
Barnsley	0%	0%	0%	0%	0%	0%	0%	0%	3%	3%
Chesterfield	0%	1%	0%	0%	0%	0%	4%	0%	13%	18%
NE Derbyshire	0%	1%	0%	0%	0%	0%	1%	0%	7%	9%
Bolsover	0%	1%	0%	0%	0%	0%	2%	0%	19%	22%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	7%	8%
Bassetlaw	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
All	**0%**	**7%**	**0%**	**0%**	**0%**	**0%**	**10%**	**0%**	**83%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Freight	AM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	**12**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	4	0	0	0	0	0	**4**
Barnsley	0	1	5	150	0	0	0	0	0	**156**
Chesterfield	0	0	0	0	0	0	0	0	0	**0**
NE Derbyshire	0	0	0	3	0	0	0	0	0	**3**
Bolsover	0	0	0	3	0	0	0	0	0	**3**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	8	0	0	0	0	0	**8**
All	**0**	**2**	**5**	**181**	**0**	**0**	**0**	**0**	**0**	**188**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	16	0	0	0	0	0	**16**
Rotherham	0	0	0	3	0	0	0	0	0	**3**
Doncaster	0	0	0	1	0	0	0	0	0	**1**
Barnsley	0	3	4	54	0	0	0	0	0	**61**
Chesterfield	0	0	0	2	0	0	0	0	0	**2**
NE Derbyshire	0	0	0	0	0	0	0	0	0	**0**
Bolsover	0	0	0	1	0	0	0	0	0	**1**
D. Dales	0	0	0	0	0	0	0	0	0	**0**
Bassetlaw	0	0	0	1	0	0	0	0	0	**1**
All	**0**	**3**	**4**	**79**	**0**	**0**	**0**	**0**	**0**	**86**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	**6%**
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
Barnsley	0%	1%	3%	79%	0%	0%	0%	0%	0%	**83%**
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Bolsover	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
All	**0%**	**1%**	**3%**	**96%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	19%	0%	0%	0%	0%	0%	**19%**
Rotherham	0%	0%	0%	4%	0%	0%	0%	0%	0%	**4%**
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
Barnsley	0%	3%	4%	63%	0%	0%	0%	0%	0%	**71%**
Chesterfield	0%	0%	0%	2%	0%	0%	0%	0%	0%	**2%**
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	**0%**
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	**1%**
All	**0%**	**3%**	**4%**	**92%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Screenline	Vehicle	TimePeriod	Model
7	Freight	IP	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	12
Rotherham	0	0	0	5	0	0	0	0	0	5
Doncaster	0	0	0	3	0	0	0	0	0	3
Barnsley	0	5	4	163	0	0	0	0	0	171
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	3	0	0	0	0	0	3
Bolsover	0	0	0	3	0	0	0	0	0	3
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	5	0	0	0	0	0	5
All	0	5	4	193	0	0	0	0	0	203

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	9	0	0	0	0	0	9
Rotherham	0	0	0	3	0	0	0	0	0	3
Doncaster	0	0	0	1	0	0	0	0	0	1
Barnsley	0	2	4	57	0	0	0	0	0	64
Chesterfield	0	0	0	1	0	0	0	0	0	1
NE Derbyshire	0	0	0	0	0	0	0	0	0	0
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	1	0	0	0	0	0	1
All	0	2	4	73	0	0	0	0	0	79

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	6%	0%	0%	0%	0%	0%	6%
Rotherham	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
Barnsley	0%	2%	2%	80%	0%	0%	0%	0%	0%	85%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	3%	0%	0%	0%	0%	0%	3%
All	0%	3%	2%	95%	0%	0%	0%	0%	0%	100%

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	11%	0%	0%	0%	0%	0%	11%
Rotherham	0%	0%	0%	4%	0%	0%	0%	0%	0%	4%
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Barnsley	0%	3%	5%	73%	0%	0%	0%	0%	0%	81%
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
All	0%	3%	5%	92%	0%	0%	0%	0%	0%	100%

Screenline	Vehicle	TimePeriod	Model
7	Freight	PM	Final

RSI

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	12	0	0	0	0	0	12
Rotherham	0	0	0	5	0	0	0	0	0	5
Doncaster	0	0	0	3	0	0	0	0	0	3
Barnsley	0	1	4	137	0	0	0	0	0	142
Chesterfield	0	0	0	0	0	0	0	0	0	0
NE Derbyshire	0	0	0	1	0	0	0	0	0	1
Bolsover	0	0	0	1	0	0	0	0	0	1
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	4	0	0	0	0	0	4
All	**0**	**1**	**4**	**163**	**0**	**0**	**0**	**0**	**0**	**169**

Model

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0	0	0	10	0	0	0	0	0	10
Rotherham	0	0	0	2	0	0	0	0	0	2
Doncaster	0	0	0	1	0	0	0	0	0	1
Barnsley	0	2	4	52	0	0	0	0	0	59
Chesterfield	0	0	0	1	0	0	0	0	0	1
NE Derbyshire	0	0	0	0	0	0	0	0	0	0
Bolsover	0	0	0	0	0	0	0	0	0	0
D. Dales	0	0	0	0	0	0	0	0	0	0
Bassetlaw	0	0	0	1	0	0	0	0	0	1
All	**0**	**2**	**4**	**68**	**0**	**0**	**0**	**0**	**0**	**74**

% of all RSI trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	7%	0%	0%	0%	0%	0%	7%
Rotherham	0%	0%	0%	3%	0%	0%	0%	0%	0%	3%
Doncaster	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
Barnsley	0%	1%	2%	81%	0%	0%	0%	0%	0%	84%
Chesterfield	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
NE Derbyshire	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Bolsover	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	2%	0%	0%	0%	0%	0%	2%
All	**0%**	**1%**	**2%**	**97%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

% of all Model trips

	Sheffield	Rotherham	Doncaster	Barnsley	Chesterfield	NE Derbyshire	Bolsover	D. Dales	Bassetlaw	All
Sheffield	0%	0%	0%	13%	0%	0%	0%	0%	0%	13%
Rotherham	0%	0%	0%	3%	0%	0%	0%	0%	0%	3%
Doncaster	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
Barnsley	0%	3%	6%	70%	0%	0%	0%	0%	0%	79%
Chesterfield	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
NE Derbyshire	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bolsover	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
D. Dales	0%	0%	0%	0%	0%	0%	0%	0%	0%	0%
Bassetlaw	0%	0%	0%	1%	0%	0%	0%	0%	0%	1%
All	**0%**	**3%**	**6%**	**91%**	**0%**	**0%**	**0%**	**0%**	**0%**	**100%**

Table 119. Summary of Sector to Sector Comparisons (Post)

Screenline	Time Period	Cars (UC1 + UC2 + UC3)	Freight (UC4 + UC5 + UC6)
1	AM	Looks good	Overall low trips but proportions broadly correct. Doncaster to Sheffield is higher in the model than observed.
	IP	Looks good	Overall low trips but proportions broadly correct
	PM	Looks good	Overall low trips but proportions broadly correct
2	AM	No trips to Sheffield in model but there are in RSI records?	Looks good
	IP	No trips to Sheffield in model but there are in RSI records?	Looks good
	PM	No trips to Sheffield in model but there are in RSI records?	Looks good
5	AM	NE Derbyshire + Bolsover to Bassetlaw about twice as high in the model as RSI would suggest. Rotherham to Rotherham is a little high.	Looks good
	IP	Looks good	Looks good
	PM	Looks good	Sheffield to Bassetlaw is a little low but broadly correct
7	AM	Looks good	Looks good
	IP	Looks good	Low trips but proportions look good
	PM	Looks good	Looks good

Source: AECOM analysis

The screenlines with comments mentioned above are discussed below along with any adjustments to the prior matrix that may be required.

Car comparison - Screenline 2

For this screenline in the RSI records there were a number of trips finishing in Sheffield across all three time periods. On further investigation it was found that most of these trips were heading to The Norfolk Arms pub which does lie in Sheffield. However the zone (10091) that encompasses this postcode loads to the east of the RSI site. If we were intending to build the prior matrix from RSI records then adjustments would be needed, however as we are just using this for checks then no adjustment is needed.

In the AM Sheffield to Chesterfield remains too high for car movements compared to RSIs, though is closer to the observations after adjustments and estimation has been applied.

Car comparison - Screenline 5

In the AM Car trips routing between NE Derbyshire and Bolsover to Bassetlaw is higher in the model than the RSI records would suggest. A few of the routes passes through this screenline in the model were checked and it was logical routing. Therefore either the trips were missed during the RSI interview or there are too many trips between these two sectors in the matrix.

Also in the AM time period Rotherham to Rotherham is a little high in the model compared to the RSI records. There are 68 records in the model compared to 15 observed. Most of the trips through this screenline in the model have a origin and destination close to Anston, where RSI Site 501was moved to. Therefore whether the trip routes through the RSI link or not is very sensitive to coding, including where centroids are loaded.

In the IP for cars the Bolsover to Bassetlaw is not seen in the current prior matrix. Some adjustment may be required for trips travelling to Bassetlaw from Bolsover.

Freight comparisons

At screenline 1 during the AM period Doncaster to Sheffield is high in the model, however we would expect most of these trips to take the M18 / M1 motorway. Therefore there might be some issues with routeing in the model. As this is only 50 PCUs this is not a major issue.

Screenline 5 in the PM has trips from Sheffield to Bassetlaw lower in the model. However there are multiple routes of a similar time and distance between these areas, some of the routes will pass through the screenline (near Worksop) but some will not for example by using the M18 and A1.

Trip Length Distributions

Trip length distribution profiles have not been noticeably altered by the estimation process, and continue to show a reasonable fit to the RSI records. Car remains closer to observations than freight. These are shown in the following pages.

Conclusion

Using the RSI matrices to check the post estimated matrix assignment has not raised any new concerns. There are some discrepancies between the observed and model data, particularly for freight movements; which make a relatively small volume.

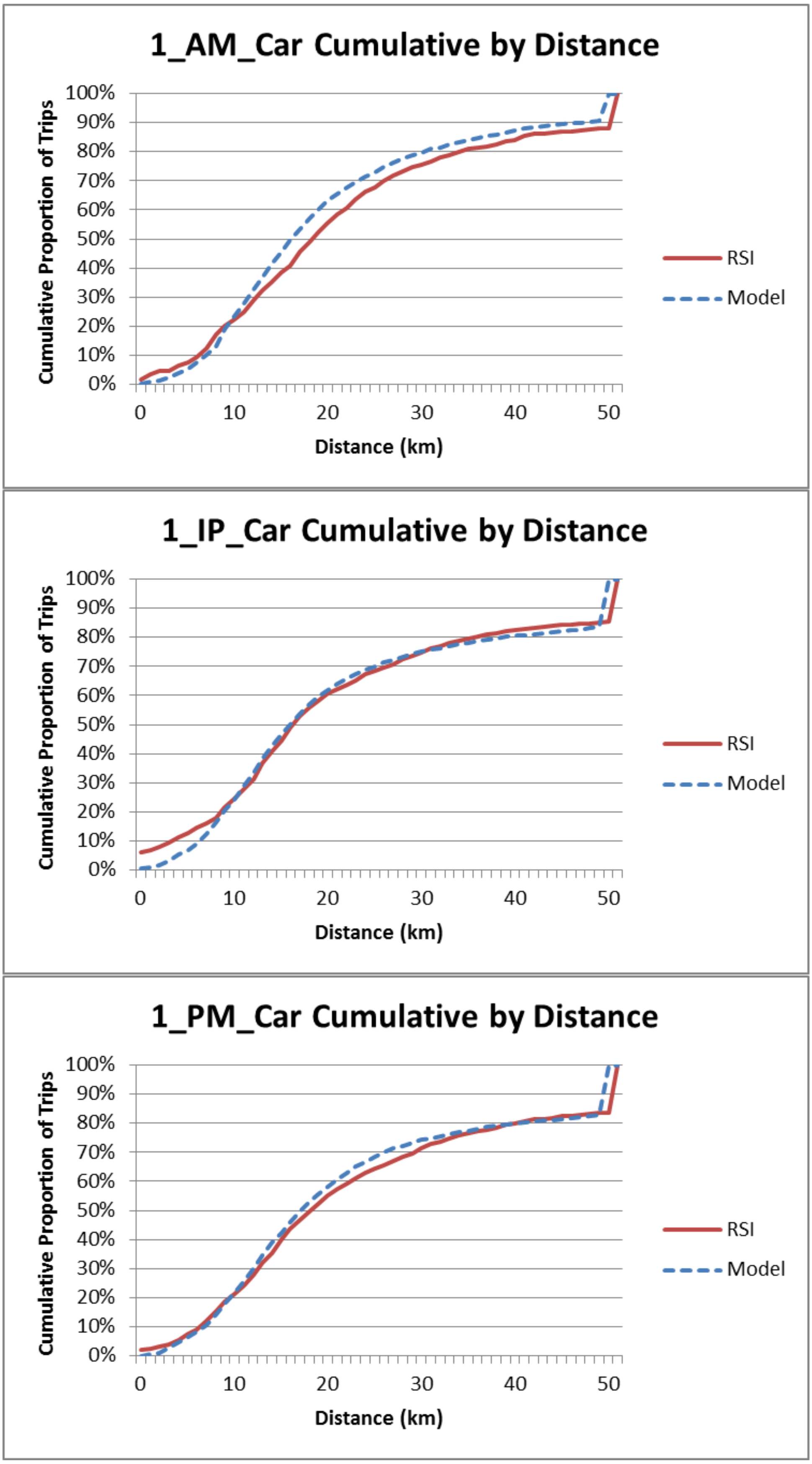


Figure 15. Car TLD at Screenline 1, Observed (Solid Red) vs Post Model (Dotted Blue)

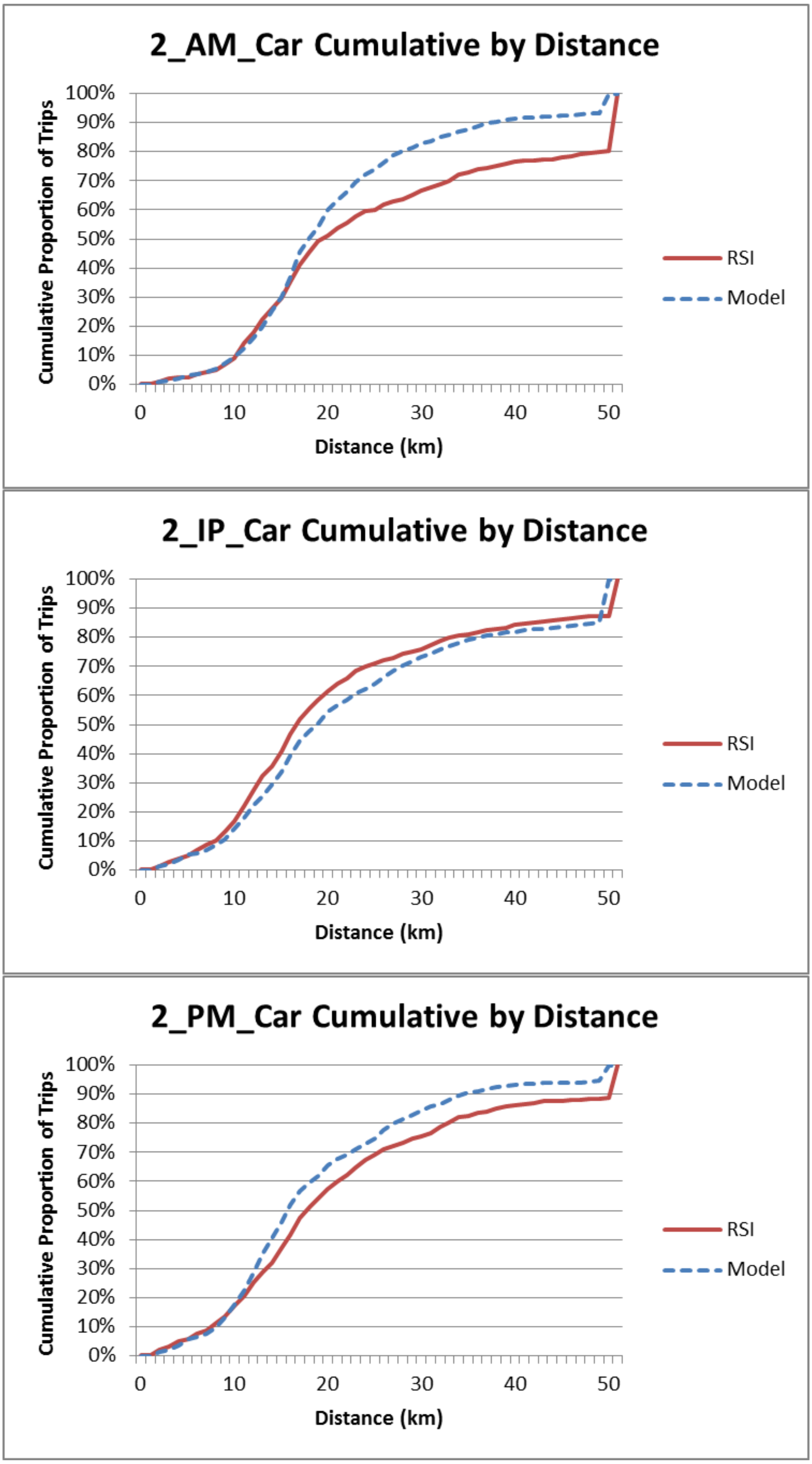


Figure 15. Car TLD at Screenline 2, Observed (Solid Red) vs Post Model (Dotted Blue)

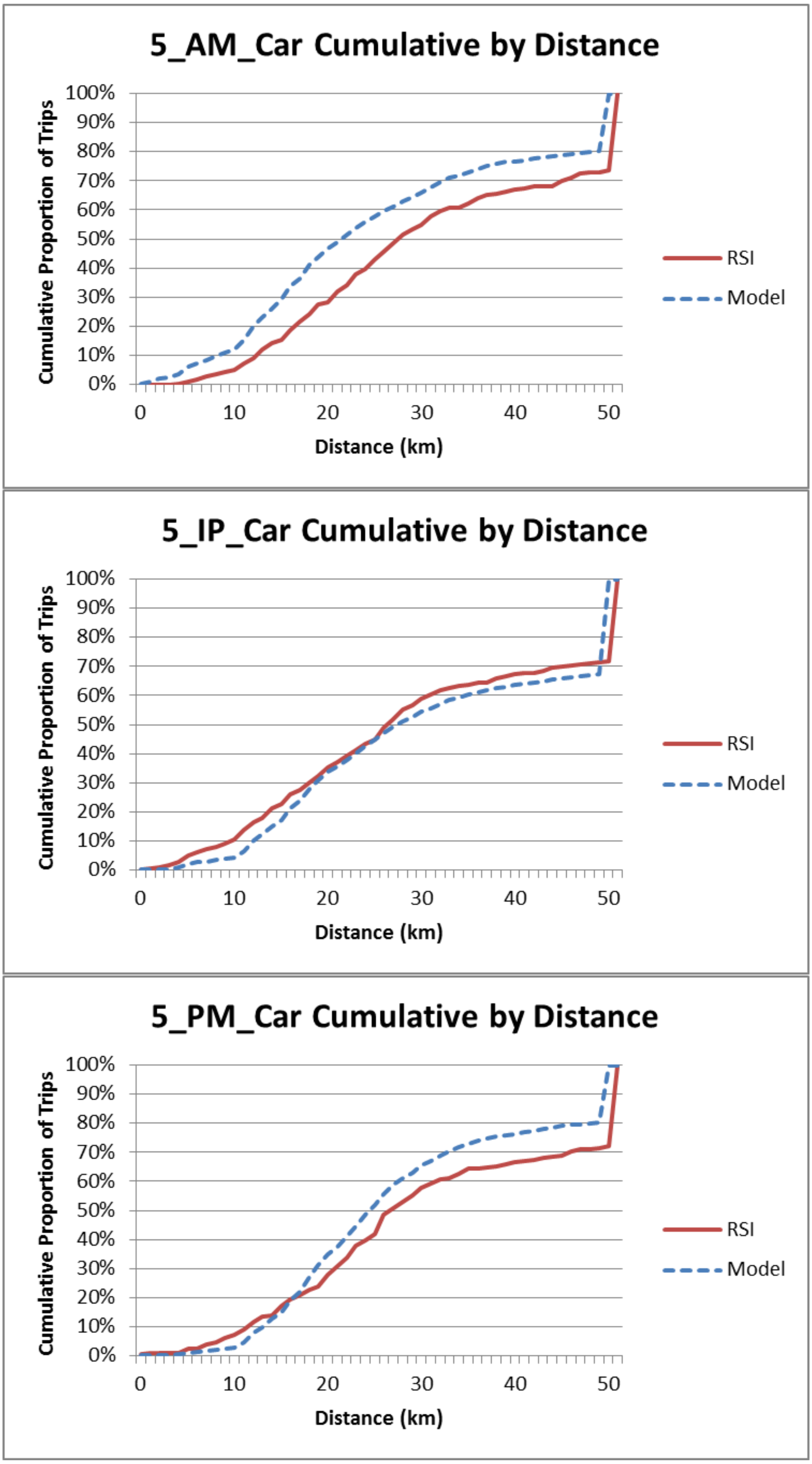
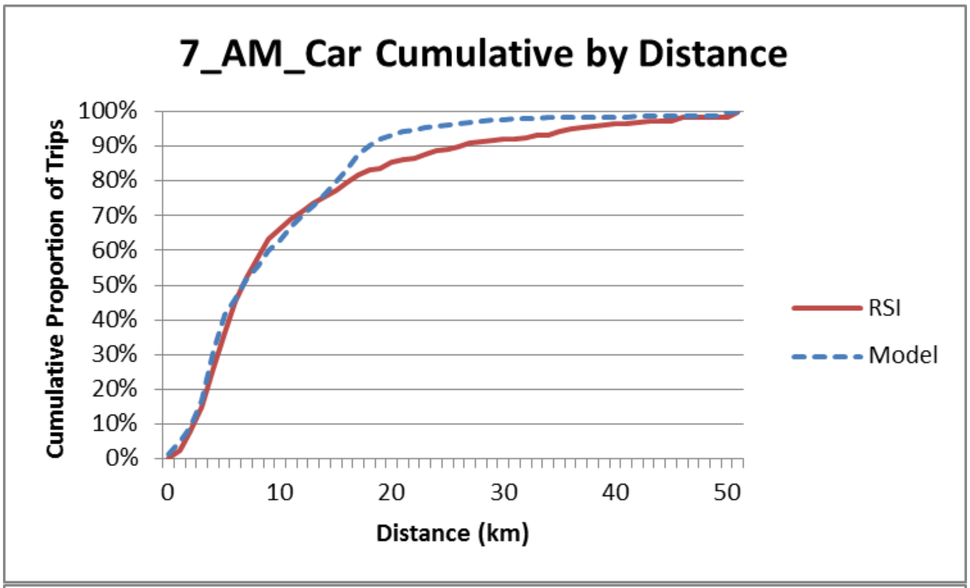
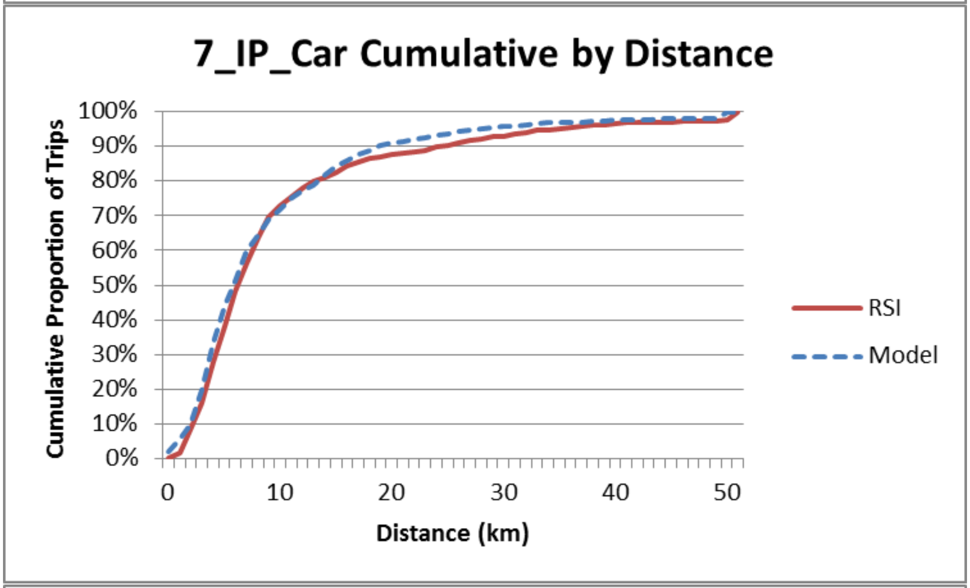


Figure 15. Car TLD at Screenline 5, Observed (Solid Red) vs Post Model (Dotted Blue)





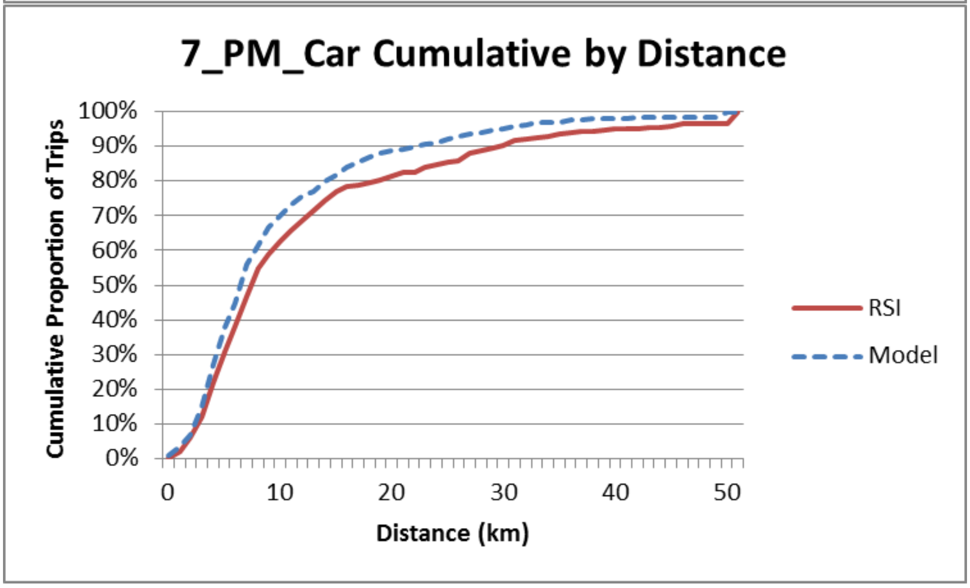
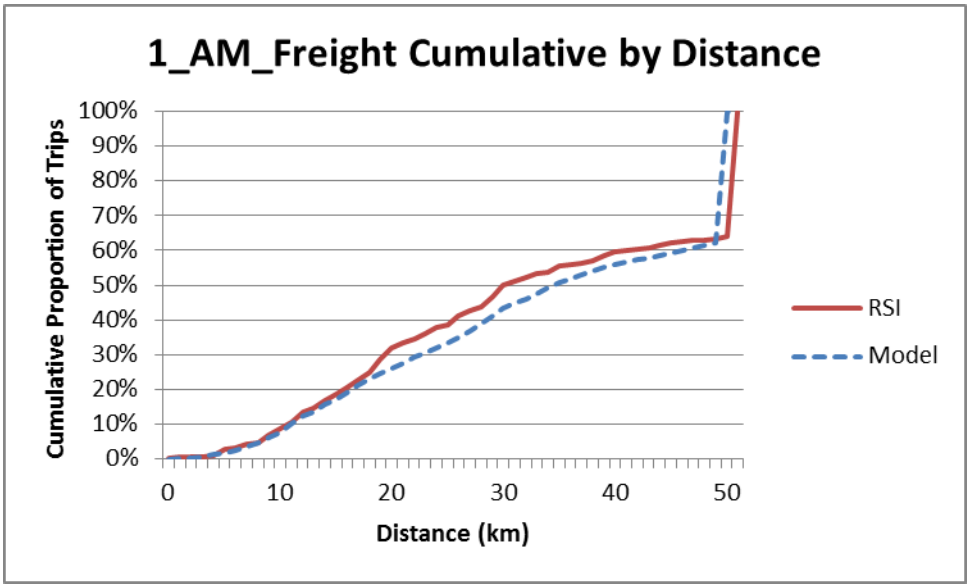
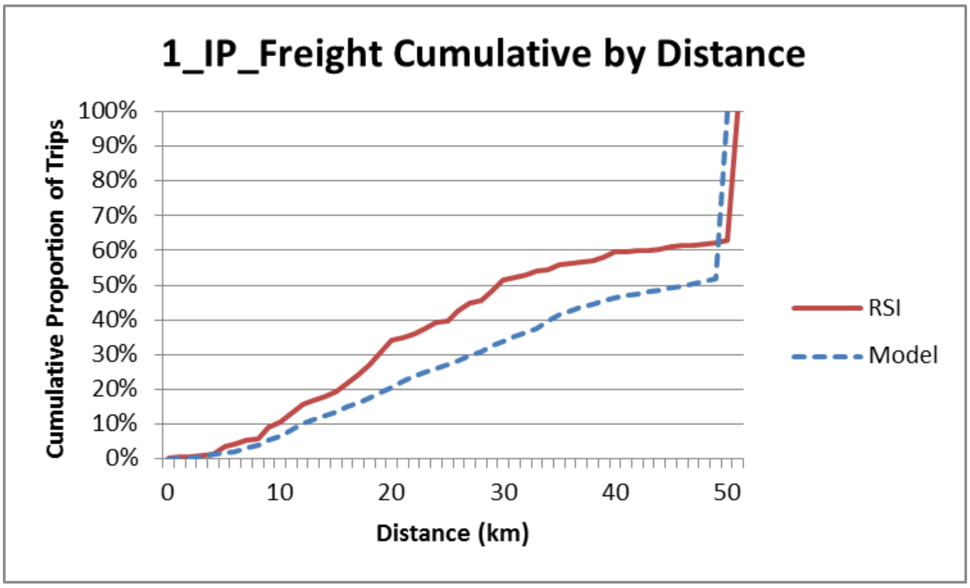


Figure 15. Car TLD at Screenline 7, Observed (Solid Red) vs Post Model (Dotted Blue)





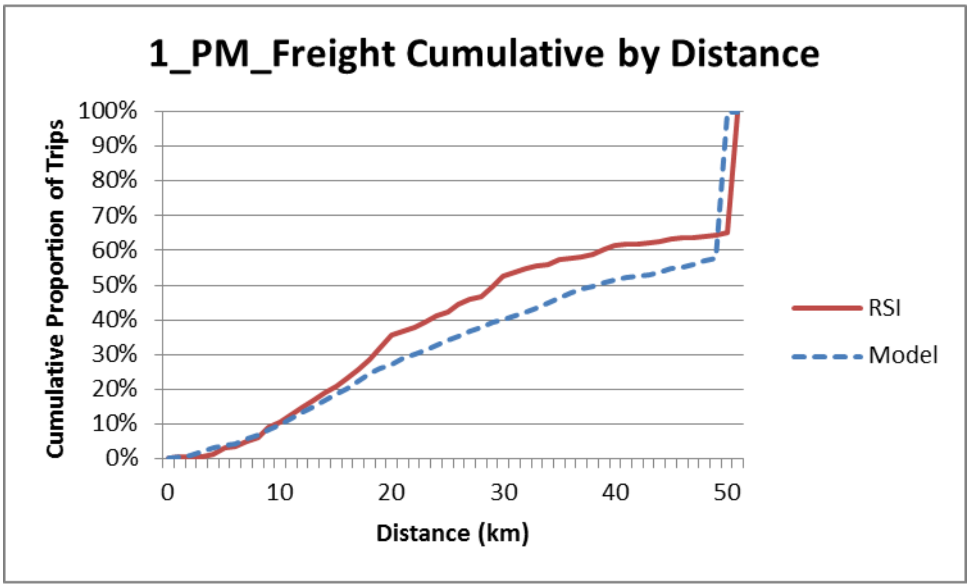


Figure 15. Freight TLD at Screenline 1, Observed (Solid Red) vs Post Model (Dotted Blue)

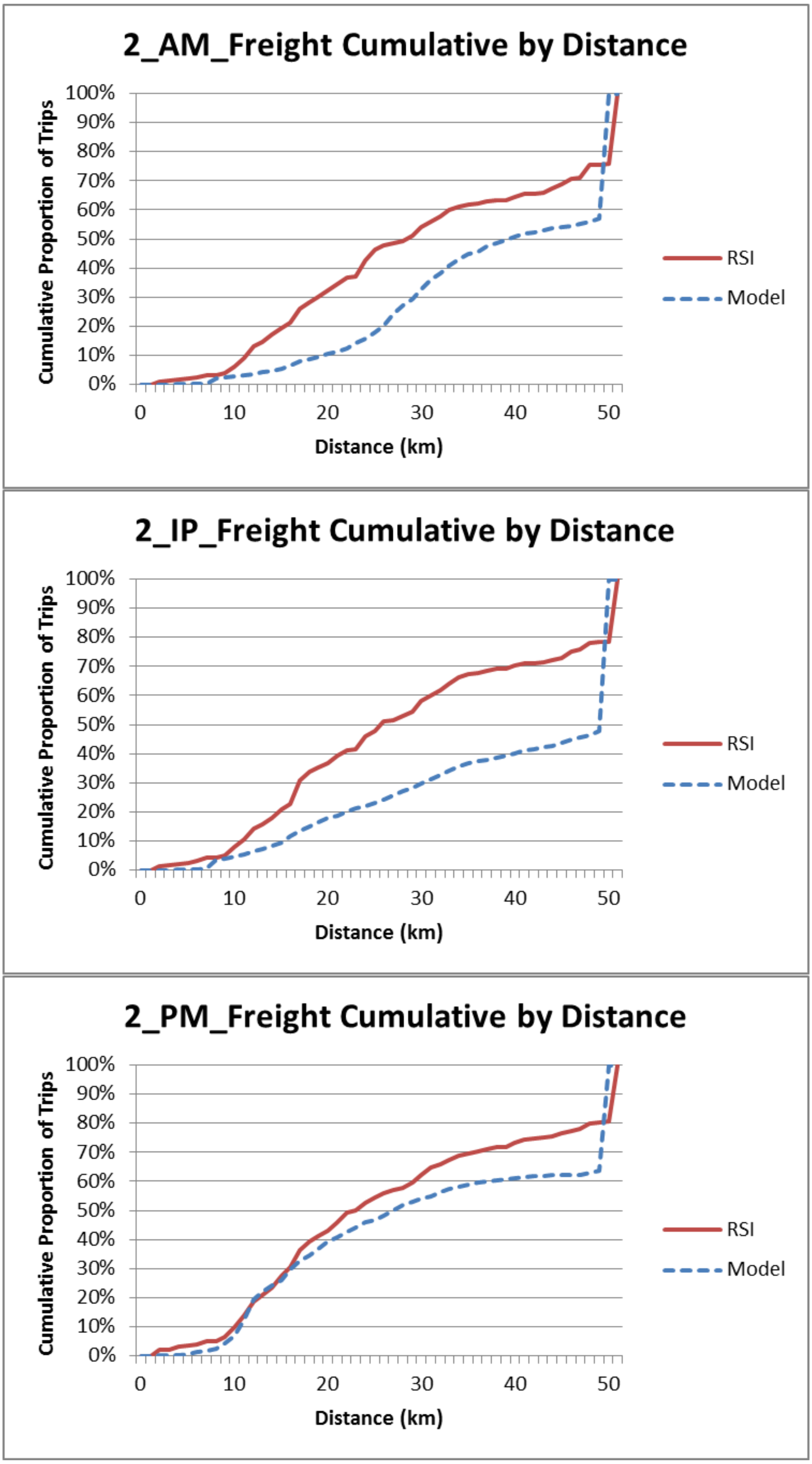


Figure 15. Freight TLD at Screenline 2, Observed (Solid Red) vs Post Model (Dotted Blue)

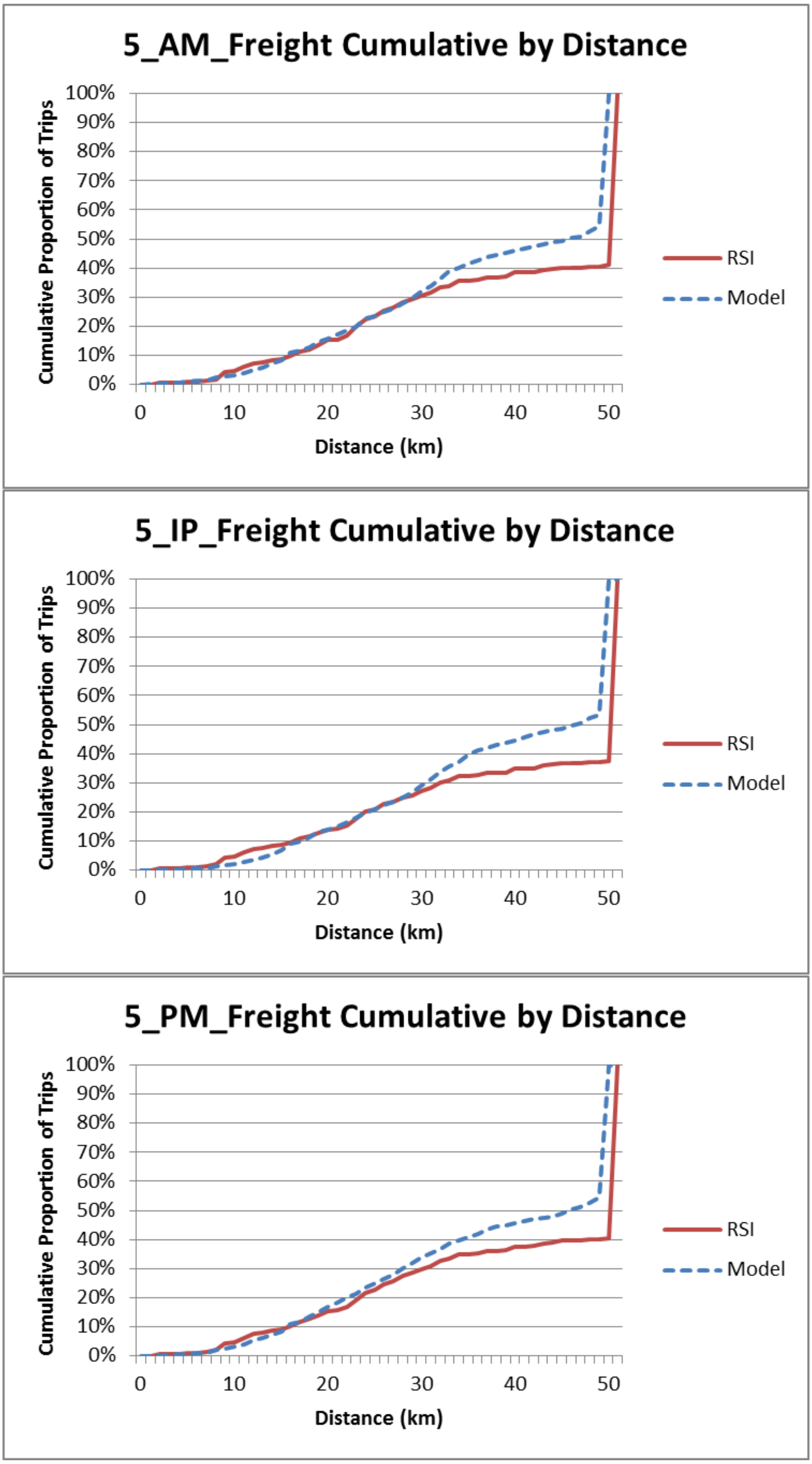


Figure 15. Freight TLD at Screenline 5, Observed (Solid Red) vs Post Model (Dotted Blue)

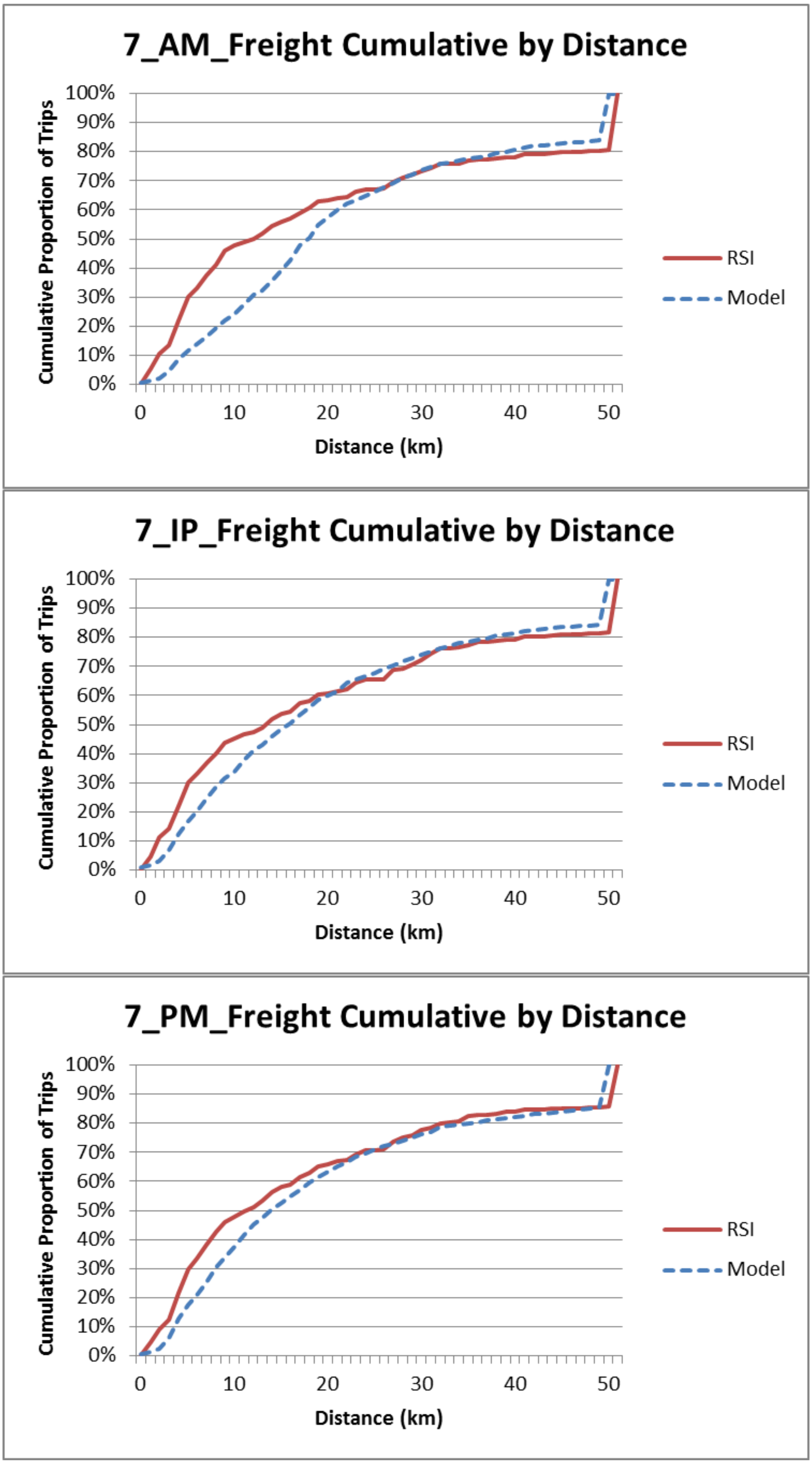


Figure 15. Freight TLD at Screenline 7, Observed (Solid Red) vs Post Model (Dotted Blue)

Appendix L Journey Time Routes

L.1 Journey time summary table

This table below compares the observed and model journey time for 150 selected routes. The AM, IP and PM hours are compared in turn. The final column indicates if the route falls within the particular scheme area: IC refers to Innovation Corridor, MT is Mass Transit and PNC is Pan Northern Connectivity.

Table 120. <Caption>

	AM			IP			PM			Inside Scheme Area		
Route	Observed	Model	Pass	Observed	Model	Pass	Observed	Model	Pass	IC	MT	PNC
B11N	718	748	Y	628	669	Y	659	712	Y	☒	☒	☑
B11S	746	650	Y	592	652	Y	690	711	Y	☒	☒	☑
B12E	443	335	N	357	333	Y	388	355	Y	☒	☒	☑
B12W	369	327	Y	333	319	Y	437	327	N	☒	☒	☑
B13E	769	510	N	488	516	Y	500	664	N	☒	☒	☑
B13W	516	693	N	505	501	Y	683	517	N	☒	☒	☑
B14N	572	602	Y	564	614	Y	735	652	Y	☒	☒	☑
B14S	723	844	N	641	783	N	721	716	Y	☒	☒	☑
B15E	1118	1105	Y	1002	981	Y	1008	998	Y	☒	☒	☑
B15W	1043	1034	Y	1001	1000	Y	1120	1246	Y	☒	☒	☑
B1N	431	416	Y	425	400	Y	432	427	Y	☑	☒	☑
B1S	674	422	N	446	405	Y	495	434	Y	☑	☒	☑
B2E	703	708	Y	636	675	Y	875	816	Y	☒	☒	☑
B2W	711	729	Y	674	650	Y	920	721	N	☒	☒	☑
B3E	675	726	Y	624	674	Y	746	741	Y	☒	☒	☑
B3W	826	783	Y	622	635	Y	703	655	Y	☒	☒	☑
B4N	458	461	Y	420	441	Y	416	446	Y	☒	☒	☑
B4S	433	443	Y	423	440	Y	430	492	Y	☒	☒	☑
B5N	663	755	Y	645	743	N	913	1070	N	☒	☒	☑
B5S	752	758	Y	631	706	Y	664	728	Y	☒	☒	☑

	AM			IP			PM			Inside Scheme Area		
Route	Observed	Model	Pass	Observed	Model	Pass	Observed	Model	Pass	IC	MT	PNC
B6N	902	903	Y	830	881	Y	1144	908	N	☒	☒	☑
B6S	1059	962	Y	876	933	Y	987	972	Y	☒	☒	☑
B7N	662	688	Y	657	649	Y	642	686	Y	☒	☒	☑
B7S	686	665	Y	634	635	Y	624	684	Y	☒	☒	☑
B8E	1274	1232	Y	963	1089	Y	956	1135	N	☒	☒	☑
B8W	963	1112	N	984	1093	Y	1325	1378	Y	☒	☒	☑
B9N	900	919	Y	918	919	Y	1093	1032	Y	☑	☑	☑
B9S	1351	1235	Y	911	906	Y	941	911	Y	☑	☑	☑
C1E	1165	888	N	912	872	Y	1091	1045	Y	☒	☒	☒
C1W	1305	1178	Y	931	911	Y	1073	1015	Y	☒	☒	☒
C2E	431	491	Y	315	320	Y	589	740	N	☒	☒	☒
C2W	347	370	Y	321	328	Y	351	406	Y	☒	☒	☒
C3E	1419	1241	Y	1211	1116	Y	1395	1160	N	☒	☒	☒
C3W	1016	1072	Y	1023	1015	Y	1041	1103	Y	☒	☒	☒
C5N	1029	854	N	749	697	Y	919	858	Y	☒	☒	☒
C5S	733	717	Y	674	680	Y	779	742	Y	☒	☒	☒
C6E	1242	1145	Y	1066	1037	Y	1274	1360	Y	☒	☒	☒
C6W	1376	1216	Y	1083	1031	Y	1338	1042	N	☒	☒	☒
DD1N	1155	1192	Y	1057	1139	Y	1054	1282	N	☒	☒	☒
DD1S	1076	1576	N	1061	1152	Y	1045	1699	N	☒	☒	☒
DD2N	1587	1852	N	1562	1579	Y	1498	1685	Y	☒	☒	☒
DD2S	1568	1463	Y	1538	1454	Y	1494	1564	Y	☒	☒	☒
DD3N	1042	1098	Y	955	1045	Y	982	1085	Y	☒	☒	☒
DD3S	989	1152	N	934	1063	Y	983	1130	Y	☒	☒	☒

	AM			IP			PM			Inside Scheme Area		
Route	Observed	Model	Pass	Observed	Model	Pass	Observed	Model	Pass	IC	MT	PNC
D10N	335	322	Y	329	320	Y	327	321	Y	☒	☒	☑
D10S	333	324	Y	326	322	Y	324	326	Y	☒	☒	☑
D11E	414	325	N	297	275	Y	273	270	Y	☒	☒	☑
D11W	293	295	Y	287	291	Y	399	299	N	☒	☒	☑
D12E	571	568	Y	553	570	Y	688	604	Y	☒	☒	☑
D12W	558	591	Y	481	541	Y	500	554	Y	☒	☒	☑
D13N	586	568	Y	484	643	N	556	661	N	☒	☒	☑
D13S	666	584	Y	488	616	N	594	608	Y	☒	☒	☑
D14E	899	775	Y	540	521	Y	561	559	Y	☒	☒	☑
D14W	481	478	Y	462	467	Y	585	566	Y	☒	☒	☑
D15N	719	668	Y	689	661	Y	688	703	Y	☒	☒	☑
D15S	682	697	Y	688	675	Y	757	713	Y	☒	☒	☑
D1E	667	628	Y	595	577	Y	627	619	Y	☒	☒	☑
D1W	632	660	Y	578	605	Y	722	684	Y	☒	☒	☑
D2N	762	715	Y	670	701	Y	682	735	Y	☒	☒	☑
D2S	731	731	Y	684	689	Y	819	739	Y	☒	☒	☑
D3E	1205	1367	Y	1176	1216	Y	1486	1417	Y	☑	☒	☑
D3W	1484	1633	Y	1178	1241	Y	1260	1326	Y	☑	☒	☑
D4N	597	657	Y	606	670	Y	635	728	Y	☒	☒	☑
D4S	1056	739	N	703	694	Y	709	717	Y	☒	☒	☑
D5N	412	395	Y	385	399	Y	374	415	Y	☒	☒	☑
D5S	584	443	N	415	431	Y	423	468	Y	☒	☒	☑
D6N	1415	1445	Y	1201	1360	Y	1565	1565	Y	☒	☒	☑
D6S	1339	1527	Y	1266	1612	N	1512	1844	N	☒	☒	☑

	AM			IP			PM			Inside Scheme Area		
Route	**Observed**	**Model**	**Pass**	**Observed**	**Model**	**Pass**	**Observed**	**Model**	**Pass**	**IC**	**MT**	**PNC**
D7E	275	281	Y	275	273	Y	312	303	Y	☒	☒	☑
D7W	345	308	Y	280	278	Y	322	299	Y	☒	☒	☑
D8N	488	422	Y	356	323	Y	460	332	N	☒	☒	☑
D8S	343	349	Y	331	334	Y	486	380	N	☒	☒	☑
R10E	780	714	Y	638	674	Y	679	731	Y	☑	☑	☑
R10W	662	727	Y	644	687	Y	1078	931	Y	☑	☑	☑
R11N	1334	1267	Y	1215	1213	Y	1545	1331	Y	☑	☑	☑
R11S	1758	1699	Y	1205	1305	Y	1392	1463	Y	☑	☑	☑
R13E	876	973	Y	877	954	Y	1079	1100	Y	☑	☒	☒
R13W	1213	1098	Y	871	923	Y	1014	1075	Y	☑	☒	☒
R14E	419	421	Y	451	425	Y	813	432	N	☑	☒	☑
R14W	433	412	Y	439	397	Y	458	398	Y	☑	☒	☑
R2N	235	197	Y	214	199	Y	469	210	N	☑	☑	☒
D7E	275	281	Y	275	273	Y	312	303	Y	☒	☒	☑
D7W	345	308	Y	280	278	Y	322	299	Y	☒	☒	☑
D8N	488	422	Y	356	323	Y	460	332	N	☒	☒	☑
D8S	343	349	Y	331	334	Y	486	380	N	☒	☒	☑
R10E	780	714	Y	638	674	Y	679	731	Y	☑	☑	☑
R10W	662	727	Y	644	687	Y	1078	931	Y	☑	☑	☑
R11N	1334	1267	Y	1215	1213	Y	1545	1331	Y	☑	☑	☑
R11S	1758	1699	Y	1205	1305	Y	1392	1463	Y	☑	☑	☑
R13E	876	973	Y	877	954	Y	1079	1100	Y	☑	☒	☒
R13W	1213	1098	Y	871	923	Y	1014	1075	Y	☑	☒	☒
R14E	419	421	Y	451	425	Y	813	432	N	☑	☒	☑

	AM			IP			PM			Inside Scheme Area		
Route	**Observed**	**Model**	**Pass**	**Observed**	**Model**	**Pass**	**Observed**	**Model**	**Pass**	**IC**	**MT**	**PNC**
R14W	433	412	Y	439	397	Y	458	398	Y	☑	☒	☑
R2N	235	197	Y	214	199	Y	469	210	N	☑	☑	R2N
R2S	181	200	Y	164	197	Y	171	189	Y	☑	☑	R2S
R3E	797	899	Y	810	924	Y	1201	1054	Y	☑	☑	R3E
R3W	1049	986	Y	826	919	Y	978	870	Y	☑	☑	R3W
R4E	305	284	Y	276	286	Y	300	299	Y	☑	☑	R4E
R4W	359	304	Y	294	297	Y	305	303	Y	☑	☑	R4W
R5E	244	281	Y	236	280	Y	505	305	N	☑	☑	☒
R5W	360	322	Y	266	305	Y	333	309	Y	☑	☑	☒
R6N	343	392	Y	203	242	Y	261	245	Y	☑	☒	☒
R6S	247	264	Y	205	251	Y	500	367	N	☑	☒	☒
R7N	595	562	Y	486	543	Y	698	608	Y	☑	☒	☒
R7S	657	675	Y	478	537	Y	588	575	Y	☑	☒	☒
R9N	1389	1578	Y	1254	1501	N	1952	1687	Y	☑	☑	☑
R9S	2028	1885	Y	1259	1383	Y	1681	1527	Y	☑	☑	☑
S10N	2489	1819	N	1546	1472	Y	1923	1888	Y	☑	☑	☒
S10S	1809	1762	Y	1540	1630	Y	2149	1893	Y	☑	☑	☒
S11N	360	165	N	108	115	Y	180	134	Y	☒	☑	☒
S11S	114	122	Y	119	137	Y	190	149	Y	☒	☑	☒
S12E	1043	695	N	740	713	Y	761	673	Y	☒	☑	☒
S12W	709	725	Y	669	669	Y	901	690	N	☒	☑	☒
S13N	1471	1033	N	762	770	Y	1151	836	N	☒	☑	☒
S13S	709	938	N	805	846	Y	1134	1049	Y	☒	☑	☒
S14N	1735	1478	Y	1456	1458	Y	1435	1484	Y	☒	☑	☒

	AM			IP			PM			Inside Scheme Area		
Route	Observed	Model	Pass	Observed	Model	Pass	Observed	Model	Pass	IC	MT	PNC
S14S	1432	1468	Y	1457	1486	Y	1627	1554	Y	☒	☑	☒
S15N	717	710	Y	674	672	Y	786	687	Y	☑	☑	☒
S15S	647	637	Y	579	633	Y	681	634	Y	☑	☑	☒
S16N	434	437	Y	395	399	Y	413	440	Y	☑	☒	☒
S16S	423	435	Y	396	396	Y	407	440	Y	☑	☒	☒
S1N	899	1010	Y	883	1024	N	1306	1117	Y	☑	☑	☒
S1S	1411	1243	Y	892	995	Y	1209	1069	Y	☑	☑	☒
S2E	489	534	Y	425	533	N	1034	569	N	☑	☑	☒
S2W	1095	949	Y	428	527	N	707	783	Y	☑	☑	☒
S3N	668	622	Y	528	523	Y	518	552	Y	☑	☑	☒
S3S	518	548	Y	504	533	Y	932	738	N	☑	☑	☒
S4N	567	498	Y	423	474	Y	555	531	Y	☑	☑	☒
S4S	382	436	Y	376	446	N	531	529	Y	☑	☑	☒
S5E	944	887	Y	722	820	Y	873	825	Y	☑	☑	☒
S5W	1120	988	Y	740	873	N	1011	967	Y	☑	☑	☒
S6N	1230	1047	Y	842	956	Y	1321	960	N	☑	☑	☒
S6S	1299	1117	Y	1004	1051	Y	1710	1155	N	☑	☑	☒
S7N	2362	2021	Y	1558	1694	Y	1884	1979	Y	☑	☑	☒
S7S	1671	1696	Y	1519	1652	Y	2041	2013	Y	☑	☑	☒
S8N	1269	718	N	659	722	Y	727	656	Y	☑	☑	☒
S8S	765	835	Y	645	650	Y	1127	1139	Y	☑	☑	☒
S9E	768	965	N	657	728	Y	1030	988	Y	☑	☑	☒
S9W	1185	919	N	646	728	Y	809	861	Y	☑	☑	☒
W10E	1100	1241	Y	1003	924	Y	1017	954	Y	☒	☒	☒

	AM			IP			PM			Inside Scheme Area		
Route	Observed	Model	Pass	Observed	Model	Pass	Observed	Model	Pass	IC	MT	PNC
W10W	984	1314	N	996	1043	Y	983	1234	N	☒	☒	☒
W11E	584	829	N	599	566	Y	544	592	Y	☒	☒	☒
W11W	526	556	Y	620	531	Y	636	623	Y	☒	☒	☒
W12N	393	434	Y	397	443	Y	410	441	Y	☒	☒	☒
W12S	402	434	Y	399	442	Y	401	438	Y	☒	☒	☒
W1N	547	527	Y	487	516	Y	510	560	Y	☑	☒	☒
W1S	463	425	Y	431	411	Y	458	431	Y	☑	☒	☒
W2E	912	946	Y	940	998	Y	920	929	Y	☒	☒	☒
W2W	940	871	Y	952	863	Y	913	874	Y	☒	☒	☒
W3N	1640	1475	Y	1252	1312	Y	1278	1435	Y	☒	☒	☑
W3S	1256	1267	Y	1244	1234	Y	1329	1410	Y	☒	☒	☑
W4E	723	899	N	692	801	N	735	908	N	☒	☒	☒
W4W	811	890	Y	691	755	Y	741	882	N	☒	☒	☒
W5E	1049	668	N	789	620	N	844	665	N	☒	☒	☒
W5W	765	708	Y	680	663	Y	733	697	Y	☒	☒	☒
W6N	661	640	Y	638	587	Y	650	605	Y	☒	☒	☑
W6S	629	548	Y	612	548	Y	623	589	Y	☒	☒	☑
W7N	959	882	Y	971	864	Y	982	884	Y	☒	☒	☒
W7S	1022	970	Y	984	895	Y	979	919	Y	☒	☒	☒
W8E	222	237	Y	209	217	Y	228	245	Y	☒	☒	☒
W8W	200	247	Y	195	216	Y	208	238	Y	☒	☒	☒
W9N	423	464	Y	413	469	Y	427	469	Y	☒	☒	☒
W9S	423	443	Y	408	453	Y	413	452	Y	☒	☒	☒

Source: <Source>

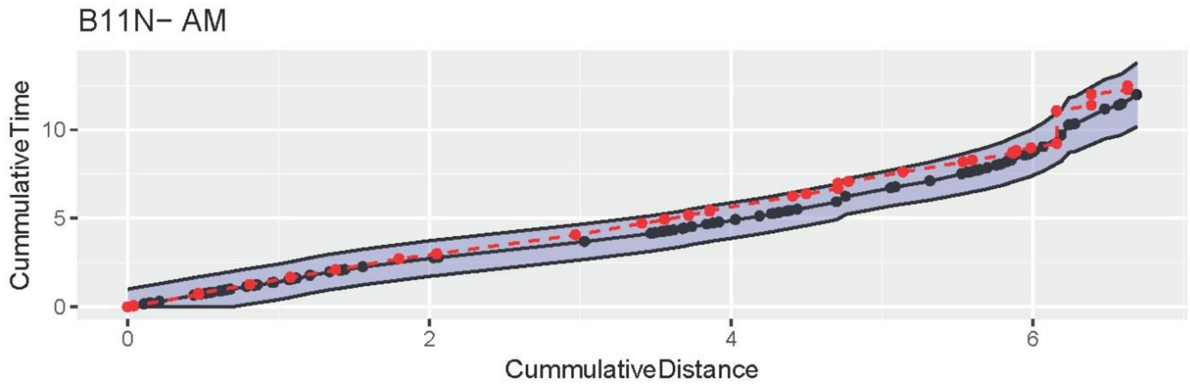
L.2 Journey Time Route graphs in Final Model

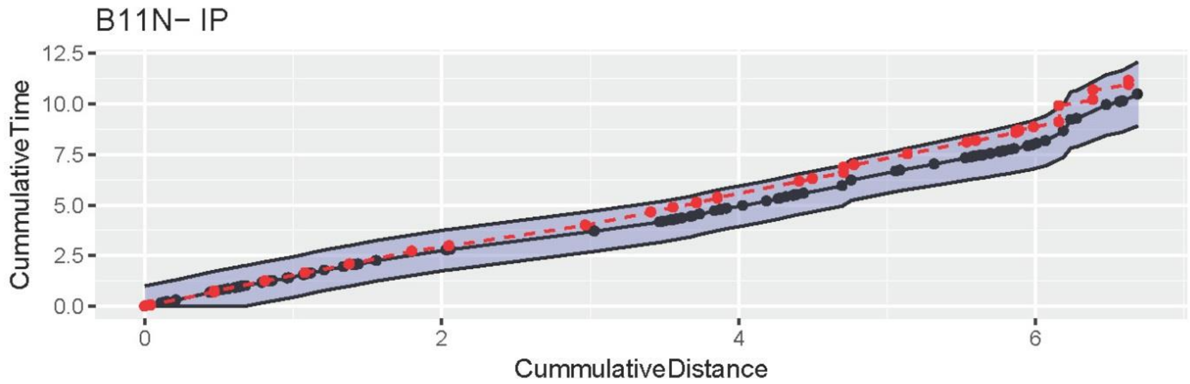
These plots show the observed and modelled journey times.

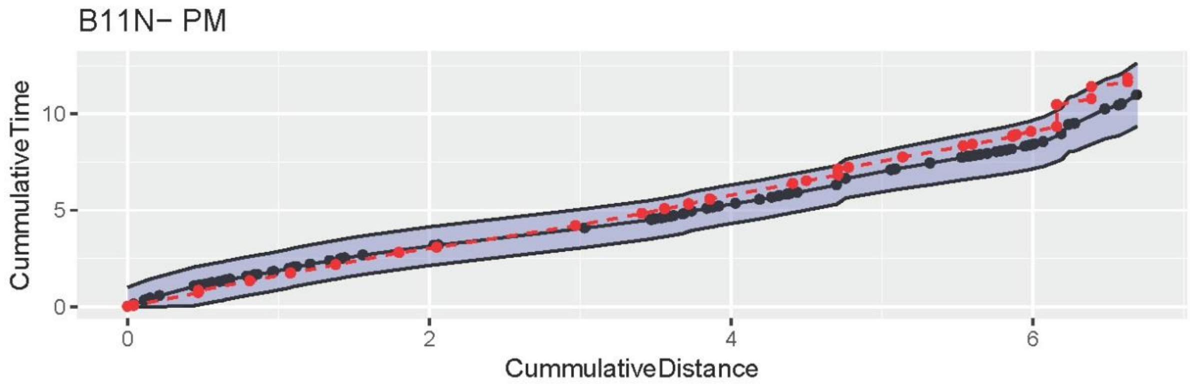
Key:

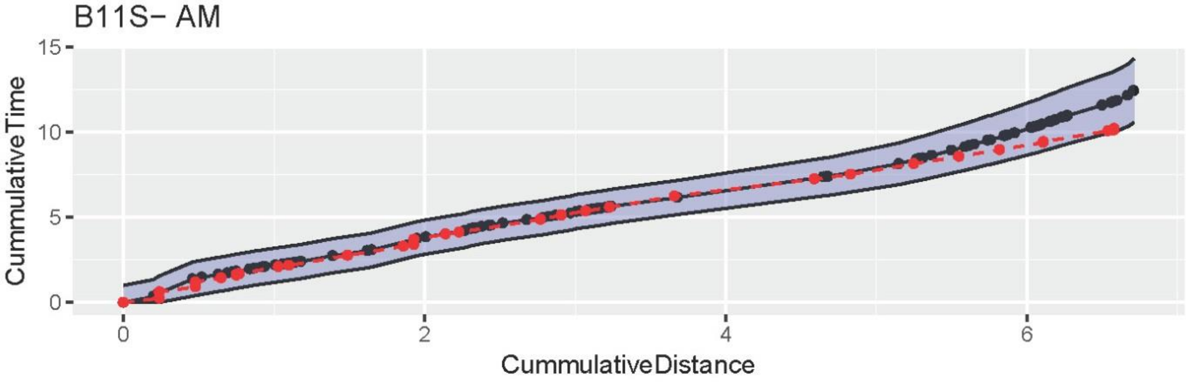
Black - Observed with +/-15% WebTAG standard

Red - Modelled





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CummulativeDistance
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2
4
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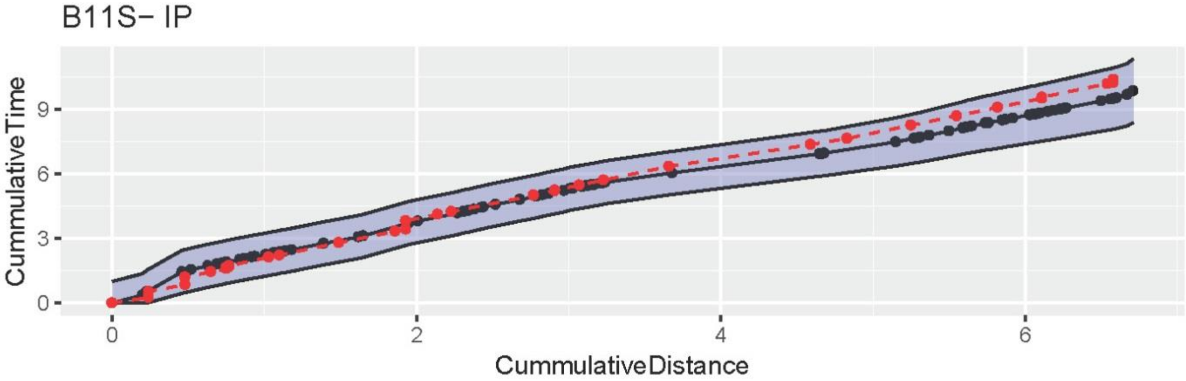
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CummulativeDistance
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3
6
9
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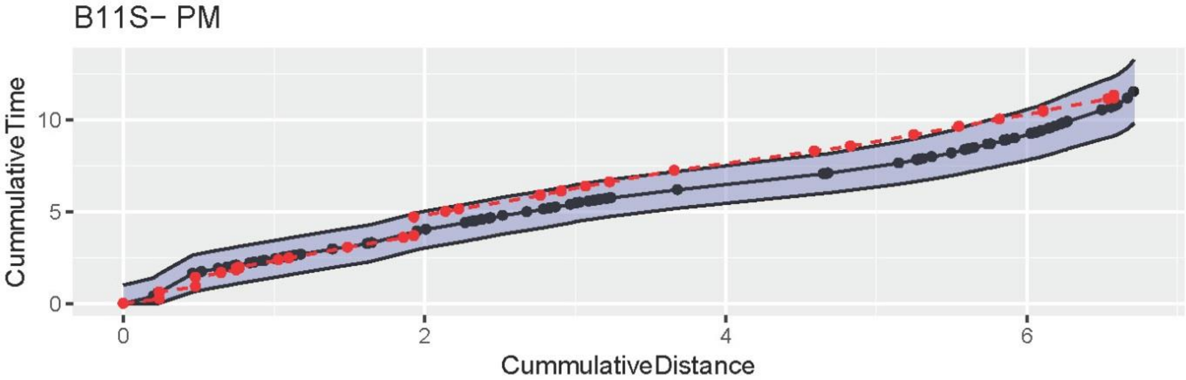
2
4
6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CummulativeDistance
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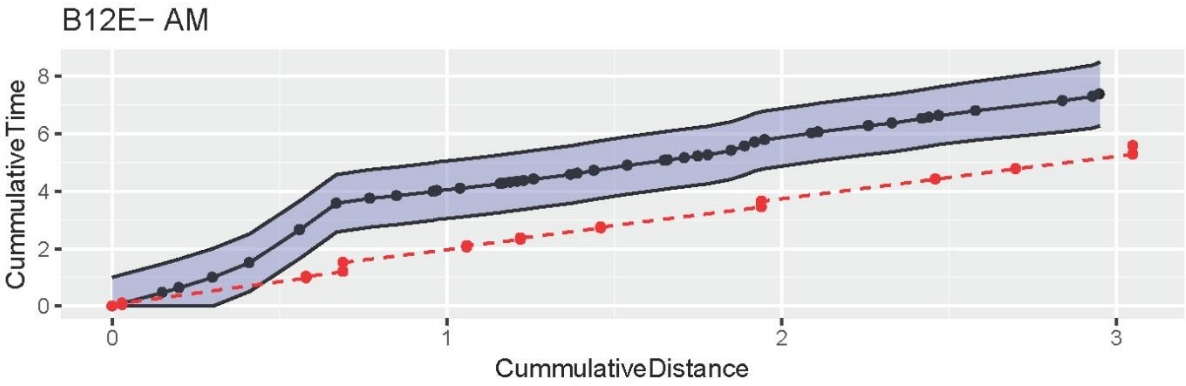
0
2
4
6


B12E- AM
CummulativeTime
CummulativeDistance
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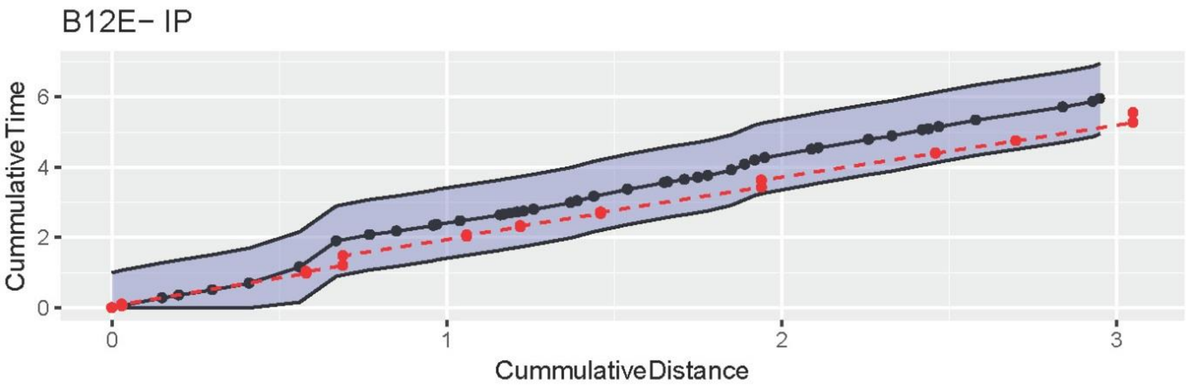
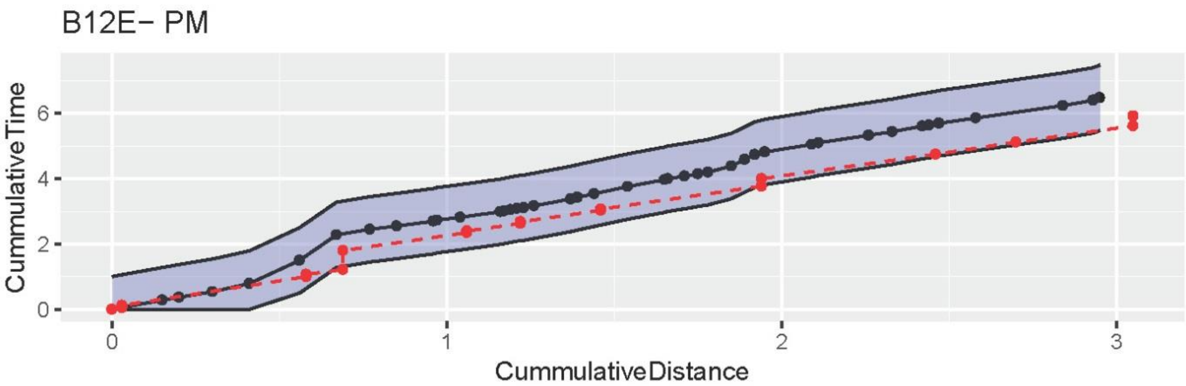
2
4
6
8
0
1
2
3


B12E- IP
CummulativeTime
CummulativeDistance
0
2
4
6
0
1
2
3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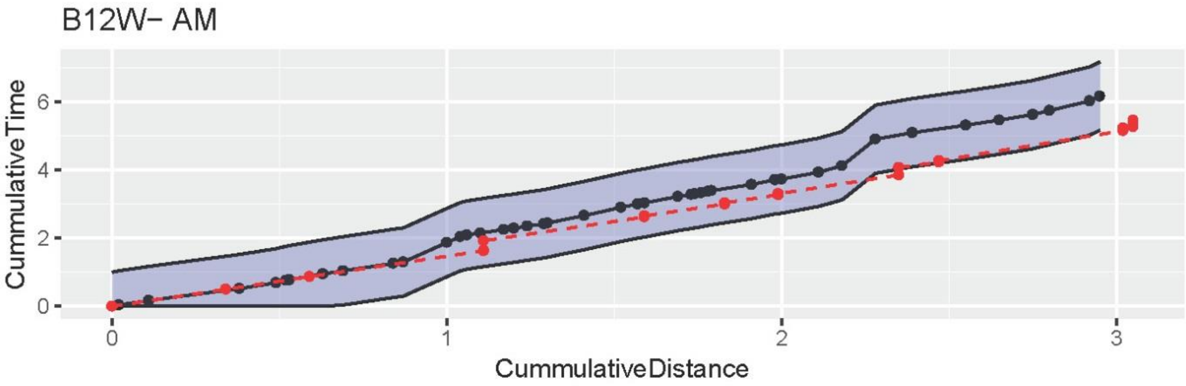
CummulativeDistance
0
2
4
6
0
1
2
3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CummulativeTime
CummulativeDistance
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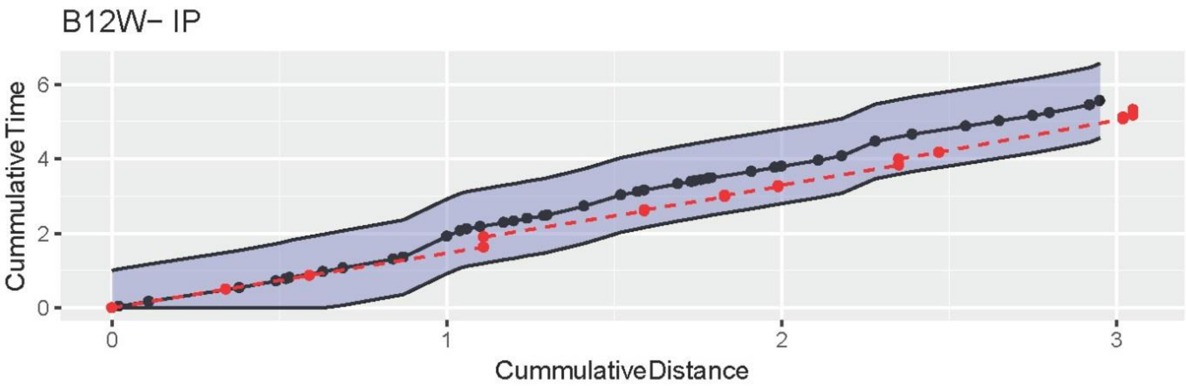
2
4
6
0
1
2
3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CummulativeDistance
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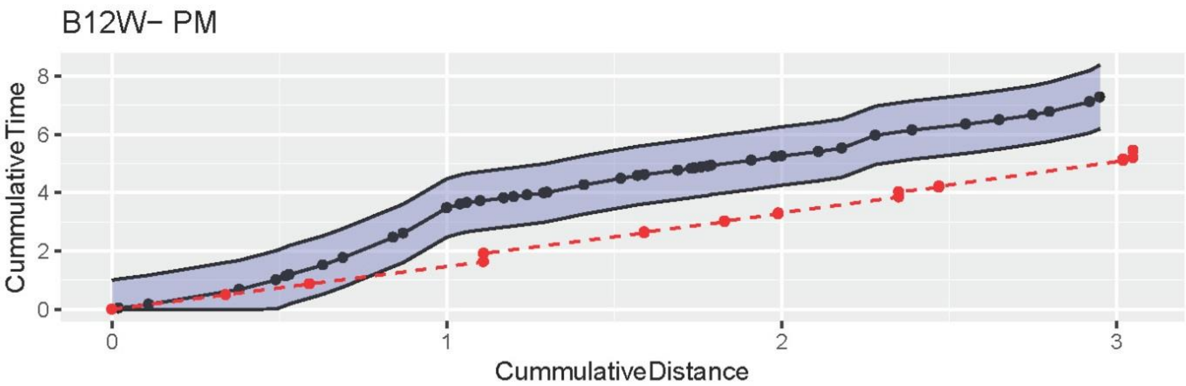
2
4
6
0
1
2
3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CummulativeTime
CummulativeDistance
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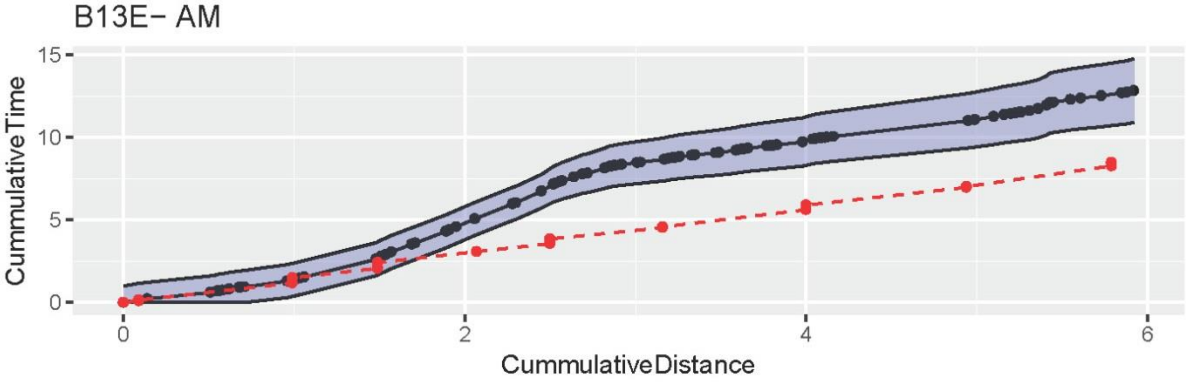
2
4
6
8
0
1
2
3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CummulativeDistance
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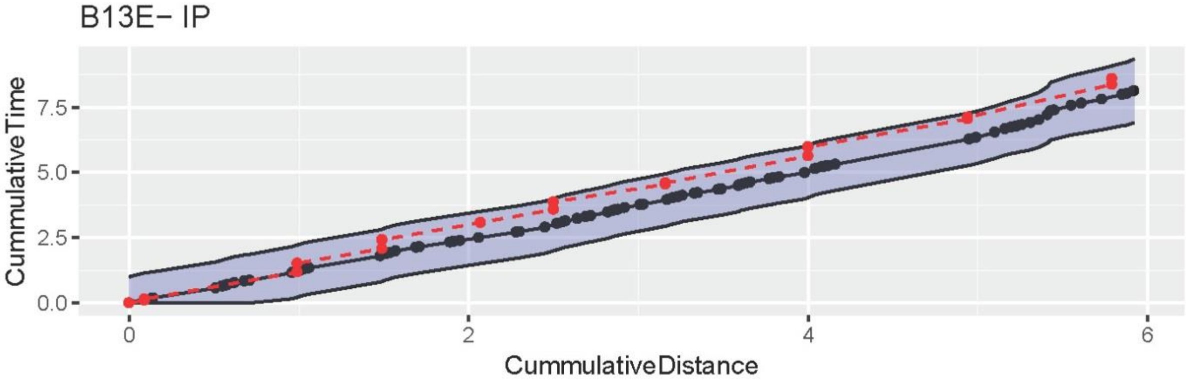
10
5
0
0
2
4
6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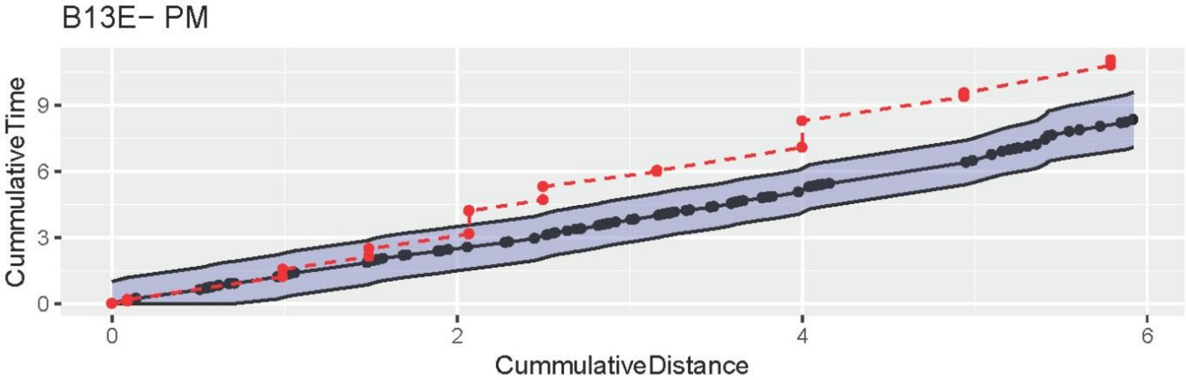
0
2
4
6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CummulativeTime
CummulativeDistance
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6
3
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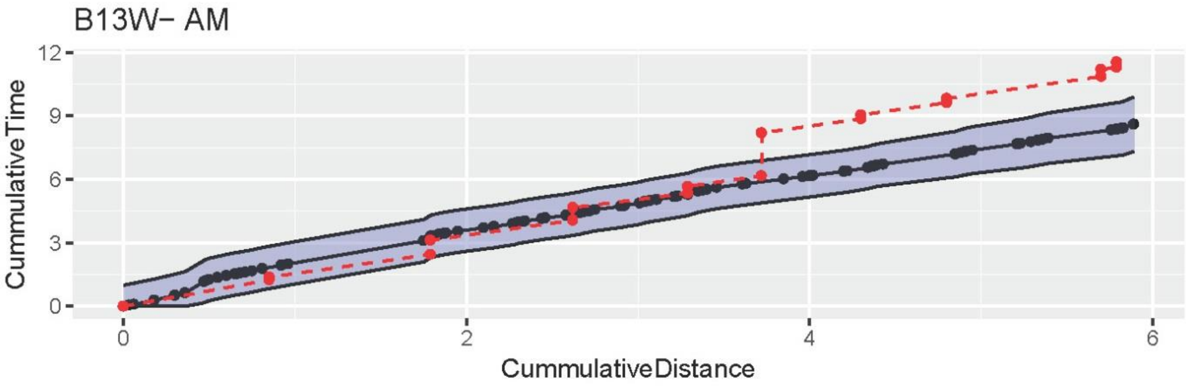
0
2
4
6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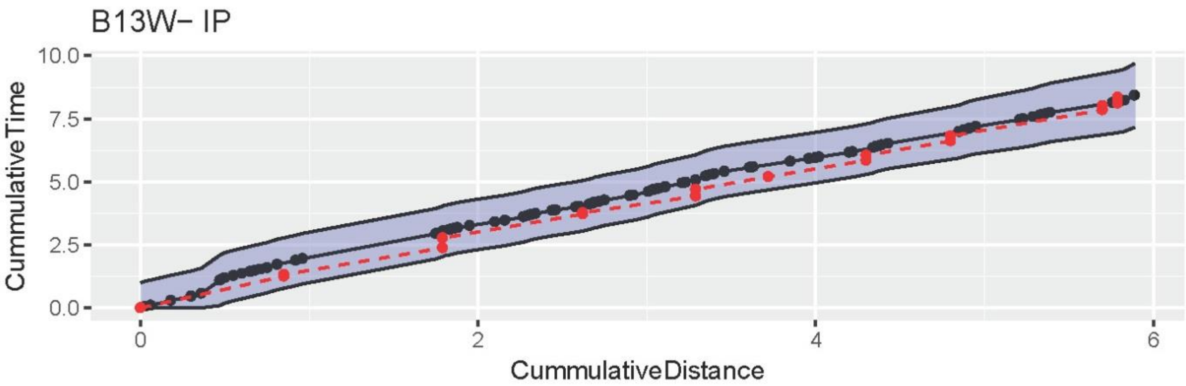
6
9
12
0
2
4
6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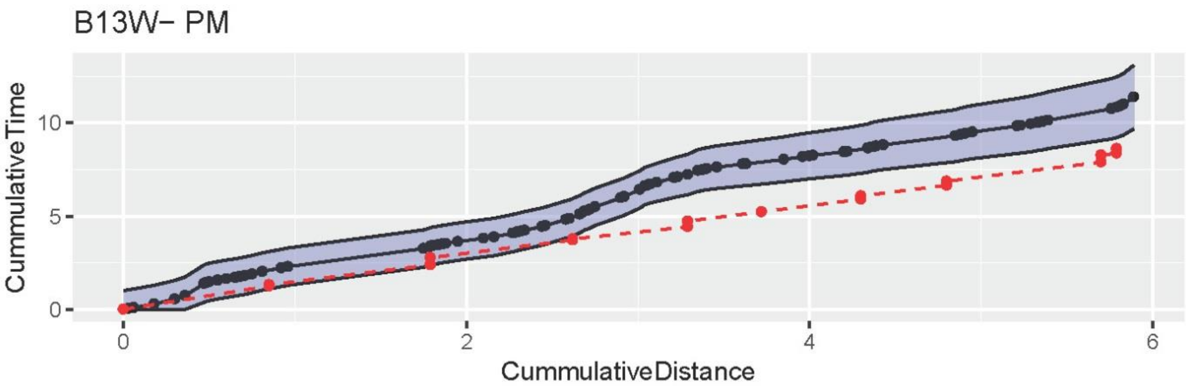
5.0
7.5
10.0
0
2
4
6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CummulativeTime
CummulativeDistance
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5
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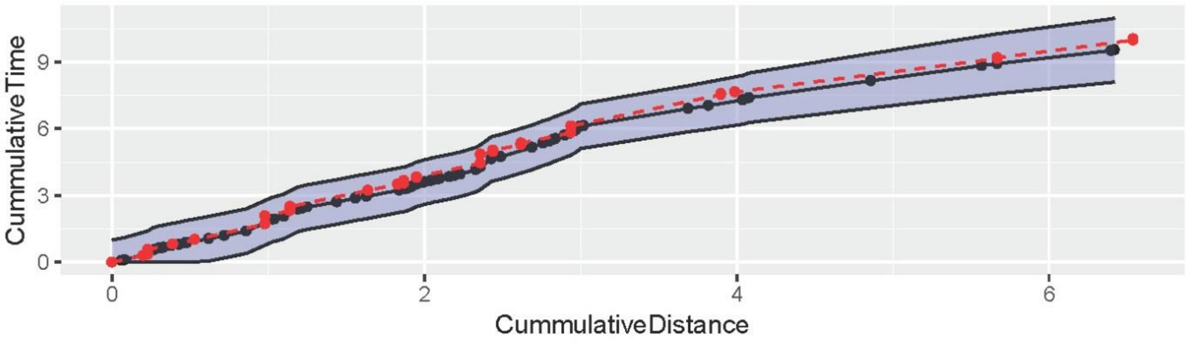
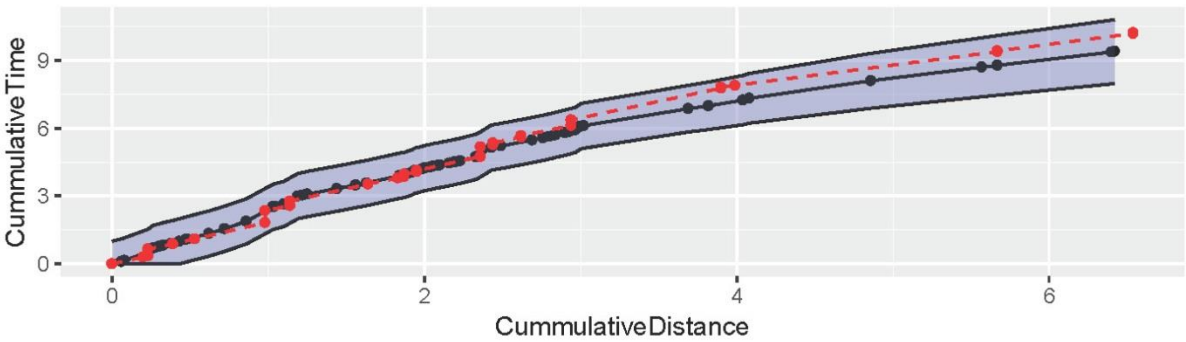
0
2
4
6

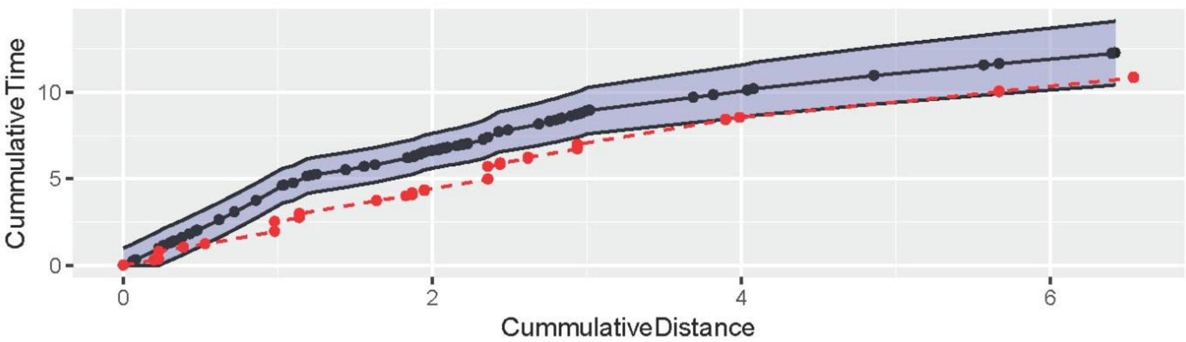
B14N- AM

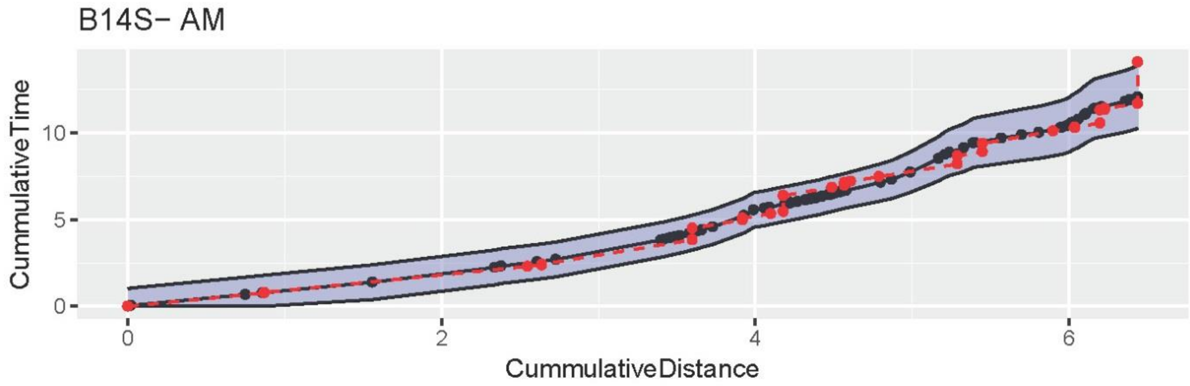


B14N- IP



B14N- PM

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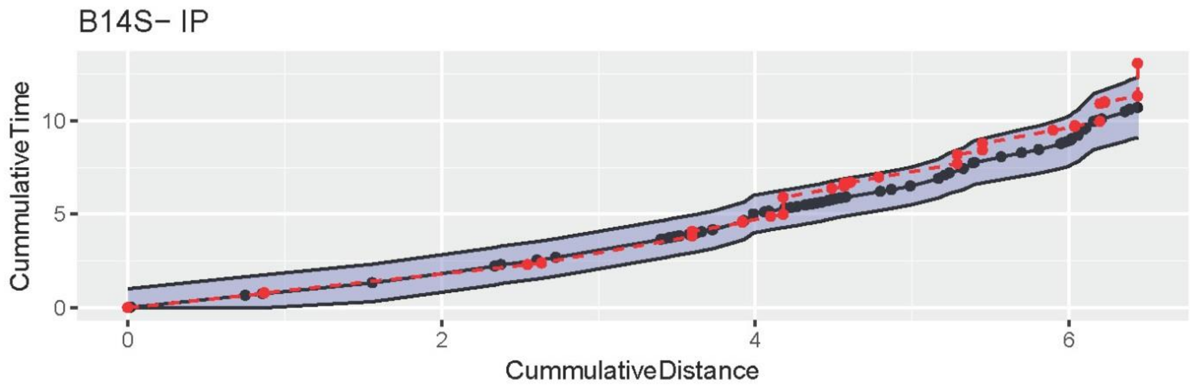
5
10
0
2
4
6
CummulativeDistance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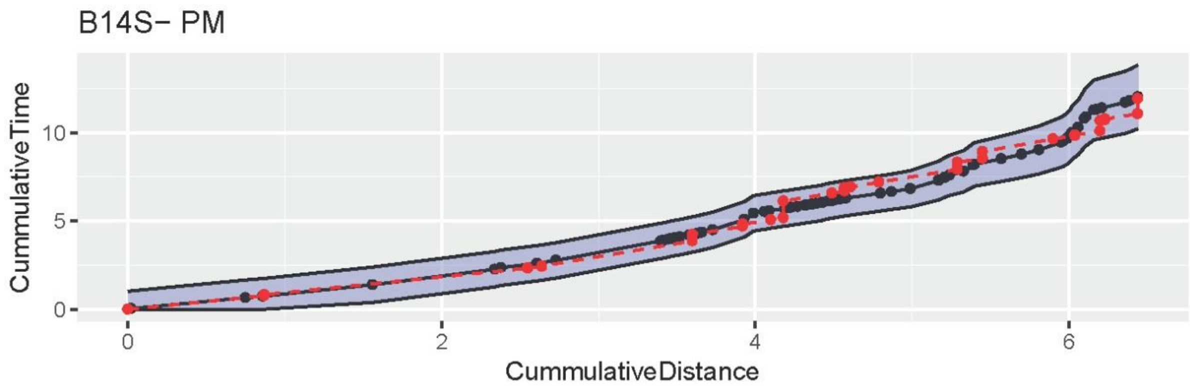
2
4
6
CummulativeDistance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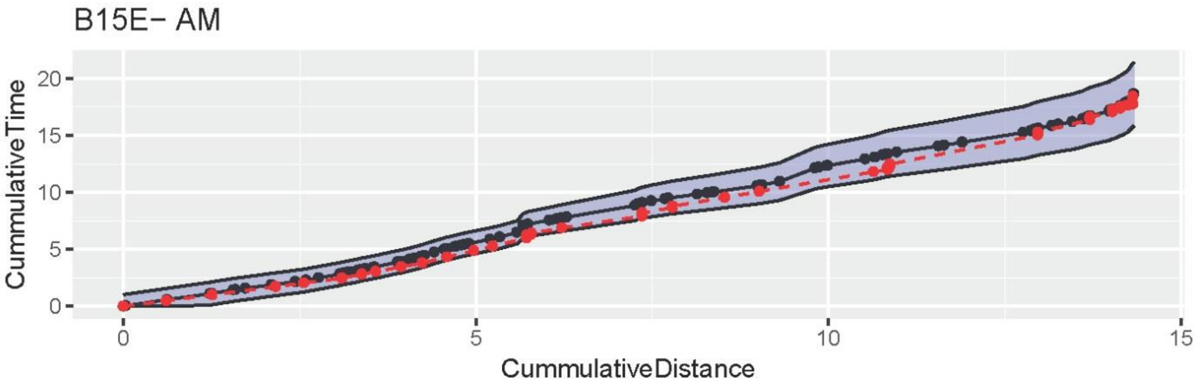
0
2
4
6
CummulativeDistance


B15E- AM
CummulativeTime
CummulativeDistance
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5
10
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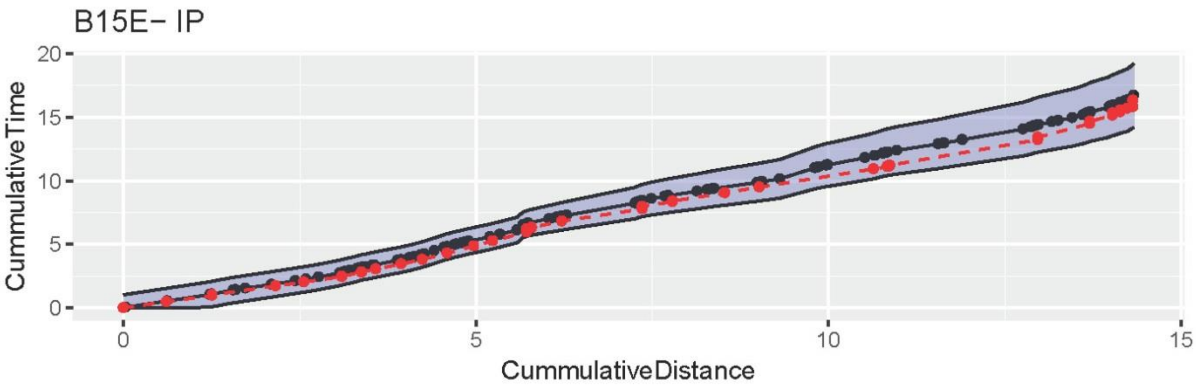
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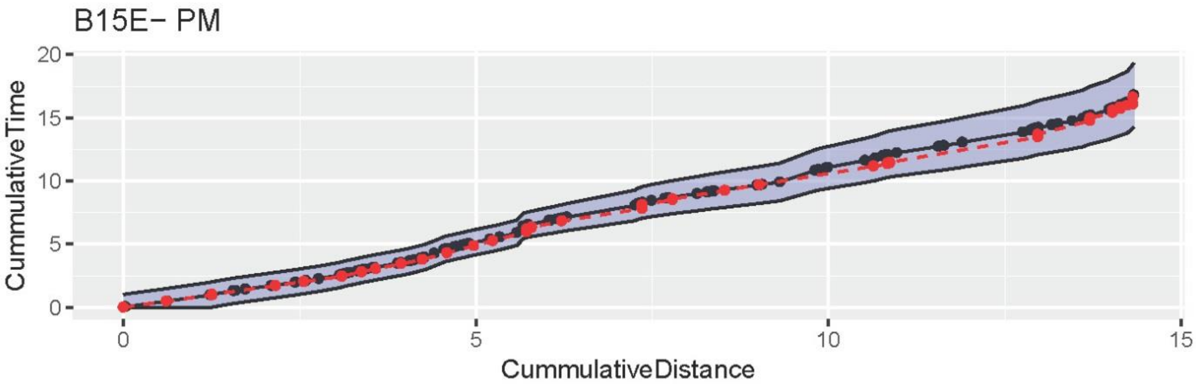
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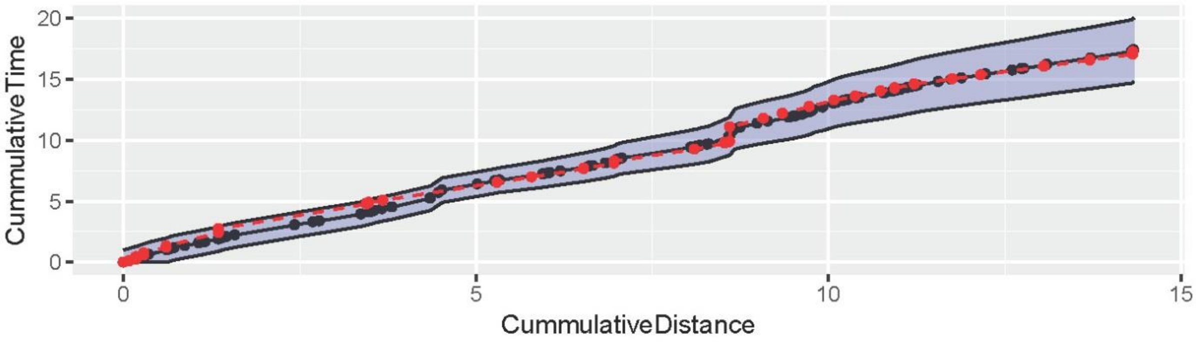

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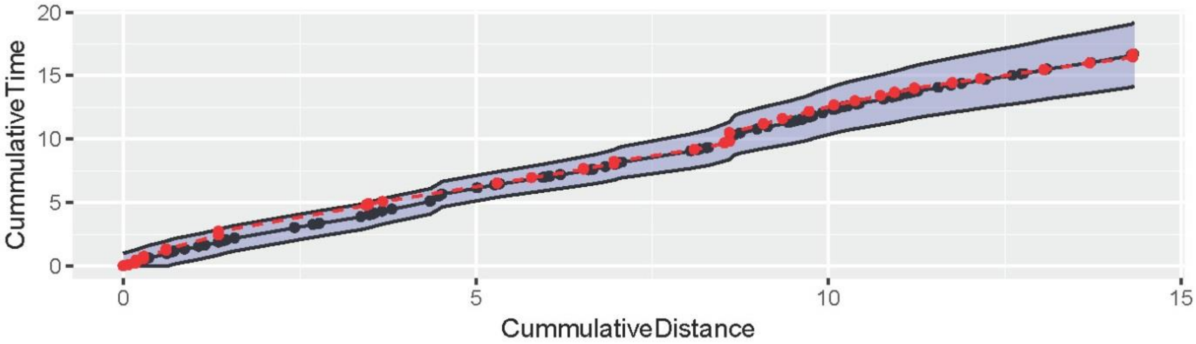

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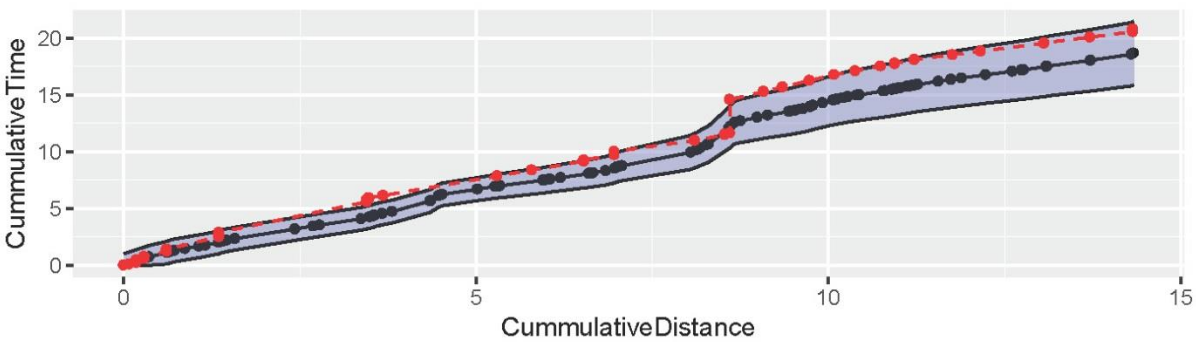

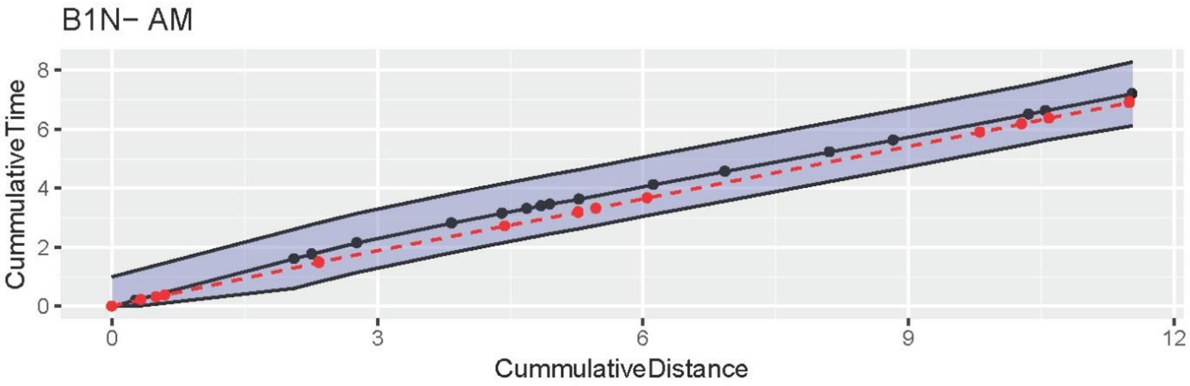
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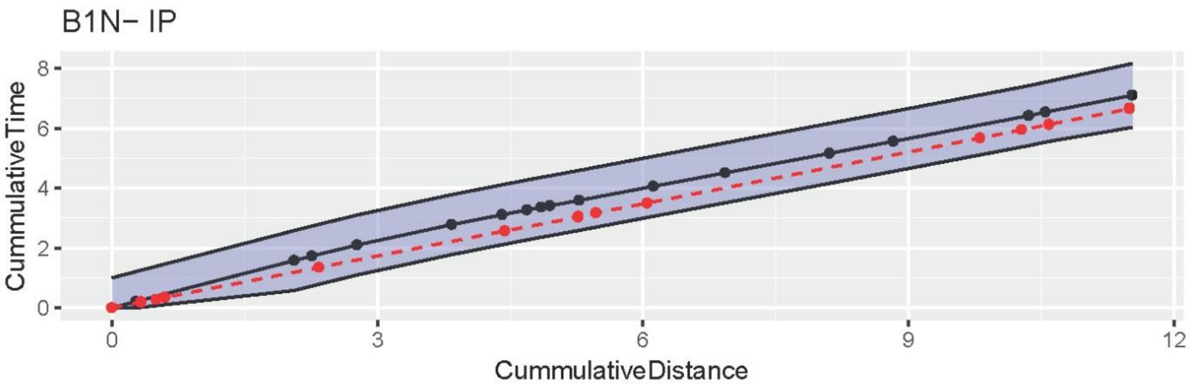
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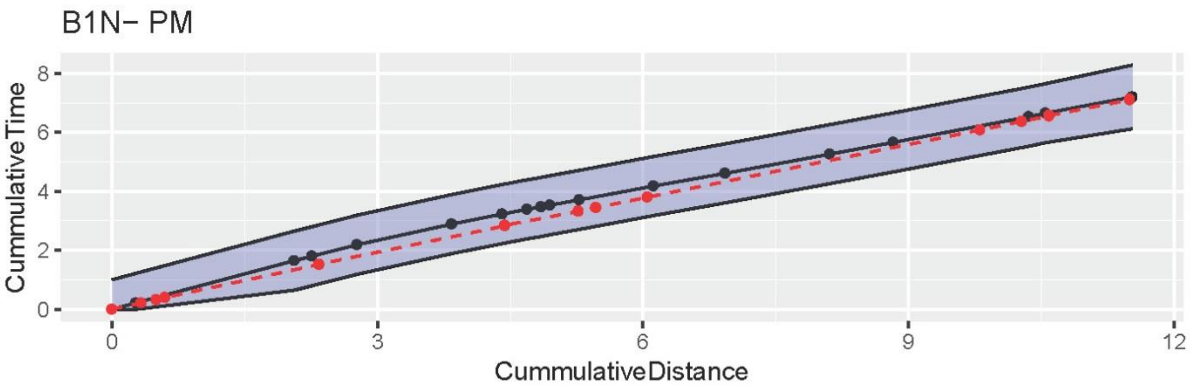
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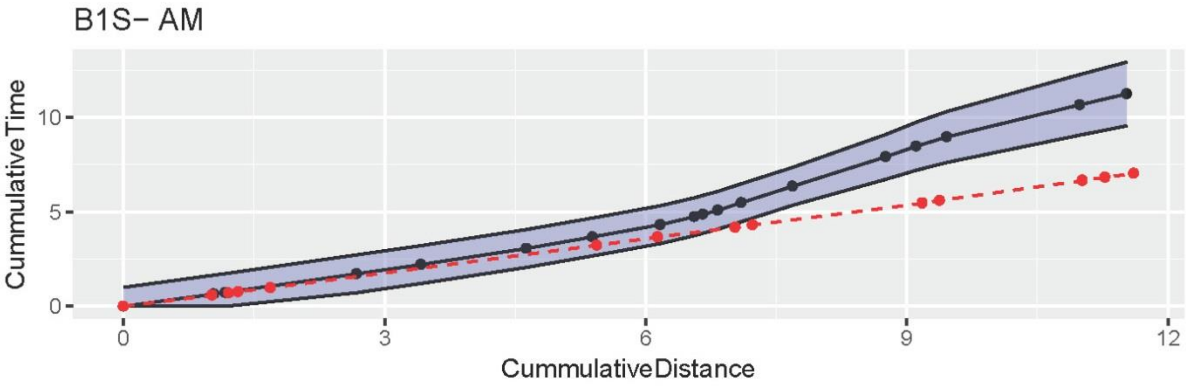
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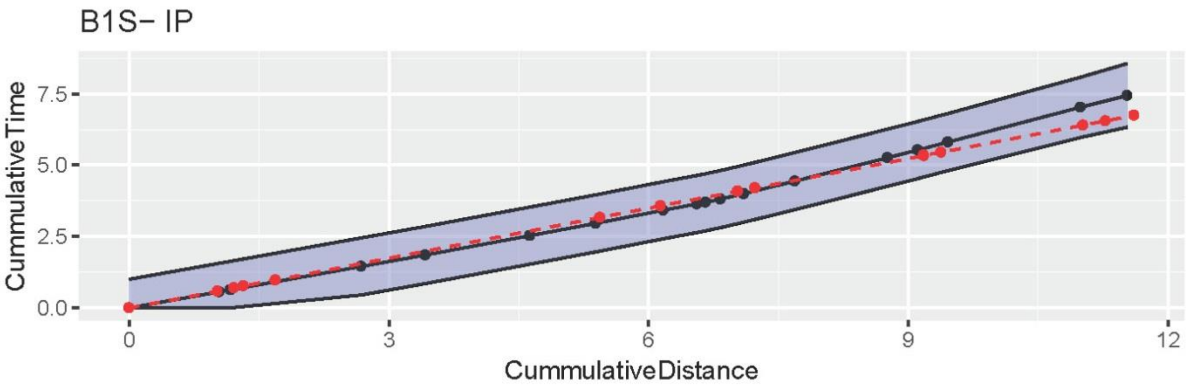
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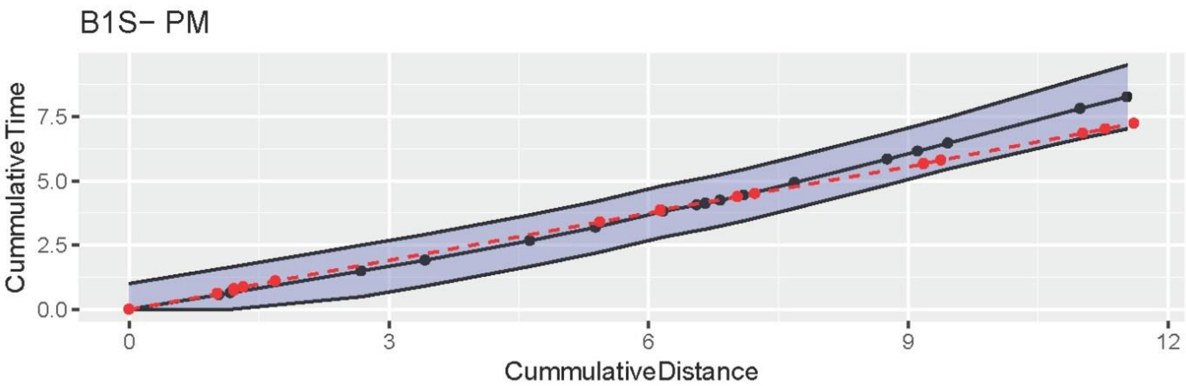
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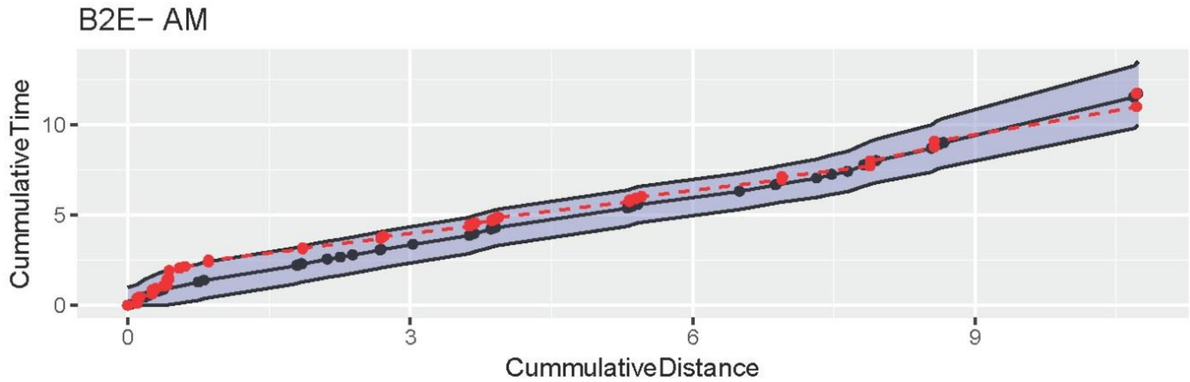
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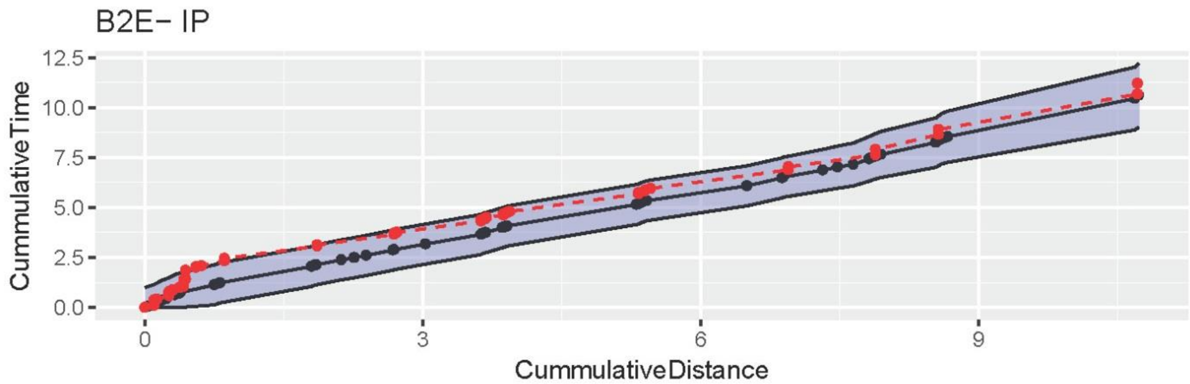
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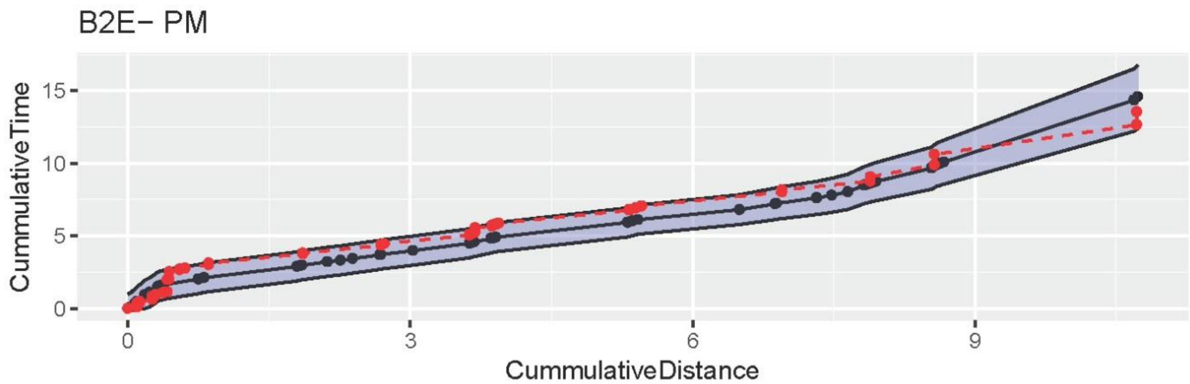
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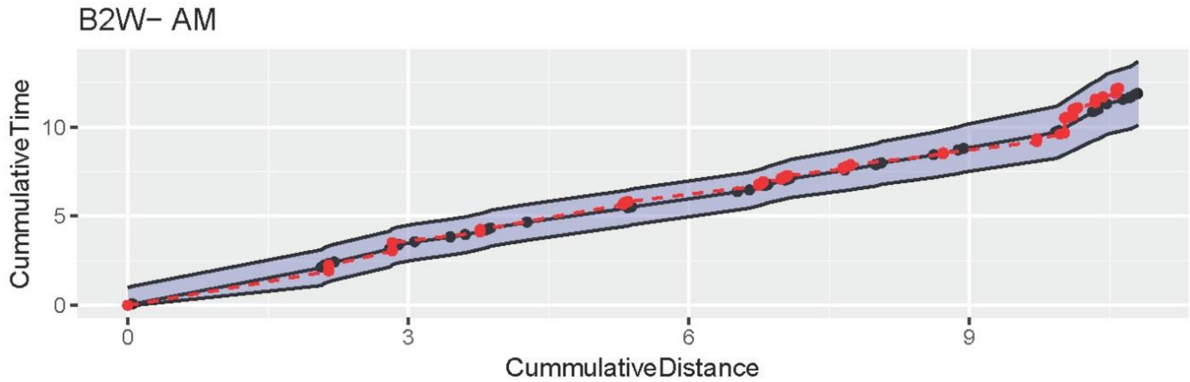
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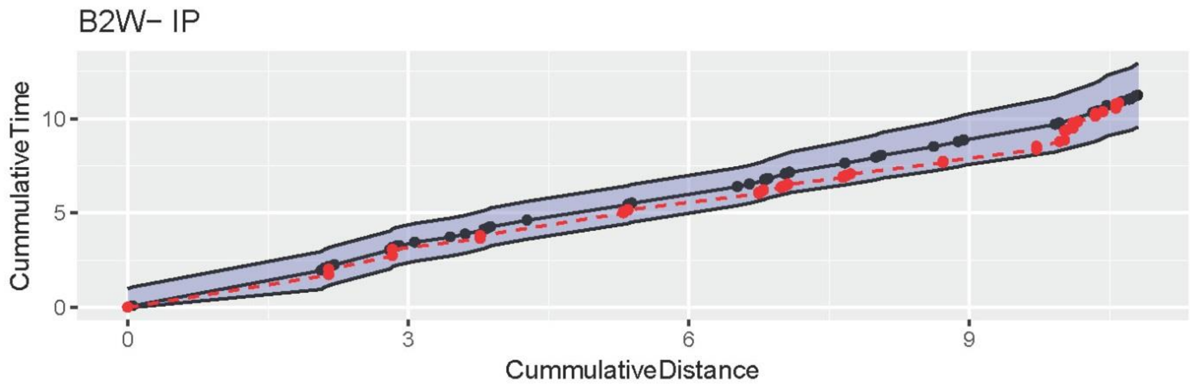
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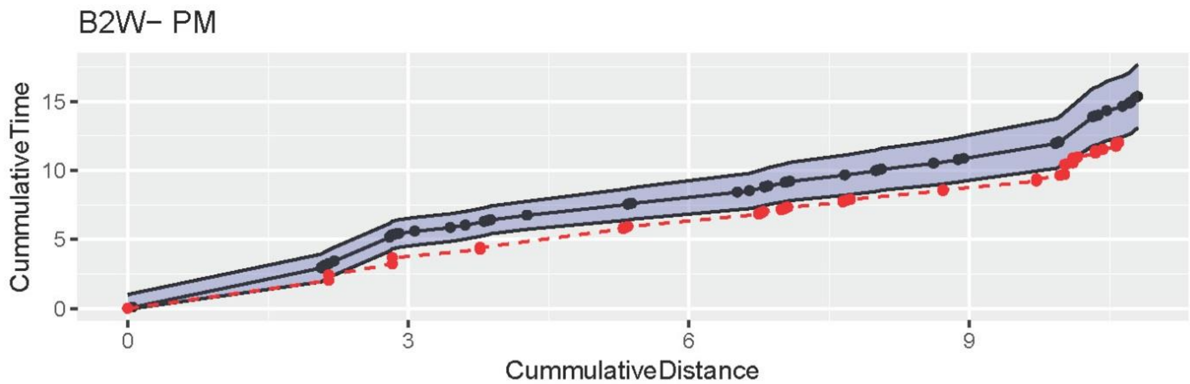
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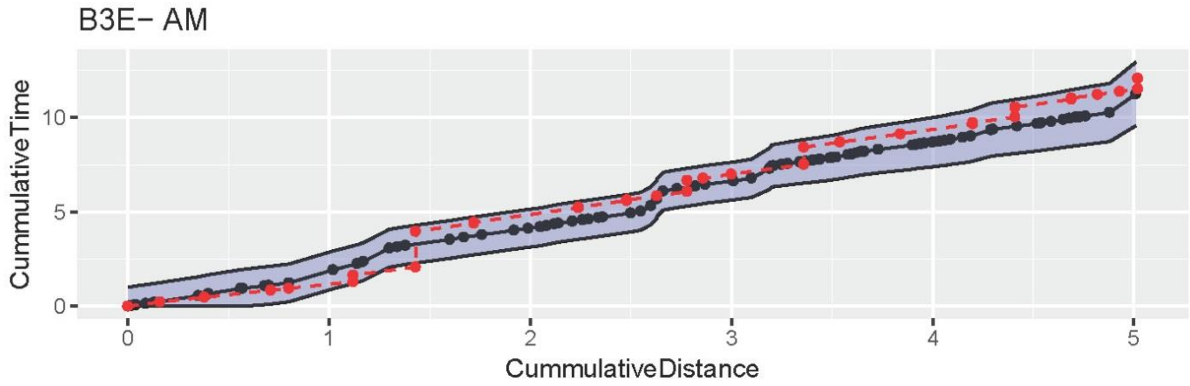
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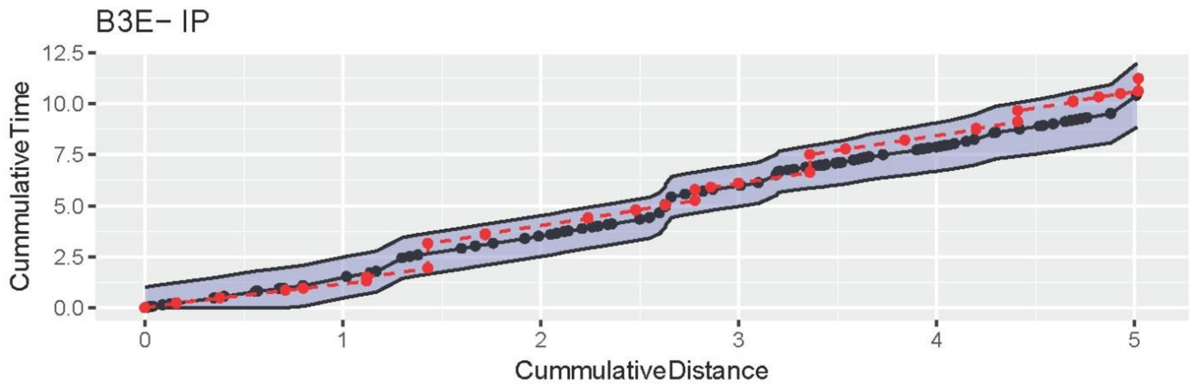
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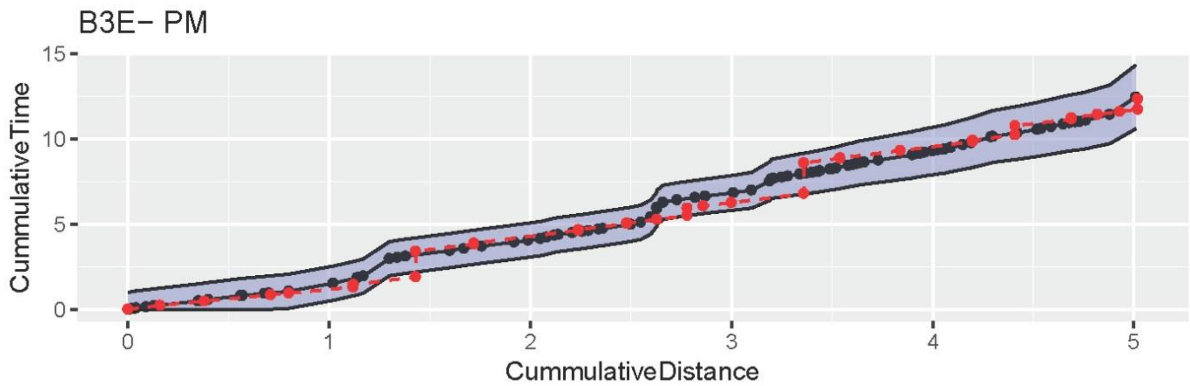
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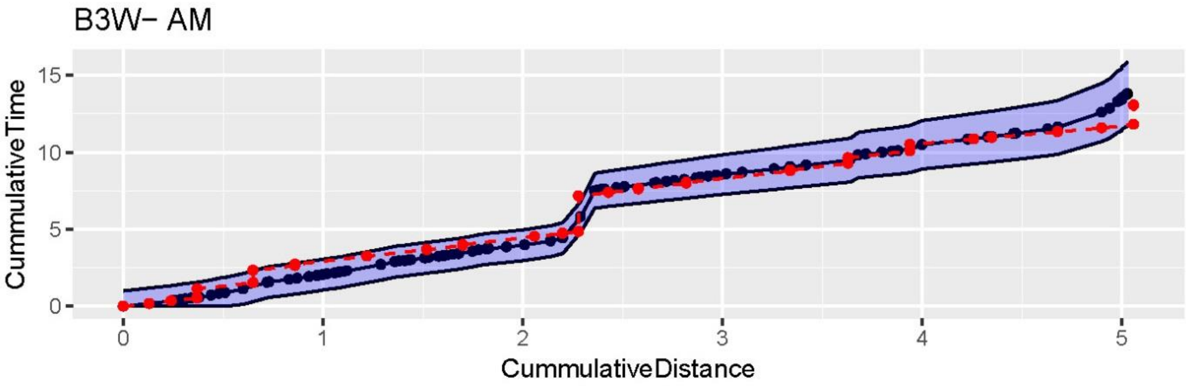
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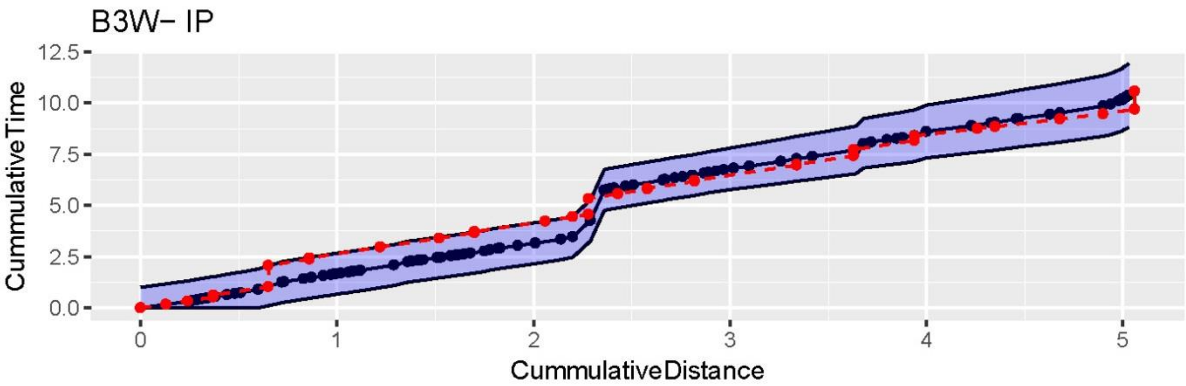
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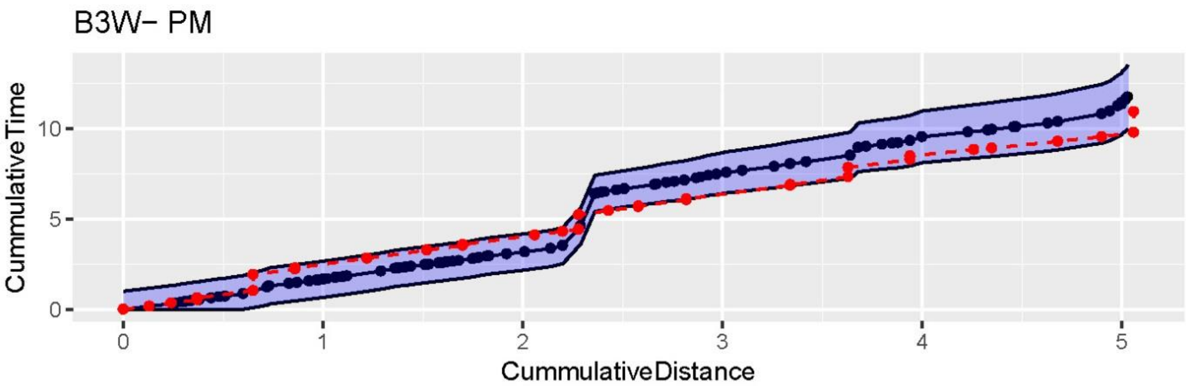
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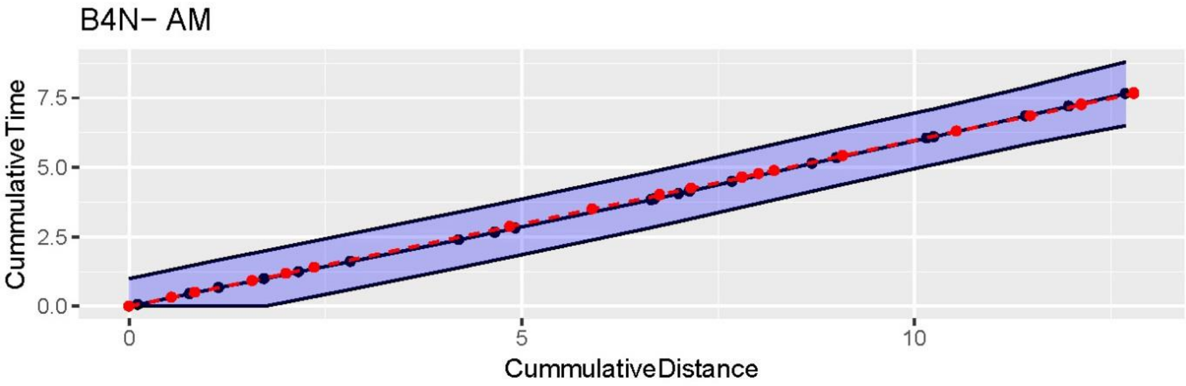
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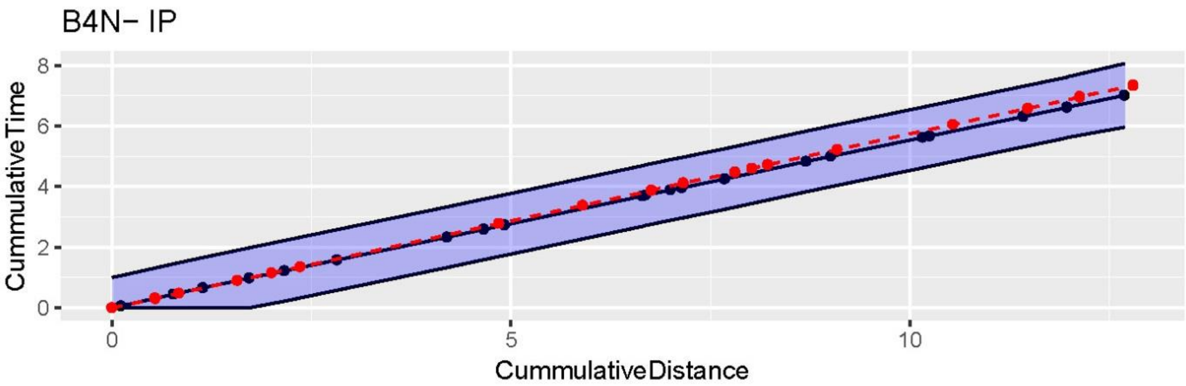
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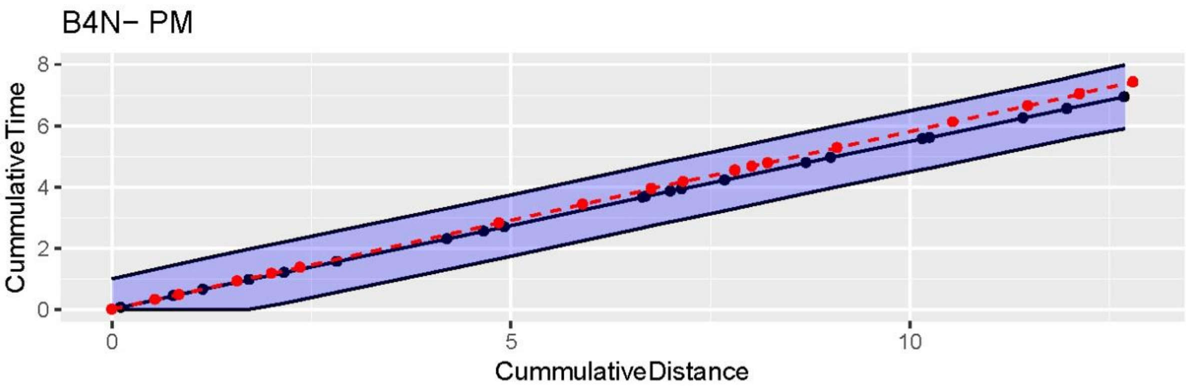
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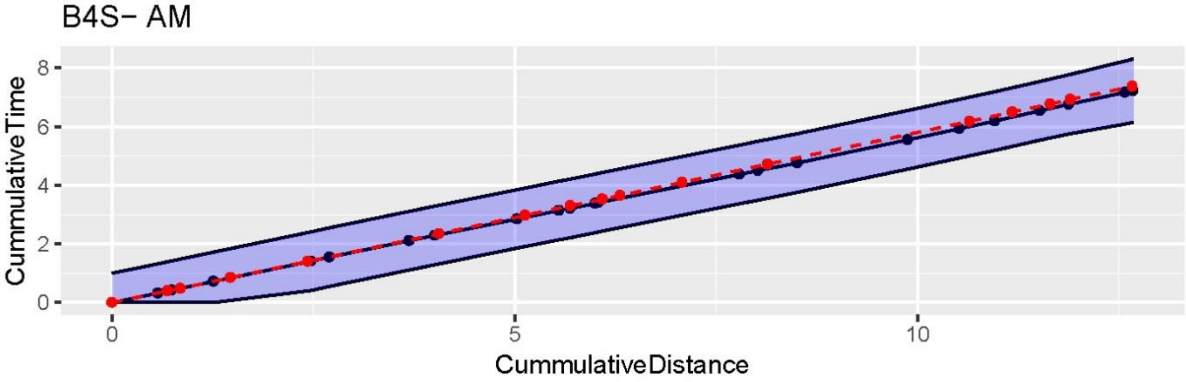
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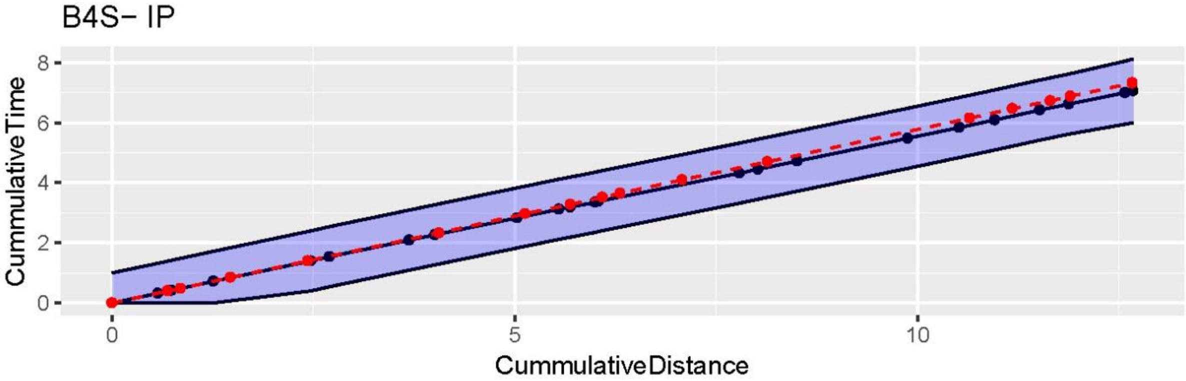
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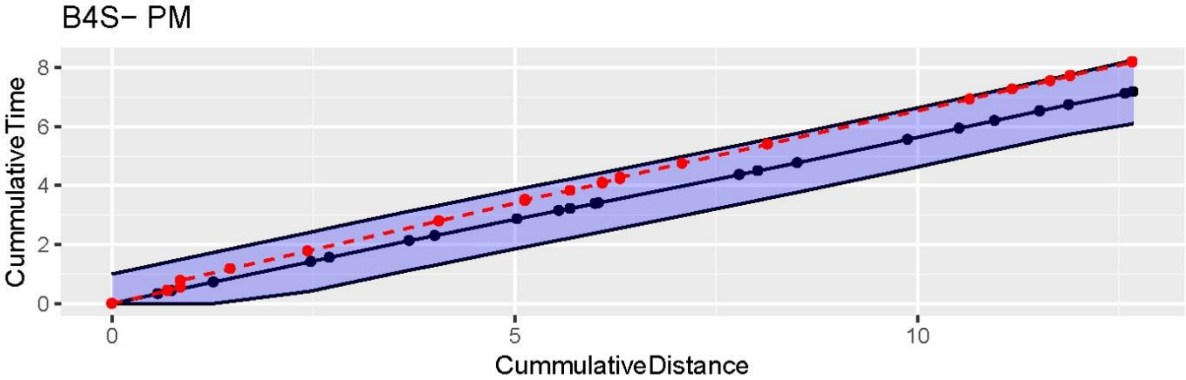
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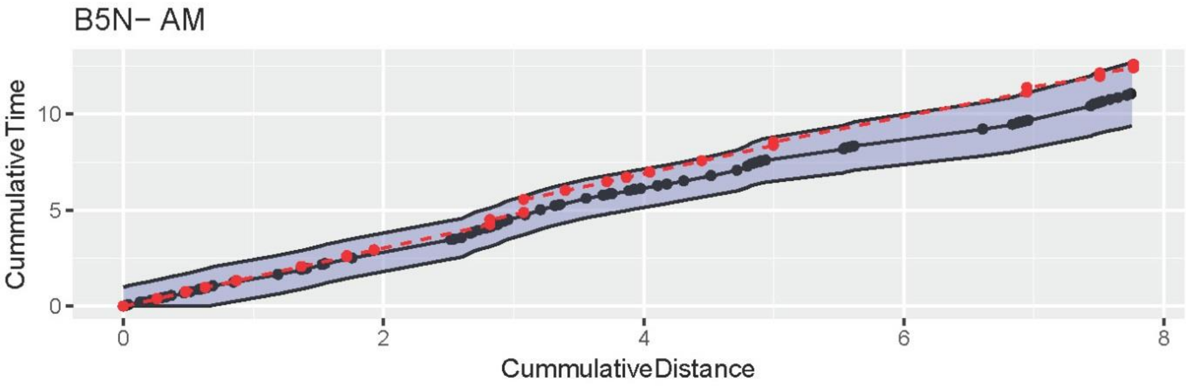
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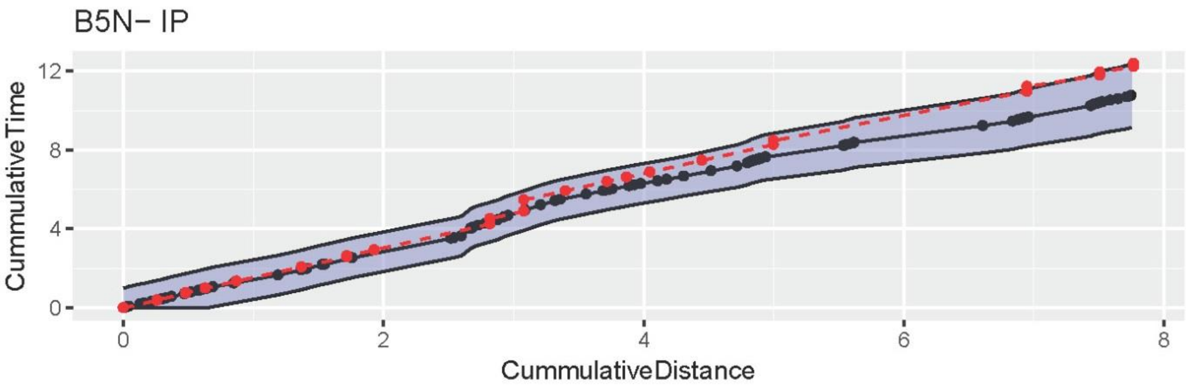
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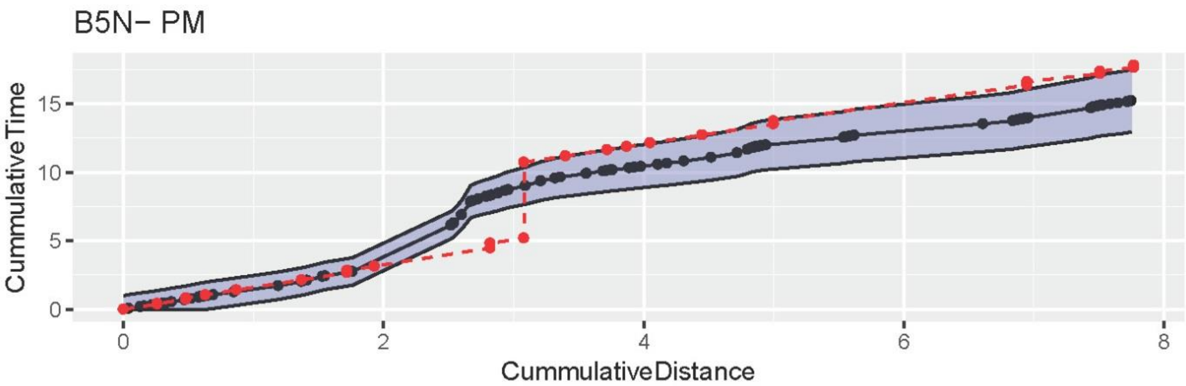
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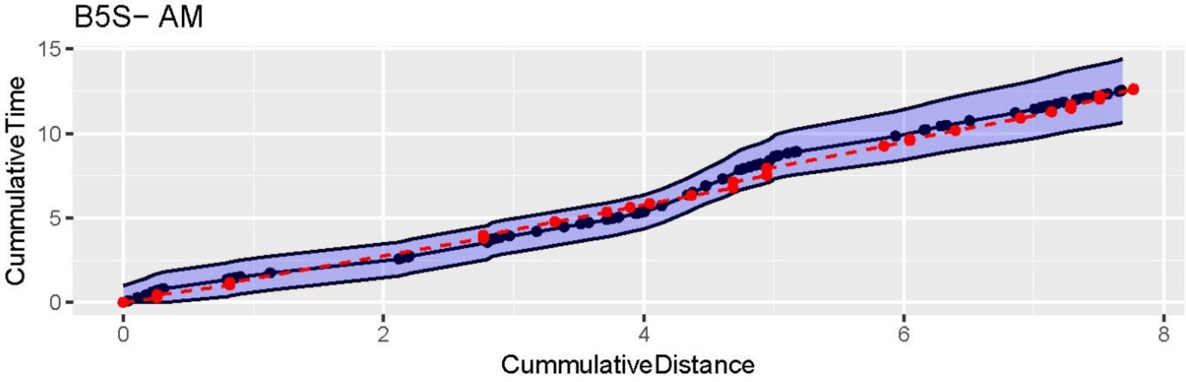
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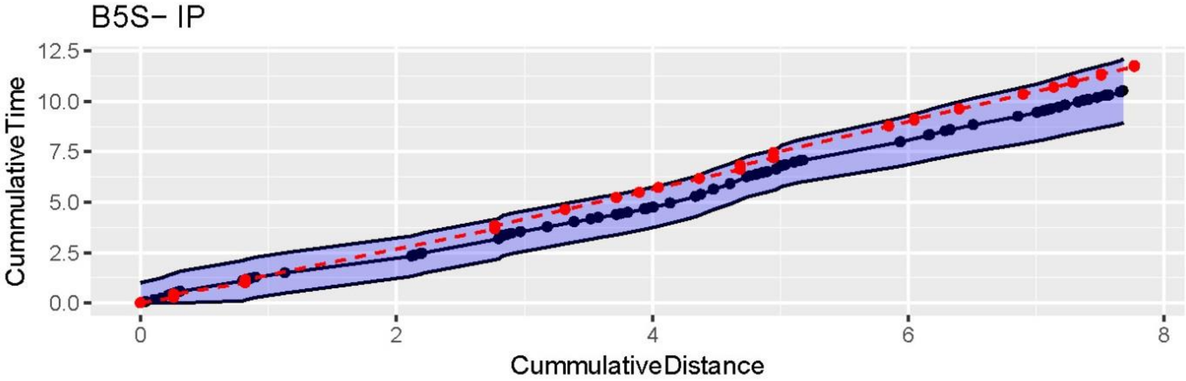
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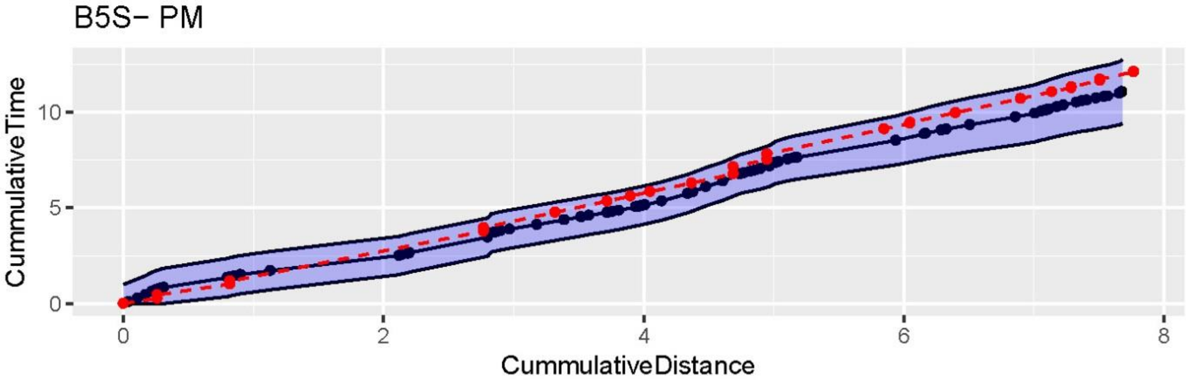
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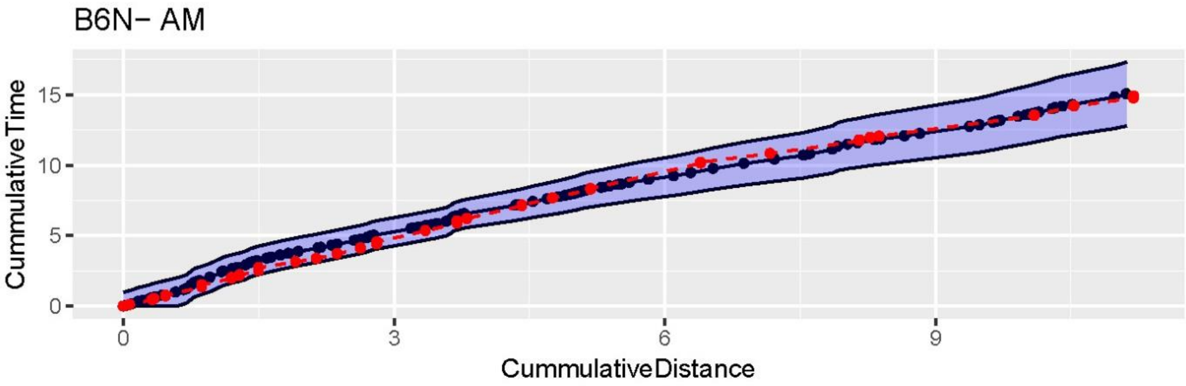
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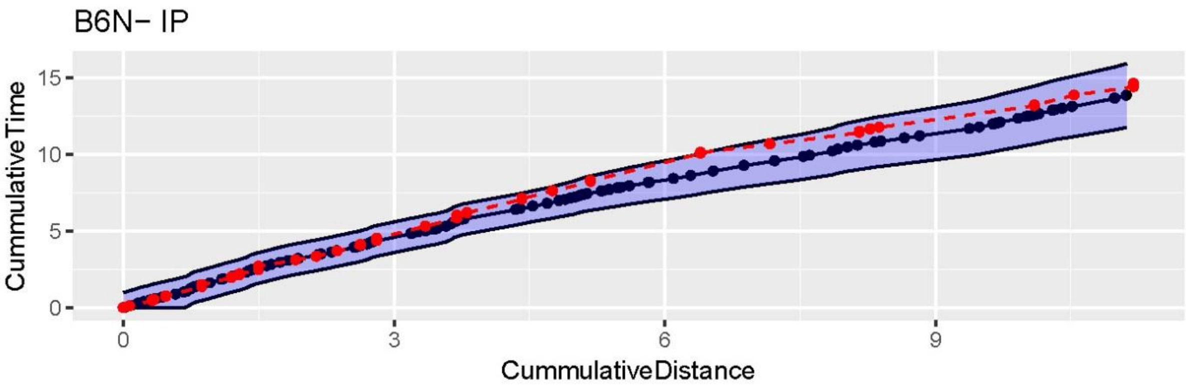
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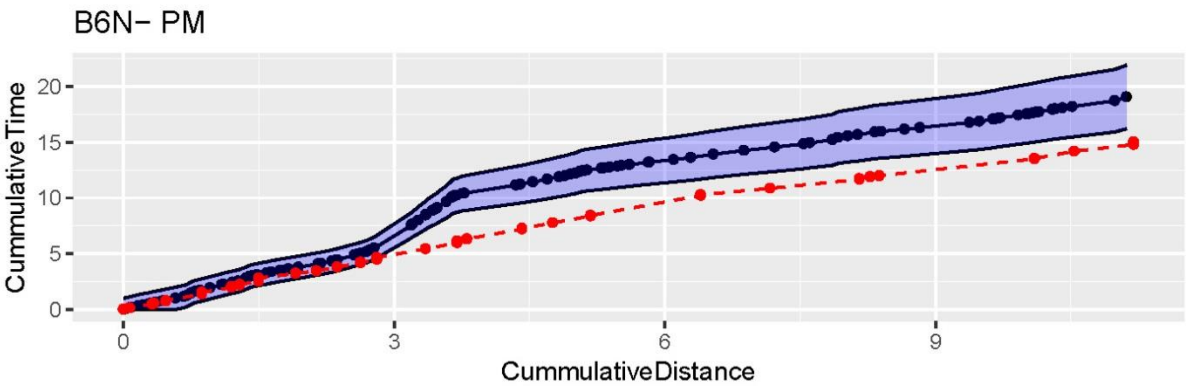
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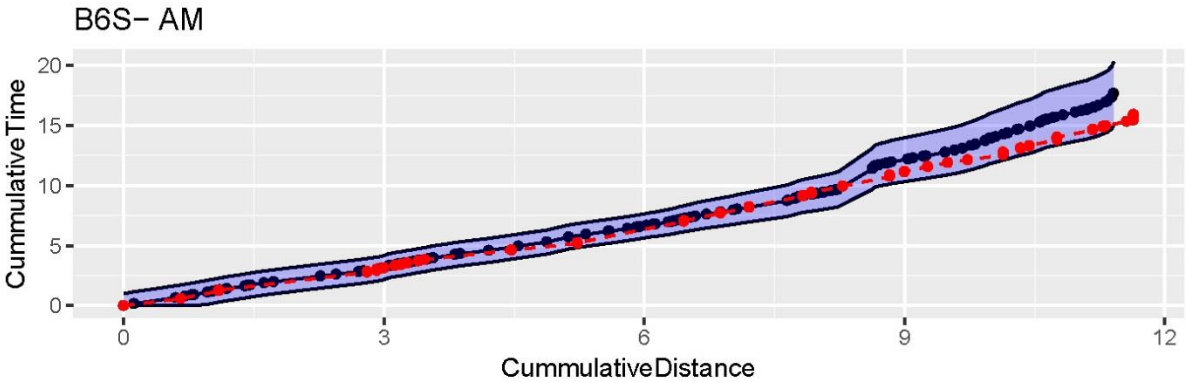
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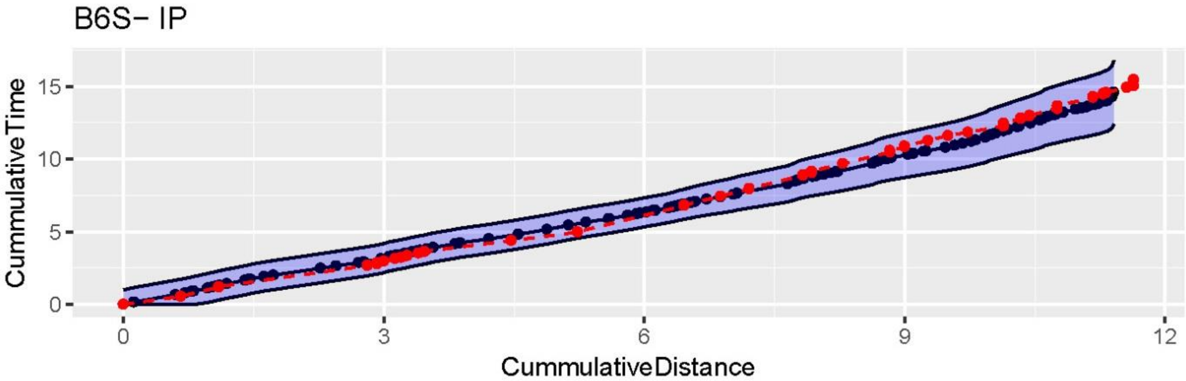
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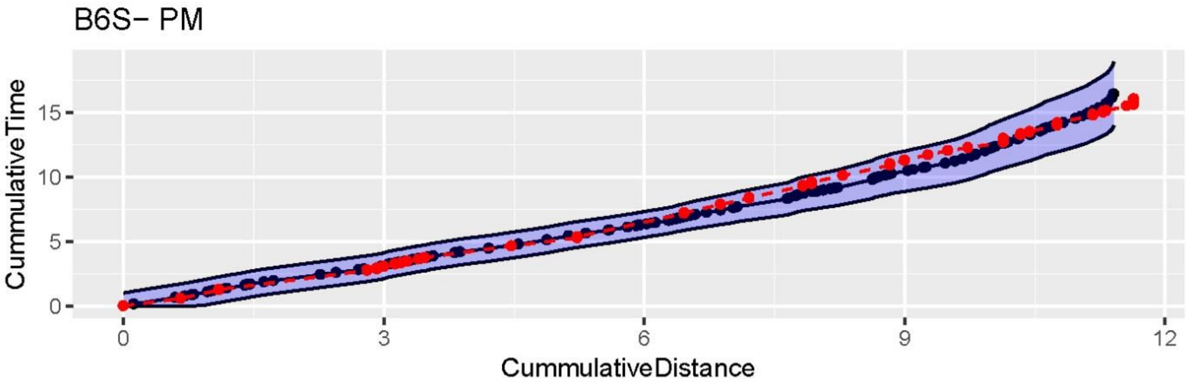
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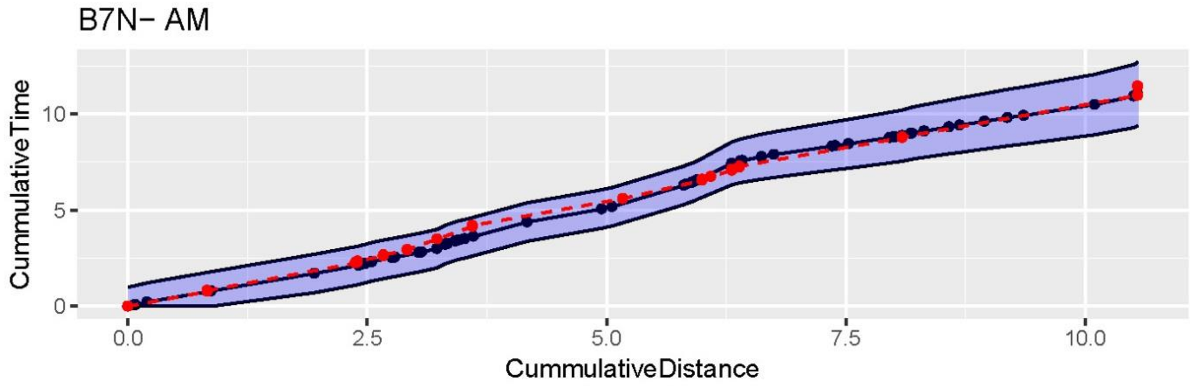
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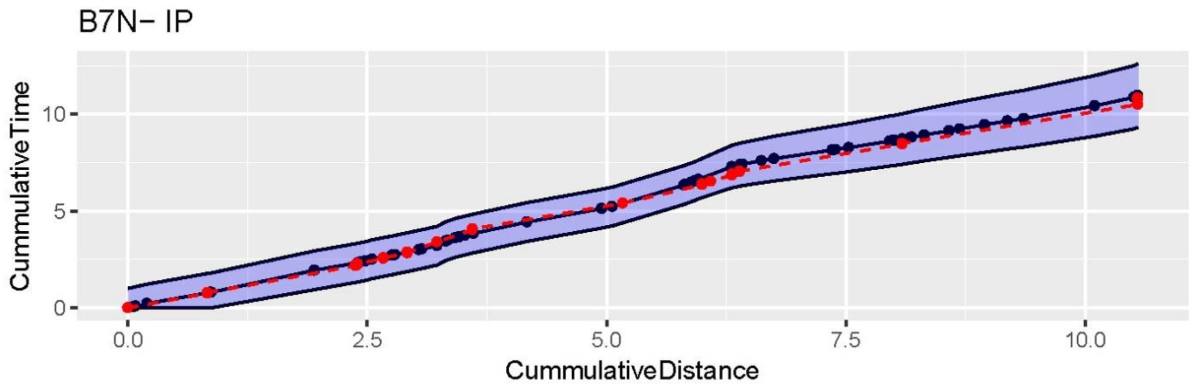
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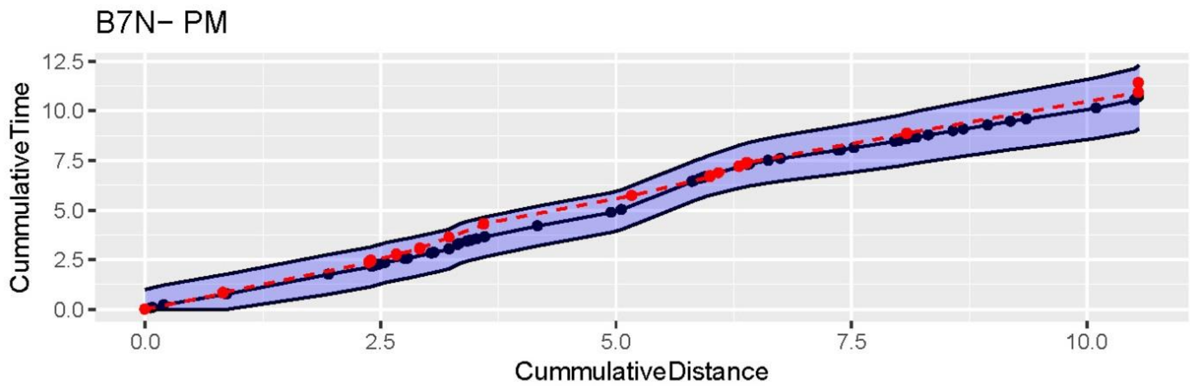
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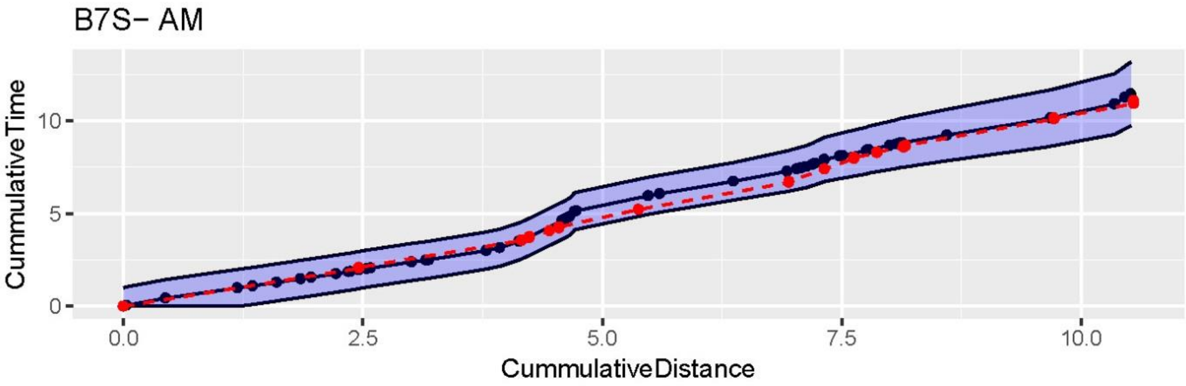
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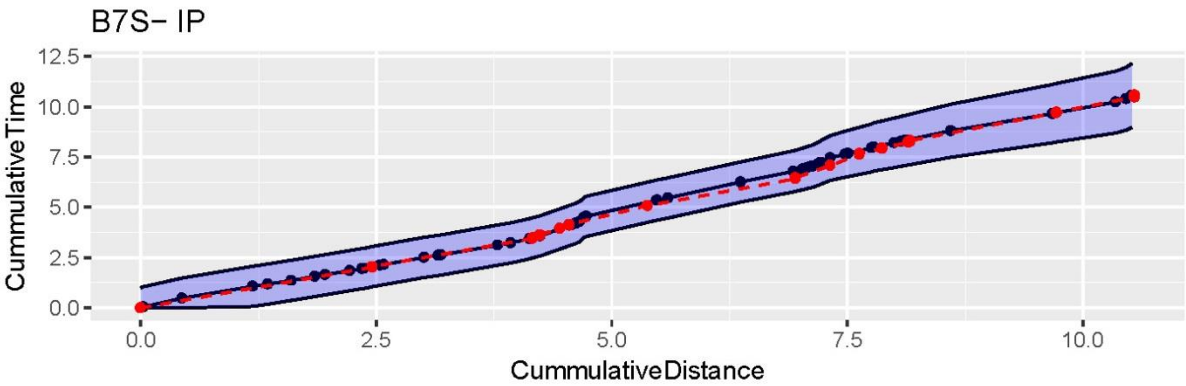
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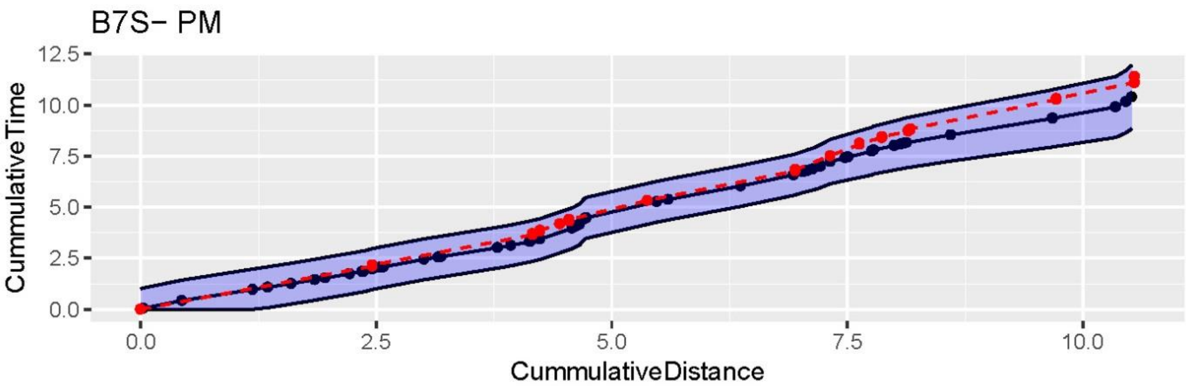
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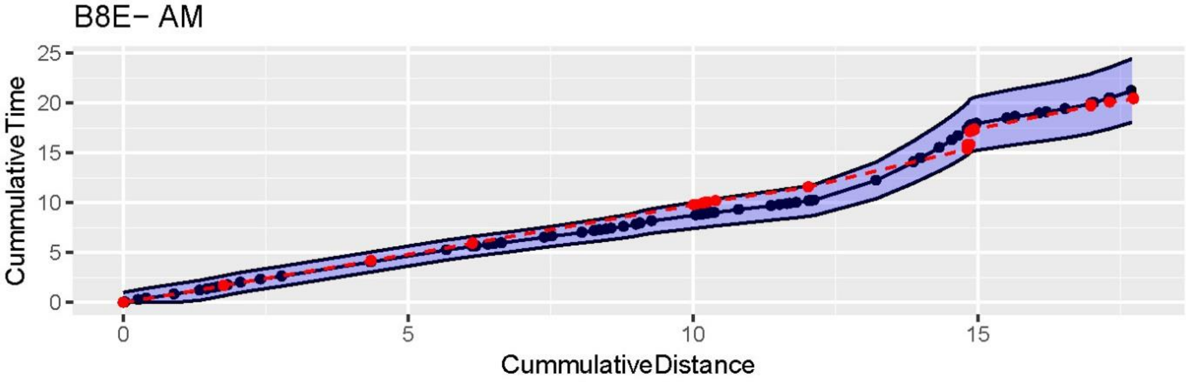
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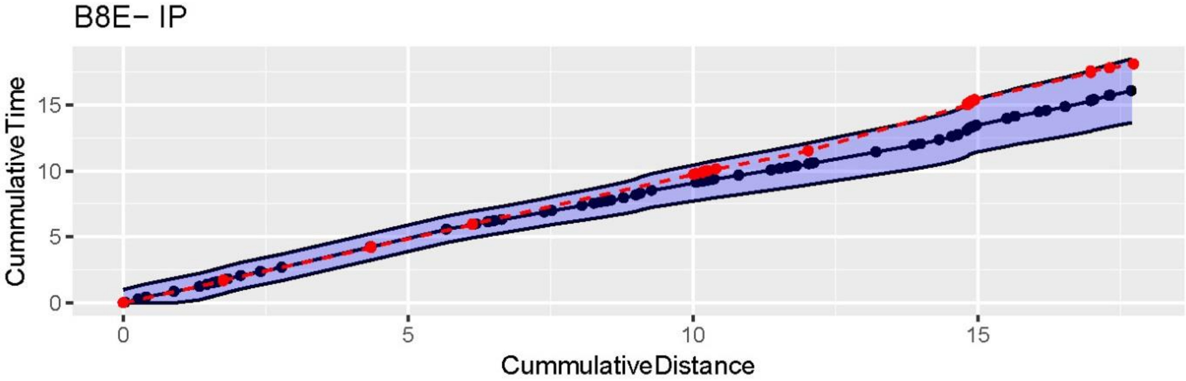
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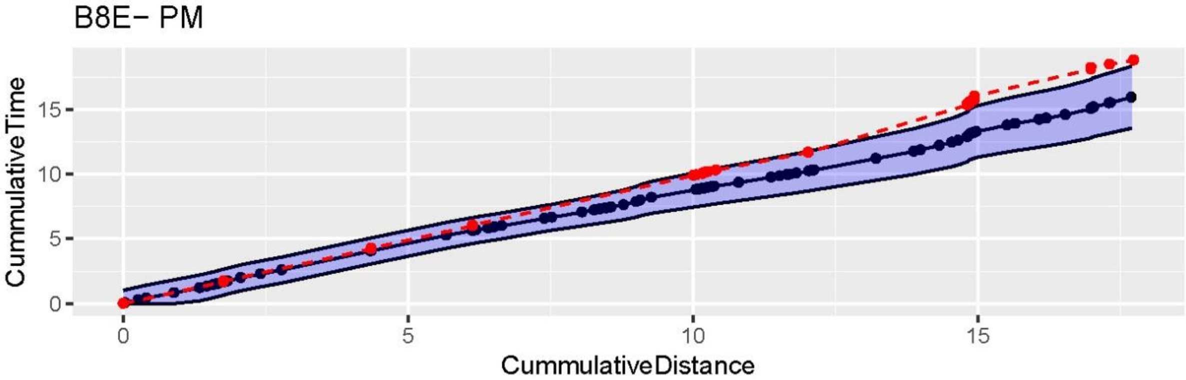
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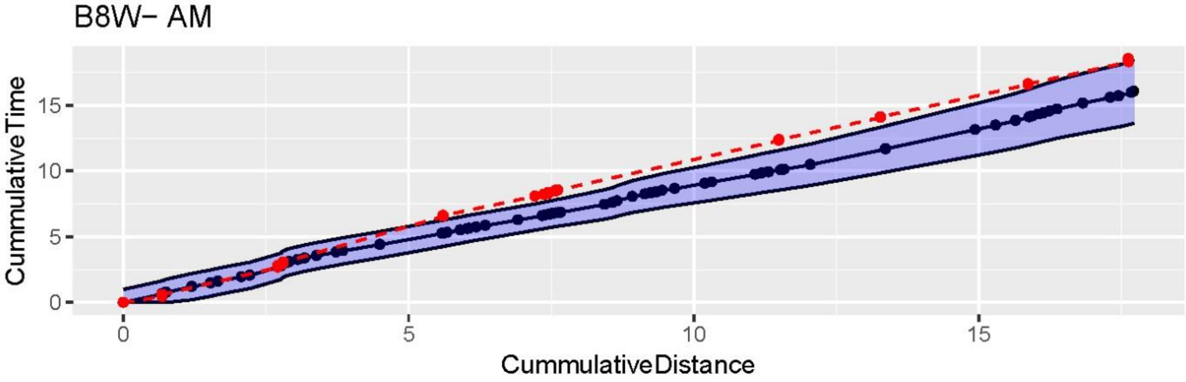
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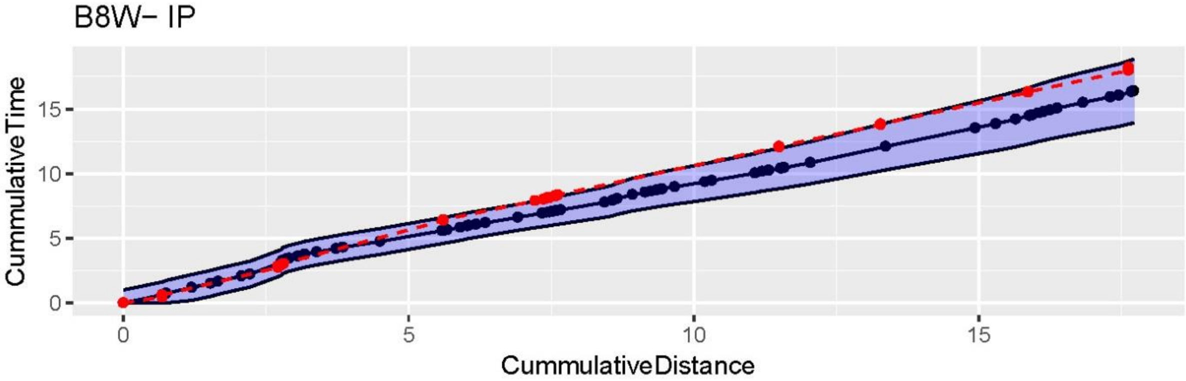
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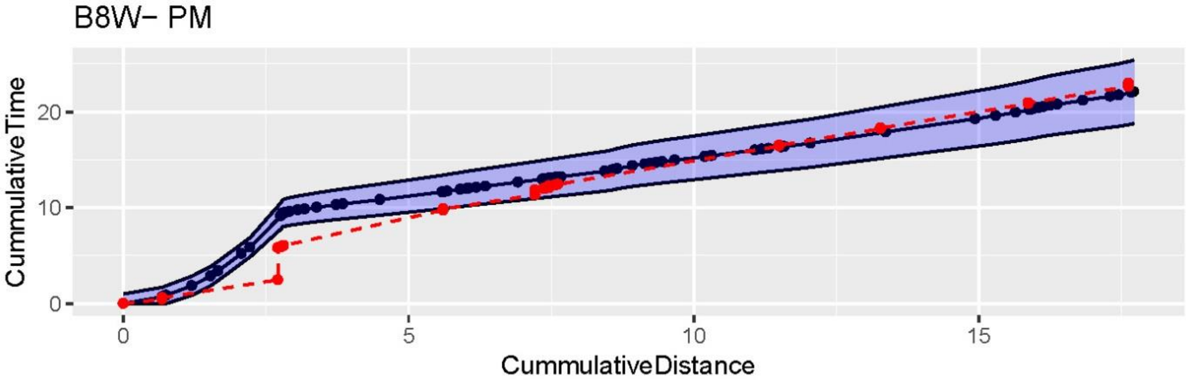
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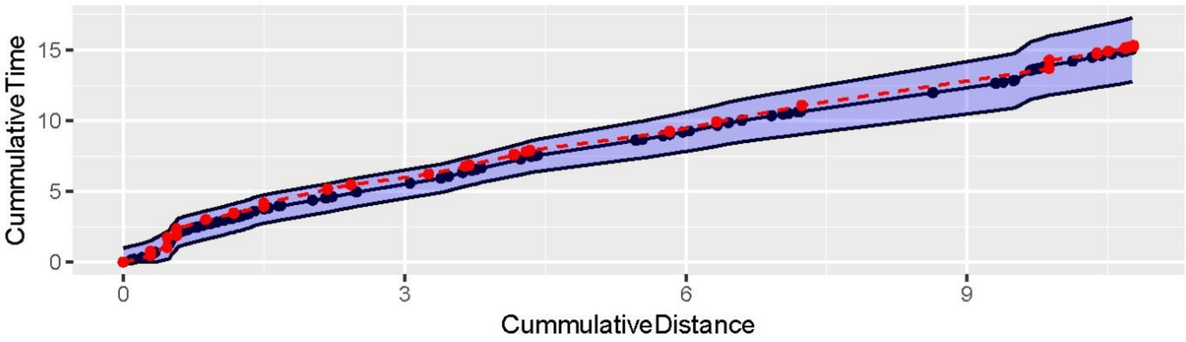

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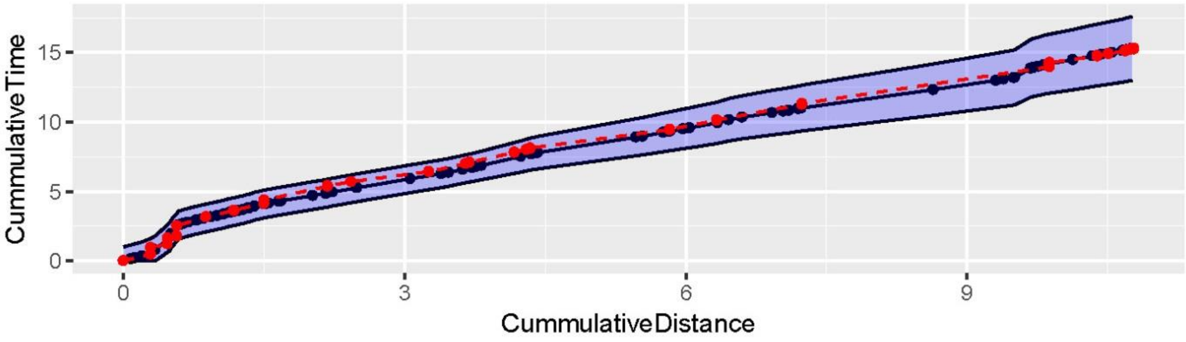

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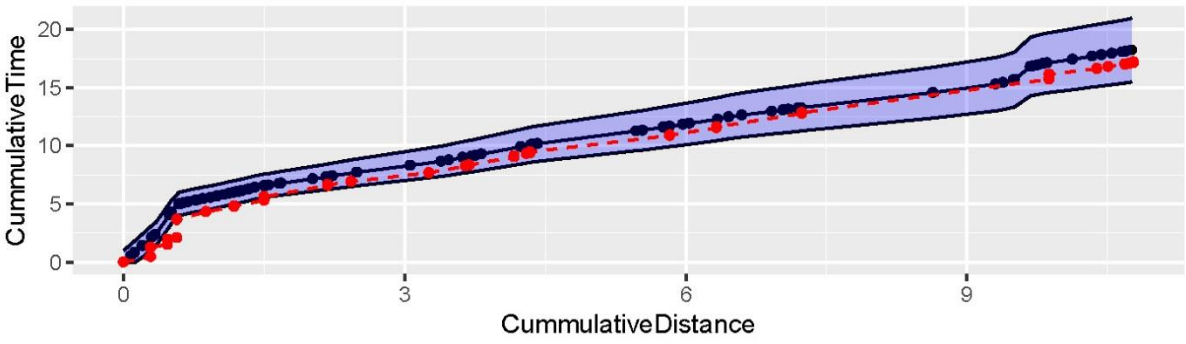

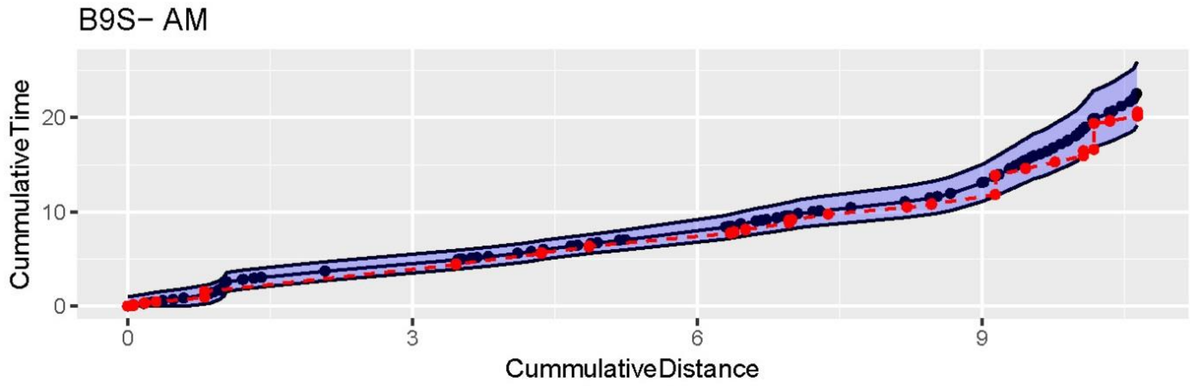
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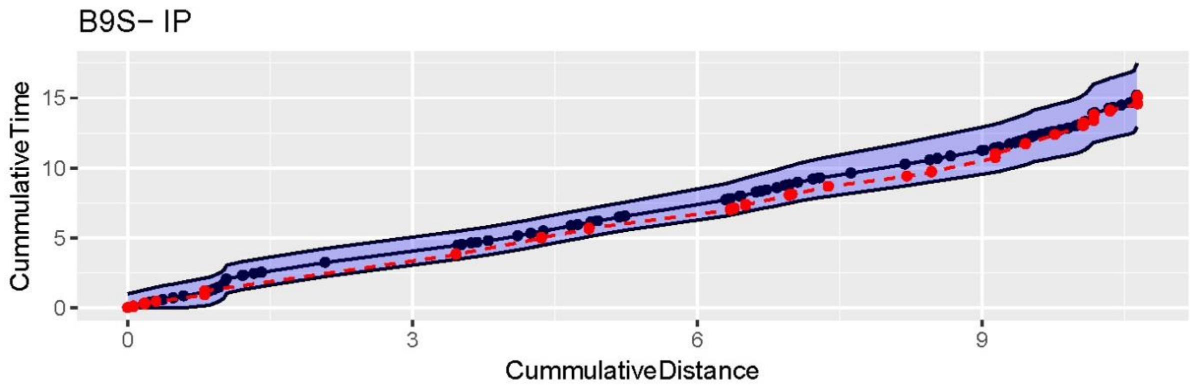
CummulativeDistance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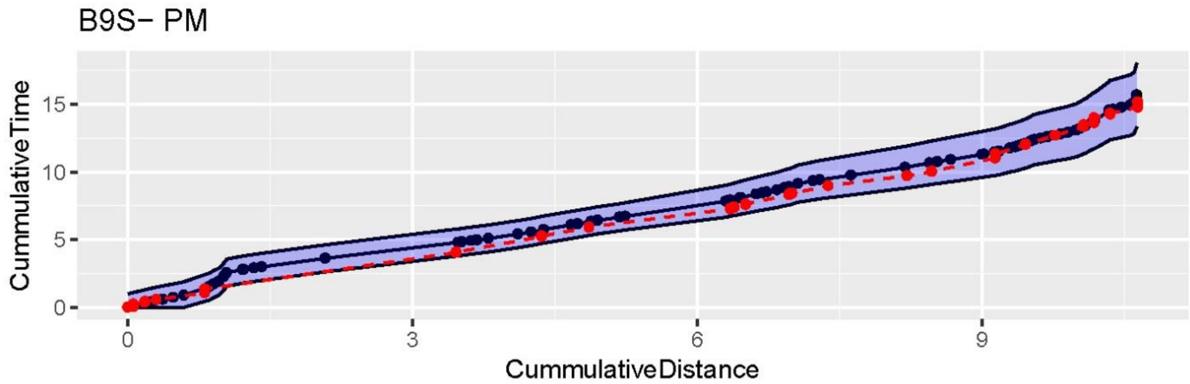
CummulativeDistance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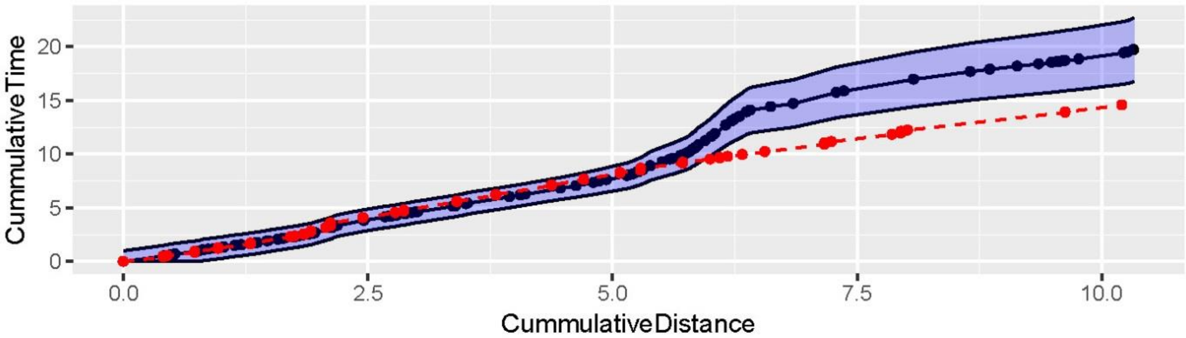
CummulativeDistance

C1E- AM



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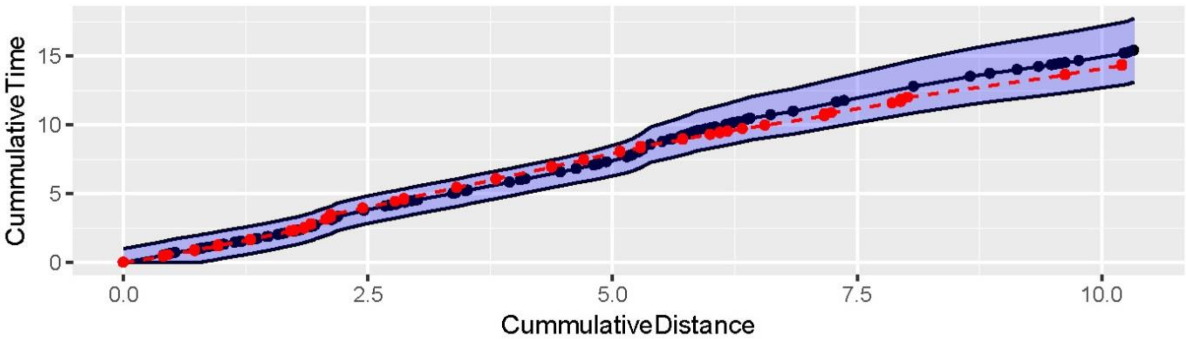
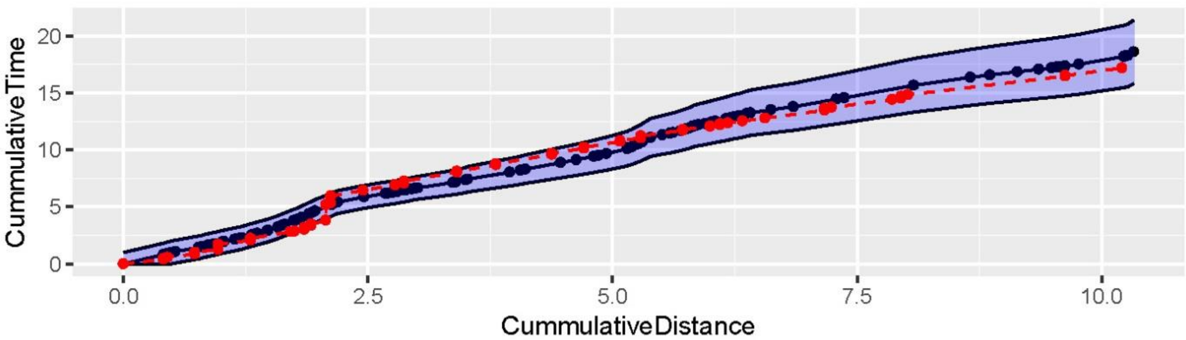
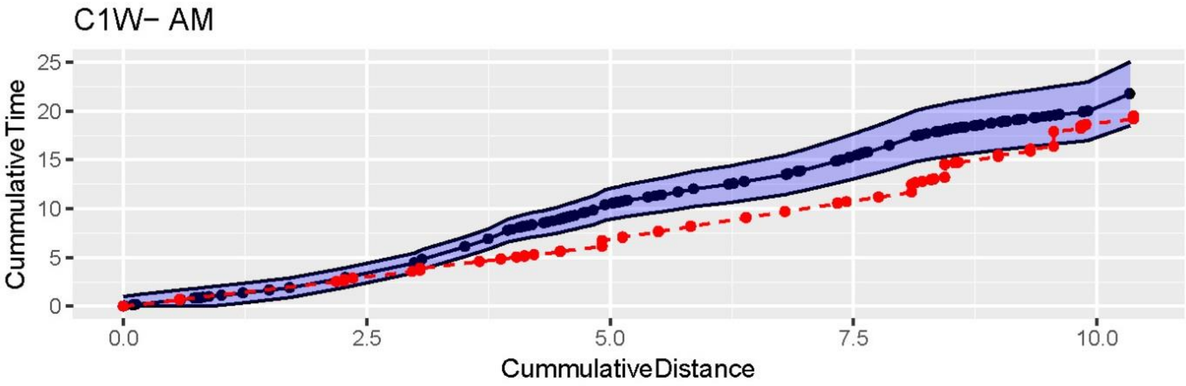


C1E- PM

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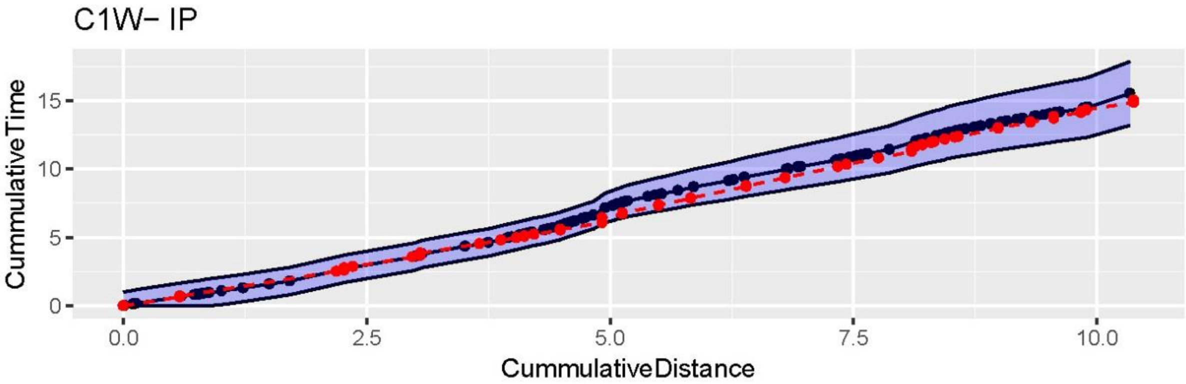
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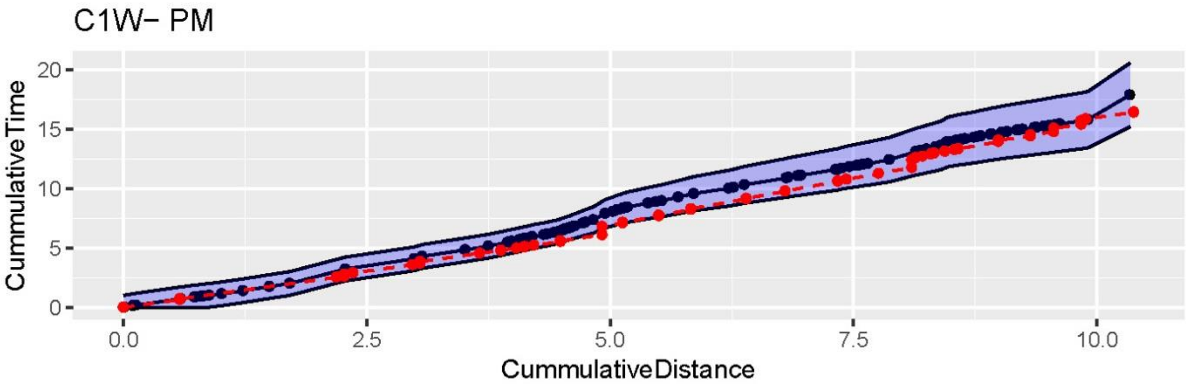
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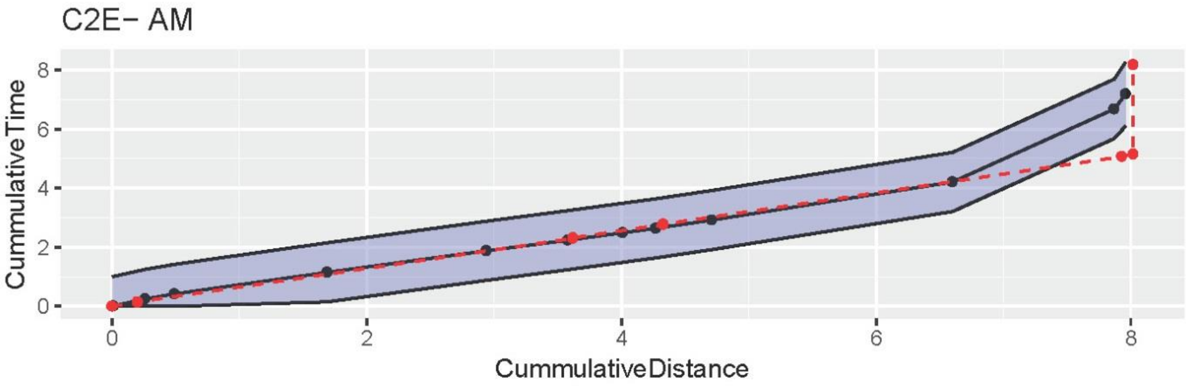
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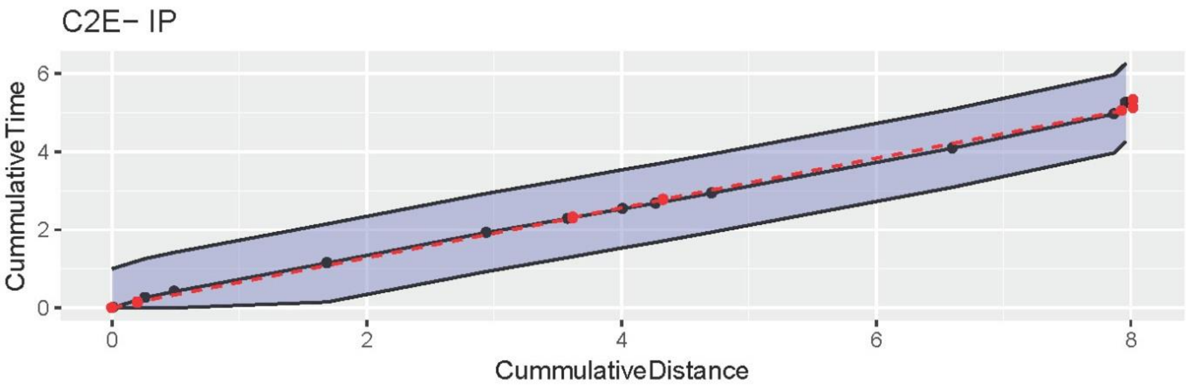
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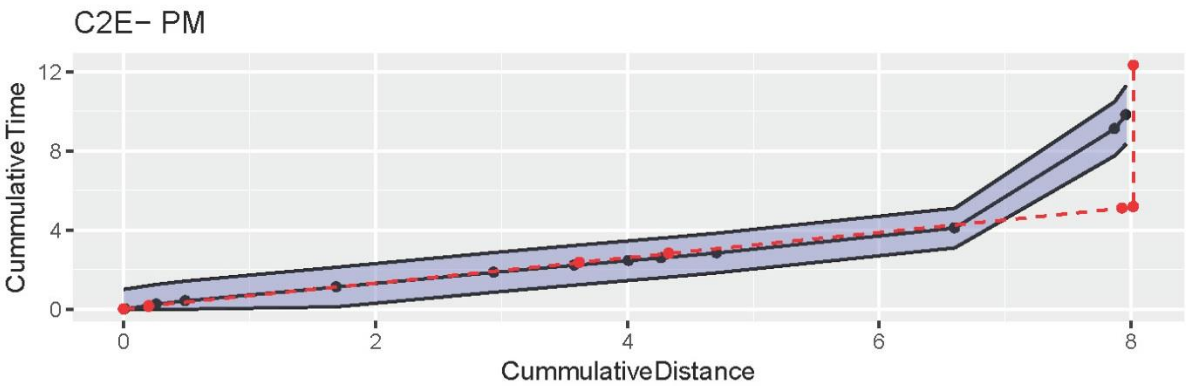
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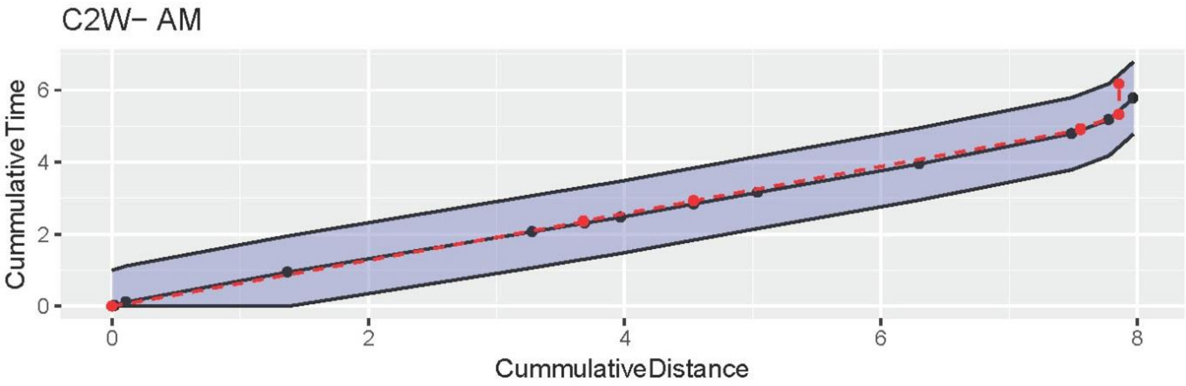
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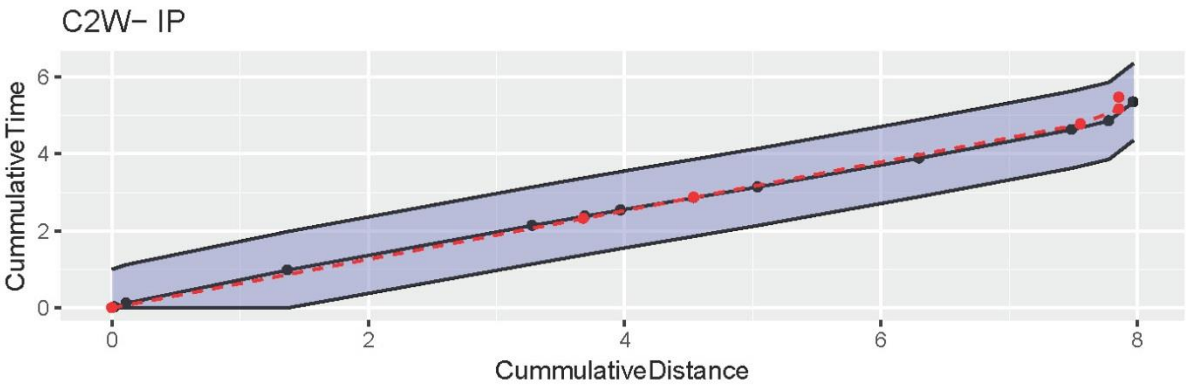
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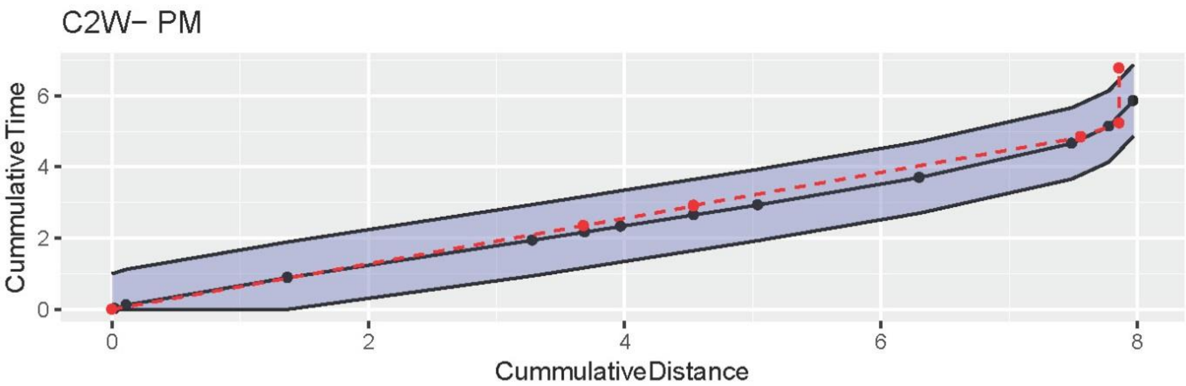
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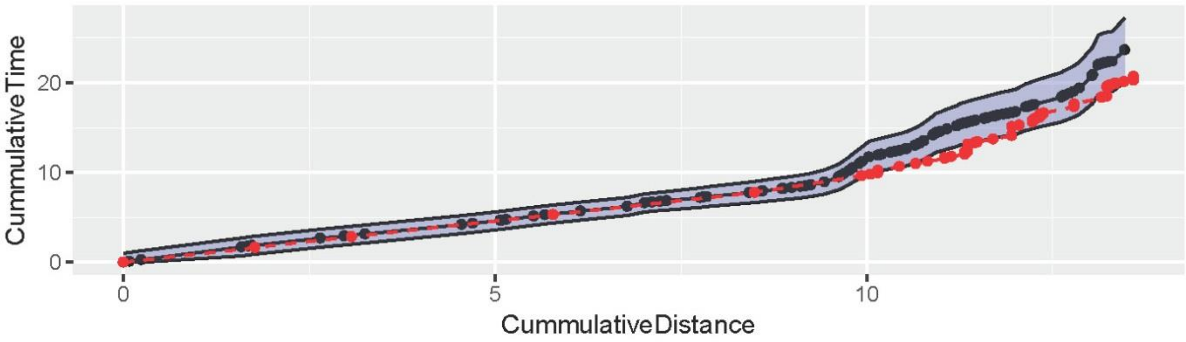
C3E- AM



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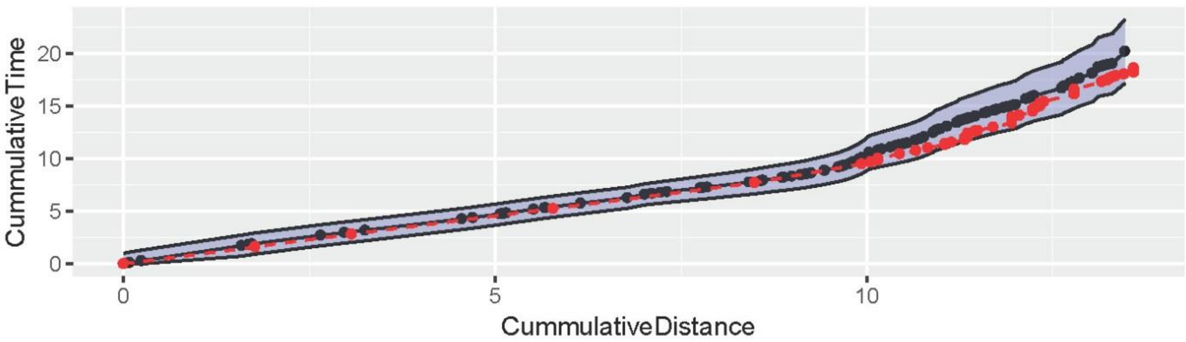
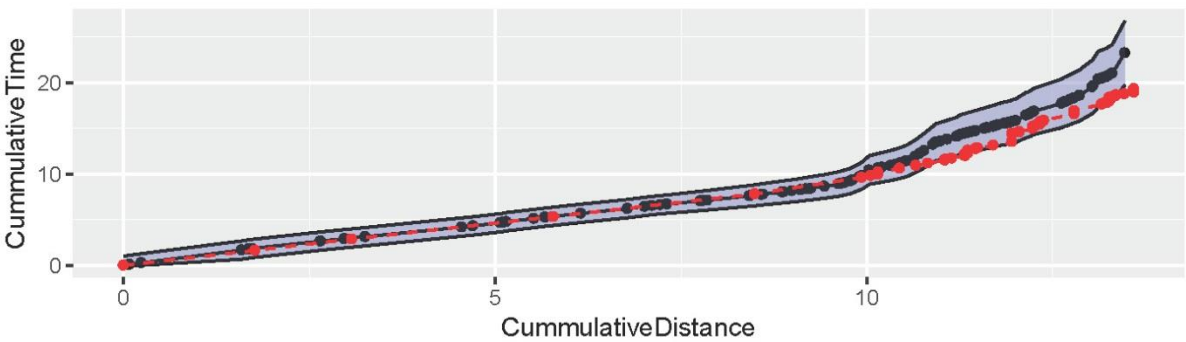
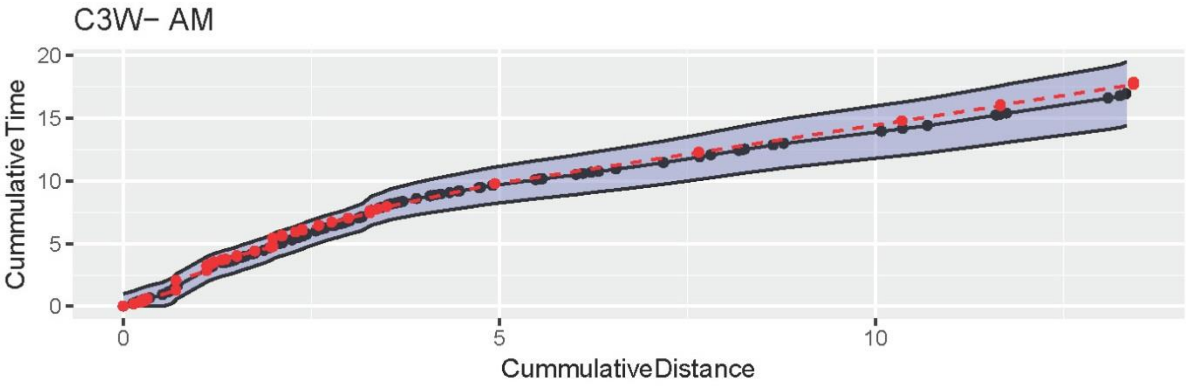


C3E- PM

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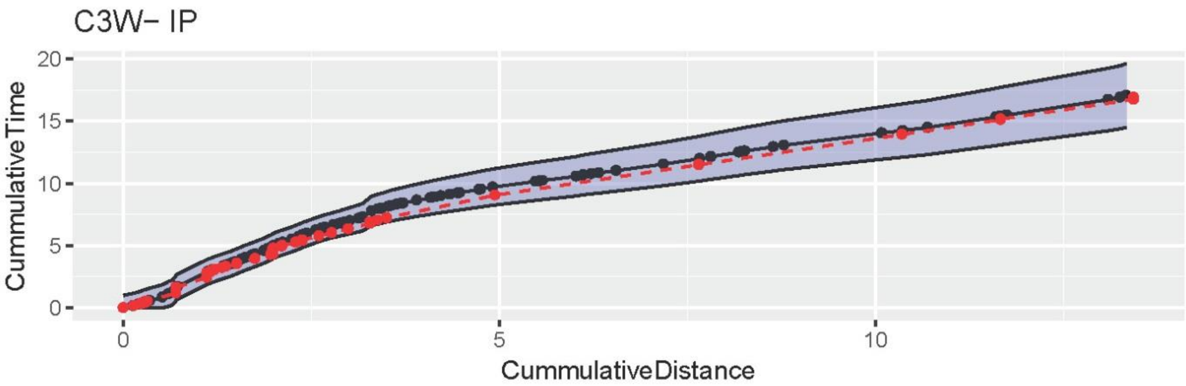
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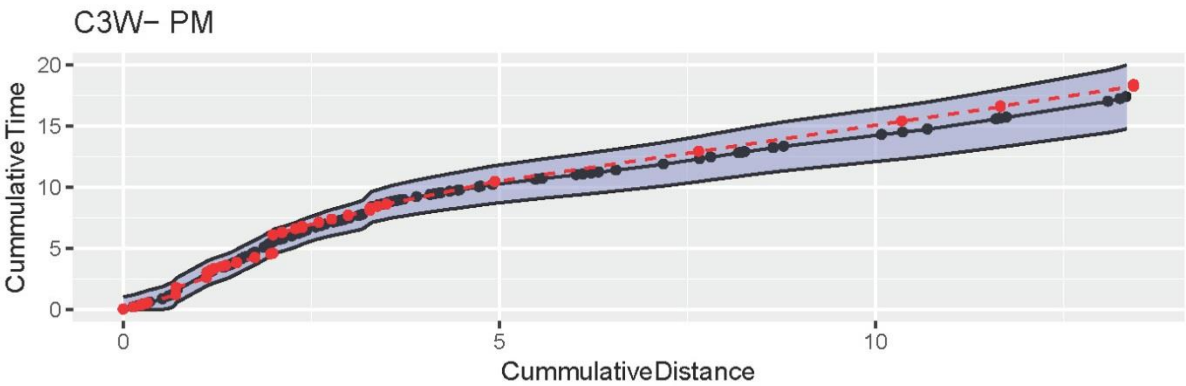
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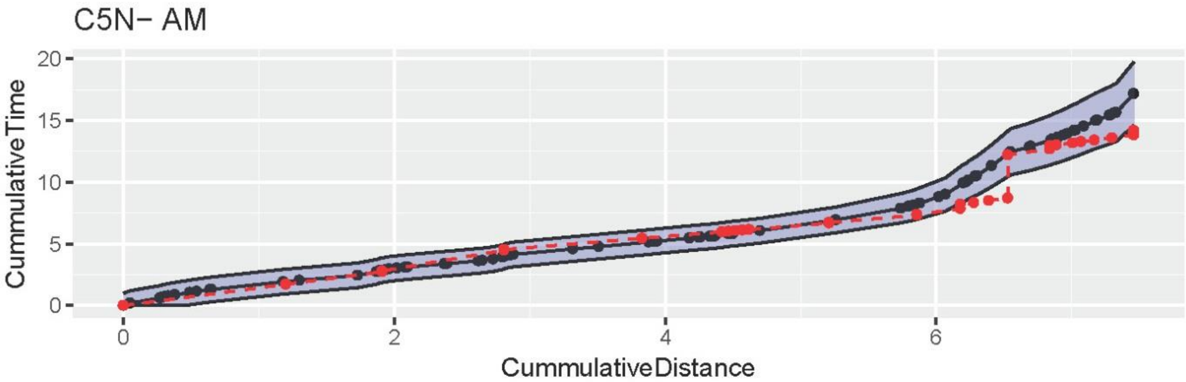
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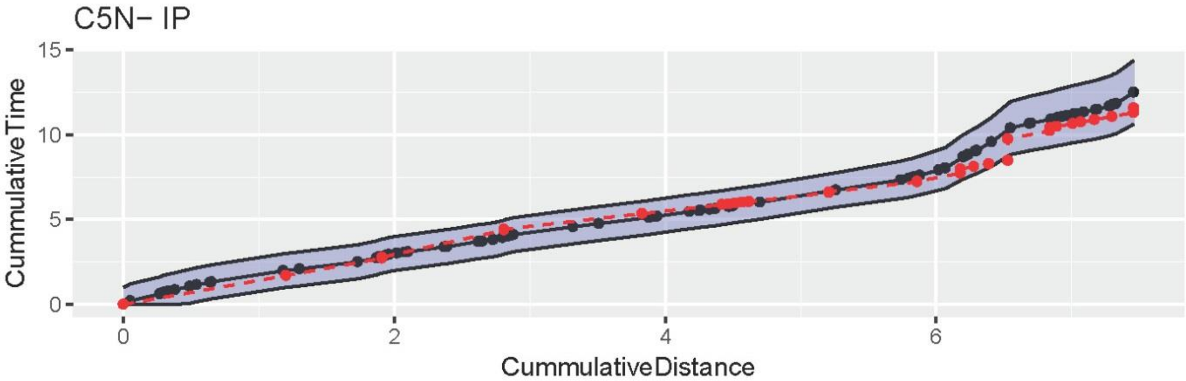
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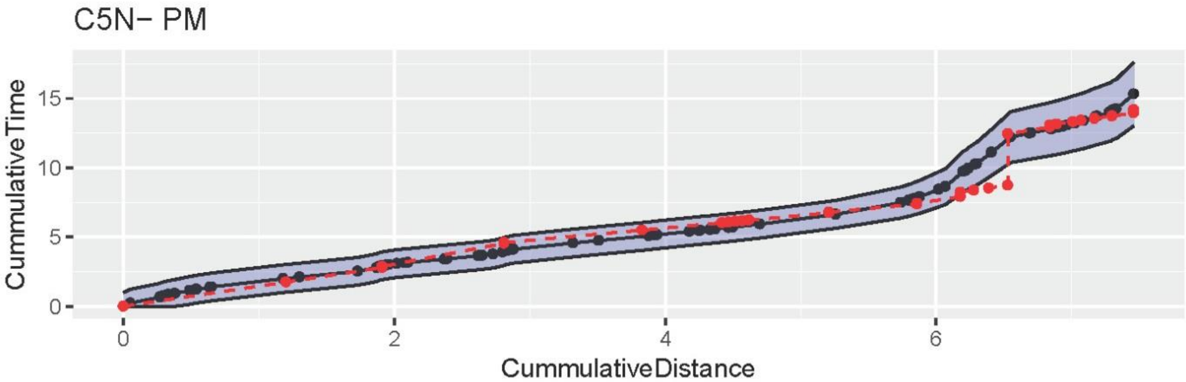
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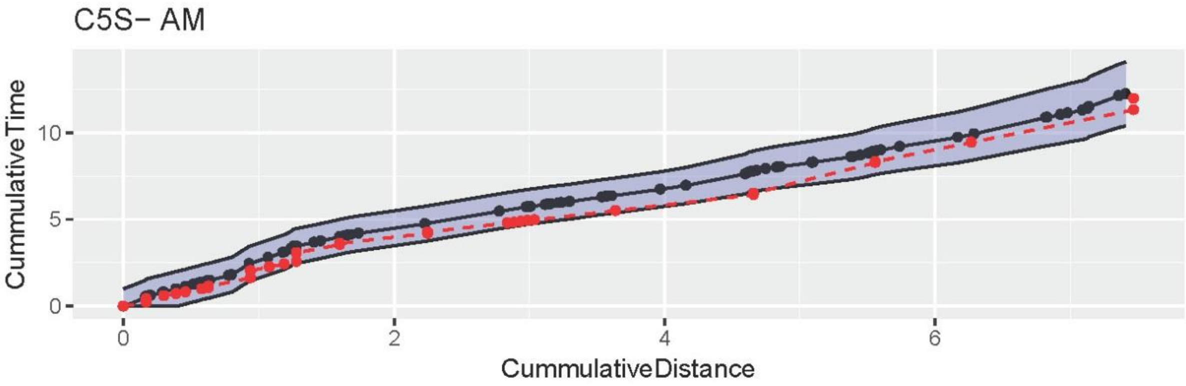
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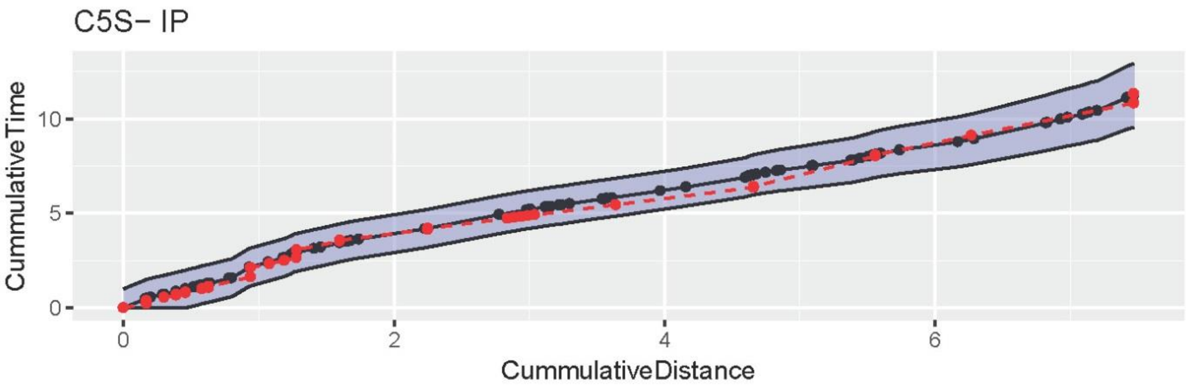
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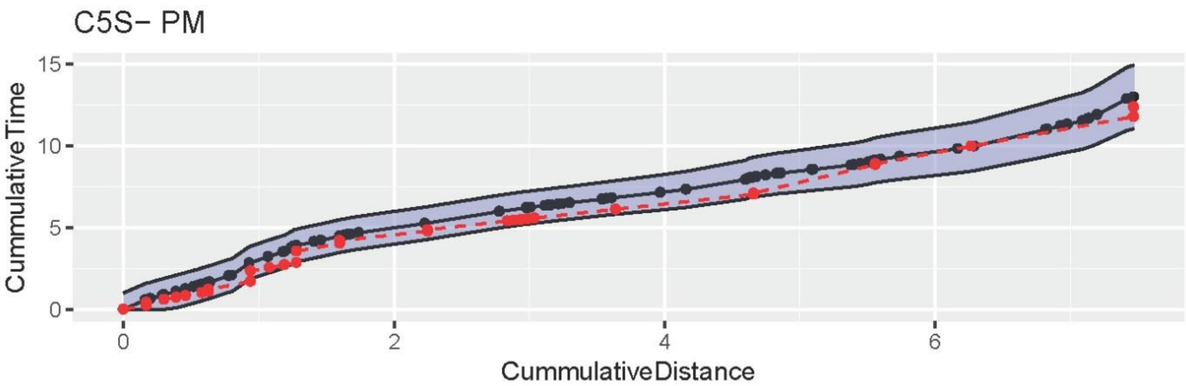
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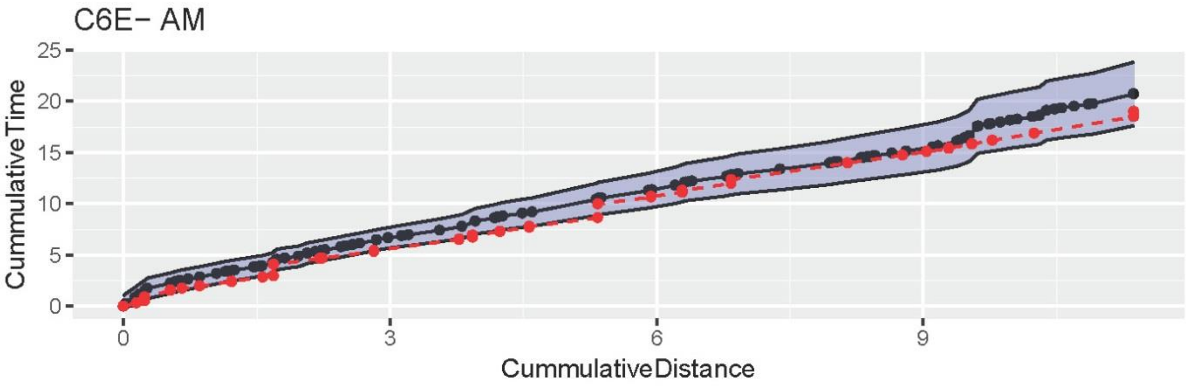
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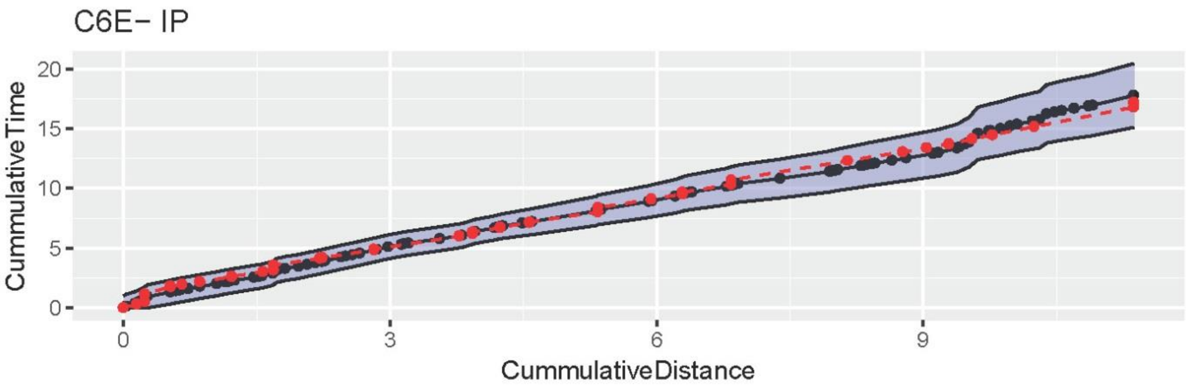
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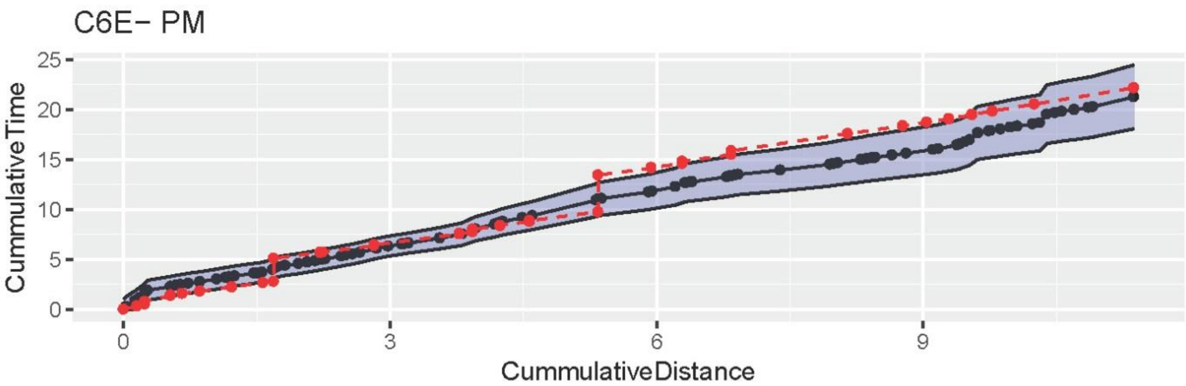
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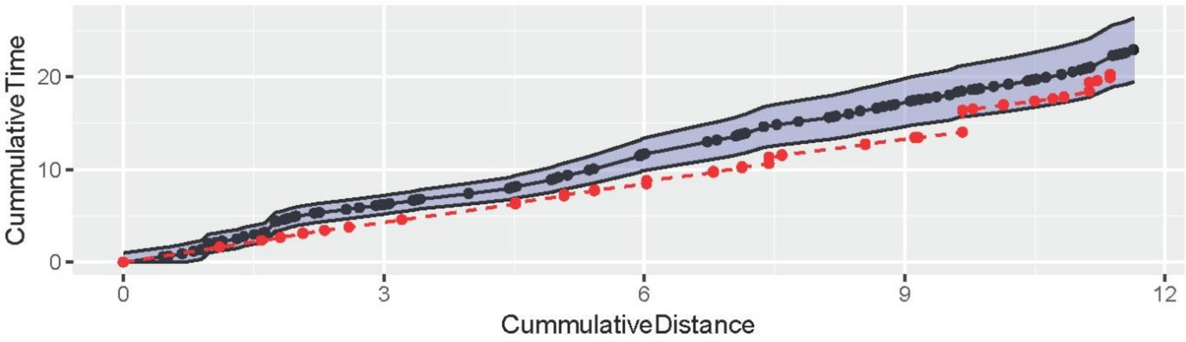
C6W- AM



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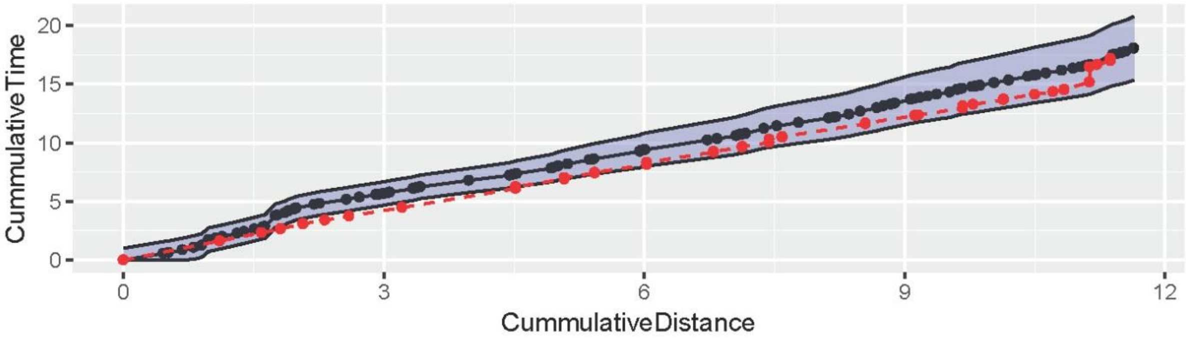
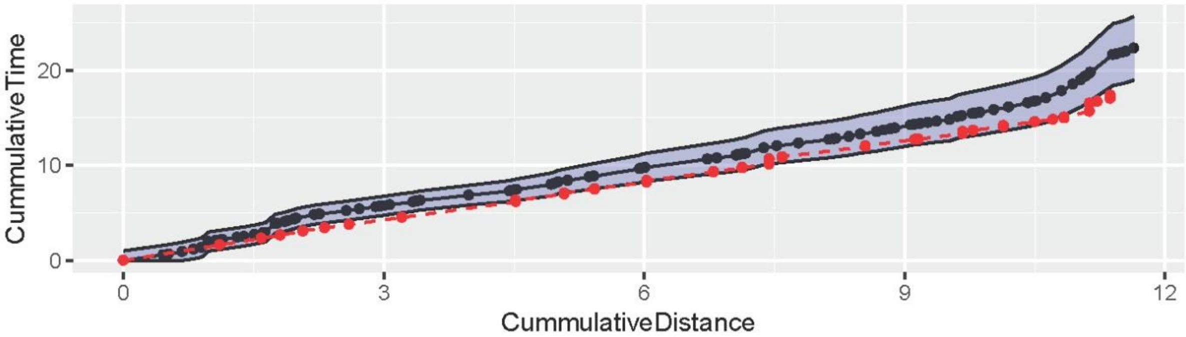
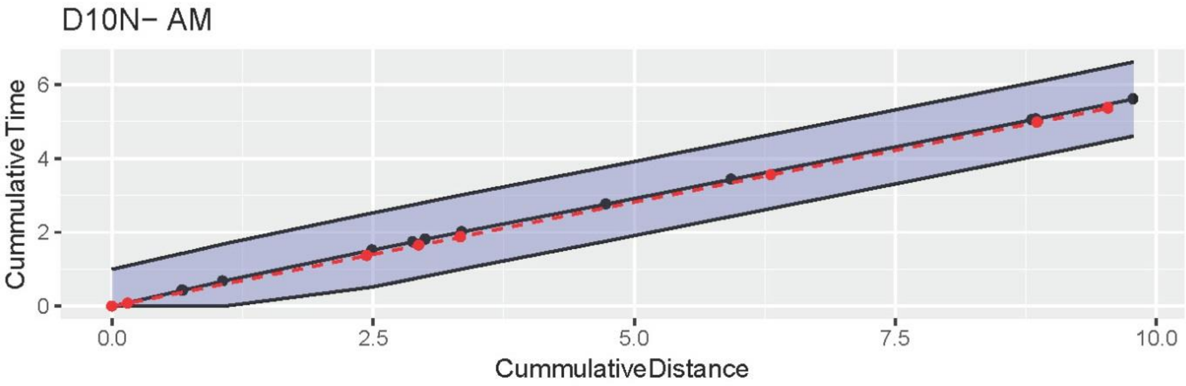


C6W- PM

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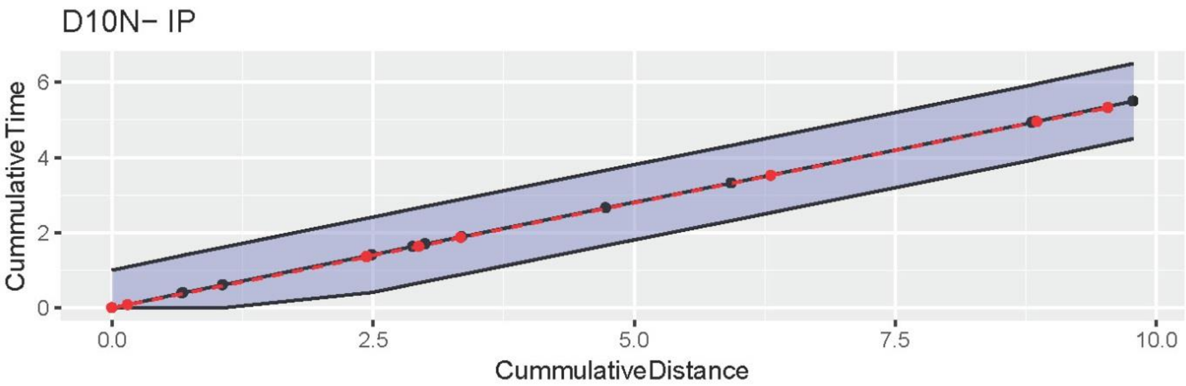
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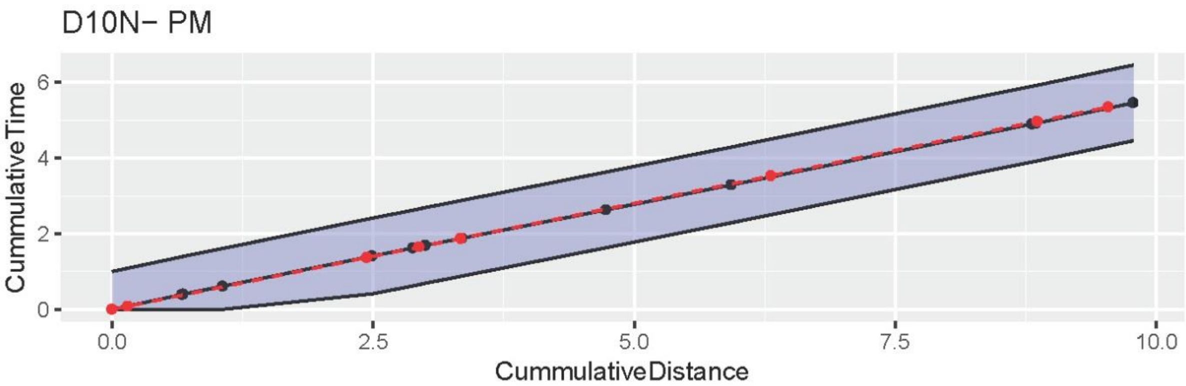
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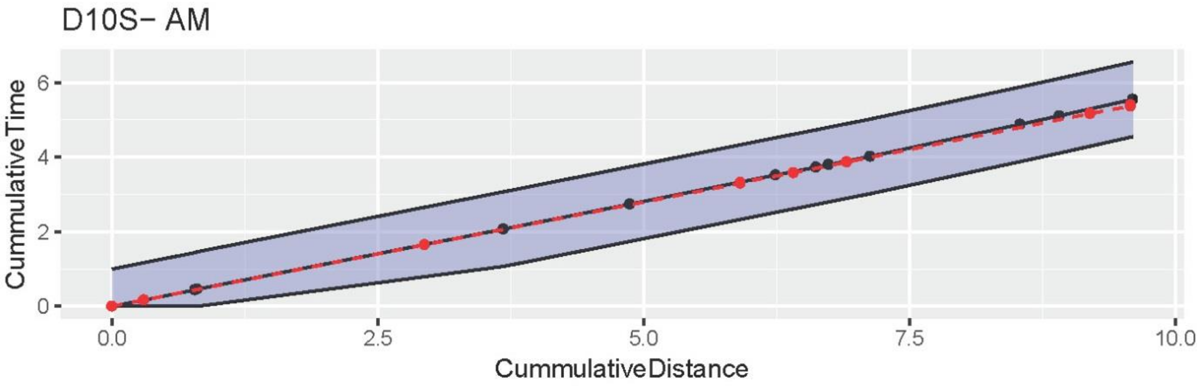
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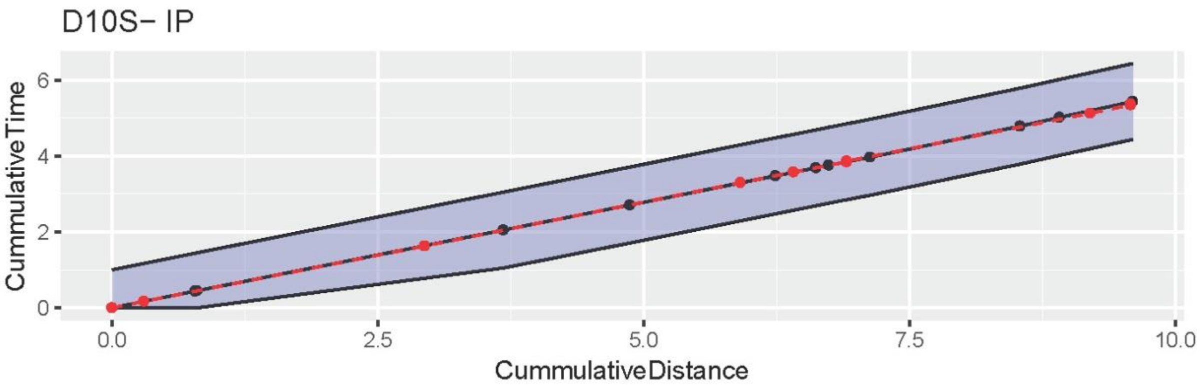
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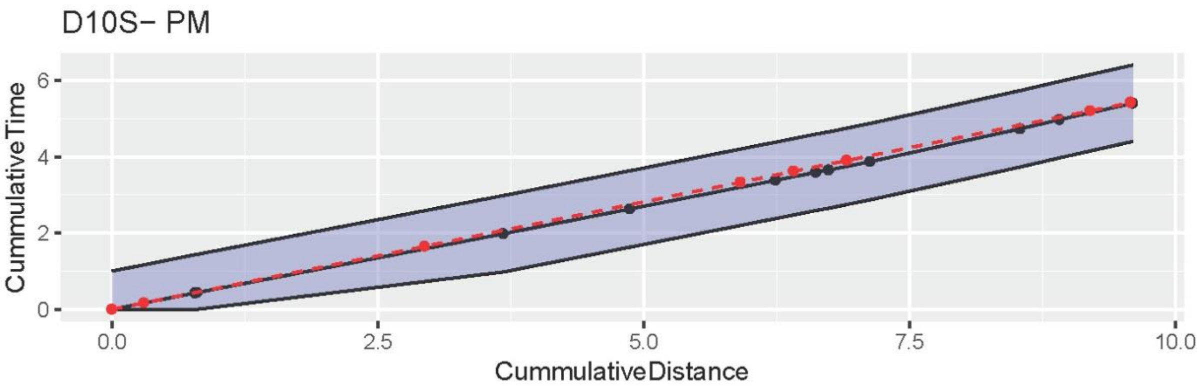
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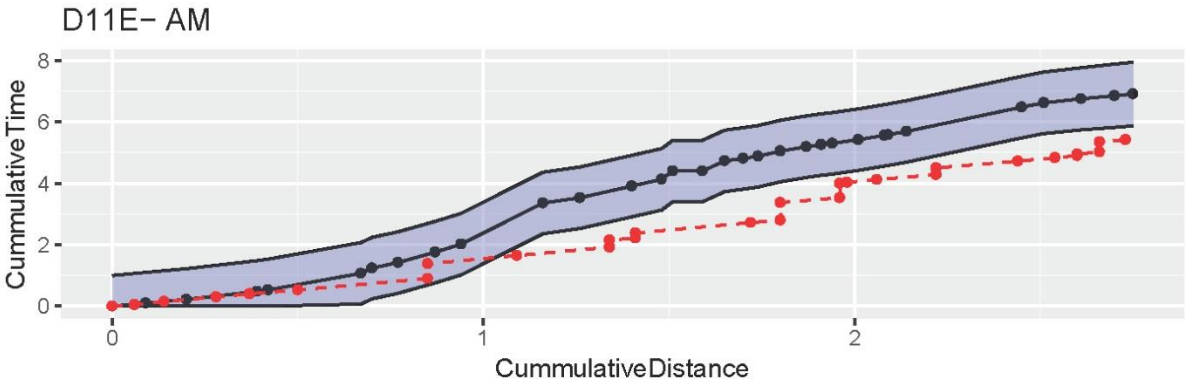
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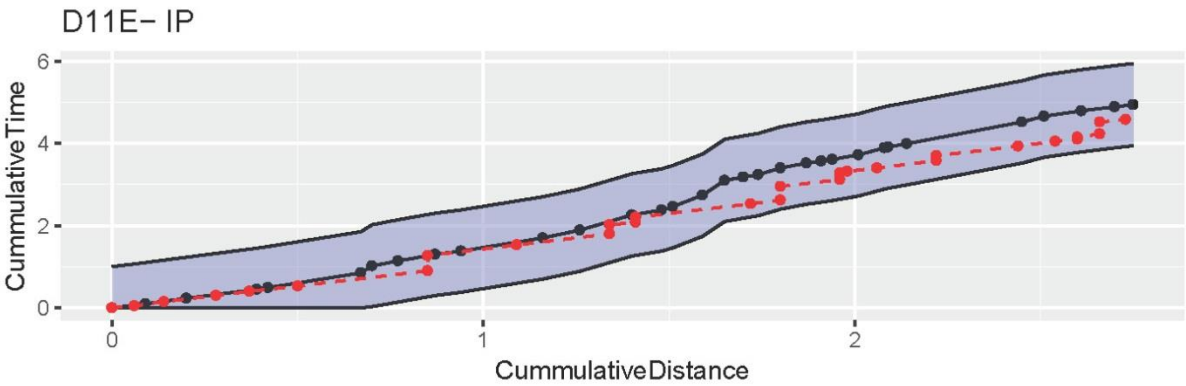
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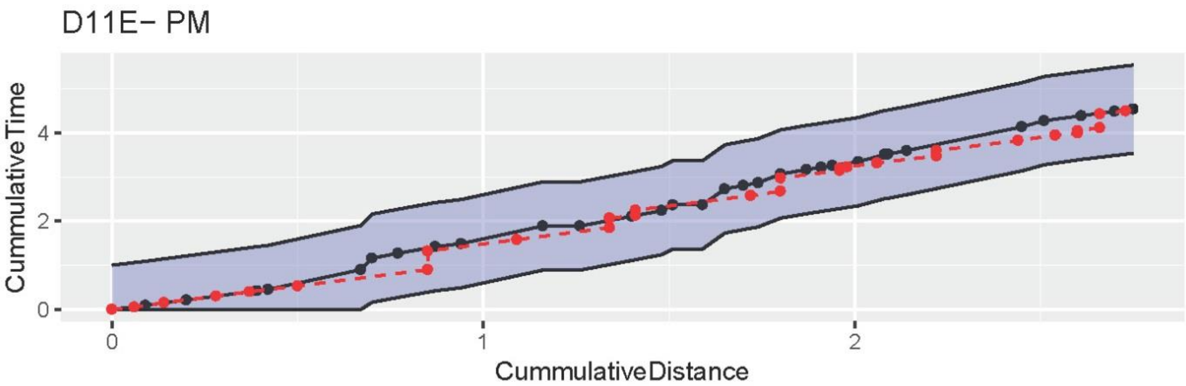
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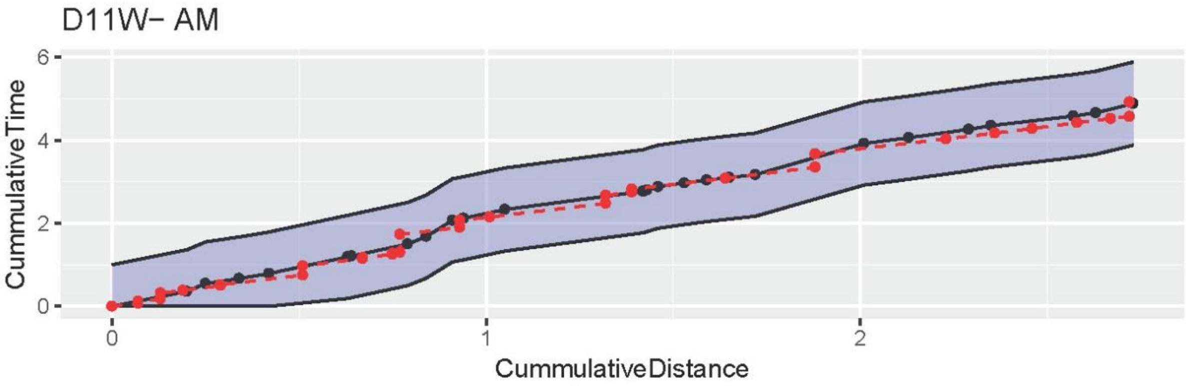
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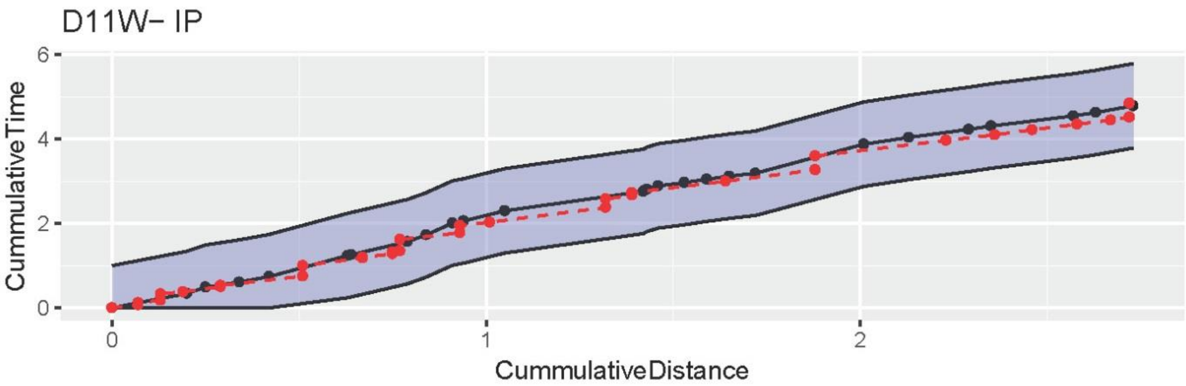
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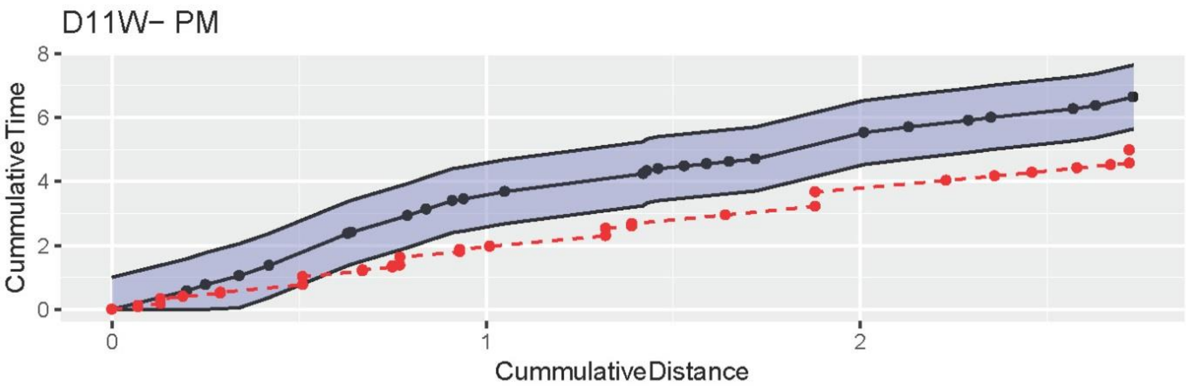
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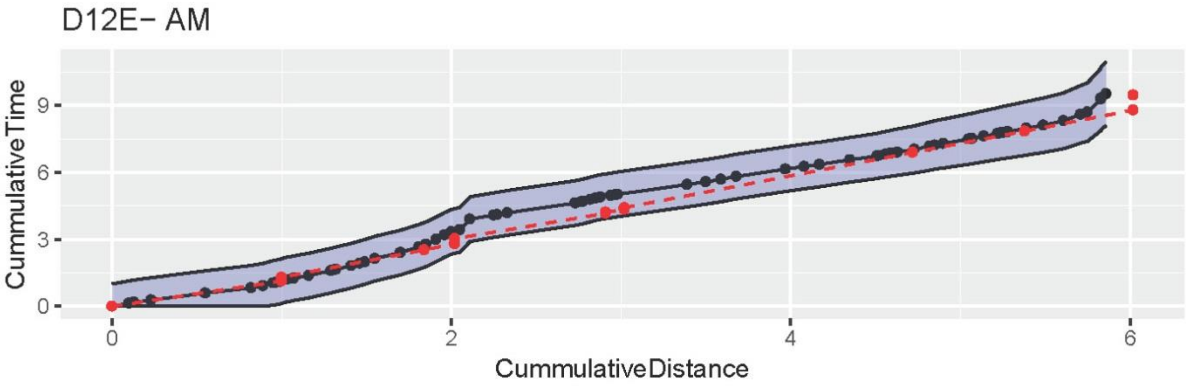
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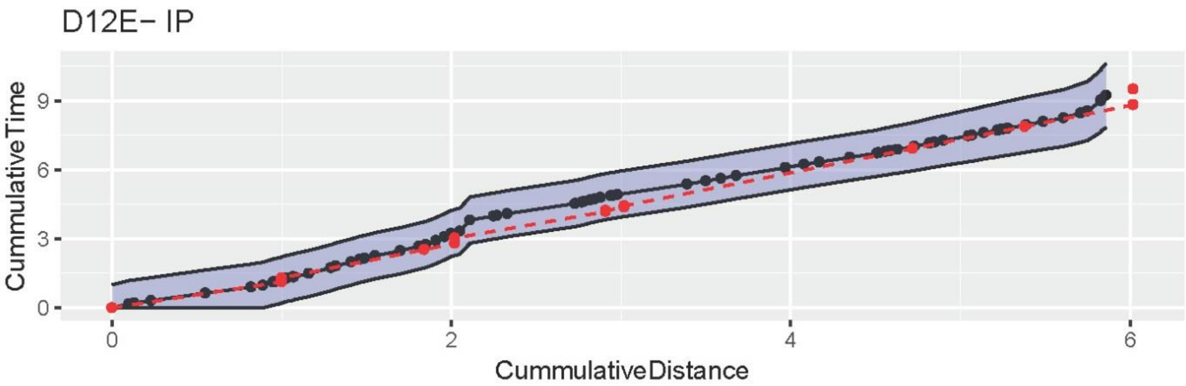
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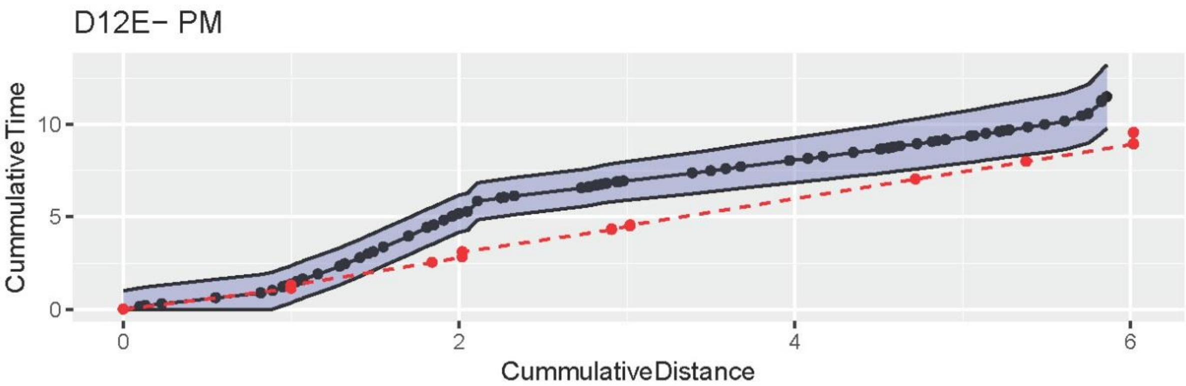
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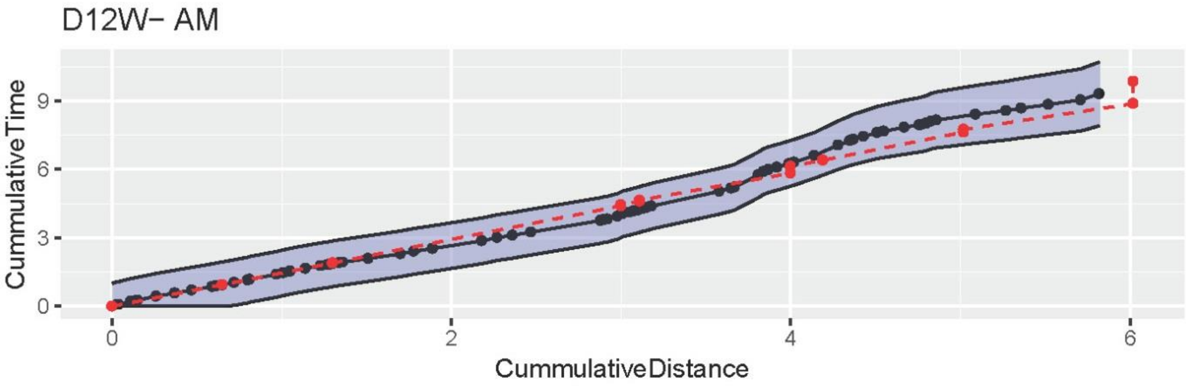
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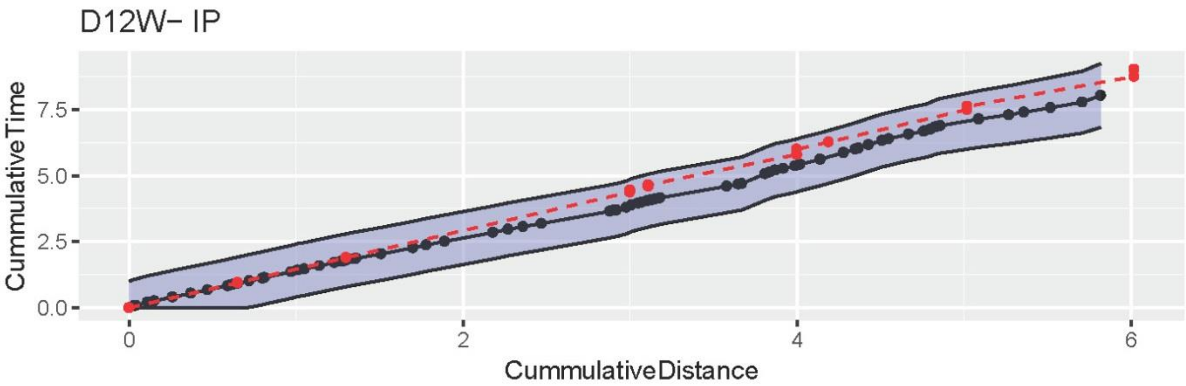
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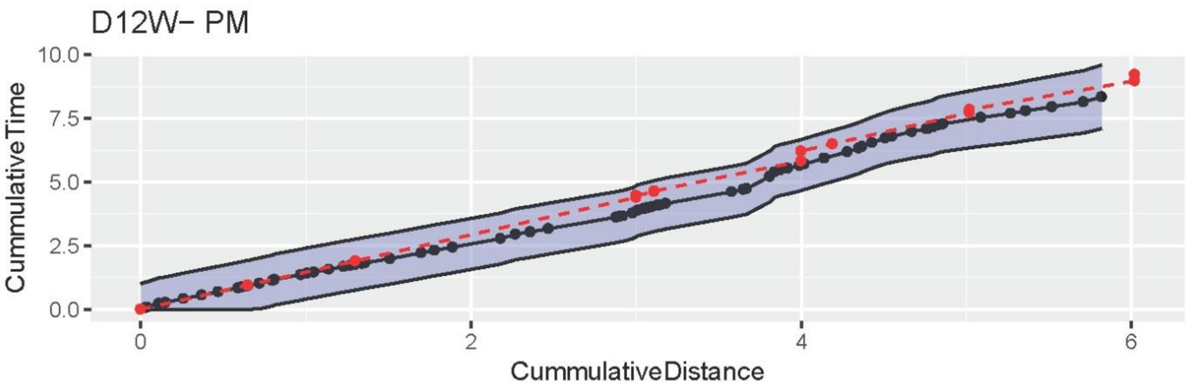
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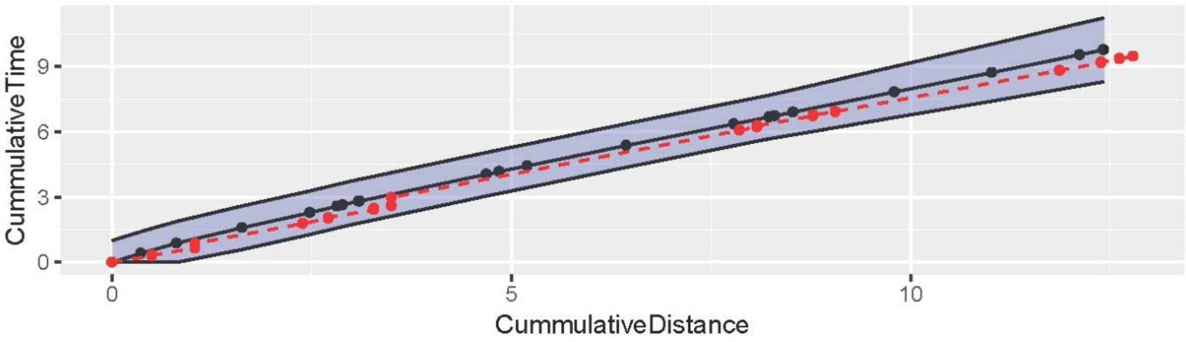

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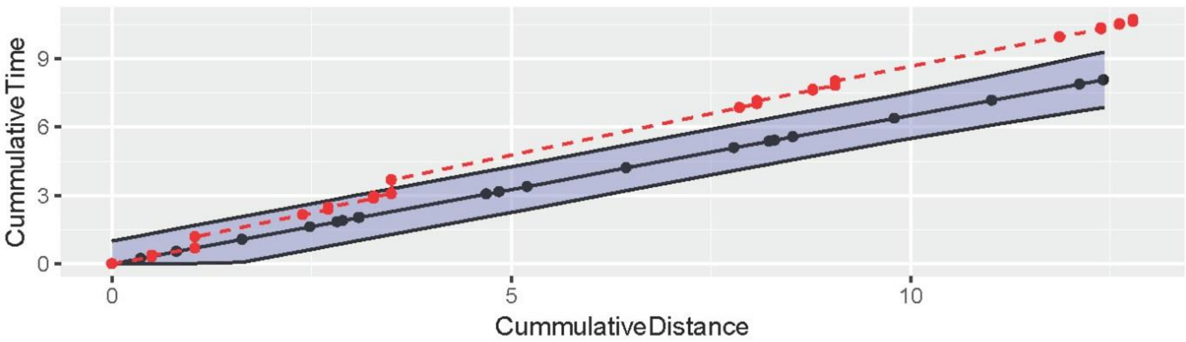
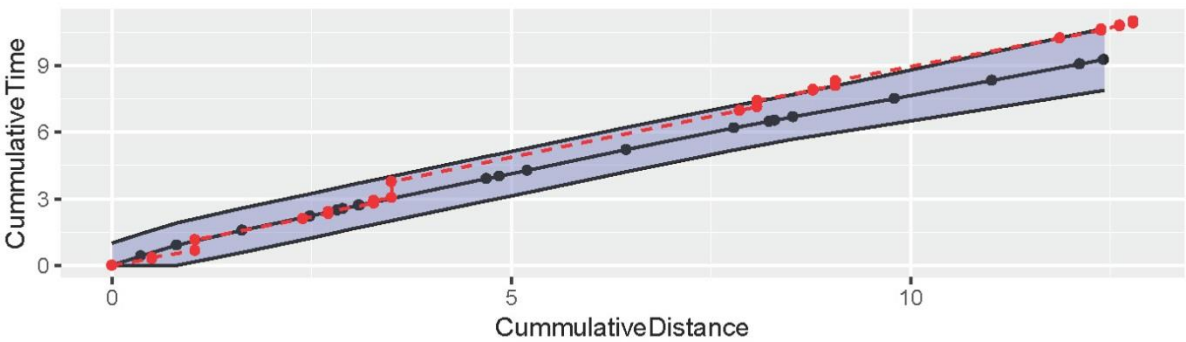
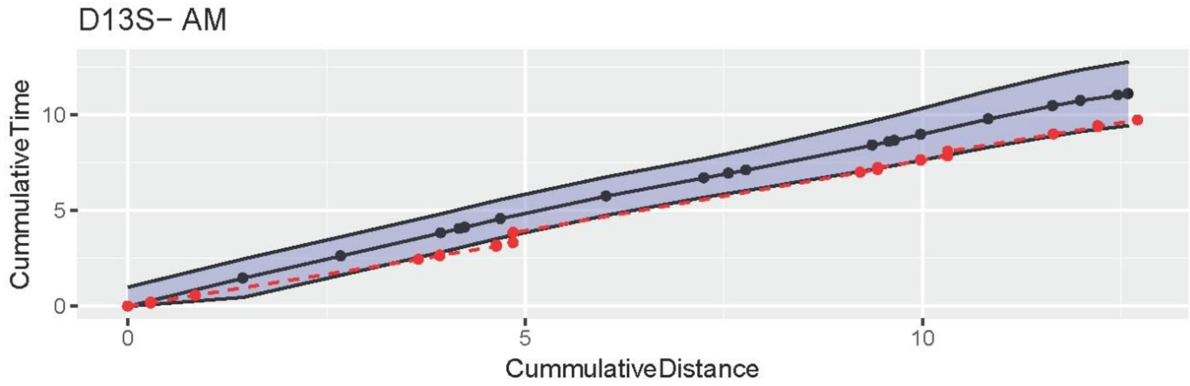


D13N- PM

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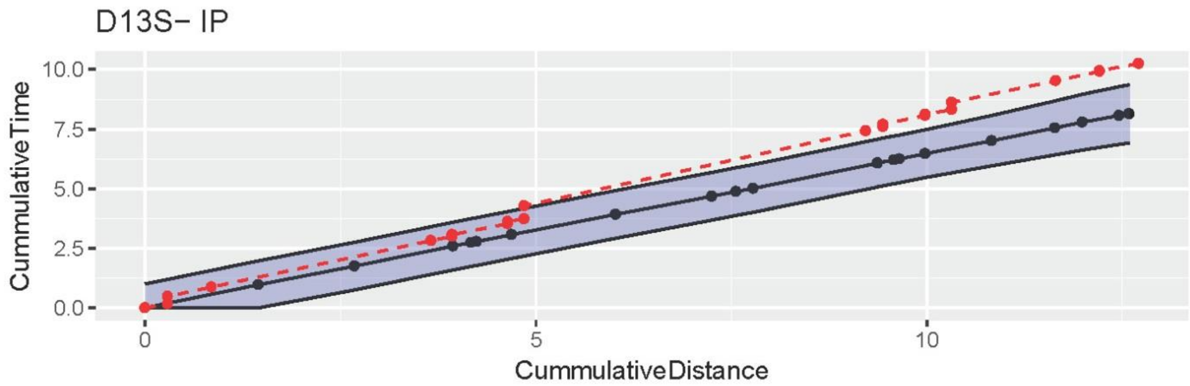
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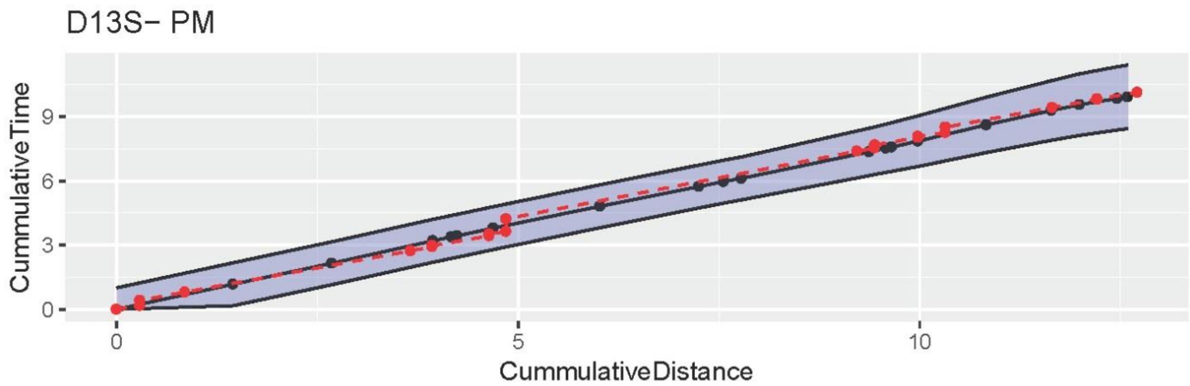
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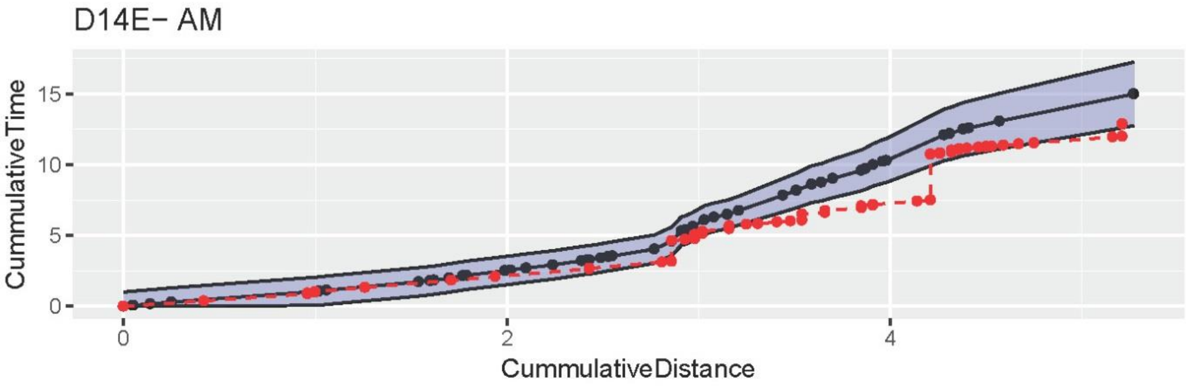
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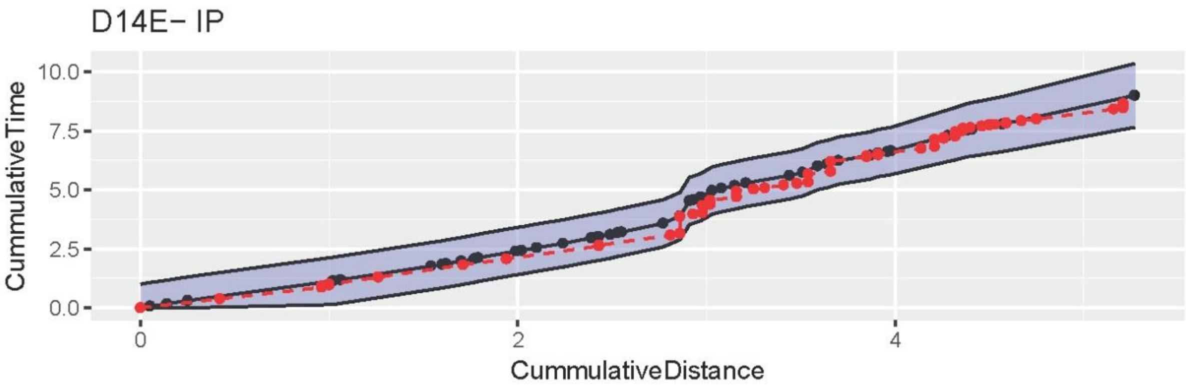
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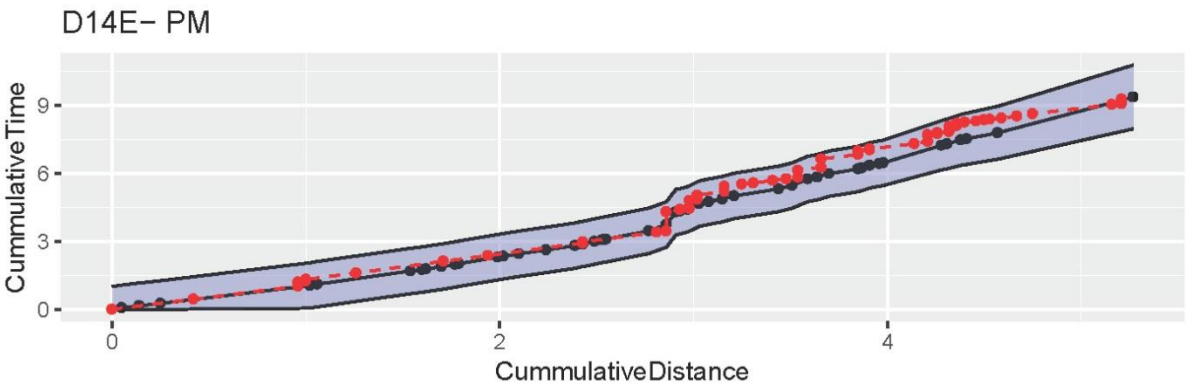
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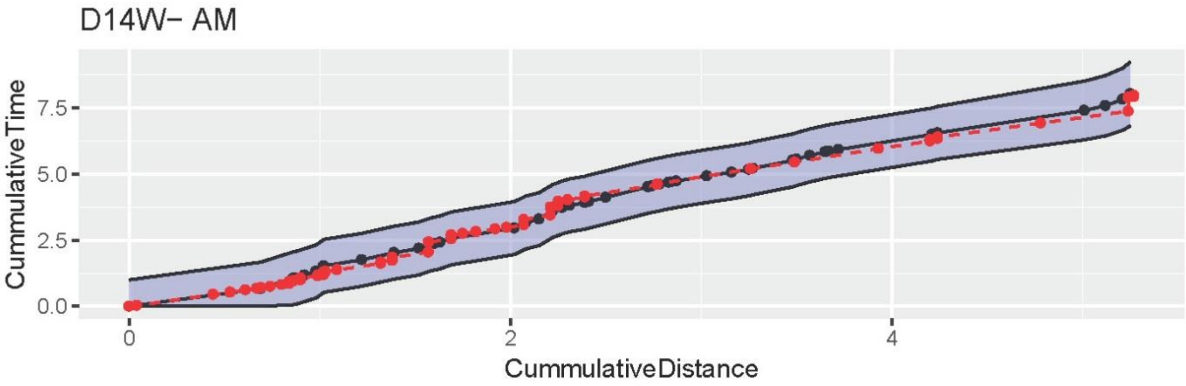
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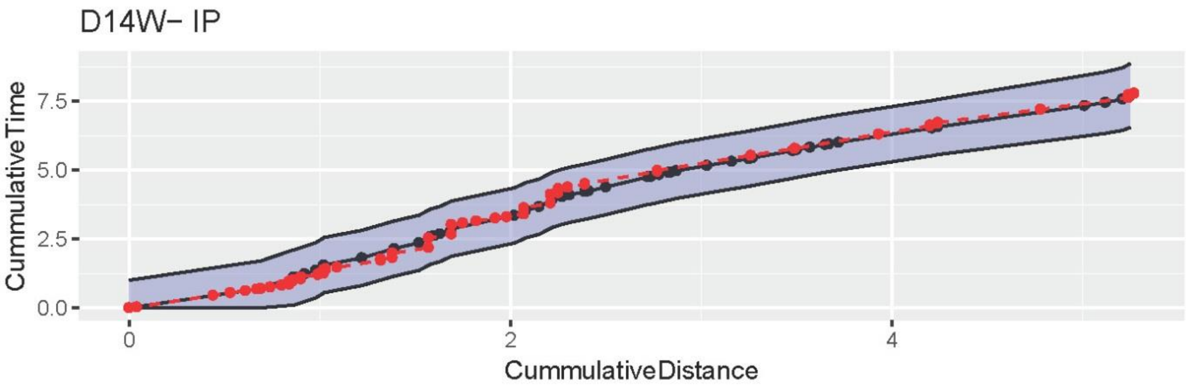
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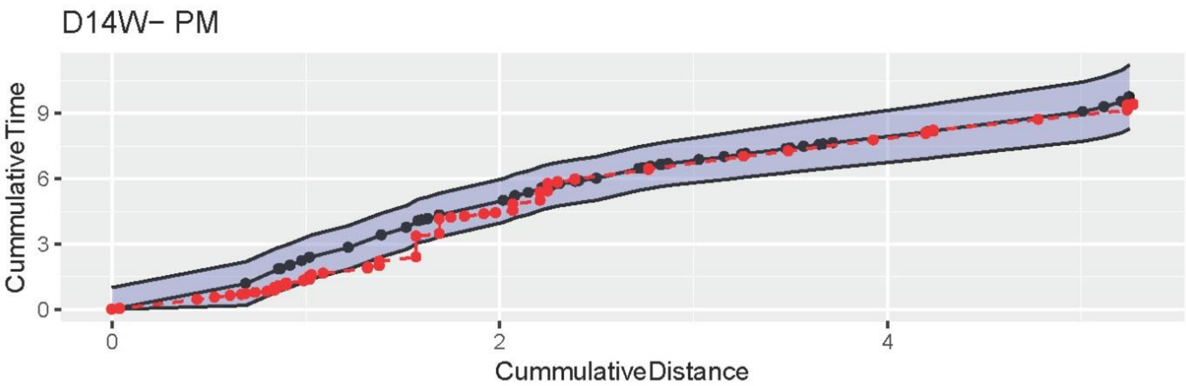
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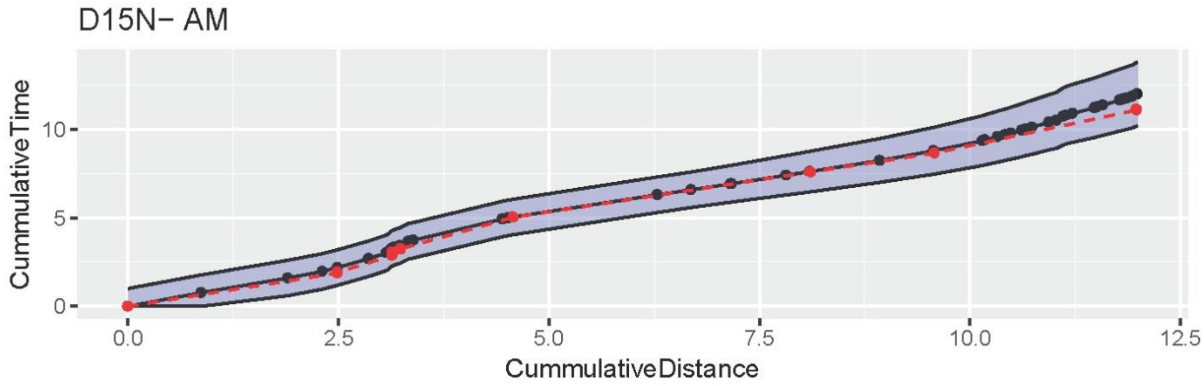
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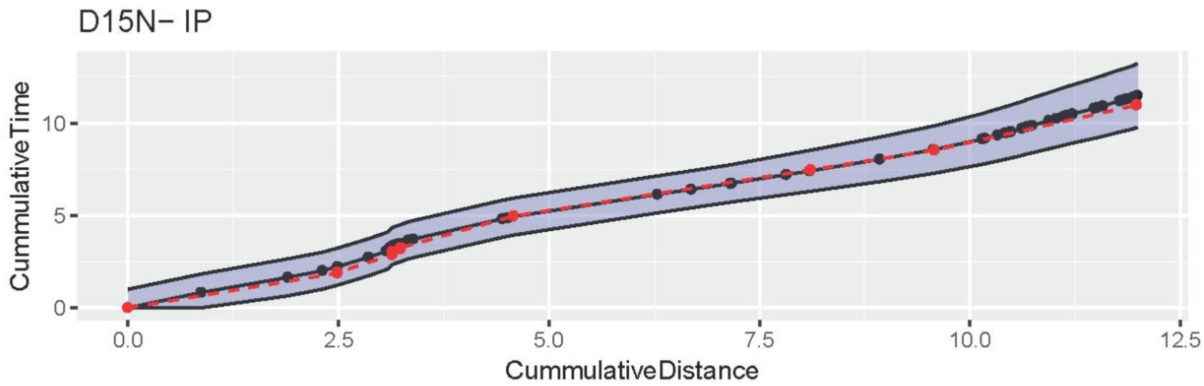
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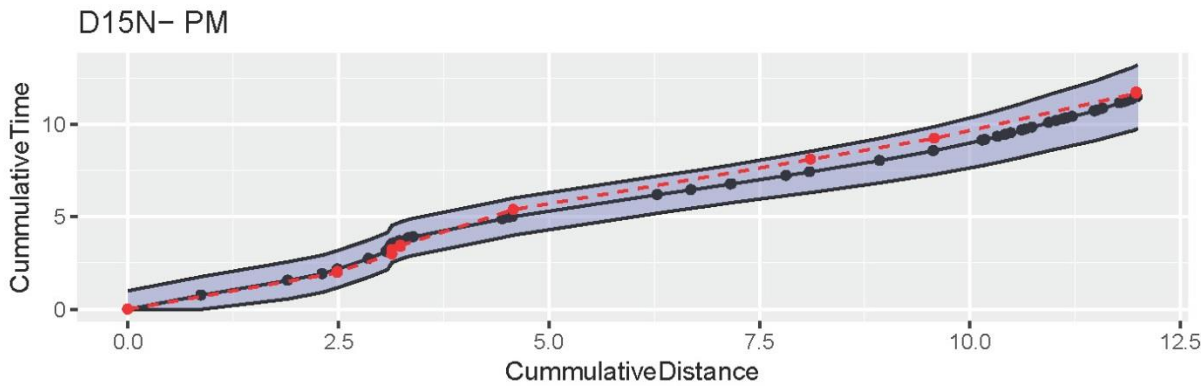
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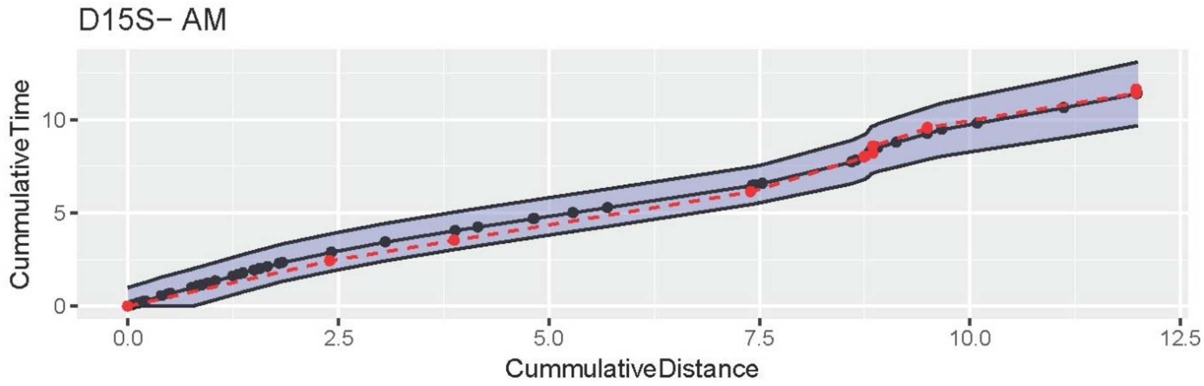
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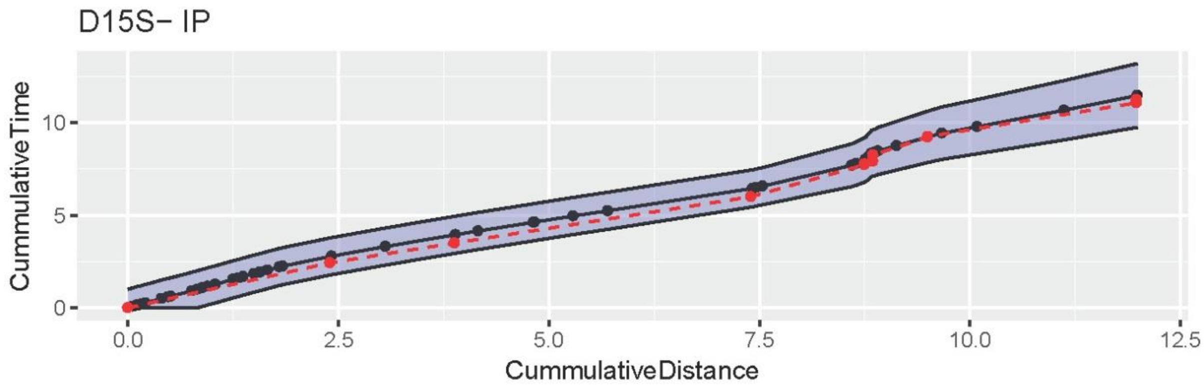
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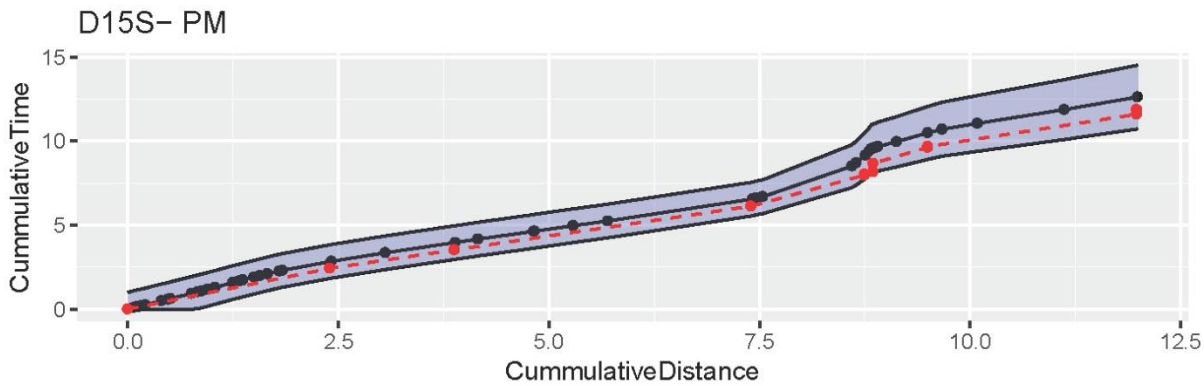
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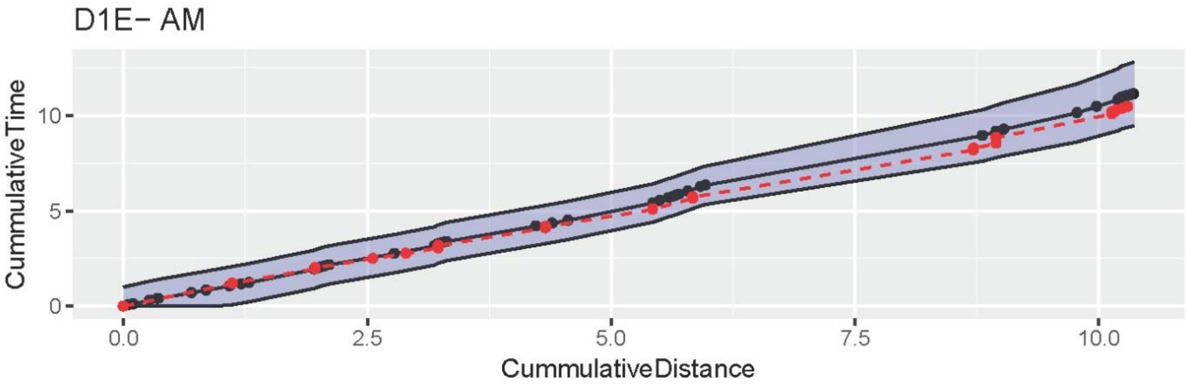
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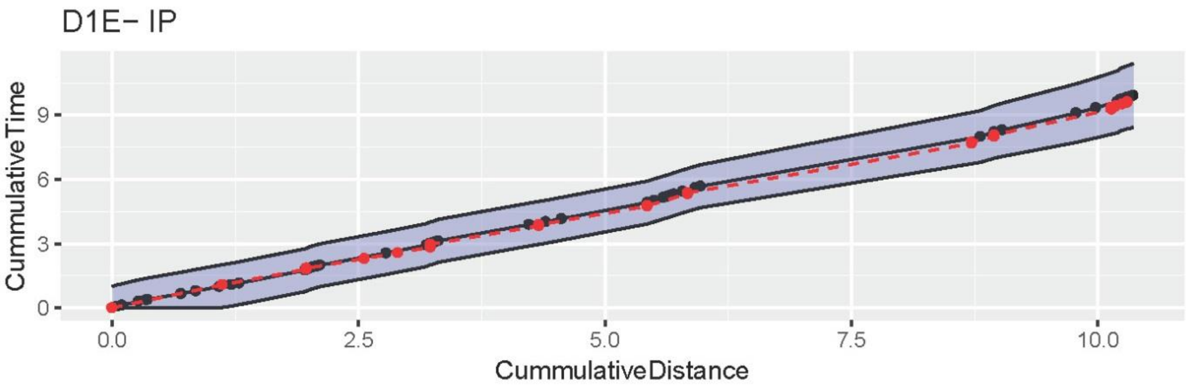
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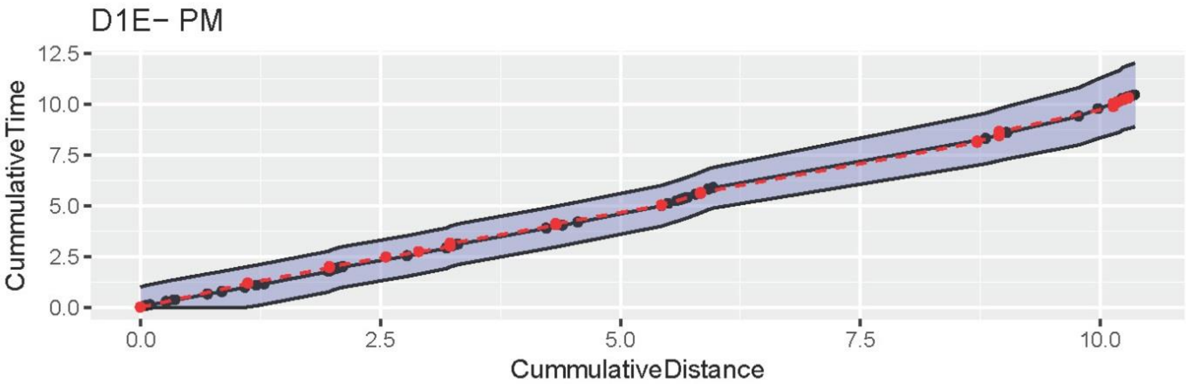
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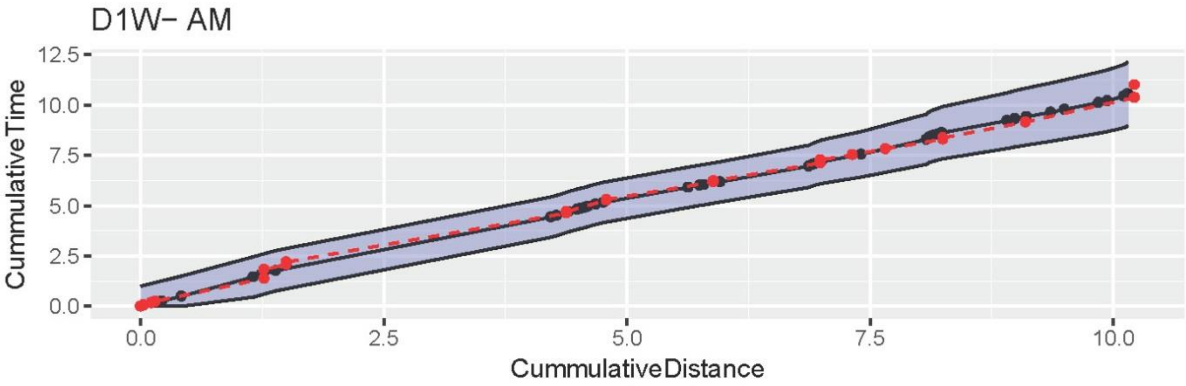
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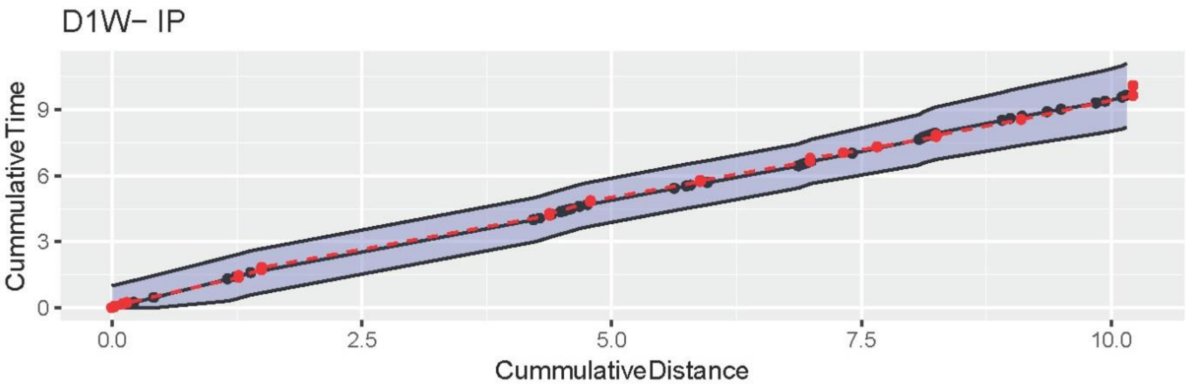
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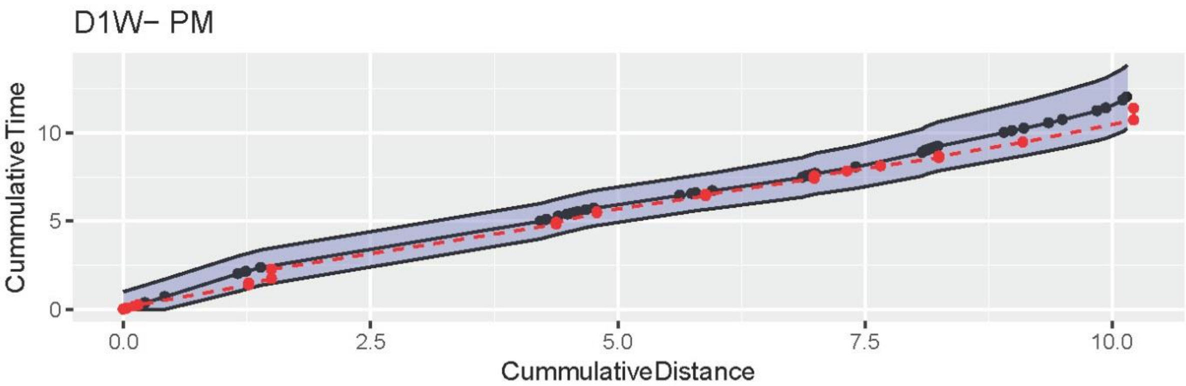
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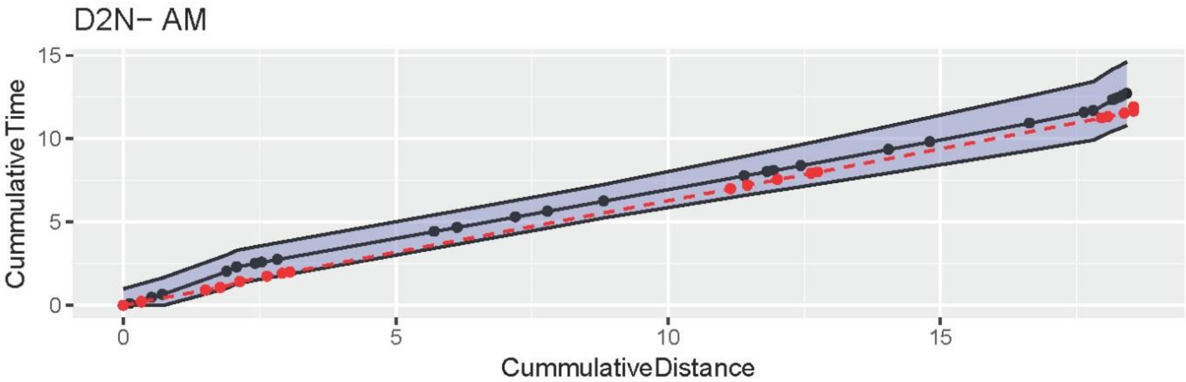
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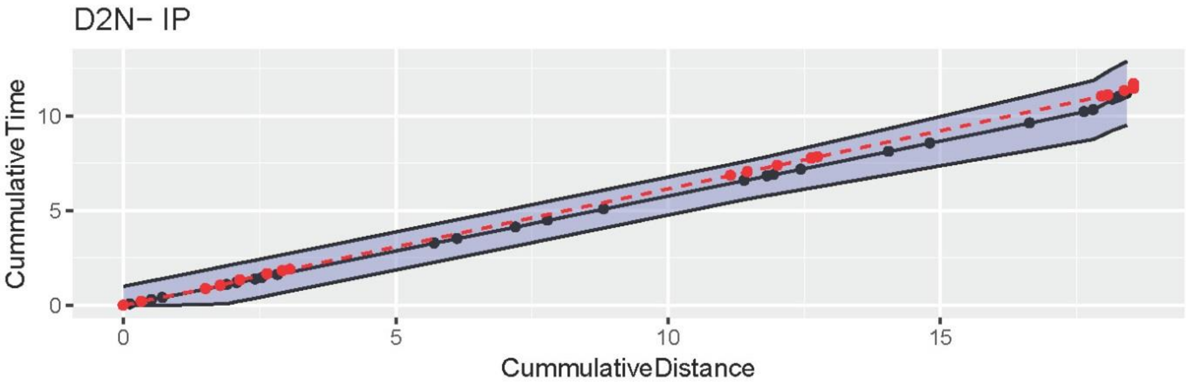
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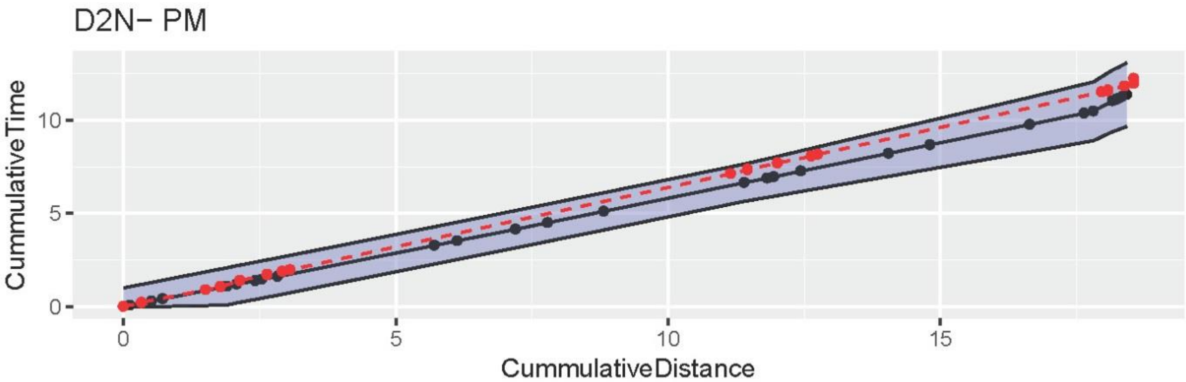
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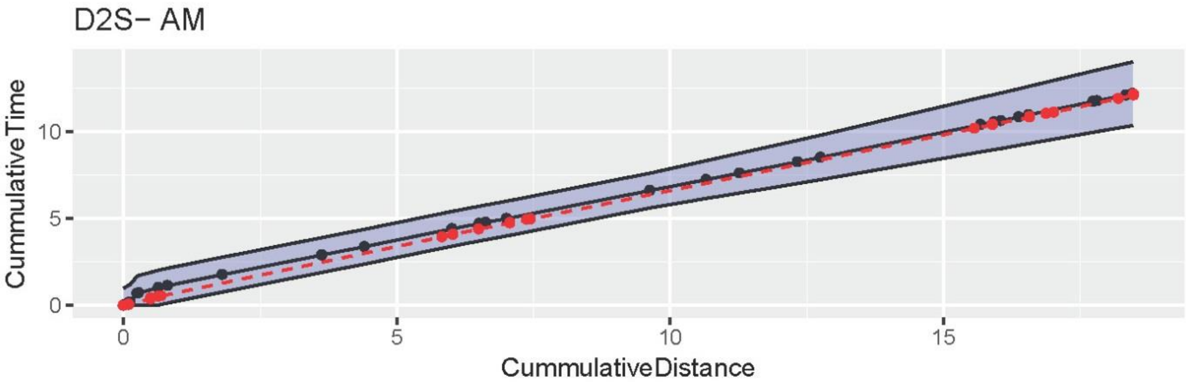
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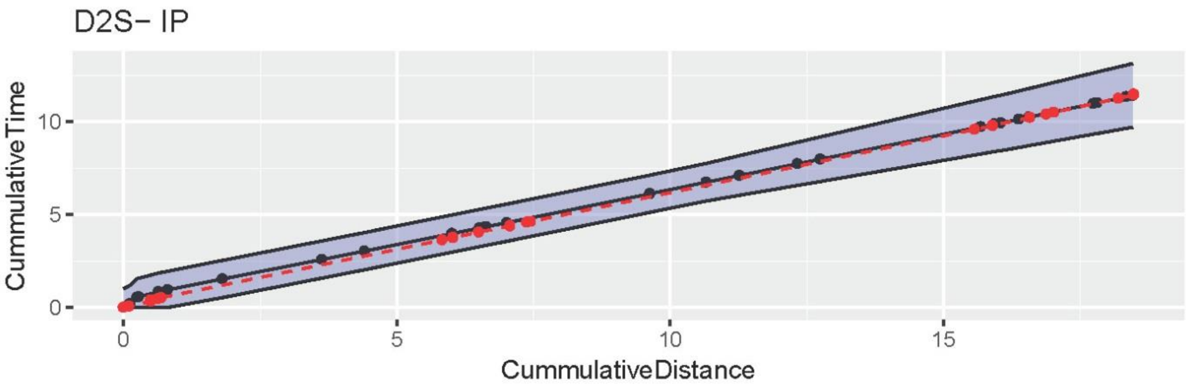
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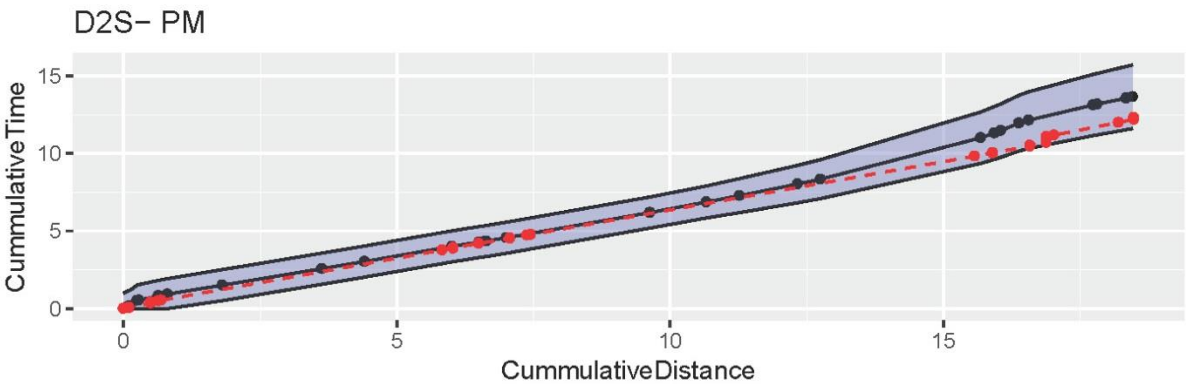
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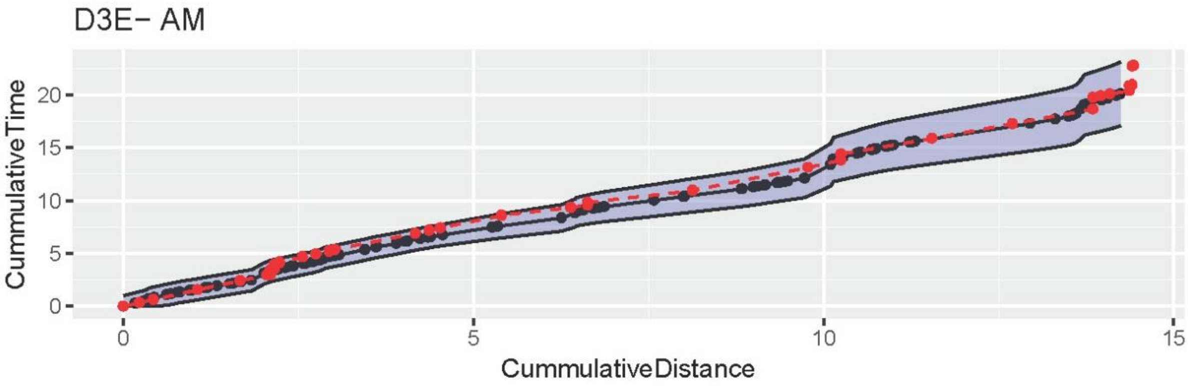
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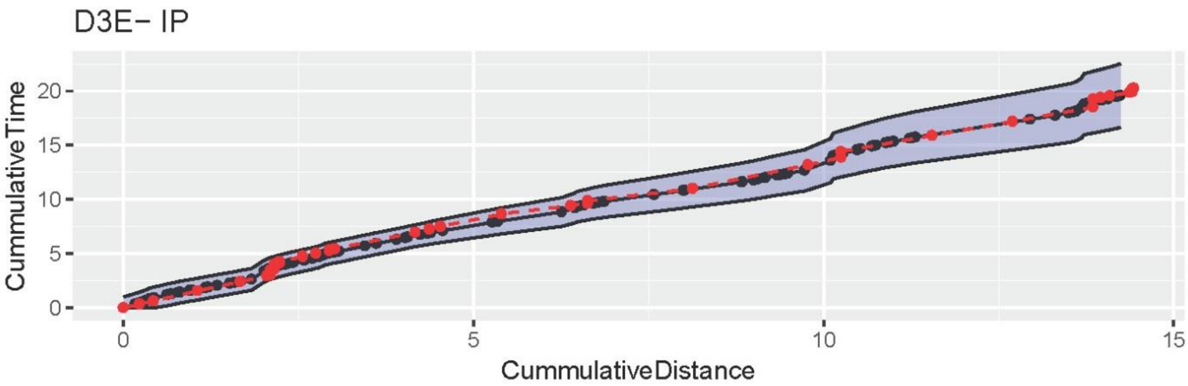
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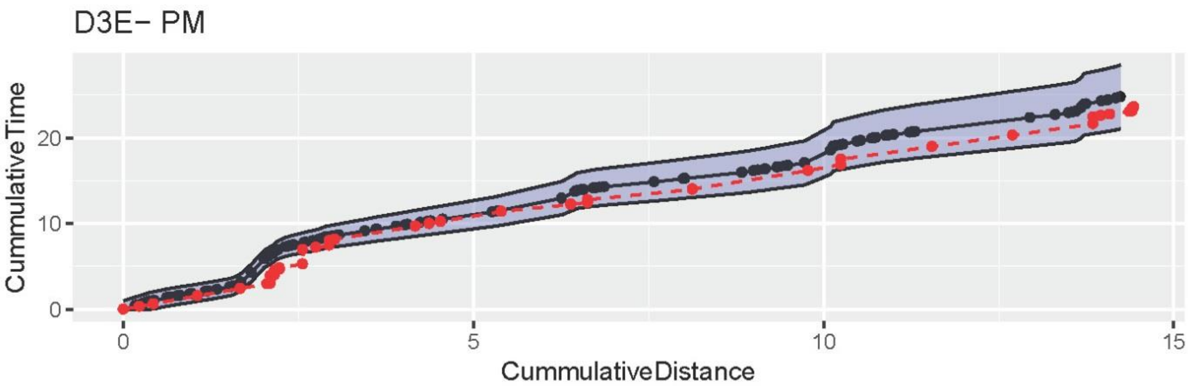
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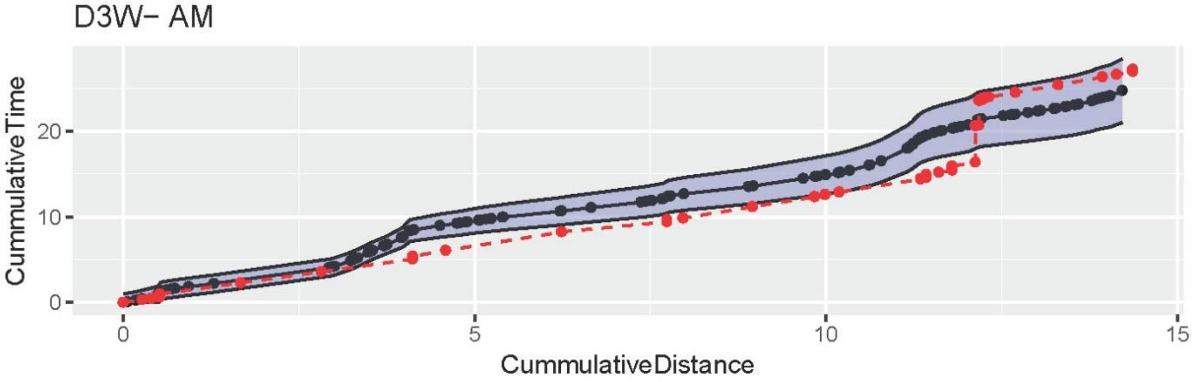
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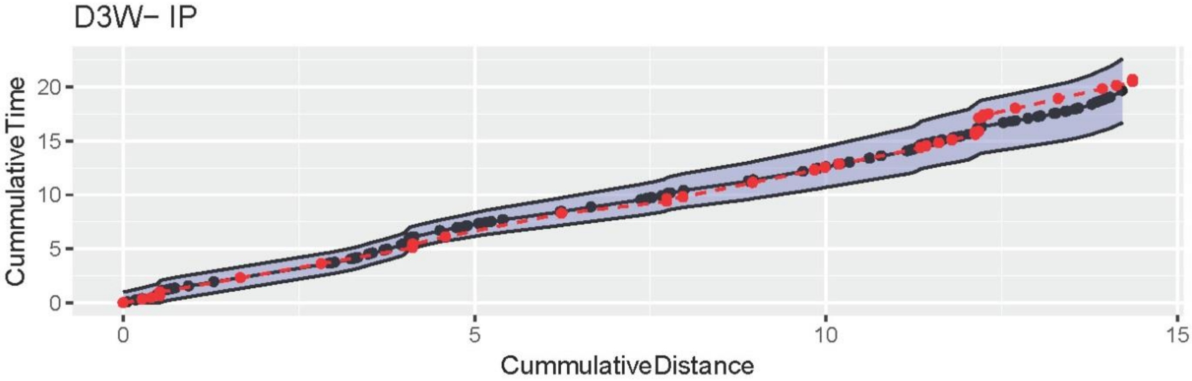
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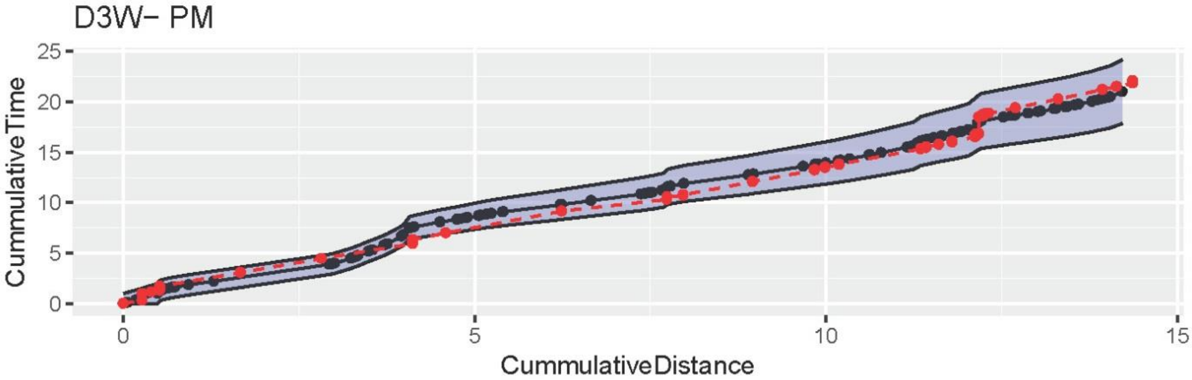
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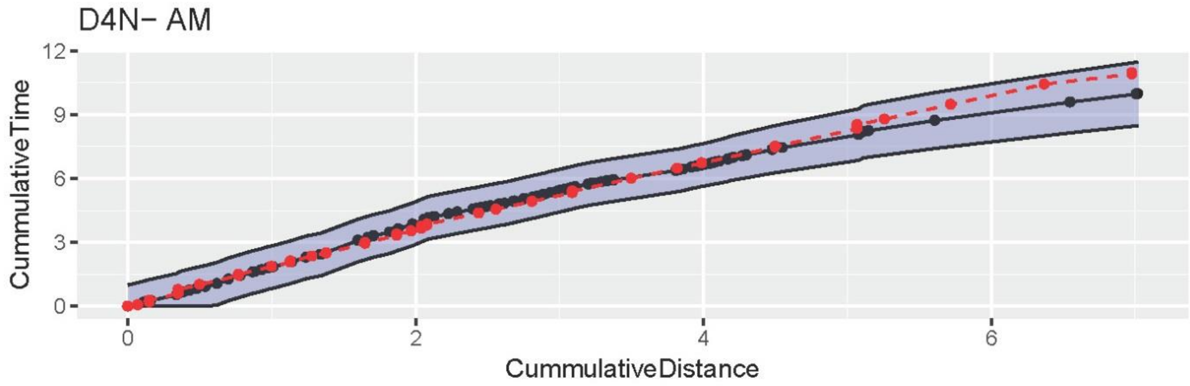
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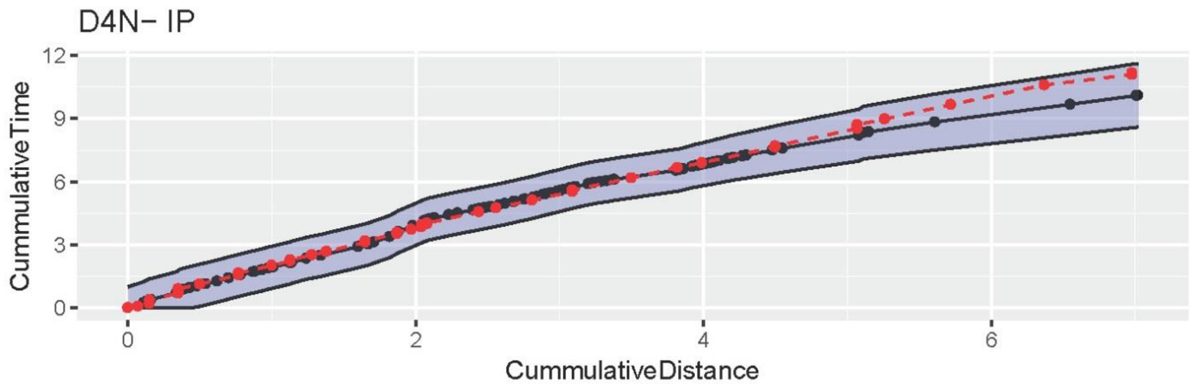
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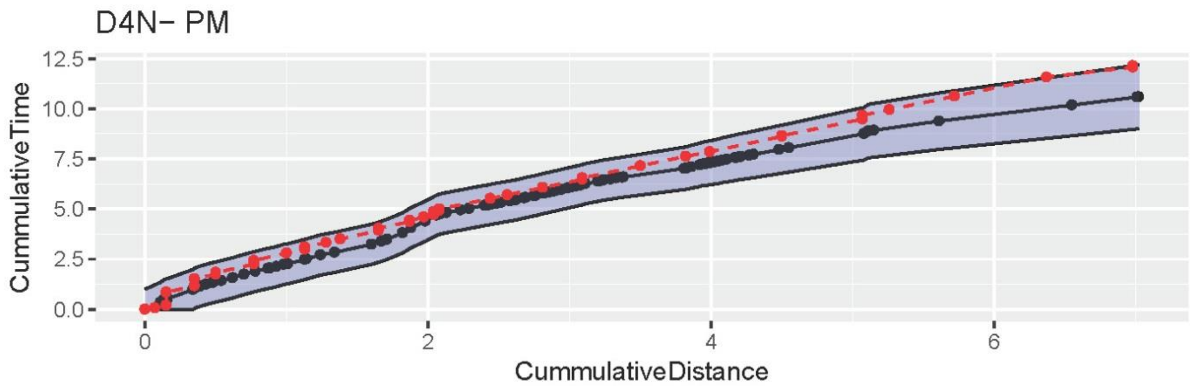
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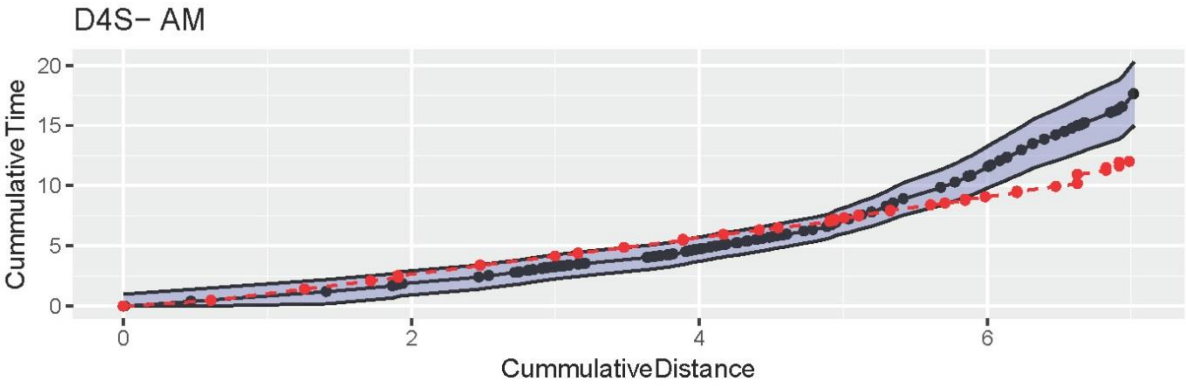
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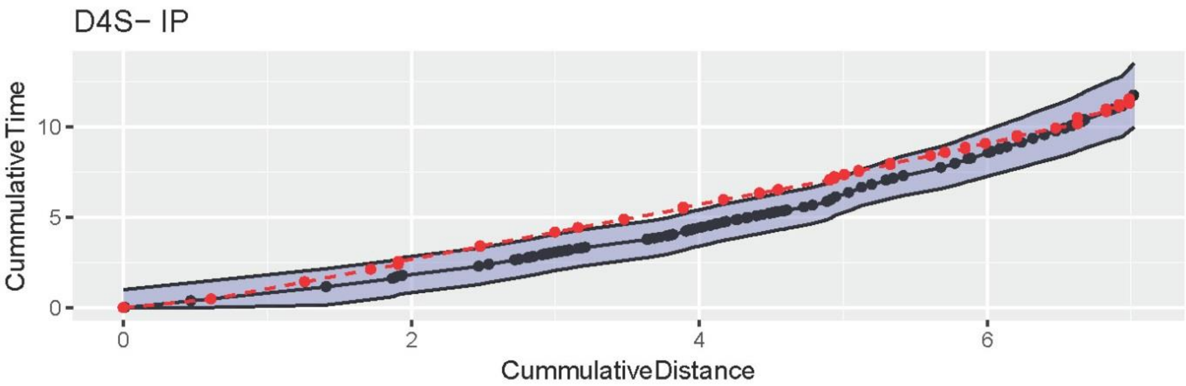
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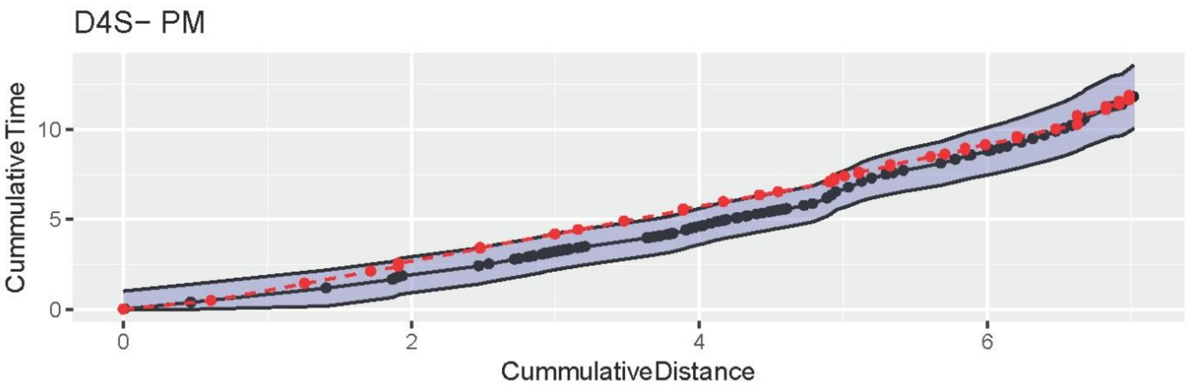
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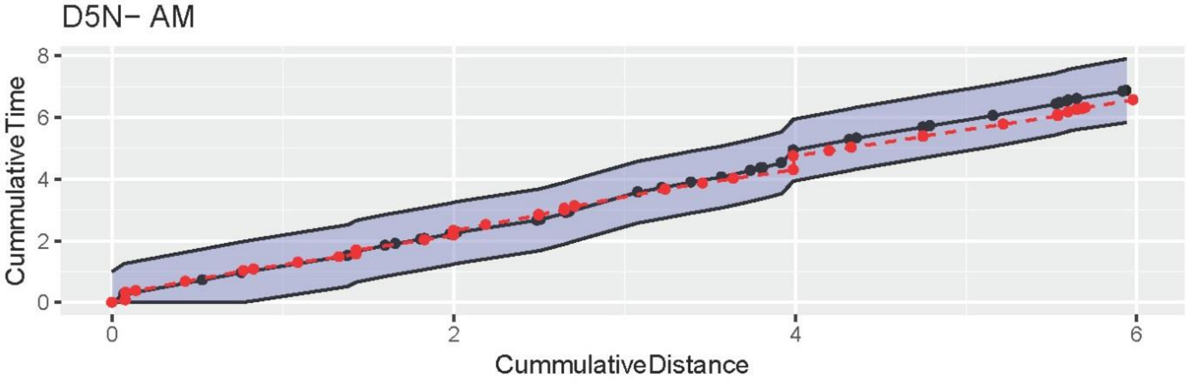
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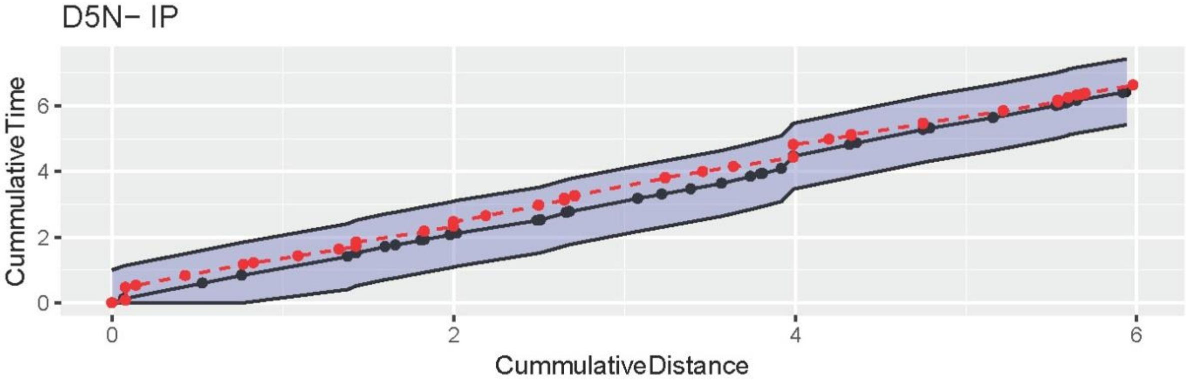
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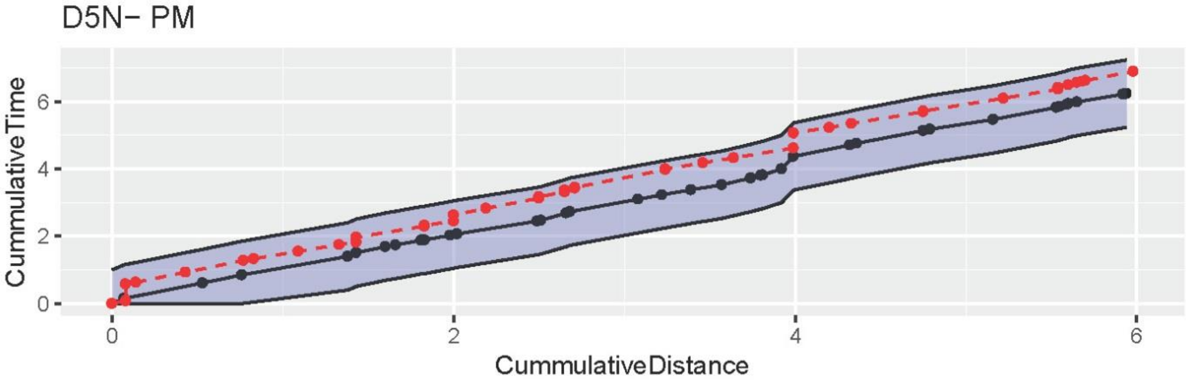
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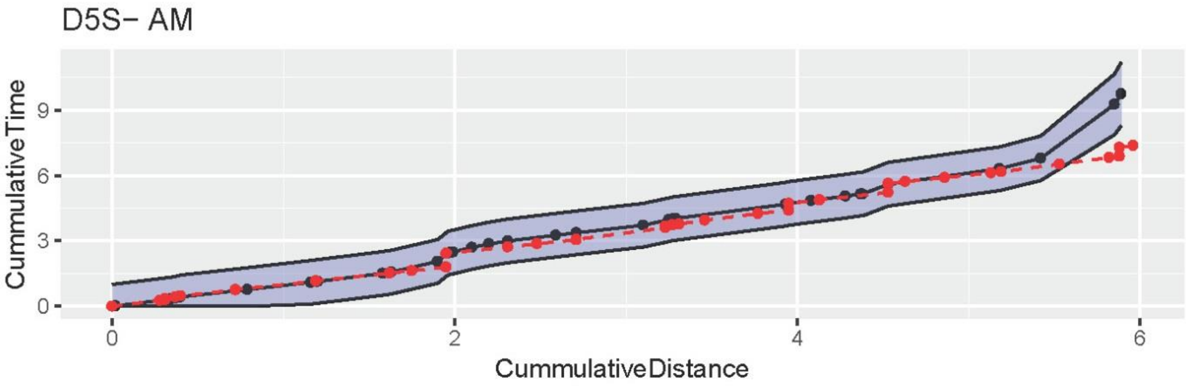
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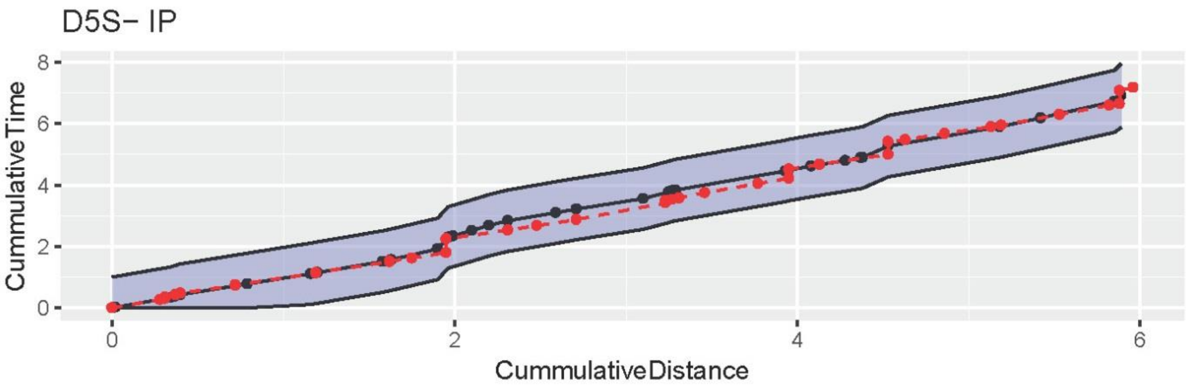
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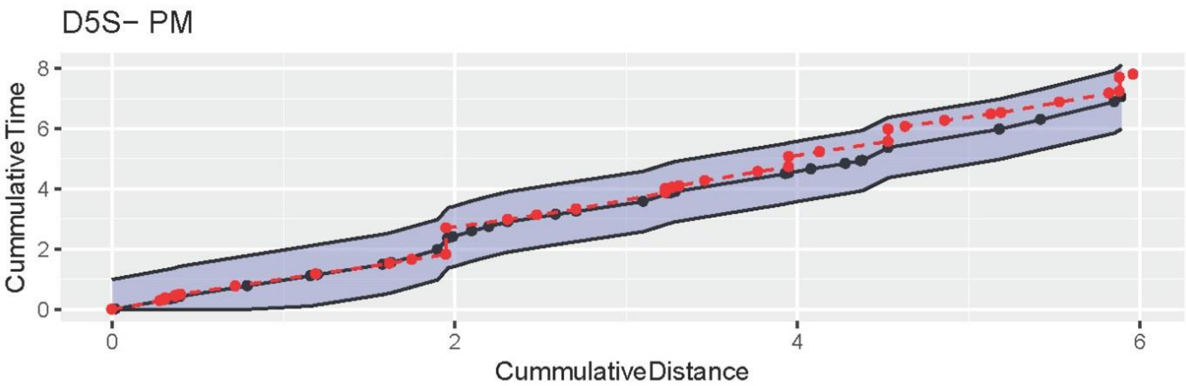
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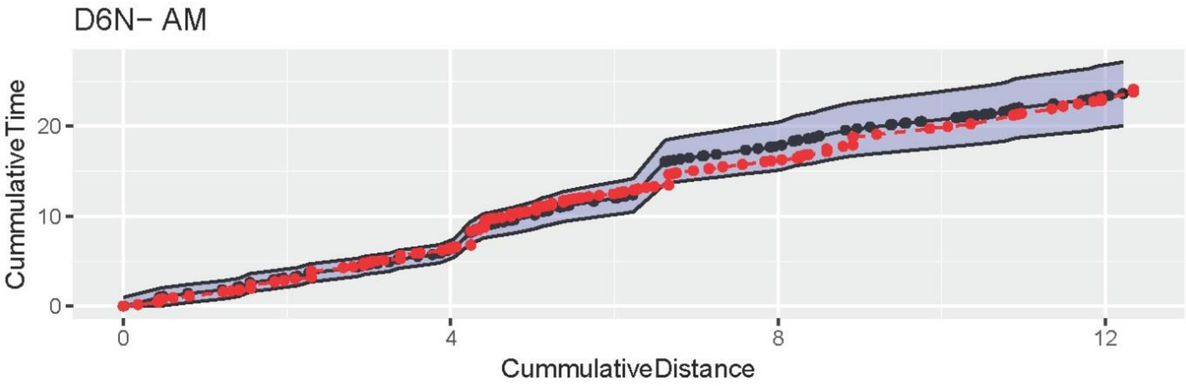
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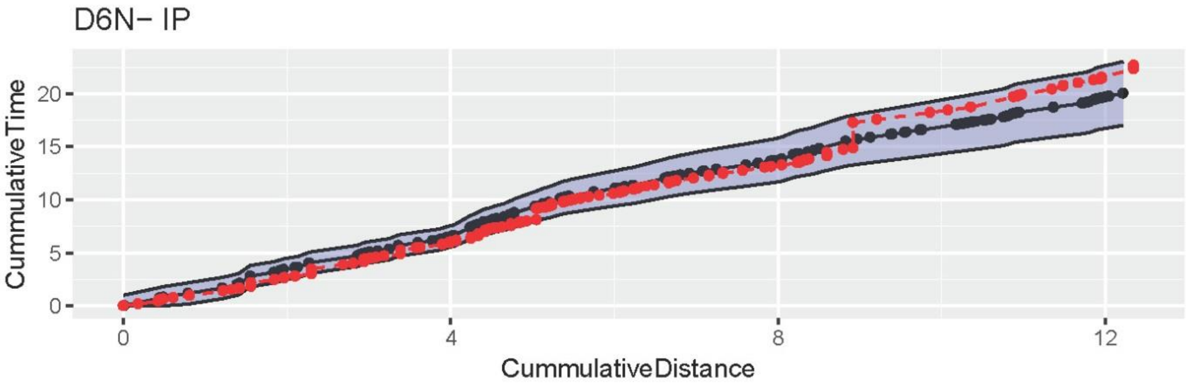
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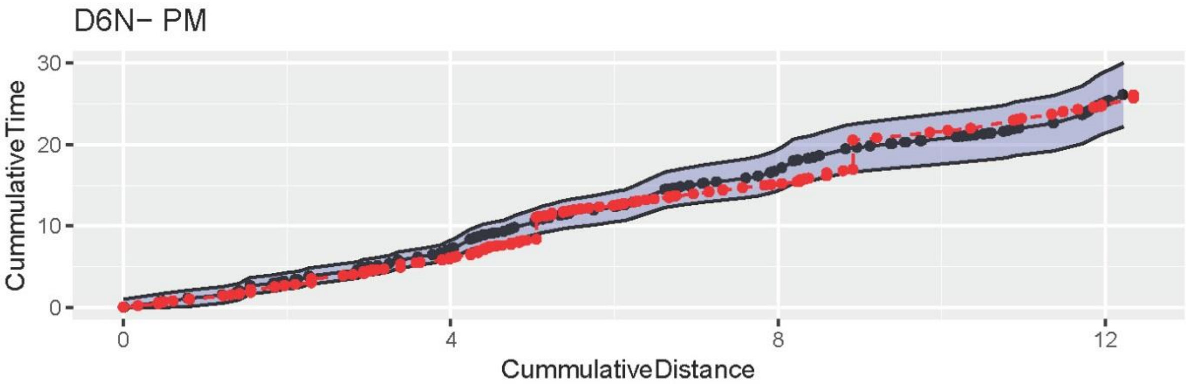
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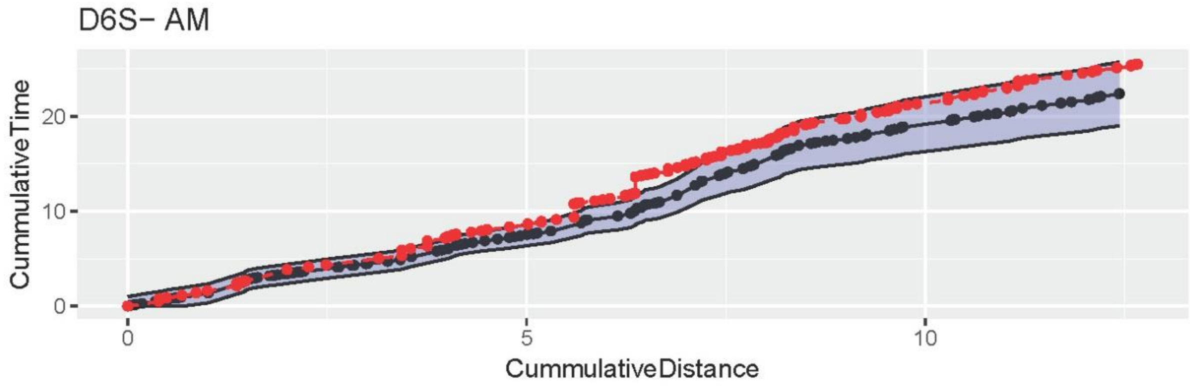
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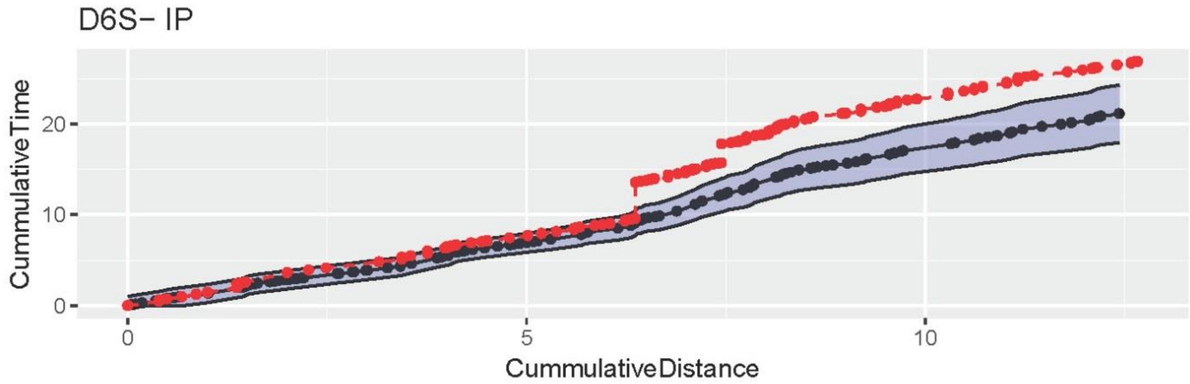
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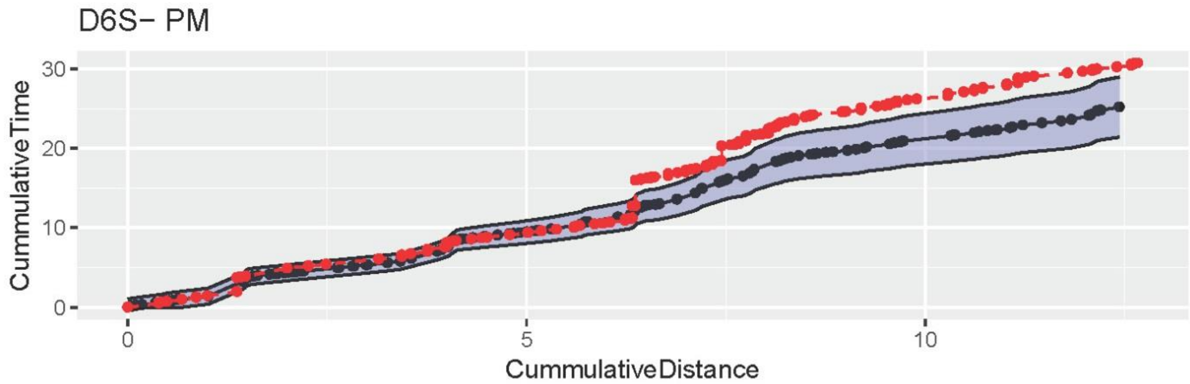
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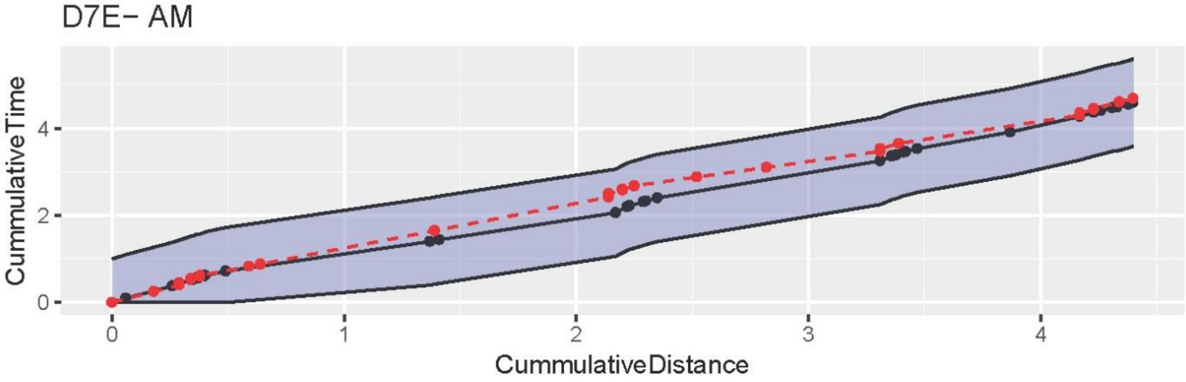
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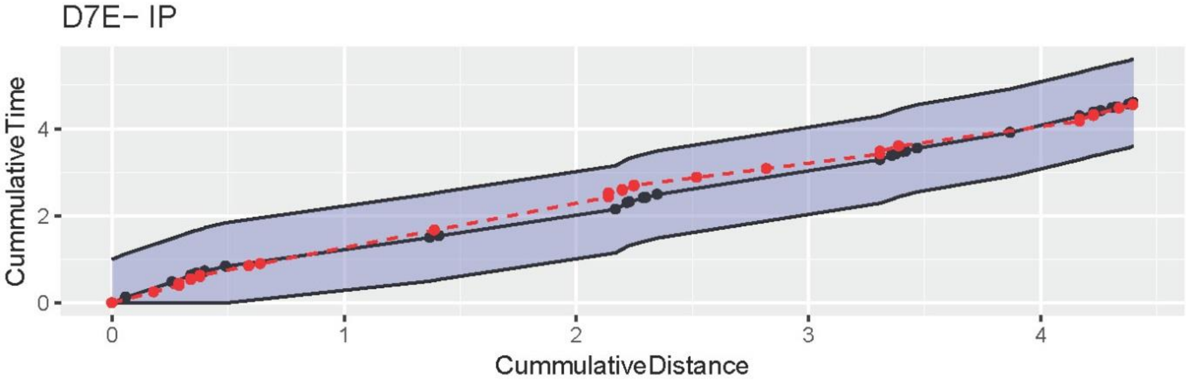
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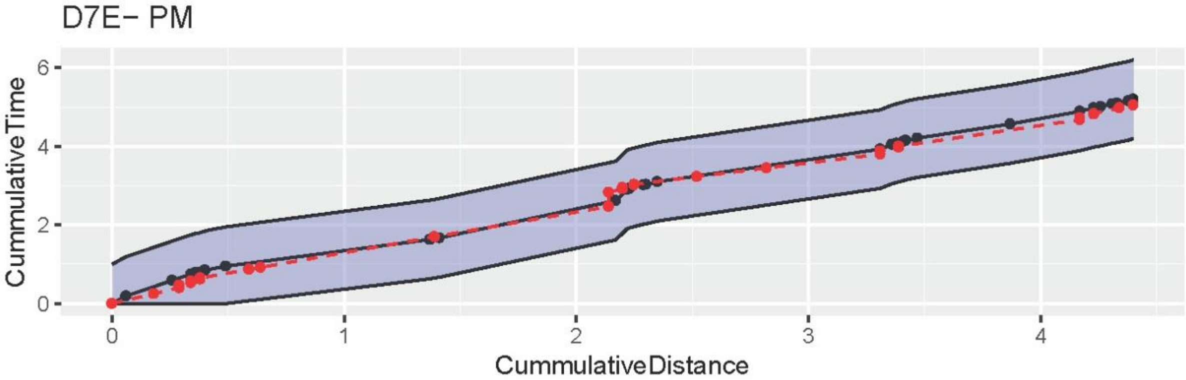
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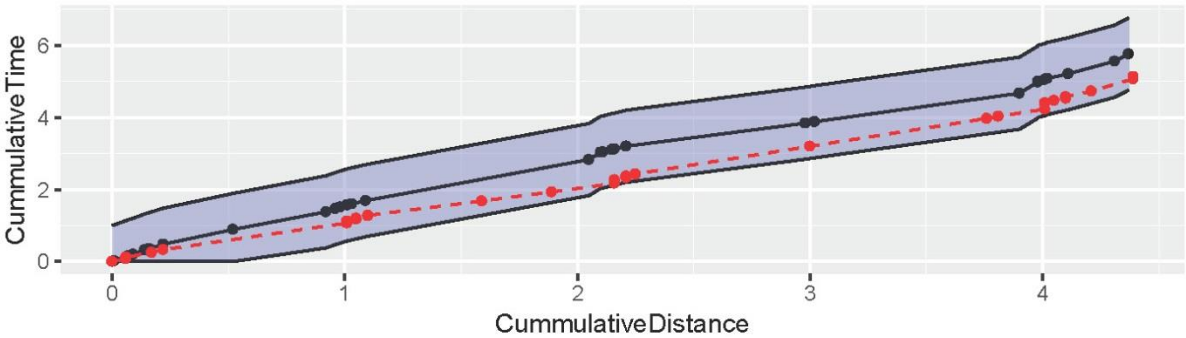
D7W- AM



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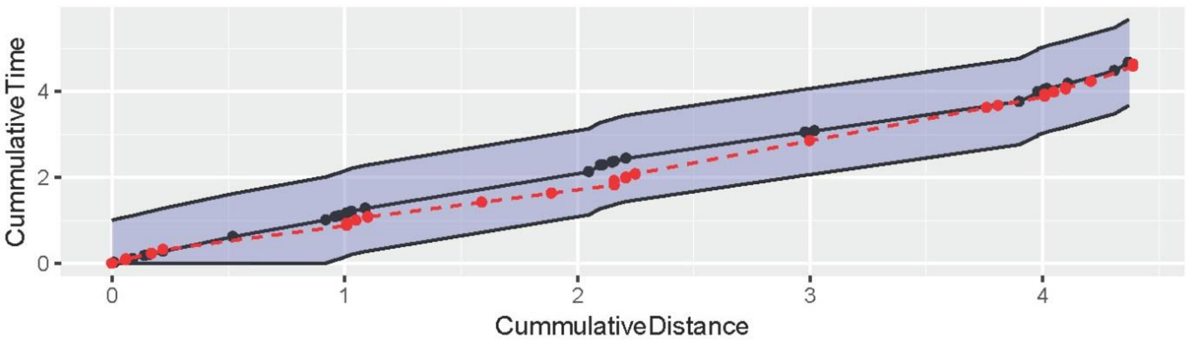

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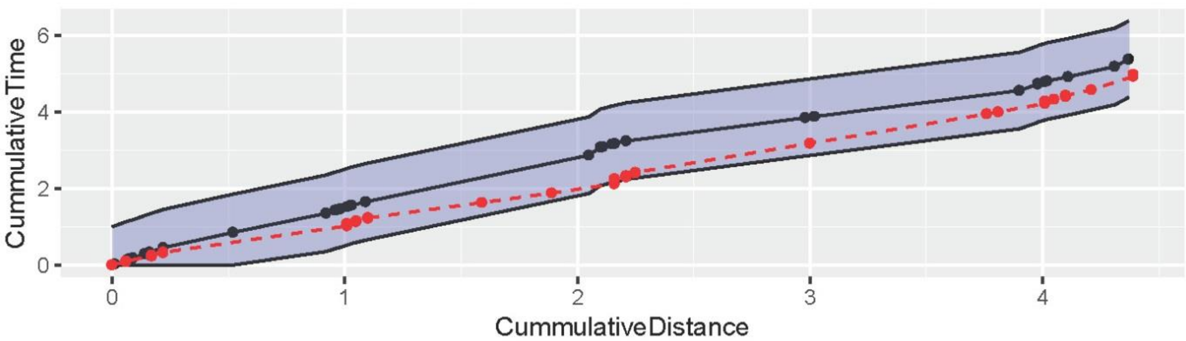

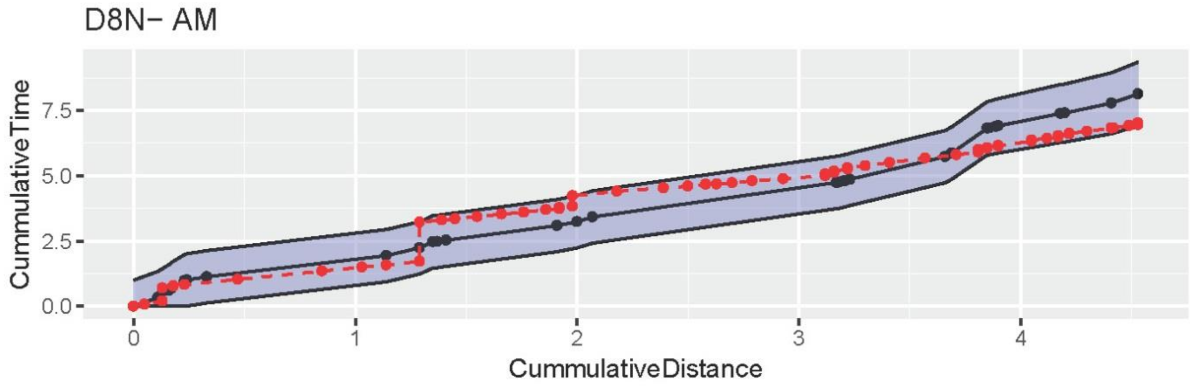
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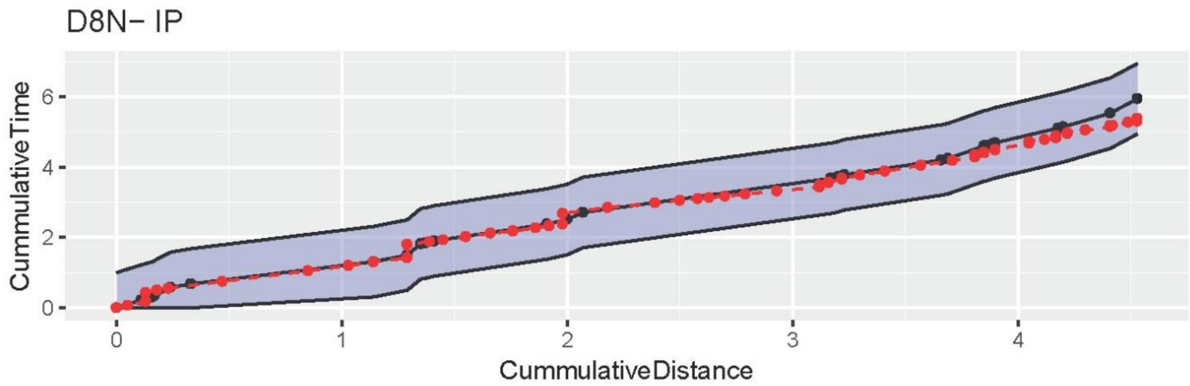
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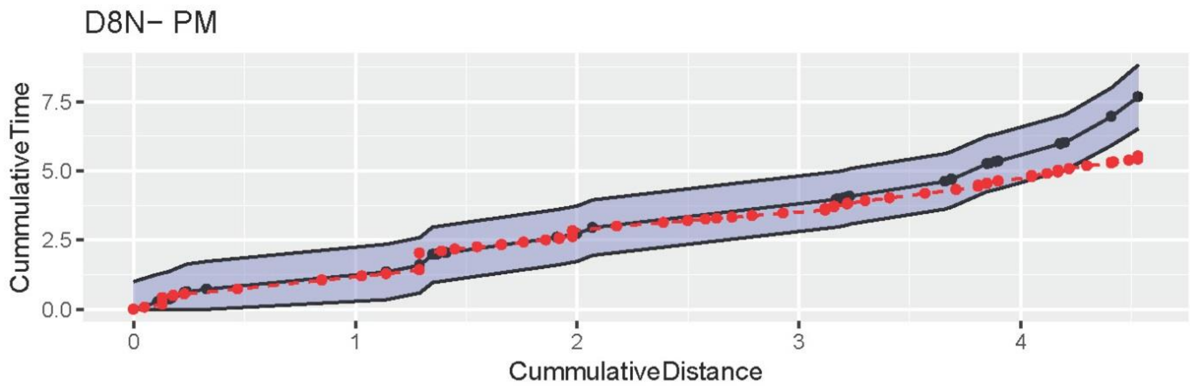
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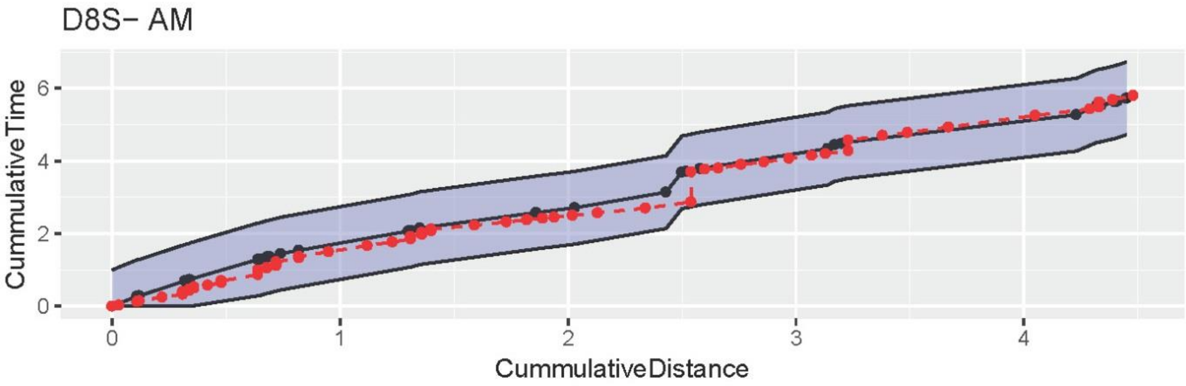
CummulativeDistance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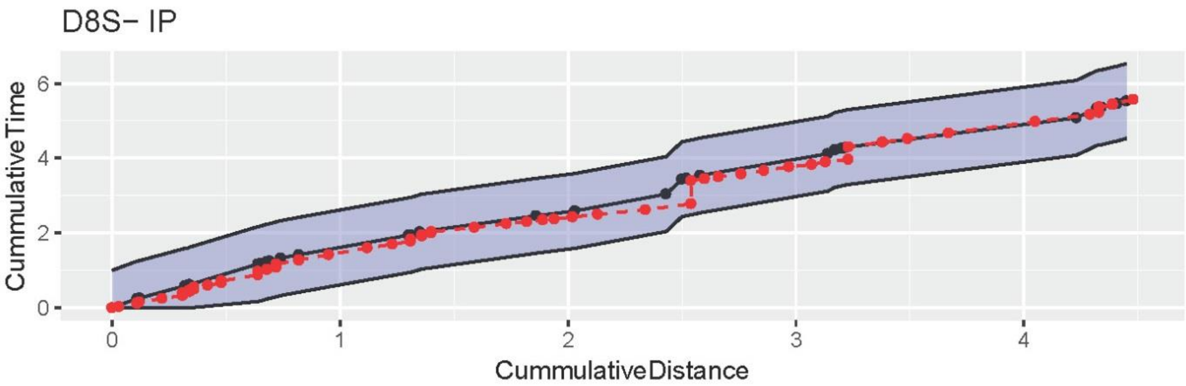
CummulativeDistance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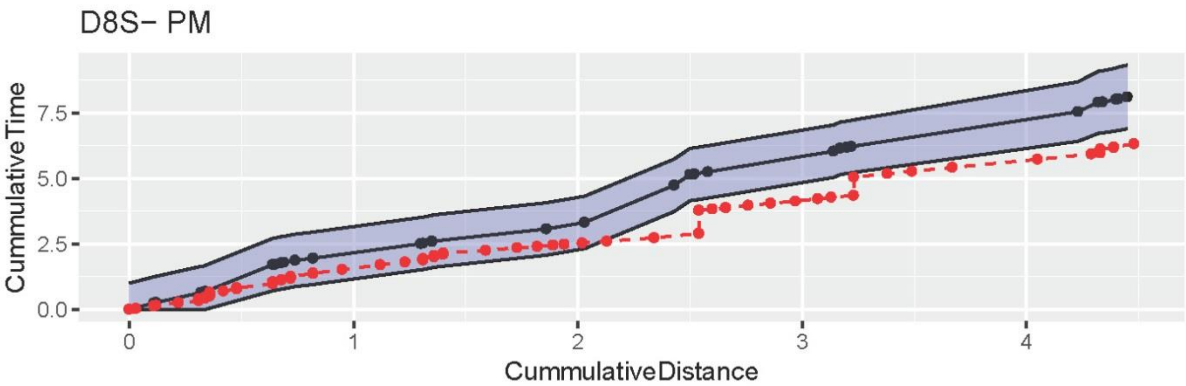
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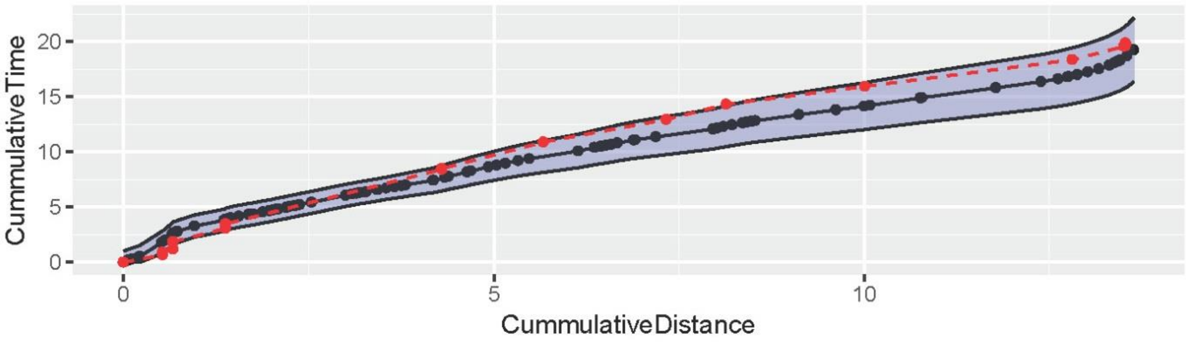

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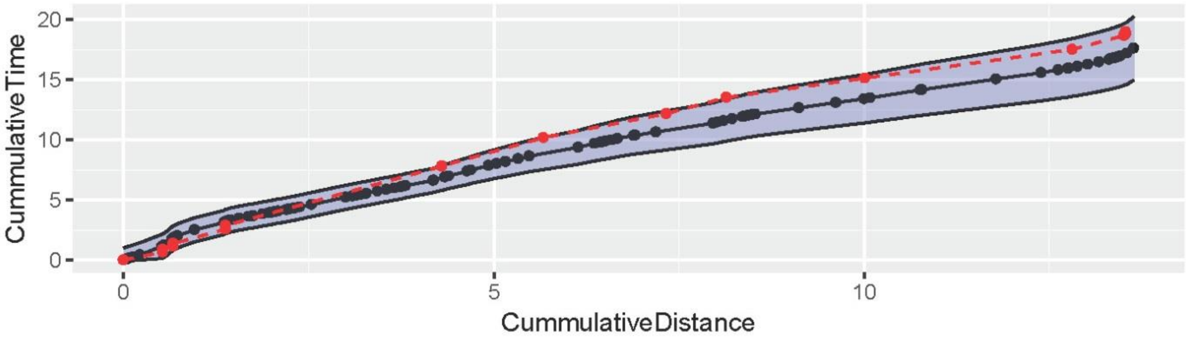

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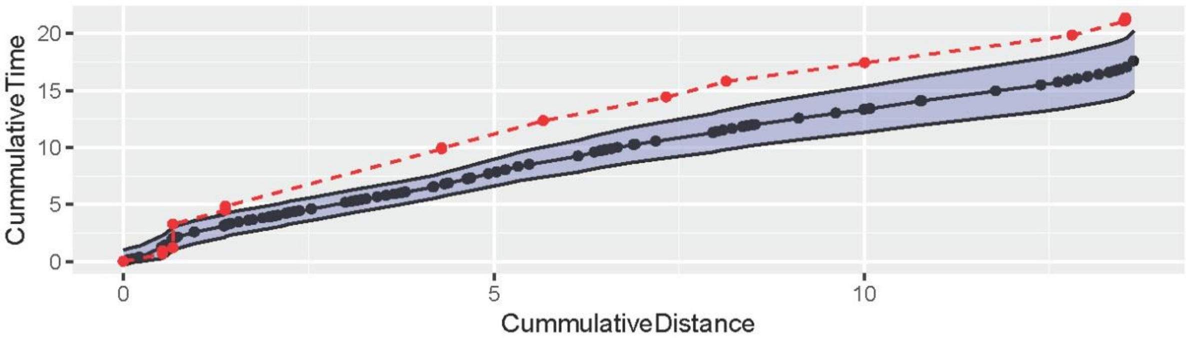

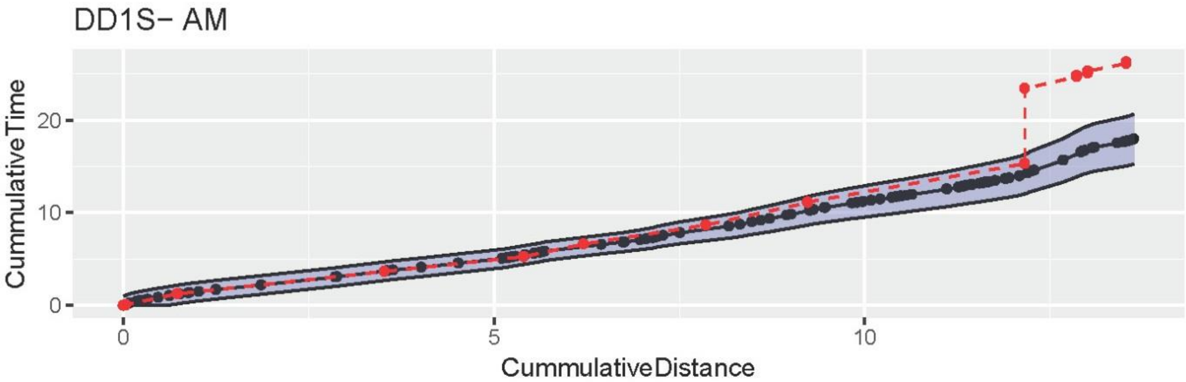
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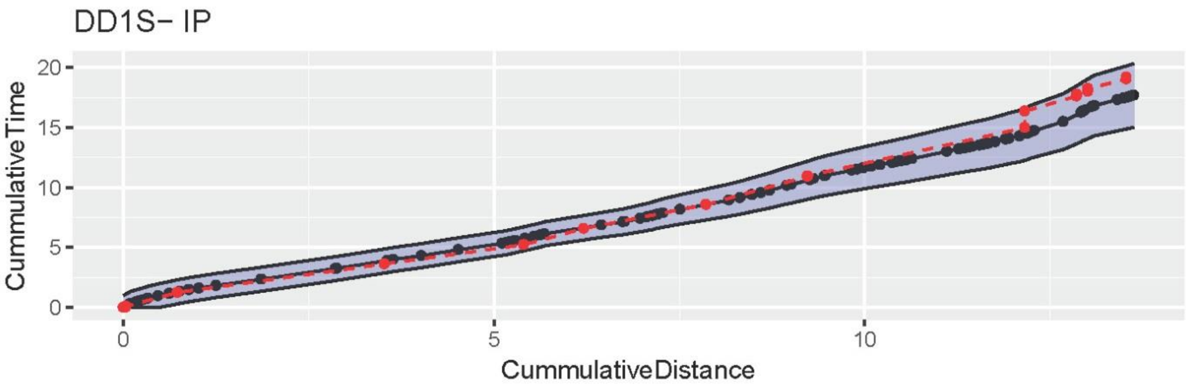
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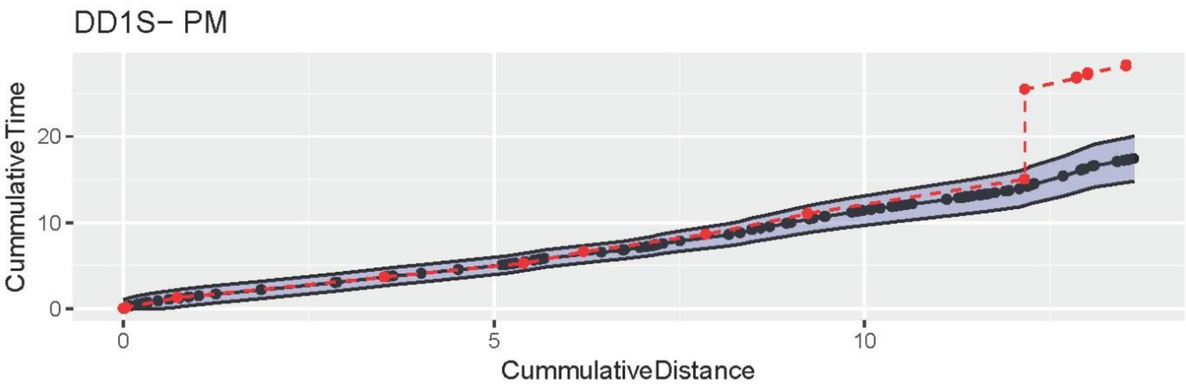
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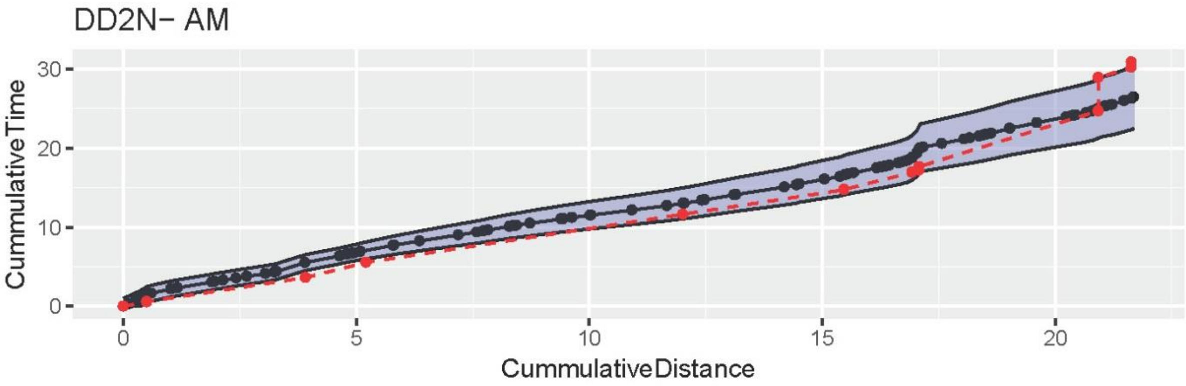
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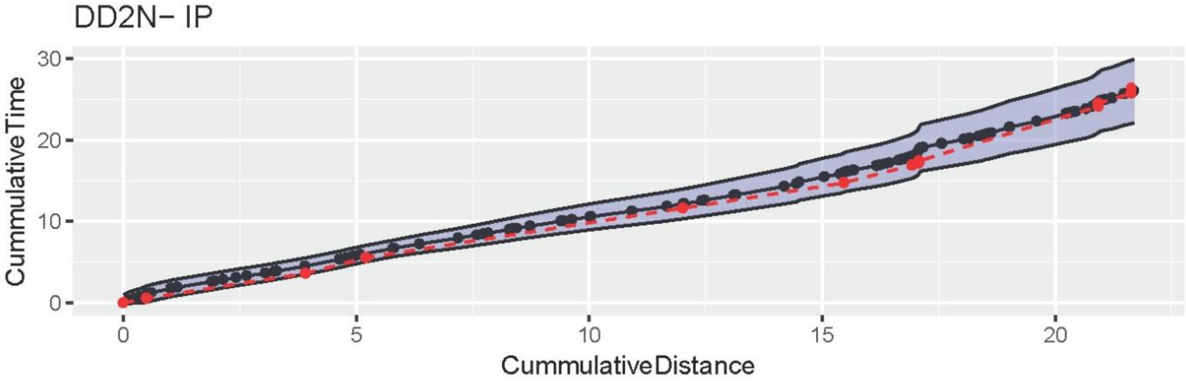
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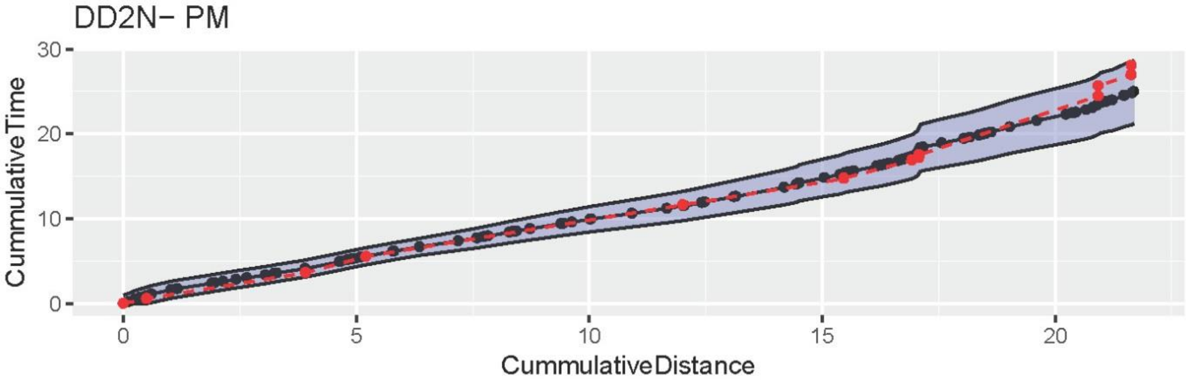
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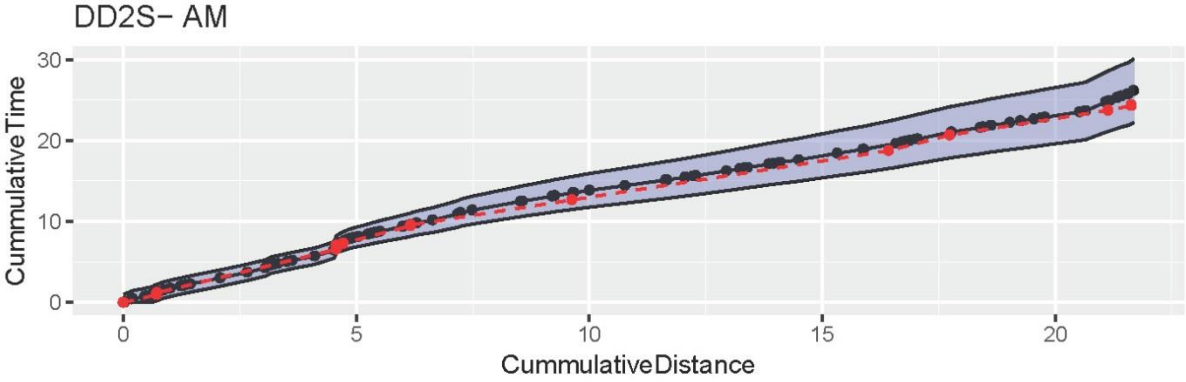
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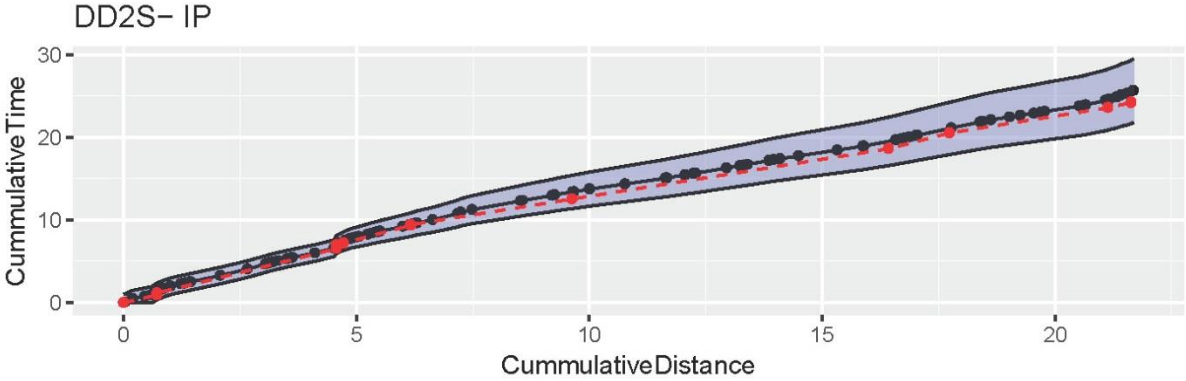
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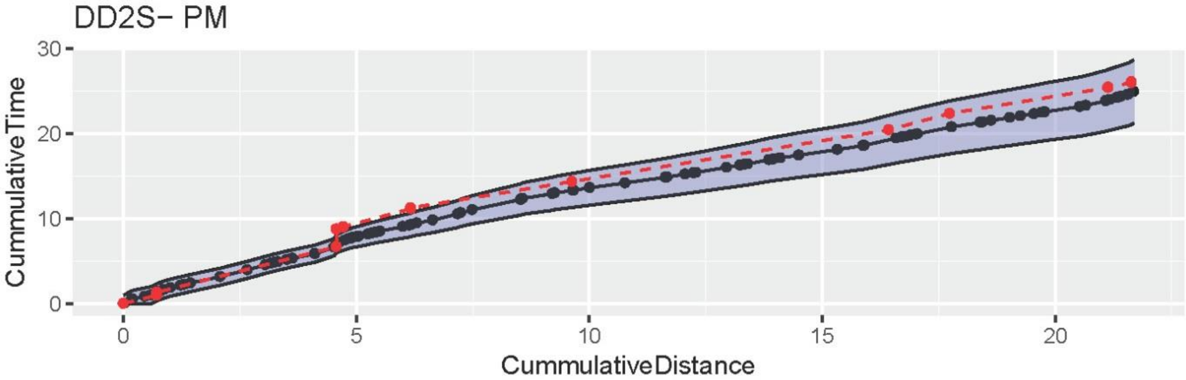
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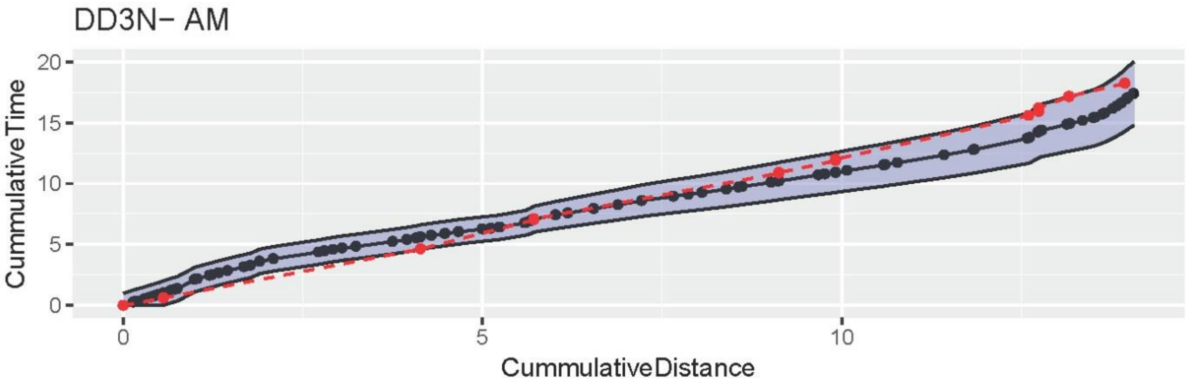
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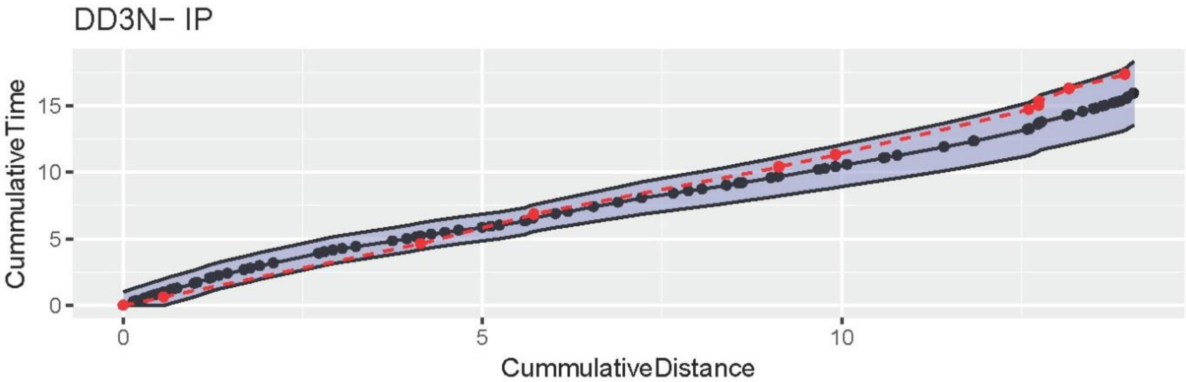
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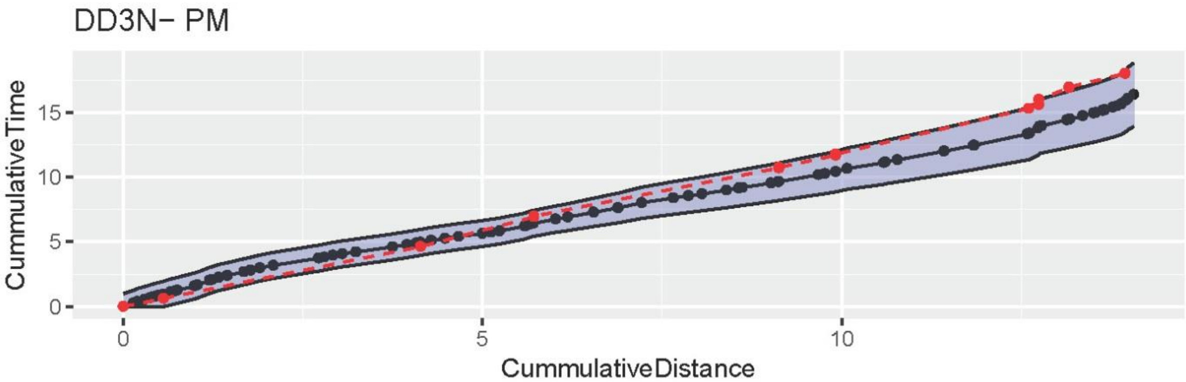
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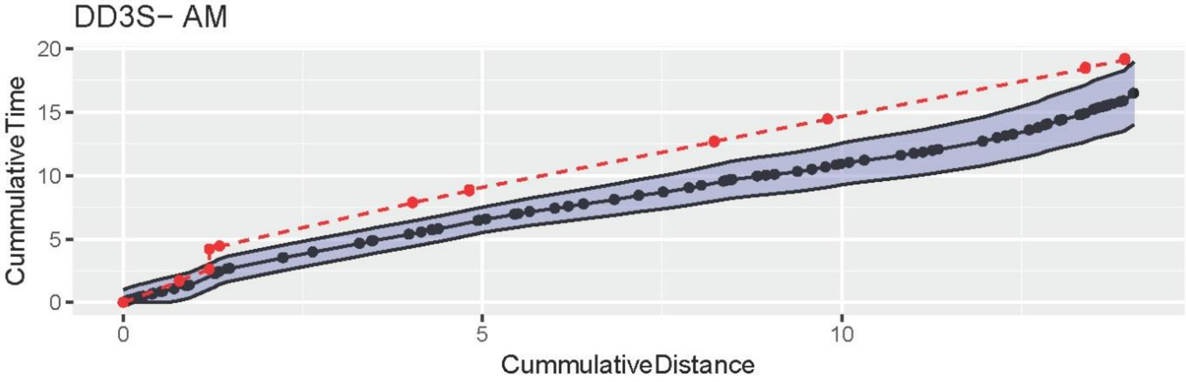
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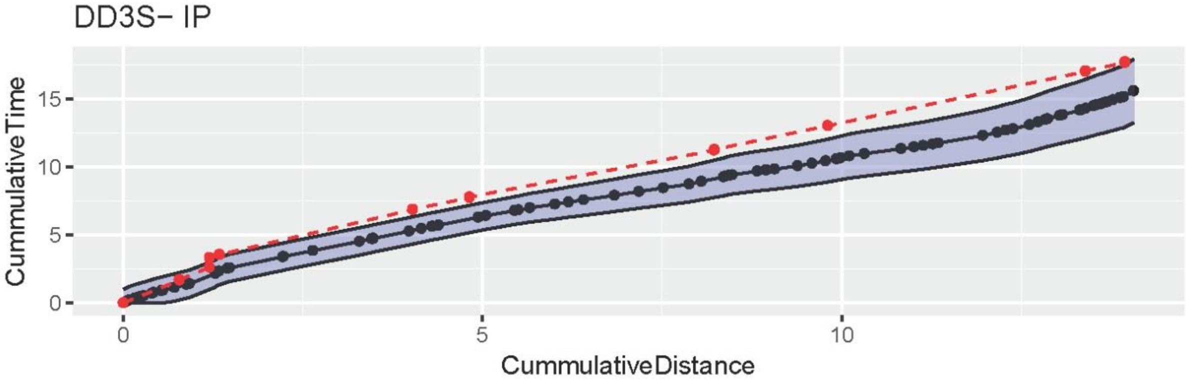
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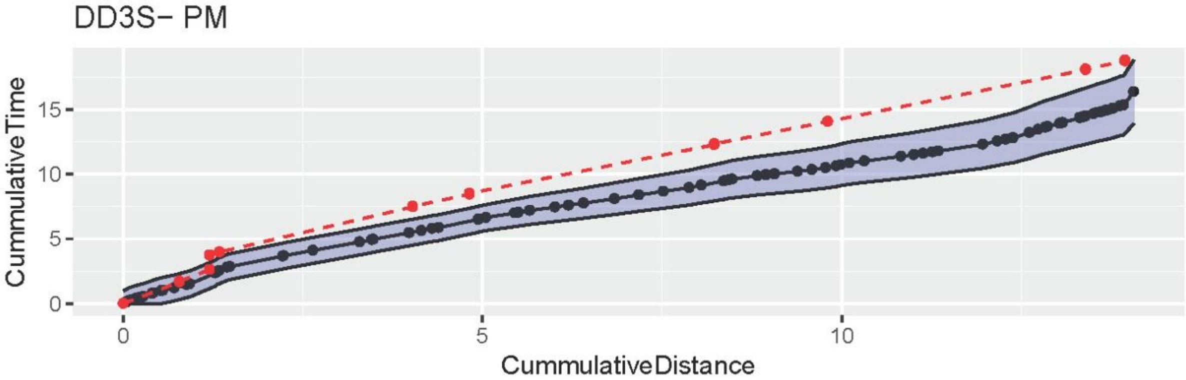
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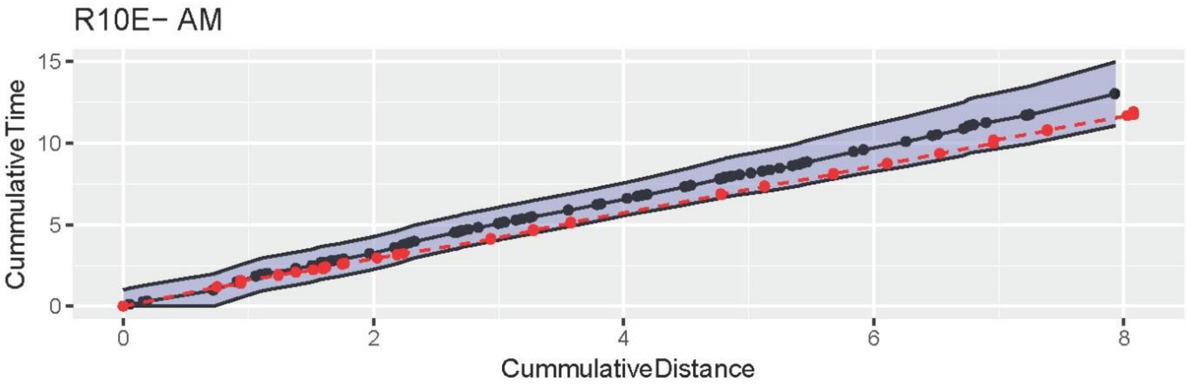
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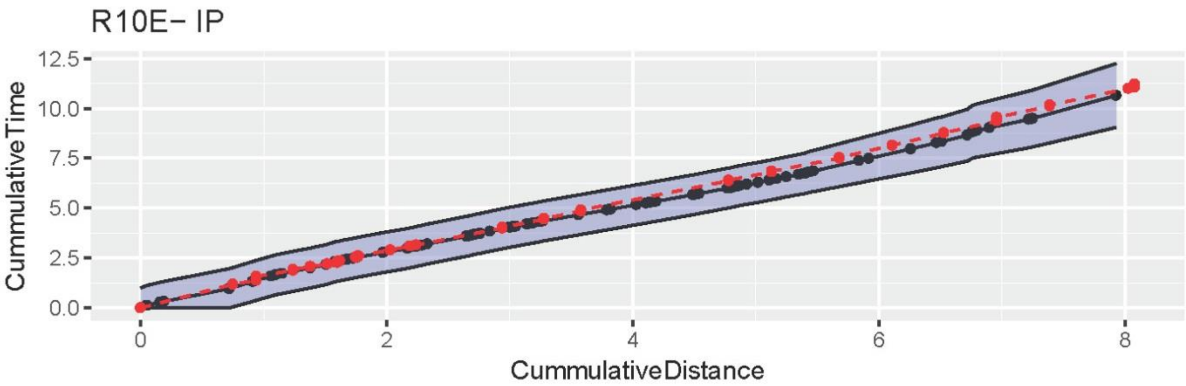
CummulativeDistance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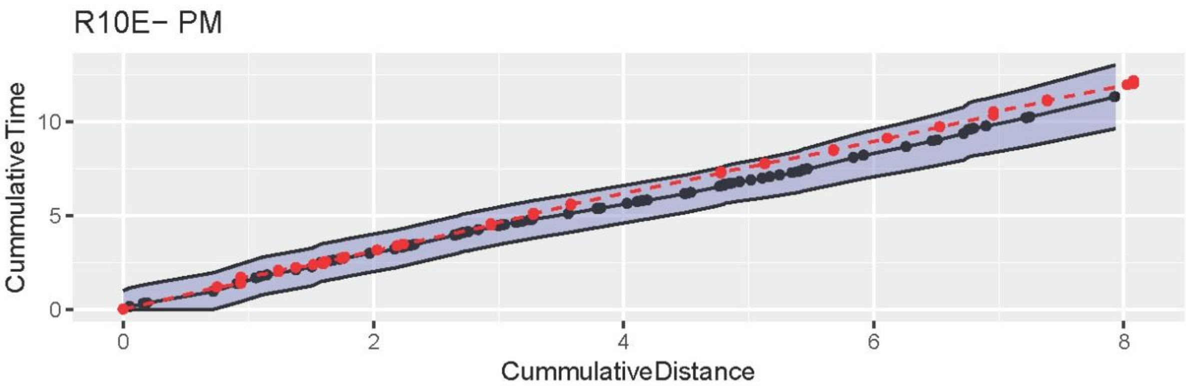
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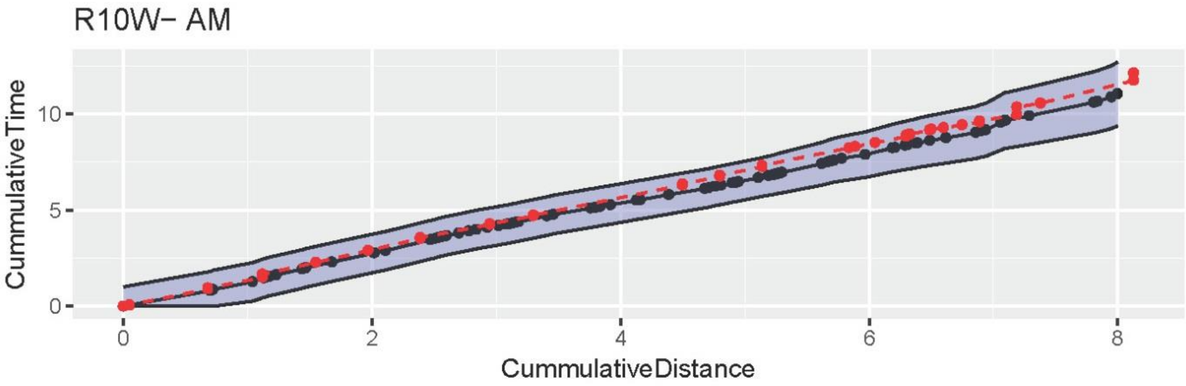
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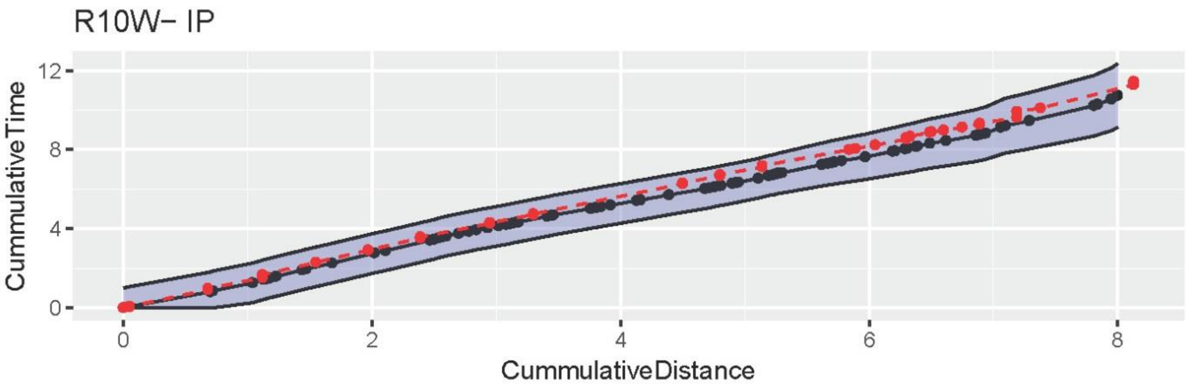
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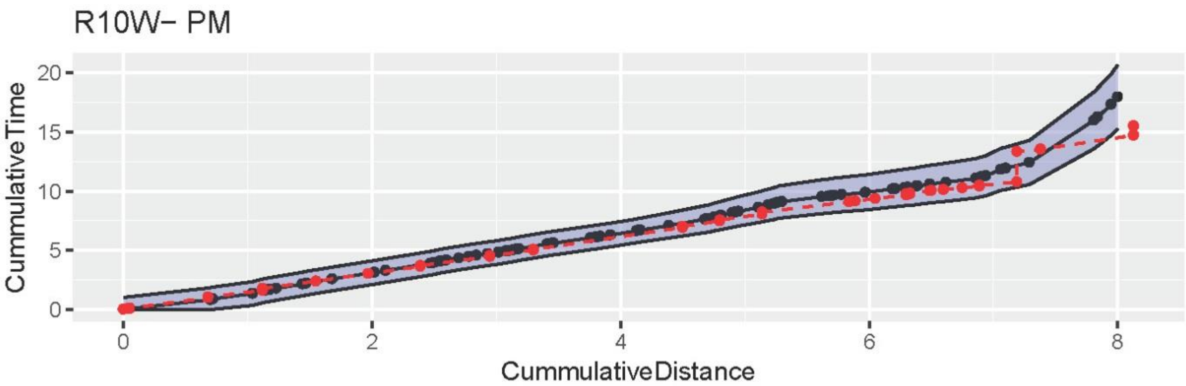
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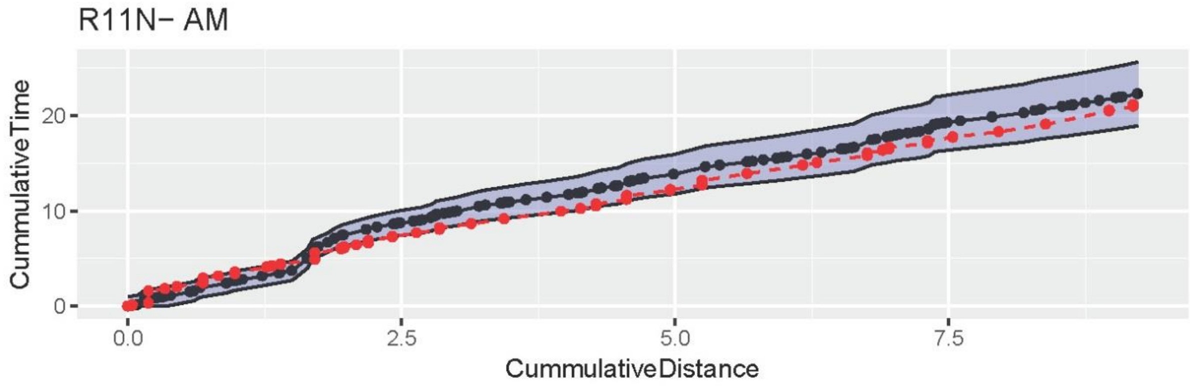
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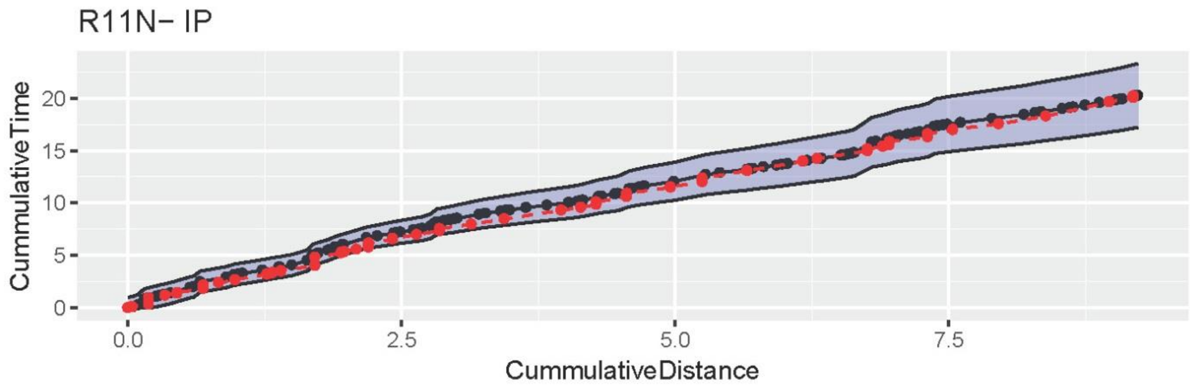
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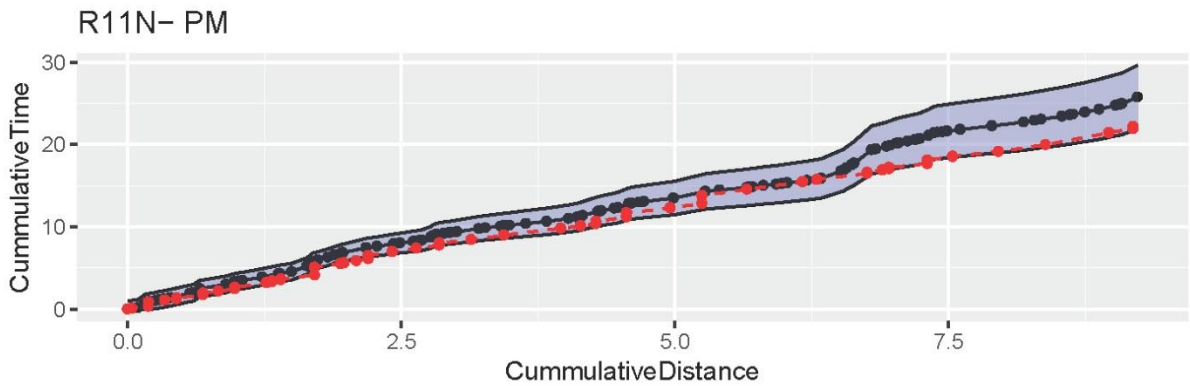
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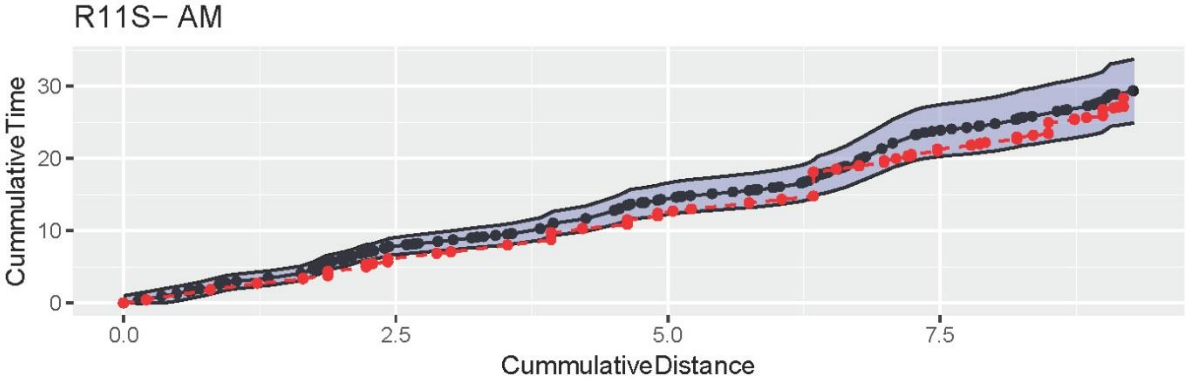
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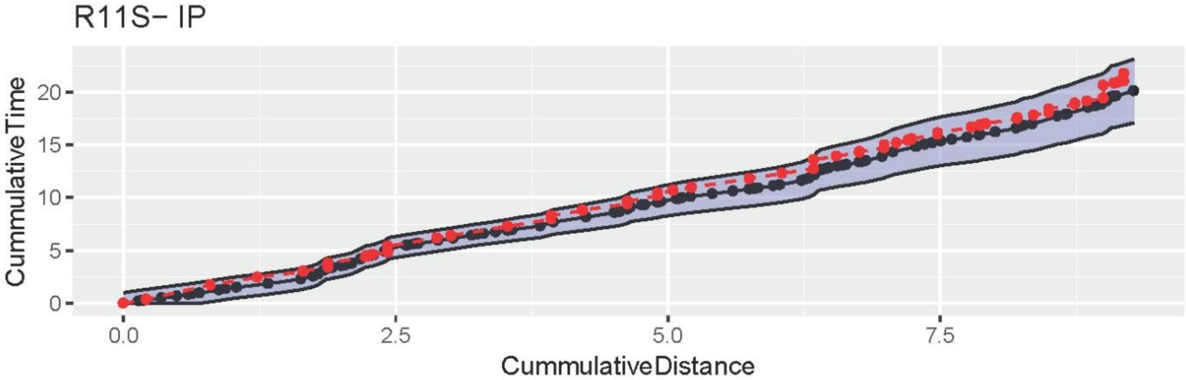
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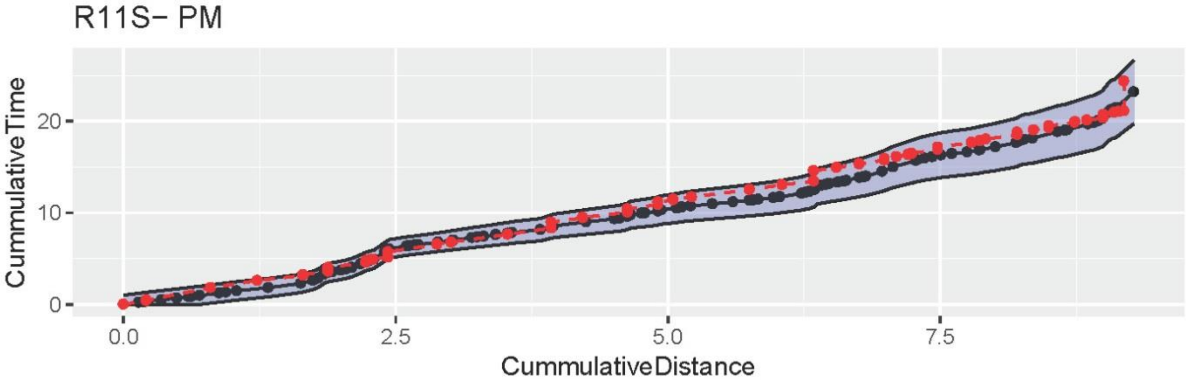
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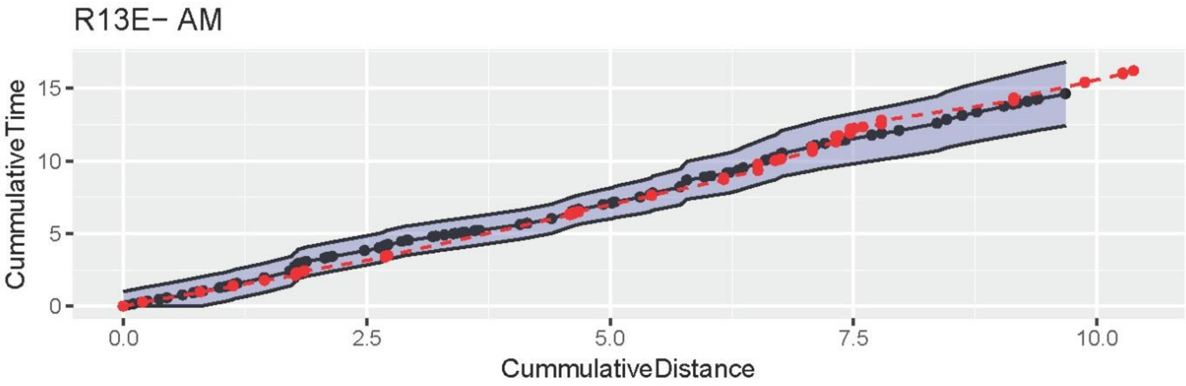
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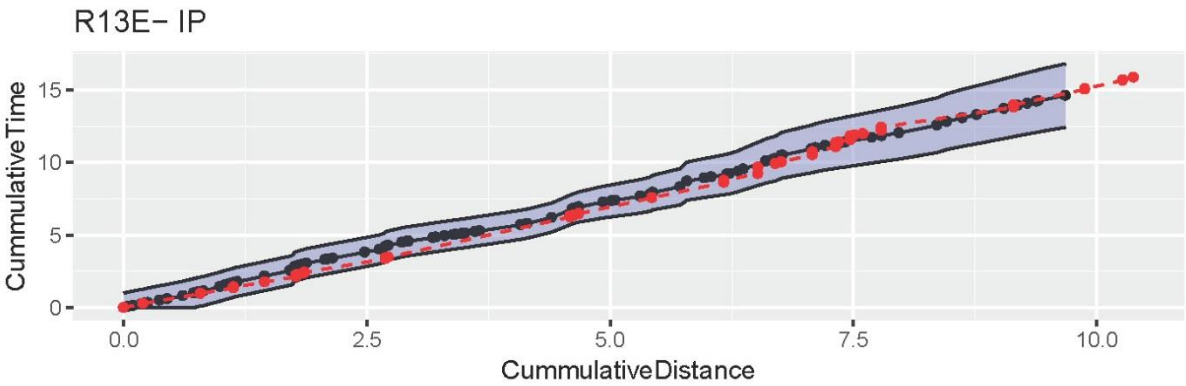
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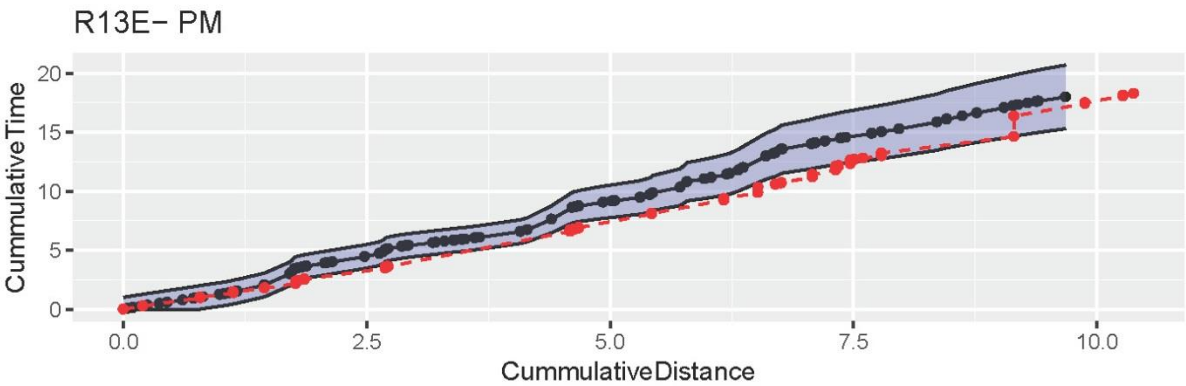
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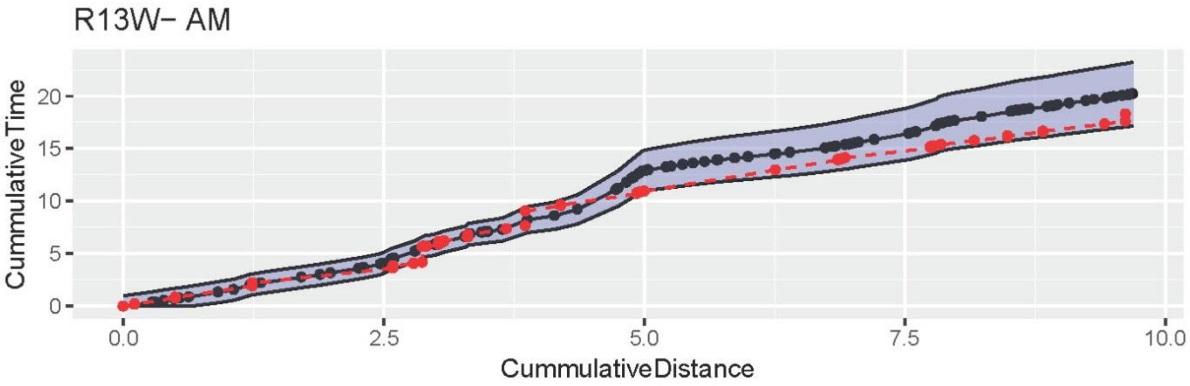
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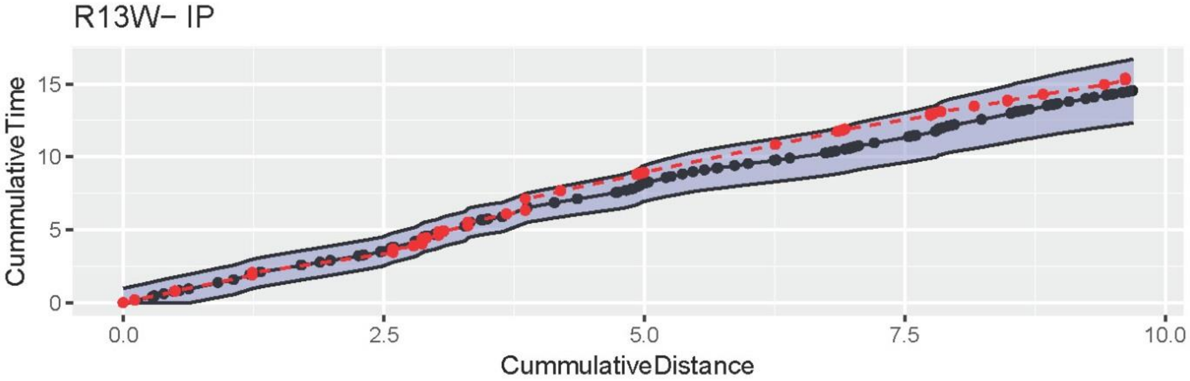
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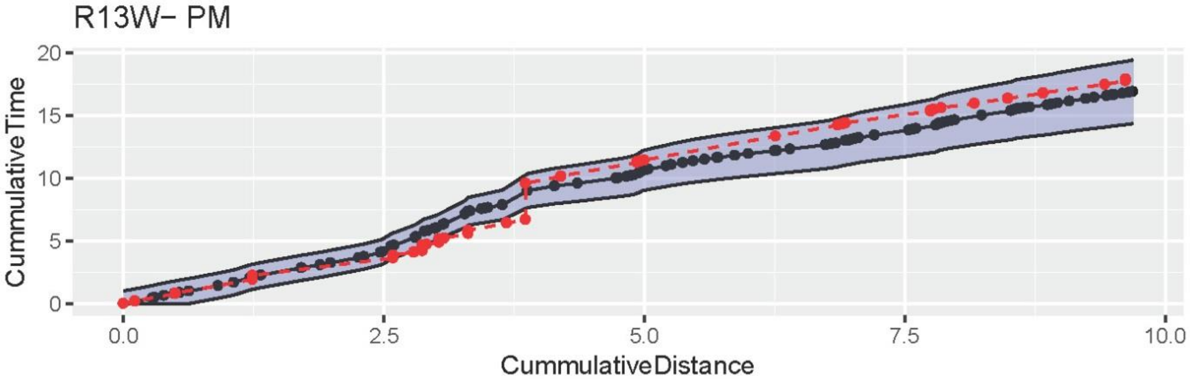
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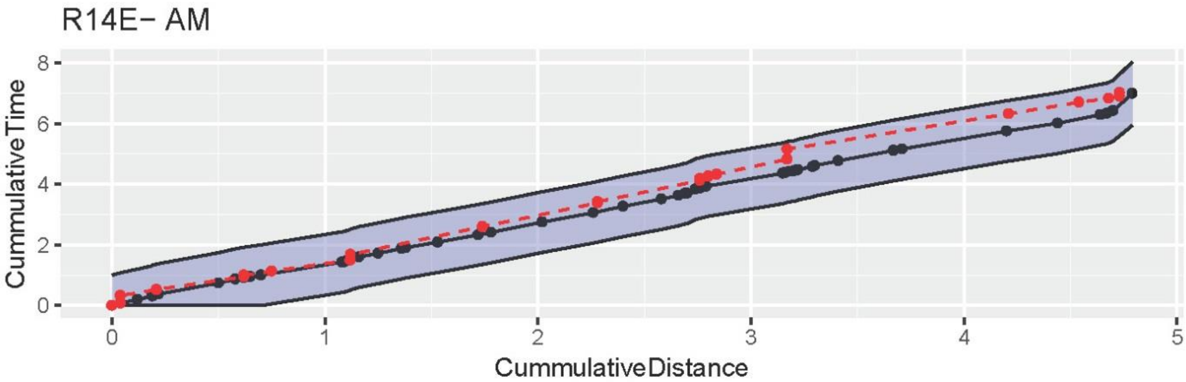
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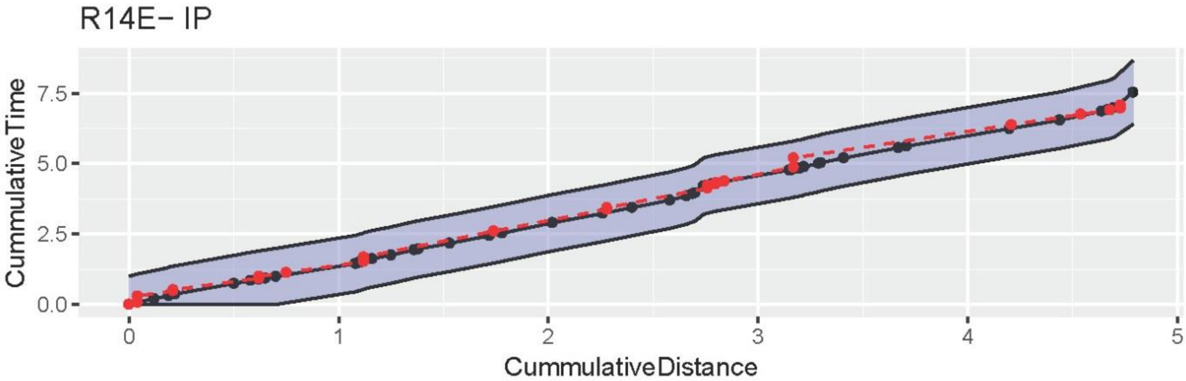
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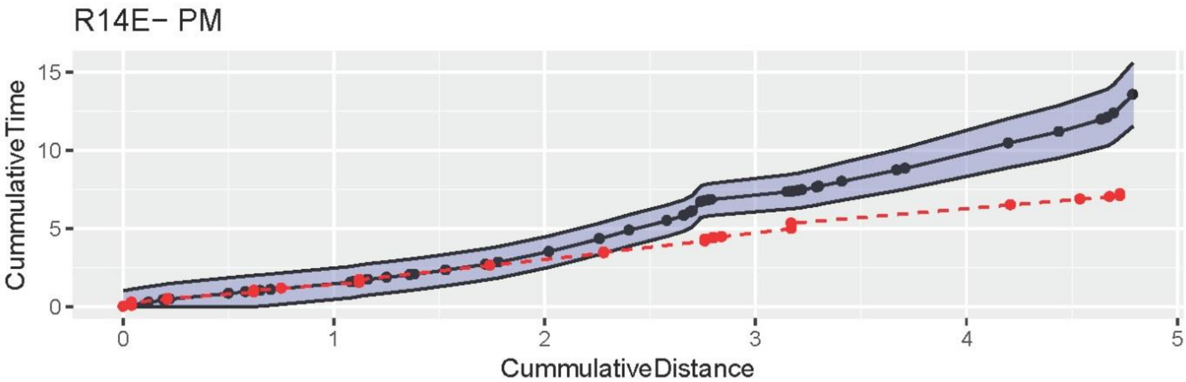
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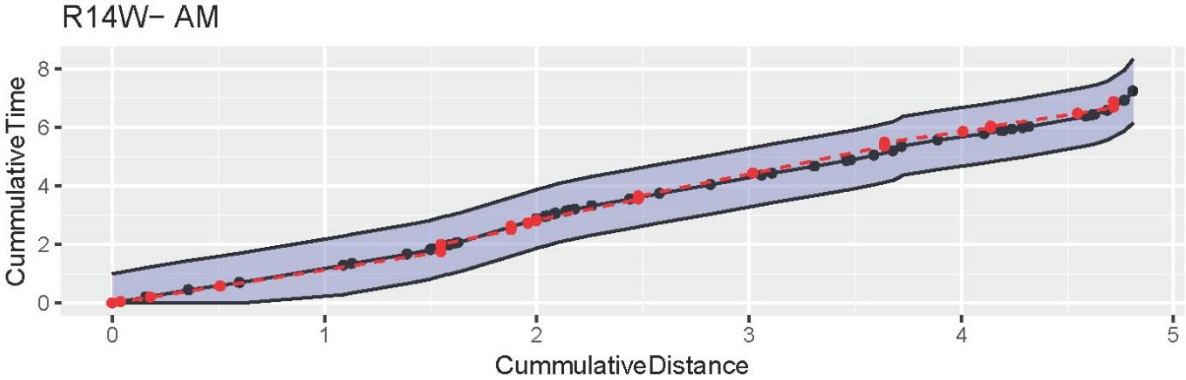
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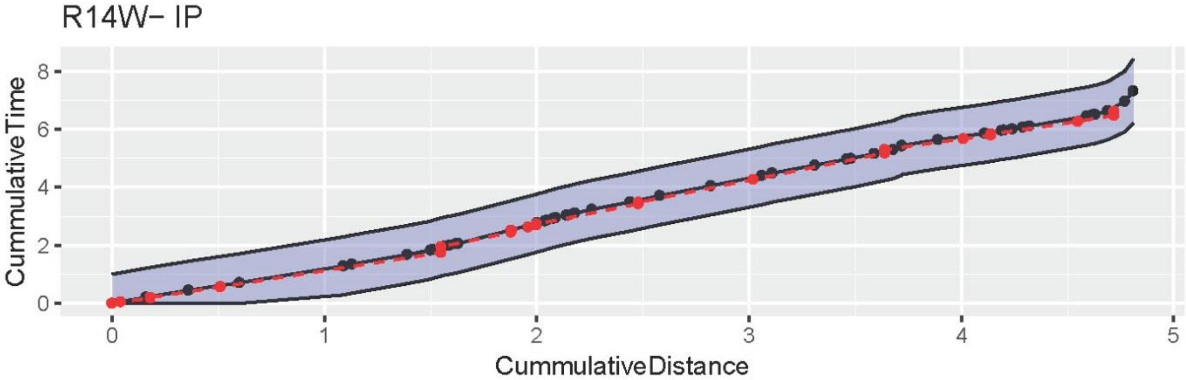
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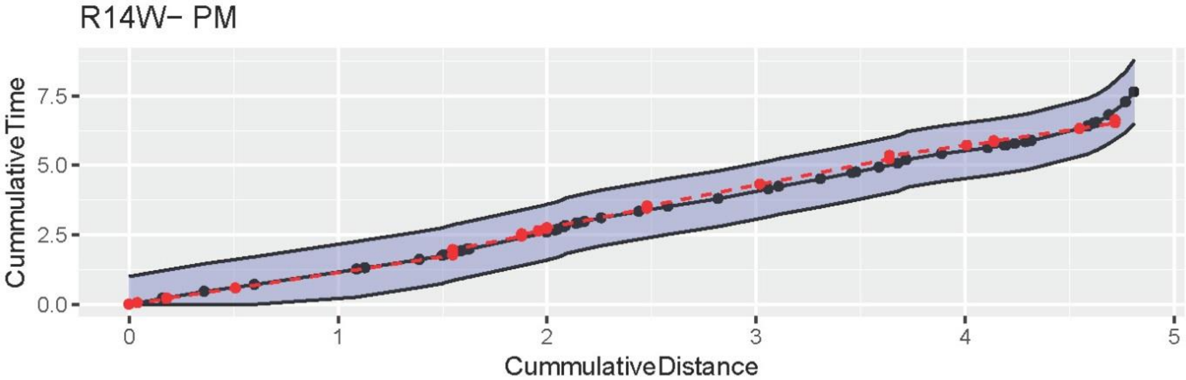
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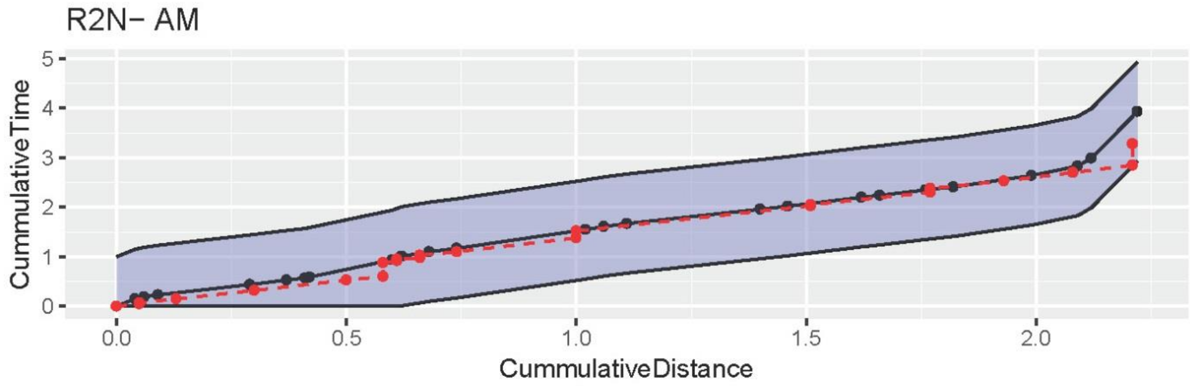
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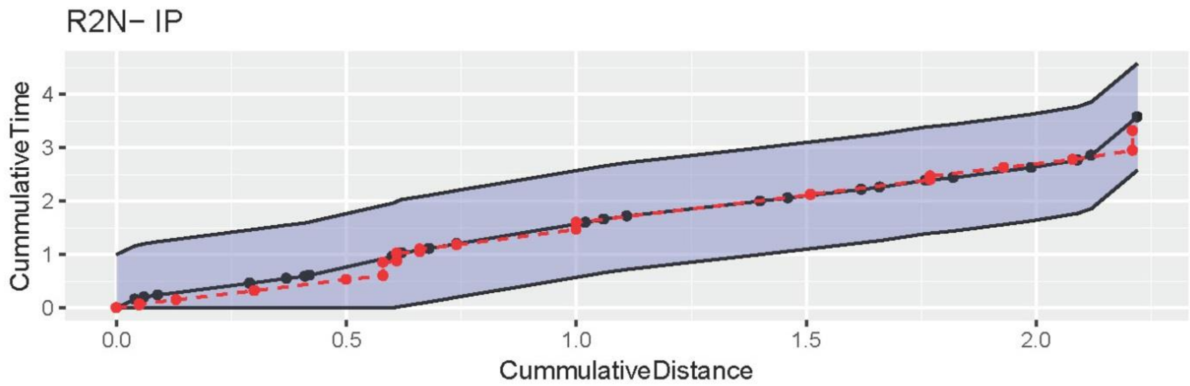
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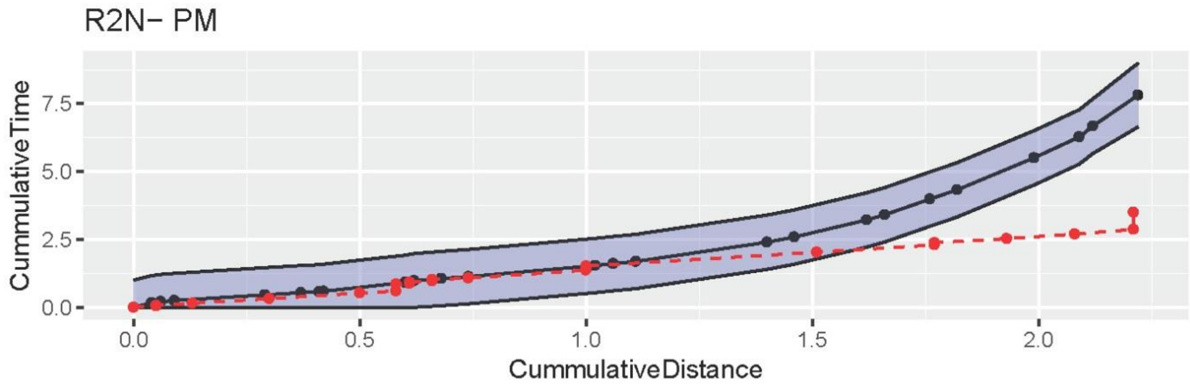
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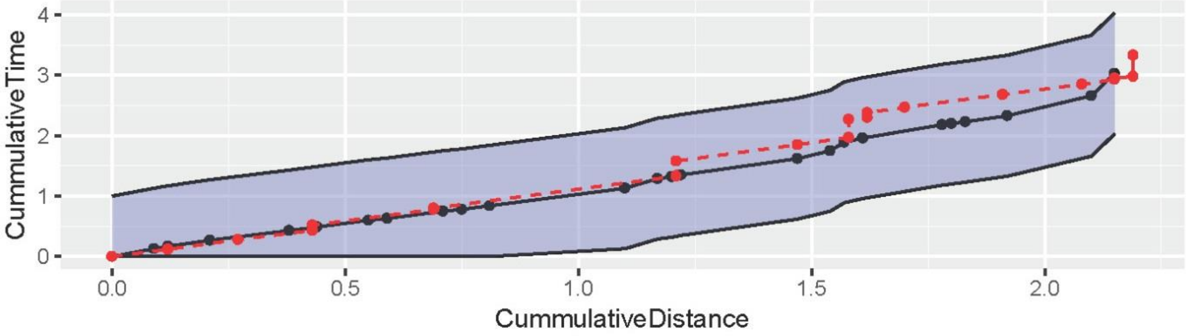
R2S- AM



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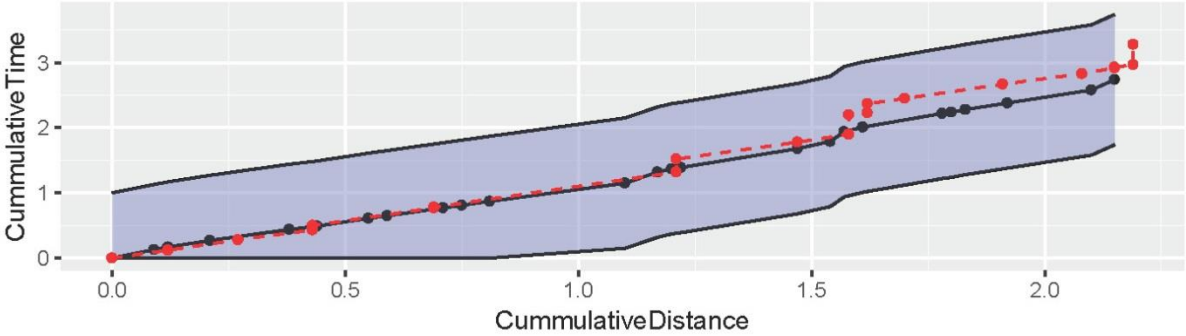
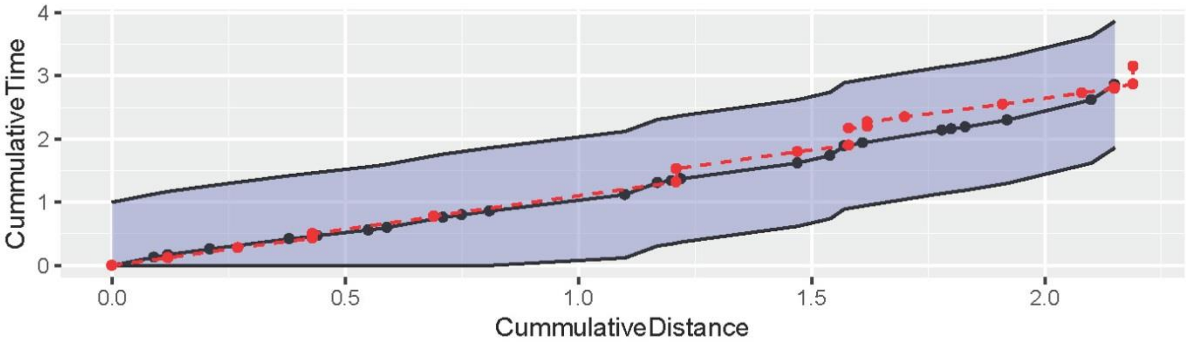
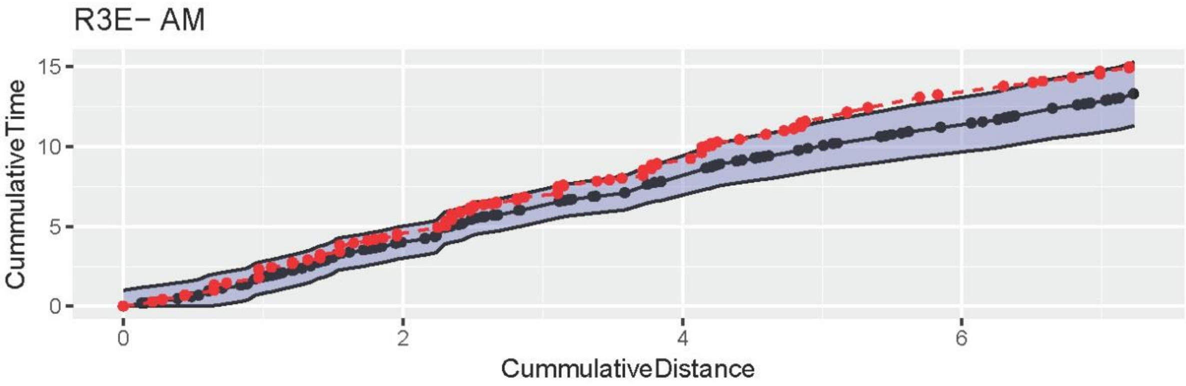


R2S- PM

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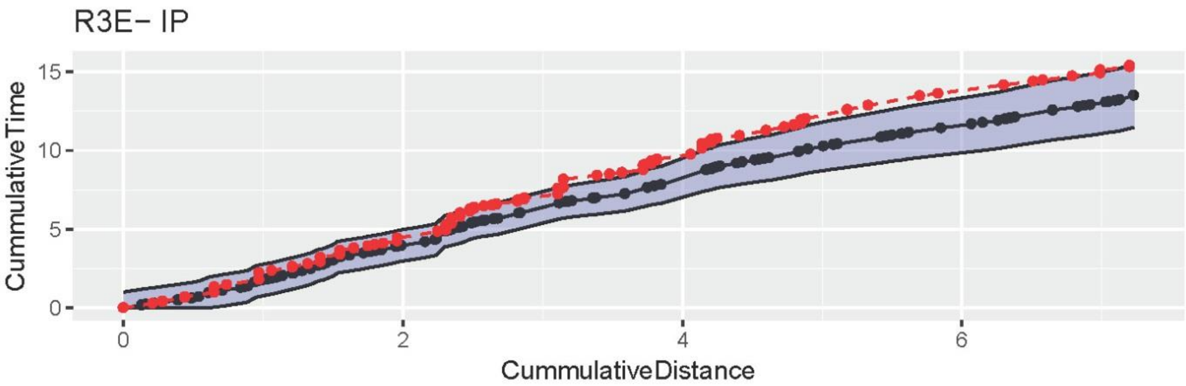
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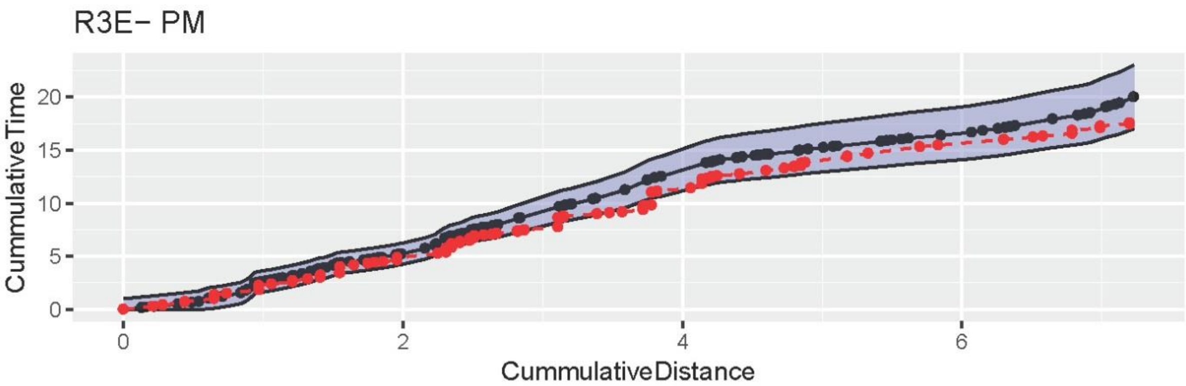
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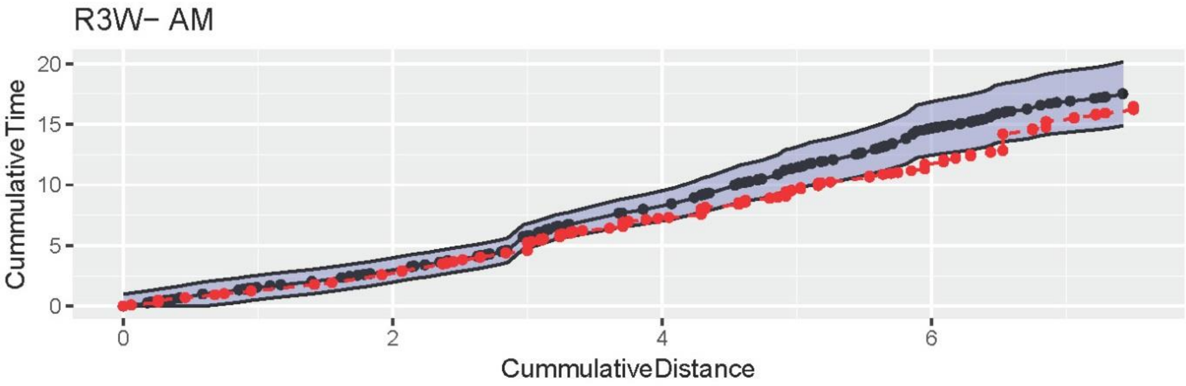
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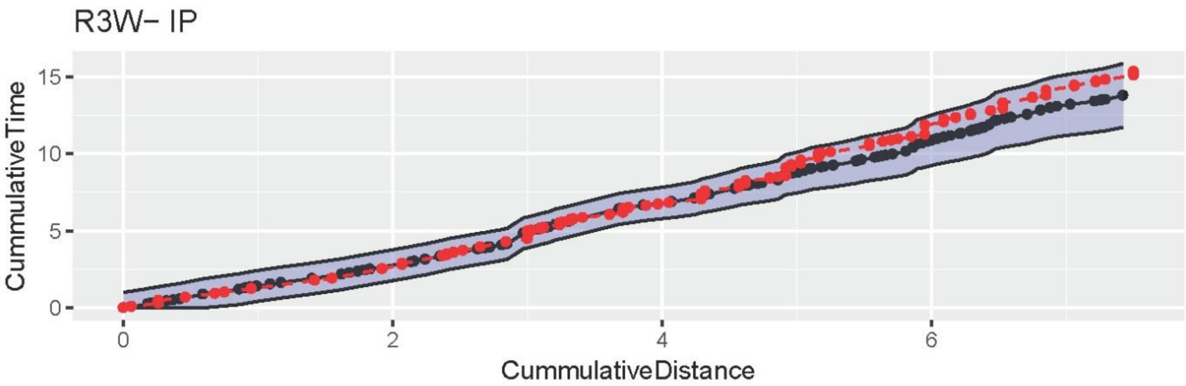
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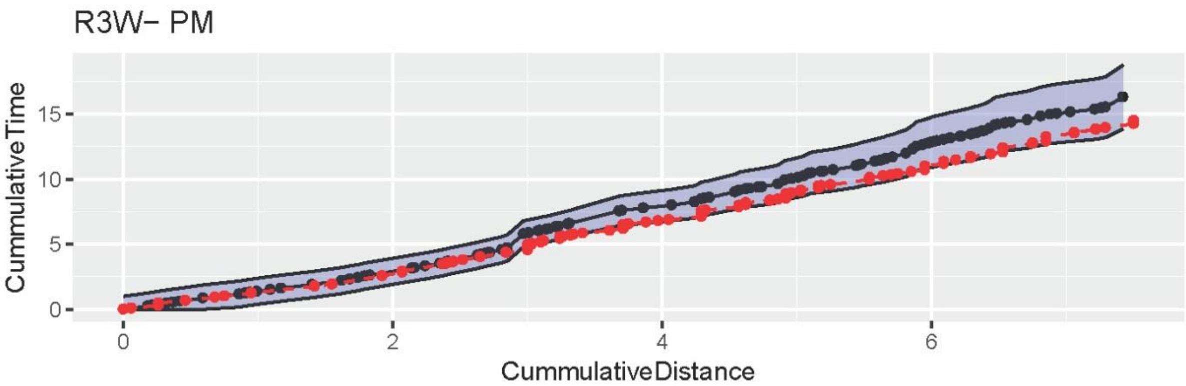
R3W- PM
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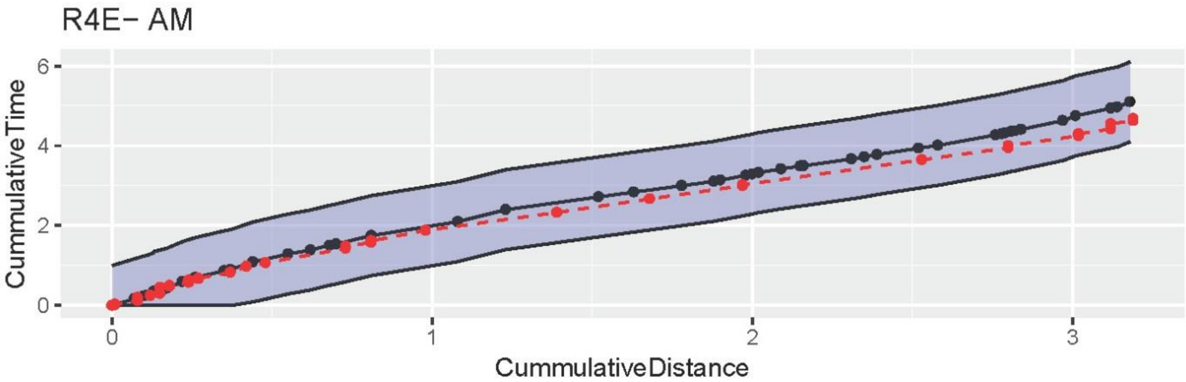
CummulativeDistance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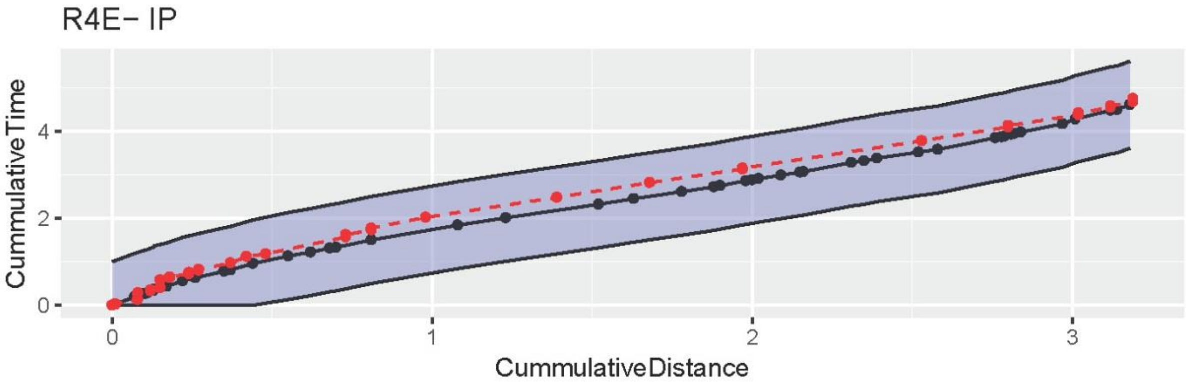
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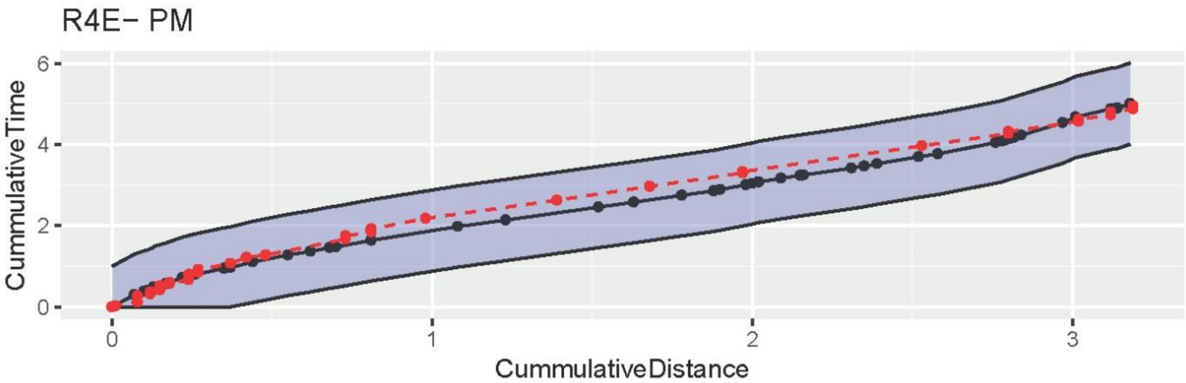
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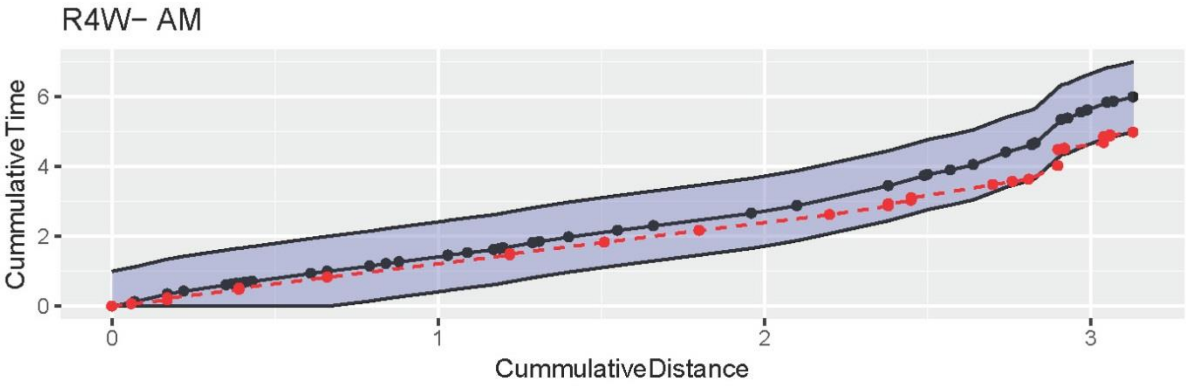
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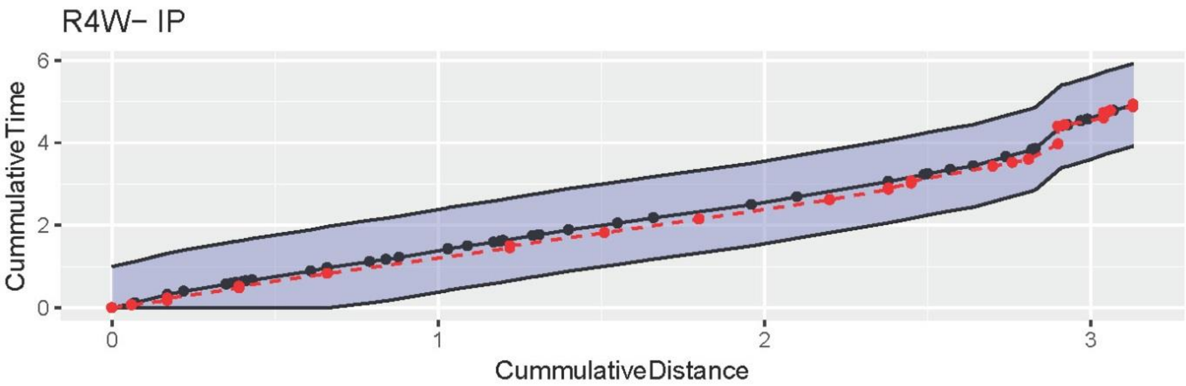
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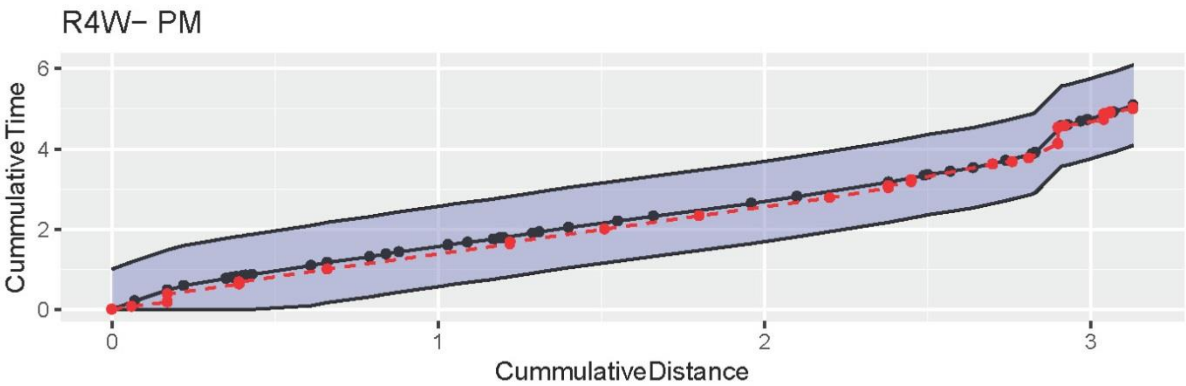
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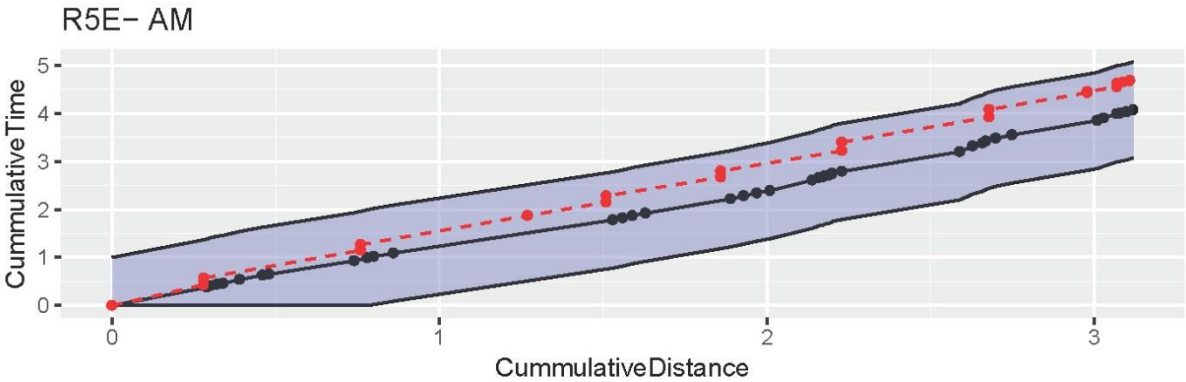
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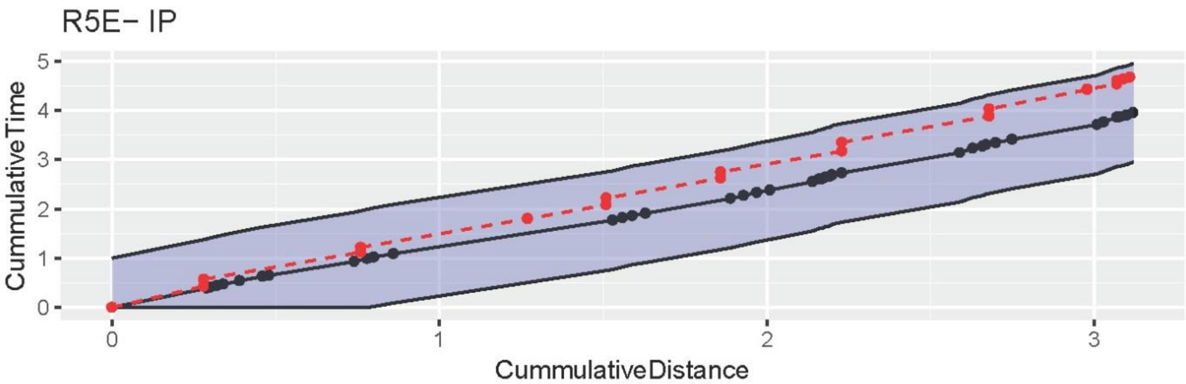
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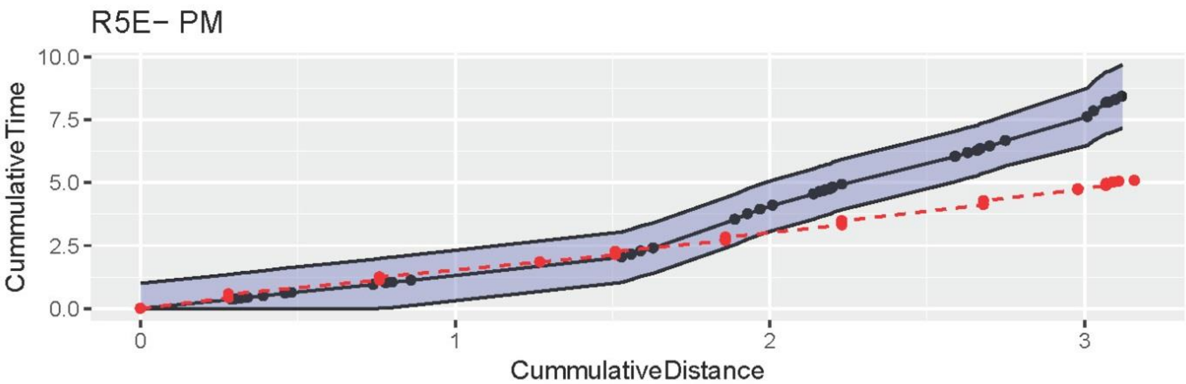
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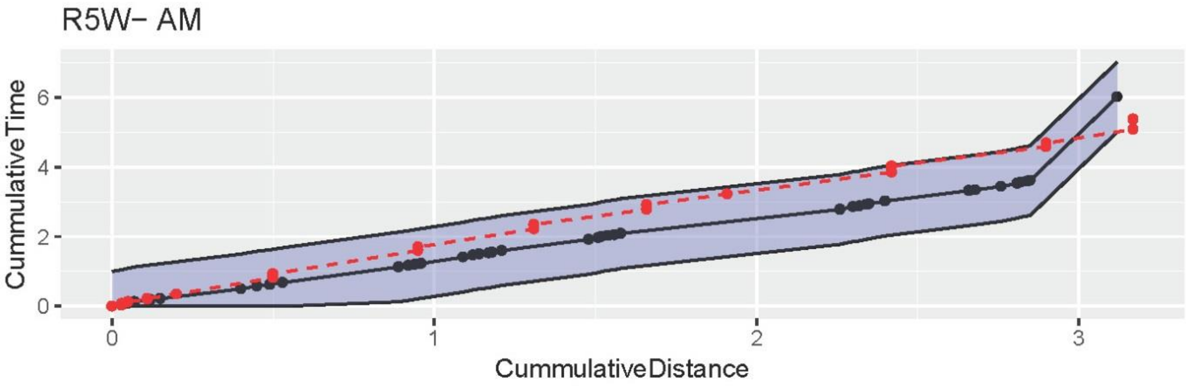
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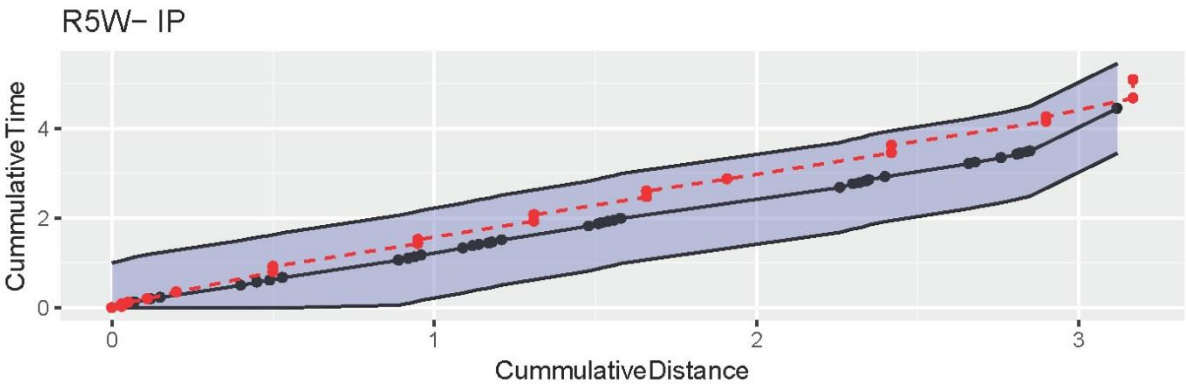
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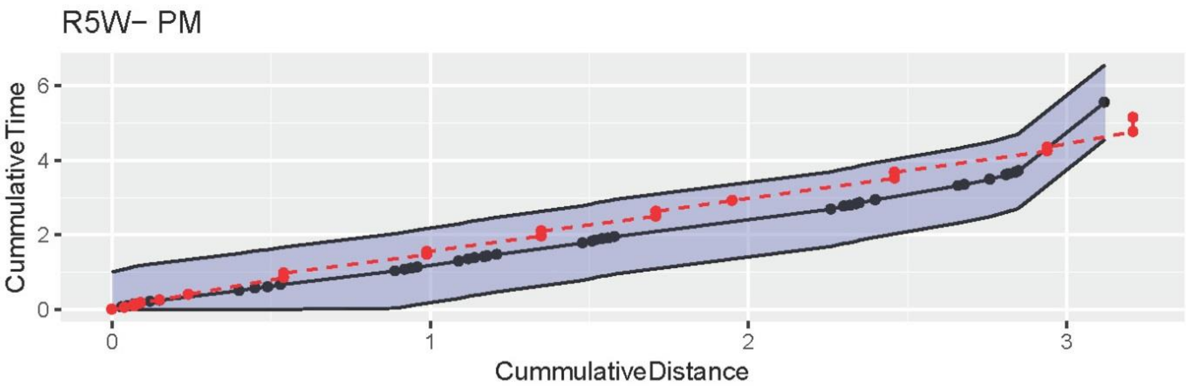
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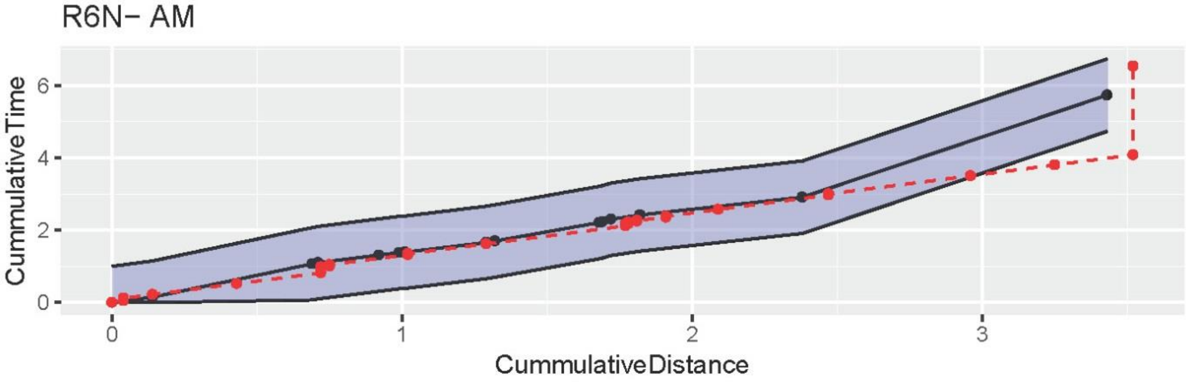
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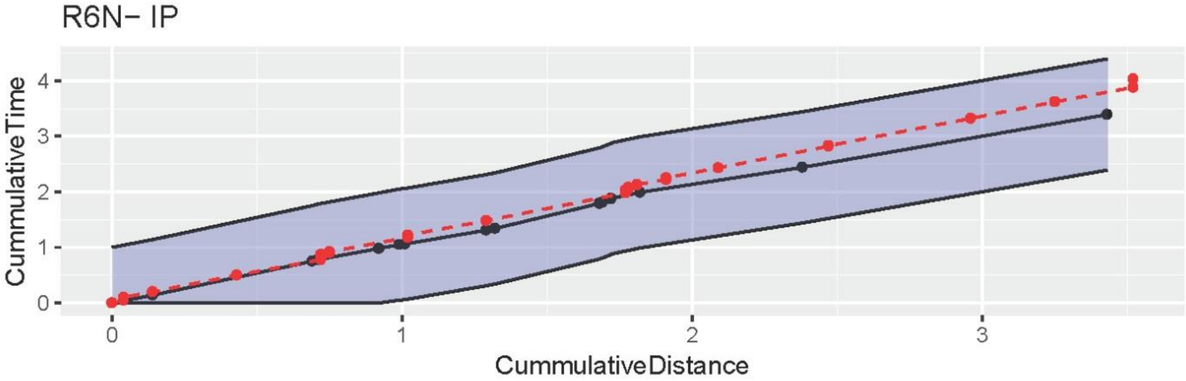
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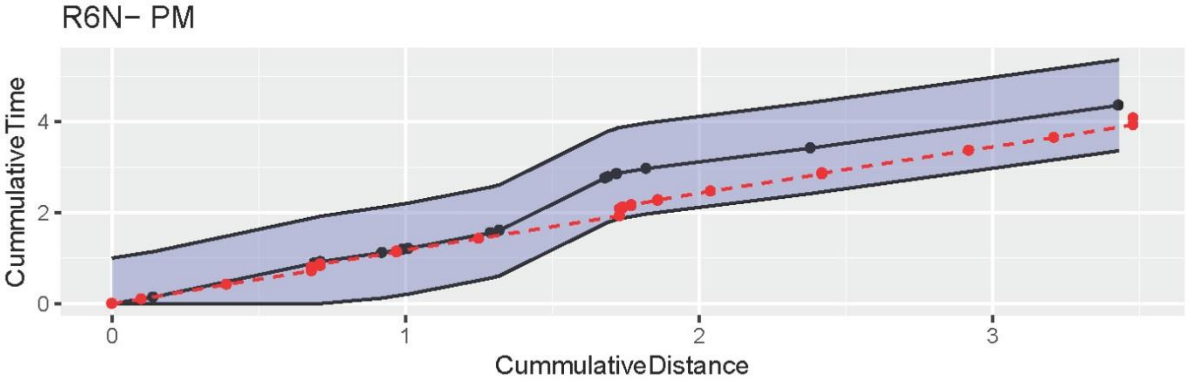
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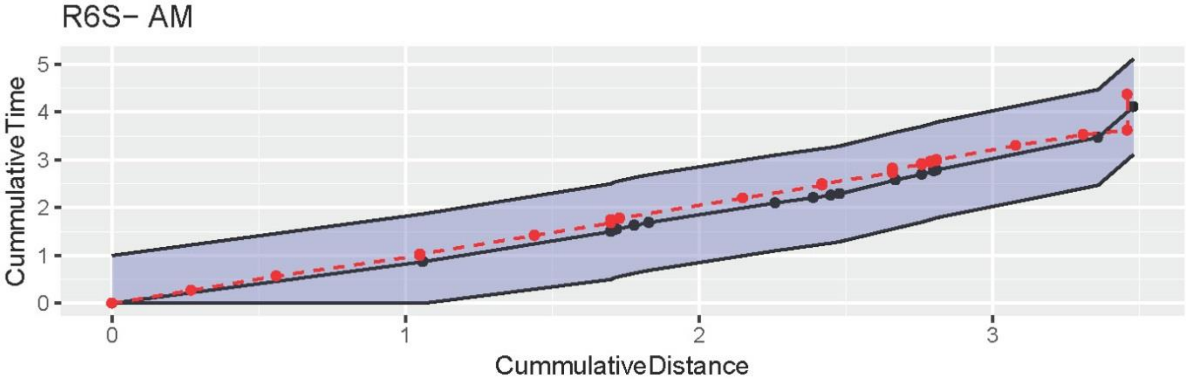
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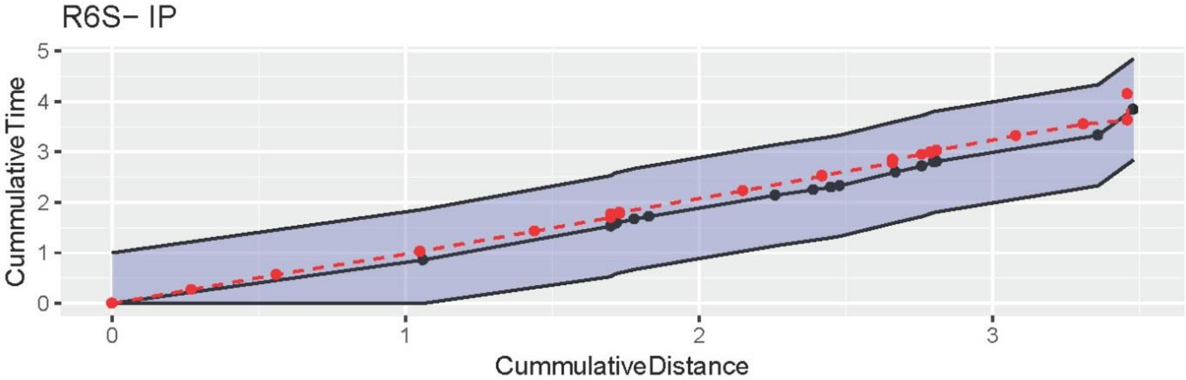
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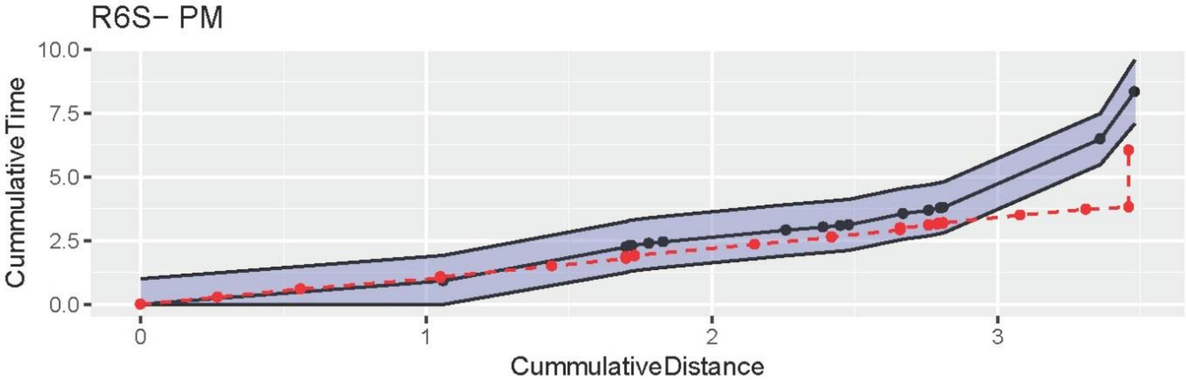
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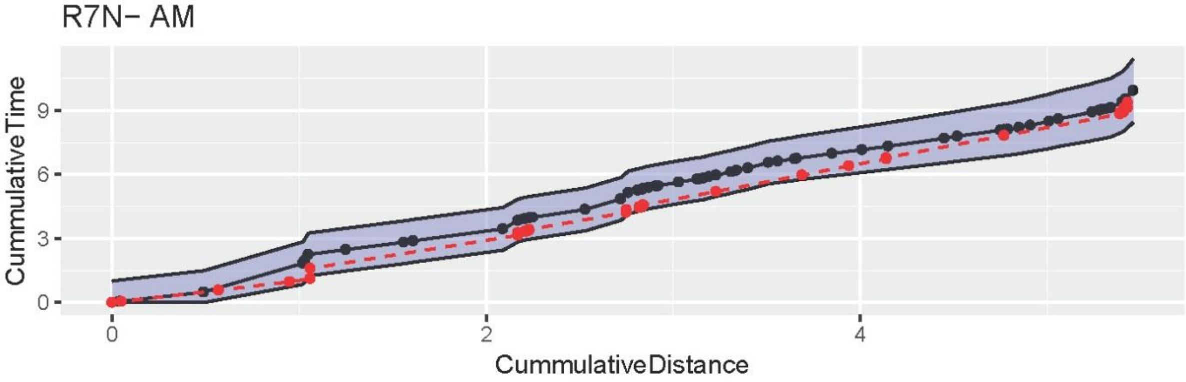
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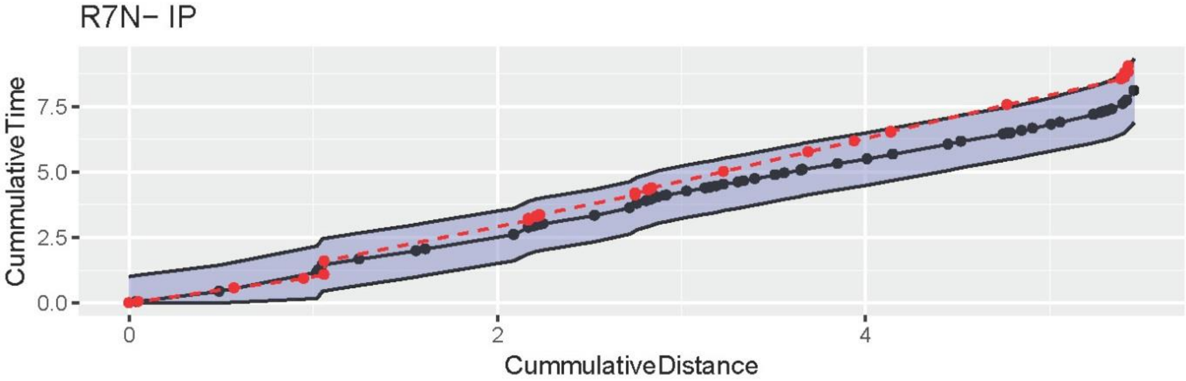
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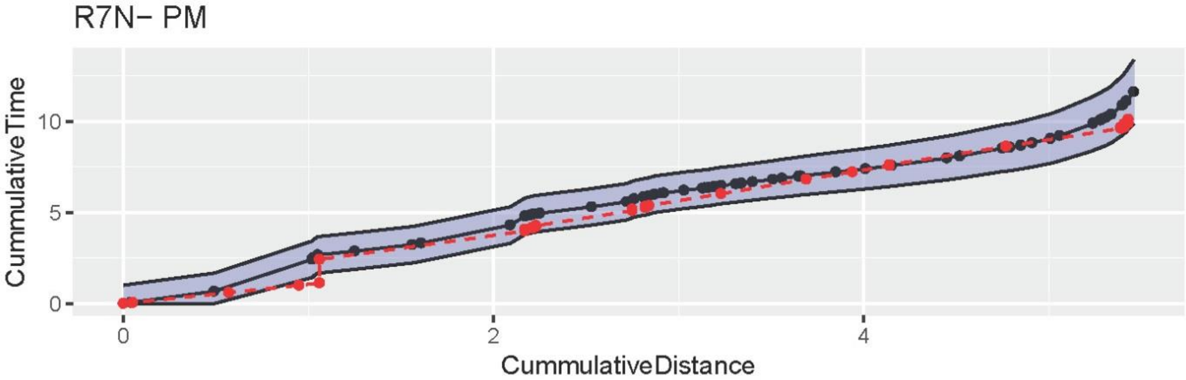
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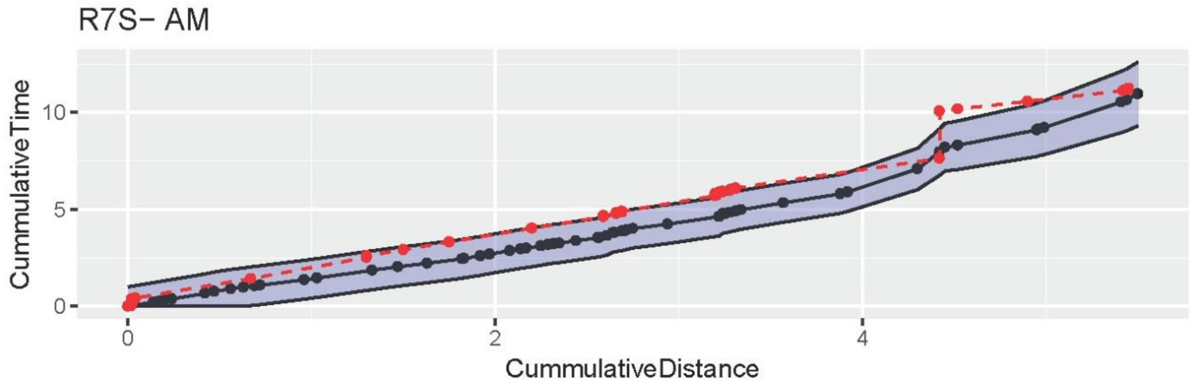
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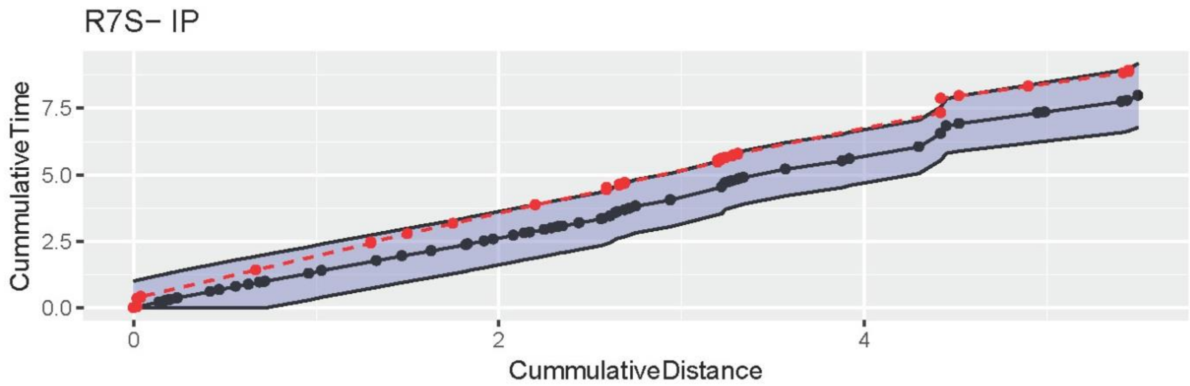
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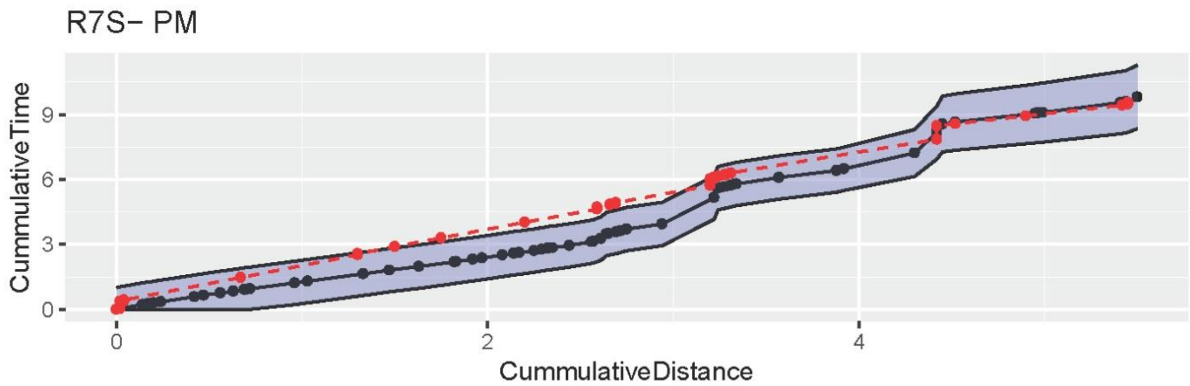
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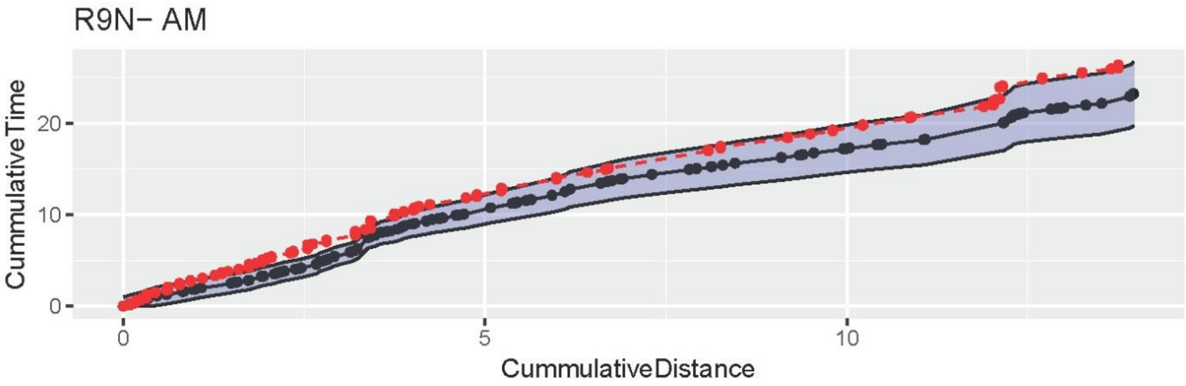
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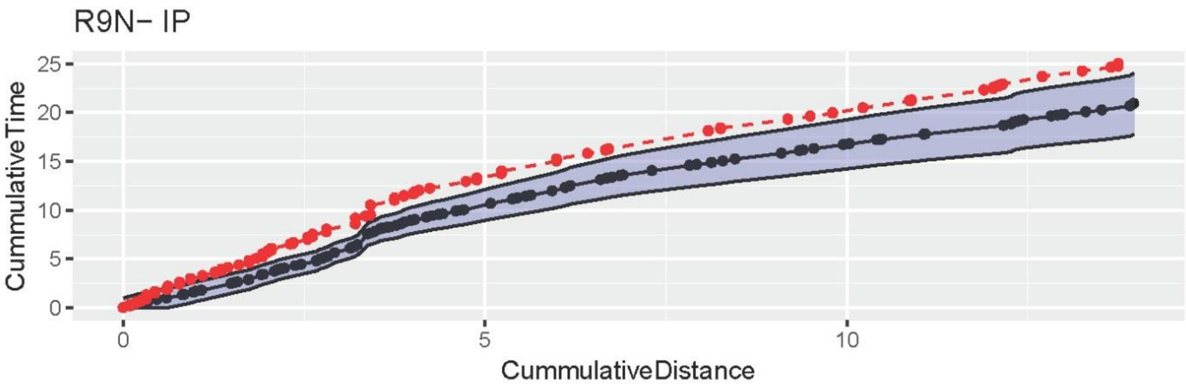
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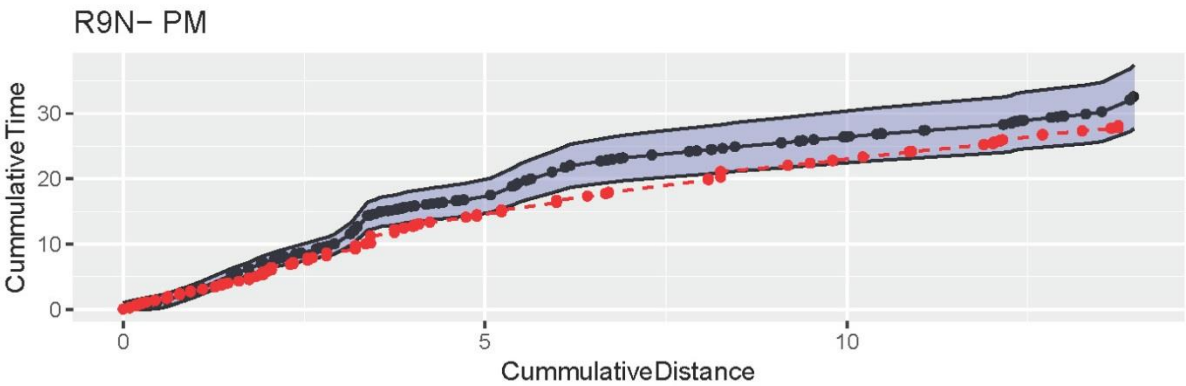
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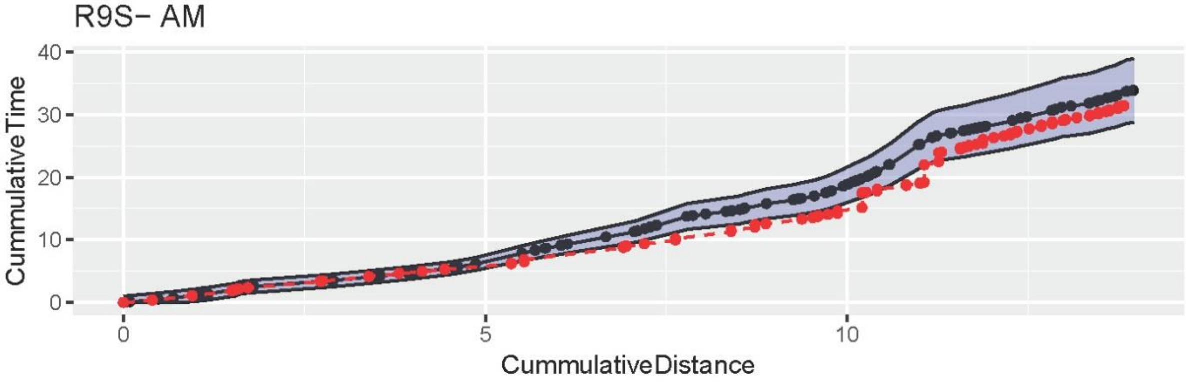
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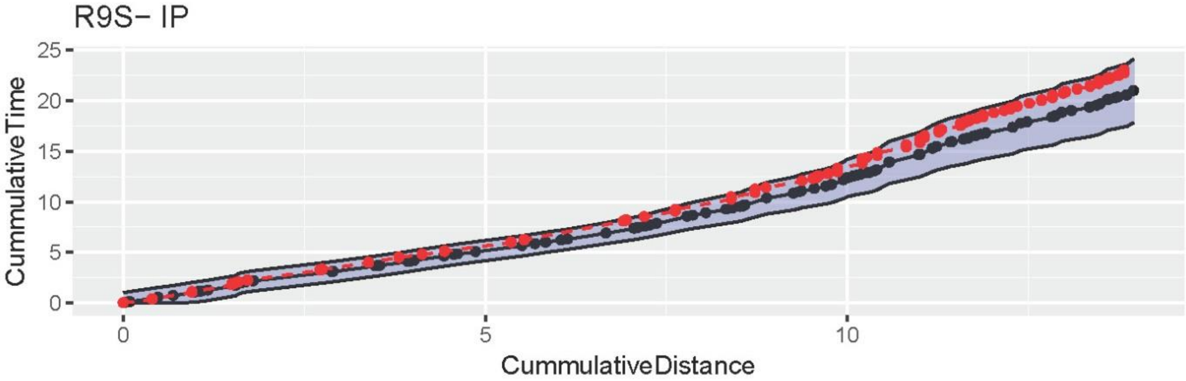
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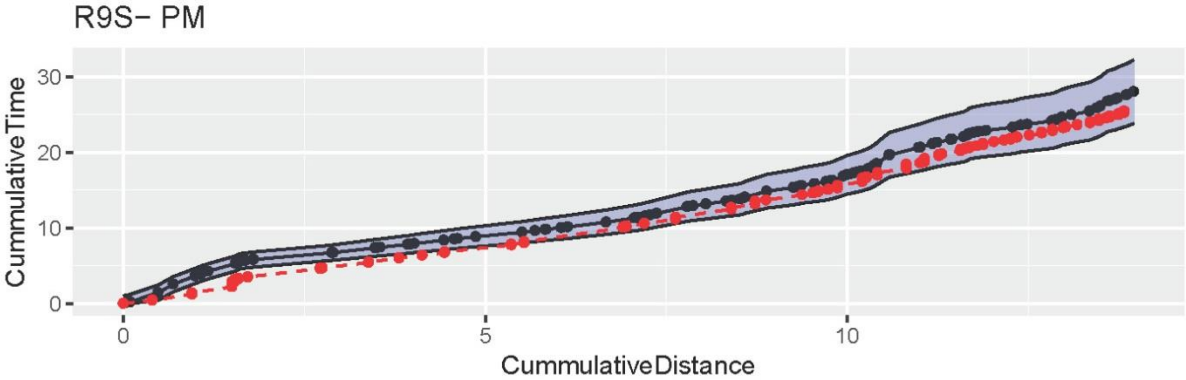
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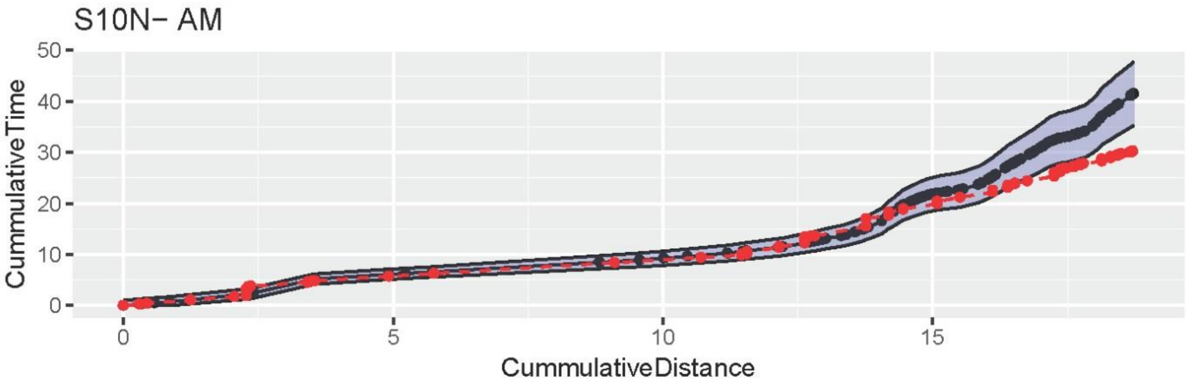
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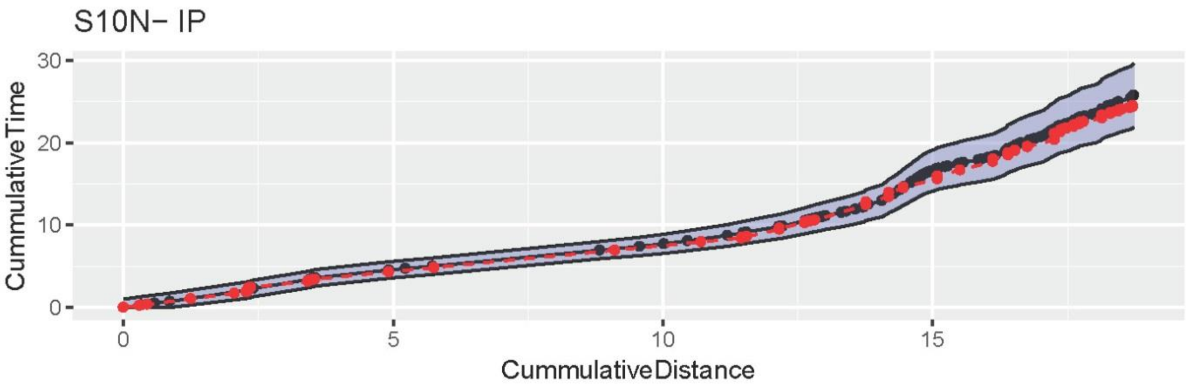
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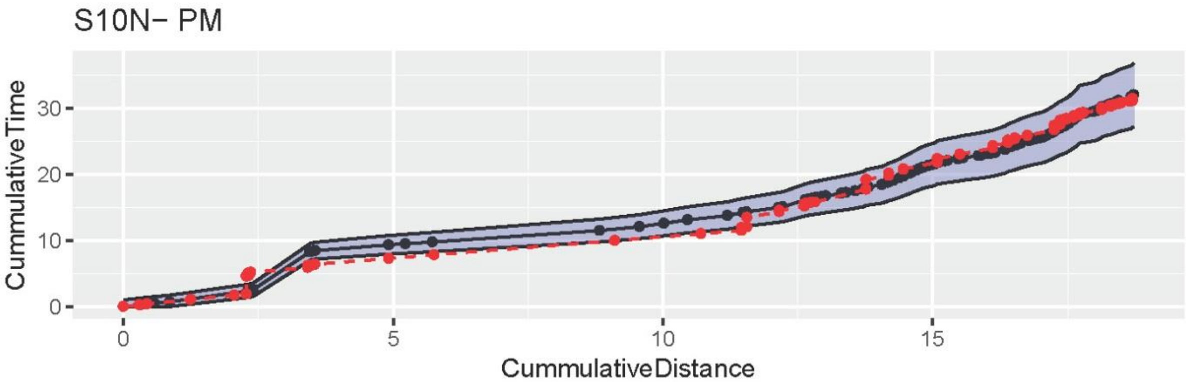
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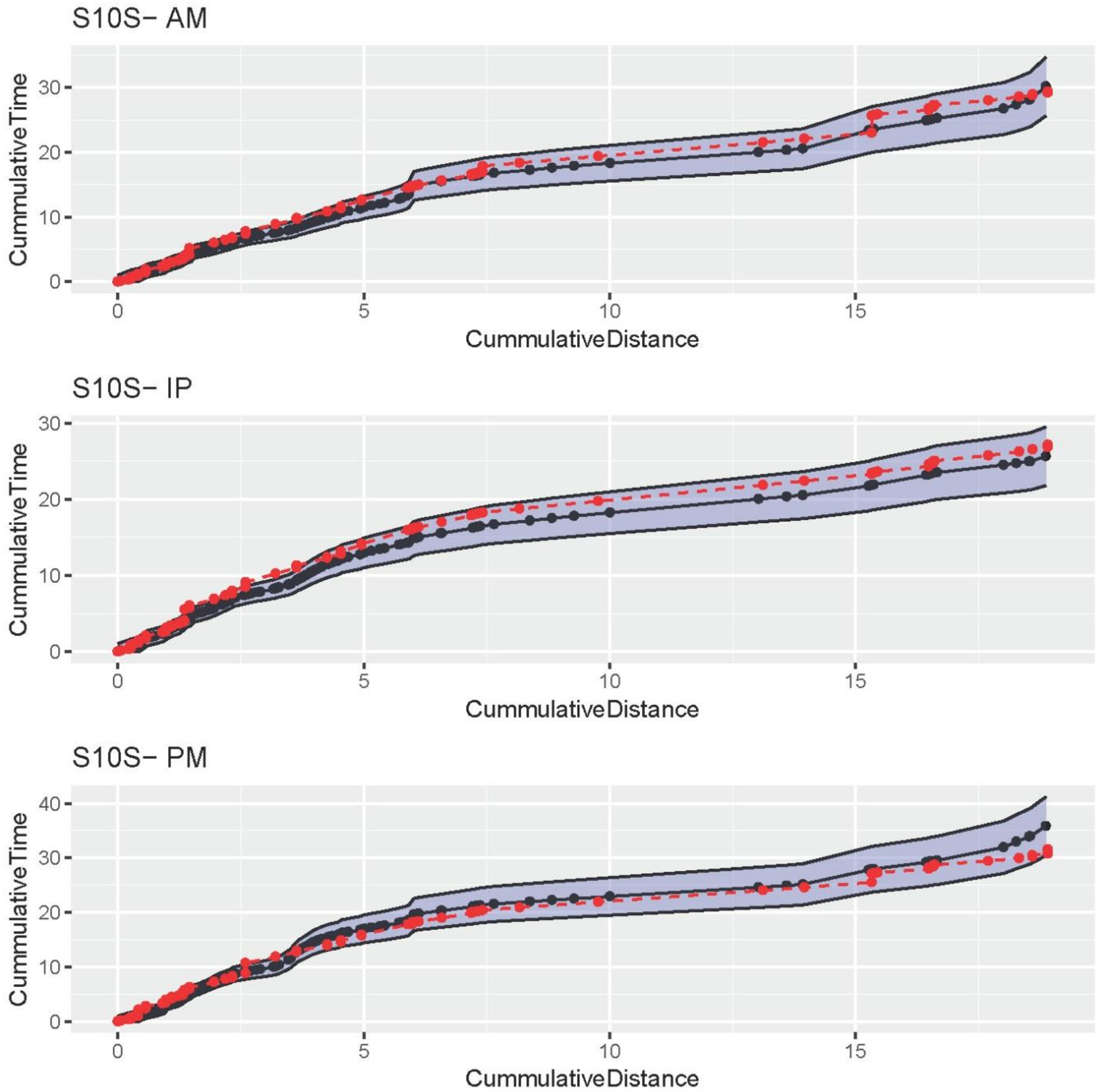
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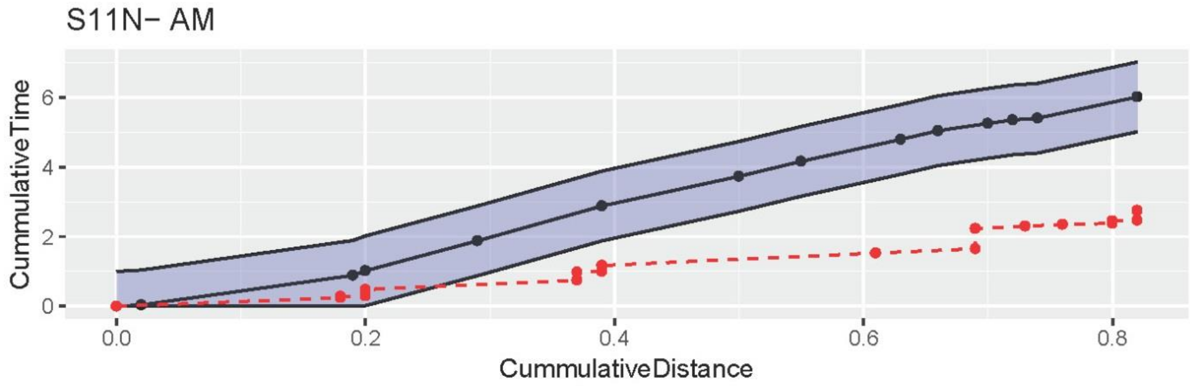
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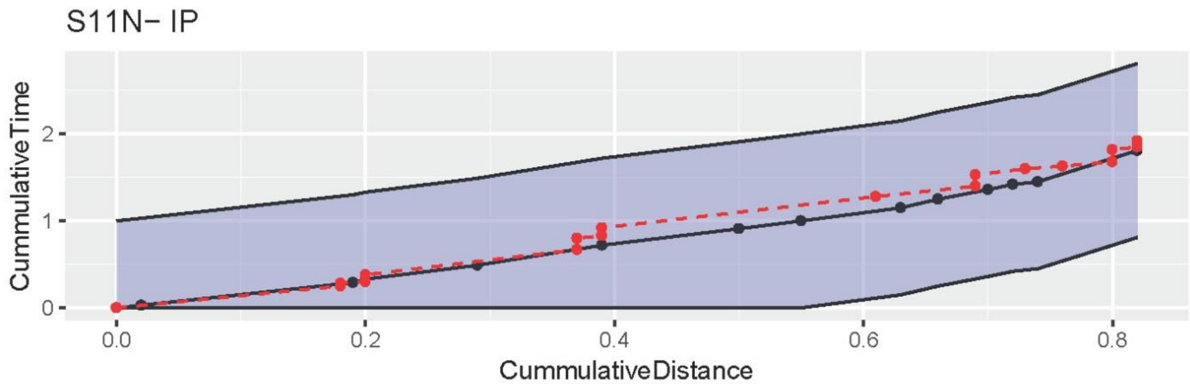
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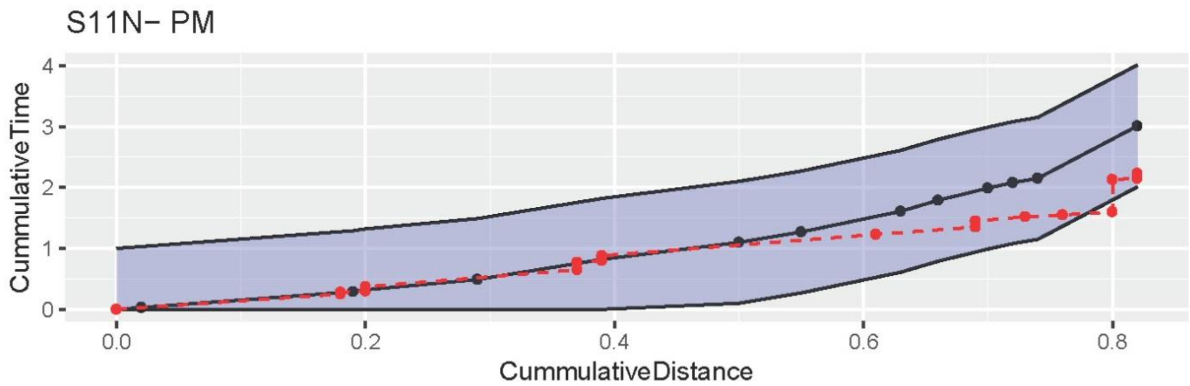
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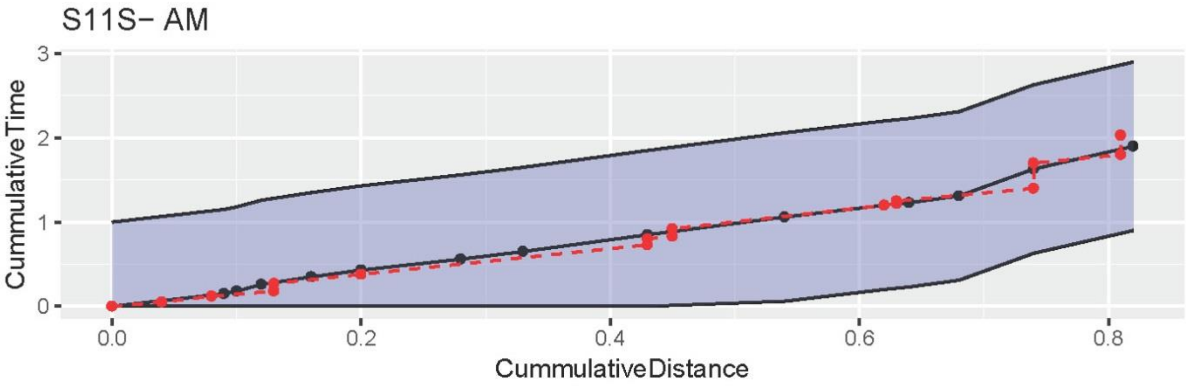
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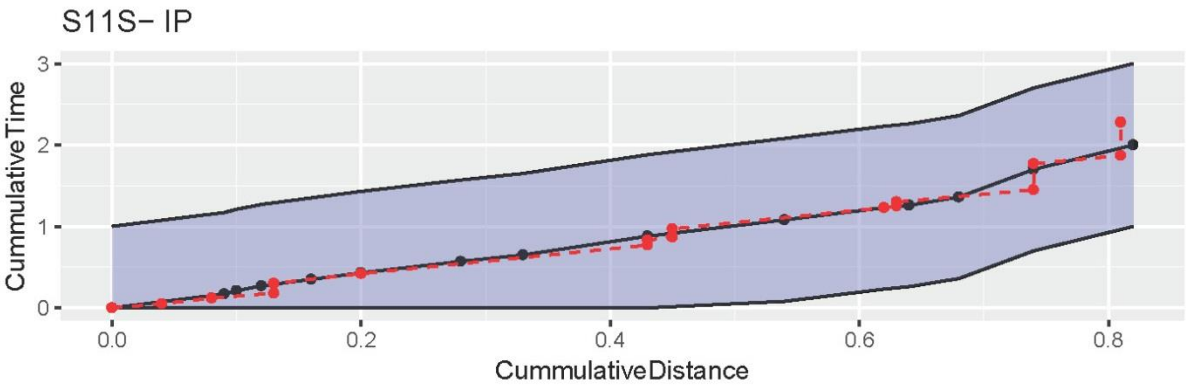
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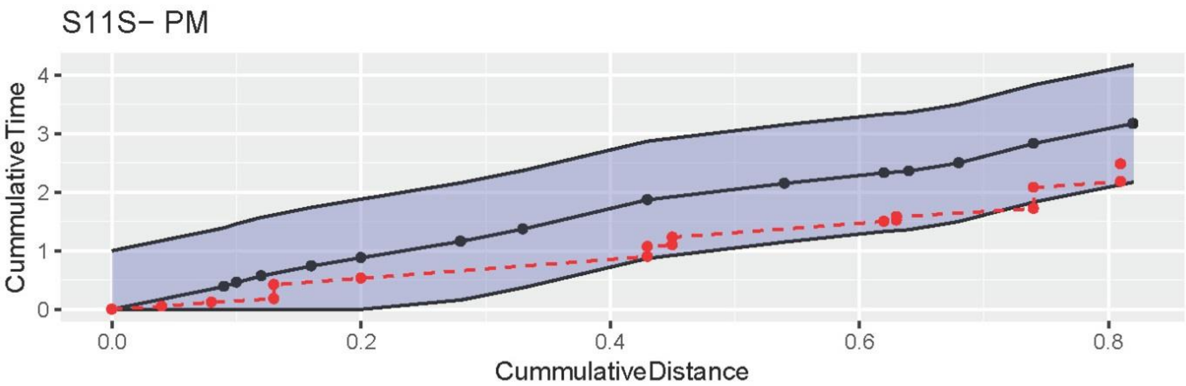
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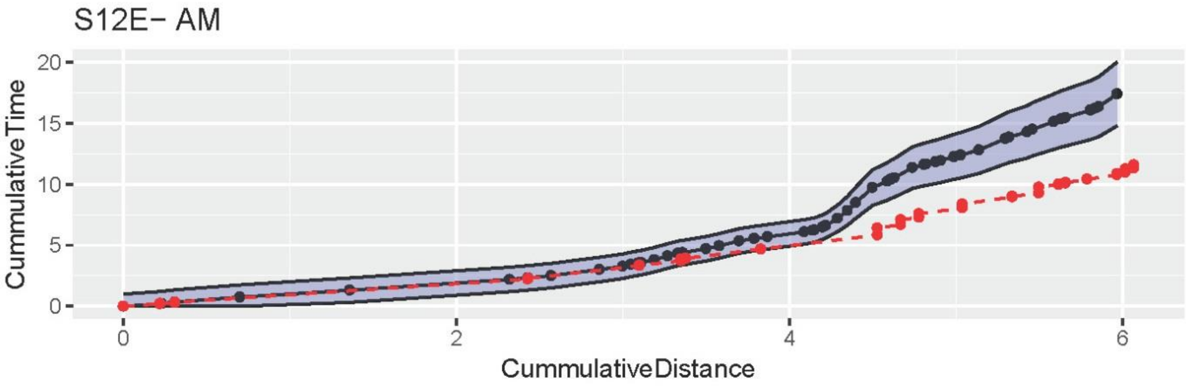
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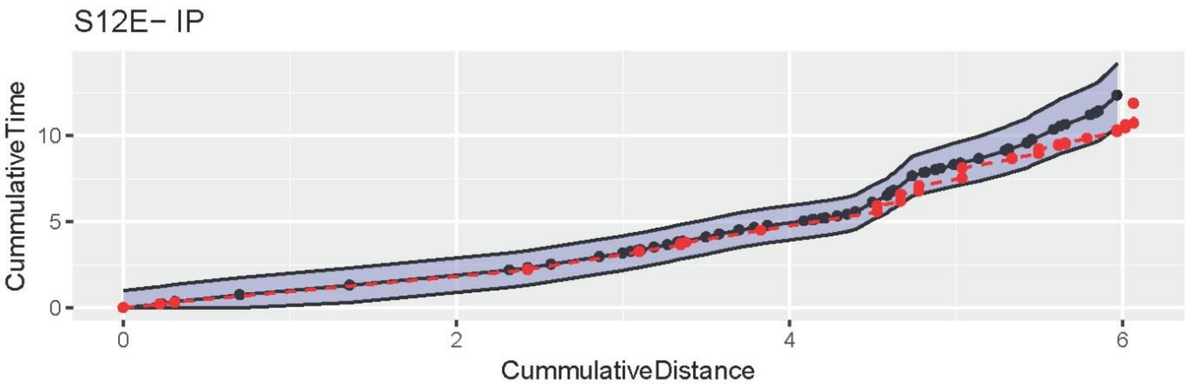
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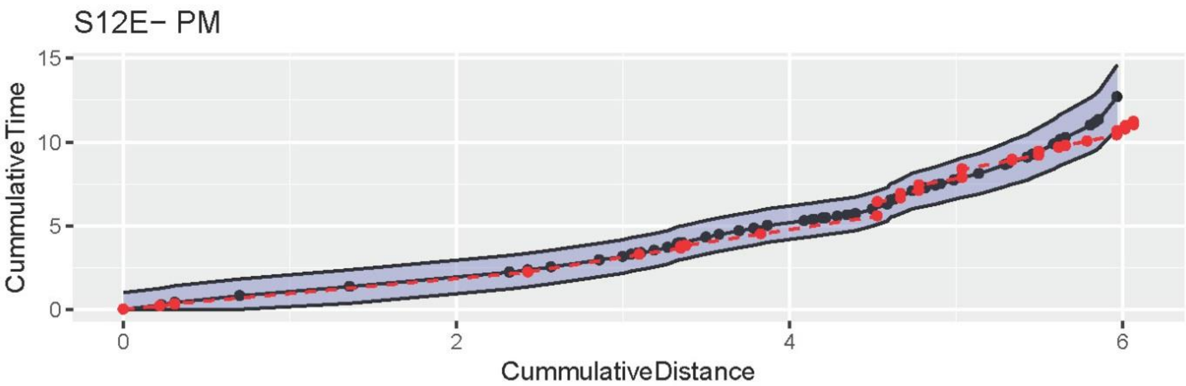
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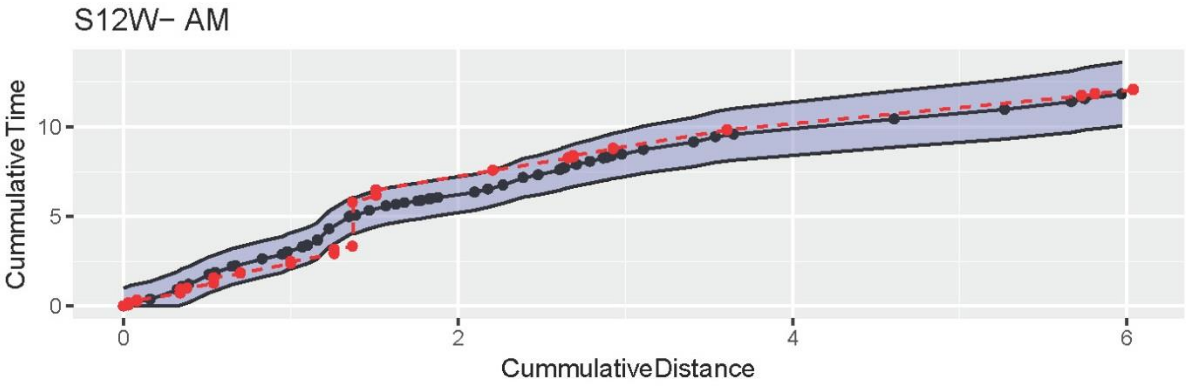
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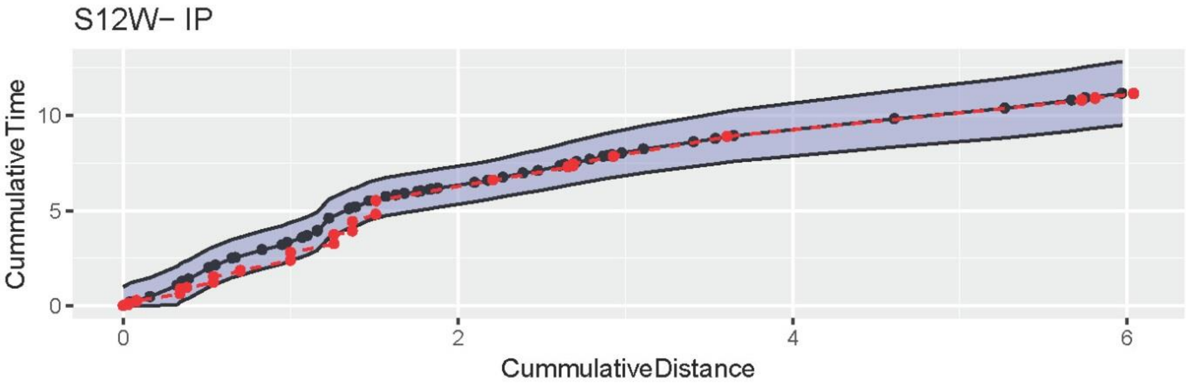
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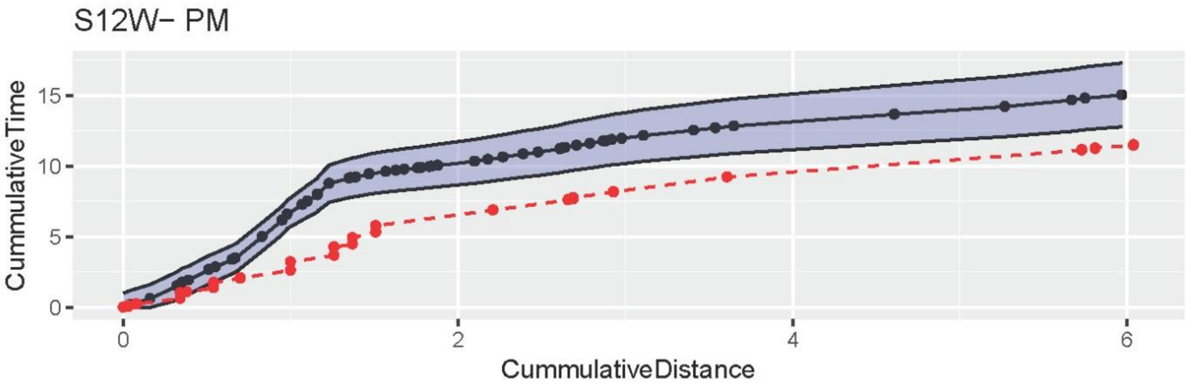
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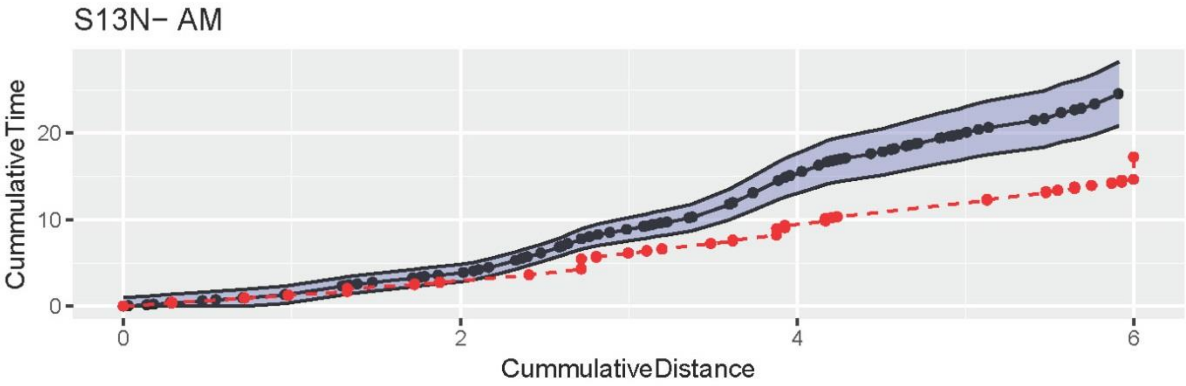
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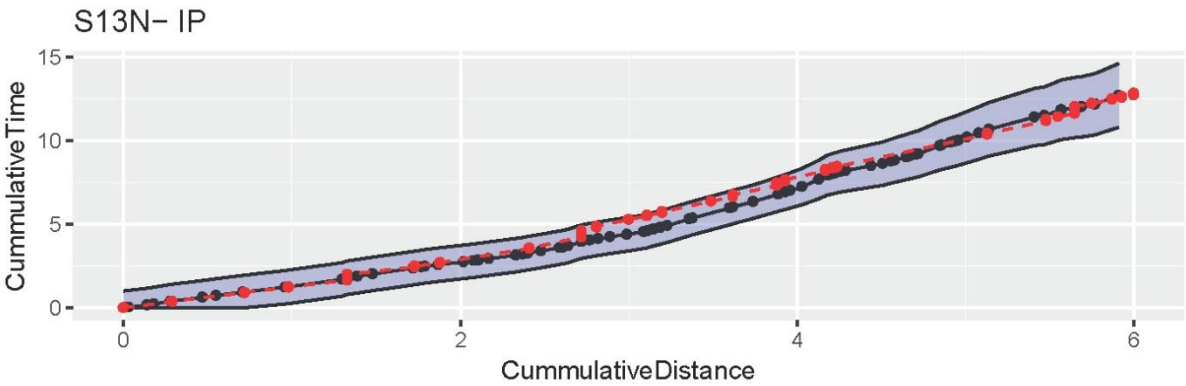
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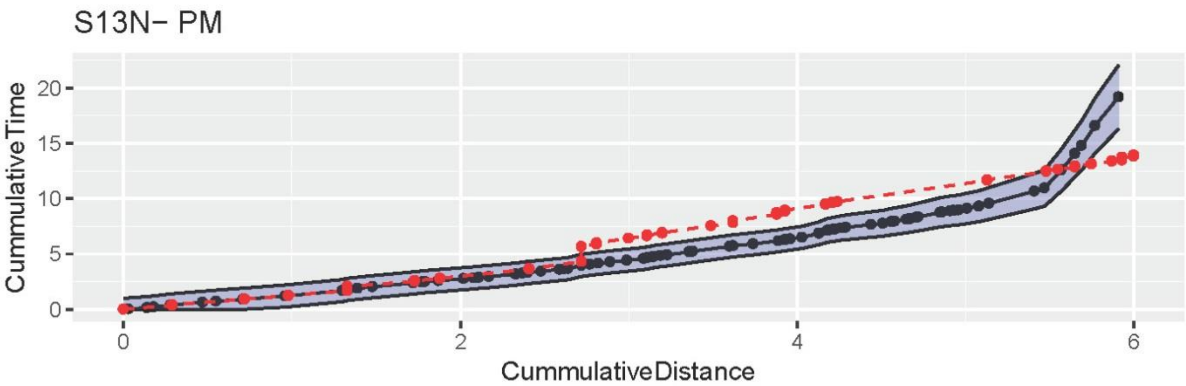
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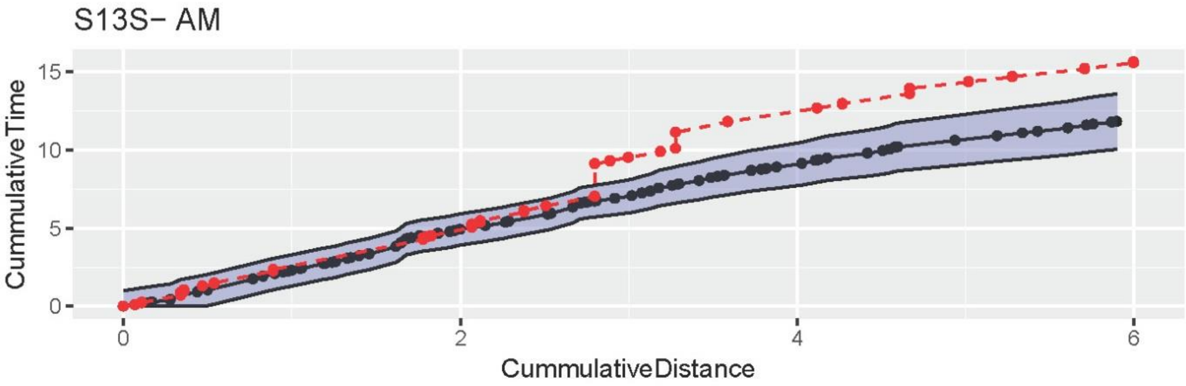
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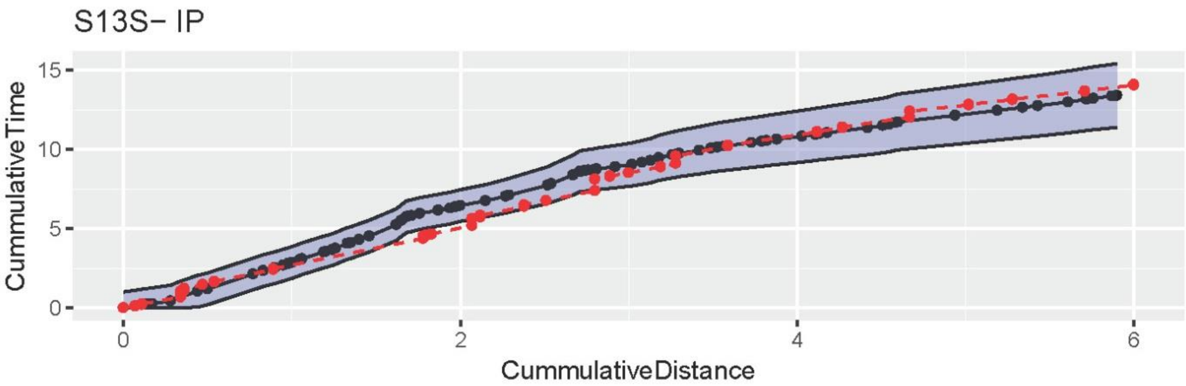
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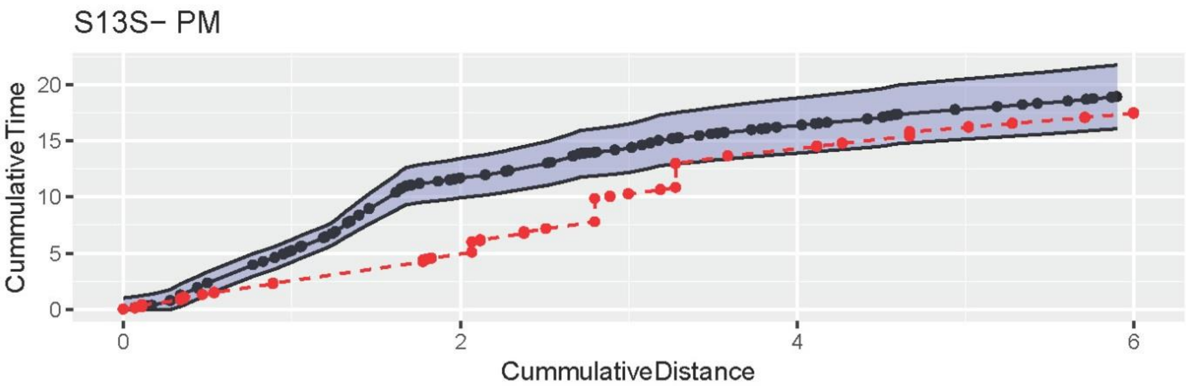
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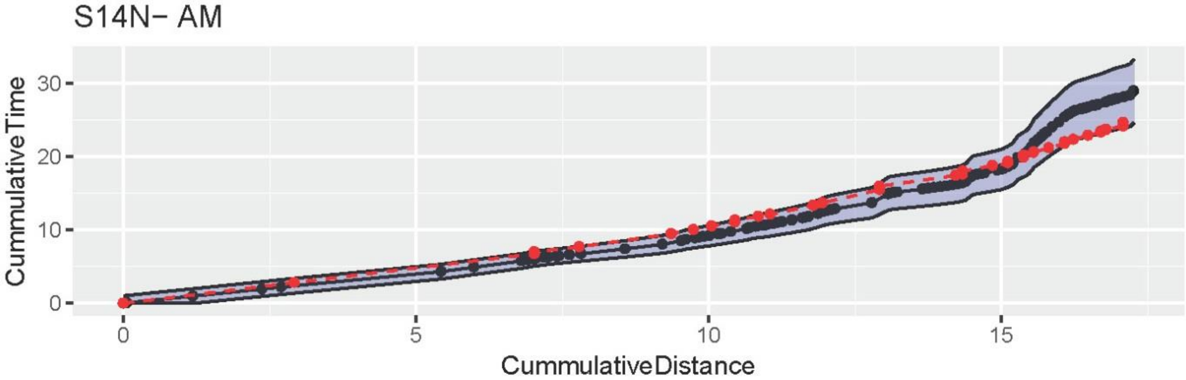
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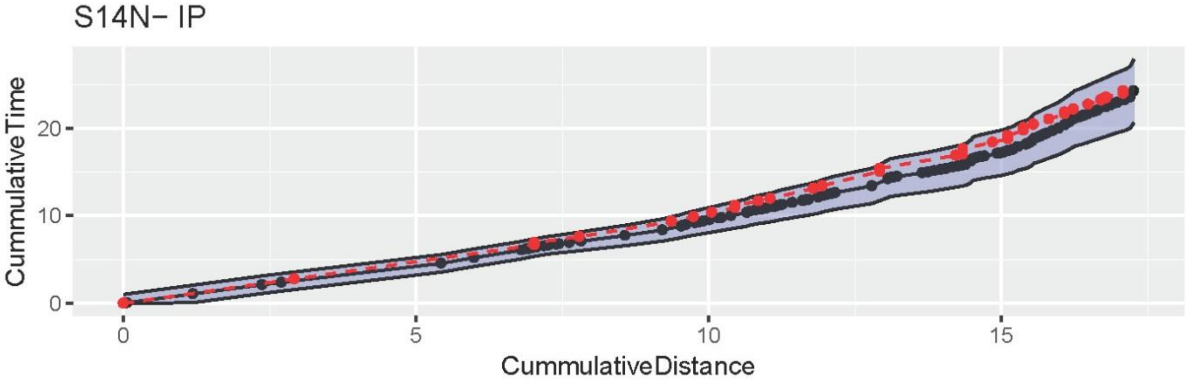
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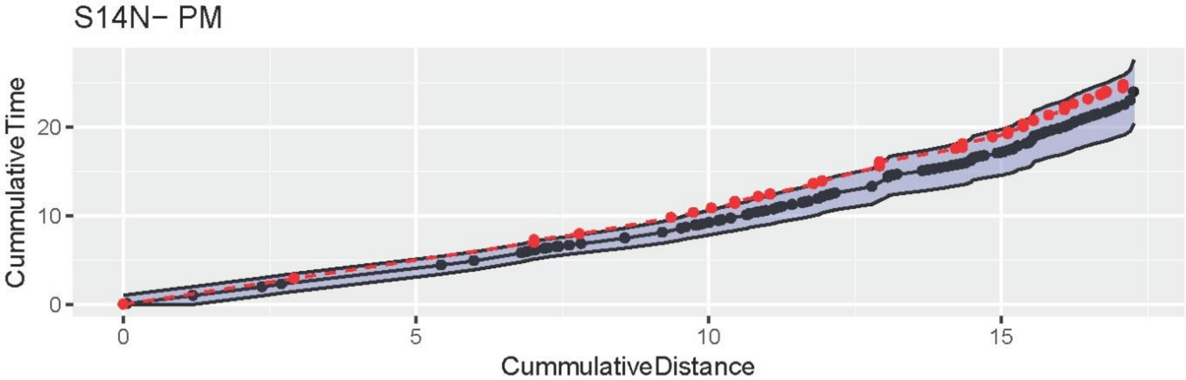
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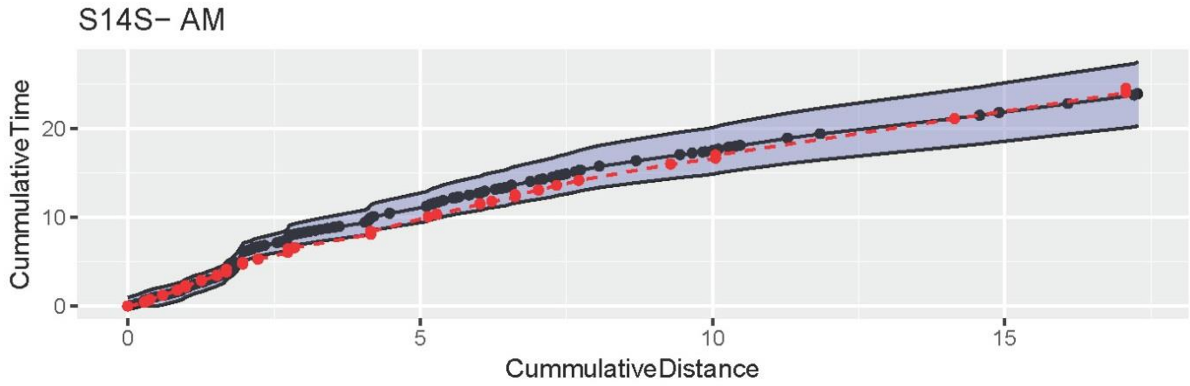
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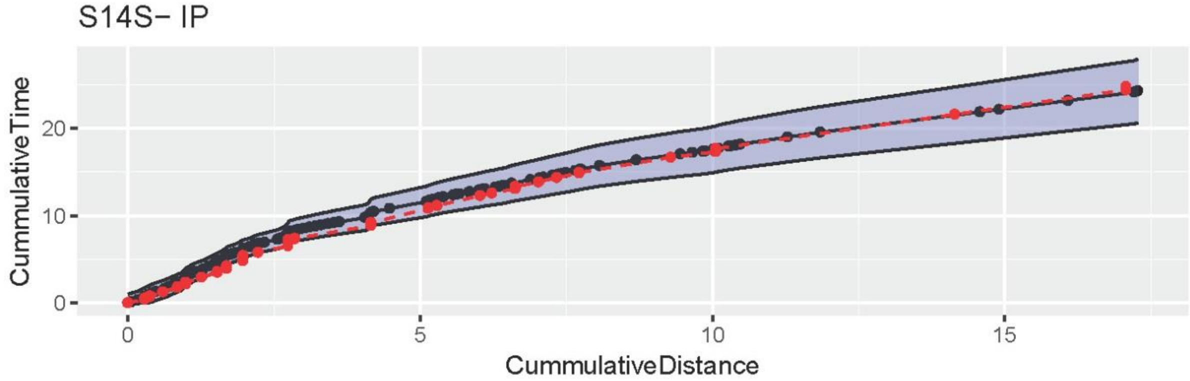
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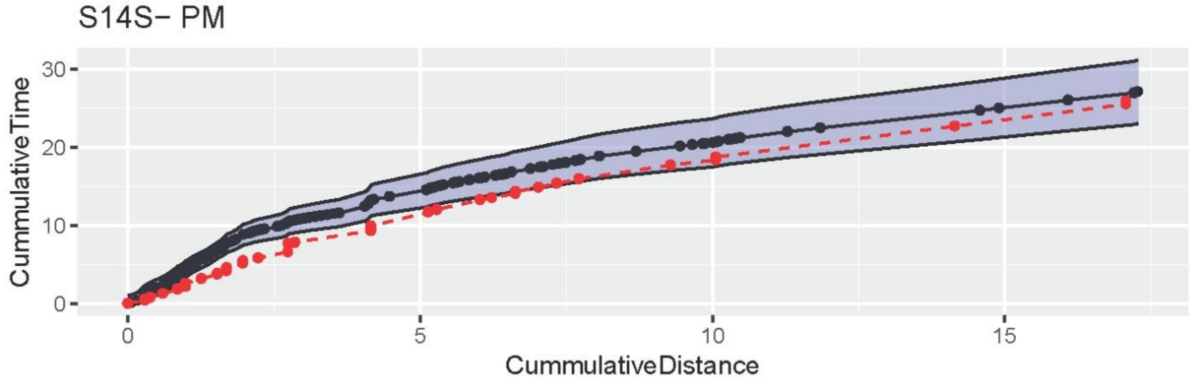
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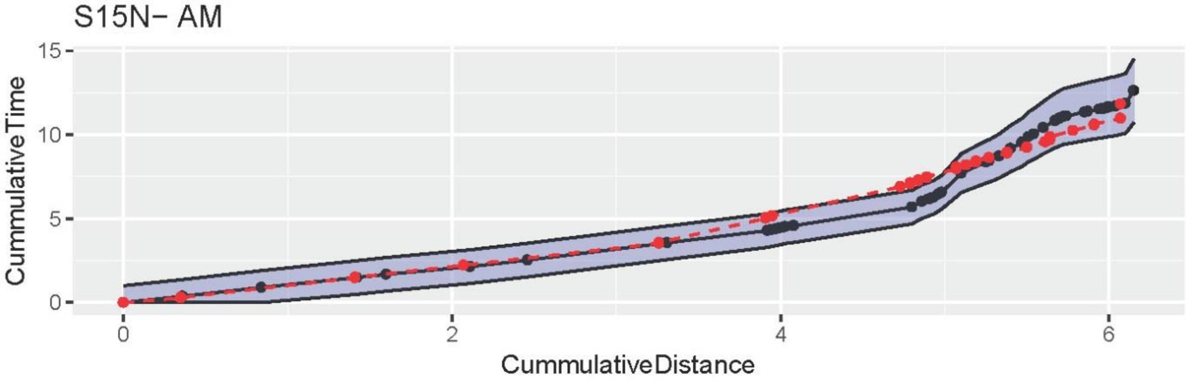
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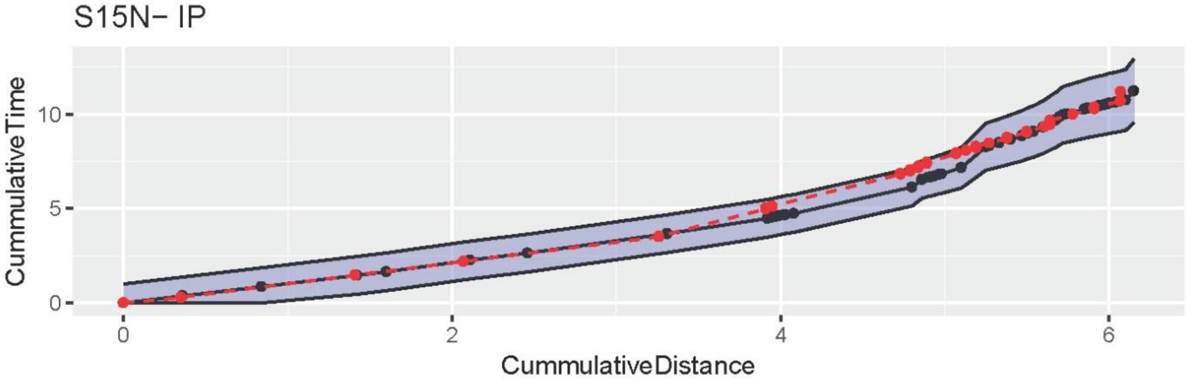
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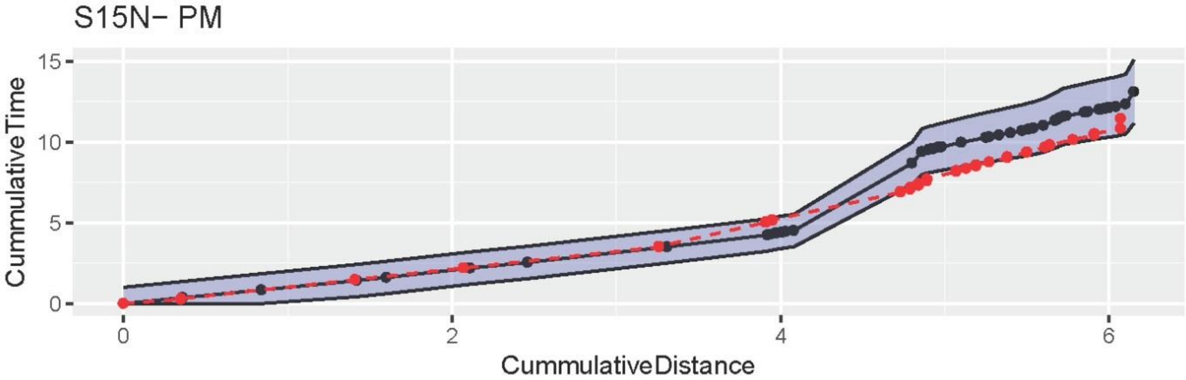
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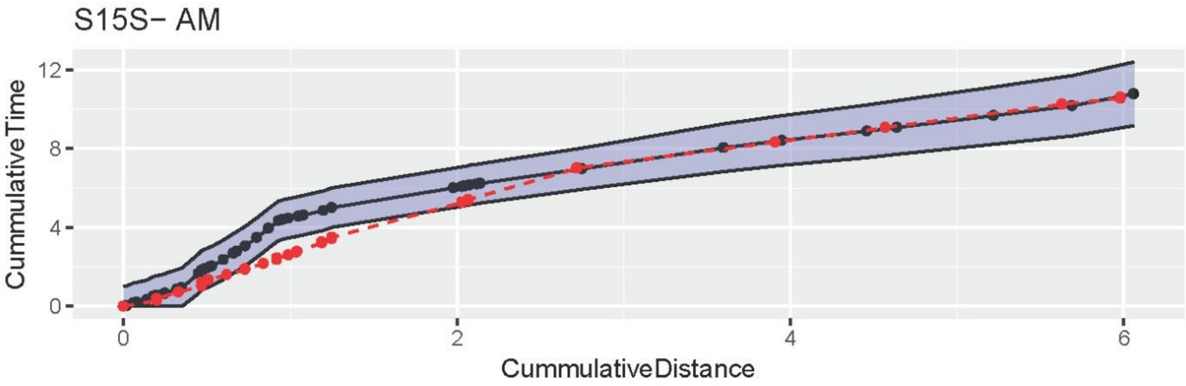
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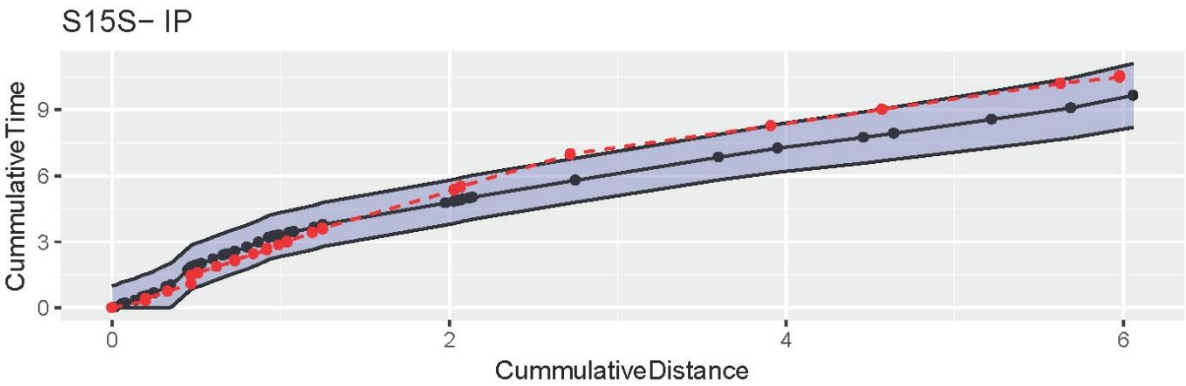
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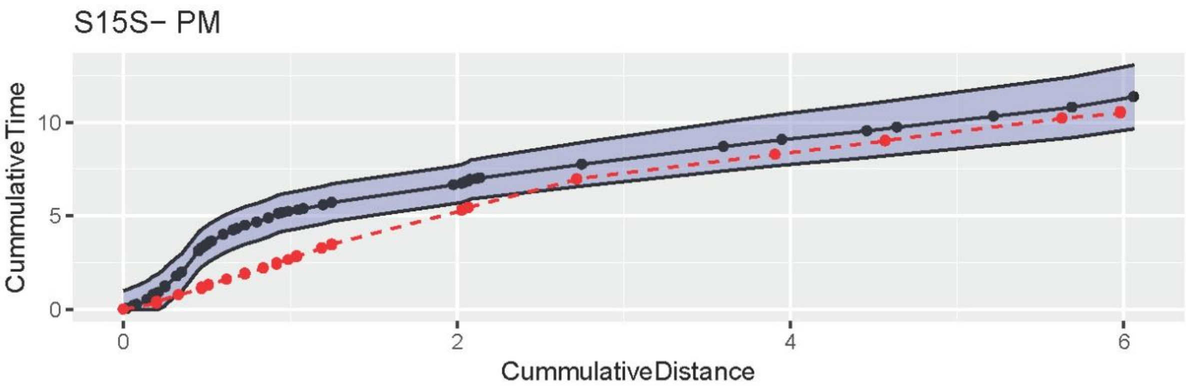
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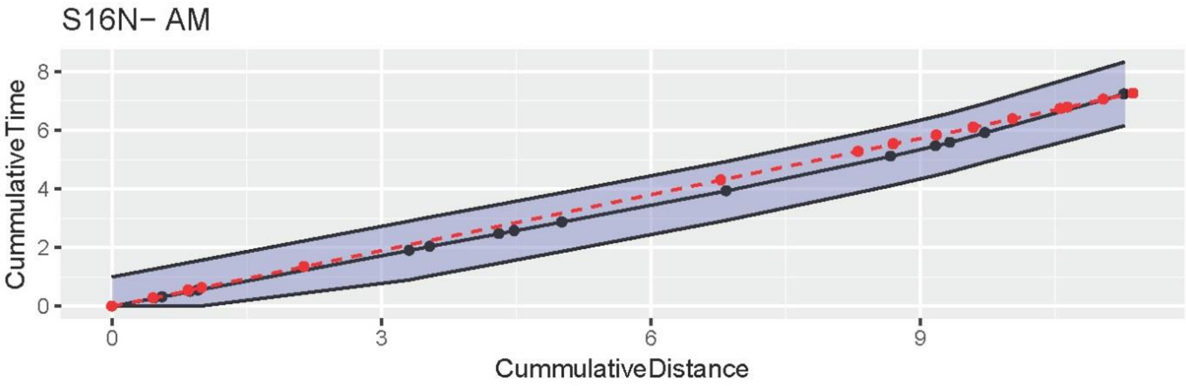
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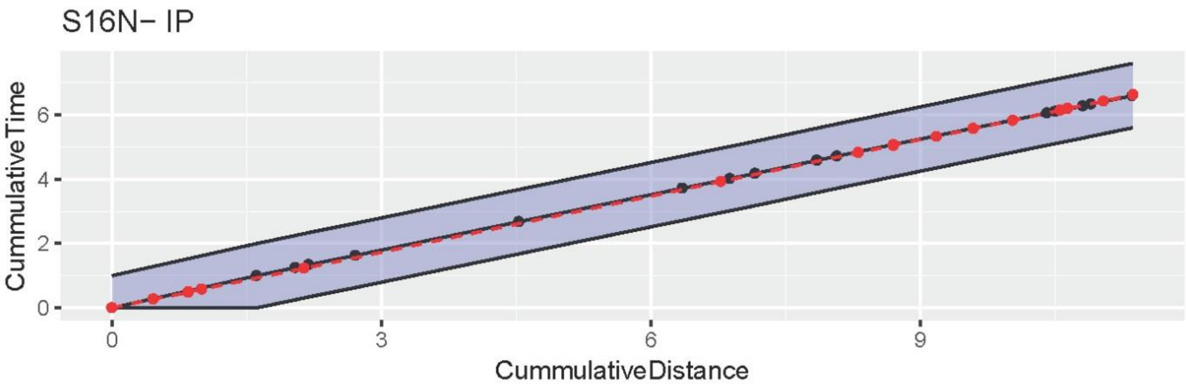
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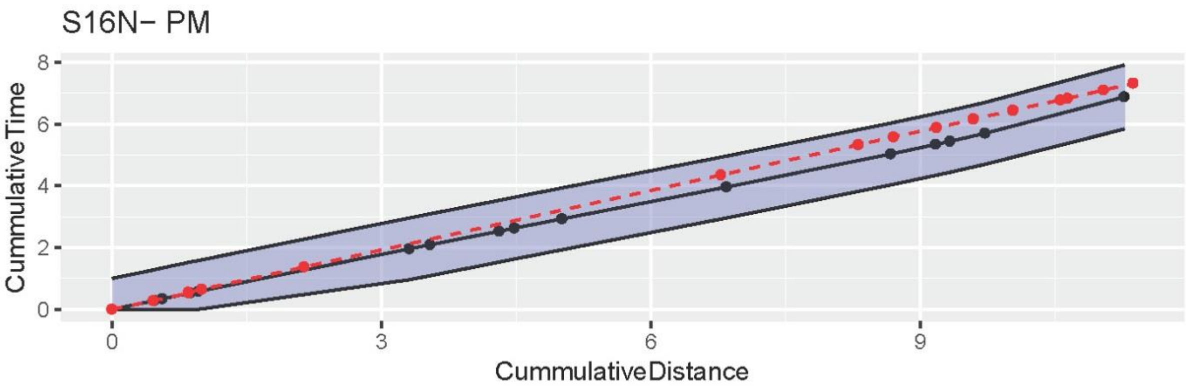
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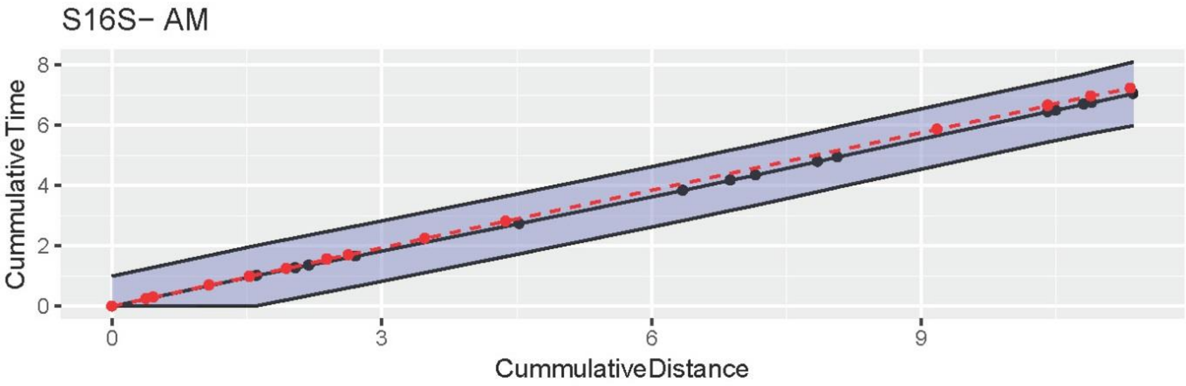
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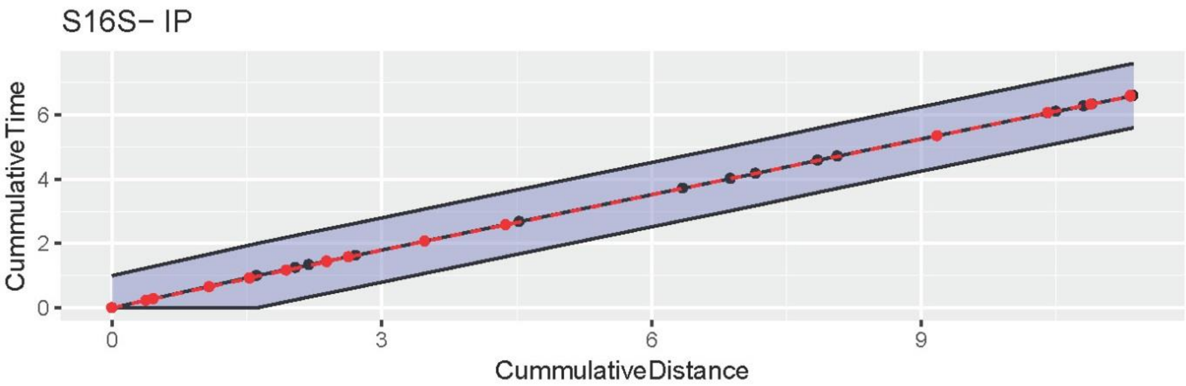
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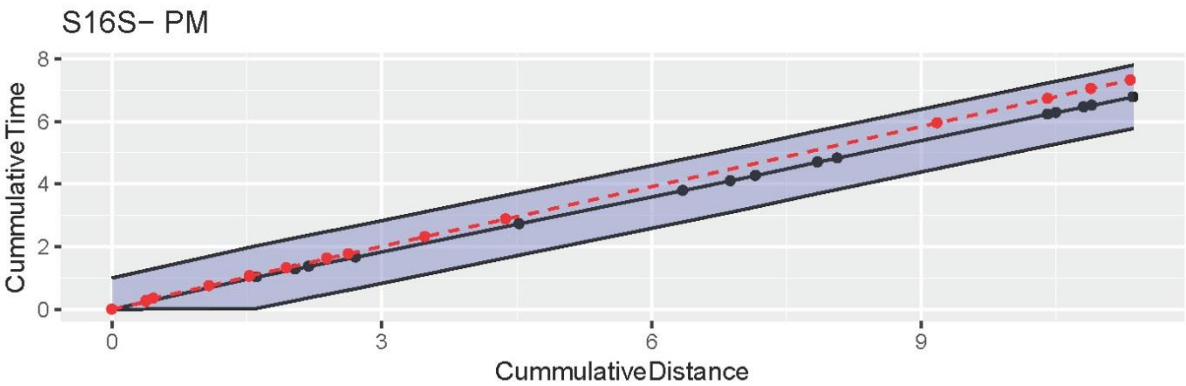
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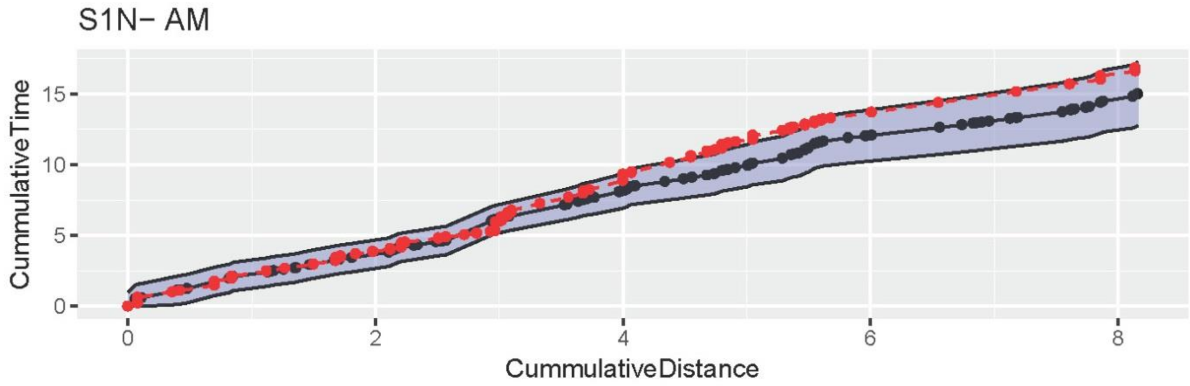
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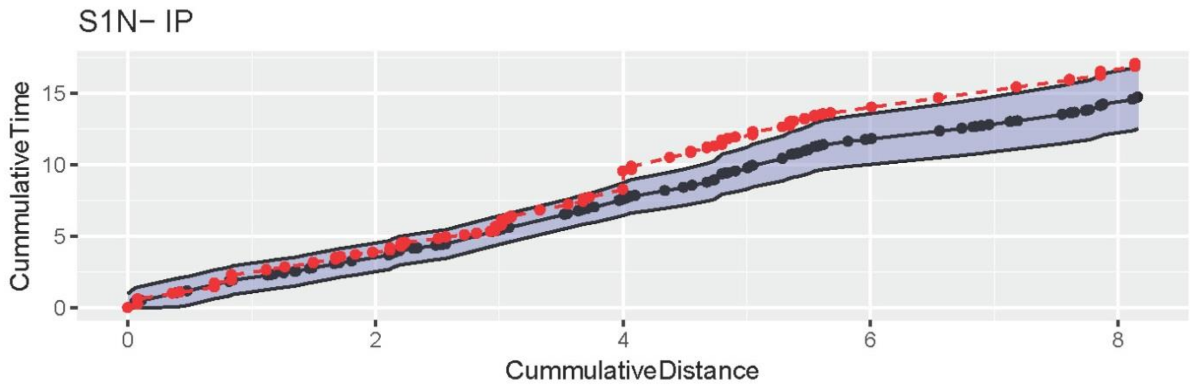
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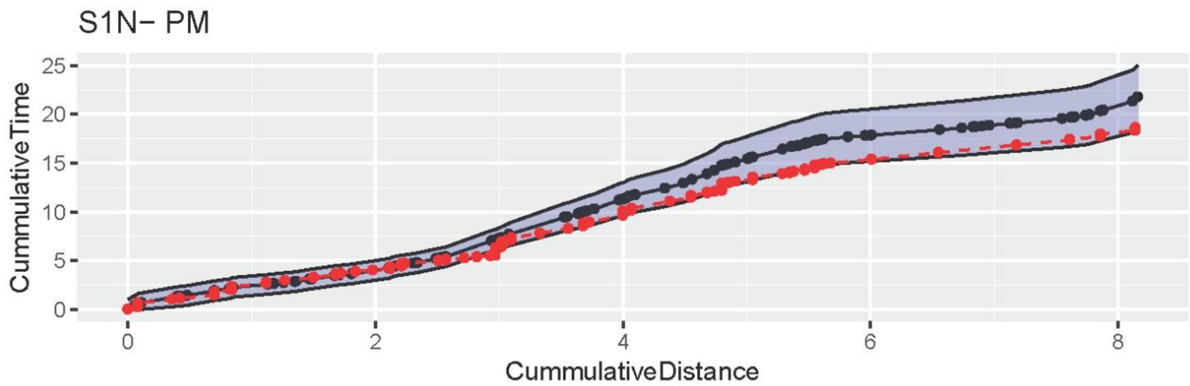
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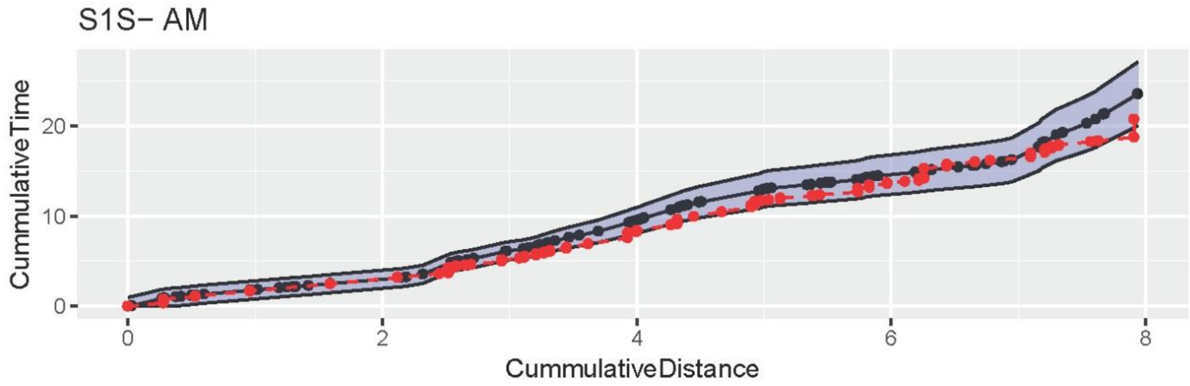
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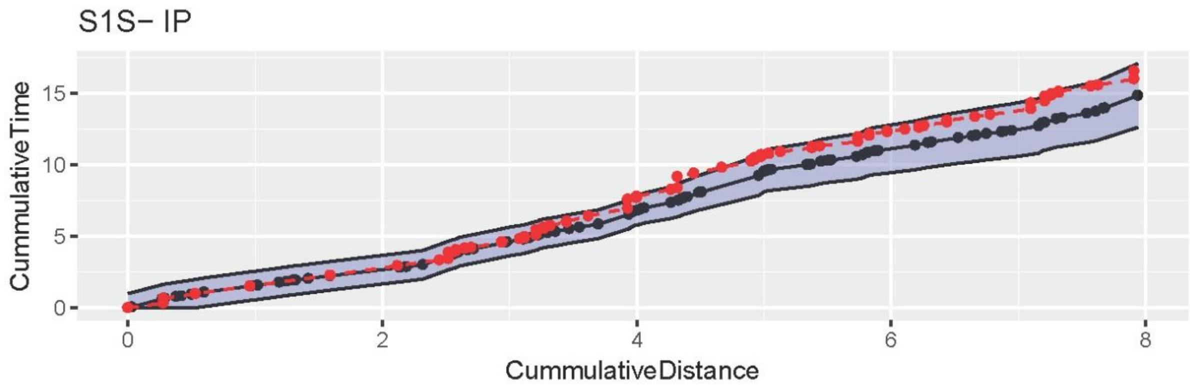
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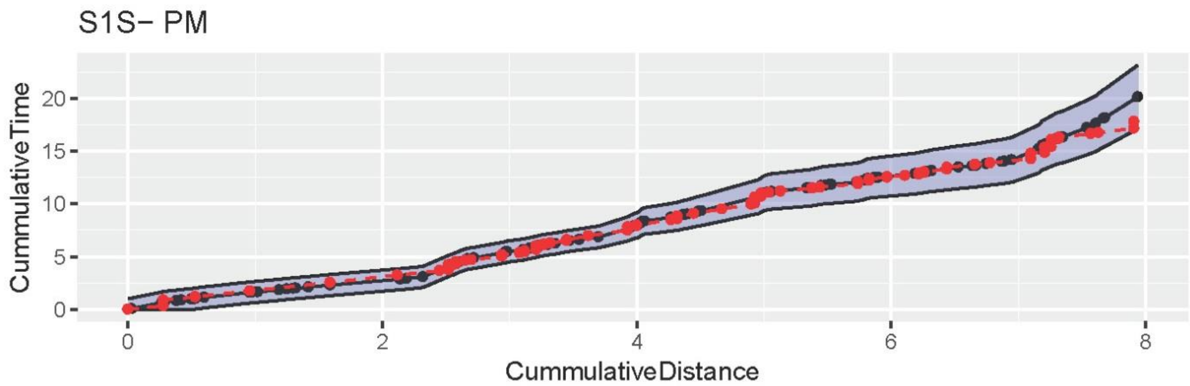
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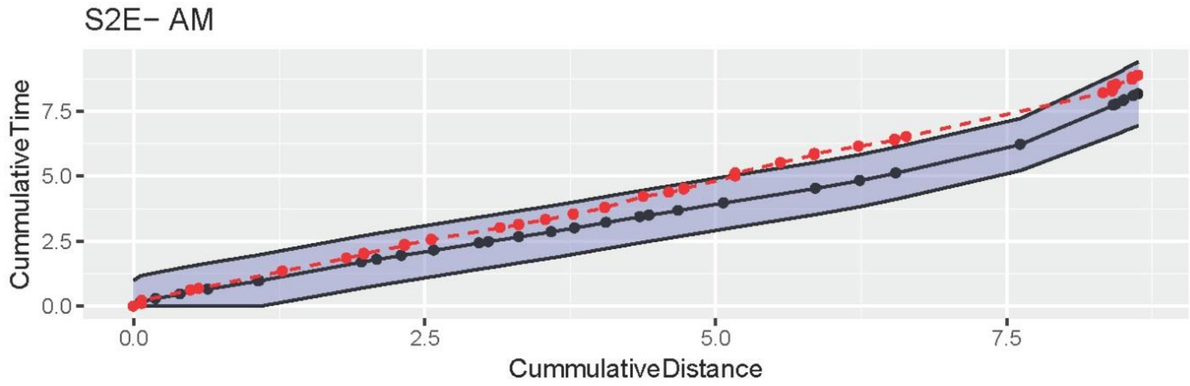
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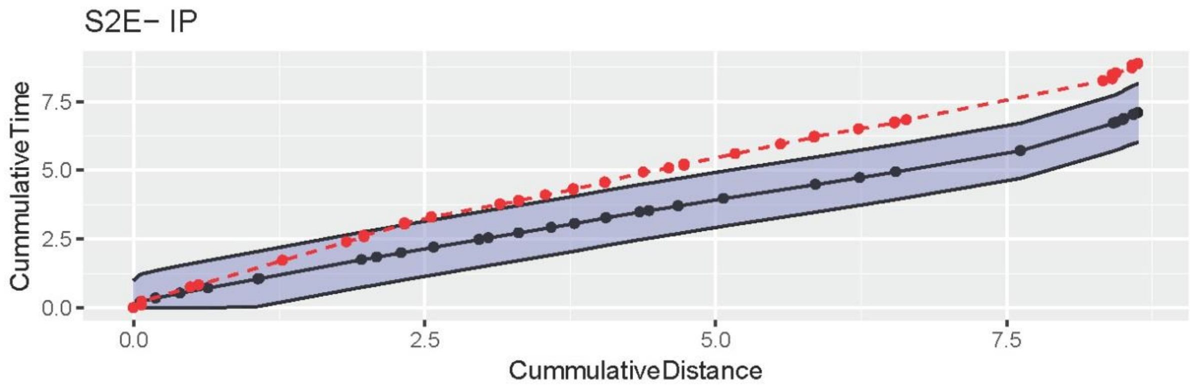
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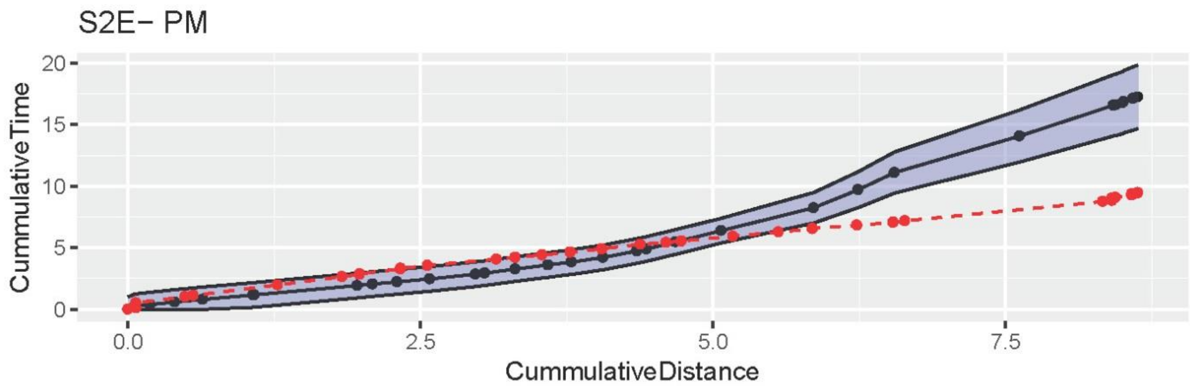
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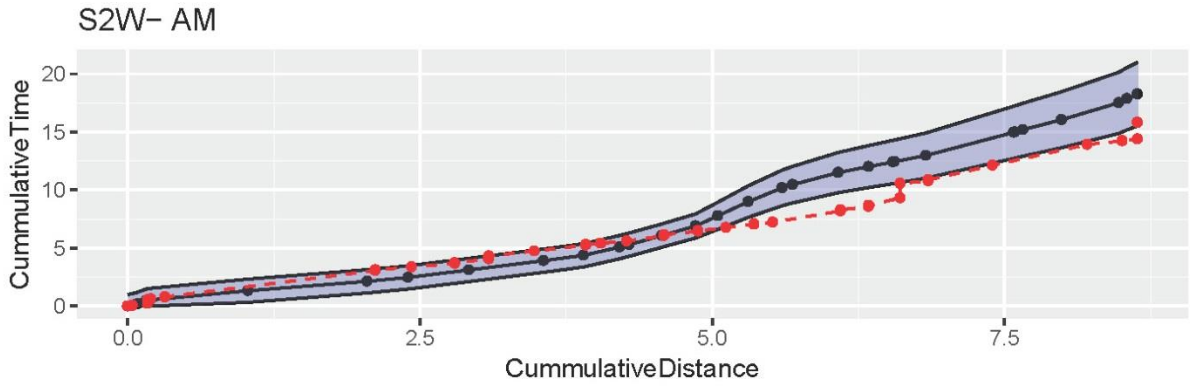
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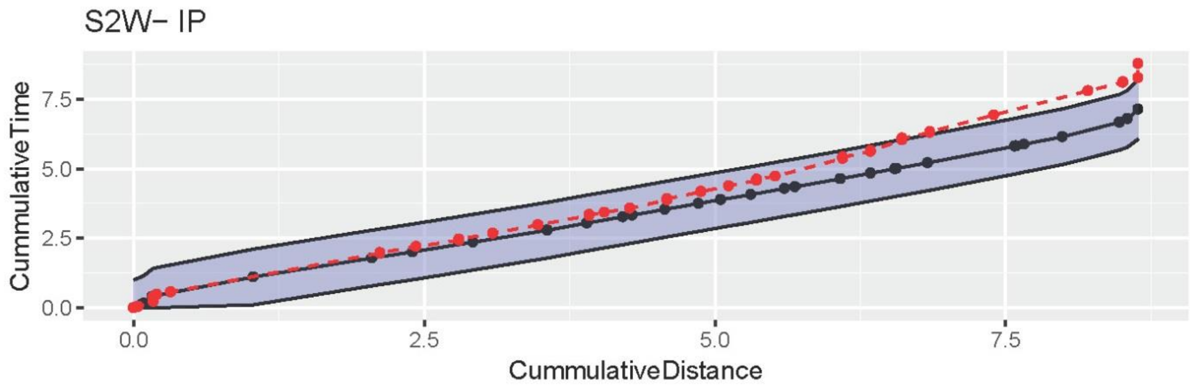
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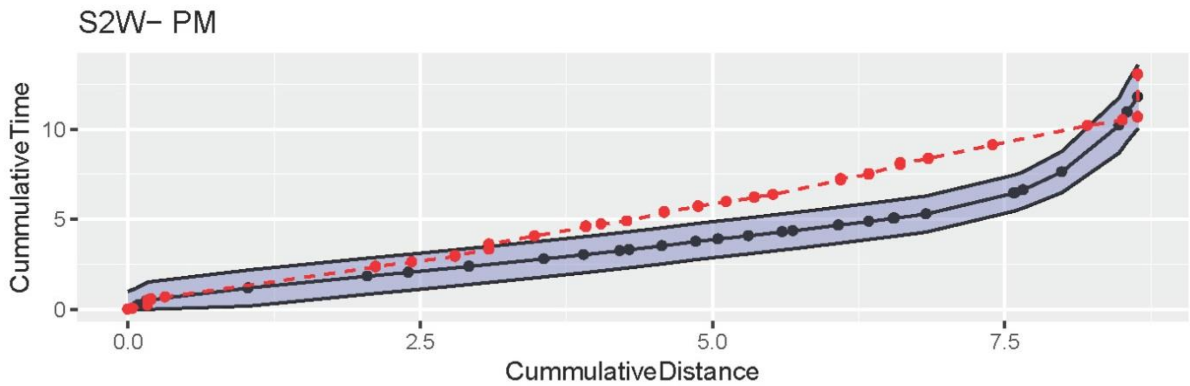
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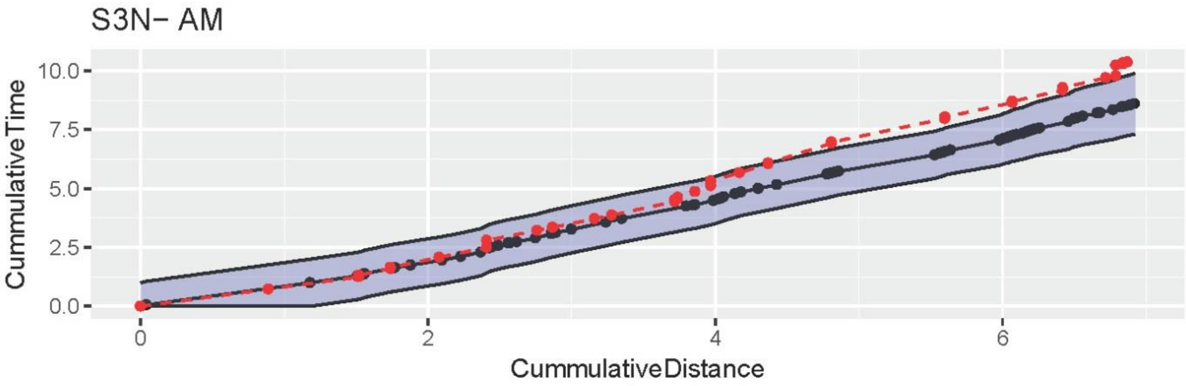
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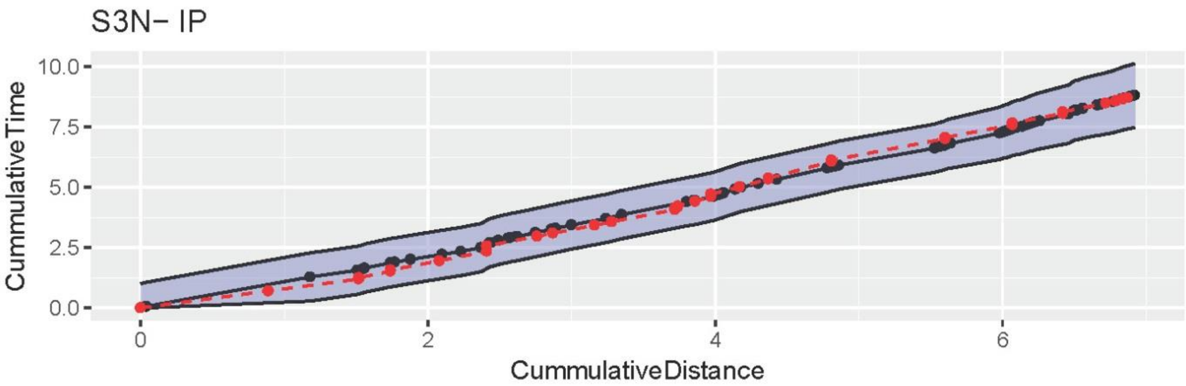
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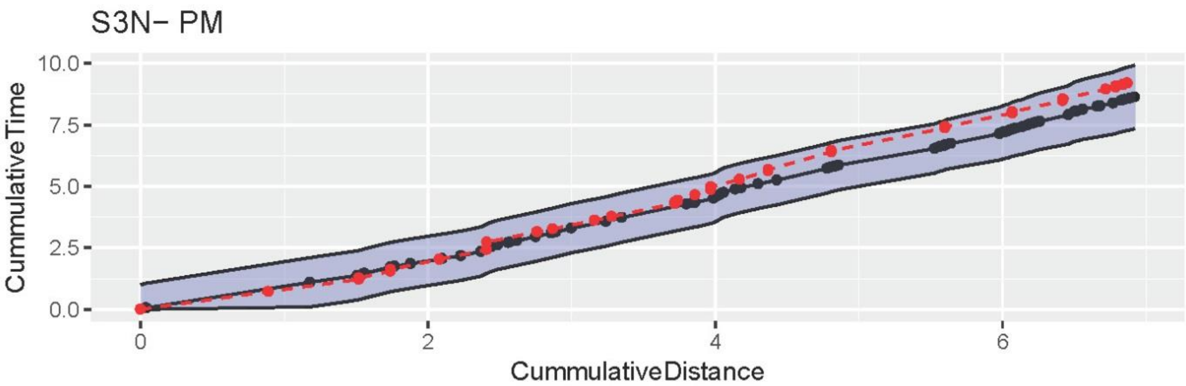
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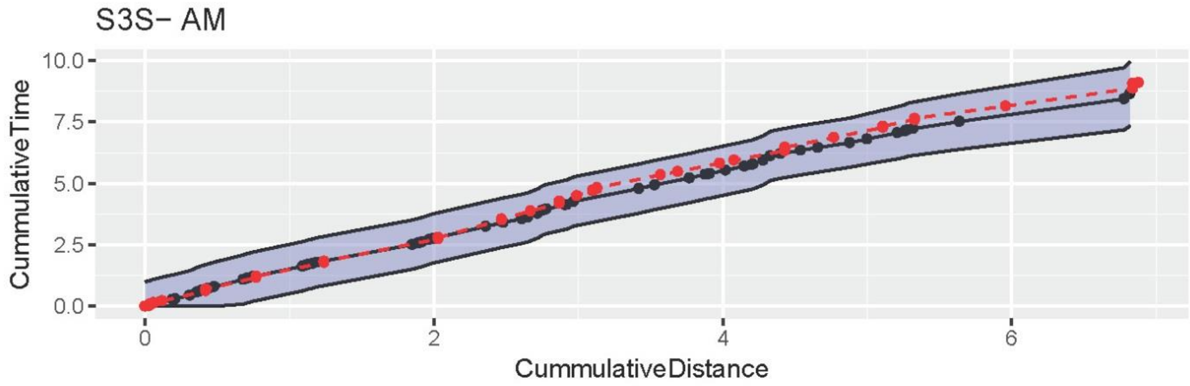
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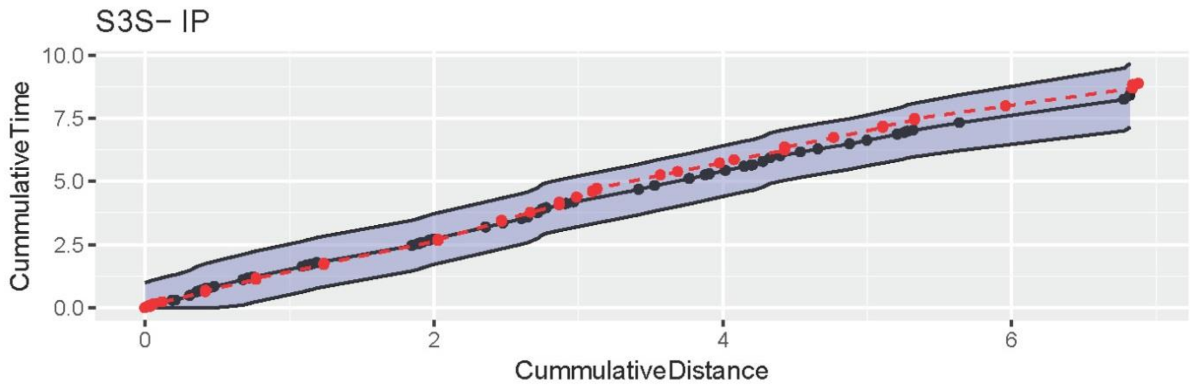
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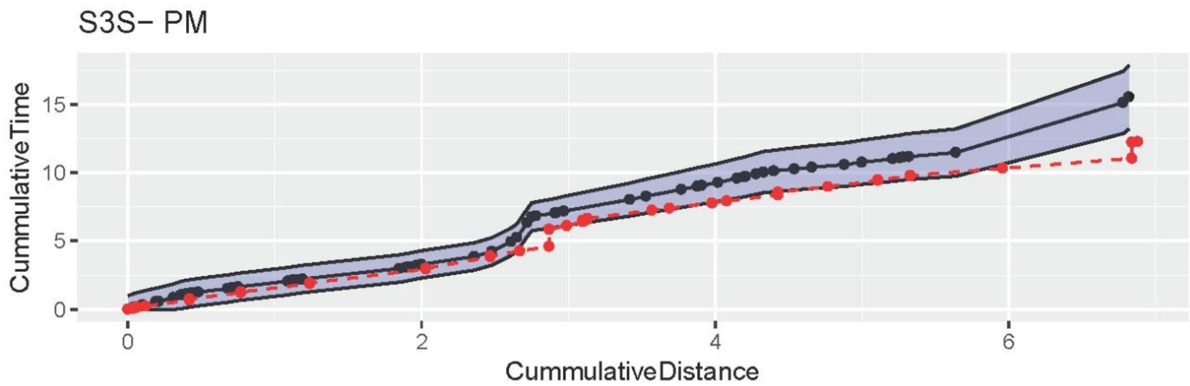
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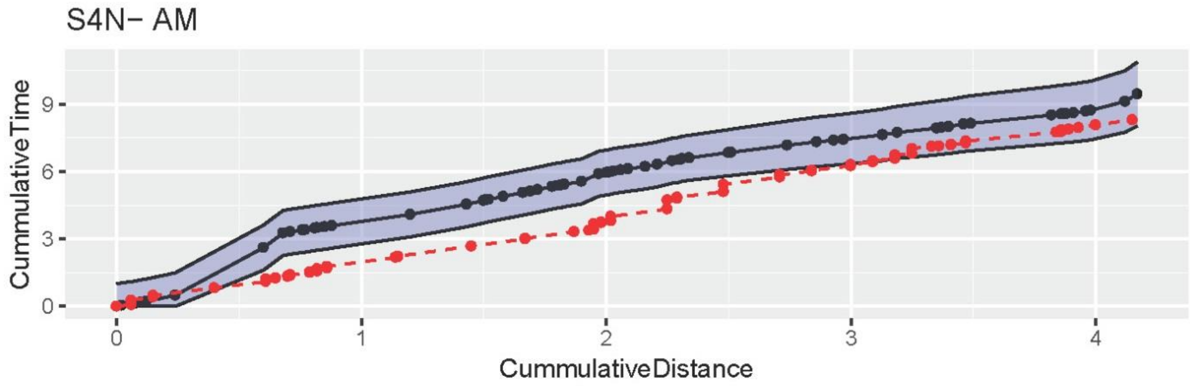
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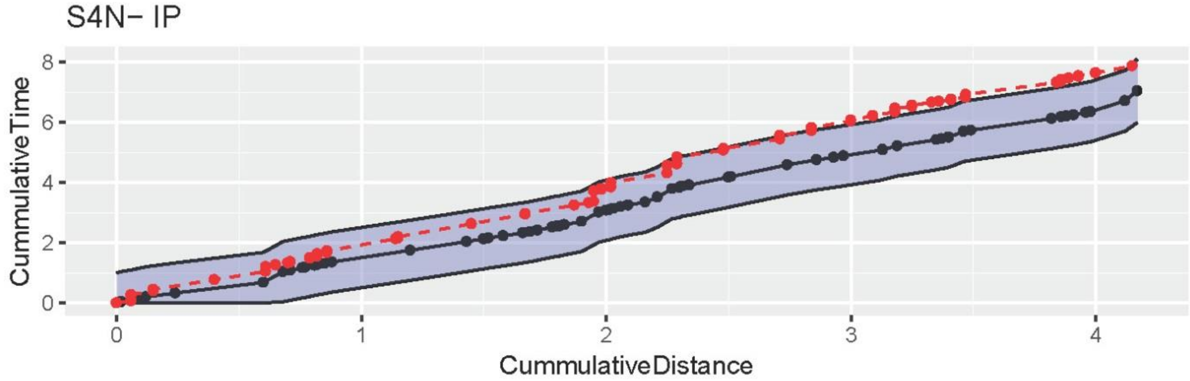
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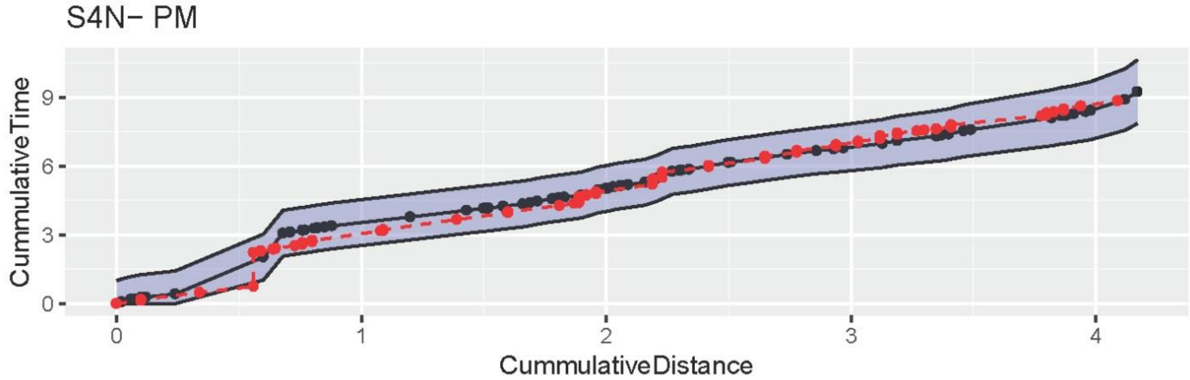
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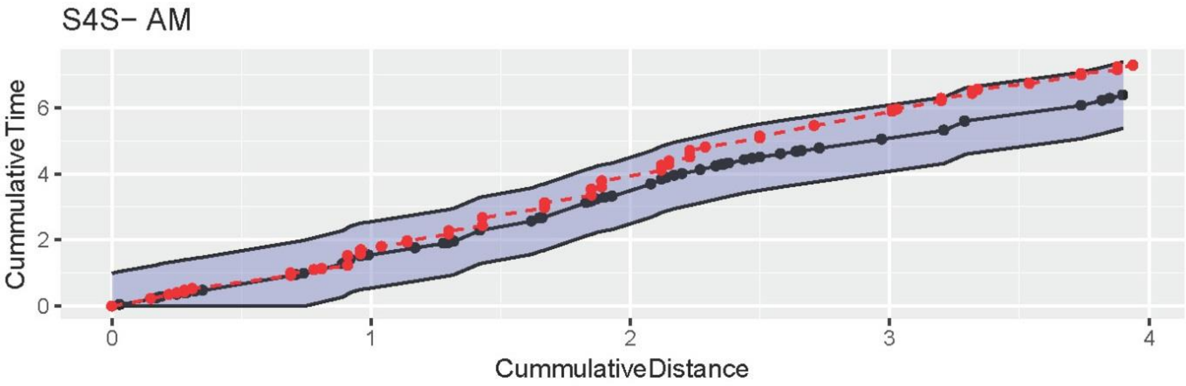
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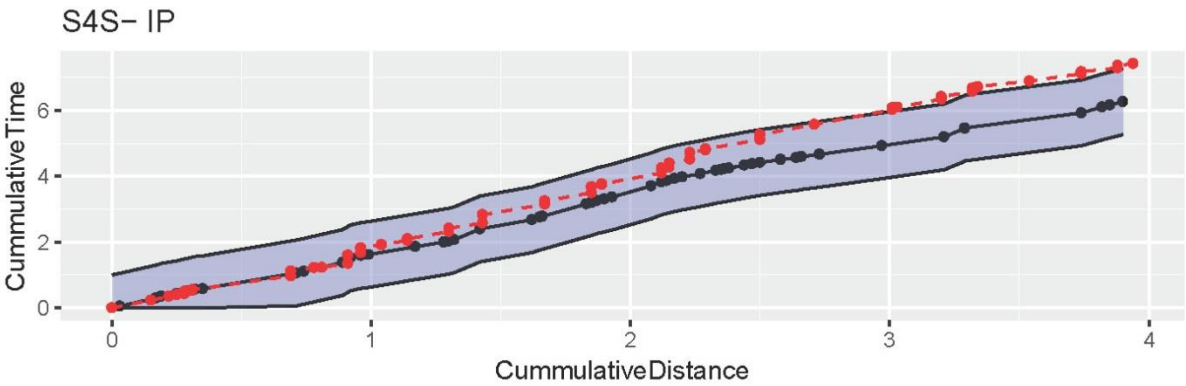
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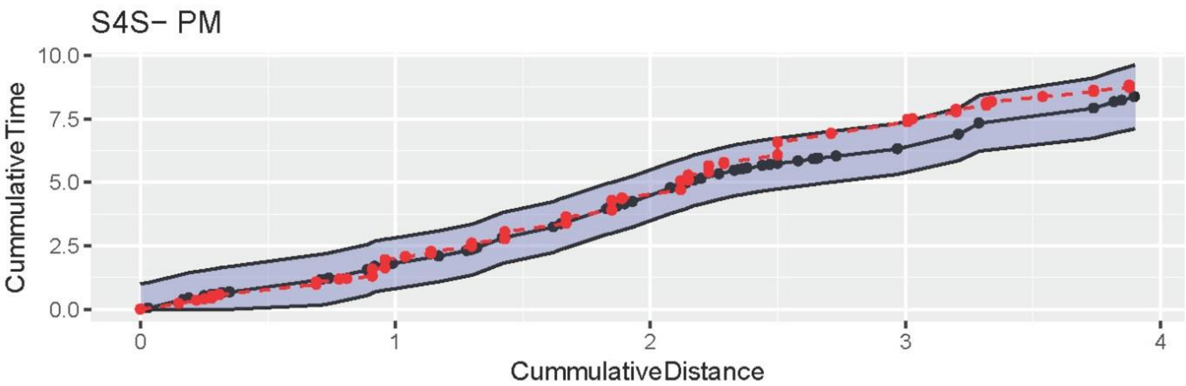
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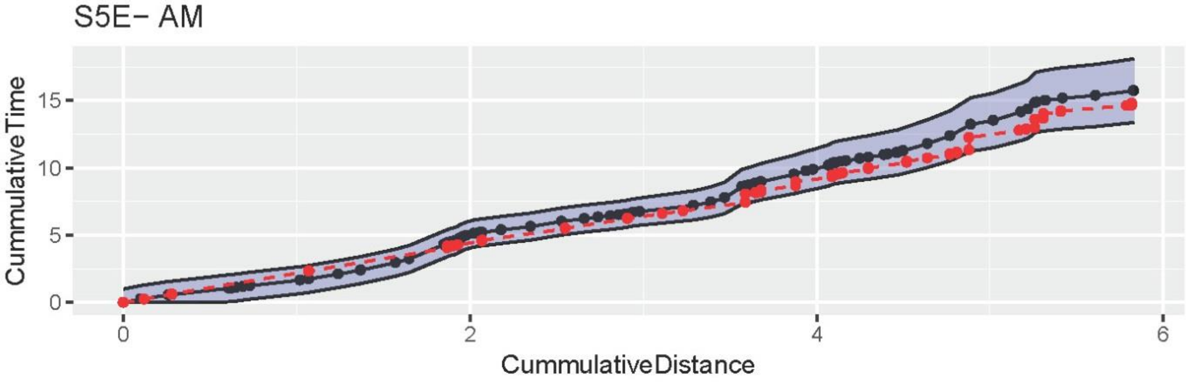
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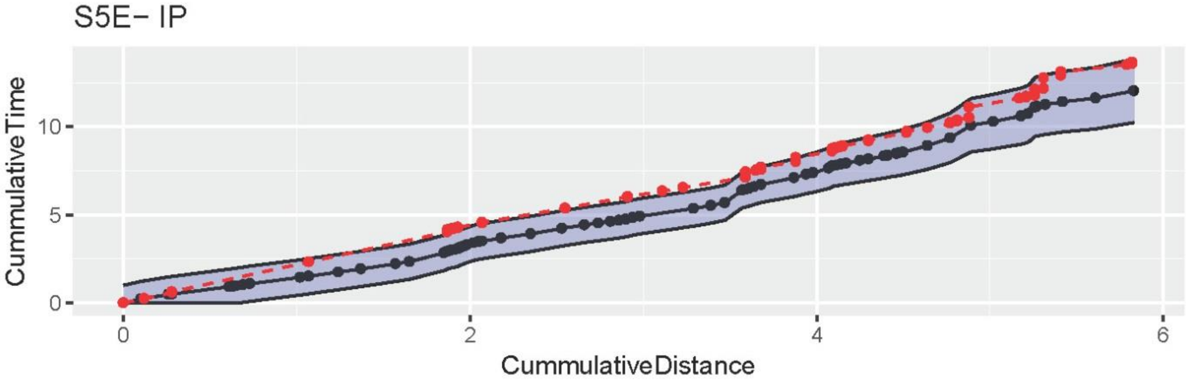
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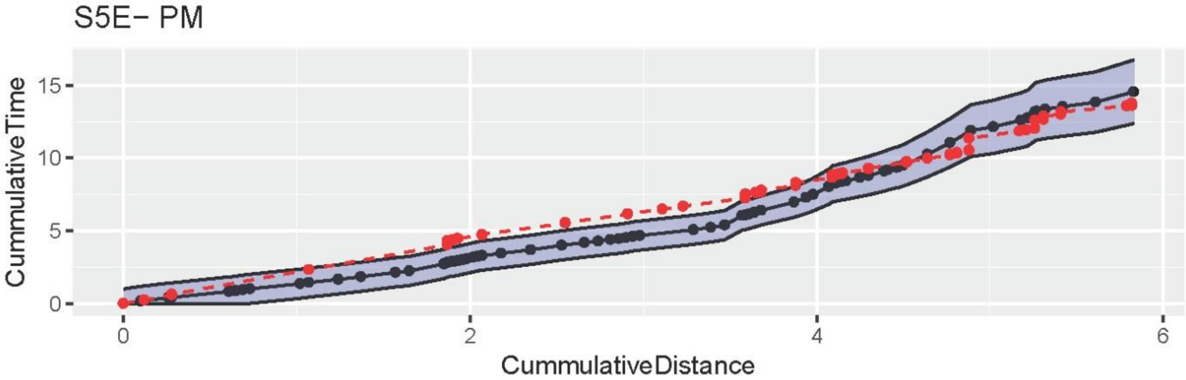
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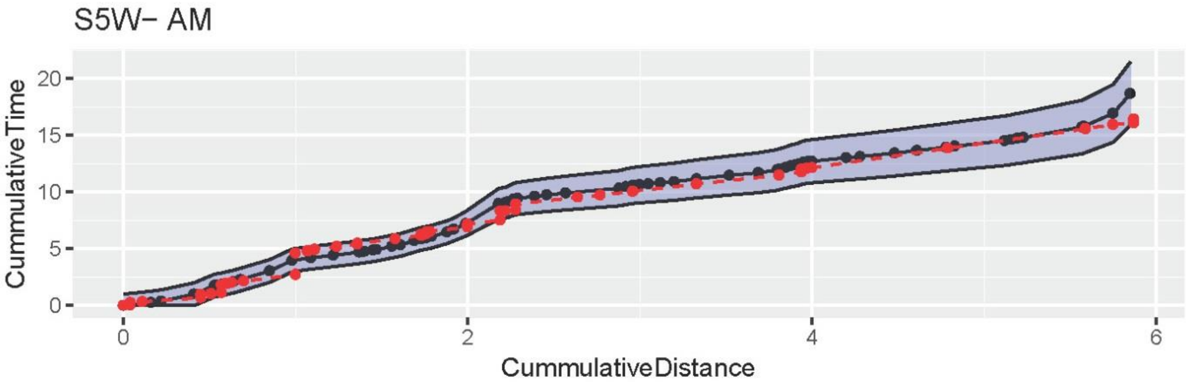
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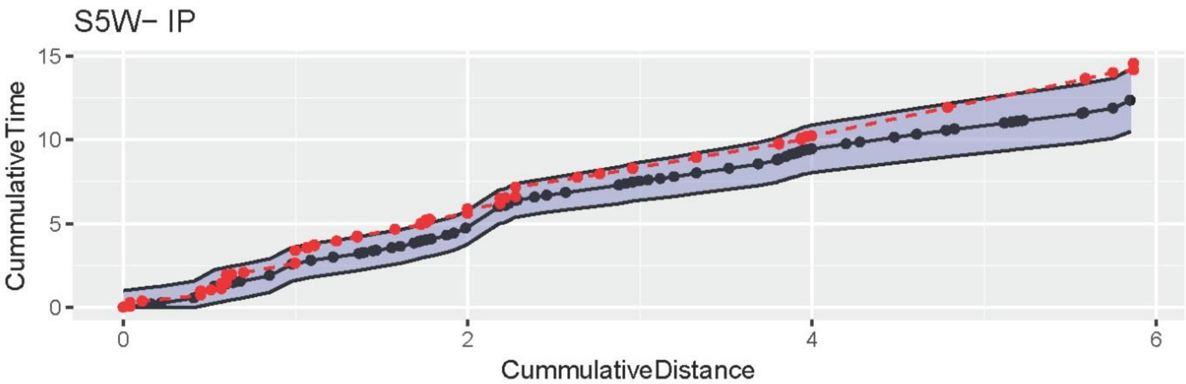
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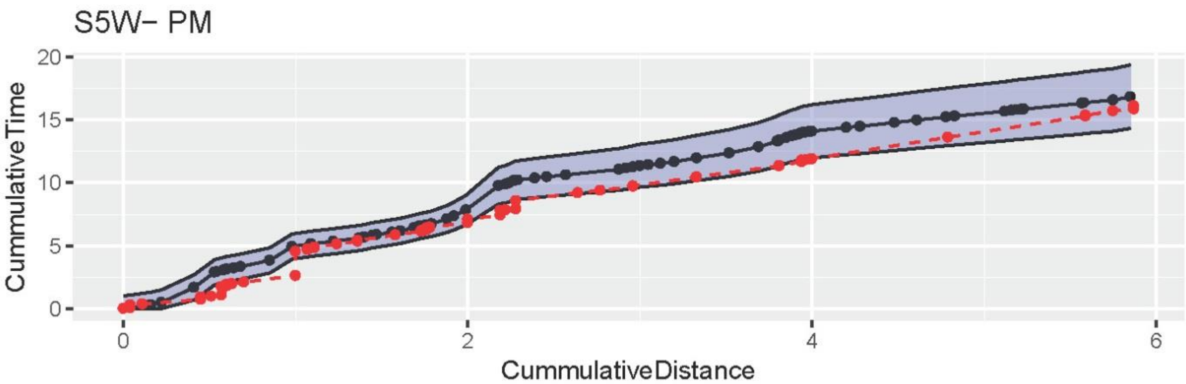
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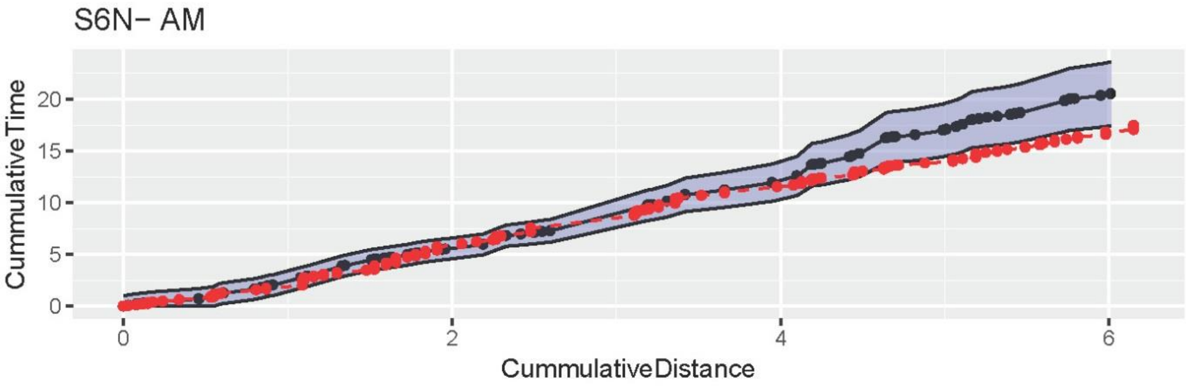
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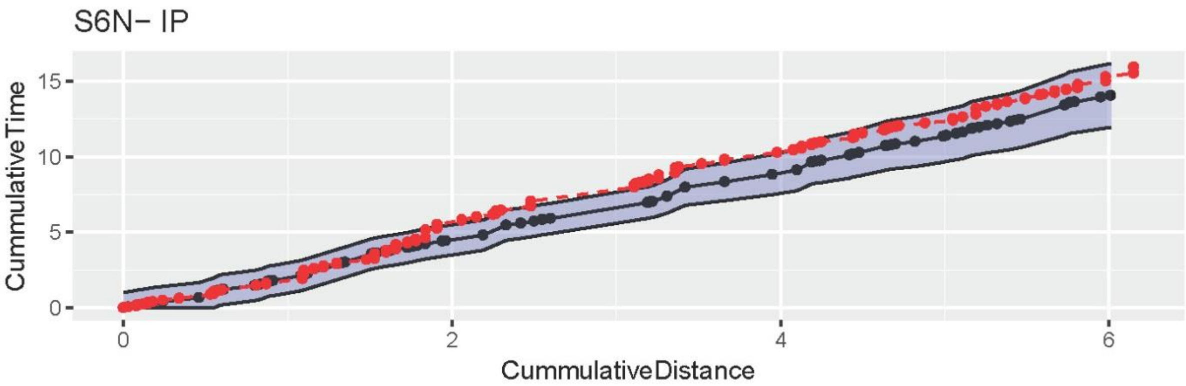
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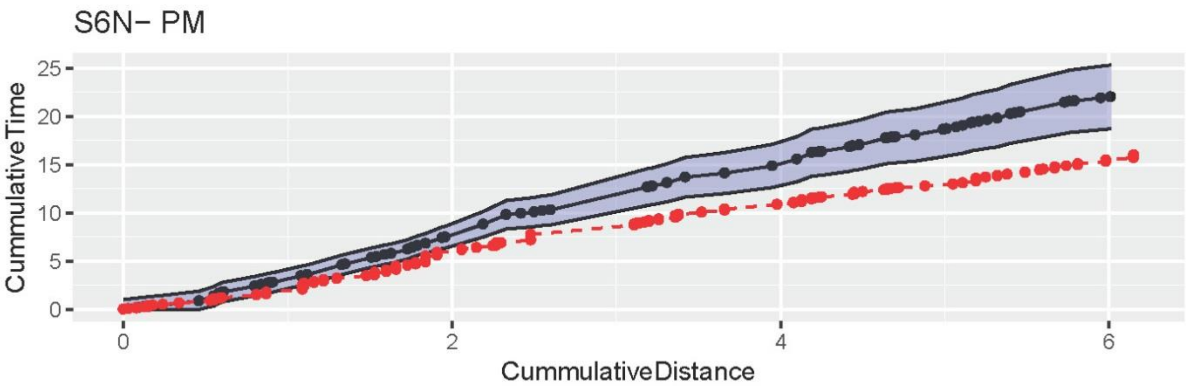
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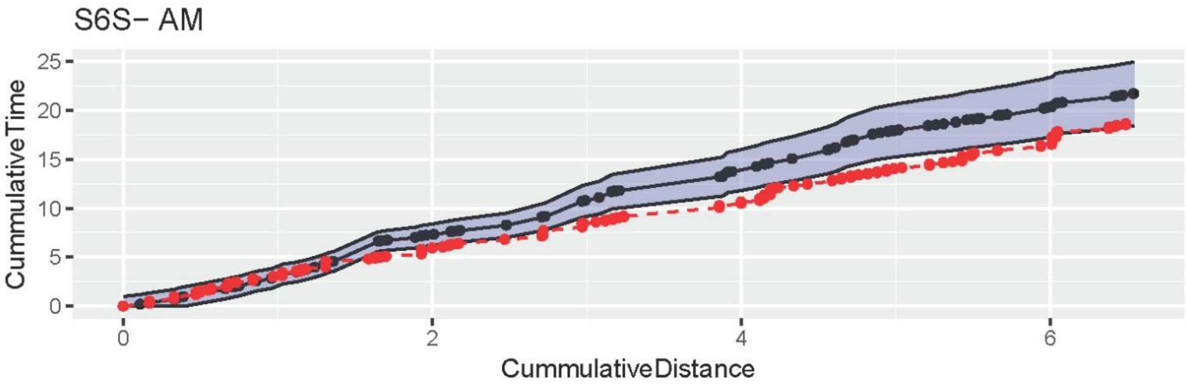
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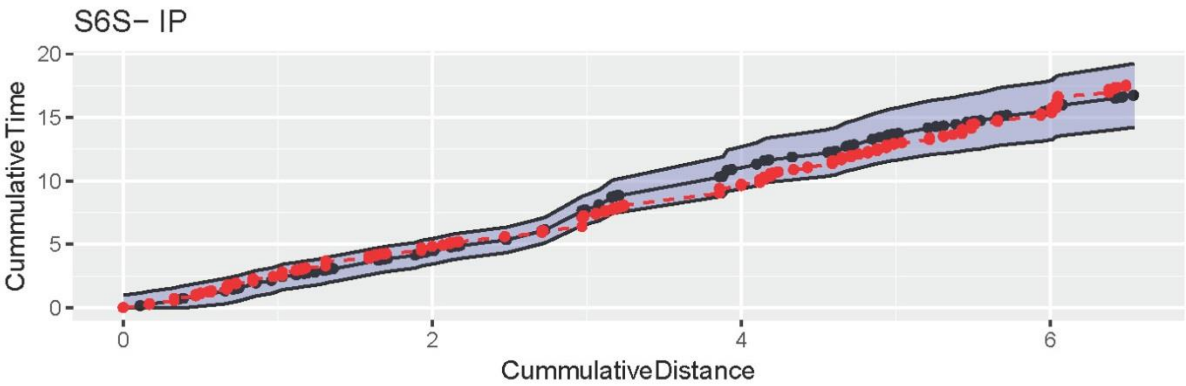
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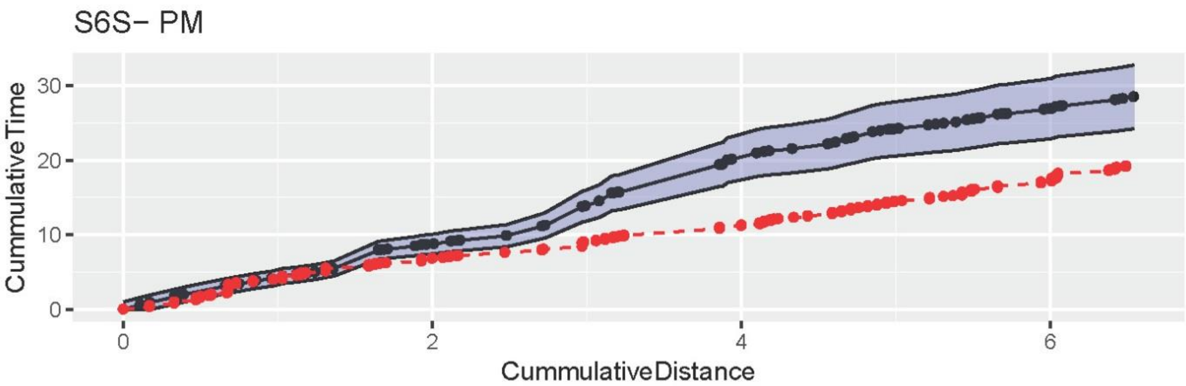
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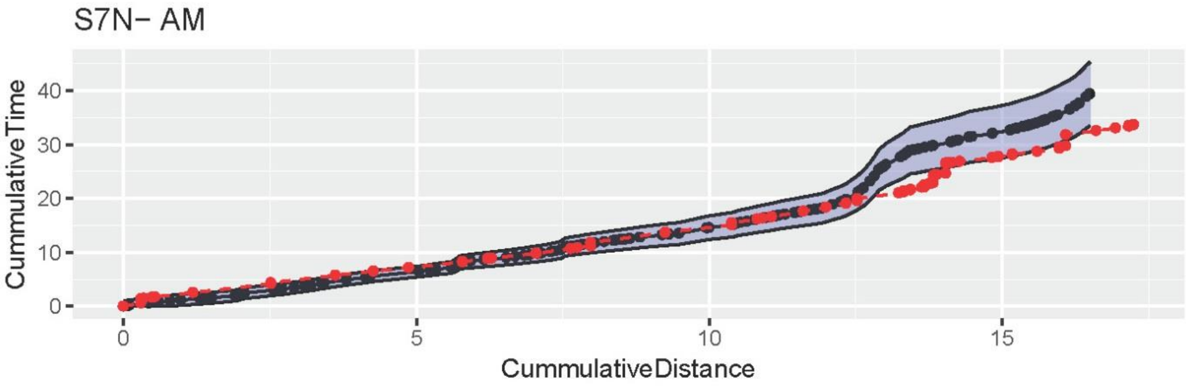
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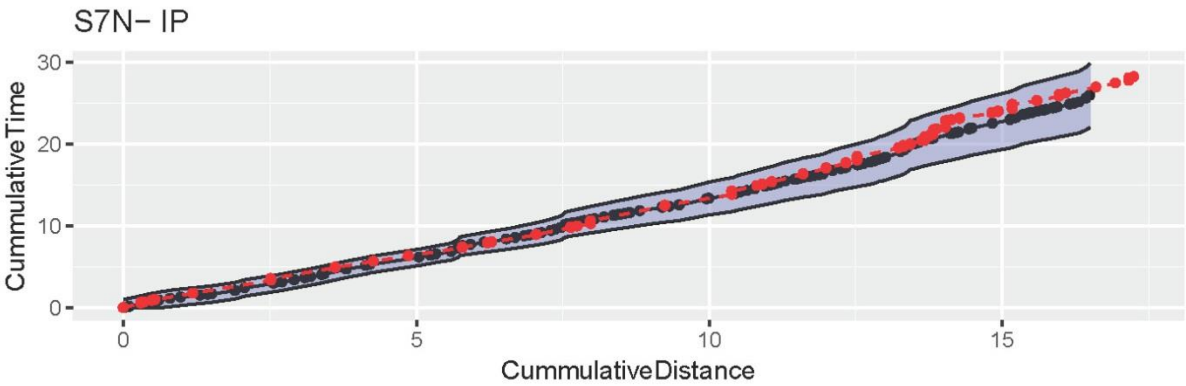
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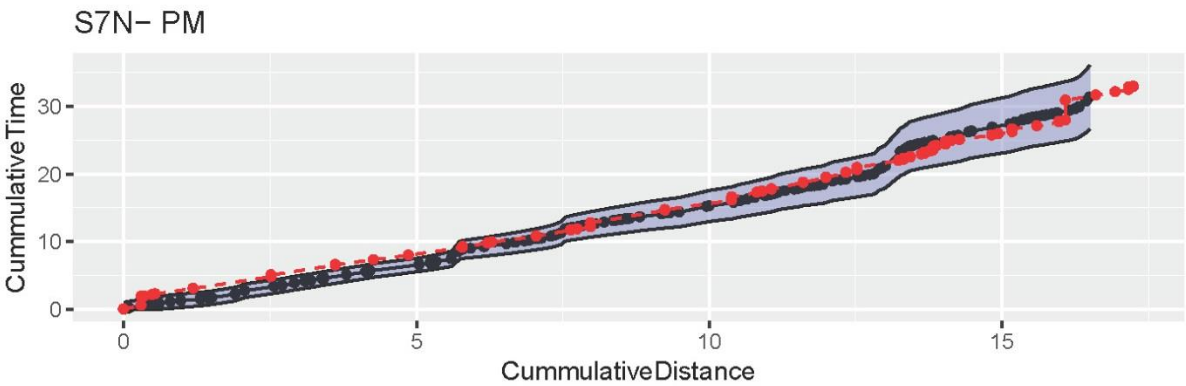
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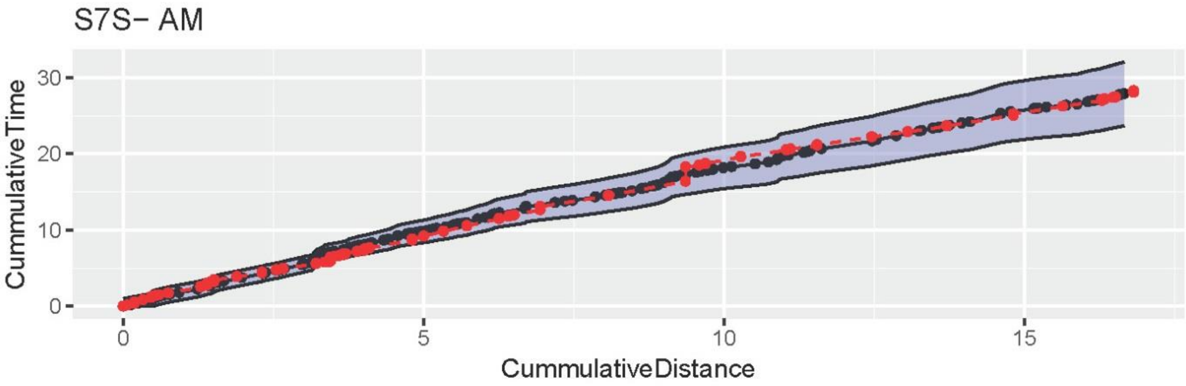
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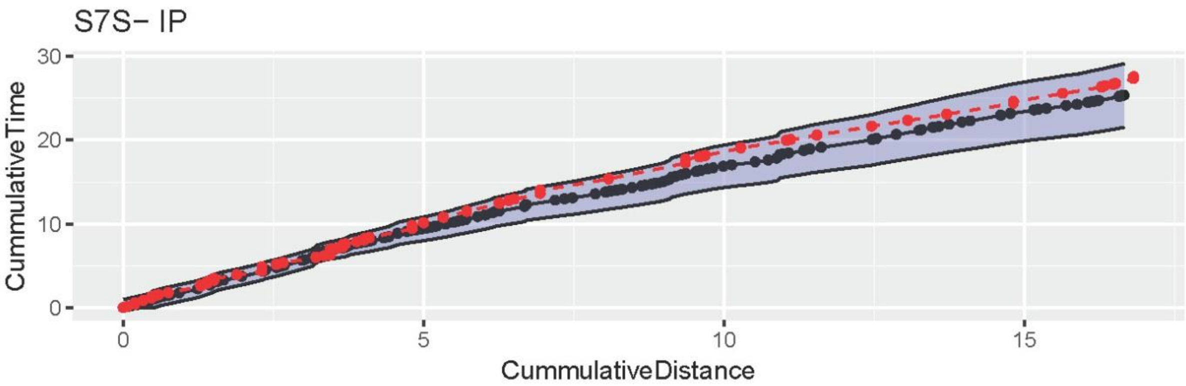
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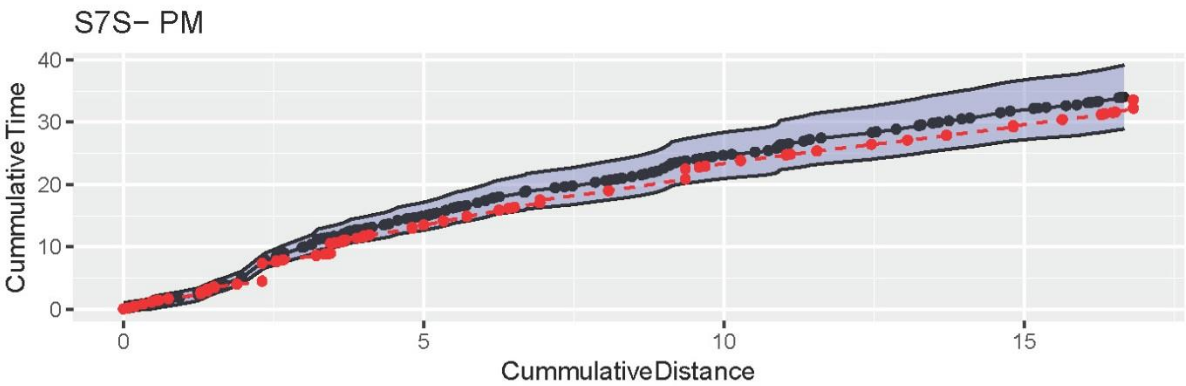
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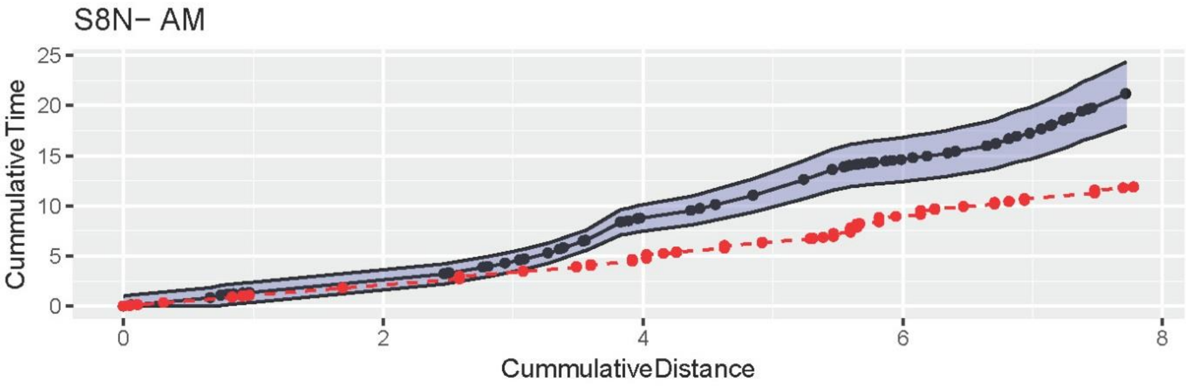
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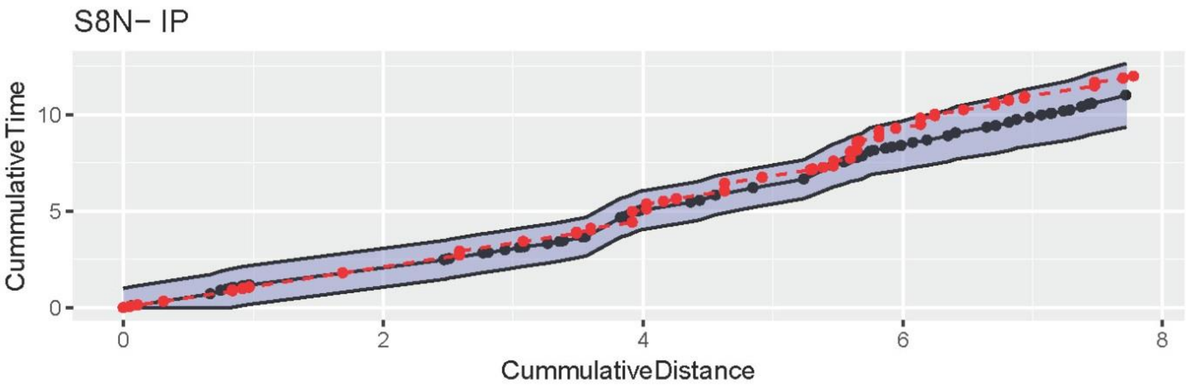
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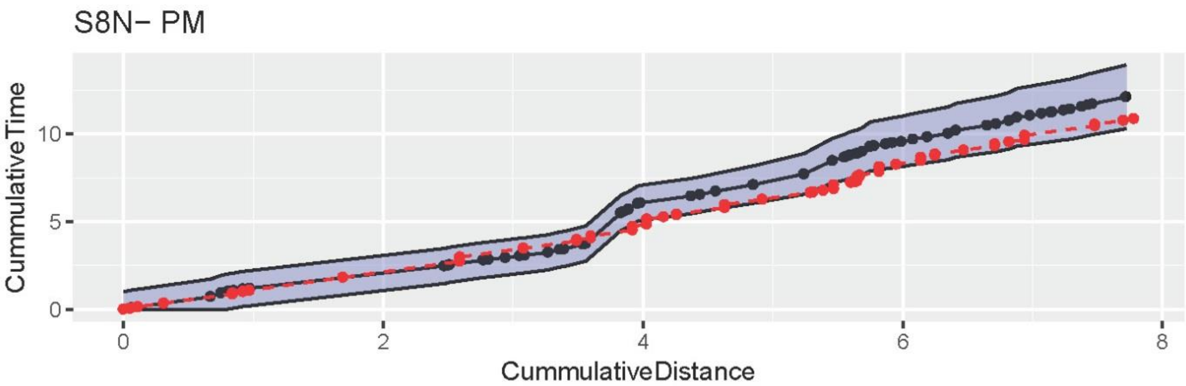
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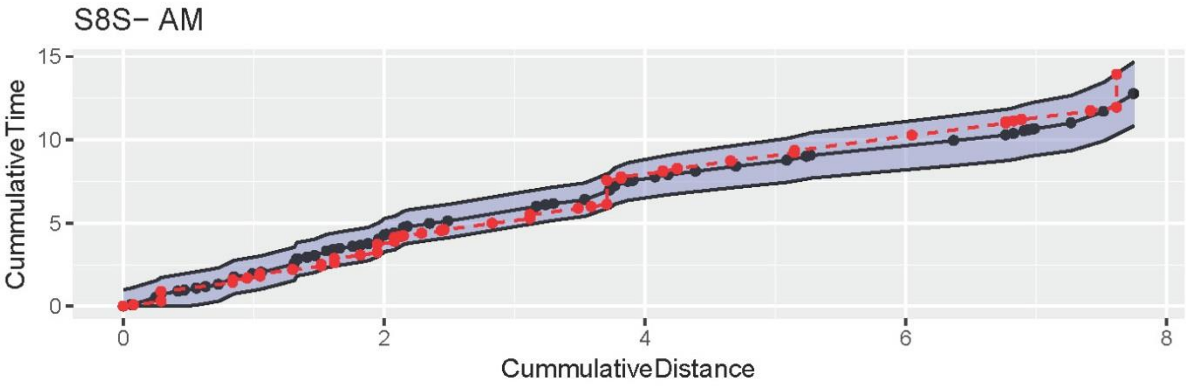
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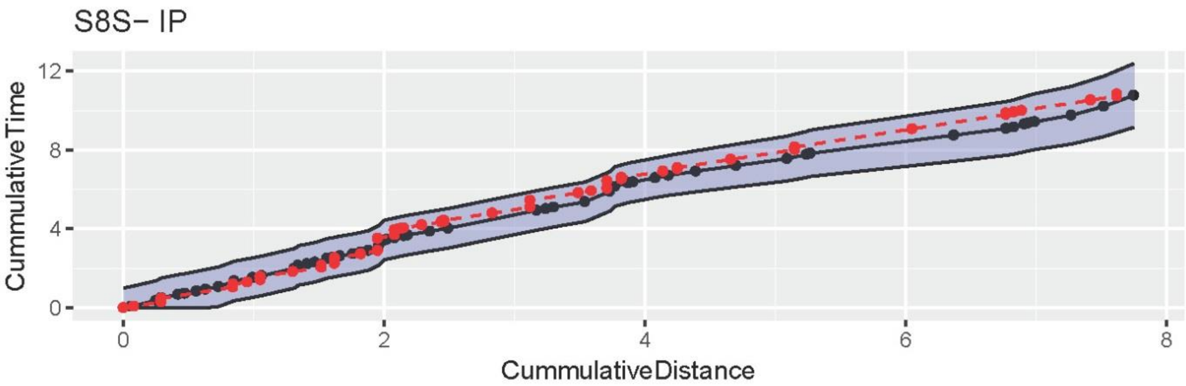
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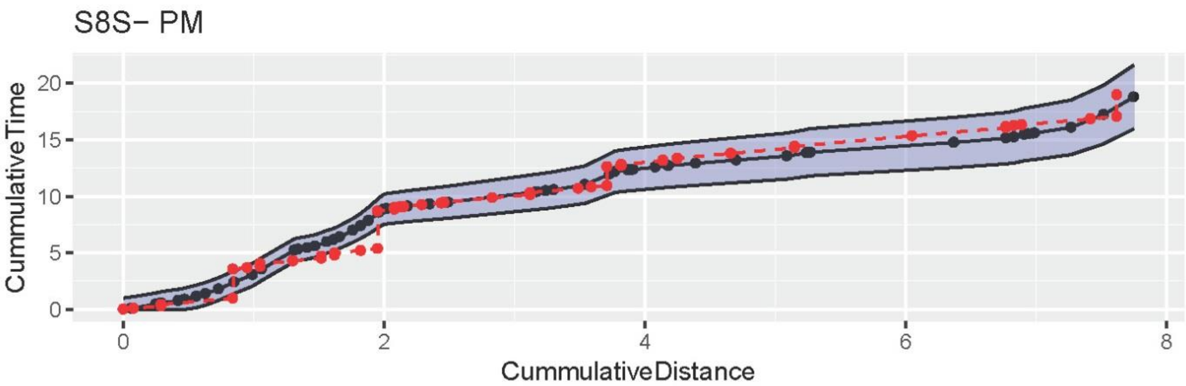
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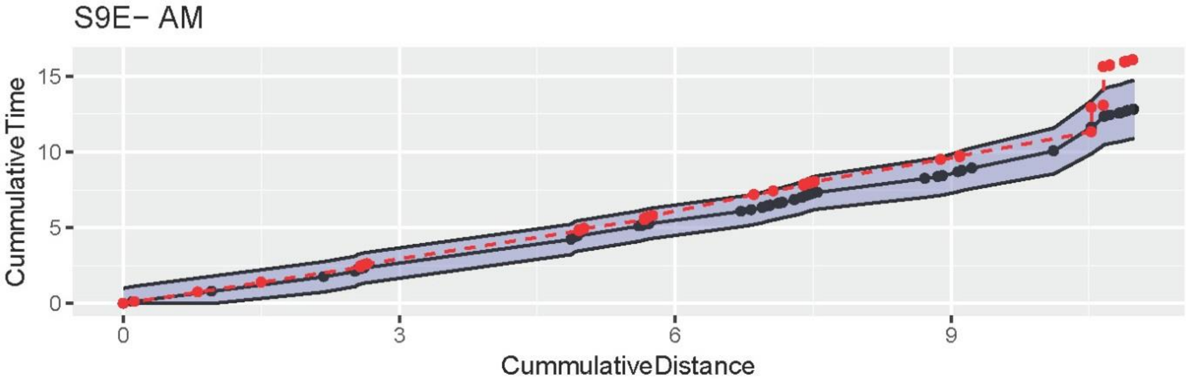
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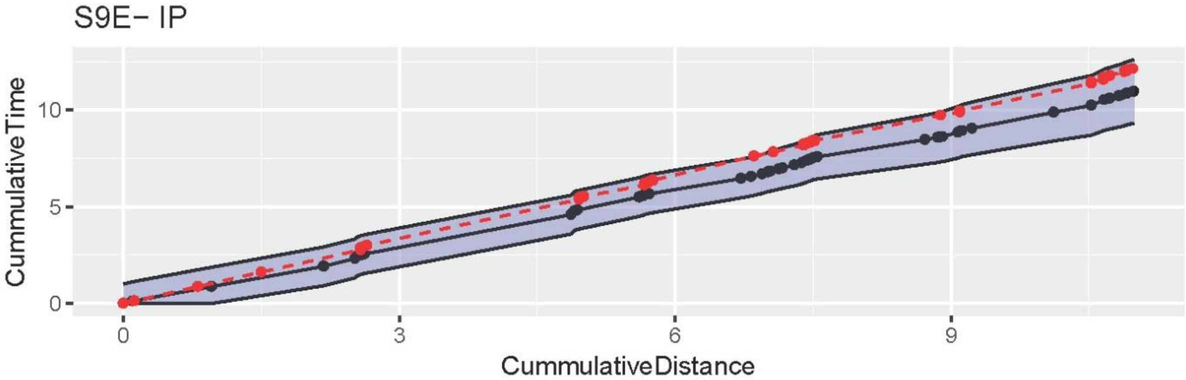
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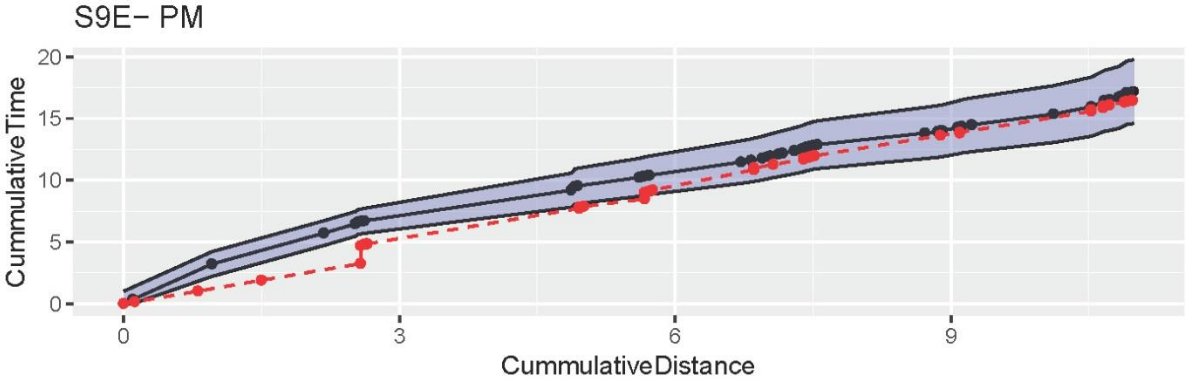
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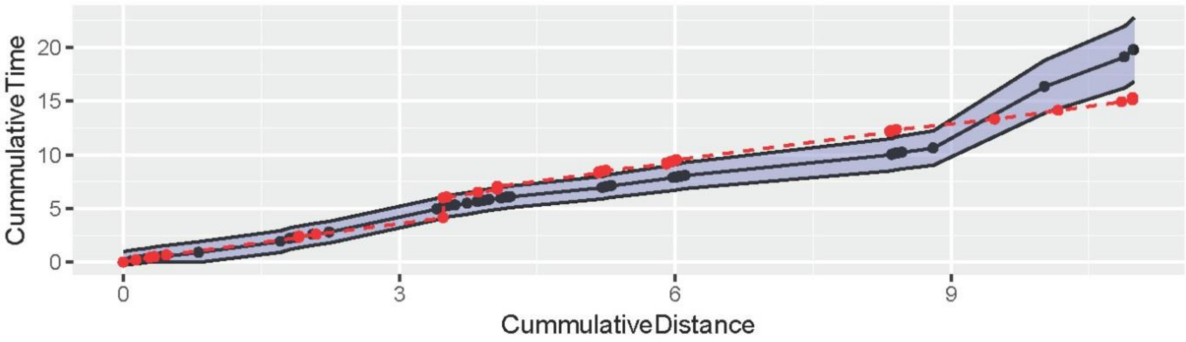

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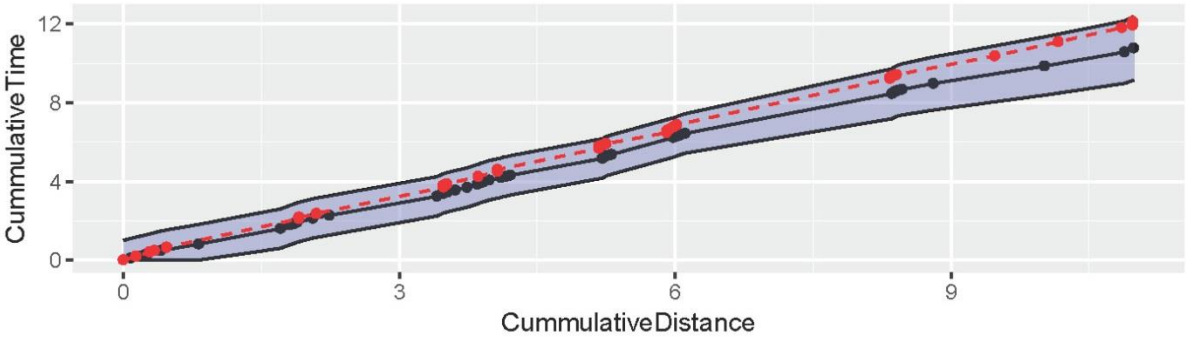

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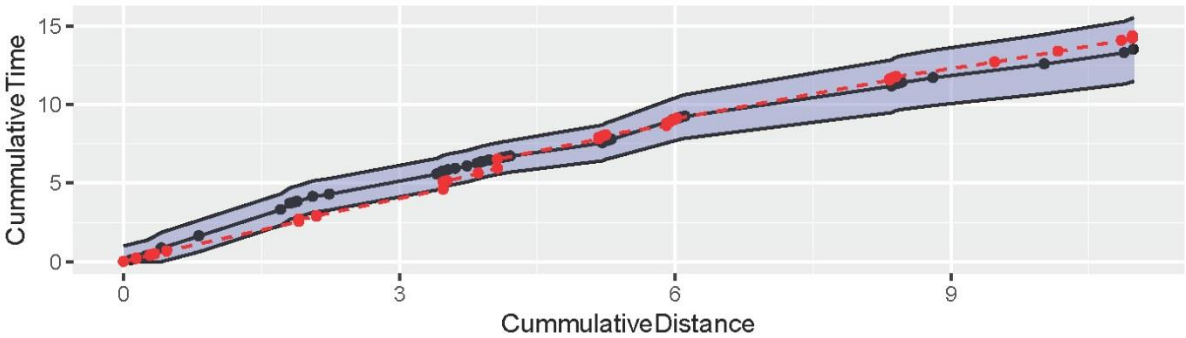

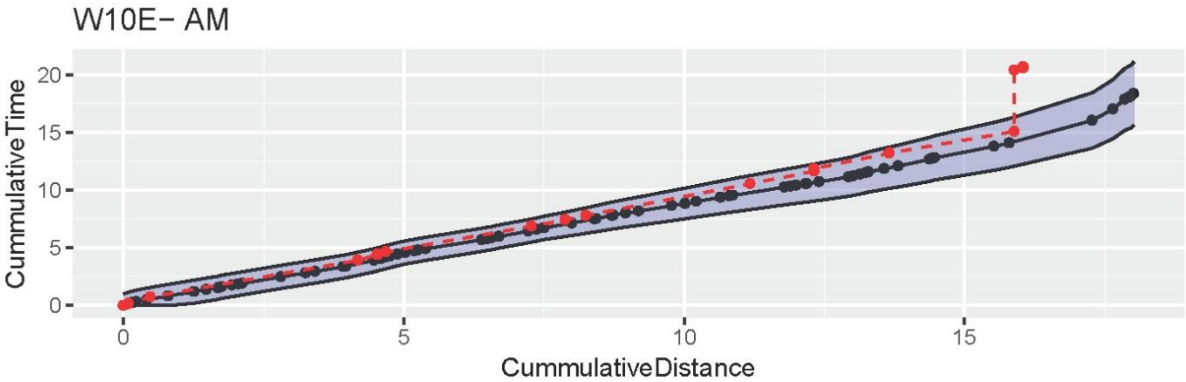
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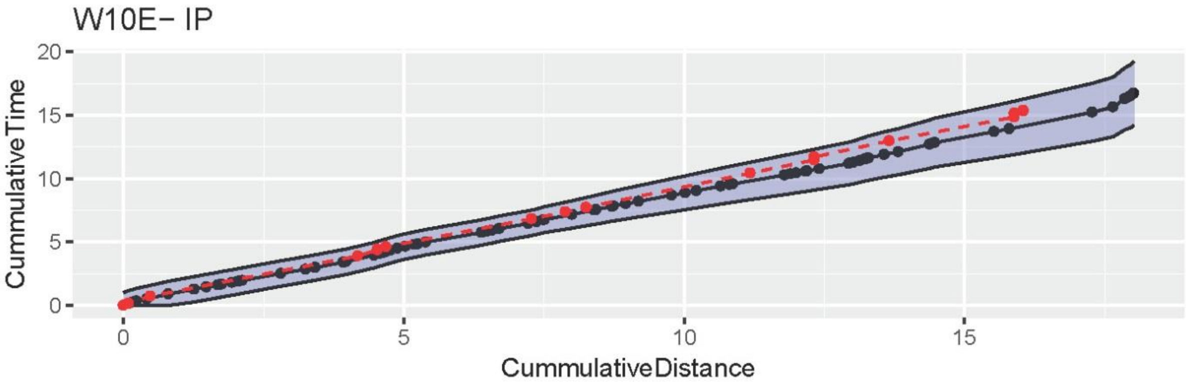
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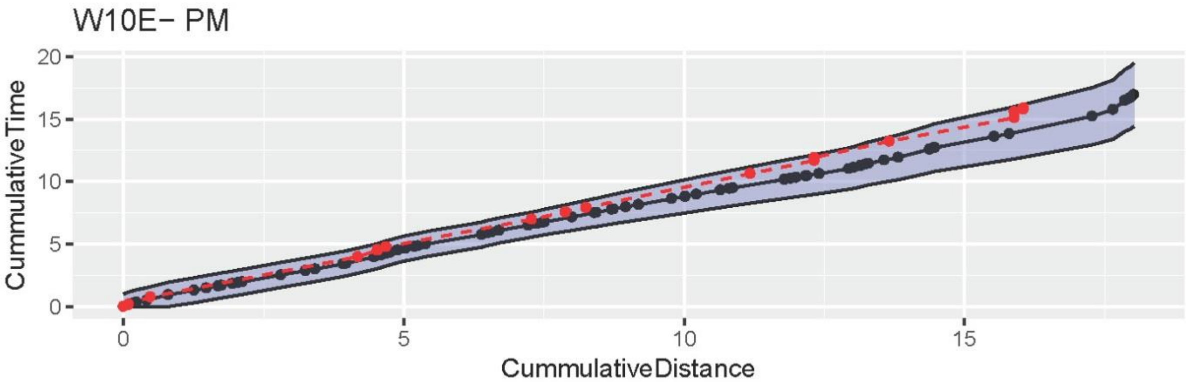
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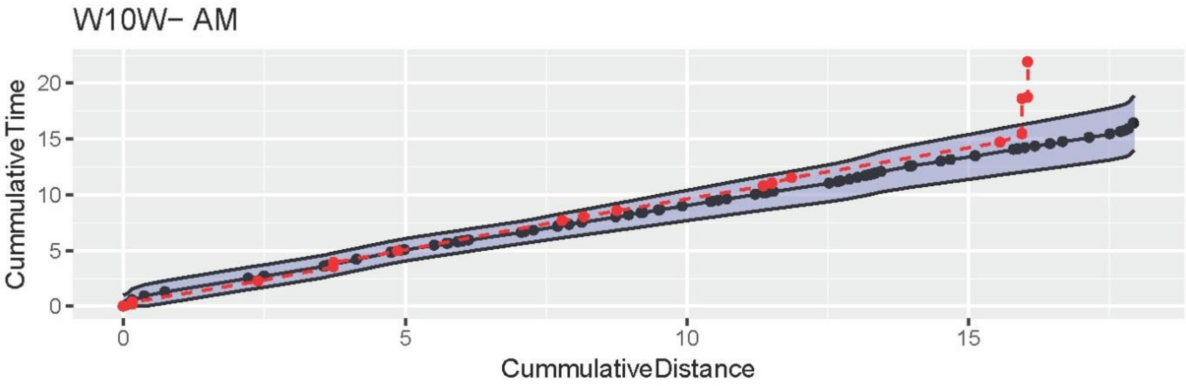
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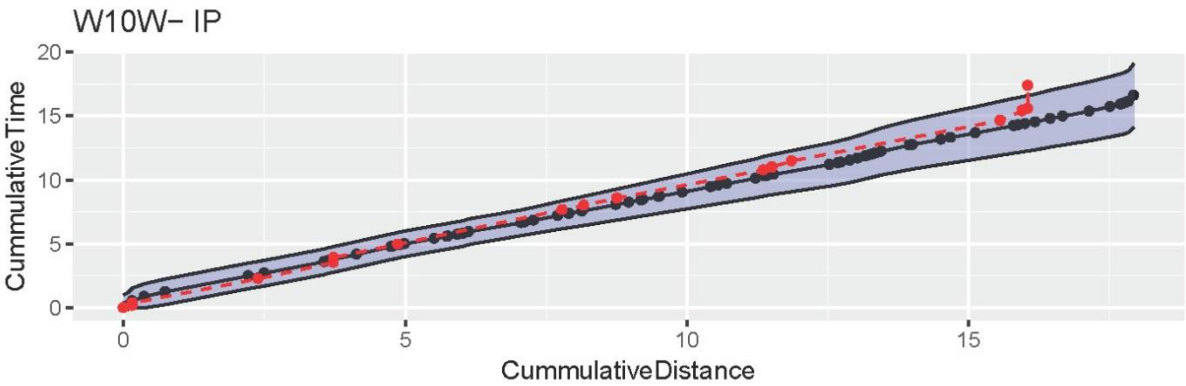
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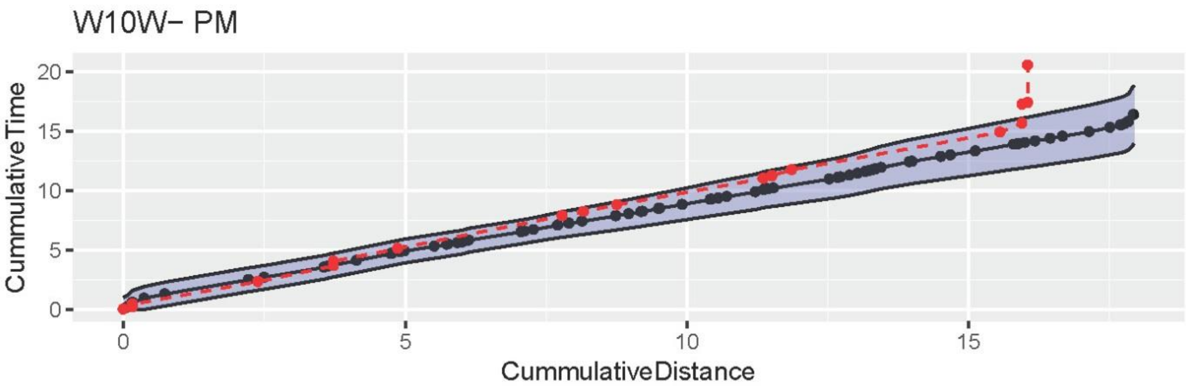
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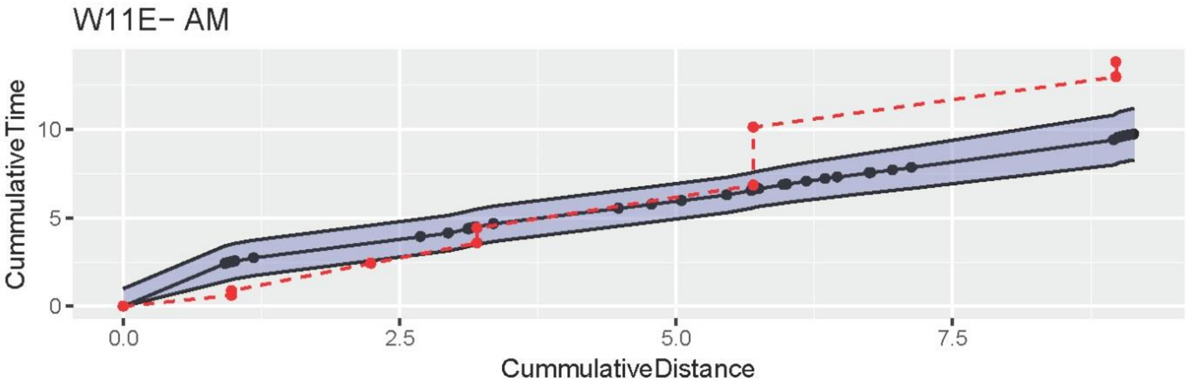
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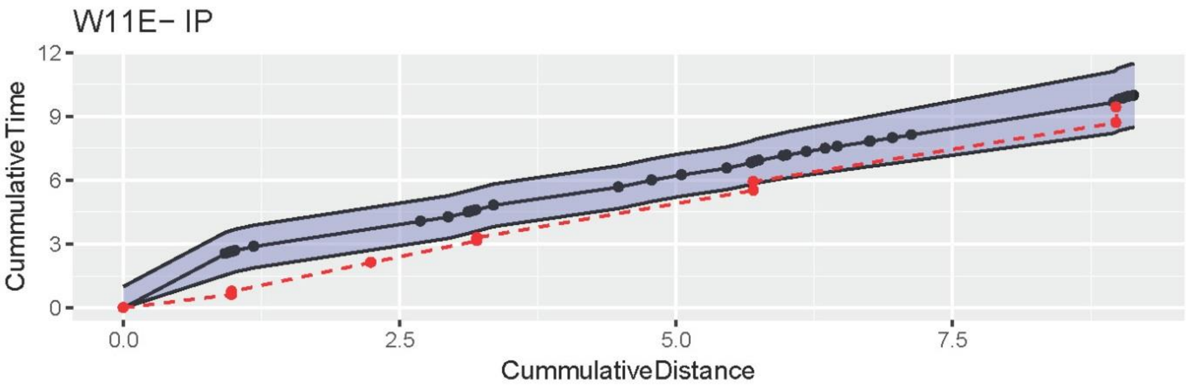
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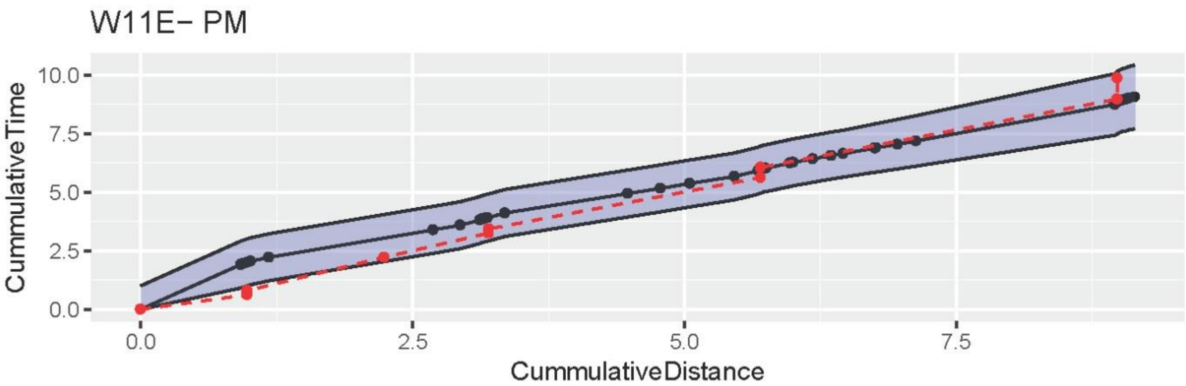
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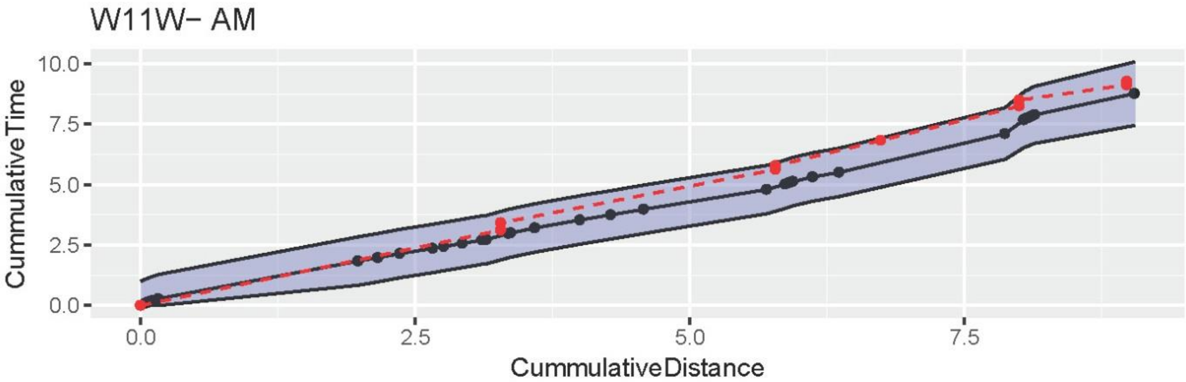
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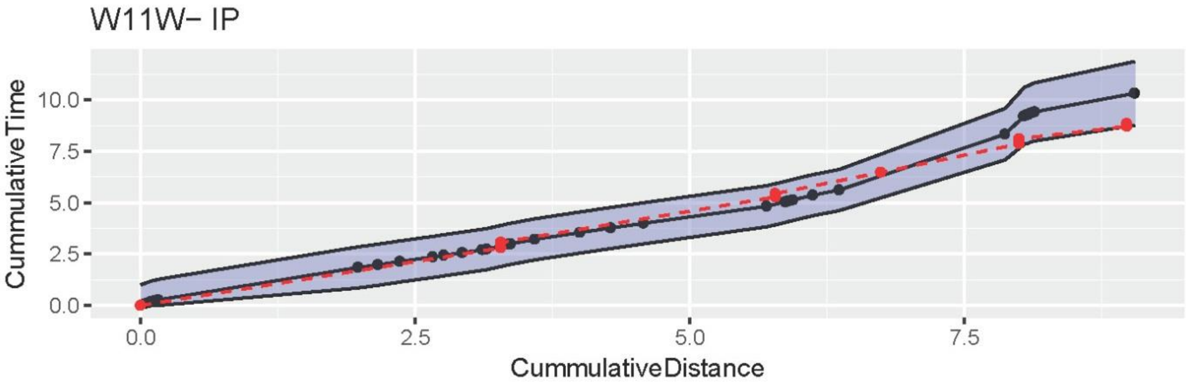
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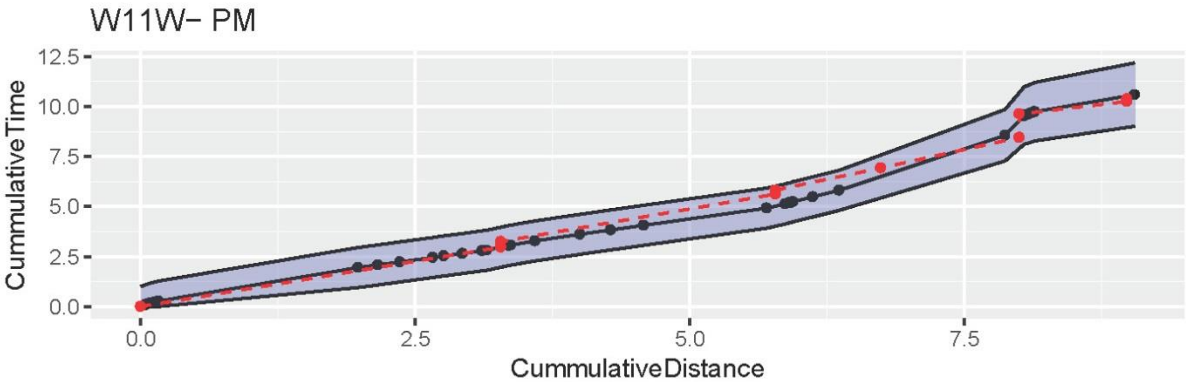
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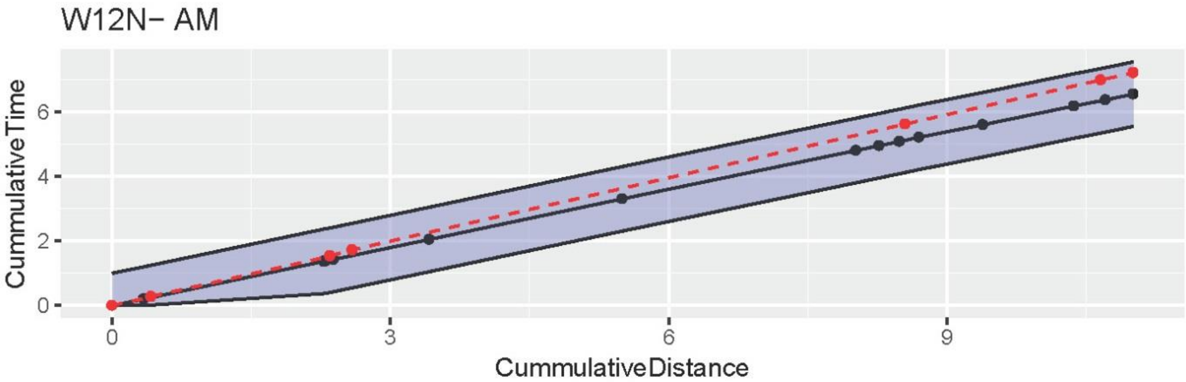
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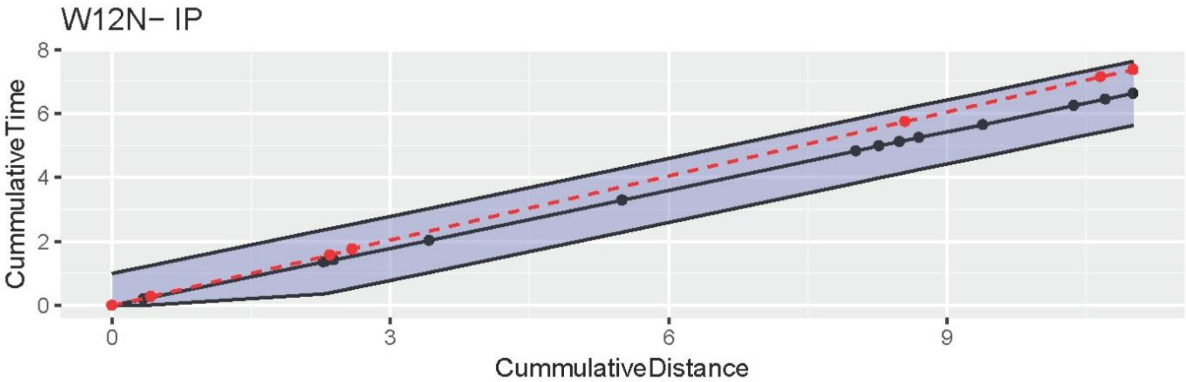
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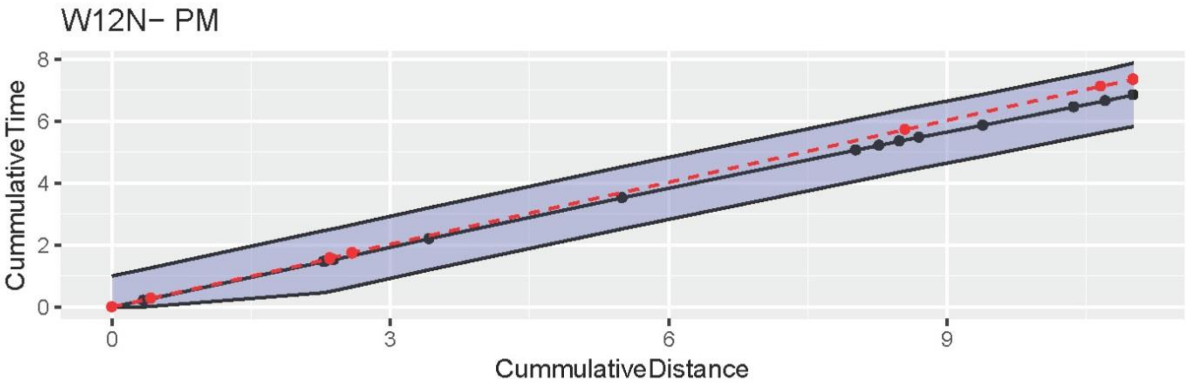
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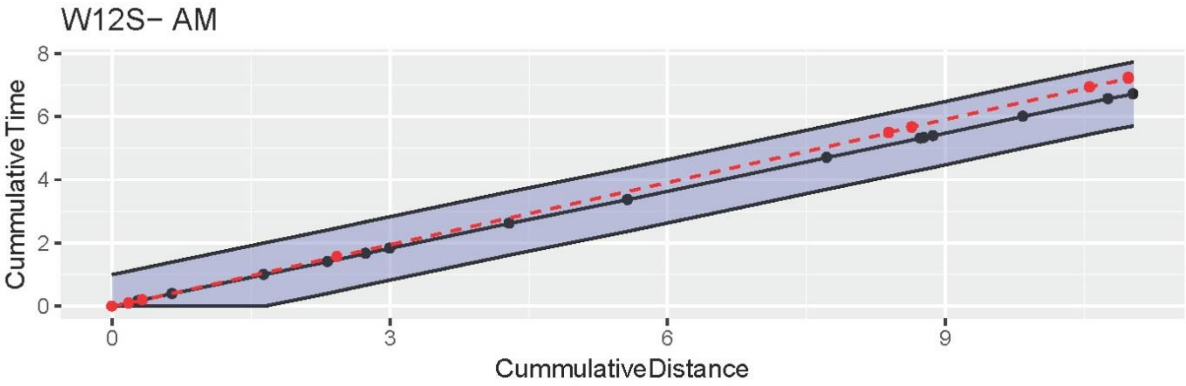
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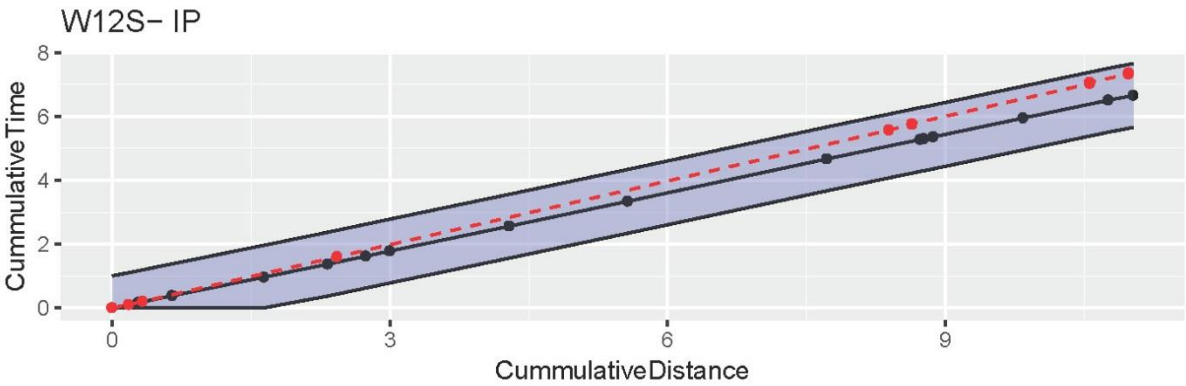
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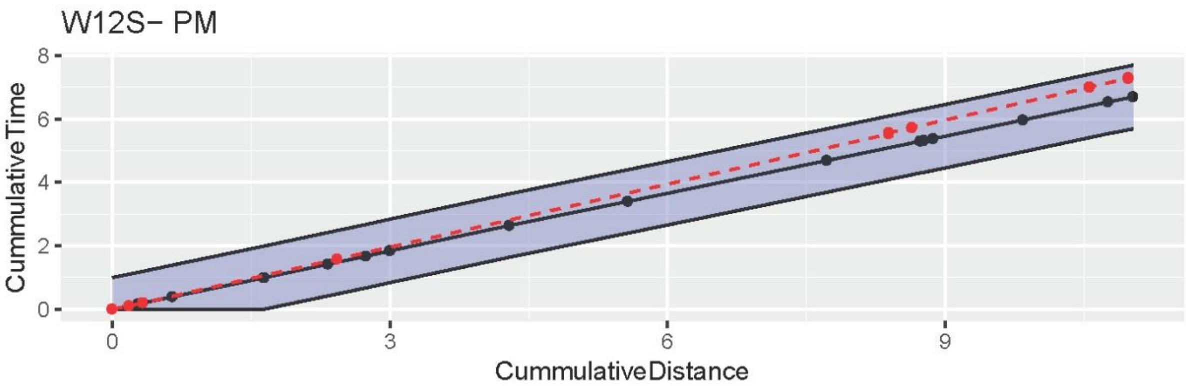
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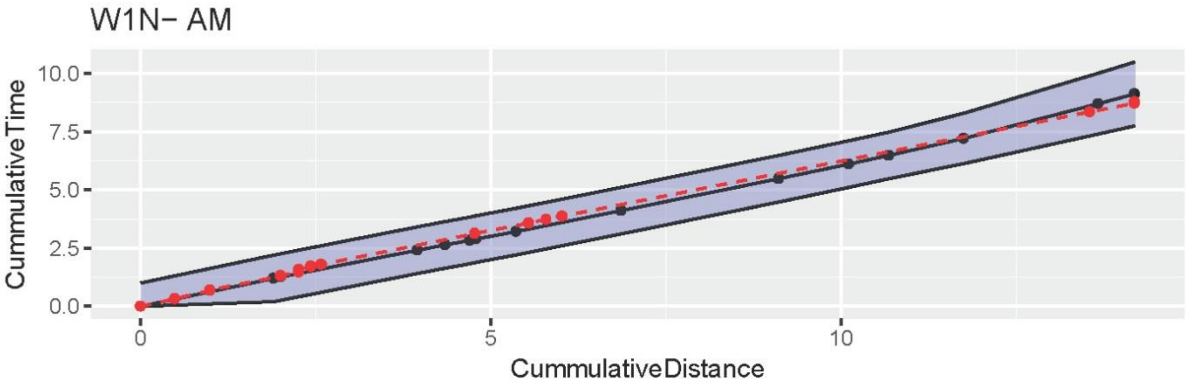
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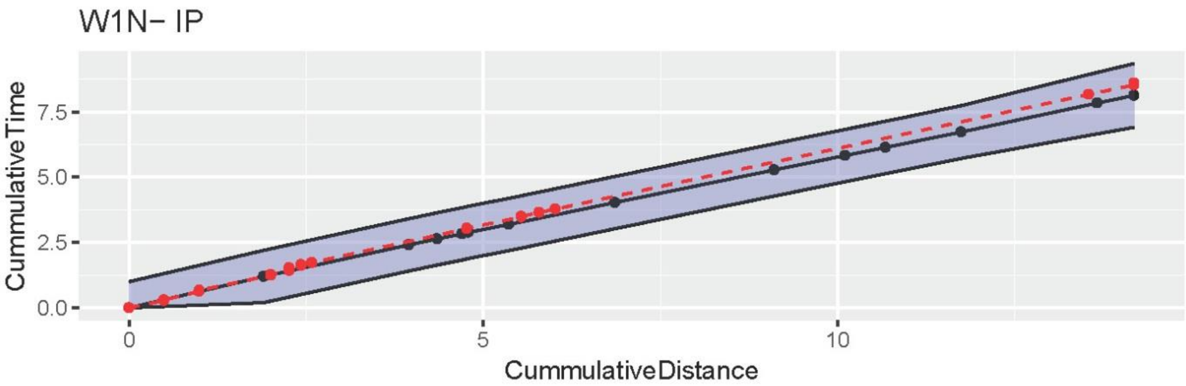
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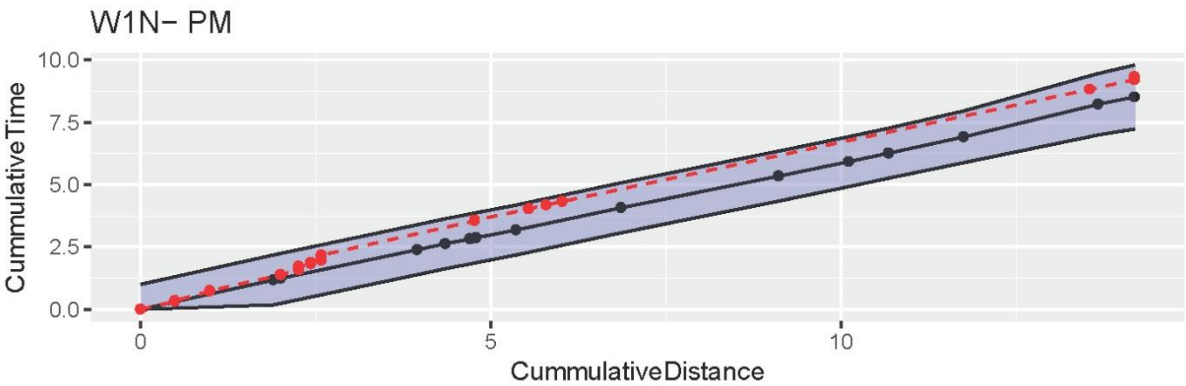
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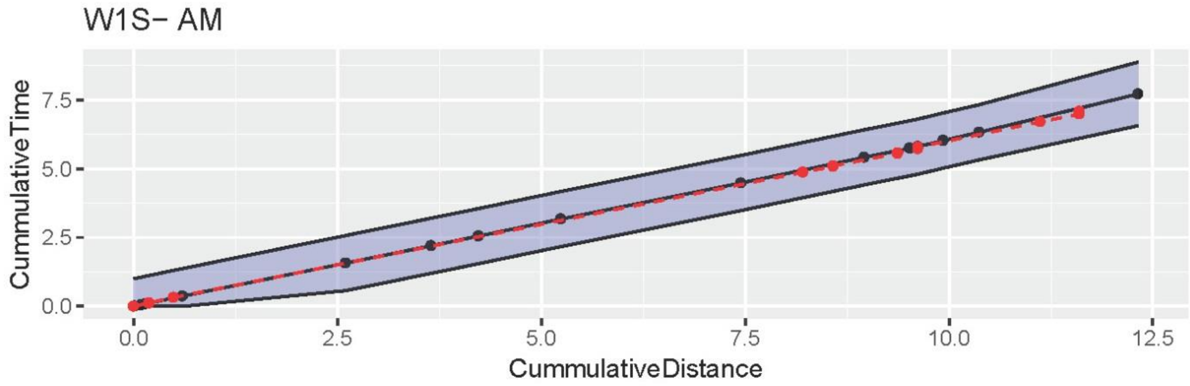
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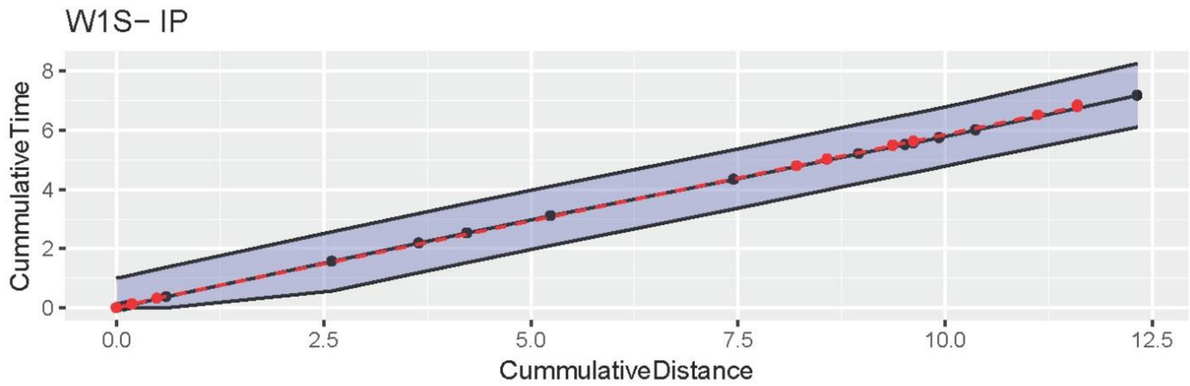
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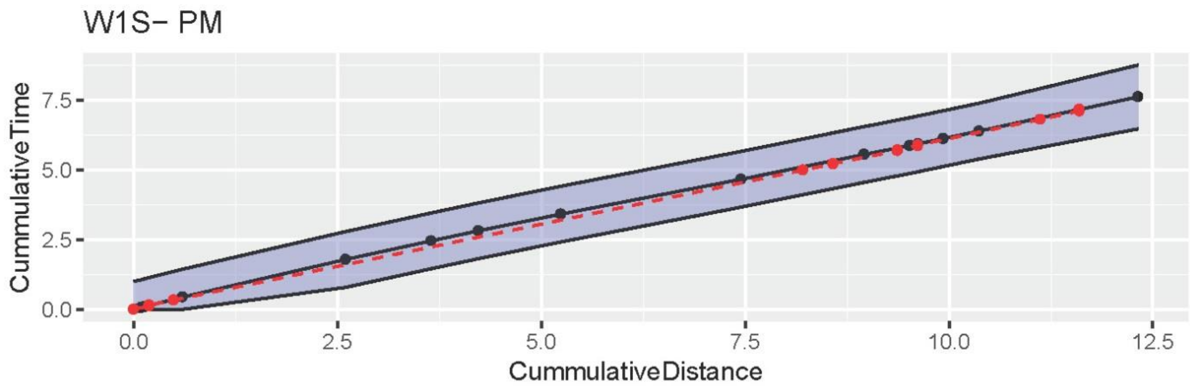
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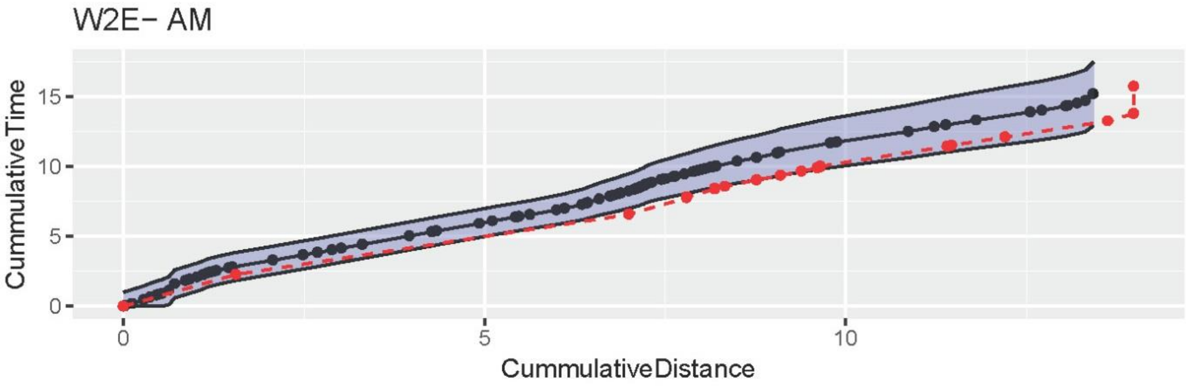
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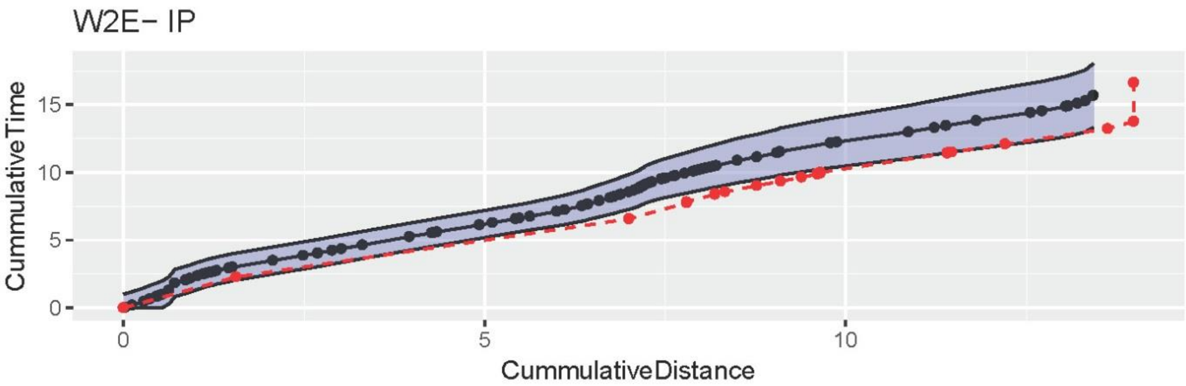
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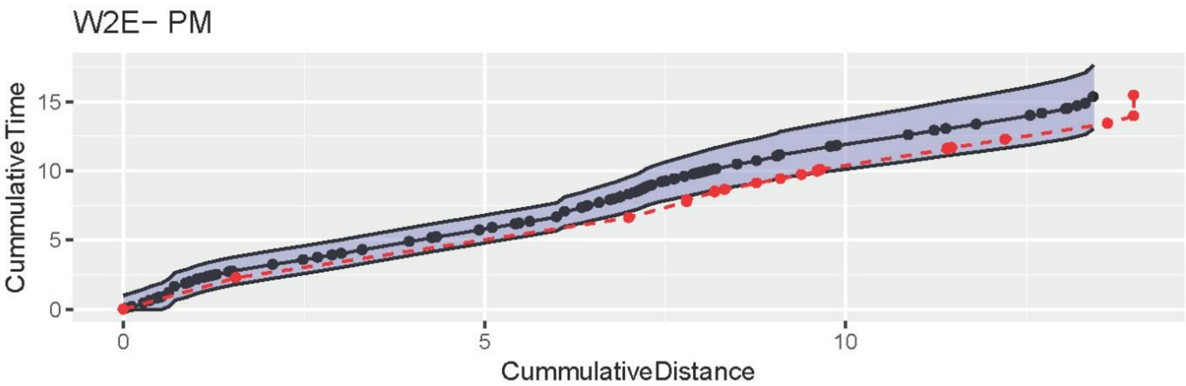
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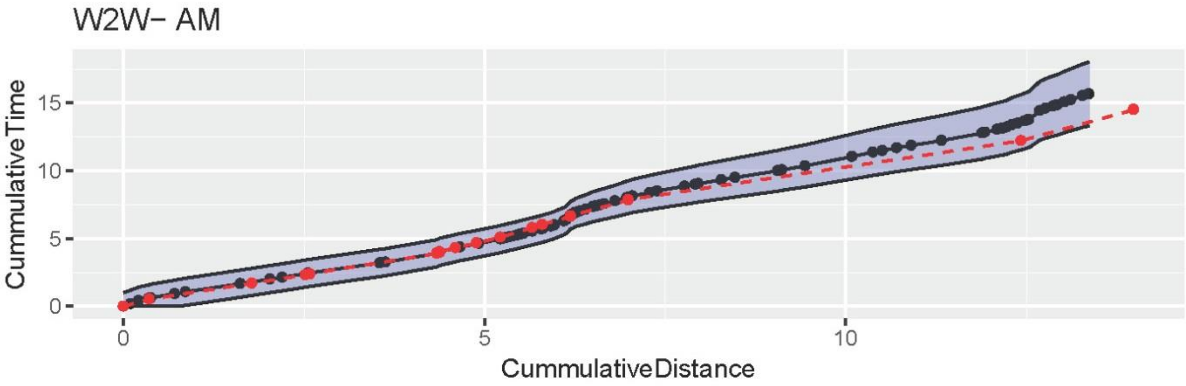
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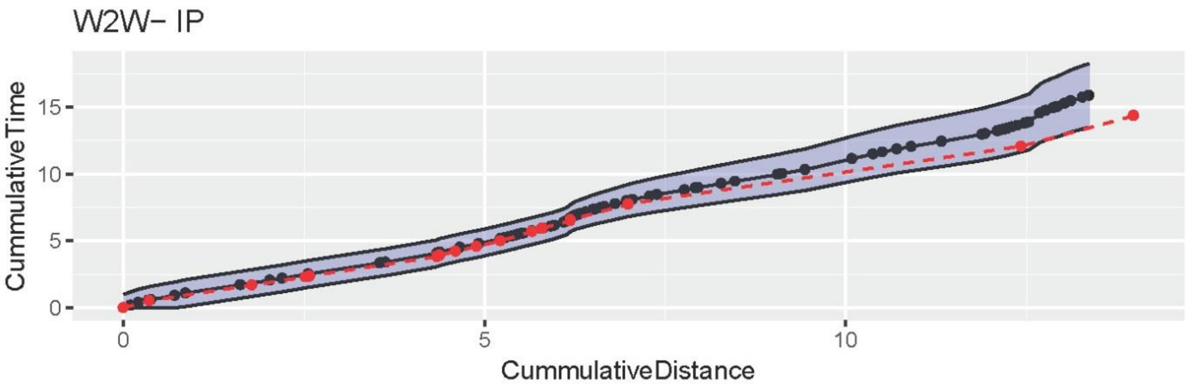
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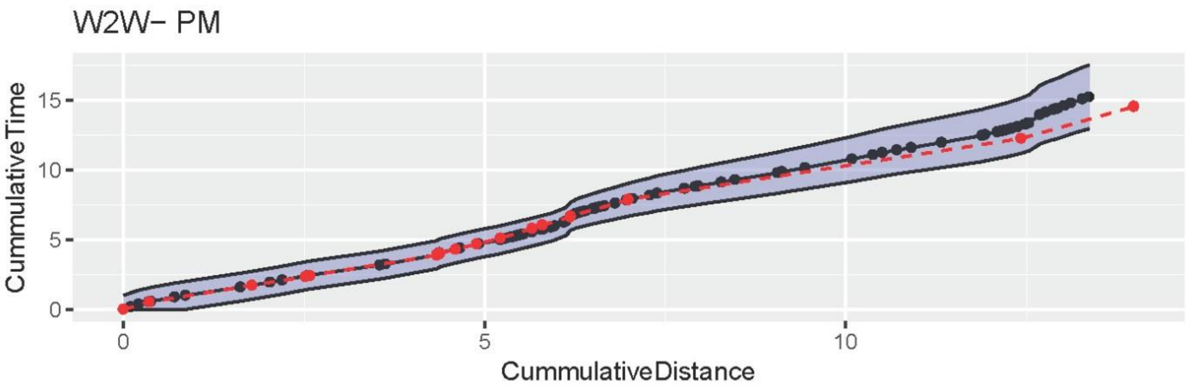
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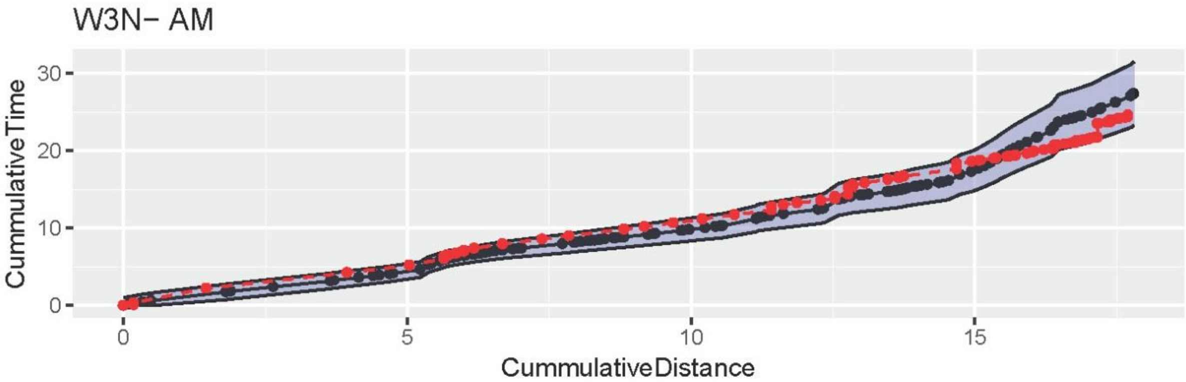
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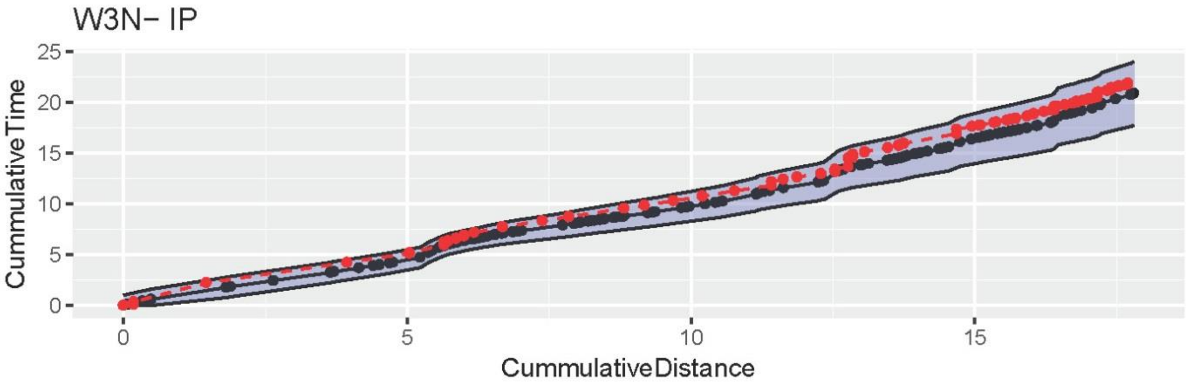
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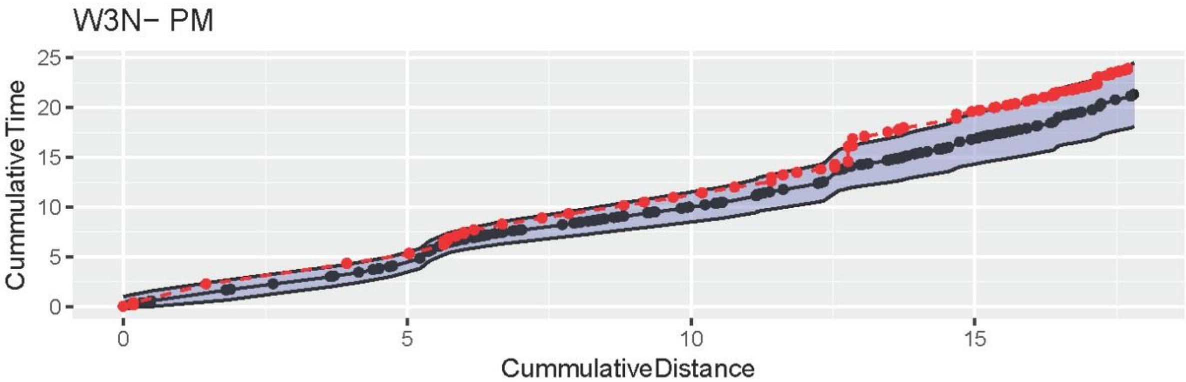
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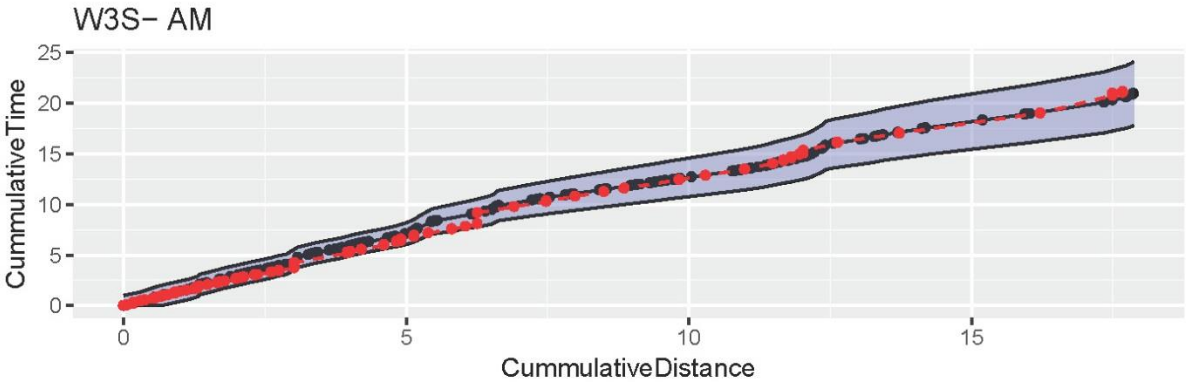
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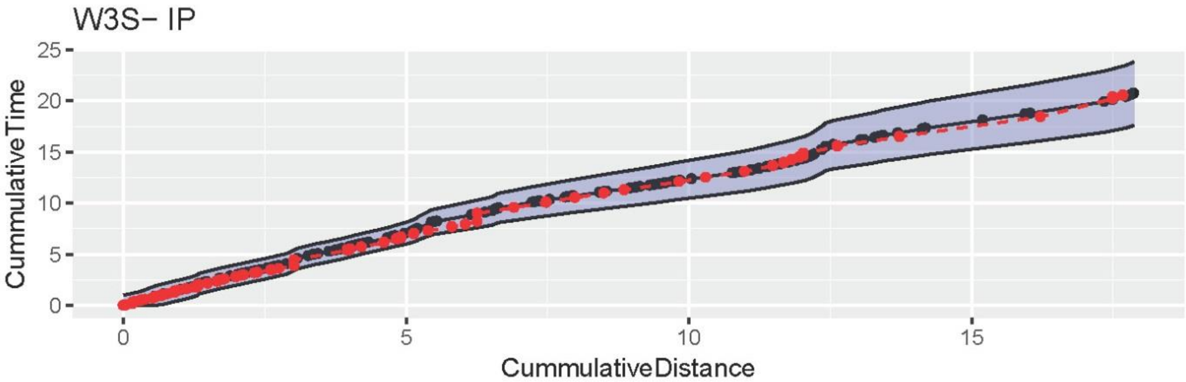
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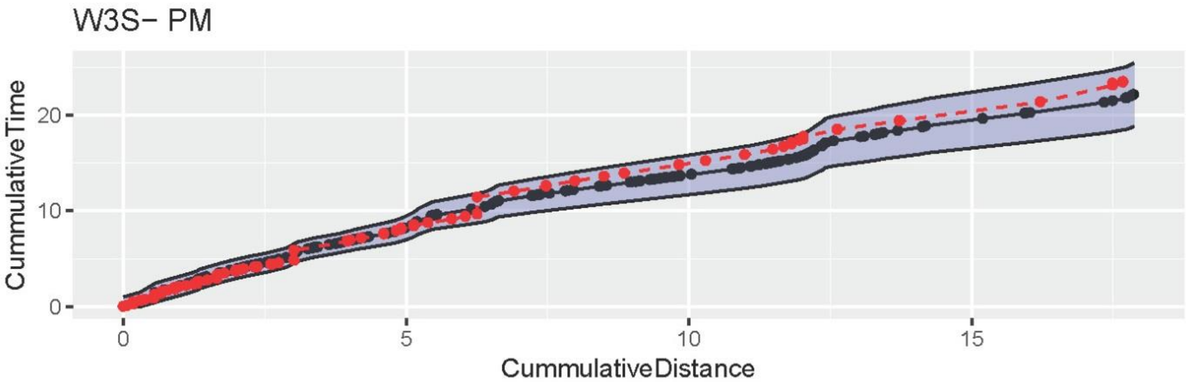
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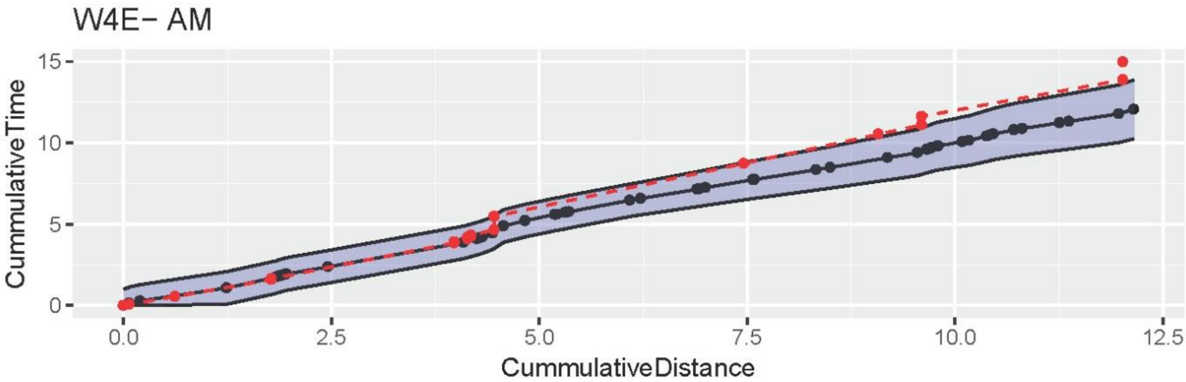
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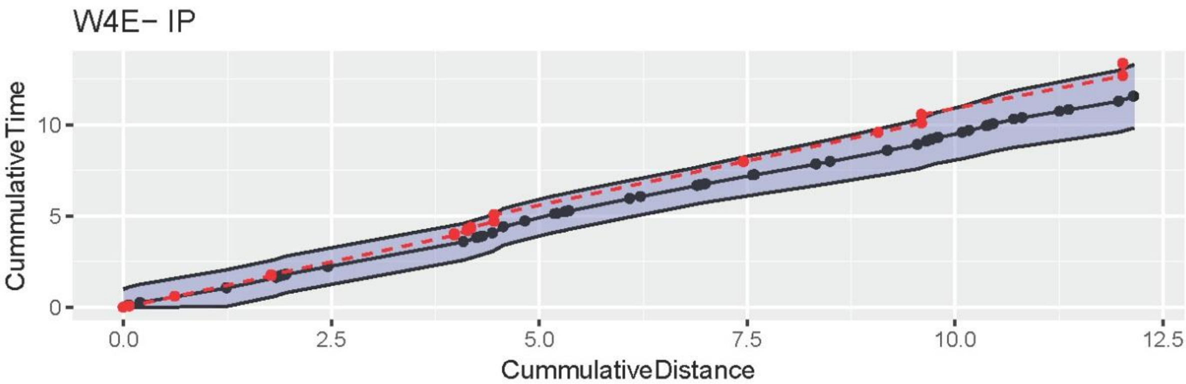
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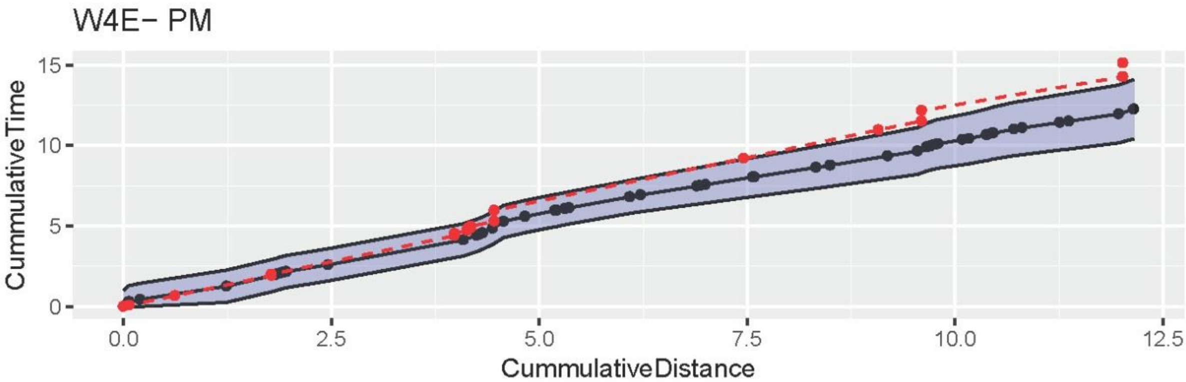
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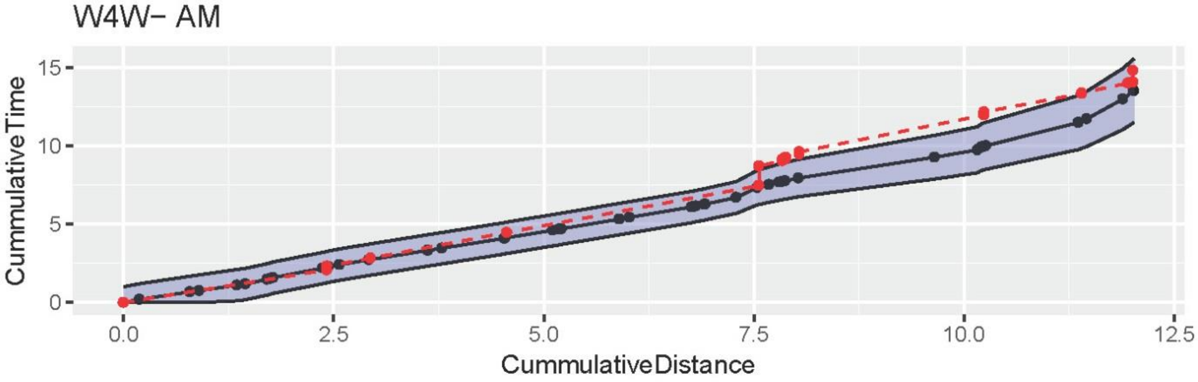
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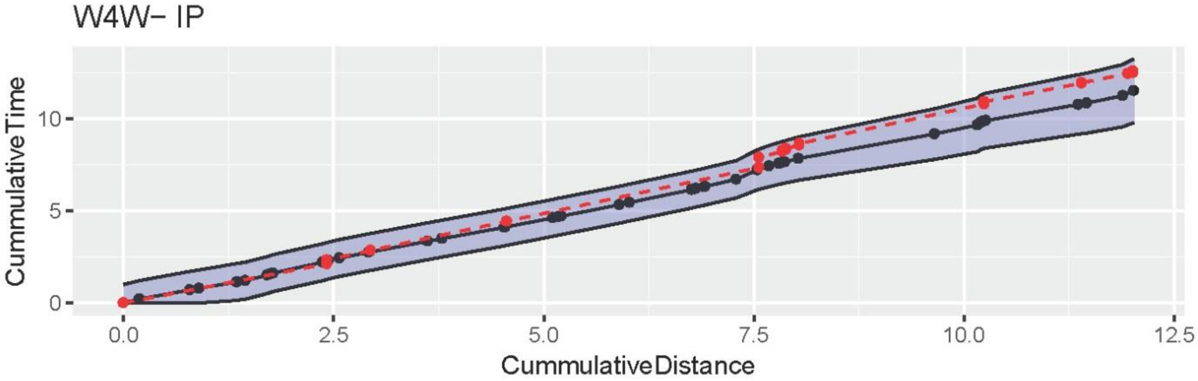
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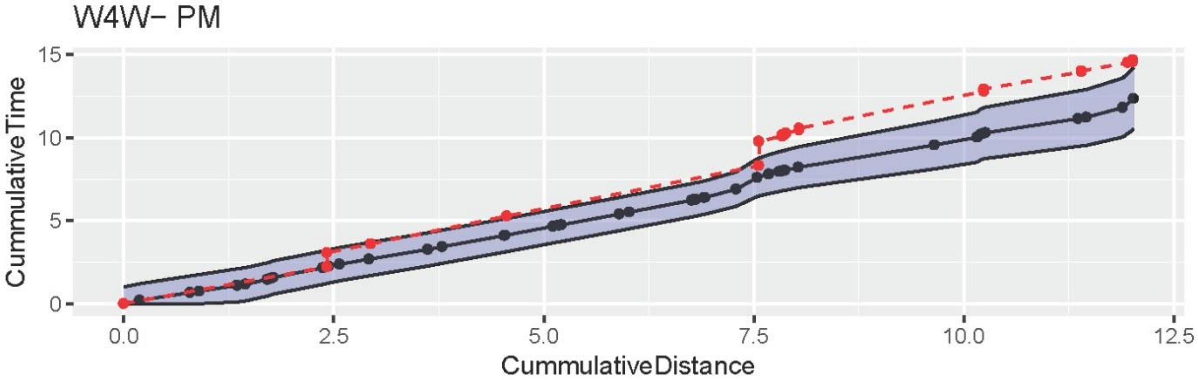
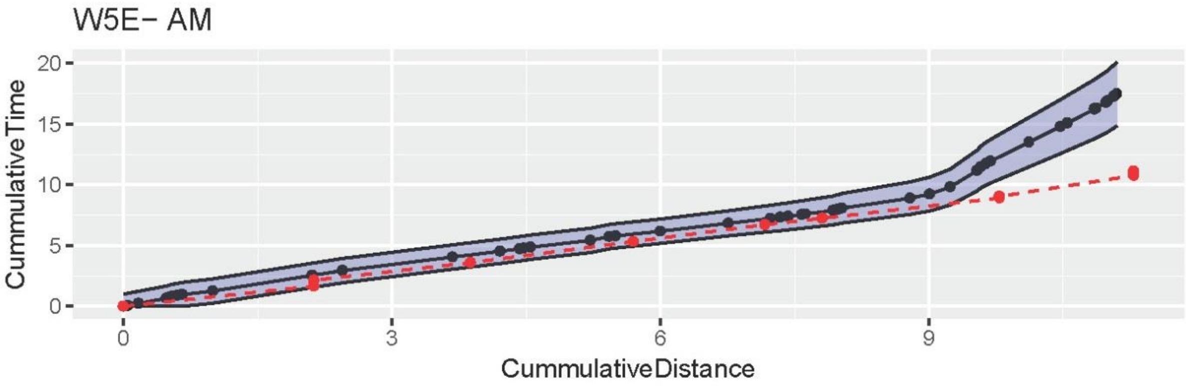
CummulativeDistance


W4W- PM
CummulativeTime
15
10
5
0
0.0
2.5
5.0
7.5
10.0
12.5
CummulativeDistance


W5E- AM
CummulativeTime
CummulativeDistance
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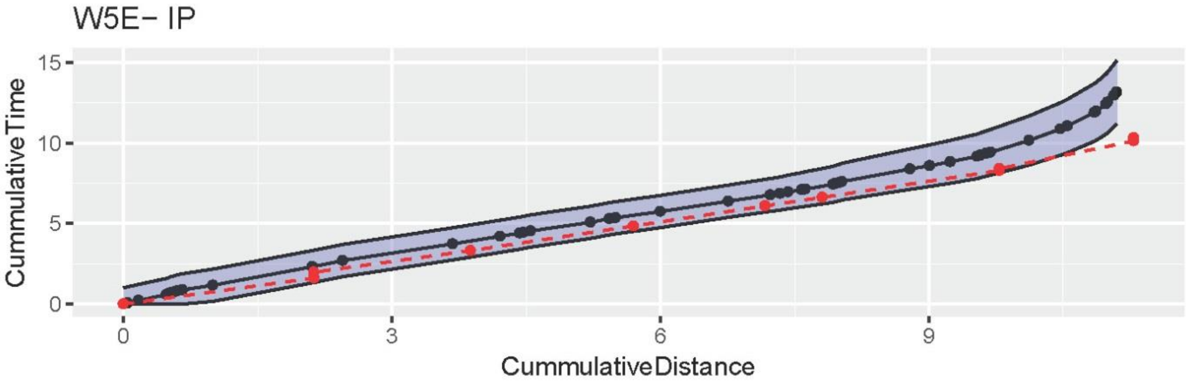
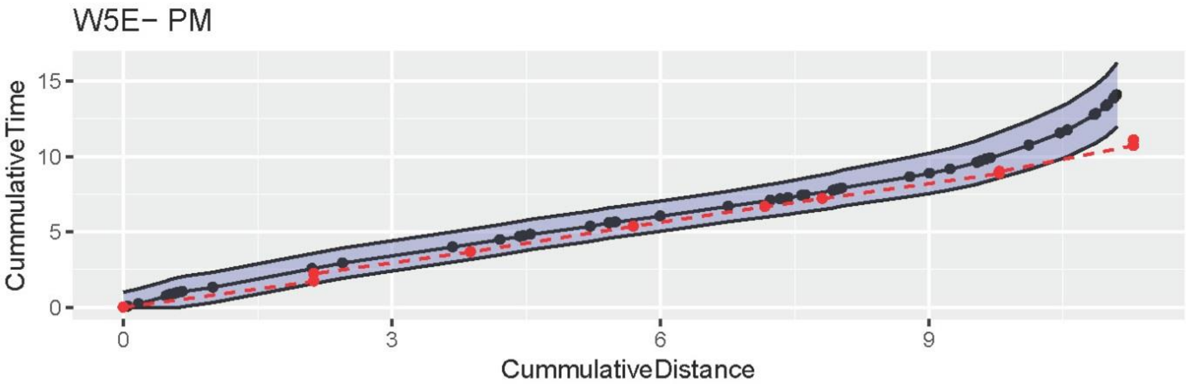
5
10
15
20
0
3
6
9


W5E- IP
CummulativeTime
CummulativeDistance
0
5
10
15
0
3
6
9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CummulativeTime
CummulativeDistance
0
5
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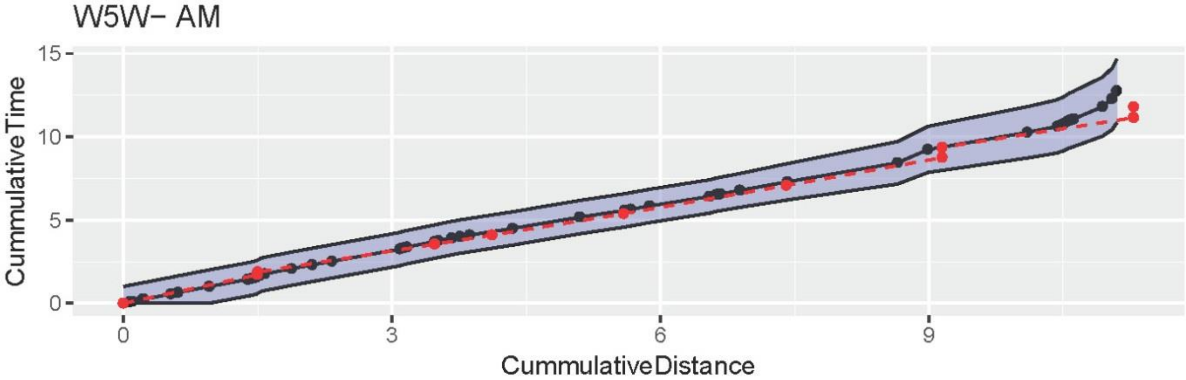
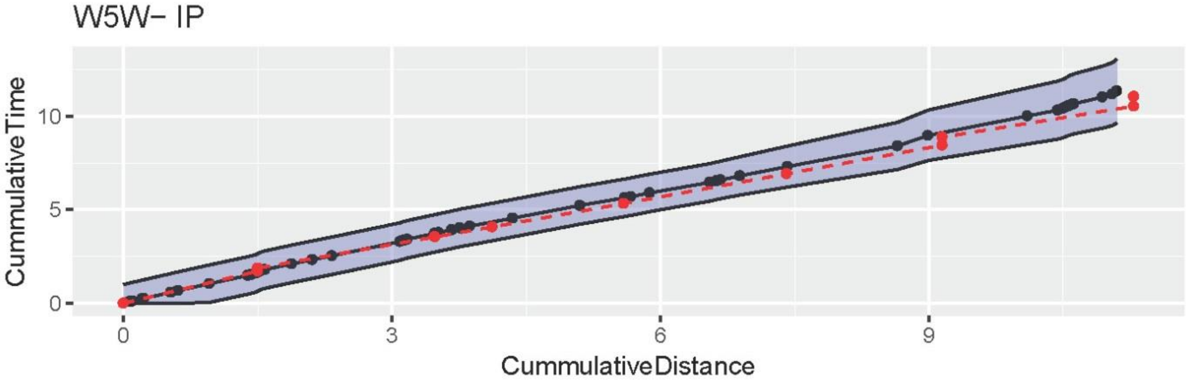
15
0
3
6
9


W5W- AM
CummulativeTime
CummulativeDistance
15
10
5
0
0
3
6
9


W5W- IP
CummulativeTime
CummulativeDistance
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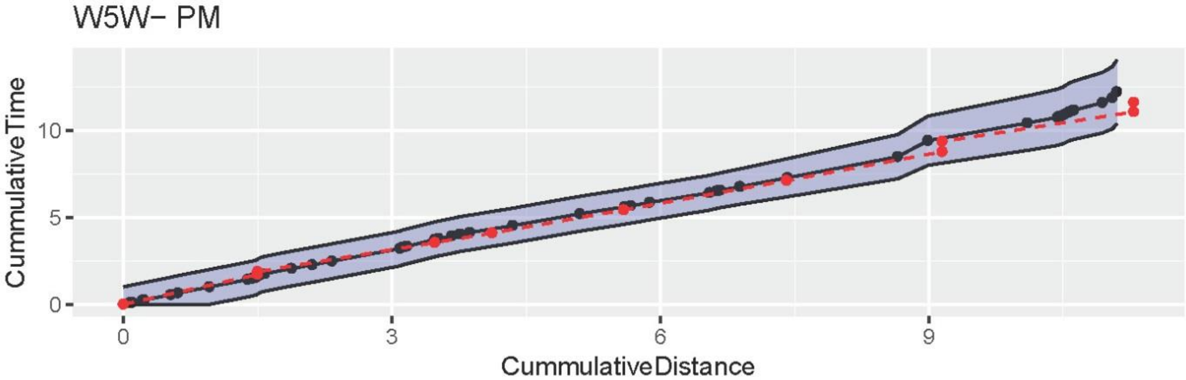
5
0
0
3
6
9


W5W- PM
CummulativeTime
CummulativeDistance
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0
0
3
6
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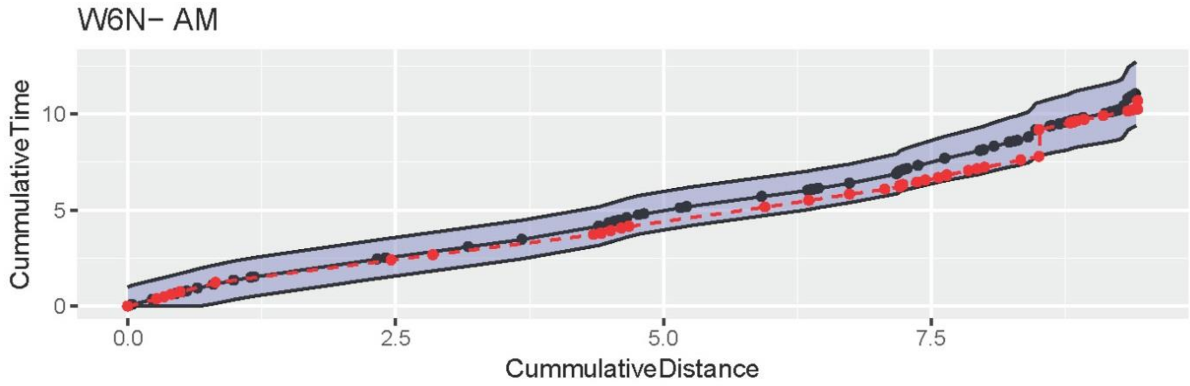
W6N- AM
CummulativeTime
CummulativeDistance
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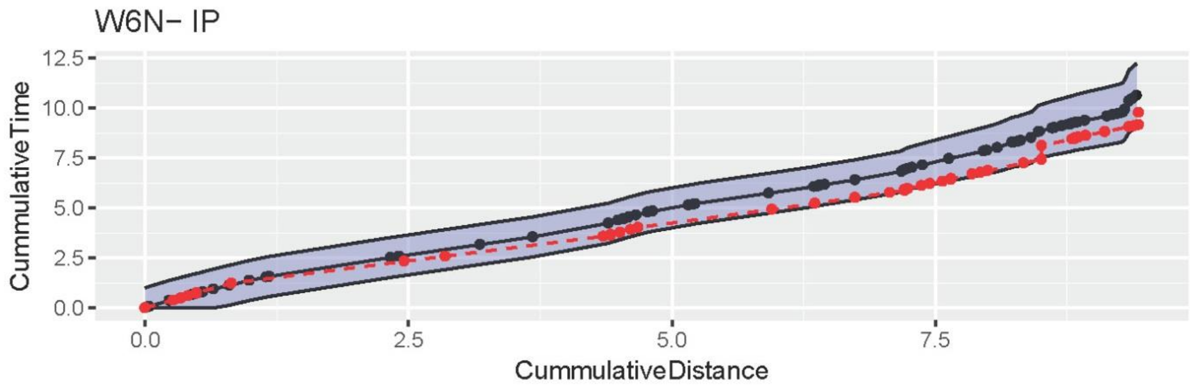
0.0
2.5
5.0
7.5


W6N- IP
CummulativeTime
CummulativeDistance
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5.0
7.5
10.0
12.5
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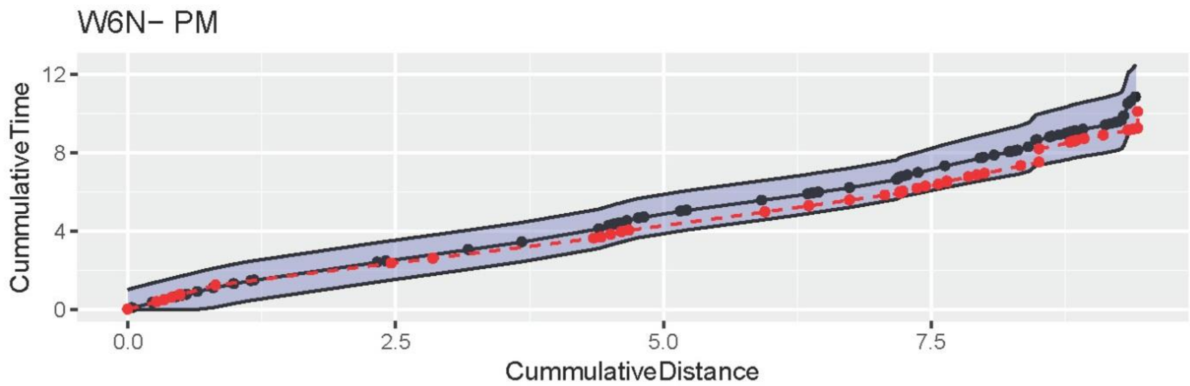
2.5
5.0
7.5


W6N- PM
CummulativeTime
CummulativeDistance
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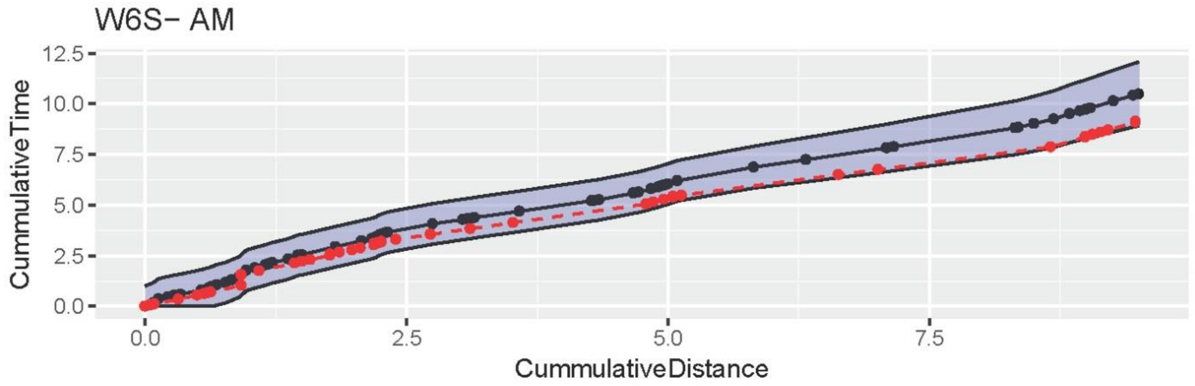
4
8
12
0.0
2.5
5.0
7.5


W6S- AM
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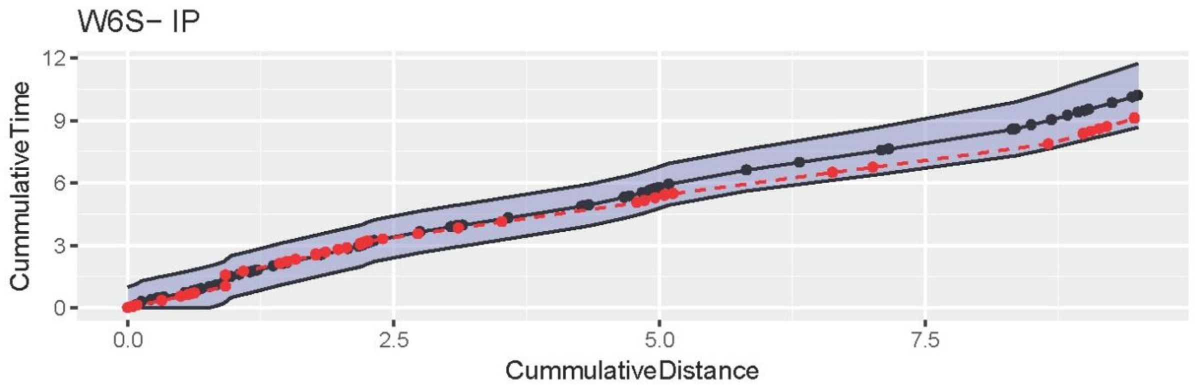
12.5
10.0
7.5
5.0
2.5
0.0
0.0
2.5
5.0
7.5
CummulativeDistance


W6S- IP
CummulativeTime
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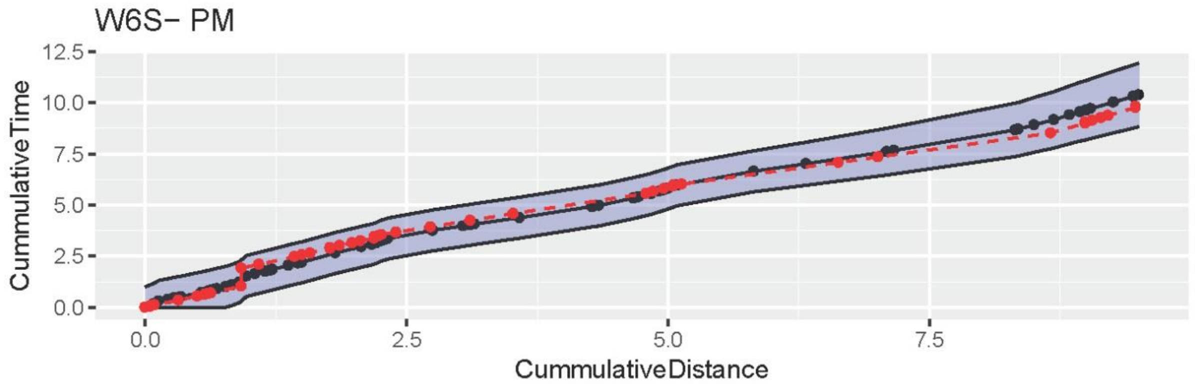
9
6
3
0
0.0
2.5
5.0
7.5
CummulativeDistance


W6S- PM
CummulativeTime
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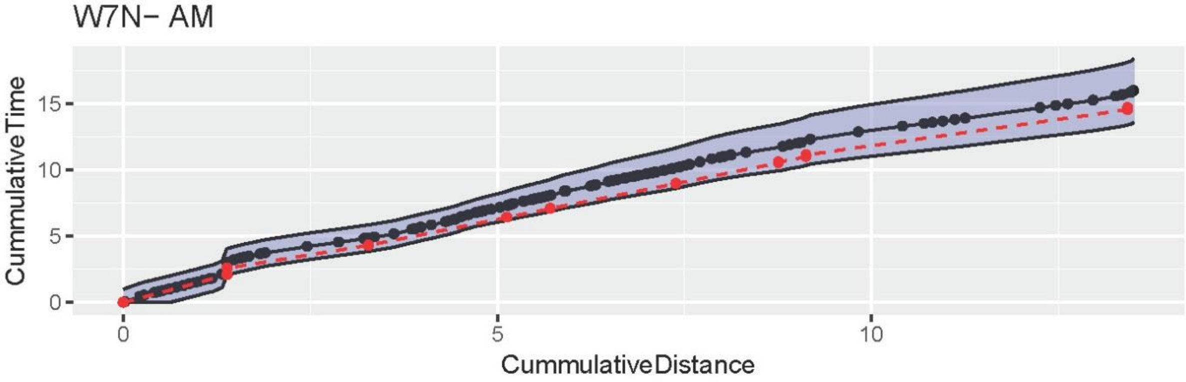
10.0
7.5
5.0
2.5
0.0
0.0
2.5
5.0
7.5
CummulativeDistance


W7N- AM
CummulativeTime
CummulativeDistance
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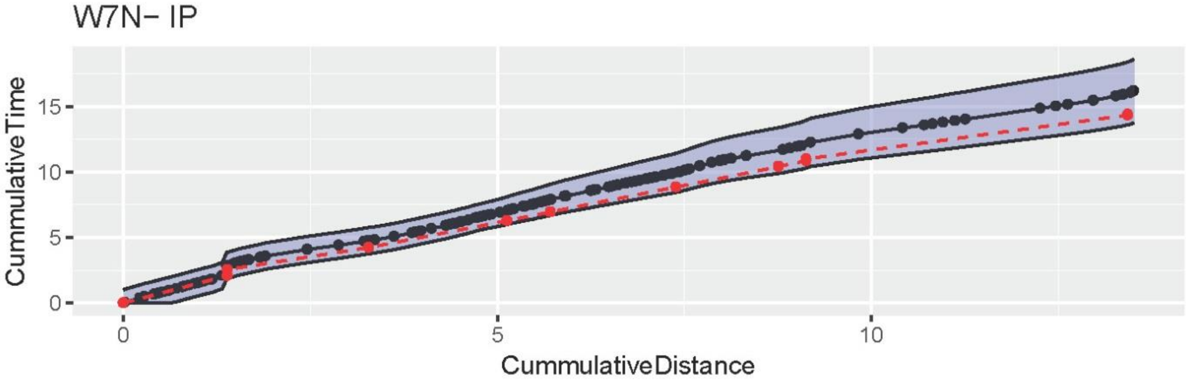
10
15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CummulativeTime
CummulativeDistance
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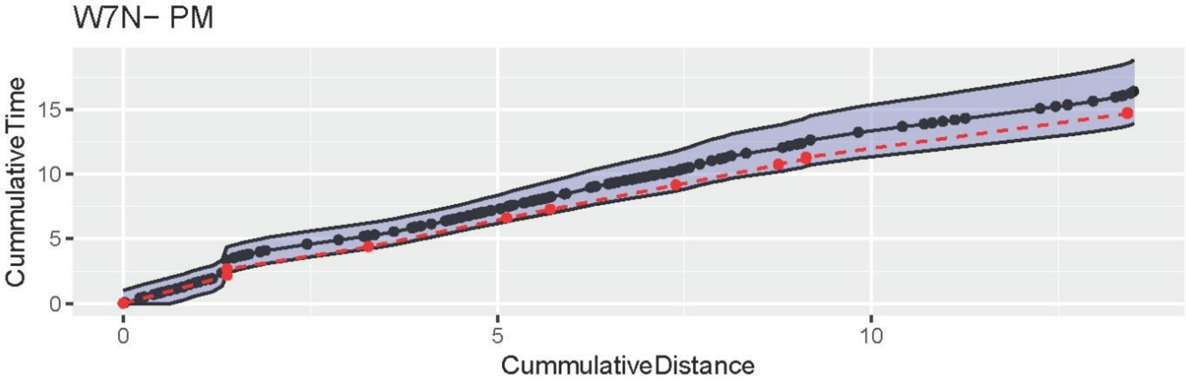
5
10
15


W7N- PM
CummulativeTime
CummulativeDistance
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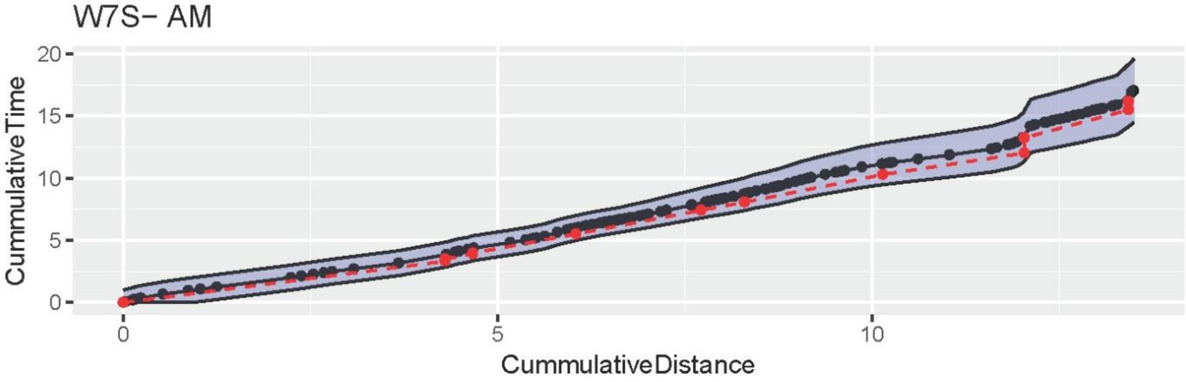
5
10
15


W7S- AM
CummulativeTime
CummulativeDistance
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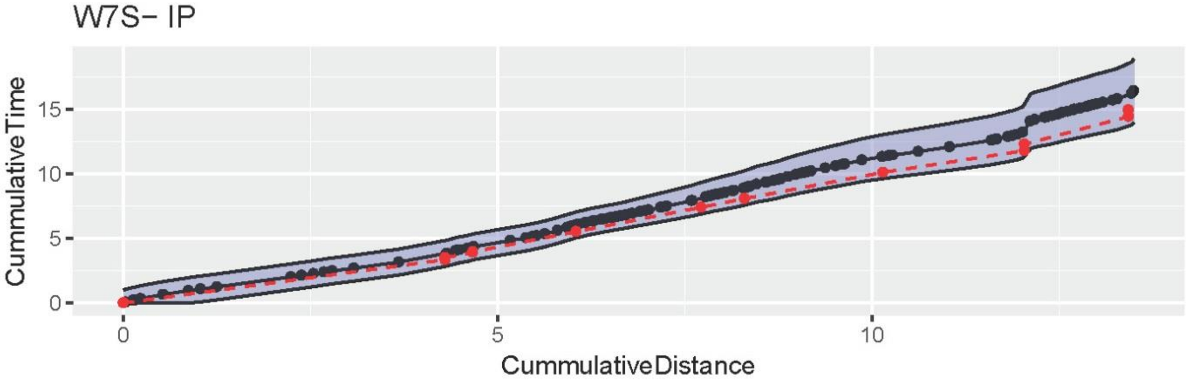
15
10
5
0
0
5
10


W7S- IP
CummulativeTime
CummulativeDistance
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5
0
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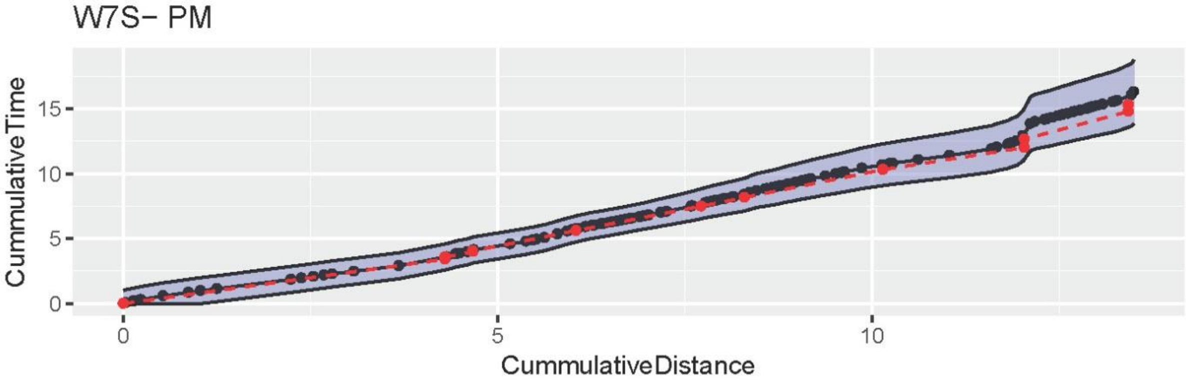
5
10


W7S- PM
CummulativeTime
CummulativeDistance
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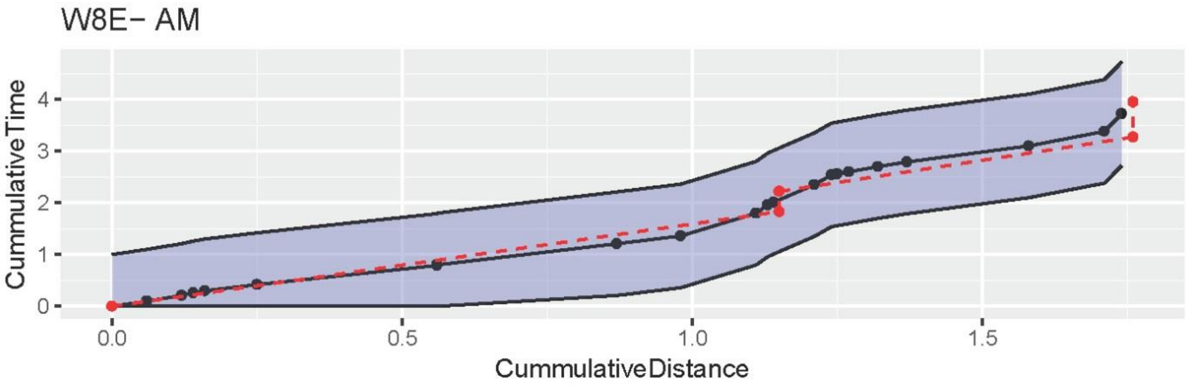
10
5
0
0
5
10


W8E- AM
CummulativeTime
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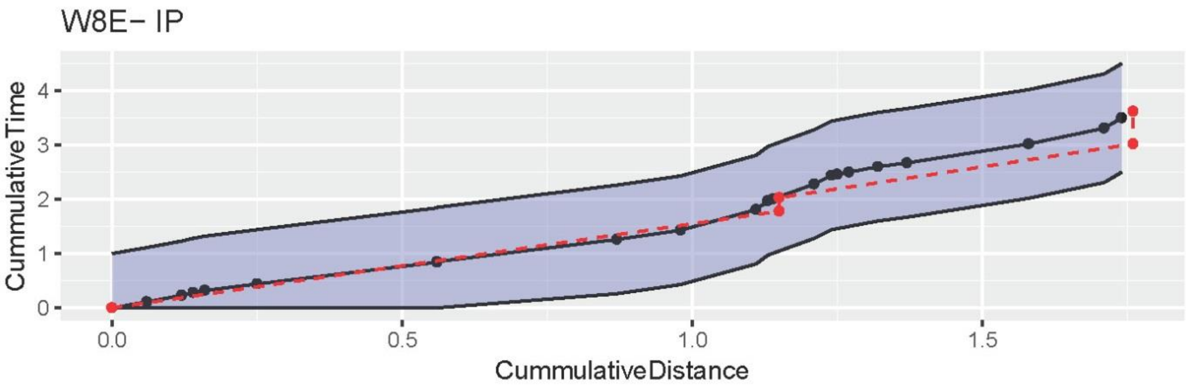
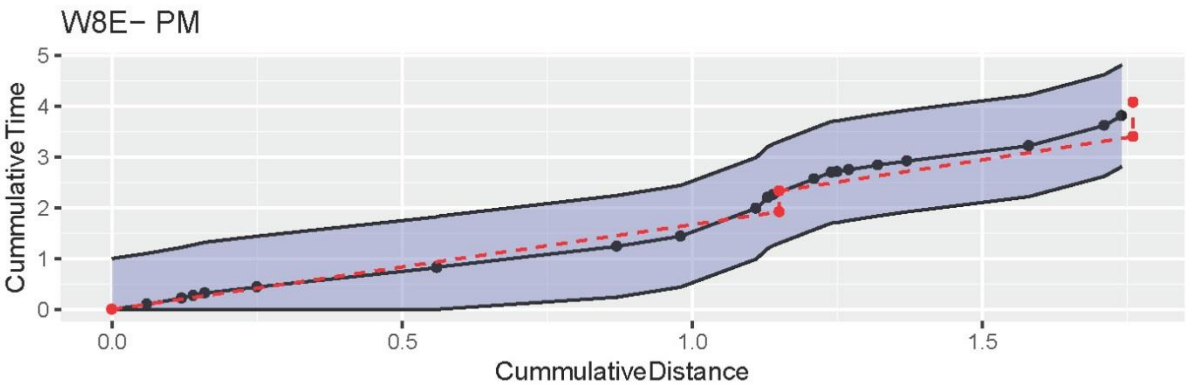
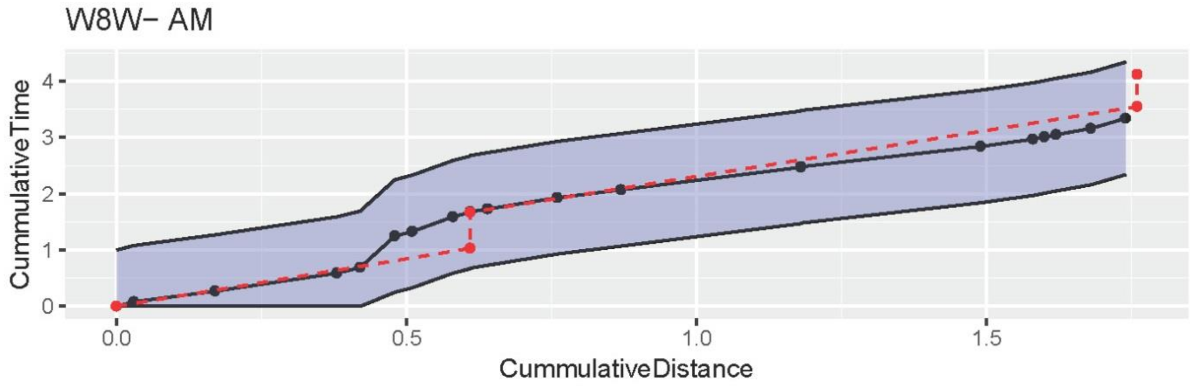
3
2
1
0
0.0
0.5
1.0
1.5
CummulativeDistance


W8E- IP
CummulativeTime
4
3
2
1
0
0.0
0.5
1.0
1.5
CummulativeDistance


W8E- PM
CummulativeTime
5
4
3
2
1
0
0.0
0.5
1.0
1.5
CummulativeDistance


W8W- AM
CummulativeTime
CummulativeDistance
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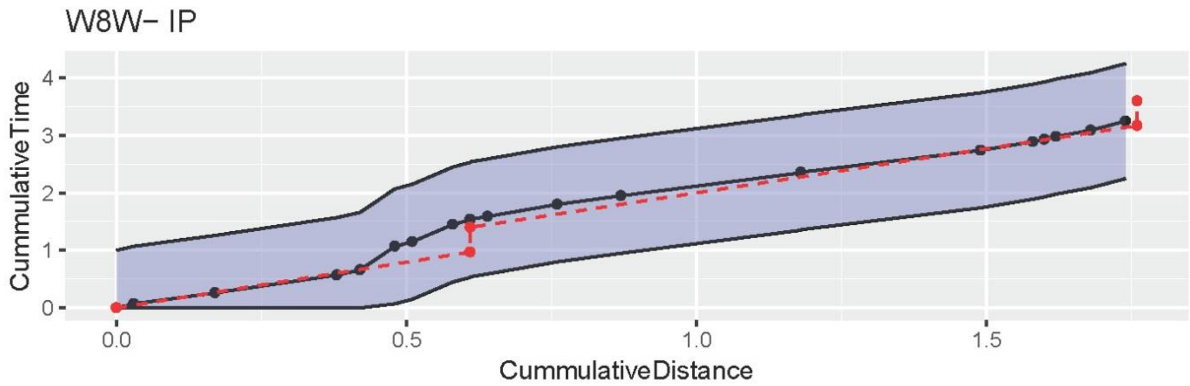
1
2
3
4
0.0
0.5
1.0
1.5


W8W- IP
CummulativeTime
CummulativeDistance
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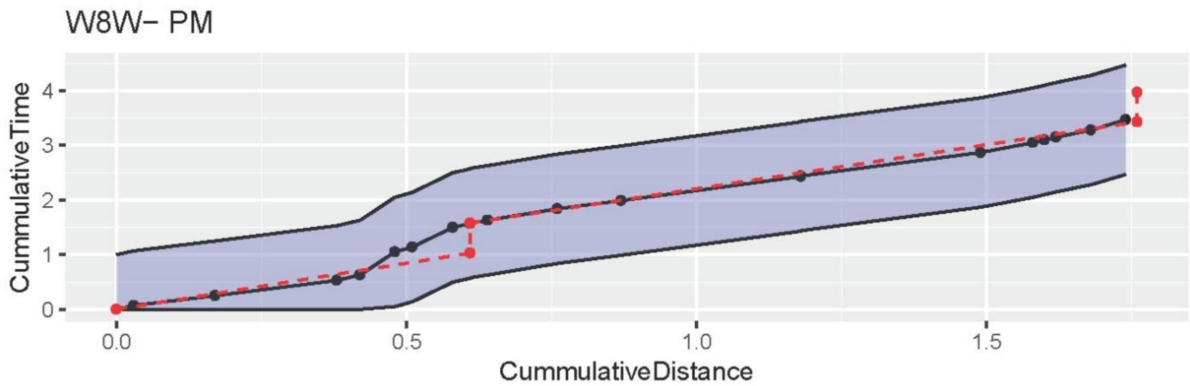
1
2
3
4
0.0
0.5
1.0
1.5


W8W- PM
CummulativeTime
CummulativeDistance
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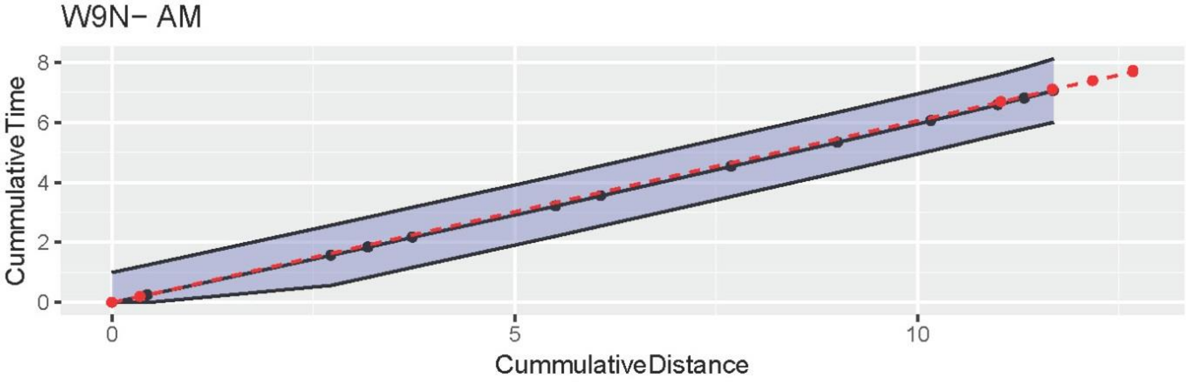
1
2
3
4
0.0
0.5
1.0
1.5


W9N- AM
CummulativeTime
CummulativeDistance
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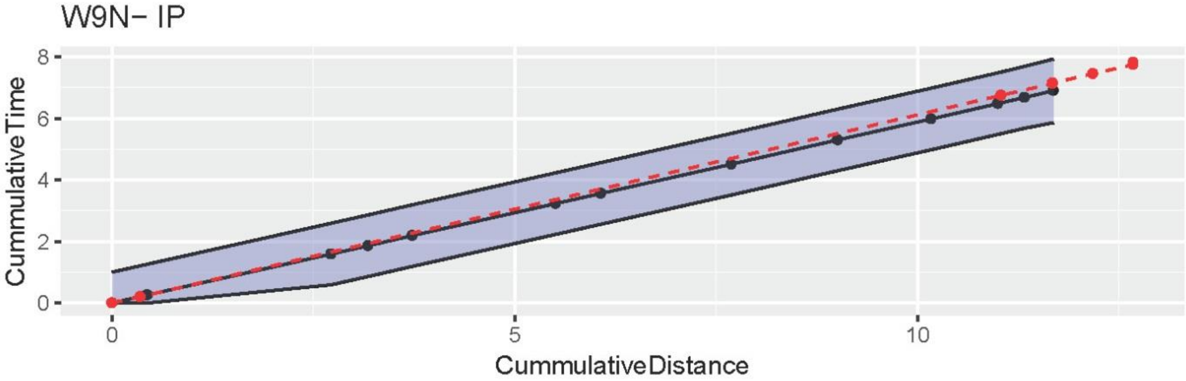
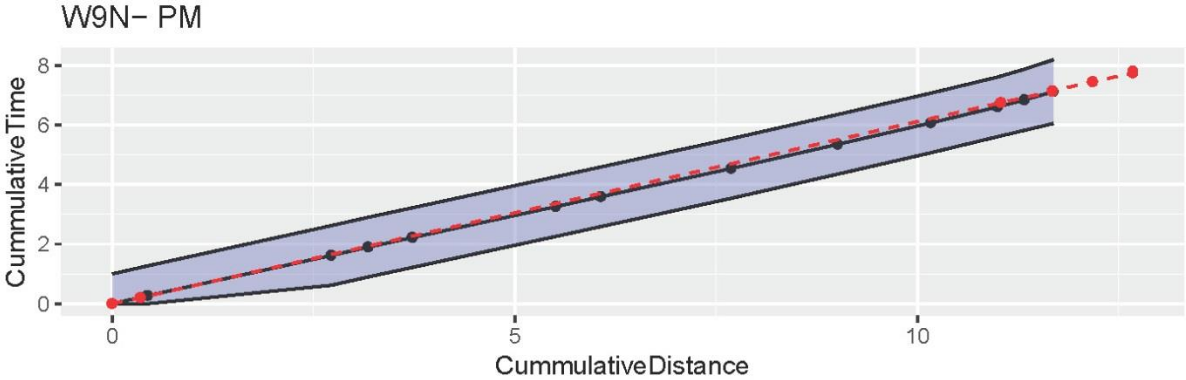
2
4
6
8
0
5
10


W9N- IP
CummulativeTime
CummulativeDistance
0
2
4
6
8
0
5
10


W9N- PM
CummulativeTime
CummulativeDistance
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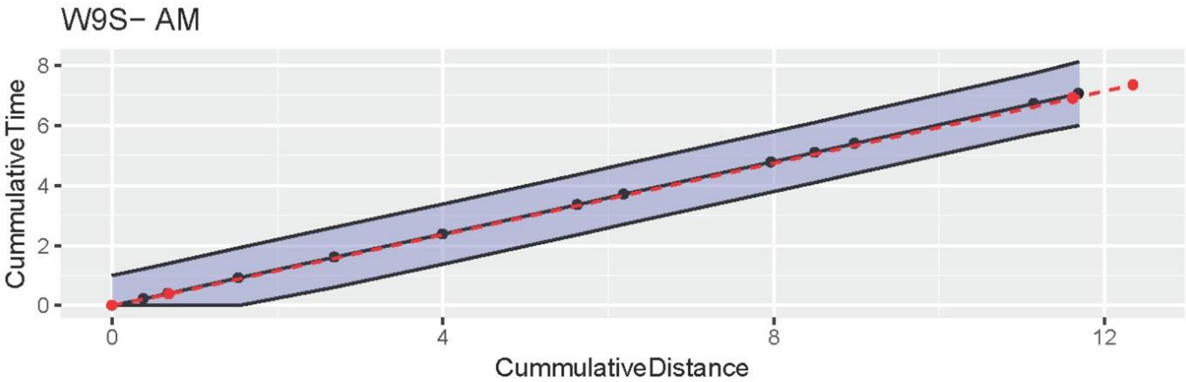
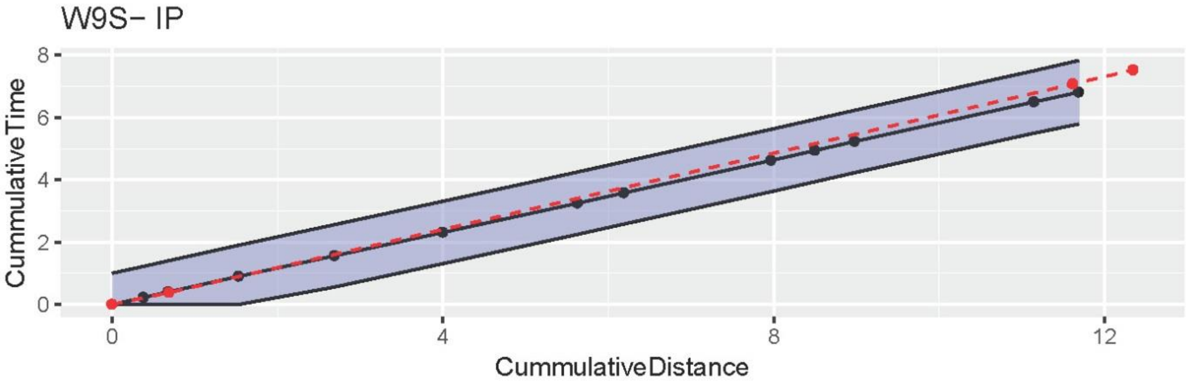
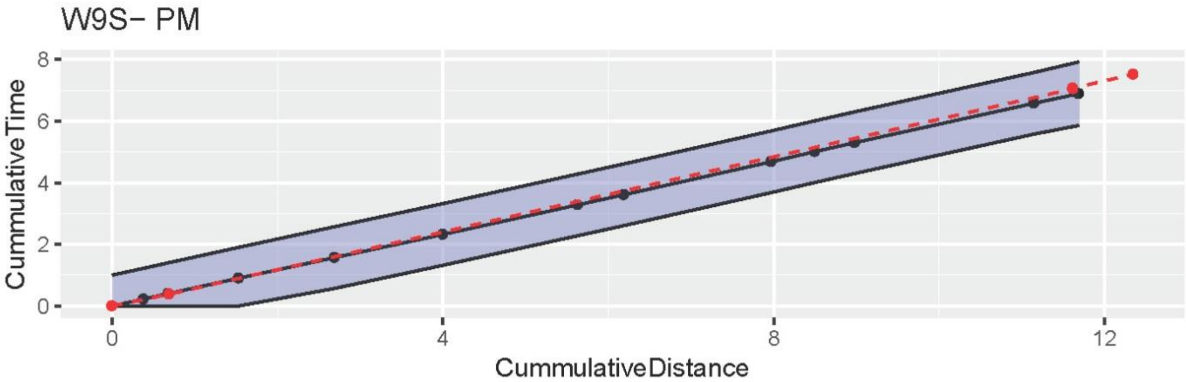
2
4
6
8
0
5
10


W9S- AM
CummulativeTime
CummulativeDistance
0
2
4
6
8
0
4
8
12


W9S- IP
CummulativeTime
CummulativeDistance
0
2
4
6
8
0
4
8
12


W9S- PM
CummulativeTime
CummulativeDistance
0
2
4
6
8
0
4
8
12

Appendix M Screenlines Summary Table

M.1 AM Screenline Table Comparisons All Vehicles

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	664	542	-122	-18%	FALSE	FALSE	FALSE	5.0	FALSE	AM	All
A02	A	CAL	FALSE	FALSE	FALSE	733	737	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
A06	A	VAL	FALSE	FALSE	FALSE	1026	1007	-19	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
A08	A	CAL	FALSE	FALSE	FALSE	128	136	8	6%	FALSE	TRUE	TRUE	0.7	TRUE	AM	All
A1	A	CAL	FALSE	FALSE	TRUE	2790	2792	2	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
A12	A	VAL	FALSE	FALSE	FALSE	587	584	-3	-1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
A13	A	CAL	FALSE	FALSE	TRUE	610	612	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
A15	A	CAL	FALSE	FALSE	TRUE	821	752	-69	-8%	FALSE	TRUE	TRUE	2.4	TRUE	AM	All
A16	A	CAL	FALSE	FALSE	TRUE	665	644	-20	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
B08	A	CAL	FALSE	FALSE	FALSE	786	736	-50	-6%	FALSE	TRUE	TRUE	1.8	TRUE	AM	All
B14	A	CAL	FALSE	FALSE	FALSE	2374	1730	-644	-27%	FALSE	FALSE	FALSE	14.2	FALSE	AM	All

B15	A	VAL	FALSE	FALSE	FALSE	2841	2826	-15	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
B16	A	CAL	FALSE	FALSE	FALSE	666	651	-15	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
B17	A	CAL	FALSE	FALSE	TRUE	518	513	-5	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
B18	A	CAL	FALSE	FALSE	TRUE	388	370	-18	-5%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
B19	A	CAL	FALSE	FALSE	TRUE	299	190	-109	-37%	FALSE	FALSE	FALSE	7.0	FALSE	AM	All
B20	A	CAL	FALSE	FALSE	TRUE	2584	2571	-13	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
B21	A	CAL	FALSE	FALSE	TRUE	200	198	-1	-1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
C02	A	CAL	FALSE	FALSE	FALSE	397	372	-25	-6%	FALSE	TRUE	TRUE	1.3	TRUE	AM	All
C03	A	CAL	FALSE	FALSE	FALSE	243	220	-23	-10%	FALSE	TRUE	TRUE	1.5	TRUE	AM	All
C06	A	CAL	FALSE	FALSE	FALSE	62	59	-3	-5%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
D02	A	CAL	FALSE	FALSE	FALSE	729	671	-58	-8%	FALSE	TRUE	TRUE	2.2	TRUE	AM	All
D06	A	CAL	FALSE	FALSE	TRUE	600	585	-15	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
D17	A	CAL	FALSE	FALSE	FALSE	532	533	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D18	A	CAL	FALSE	FALSE	FALSE	922	900	-22	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
D19	A	VAL	FALSE	TRUE	FALSE	518	546	28	5%	FALSE	TRUE	TRUE	1.2	TRUE	AM	All
D20	A	CAL	FALSE	FALSE	FALSE	779	744	-35	-5%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
D21	A	CAL	FALSE	TRUE	FALSE	363	365	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
D22	A	CAL	FALSE	TRUE	FALSE	1496	1326	-171	-11%	FALSE	FALSE	TRUE	4.5	FALSE	AM	All
D23	A	CAL	FALSE	TRUE	FALSE	1440	1316	-124	-9%	FALSE	TRUE	TRUE	3.3	TRUE	AM	All
D24	A	CAL	FALSE	TRUE	FALSE	560	524	-36	-6%	FALSE	TRUE	TRUE	1.6	TRUE	AM	All
D25	A	CAL	FALSE	TRUE	FALSE	916	869	-47	-5%	FALSE	TRUE	TRUE	1.6	TRUE	AM	All
D26	A	CAL	FALSE	TRUE	FALSE	413	394	-19	-5%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
D27	A	CAL	FALSE	FALSE	TRUE	607	675	68	11%	FALSE	FALSE	TRUE	2.7	TRUE	AM	All
D28	A	CAL	FALSE	FALSE	FALSE	658	606	-51	-8%	FALSE	TRUE	TRUE	2.0	TRUE	AM	All

D29	A	CAL	FALSE	FALSE	FALSE	1323	1269	-54	-4%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
D30	A	CAL	FALSE	FALSE	FALSE	866	854	-12	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
D31	A	CAL	FALSE	FALSE	FALSE	843	785	-58	-7%	FALSE	TRUE	TRUE	2.0	TRUE	AM	All
D33	A	CAL	FALSE	TRUE	FALSE	522	479	-43	-8%	FALSE	TRUE	TRUE	1.9	TRUE	AM	All
E04	A	CAL	TRUE	TRUE	FALSE	1130	1058	-72	-6%	FALSE	TRUE	TRUE	2.2	TRUE	AM	All
E14	A	CAL	FALSE	TRUE	FALSE	269	267	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
E16	A	CAL	FALSE	FALSE	FALSE	367	357	-10	-3%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
E17	A	CAL	TRUE	FALSE	FALSE	998	945	-53	-5%	FALSE	TRUE	TRUE	1.7	TRUE	AM	All
E21	A	CAL	FALSE	FALSE	FALSE	599	687	88	15%	FALSE	FALSE	TRUE	3.5	TRUE	AM	All
E22	A	CAL	FALSE	FALSE	FALSE	599	471	-128	-21%	FALSE	FALSE	FALSE	5.6	FALSE	AM	All
E23	A	CAL	FALSE	FALSE	FALSE	641	619	-22	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
E25	A	CAL	FALSE	TRUE	FALSE	1548	1420	-128	-8%	FALSE	TRUE	TRUE	3.3	TRUE	AM	All
E26	A	CAL	FALSE	FALSE	FALSE	1045	1014	-31	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
E28	A	CAL	TRUE	TRUE	FALSE	747	663	-84	-11%	FALSE	FALSE	TRUE	3.2	TRUE	AM	All
E29	A	CAL	TRUE	TRUE	FALSE	819	806	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
E30	A	CAL	TRUE	TRUE	FALSE	953	946	-7	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
E31	A	CAL	TRUE	TRUE	FALSE	567	540	-27	-5%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
E33	A	CAL	FALSE	TRUE	FALSE	1103	1073	-30	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
E34	A	CAL	TRUE	FALSE	FALSE	1396	1368	-29	-2%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
E35	A	CAL	FALSE	FALSE	FALSE	566	524	-41	-7%	FALSE	TRUE	TRUE	1.8	TRUE	AM	All
E36	A	CAL	TRUE	FALSE	FALSE	961	971	9	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
E37	A	CAL	TRUE	FALSE	FALSE	644	572	-72	-11%	FALSE	FALSE	TRUE	2.9	TRUE	AM	All
E38	A	CAL	FALSE	FALSE	FALSE	658	557	-100	-15%	FALSE	FALSE	FALSE	4.1	FALSE	AM	All
E39	A	CAL	FALSE	FALSE	FALSE	799	774	-25	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All

E40	A	CAL	TRUE	FALSE	FALSE	574	597	24	4%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
E41	A	CAL	TRUE	TRUE	FALSE	594	511	-83	-14%	FALSE	FALSE	TRUE	3.5	TRUE	AM	All
E42	A	CAL	FALSE	FALSE	FALSE	420	397	-23	-5%	FALSE	TRUE	TRUE	1.1	TRUE	AM	All
E44	A	CAL	TRUE	FALSE	FALSE	2156	1988	-168	-8%	FALSE	TRUE	TRUE	3.7	TRUE	AM	All
E46	A	CAL	FALSE	FALSE	FALSE	210	216	6	3%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
F03	A	CAL	FALSE	FALSE	FALSE	438	426	-12	-3%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
F07	A	CAL	FALSE	FALSE	FALSE	631	613	-18	-3%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
G09	A	CAL	FALSE	FALSE	FALSE	254	254	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
M1	A	CAL	FALSE	FALSE	FALSE	4344	4271	-73	-2%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
M18	A	CAL	FALSE	FALSE	FALSE	8880	9011	130	1%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
M500	A	CAL	FALSE	FALSE	FALSE	2028	2024	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
M502	A	CAL	FALSE	FALSE	TRUE	1464	1518	54	4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
M503	A	CAL	FALSE	FALSE	FALSE	4614	4528	-86	-2%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
M504	A	CAL	FALSE	FALSE	FALSE	3585	3646	62	2%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
M505	A	CAL	FALSE	FALSE	FALSE	1968	1957	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
M506	A	CAL	FALSE	FALSE	FALSE	2737	2723	-14	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
M508	A	CAL	FALSE	FALSE	FALSE	4254	4270	16	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
M62	A	VAL	FALSE	FALSE	FALSE	2461	2489	29	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL001	A	CAL	FALSE	TRUE	FALSE	6338	6188	-149	-2%	TRUE	TRUE	TRUE	1.9	TRUE	AM	All
SL002	A	CAL	FALSE	TRUE	FALSE	3408	3261	-148	-4%	TRUE	TRUE	TRUE	2.6	TRUE	AM	All
SL003	A	VAL	FALSE	FALSE	TRUE	3399	3319	-80	-2%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL004	A	CAL	FALSE	FALSE	TRUE	743	696	-47	-6%	FALSE	TRUE	TRUE	1.8	TRUE	AM	All
SL005	A	VAL	FALSE	TRUE	TRUE	3604	3566	-39	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL006	A	CAL	FALSE	FALSE	TRUE	2595	2600	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All

SL007	A	CAL	FALSE	FALSE	TRUE	1434	1401	-33	-2%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
SL008	A	VAL	FALSE	FALSE	FALSE	6458	6420	-38	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL009	A	VAL	FALSE	FALSE	FALSE	3822	3694	-128	-3%	TRUE	TRUE	TRUE	2.1	TRUE	AM	All
SL010	A	CAL	FALSE	FALSE	FALSE	3415	3451	36	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL011	A	CAL	FALSE	FALSE	FALSE	1522	1553	31	2%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL012	A	CAL	FALSE	FALSE	FALSE	3069	3073	4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL013	A	CAL	FALSE	FALSE	FALSE	567	577	9	2%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
SL014	A	VAL	FALSE	FALSE	FALSE	458	454	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL016	A	VAL	FALSE	FALSE	TRUE	3564	3579	15	0%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL017	A	CAL	FALSE	FALSE	FALSE	840	817	-23	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL018	A	VAL	FALSE	FALSE	FALSE	2523	2470	-53	-2%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
SL019	A	VAL	TRUE	FALSE	FALSE	2872	2845	-27	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL020	A	CAL	FALSE	FALSE	FALSE	1923	1908	-15	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL021	A	CAL	FALSE	FALSE	FALSE	163	154	-8	-5%	FALSE	TRUE	TRUE	0.7	TRUE	AM	All
SL022	A	CAL	FALSE	FALSE	FALSE	3593	3597	4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL023	A	VAL	FALSE	FALSE	FALSE	2247	2225	-21	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL024	A	VAL	FALSE	FALSE	FALSE	981	980	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
SL025	A	CAL	FALSE	FALSE	FALSE	803	771	-32	-4%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
SL026	A	VAL	FALSE	FALSE	FALSE	756	766	10	1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
SL027	A	CAL	FALSE	FALSE	FALSE	2546	2536	-10	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL028	A	CAL	FALSE	FALSE	FALSE	1546	1558	12	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL029	A	VAL	FALSE	FALSE	FALSE	2437	2445	7	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL030	A	VAL	FALSE	FALSE	FALSE	2106	2217	111	5%	FALSE	TRUE	FALSE	2.4	TRUE	AM	All
SL031	A	VAL	TRUE	FALSE	FALSE	1605	1549	-55	-3%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All

SL032	A	CAL	TRUE	TRUE	FALSE	1954	1876	-79	-4%	TRUE	TRUE	TRUE	1.8	TRUE	AM	All
SL033	A	CAL	TRUE	TRUE	FALSE	927	829	-99	-11%	FALSE	FALSE	FALSE	3.3	TRUE	AM	All
SL034	A	CAL	TRUE	FALSE	FALSE	2345	2218	-127	-5%	FALSE	TRUE	TRUE	2.7	TRUE	AM	All
SL035	A	VAL	TRUE	FALSE	FALSE	933	894	-39	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
SL036	A	VAL	FALSE	FALSE	FALSE	1121	1076	-46	-4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL037	A	CAL	TRUE	TRUE	FALSE	4418	4155	-262	-6%	FALSE	TRUE	TRUE	4.0	FALSE	AM	All
SL038	A	CAL	TRUE	TRUE	FALSE	4123	3872	-251	-6%	FALSE	TRUE	FALSE	4.0	TRUE	AM	All
SL039	A	CAL	TRUE	FALSE	FALSE	2093	2096	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL040	A	CAL	TRUE	FALSE	FALSE	1164	1144	-20	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL041	A	VAL	TRUE	FALSE	FALSE	2146	2064	-83	-4%	TRUE	TRUE	TRUE	1.8	TRUE	AM	All
SL042	A	VAL	FALSE	FALSE	FALSE	1655	1596	-59	-4%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
SL043	A	CAL	TRUE	FALSE	FALSE	919	846	-72	-8%	FALSE	TRUE	TRUE	2.4	TRUE	AM	All
SL044	A	VAL	TRUE	TRUE	FALSE	1024	951	-73	-7%	FALSE	TRUE	TRUE	2.3	TRUE	AM	All
SL045	A	VAL	TRUE	TRUE	FALSE	1618	1565	-54	-3%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
SL046	A	CAL	FALSE	TRUE	FALSE	6917	6676	-241	-3%	TRUE	TRUE	TRUE	2.9	TRUE	AM	All
SL047	A	VAL	FALSE	FALSE	FALSE	472	283	-189	-40%	FALSE	FALSE	FALSE	9.7	FALSE	AM	All
SL048	A	VAL	FALSE	FALSE	FALSE	1479	1472	-7	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL049	A	CAL	TRUE	TRUE	FALSE	6317	6134	-184	-3%	TRUE	TRUE	TRUE	2.3	TRUE	AM	All
SL050	A	VAL	FALSE	FALSE	TRUE	2999	2787	-211	-7%	FALSE	TRUE	FALSE	3.9	TRUE	AM	All
SL051	A	CAL	TRUE	TRUE	FALSE	1217	1172	-45	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
SL052	A	VAL	FALSE	FALSE	FALSE	1004	1047	43	4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL053	A	VAL	FALSE	FALSE	TRUE	411	412	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
SL054	A	VAL	FALSE	FALSE	FALSE	3137	3126	-11	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL055	A	CAL	FALSE	FALSE	FALSE	6892	6804	-88	-1%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All

SL057	A	CAL	FALSE	FALSE	FALSE	616	614	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL058	A	CAL	FALSE	FALSE	FALSE	842	869	27	3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
SL059	A	CAL	FALSE	FALSE	FALSE	1308	1328	19	1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL060	A	VAL	FALSE	FALSE	FALSE	503	471	-33	-6%	FALSE	TRUE	TRUE	1.5	TRUE	AM	All
SL061	A	VAL	FALSE	TRUE	FALSE	2309	2236	-73	-3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
SL062	A	CAL	FALSE	TRUE	FALSE	971	948	-23	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
SL063	A	CAL	TRUE	TRUE	FALSE	3237	3019	-217	-7%	FALSE	TRUE	TRUE	3.9	TRUE	AM	All
SL064	A	CAL	FALSE	FALSE	FALSE	6237	6126	-111	-2%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL065	A	VAL	FALSE	FALSE	FALSE	3570	3420	-150	-4%	TRUE	TRUE	TRUE	2.5	TRUE	AM	All
SL066	A	CAL	TRUE	TRUE	FALSE	3776	3840	64	2%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
SL067	A	CAL	FALSE	FALSE	FALSE	826	828	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL068	A	CAL	FALSE	FALSE	FALSE	130	137	7	5%	FALSE	TRUE	TRUE	0.6	TRUE	AM	All
SL069	A	CAL	FALSE	TRUE	FALSE	895	867	-29	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
SL070	A	CAL	FALSE	TRUE	FALSE	2295	2198	-97	-4%	TRUE	TRUE	TRUE	2.0	TRUE	AM	All
SL071	A	CAL	FALSE	TRUE	FALSE	4436	4400	-37	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL072	A	VAL	TRUE	FALSE	FALSE	3530	3615	85	2%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL073	A	CAL	FALSE	TRUE	FALSE	3355	3152	-203	-6%	FALSE	TRUE	FALSE	3.6	TRUE	AM	All
SL074	A	CAL	FALSE	FALSE	FALSE	1152	1160	8	1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL075	A	CAL	FALSE	FALSE	FALSE	2050	1986	-64	-3%	TRUE	TRUE	TRUE	1.4	TRUE	AM	All
SL076	A	CAL	TRUE	TRUE	FALSE	1113	1002	-110	-10%	FALSE	TRUE	TRUE	3.4	TRUE	AM	All
A01	B	CAL	FALSE	FALSE	FALSE	518	424	-94	-18%	FALSE	FALSE	FALSE	4.3	FALSE	AM	All
A02	B	CAL	FALSE	FALSE	FALSE	501	474	-27	-5%	FALSE	TRUE	TRUE	1.2	TRUE	AM	All
A06	B	VAL	FALSE	FALSE	FALSE	1001	1004	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
A08	B	CAL	FALSE	FALSE	FALSE	106	107	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All

A1	B	CAL	FALSE	FALSE	TRUE	2818	2904	86	3%	TRUE	TRUE	TRUE	1.6	TRUE	AM	All
A12	B	VAL	FALSE	FALSE	FALSE	658	668	10	2%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
A13	B	CAL	FALSE	FALSE	TRUE	462	442	-20	-4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
A15	B	CAL	FALSE	FALSE	TRUE	671	620	-50	-8%	FALSE	TRUE	TRUE	2.0	TRUE	AM	All
A16	B	CAL	FALSE	FALSE	TRUE	554	560	6	1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
B08	B	CAL	FALSE	FALSE	FALSE	539	522	-17	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
B14	B	CAL	FALSE	FALSE	FALSE	2707	2291	-416	-15%	FALSE	FALSE	FALSE	8.3	FALSE	AM	All
B15	B	VAL	FALSE	FALSE	FALSE	1843	1856	13	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
B16	B	CAL	FALSE	FALSE	FALSE	537	488	-49	-9%	FALSE	TRUE	TRUE	2.2	TRUE	AM	All
B17	B	CAL	FALSE	FALSE	TRUE	475	433	-42	-9%	FALSE	TRUE	TRUE	2.0	TRUE	AM	All
B18	B	CAL	FALSE	FALSE	TRUE	401	395	-6	-2%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
B19	B	CAL	FALSE	FALSE	TRUE	275	277	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
B20	B	CAL	FALSE	FALSE	TRUE	1947	1961	14	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
B21	B	CAL	FALSE	FALSE	TRUE	230	229	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
C02	B	CAL	FALSE	FALSE	FALSE	405	405	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
C03	B	CAL	FALSE	FALSE	FALSE	334	333	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
C06	B	CAL	FALSE	FALSE	FALSE	84	84	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D02	B	CAL	FALSE	FALSE	FALSE	824	793	-31	-4%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
D06	B	CAL	FALSE	FALSE	TRUE	892	872	-20	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
D17	B	CAL	FALSE	FALSE	FALSE	256	254	-2	-1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
D18	B	CAL	FALSE	FALSE	FALSE	418	417	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D19	B	VAL	FALSE	TRUE	FALSE	440	437	-3	-1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
D20	B	CAL	FALSE	FALSE	FALSE	849	800	-49	-6%	FALSE	TRUE	TRUE	1.7	TRUE	AM	All
D21	B	CAL	FALSE	TRUE	FALSE	635	573	-62	-10%	FALSE	TRUE	TRUE	2.5	TRUE	AM	All

D22	B	CAL	FALSE	TRUE	FALSE	1034	991	-42	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
D23	B	CAL	FALSE	TRUE	FALSE	1030	970	-60	-6%	FALSE	TRUE	TRUE	1.9	TRUE	AM	All
D24	B	CAL	FALSE	TRUE	FALSE	313	313	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D25	B	CAL	FALSE	TRUE	FALSE	1104	1065	-39	-4%	TRUE	TRUE	TRUE	1.2	TRUE	AM	All
D26	B	CAL	FALSE	TRUE	FALSE	327	303	-24	-7%	FALSE	TRUE	TRUE	1.4	TRUE	AM	All
D27	B	CAL	FALSE	FALSE	TRUE	908	941	33	4%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
D28	B	CAL	FALSE	FALSE	FALSE	818	788	-30	-4%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
D29	B	CAL	FALSE	FALSE	FALSE	816	815	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D30	B	CAL	FALSE	FALSE	FALSE	744	730	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
D31	B	CAL	FALSE	FALSE	FALSE	391	392	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
D33	B	CAL	FALSE	TRUE	FALSE	731	719	-12	-2%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
E04	B	CAL	TRUE	TRUE	FALSE	668	649	-20	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
E14	B	CAL	FALSE	TRUE	FALSE	1073	1018	-55	-5%	FALSE	TRUE	TRUE	1.7	TRUE	AM	All
E16	B	CAL	FALSE	FALSE	FALSE	269	263	-6	-2%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
E17	B	CAL	TRUE	FALSE	FALSE	1277	1624	346	27%	FALSE	FALSE	FALSE	9.1	FALSE	AM	All
E21	B	CAL	FALSE	FALSE	FALSE	526	549	23	4%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
E22	B	CAL	FALSE	FALSE	FALSE	544	417	-127	-23%	FALSE	FALSE	FALSE	5.8	FALSE	AM	All
E23	B	CAL	FALSE	FALSE	FALSE	621	602	-19	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
E25	B	CAL	FALSE	TRUE	FALSE	1302	1161	-141	-11%	FALSE	FALSE	TRUE	4.0	FALSE	AM	All
E26	B	CAL	FALSE	FALSE	FALSE	787	737	-49	-6%	FALSE	TRUE	TRUE	1.8	TRUE	AM	All
E28	B	CAL	TRUE	TRUE	FALSE	534	522	-12	-2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
E29	B	CAL	TRUE	TRUE	FALSE	1354	1244	-109	-8%	FALSE	TRUE	TRUE	3.0	TRUE	AM	All
E30	B	CAL	TRUE	TRUE	FALSE	501	465	-36	-7%	FALSE	TRUE	TRUE	1.7	TRUE	AM	All
E31	B	CAL	TRUE	TRUE	FALSE	862	843	-19	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All

E33	B	CAL	FALSE	TRUE	FALSE	727	714	-13	-2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
E34	B	CAL	TRUE	FALSE	FALSE	522	594	72	14%	FALSE	FALSE	TRUE	3.1	TRUE	AM	All
E35	B	CAL	FALSE	FALSE	FALSE	121	132	11	9%	FALSE	TRUE	TRUE	1.0	TRUE	AM	All
E36	B	CAL	TRUE	FALSE	FALSE	462	477	15	3%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
E37	B	CAL	TRUE	FALSE	FALSE	517	518	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
E38	B	CAL	FALSE	FALSE	FALSE	572	431	-141	-25%	FALSE	FALSE	FALSE	6.3	FALSE	AM	All
E39	B	CAL	FALSE	FALSE	FALSE	626	587	-39	-6%	FALSE	TRUE	TRUE	1.6	TRUE	AM	All
E40	B	CAL	TRUE	FALSE	FALSE	740	724	-16	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
E41	B	CAL	TRUE	TRUE	FALSE	381	356	-25	-6%	FALSE	TRUE	TRUE	1.3	TRUE	AM	All
E42	B	CAL	FALSE	FALSE	FALSE	263	233	-30	-11%	FALSE	FALSE	TRUE	1.9	TRUE	AM	All
E44	B	CAL	TRUE	FALSE	FALSE	1206	1153	-53	-4%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
E46	B	CAL	FALSE	FALSE	FALSE	224	221	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
F03	B	CAL	FALSE	FALSE	FALSE	507	418	-89	-17%	FALSE	FALSE	FALSE	4.1	FALSE	AM	All
G09	B	CAL	FALSE	FALSE	FALSE	343	346	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
M1	B	CAL	FALSE	FALSE	FALSE	4606	4603	-3	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
M18	B	CAL	FALSE	FALSE	FALSE	9527	9522	-5	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
M500	B	CAL	FALSE	FALSE	FALSE	2093	2088	-5	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
M502	B	CAL	FALSE	FALSE	TRUE	1646	1630	-16	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
M503	B	CAL	FALSE	FALSE	FALSE	4655	4615	-39	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
M504	B	CAL	FALSE	FALSE	FALSE	4181	4129	-52	-1%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
M505	B	CAL	FALSE	FALSE	FALSE	2000	1967	-32	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
M506	B	CAL	FALSE	FALSE	FALSE	2350	2487	137	6%	FALSE	TRUE	TRUE	2.8	TRUE	AM	All
M508	B	CAL	FALSE	FALSE	FALSE	4132	4110	-22	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
M62	B	VAL	FALSE	FALSE	FALSE	2412	2412	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All

SL001	B	CAL	FALSE	TRUE	FALSE	4580	4542	-37	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL002	B	CAL	FALSE	TRUE	FALSE	2244	2220	-25	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL003	B	VAL	FALSE	FALSE	TRUE	3161	3123	-37	-1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
SL004	B	CAL	FALSE	FALSE	TRUE	656	625	-31	-5%	TRUE	TRUE	TRUE	1.2	TRUE	AM	All
SL005	B	VAL	FALSE	TRUE	TRUE	4306	4164	-143	-3%	TRUE	TRUE	TRUE	2.2	TRUE	AM	All
SL006	B	CAL	FALSE	FALSE	TRUE	2442	2429	-13	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL007	B	CAL	FALSE	FALSE	TRUE	1535	1504	-31	-2%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL008	B	VAL	FALSE	FALSE	FALSE	4929	4879	-51	-1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
SL009	B	VAL	FALSE	FALSE	FALSE	3558	3447	-110	-3%	TRUE	TRUE	TRUE	1.9	TRUE	AM	All
SL010	B	CAL	FALSE	FALSE	FALSE	1891	1895	4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL011	B	CAL	FALSE	FALSE	FALSE	1555	1516	-39	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
SL012	B	CAL	FALSE	FALSE	FALSE	2353	2364	10	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL013	B	CAL	FALSE	FALSE	FALSE	572	565	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL014	B	VAL	FALSE	FALSE	FALSE	401	398	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL016	B	VAL	FALSE	FALSE	TRUE	3765	3801	36	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL017	B	CAL	FALSE	FALSE	FALSE	864	873	9	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL018	B	VAL	FALSE	FALSE	FALSE	2417	2212	-204	-8%	FALSE	TRUE	FALSE	4.2	FALSE	AM	All
SL019	B	VAL	TRUE	FALSE	FALSE	2561	2528	-32	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL020	B	CAL	FALSE	FALSE	FALSE	1661	1652	-9	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL021	B	CAL	FALSE	FALSE	FALSE	333	309	-24	-7%	FALSE	TRUE	TRUE	1.3	TRUE	AM	All
SL022	B	CAL	FALSE	FALSE	FALSE	3636	3654	17	0%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL023	B	VAL	FALSE	FALSE	FALSE	2365	2330	-35	-1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
SL024	B	VAL	FALSE	FALSE	FALSE	848	814	-35	-4%	TRUE	TRUE	TRUE	1.2	TRUE	AM	All
SL025	B	CAL	FALSE	FALSE	FALSE	1428	1388	-40	-3%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All

SL026	B	VAL	FALSE	FALSE	FALSE	710	652	-58	-8%	FALSE	TRUE	TRUE	2.2	TRUE	AM	All
SL027	B	CAL	FALSE	FALSE	FALSE	2457	2383	-74	-3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
SL028	B	CAL	FALSE	FALSE	FALSE	1406	1387	-19	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL029	B	VAL	FALSE	FALSE	FALSE	2393	2366	-26	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL030	B	VAL	FALSE	FALSE	FALSE	2102	2172	70	3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
SL031	B	VAL	TRUE	FALSE	FALSE	1907	1901	-6	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL032	B	CAL	TRUE	TRUE	FALSE	1706	1596	-110	-6%	FALSE	TRUE	TRUE	2.7	TRUE	AM	All
SL033	B	CAL	TRUE	TRUE	FALSE	397	346	-51	-13%	FALSE	FALSE	FALSE	2.6	TRUE	AM	All
SL034	B	CAL	TRUE	FALSE	FALSE	1738	1688	-51	-3%	TRUE	TRUE	TRUE	1.2	TRUE	AM	All
SL035	B	VAL	TRUE	FALSE	FALSE	1301	1314	14	1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
SL036	B	VAL	FALSE	FALSE	FALSE	970	933	-36	-4%	TRUE	TRUE	TRUE	1.2	TRUE	AM	All
SL037	B	CAL	TRUE	TRUE	FALSE	3555	3425	-131	-4%	TRUE	TRUE	TRUE	2.2	TRUE	AM	All
SL038	B	CAL	TRUE	TRUE	FALSE	3320	3194	-127	-4%	TRUE	TRUE	TRUE	2.2	TRUE	AM	All
SL039	B	CAL	TRUE	FALSE	FALSE	1167	1140	-27	-2%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL040	B	CAL	TRUE	FALSE	FALSE	1144	1138	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL041	B	VAL	TRUE	FALSE	FALSE	1325	1277	-47	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	All
SL042	B	VAL	FALSE	FALSE	FALSE	1607	1566	-41	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	All
SL043	B	CAL	TRUE	FALSE	FALSE	437	418	-20	-4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
SL044	B	VAL	TRUE	TRUE	FALSE	525	518	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL045	B	VAL	TRUE	TRUE	FALSE	831	815	-16	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL046	B	CAL	FALSE	TRUE	FALSE	6895	6676	-219	-3%	TRUE	TRUE	TRUE	2.7	TRUE	AM	All
SL047	B	VAL	FALSE	FALSE	FALSE	368	366	-2	-1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL048	B	VAL	FALSE	FALSE	FALSE	1267	1260	-6	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL049	B	CAL	TRUE	TRUE	FALSE	5606	5472	-134	-2%	TRUE	TRUE	TRUE	1.8	TRUE	AM	All

SL050	B	VAL	FALSE	FALSE	TRUE	2735	2658	-77	-3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	All
SL051	B	CAL	TRUE	TRUE	FALSE	1060	874	-185	-17%	FALSE	FALSE	FALSE	6.0	FALSE	AM	All
SL052	B	VAL	FALSE	FALSE	FALSE	665	660	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	All
SL053	B	VAL	FALSE	FALSE	TRUE	438	439	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	All
SL054	B	VAL	FALSE	FALSE	FALSE	2504	2472	-31	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL055	B	CAL	FALSE	FALSE	FALSE	4672	4617	-55	-1%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL057	B	CAL	FALSE	FALSE	FALSE	601	574	-27	-4%	TRUE	TRUE	TRUE	1.1	TRUE	AM	All
SL058	B	CAL	FALSE	FALSE	FALSE	1154	1143	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL059	B	CAL	FALSE	FALSE	FALSE	2050	1977	-73	-4%	TRUE	TRUE	TRUE	1.6	TRUE	AM	All
SL060	B	VAL	FALSE	FALSE	FALSE	689	669	-20	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	All
SL061	B	VAL	FALSE	TRUE	FALSE	2193	2174	-19	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
SL062	B	CAL	FALSE	TRUE	FALSE	643	610	-32	-5%	FALSE	TRUE	TRUE	1.3	TRUE	AM	All
SL063	B	CAL	TRUE	TRUE	FALSE	1776	1662	-114	-6%	FALSE	TRUE	TRUE	2.8	TRUE	AM	All
SL064	B	CAL	FALSE	FALSE	FALSE	5819	5844	26	0%	TRUE	TRUE	TRUE	0.3	TRUE	AM	All
SL065	B	VAL	FALSE	FALSE	FALSE	3032	2923	-109	-4%	TRUE	TRUE	TRUE	2.0	TRUE	AM	All
SL066	B	CAL	TRUE	TRUE	FALSE	4041	3829	-212	-5%	FALSE	TRUE	FALSE	3.4	TRUE	AM	All
SL067	B	CAL	FALSE	FALSE	FALSE	652	676	24	4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	All
SL068	B	CAL	FALSE	FALSE	FALSE	134	136	1	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All
SL069	B	CAL	FALSE	TRUE	FALSE	1097	1078	-19	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	All
SL070	B	CAL	FALSE	TRUE	FALSE	1060	1047	-13	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	All
SL071	B	CAL	FALSE	TRUE	FALSE	5053	5089	36	1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	All
SL072	B	VAL	TRUE	FALSE	FALSE	3294	3255	-39	-1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	All
SL073	B	CAL	FALSE	TRUE	FALSE	3232	3109	-123	-4%	TRUE	TRUE	TRUE	2.2	TRUE	AM	All
SL074	B	CAL	FALSE	FALSE	FALSE	1077	1073	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	All

SL075	B	CAL	FALSE	FALSE	FALSE	2505	2398	-106	-4%	TRUE	TRUE	TRUE	2.1	TRUE	AM	All
SL076	B	CAL	TRUE	TRUE	FALSE	690	597	-93	-13%	FALSE	FALSE	TRUE	3.7	TRUE	AM	All

M.2 AM Screenline Table Comparisons Cars Only

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	558	441	-118	-21%	FALSE	FALSE	FALSE	5.3	FALSE	AM	Car
A02	A	CAL	FALSE	FALSE	FALSE	659	661	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
A06	A	VAL	FALSE	FALSE	FALSE	740	722	-18	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
A08	A	CAL	FALSE	FALSE	FALSE	104	112	8	8%	FALSE	TRUE	TRUE	0.8	TRUE	AM	Car
A1	A	CAL	FALSE	FALSE	TRUE	1590	1584	-7	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	Car
A12	A	VAL	FALSE	FALSE	FALSE	446	445	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
A13	A	CAL	FALSE	FALSE	TRUE	466	468	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
A15	A	CAL	FALSE	FALSE	TRUE	658	589	-69	-10%	FALSE	FALSE	TRUE	2.8	TRUE	AM	Car
A16	A	CAL	FALSE	FALSE	TRUE	578	560	-18	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	Car
B08	A	CAL	FALSE	FALSE	FALSE	652	612	-40	-6%	FALSE	TRUE	TRUE	1.6	TRUE	AM	Car
B14	A	CAL	FALSE	FALSE	FALSE	1158	830	-328	-28%	FALSE	FALSE	FALSE	10.4	FALSE	AM	Car
B15	A	VAL	FALSE	FALSE	FALSE	2527	2505	-22	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
B16	A	CAL	FALSE	FALSE	FALSE	426	415	-12	-3%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
B17	A	CAL	FALSE	FALSE	TRUE	398	392	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car

B18	A	CAL	FALSE	FALSE	TRUE	285	273	-12	-4%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
B19	A	CAL	FALSE	FALSE	TRUE	201	114	-88	-44%	FALSE	FALSE	FALSE	7.0	FALSE	AM	Car
B20	A	CAL	FALSE	FALSE	TRUE	981	967	-14	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
B21	A	CAL	FALSE	FALSE	TRUE	176	176	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
C02	A	CAL	FALSE	FALSE	FALSE	303	278	-25	-8%	FALSE	TRUE	TRUE	1.5	TRUE	AM	Car
C03	A	CAL	FALSE	FALSE	FALSE	193	170	-23	-12%	FALSE	FALSE	TRUE	1.7	TRUE	AM	Car
C06	A	CAL	FALSE	FALSE	FALSE	41	41	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
D02	A	CAL	FALSE	FALSE	FALSE	612	573	-39	-6%	FALSE	TRUE	TRUE	1.6	TRUE	AM	Car
D06	A	CAL	FALSE	FALSE	TRUE	497	470	-28	-6%	FALSE	TRUE	TRUE	1.3	TRUE	AM	Car
D17	A	CAL	FALSE	FALSE	FALSE	495	489	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
D18	A	CAL	FALSE	FALSE	FALSE	881	856	-25	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
D19	A	VAL	FALSE	TRUE	FALSE	455	474	19	4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
D20	A	CAL	FALSE	FALSE	FALSE	614	580	-34	-6%	FALSE	TRUE	TRUE	1.4	TRUE	AM	Car
D21	A	CAL	FALSE	TRUE	FALSE	309	308	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
D22	A	CAL	FALSE	TRUE	FALSE	1203	1040	-163	-14%	FALSE	FALSE	TRUE	4.9	FALSE	AM	Car
D23	A	CAL	FALSE	TRUE	FALSE	1144	1023	-121	-11%	FALSE	FALSE	TRUE	3.7	TRUE	AM	Car
D24	A	CAL	FALSE	TRUE	FALSE	512	476	-36	-7%	FALSE	TRUE	TRUE	1.6	TRUE	AM	Car
D25	A	CAL	FALSE	TRUE	FALSE	724	677	-47	-7%	FALSE	TRUE	TRUE	1.8	TRUE	AM	Car
D26	A	CAL	FALSE	TRUE	FALSE	338	318	-19	-6%	FALSE	TRUE	TRUE	1.1	TRUE	AM	Car
D27	A	CAL	FALSE	FALSE	TRUE	482	533	51	11%	FALSE	FALSE	TRUE	2.3	TRUE	AM	Car
D28	A	CAL	FALSE	FALSE	FALSE	581	565	-15	-3%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
D29	A	CAL	FALSE	FALSE	FALSE	1102	1070	-32	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	Car
D30	A	CAL	FALSE	FALSE	FALSE	749	736	-13	-2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
D31	A	CAL	FALSE	FALSE	FALSE	784	730	-53	-7%	FALSE	TRUE	TRUE	1.9	TRUE	AM	Car

D33	A	CAL	FALSE	TRUE	FALSE	406	366	-40	-10%	FALSE	TRUE	TRUE	2.0	TRUE	AM	Car
E04	A	CAL	TRUE	TRUE	FALSE	924	849	-75	-8%	FALSE	TRUE	TRUE	2.5	TRUE	AM	Car
E14	A	CAL	FALSE	TRUE	FALSE	150	148	-2	-2%	TRUE	TRUE	TRUE	0.2	TRUE	AM	Car
E16	A	CAL	FALSE	FALSE	FALSE	306	297	-9	-3%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
E17	A	CAL	TRUE	FALSE	FALSE	863	808	-54	-6%	FALSE	TRUE	TRUE	1.9	TRUE	AM	Car
E21	A	CAL	FALSE	FALSE	FALSE	513	598	85	16%	FALSE	FALSE	FALSE	3.6	TRUE	AM	Car
E22	A	CAL	FALSE	FALSE	FALSE	573	446	-127	-22%	FALSE	FALSE	FALSE	5.6	FALSE	AM	Car
E23	A	CAL	FALSE	FALSE	FALSE	532	511	-21	-4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
E25	A	CAL	FALSE	TRUE	FALSE	1307	1174	-133	-10%	FALSE	FALSE	TRUE	3.8	TRUE	AM	Car
E26	A	CAL	FALSE	FALSE	FALSE	880	842	-38	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	Car
E28	A	CAL	TRUE	TRUE	FALSE	559	469	-90	-16%	FALSE	FALSE	FALSE	4.0	TRUE	AM	Car
E29	A	CAL	TRUE	TRUE	FALSE	630	619	-11	-2%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
E30	A	CAL	TRUE	TRUE	FALSE	733	737	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
E31	A	CAL	TRUE	TRUE	FALSE	464	443	-22	-5%	TRUE	TRUE	TRUE	1.0	TRUE	AM	Car
E33	A	CAL	FALSE	TRUE	FALSE	918	876	-42	-5%	TRUE	TRUE	TRUE	1.4	TRUE	AM	Car
E34	A	CAL	TRUE	FALSE	FALSE	1207	1177	-30	-2%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
E35	A	CAL	FALSE	FALSE	FALSE	492	451	-40	-8%	FALSE	TRUE	TRUE	1.9	TRUE	AM	Car
E36	A	CAL	TRUE	FALSE	FALSE	855	852	-3	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
E37	A	CAL	TRUE	FALSE	FALSE	571	493	-78	-14%	FALSE	FALSE	TRUE	3.4	TRUE	AM	Car
E38	A	CAL	FALSE	FALSE	FALSE	539	492	-46	-9%	FALSE	TRUE	TRUE	2.0	TRUE	AM	Car
E39	A	CAL	FALSE	FALSE	FALSE	708	686	-22	-3%	TRUE	TRUE	TRUE	0.8	TRUE	AM	Car
E40	A	CAL	TRUE	FALSE	FALSE	470	484	14	3%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
E41	A	CAL	TRUE	TRUE	FALSE	522	433	-89	-17%	FALSE	FALSE	FALSE	4.1	FALSE	AM	Car
E42	A	CAL	FALSE	FALSE	FALSE	348	333	-15	-4%	TRUE	TRUE	TRUE	0.8	TRUE	AM	Car

E44	A	CAL	TRUE	FALSE	FALSE	2067	1816	-251	-12%	FALSE	FALSE	TRUE	5.7	FALSE	AM	Car
E46	A	CAL	FALSE	FALSE	FALSE	143	143	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
F03	A	CAL	FALSE	FALSE	FALSE	374	363	-10	-3%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
F07	A	CAL	FALSE	FALSE	FALSE	508	489	-19	-4%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
G09	A	CAL	FALSE	FALSE	FALSE	175	175	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
M1	A	CAL	FALSE	FALSE	FALSE	2817	2733	-84	-3%	TRUE	TRUE	TRUE	1.6	TRUE	AM	Car
M18	A	CAL	FALSE	FALSE	FALSE	5596	5598	2	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
M500	A	CAL	FALSE	FALSE	FALSE	1156	1152	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
M502	A	CAL	FALSE	FALSE	TRUE	1006	1049	43	4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	Car
M503	A	CAL	FALSE	FALSE	FALSE	2888	2860	-28	-1%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
M504	A	CAL	FALSE	FALSE	FALSE	2107	2134	27	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
M505	A	CAL	FALSE	FALSE	FALSE	1081	1070	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
M506	A	CAL	FALSE	FALSE	FALSE	1654	1678	24	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
M508	A	CAL	FALSE	FALSE	FALSE	2570	2548	-22	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
M62	A	VAL	FALSE	FALSE	FALSE	1690	1715	25	1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
SL001	A	CAL	FALSE	TRUE	FALSE	5508	5388	-121	-2%	TRUE	TRUE	TRUE	1.6	TRUE	AM	Car
SL002	A	CAL	FALSE	TRUE	FALSE	2834	2704	-130	-5%	TRUE	TRUE	TRUE	2.5	TRUE	AM	Car
SL003	A	VAL	FALSE	FALSE	TRUE	2822	2762	-60	-2%	TRUE	TRUE	TRUE	1.1	TRUE	AM	Car
SL004	A	CAL	FALSE	FALSE	TRUE	605	562	-43	-7%	FALSE	TRUE	TRUE	1.8	TRUE	AM	Car
SL005	A	VAL	FALSE	TRUE	TRUE	2862	2831	-31	-1%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
SL006	A	CAL	FALSE	FALSE	TRUE	1633	1595	-39	-2%	TRUE	TRUE	TRUE	1.0	TRUE	AM	Car
SL007	A	CAL	FALSE	FALSE	TRUE	1119	1086	-34	-3%	TRUE	TRUE	TRUE	1.0	TRUE	AM	Car
SL008	A	VAL	FALSE	FALSE	FALSE	5383	5330	-53	-1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
SL009	A	VAL	FALSE	FALSE	FALSE	3041	2926	-115	-4%	TRUE	TRUE	TRUE	2.1	TRUE	AM	Car

SL010	A	CAL	FALSE	FALSE	FALSE	2865	2901	36	1%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
SL011	A	CAL	FALSE	FALSE	FALSE	1273	1302	29	2%	TRUE	TRUE	TRUE	0.8	TRUE	AM	Car
SL012	A	CAL	FALSE	FALSE	FALSE	2417	2436	20	1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
SL013	A	CAL	FALSE	FALSE	FALSE	427	438	11	3%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
SL014	A	VAL	FALSE	FALSE	FALSE	359	359	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
SL016	A	VAL	FALSE	FALSE	TRUE	2087	2103	16	1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
SL017	A	CAL	FALSE	FALSE	FALSE	653	630	-22	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
SL018	A	VAL	FALSE	FALSE	FALSE	1997	1928	-68	-3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	Car
SL019	A	VAL	TRUE	FALSE	FALSE	2388	2351	-36	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
SL020	A	CAL	FALSE	FALSE	FALSE	1432	1423	-9	-1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	Car
SL021	A	CAL	FALSE	FALSE	FALSE	108	107	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
SL022	A	CAL	FALSE	FALSE	FALSE	2343	2355	12	1%	TRUE	TRUE	TRUE	0.2	TRUE	AM	Car
SL023	A	VAL	FALSE	FALSE	FALSE	1534	1523	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
SL024	A	VAL	FALSE	FALSE	FALSE	734	749	14	2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car
SL025	A	CAL	FALSE	FALSE	FALSE	579	552	-27	-5%	TRUE	TRUE	TRUE	1.2	TRUE	AM	Car
SL026	A	VAL	FALSE	FALSE	FALSE	617	620	3	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
SL027	A	CAL	FALSE	FALSE	FALSE	1824	1830	6	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
SL028	A	CAL	FALSE	FALSE	FALSE	1155	1143	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
SL029	A	VAL	FALSE	FALSE	FALSE	1940	1955	15	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
SL030	A	VAL	FALSE	FALSE	FALSE	1533	1633	100	7%	FALSE	TRUE	FALSE	2.5	TRUE	AM	Car
SL031	A	VAL	TRUE	FALSE	FALSE	1321	1272	-48	-4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	Car
SL032	A	CAL	TRUE	TRUE	FALSE	1574	1486	-88	-6%	FALSE	TRUE	TRUE	2.2	TRUE	AM	Car
SL033	A	CAL	TRUE	TRUE	FALSE	754	658	-96	-13%	FALSE	FALSE	FALSE	3.6	TRUE	AM	Car
SL034	A	CAL	TRUE	FALSE	FALSE	2110	2010	-100	-5%	TRUE	TRUE	TRUE	2.2	TRUE	AM	Car

SL035	A	VAL	TRUE	FALSE	FALSE	816	773	-43	-5%	FALSE	TRUE	TRUE	1.5	TRUE	AM	Car
SL036	A	VAL	FALSE	FALSE	FALSE	1050	1004	-46	-4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	Car
SL037	A	CAL	TRUE	TRUE	FALSE	3347	3163	-184	-5%	FALSE	TRUE	TRUE	3.2	TRUE	AM	Car
SL038	A	CAL	TRUE	TRUE	FALSE	3210	2973	-237	-7%	FALSE	TRUE	FALSE	4.3	FALSE	AM	Car
SL039	A	CAL	TRUE	FALSE	FALSE	1802	1800	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
SL040	A	CAL	TRUE	FALSE	FALSE	1043	1023	-20	-2%	TRUE	TRUE	TRUE	0.6	TRUE	AM	Car
SL041	A	VAL	TRUE	FALSE	FALSE	1856	1770	-86	-5%	TRUE	TRUE	TRUE	2.0	TRUE	AM	Car
SL042	A	VAL	FALSE	FALSE	FALSE	1470	1416	-54	-4%	TRUE	TRUE	TRUE	1.4	TRUE	AM	Car
SL043	A	CAL	TRUE	FALSE	FALSE	802	735	-68	-8%	FALSE	TRUE	TRUE	2.4	TRUE	AM	Car
SL044	A	VAL	TRUE	TRUE	FALSE	865	820	-45	-5%	FALSE	TRUE	TRUE	1.6	TRUE	AM	Car
SL045	A	VAL	TRUE	TRUE	FALSE	1310	1252	-58	-4%	TRUE	TRUE	TRUE	1.6	TRUE	AM	Car
SL046	A	CAL	FALSE	TRUE	FALSE	5322	5014	-307	-6%	FALSE	TRUE	TRUE	4.3	FALSE	AM	Car
SL047	A	VAL	FALSE	FALSE	FALSE	392	263	-129	-33%	FALSE	FALSE	FALSE	7.1	FALSE	AM	Car
SL048	A	VAL	FALSE	FALSE	FALSE	1175	1166	-9	-1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
SL049	A	CAL	TRUE	TRUE	FALSE	5277	5084	-194	-4%	TRUE	TRUE	TRUE	2.7	TRUE	AM	Car
SL050	A	VAL	FALSE	FALSE	TRUE	2500	2315	-185	-7%	FALSE	TRUE	FALSE	3.8	TRUE	AM	Car
SL051	A	CAL	TRUE	TRUE	FALSE	1019	981	-38	-4%	TRUE	TRUE	TRUE	1.2	TRUE	AM	Car
SL052	A	VAL	FALSE	FALSE	FALSE	905	944	38	4%	TRUE	TRUE	TRUE	1.3	TRUE	AM	Car
SL053	A	VAL	FALSE	FALSE	TRUE	340	340	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	AM	Car
SL054	A	VAL	FALSE	FALSE	FALSE	2562	2551	-11	0%	TRUE	TRUE	TRUE	0.2	TRUE	AM	Car
SL055	A	CAL	FALSE	FALSE	FALSE	5924	5845	-79	-1%	TRUE	TRUE	TRUE	1.0	TRUE	AM	Car
SL057	A	CAL	FALSE	FALSE	FALSE	482	488	6	1%	TRUE	TRUE	TRUE	0.3	TRUE	AM	Car
SL058	A	CAL	FALSE	FALSE	FALSE	614	643	29	5%	TRUE	TRUE	TRUE	1.2	TRUE	AM	Car
SL059	A	CAL	FALSE	FALSE	FALSE	1026	1043	17	2%	TRUE	TRUE	TRUE	0.5	TRUE	AM	Car

SL060	A	VAL	FALSE	FALSE	FALSE	392	359	-34	-9%	FALSE	TRUE	TRUE	1.7	TRUE	AM	Car
SL061	A	VAL	FALSE	TRUE	FALSE	1930	1864	-66	-3%	TRUE	TRUE	TRUE	1.5	TRUE	AM	Car
SL062	A	CAL	FALSE	TRUE	FALSE	805	786	-19	-2%	TRUE	TRUE	TRUE	0.7	TRUE	AM	Car
SL063	A	CAL	TRUE	TRUE	FALSE	2720	2514	-206	-8%	FALSE	TRUE	TRUE	4.0	FALSE	AM	Car
SL064	A	CAL	FALSE	FALSE	FALSE	5193	5099	-94	-2%	TRUE	TRUE	TRUE	1.3	TRUE	AM	Car
SL065	A	VAL	FALSE	FALSE	FALSE	2830	2706	-124	-4%	TRUE	TRUE	TRUE	2.4	TRUE	AM	Car
SL066	A	CAL	TRUE	TRUE	FALSE	2963	2941	-23	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
SL067	A	CAL	FALSE	FALSE	FALSE	534	537	3	1%	TRUE	TRUE	TRUE	0.1	TRUE	AM	Car
SL068	A	CAL	FALSE	FALSE	FALSE	101	107	6	5%	FALSE	TRUE	TRUE	0.5	TRUE	AM	Car
SL069	A	CAL	FALSE	TRUE	FALSE	729	704	-25	-3%	TRUE	TRUE	TRUE	0.9	TRUE	AM	Car
SL070	A	CAL	FALSE	TRUE	FALSE	2157	2056	-101	-5%	TRUE	TRUE	TRUE	2.2	TRUE	AM	Car
SL071	A	CAL	FALSE	TRUE	FALSE	2787	2764	-23	-1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
SL072	A	VAL	TRUE	FALSE	FALSE	2885	2953	68	2%	TRUE	TRUE	TRUE	1.3	TRUE	AM	Car
SL073	A	CAL	FALSE	TRUE	FALSE	2677	2482	-195	-7%	FALSE	TRUE	FALSE	3.8	TRUE	AM	Car
SL074	A	CAL	FALSE	FALSE	FALSE	893	905	12	1%	TRUE	TRUE	TRUE	0.4	TRUE	AM	Car
SL075	A	CAL	FALSE	FALSE	FALSE	1713	1653	-60	-4%	TRUE	TRUE	TRUE	1.5	TRUE	AM	Car
SL076	A	CAL	TRUE	TRUE	FALSE	910	804	-105	-12%	FALSE	FALSE	TRUE	3.6	TRUE	AM	Car

M.3 IP Screenline Table Comparisons All Vehicles

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	547	552	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
A02	A	CAL	FALSE	FALSE	FALSE	407	374	-33	-8%	FALSE	TRUE	TRUE	1.6	TRUE	IP	All
A06	A	VAL	FALSE	FALSE	FALSE	933	939	6	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
A08	A	CAL	FALSE	FALSE	FALSE	106	107	1	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
A1	A	CAL	FALSE	FALSE	TRUE	3263	3352	89	3%	TRUE	TRUE	TRUE	1.6	TRUE	IP	All
A12	A	VAL	FALSE	FALSE	FALSE	506	506	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
A13	A	CAL	FALSE	FALSE	TRUE	472	480	8	2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
A15	A	CAL	FALSE	FALSE	TRUE	741	692	-49	-7%	FALSE	TRUE	TRUE	1.8	TRUE	IP	All
A16	A	CAL	FALSE	FALSE	TRUE	473	474	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
B08	A	CAL	FALSE	FALSE	FALSE	575	551	-24	-4%	TRUE	TRUE	TRUE	1.0	TRUE	IP	All
B14	A	CAL	FALSE	FALSE	FALSE	1887	1513	-374	-20%	FALSE	FALSE	FALSE	9.1	FALSE	IP	All
B15	A	VAL	FALSE	FALSE	FALSE	2155	2137	-18	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
B16	A	CAL	FALSE	FALSE	FALSE	552	528	-24	-4%	TRUE	TRUE	TRUE	1.0	TRUE	IP	All
B17	A	CAL	FALSE	FALSE	TRUE	449	482	33	7%	FALSE	TRUE	TRUE	1.5	TRUE	IP	All

B18	A	CAL	FALSE	FALSE	TRUE	459	422	-38	-8%	FALSE	TRUE	TRUE	1.8	TRUE	IP	All
B19	A	CAL	FALSE	FALSE	TRUE	267	174	-93	-35%	FALSE	FALSE	FALSE	6.3	FALSE	IP	All
B20	A	CAL	FALSE	FALSE	TRUE	1288	1405	117	9%	FALSE	TRUE	TRUE	3.2	TRUE	IP	All
B21	A	CAL	FALSE	FALSE	TRUE	169	172	3	2%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
C02	A	CAL	FALSE	FALSE	FALSE	304	303	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
C03	A	CAL	FALSE	FALSE	FALSE	223	222	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
C06	A	CAL	FALSE	FALSE	FALSE	57	57	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
D02	A	CAL	FALSE	FALSE	FALSE	653	641	-13	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	All
D06	A	CAL	FALSE	FALSE	TRUE	510	500	-10	-2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
D17	A	CAL	FALSE	FALSE	FALSE	260	256	-5	-2%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
D18	A	CAL	FALSE	FALSE	FALSE	451	456	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
D19	A	VAL	FALSE	TRUE	FALSE	412	415	3	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
D20	A	CAL	FALSE	FALSE	FALSE	821	807	-15	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	All
D21	A	CAL	FALSE	TRUE	FALSE	379	384	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
D22	A	CAL	FALSE	TRUE	FALSE	1047	1016	-31	-3%	TRUE	TRUE	TRUE	1.0	TRUE	IP	All
D23	A	CAL	FALSE	TRUE	FALSE	1091	1070	-21	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
D24	A	CAL	FALSE	TRUE	FALSE	381	374	-6	-2%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
D25	A	CAL	FALSE	TRUE	FALSE	967	958	-9	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
D26	A	CAL	FALSE	TRUE	FALSE	355	367	12	3%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
D27	A	CAL	FALSE	FALSE	TRUE	593	599	6	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
D28	A	CAL	FALSE	FALSE	FALSE	545	526	-20	-4%	TRUE	TRUE	TRUE	0.8	TRUE	IP	All
D29	A	CAL	FALSE	FALSE	FALSE	905	914	9	1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
D30	A	CAL	FALSE	FALSE	FALSE	696	689	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
D31	A	CAL	FALSE	FALSE	FALSE	435	438	3	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All

D33	A	CAL	FALSE	TRUE	FALSE	522	521	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E04	A	CAL	TRUE	TRUE	FALSE	654	610	-44	-7%	FALSE	TRUE	TRUE	1.8	TRUE	IP	All
E14	A	CAL	FALSE	TRUE	FALSE	397	396	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
E16	A	CAL	FALSE	FALSE	FALSE	236	235	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
E17	A	CAL	TRUE	FALSE	FALSE	1102	1105	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E21	A	CAL	FALSE	FALSE	FALSE	581	591	11	2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
E22	A	CAL	FALSE	FALSE	FALSE	389	381	-8	-2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
E23	A	CAL	FALSE	FALSE	FALSE	525	522	-3	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E25	A	CAL	FALSE	TRUE	FALSE	1251	1178	-73	-6%	FALSE	TRUE	TRUE	2.1	TRUE	IP	All
E26	A	CAL	FALSE	FALSE	FALSE	905	875	-30	-3%	TRUE	TRUE	TRUE	1.0	TRUE	IP	All
E28	A	CAL	TRUE	TRUE	FALSE	537	535	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E29	A	CAL	TRUE	TRUE	FALSE	1053	1025	-27	-3%	TRUE	TRUE	TRUE	0.8	TRUE	IP	All
E30	A	CAL	TRUE	TRUE	FALSE	466	471	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
E31	A	CAL	TRUE	TRUE	FALSE	774	767	-7	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
E33	A	CAL	FALSE	TRUE	FALSE	933	915	-18	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
E34	A	CAL	TRUE	FALSE	FALSE	1168	1144	-24	-2%	TRUE	TRUE	TRUE	0.7	TRUE	IP	All
E35	A	CAL	FALSE	FALSE	FALSE	350	348	-2	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E36	A	CAL	TRUE	FALSE	FALSE	571	701	130	23%	FALSE	FALSE	FALSE	5.2	FALSE	IP	All
E37	A	CAL	TRUE	FALSE	FALSE	485	415	-70	-14%	FALSE	FALSE	TRUE	3.3	TRUE	IP	All
E38	A	CAL	FALSE	FALSE	FALSE	562	457	-105	-19%	FALSE	FALSE	FALSE	4.6	FALSE	IP	All
E39	A	CAL	FALSE	FALSE	FALSE	535	541	6	1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
E40	A	CAL	TRUE	FALSE	FALSE	585	602	17	3%	TRUE	TRUE	TRUE	0.7	TRUE	IP	All
E41	A	CAL	TRUE	TRUE	FALSE	444	447	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
E42	A	CAL	FALSE	FALSE	FALSE	285	275	-11	-4%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All

E44	A	CAL	TRUE	FALSE	FALSE	1045	1047	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
E46	A	CAL	FALSE	FALSE	FALSE	209	211	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
F03	A	CAL	FALSE	FALSE	FALSE	329	326	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
F07	A	CAL	FALSE	FALSE	FALSE	403	403	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
G09	A	CAL	FALSE	FALSE	FALSE	280	279	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
M1	A	CAL	FALSE	FALSE	FALSE	4454	4495	41	1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
M18	A	CAL	FALSE	FALSE	FALSE	8654	8680	26	0%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
M500	A	CAL	FALSE	FALSE	FALSE	2246	2255	9	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
M502	A	CAL	FALSE	FALSE	TRUE	1345	1350	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
M503	A	CAL	FALSE	FALSE	FALSE	4691	4657	-34	-1%	TRUE	TRUE	TRUE	0.5	TRUE	IP	All
M504	A	CAL	FALSE	FALSE	FALSE	3429	3406	-23	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
M505	A	CAL	FALSE	FALSE	FALSE	2213	2222	9	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
M506	A	CAL	FALSE	FALSE	FALSE	2031	2029	-2	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
M508	A	CAL	FALSE	FALSE	FALSE	3784	3781	-3	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
M62	A	VAL	FALSE	FALSE	FALSE	2154	2169	14	1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL001	A	CAL	FALSE	TRUE	FALSE	4363	4345	-18	0%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL002	A	CAL	FALSE	TRUE	FALSE	2707	2702	-6	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL003	A	VAL	FALSE	FALSE	TRUE	2668	2654	-14	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL004	A	CAL	FALSE	FALSE	TRUE	661	655	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL005	A	VAL	FALSE	TRUE	TRUE	2873	2861	-12	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL006	A	CAL	FALSE	FALSE	TRUE	1774	1784	9	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL007	A	CAL	FALSE	FALSE	TRUE	984	965	-19	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
SL008	A	VAL	FALSE	FALSE	FALSE	5398	5392	-6	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL009	A	VAL	FALSE	FALSE	FALSE	2834	2787	-48	-2%	TRUE	TRUE	TRUE	0.9	TRUE	IP	All

SL010	A	CAL	FALSE	FALSE	FALSE	2351	2344	-7	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL011	A	CAL	FALSE	FALSE	FALSE	1149	1151	2	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL012	A	CAL	FALSE	FALSE	FALSE	1962	1953	-9	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL013	A	CAL	FALSE	FALSE	FALSE	424	420	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL014	A	VAL	FALSE	FALSE	FALSE	322	312	-10	-3%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
SL016	A	VAL	FALSE	FALSE	TRUE	3810	3892	82	2%	TRUE	TRUE	TRUE	1.3	TRUE	IP	All
SL017	A	CAL	FALSE	FALSE	FALSE	645	605	-39	-6%	FALSE	TRUE	TRUE	1.6	TRUE	IP	All
SL018	A	VAL	FALSE	FALSE	FALSE	2006	1979	-26	-1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
SL019	A	VAL	TRUE	FALSE	FALSE	2049	2035	-14	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL020	A	CAL	FALSE	FALSE	FALSE	1299	1306	7	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL021	A	CAL	FALSE	FALSE	FALSE	144	144	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL022	A	CAL	FALSE	FALSE	FALSE	3343	3330	-13	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL023	A	VAL	FALSE	FALSE	FALSE	1773	1756	-17	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
SL024	A	VAL	FALSE	FALSE	FALSE	614	608	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL025	A	CAL	FALSE	FALSE	FALSE	687	635	-51	-7%	FALSE	TRUE	TRUE	2.0	TRUE	IP	All
SL026	A	VAL	FALSE	FALSE	FALSE	465	462	-3	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL027	A	CAL	FALSE	FALSE	FALSE	1991	1973	-18	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
SL028	A	CAL	FALSE	FALSE	FALSE	1242	1256	14	1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
SL029	A	VAL	FALSE	FALSE	FALSE	1863	1844	-19	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
SL030	A	VAL	FALSE	FALSE	FALSE	1849	1913	64	3%	TRUE	TRUE	TRUE	1.5	TRUE	IP	All
SL031	A	VAL	TRUE	FALSE	FALSE	1363	1352	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL032	A	CAL	TRUE	TRUE	FALSE	1711	1700	-11	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL033	A	CAL	TRUE	TRUE	FALSE	567	573	6	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL034	A	CAL	TRUE	FALSE	FALSE	1767	1763	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All

SL035	A	VAL	TRUE	FALSE	FALSE	975	956	-20	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
SL036	A	VAL	FALSE	FALSE	FALSE	884	855	-28	-3%	TRUE	TRUE	TRUE	1.0	TRUE	IP	All
SL037	A	CAL	TRUE	TRUE	FALSE	2839	2800	-40	-1%	TRUE	TRUE	TRUE	0.7	TRUE	IP	All
SL038	A	CAL	TRUE	TRUE	FALSE	3007	2994	-13	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL039	A	CAL	TRUE	FALSE	FALSE	1694	1680	-14	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL040	A	CAL	TRUE	FALSE	FALSE	930	928	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL041	A	VAL	TRUE	FALSE	FALSE	1251	1251	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL042	A	VAL	FALSE	FALSE	FALSE	1382	1354	-28	-2%	TRUE	TRUE	TRUE	0.8	TRUE	IP	All
SL043	A	CAL	TRUE	FALSE	FALSE	462	444	-18	-4%	TRUE	TRUE	TRUE	0.8	TRUE	IP	All
SL044	A	VAL	TRUE	TRUE	FALSE	486	480	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL045	A	VAL	TRUE	TRUE	FALSE	928	909	-19	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	All
SL046	A	CAL	FALSE	TRUE	FALSE	5581	5511	-70	-1%	TRUE	TRUE	TRUE	0.9	TRUE	IP	All
SL047	A	VAL	FALSE	FALSE	FALSE	241	145	-97	-40%	FALSE	FALSE	FALSE	7.0	FALSE	IP	All
SL048	A	VAL	FALSE	FALSE	FALSE	1023	1015	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL049	A	CAL	TRUE	TRUE	FALSE	4921	4816	-105	-2%	TRUE	TRUE	TRUE	1.5	TRUE	IP	All
SL050	A	VAL	FALSE	FALSE	TRUE	2410	2388	-22	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	All
SL051	A	CAL	TRUE	TRUE	FALSE	809	772	-37	-5%	TRUE	TRUE	TRUE	1.3	TRUE	IP	All
SL052	A	VAL	FALSE	FALSE	FALSE	828	820	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL053	A	VAL	FALSE	FALSE	TRUE	329	326	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	All
SL054	A	VAL	FALSE	FALSE	FALSE	2444	2430	-14	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL055	A	CAL	FALSE	FALSE	FALSE	4677	4627	-51	-1%	TRUE	TRUE	TRUE	0.7	TRUE	IP	All
SL057	A	CAL	FALSE	FALSE	FALSE	484	466	-18	-4%	TRUE	TRUE	TRUE	0.8	TRUE	IP	All
SL058	A	CAL	FALSE	FALSE	FALSE	725	726	1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL059	A	CAL	FALSE	FALSE	FALSE	1229	1228	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All

SL060	A	VAL	FALSE	FALSE	FALSE	387	378	-9	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	All
SL061	A	VAL	FALSE	TRUE	FALSE	1619	1601	-18	-1%	TRUE	TRUE	TRUE	0.5	TRUE	IP	All
SL062	A	CAL	FALSE	TRUE	FALSE	700	692	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL063	A	CAL	TRUE	TRUE	FALSE	2282	2250	-32	-1%	TRUE	TRUE	TRUE	0.7	TRUE	IP	All
SL064	A	CAL	FALSE	FALSE	FALSE	4296	4301	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL065	A	VAL	FALSE	FALSE	FALSE	2248	2171	-77	-3%	TRUE	TRUE	TRUE	1.6	TRUE	IP	All
SL066	A	CAL	TRUE	TRUE	FALSE	3595	3590	-5	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL067	A	CAL	FALSE	FALSE	FALSE	740	747	7	1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL068	A	CAL	FALSE	FALSE	FALSE	116	115	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL069	A	CAL	FALSE	TRUE	FALSE	689	691	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL070	A	CAL	FALSE	TRUE	FALSE	1139	1136	-3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL071	A	CAL	FALSE	TRUE	FALSE	4062	4078	17	0%	TRUE	TRUE	TRUE	0.3	TRUE	IP	All
SL072	A	VAL	TRUE	FALSE	FALSE	2512	2574	61	2%	TRUE	TRUE	TRUE	1.2	TRUE	IP	All
SL073	A	CAL	FALSE	TRUE	FALSE	2686	2692	7	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	All
SL074	A	CAL	FALSE	FALSE	FALSE	743	744	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL075	A	CAL	FALSE	FALSE	FALSE	1633	1633	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	All
SL076	A	CAL	TRUE	TRUE	FALSE	582	543	-39	-7%	FALSE	TRUE	TRUE	1.6	TRUE	IP	All

M.4 IP Screenline Table Comparisons Cars Only

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	441	446	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
A02	A	CAL	FALSE	FALSE	FALSE	360	326	-34	-9%	FALSE	TRUE	TRUE	1.8	TRUE	IP	Car
A06	A	VAL	FALSE	FALSE	FALSE	563	555	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
A08	A	CAL	FALSE	FALSE	FALSE	88	89	1	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
A1	A	CAL	FALSE	FALSE	TRUE	1645	1717	72	4%	TRUE	TRUE	TRUE	1.8	TRUE	IP	Car
A12	A	VAL	FALSE	FALSE	FALSE	367	369	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
A13	A	CAL	FALSE	FALSE	TRUE	359	365	6	2%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
A15	A	CAL	FALSE	FALSE	TRUE	603	555	-48	-8%	FALSE	TRUE	TRUE	2.0	TRUE	IP	Car
A16	A	CAL	FALSE	FALSE	TRUE	380	380	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
B08	A	CAL	FALSE	FALSE	FALSE	461	444	-17	-4%	TRUE	TRUE	TRUE	0.8	TRUE	IP	Car
B14	A	CAL	FALSE	FALSE	FALSE	843	634	-209	-25%	FALSE	FALSE	FALSE	7.7	FALSE	IP	Car
B15	A	VAL	FALSE	FALSE	FALSE	1851	1843	-7	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
B16	A	CAL	FALSE	FALSE	FALSE	321	308	-13	-4%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
B17	A	CAL	FALSE	FALSE	TRUE	334	363	29	9%	FALSE	TRUE	TRUE	1.6	TRUE	IP	Car

B18	A	CAL	FALSE	FALSE	TRUE	369	345	-24	-7%	FALSE	TRUE	TRUE	1.3	TRUE	IP	Car
B19	A	CAL	FALSE	FALSE	TRUE	144	80	-64	-44%	FALSE	FALSE	FALSE	6.0	FALSE	IP	Car
B20	A	CAL	FALSE	FALSE	TRUE	613	687	74	12%	FALSE	FALSE	TRUE	2.9	TRUE	IP	Car
B21	A	CAL	FALSE	FALSE	TRUE	145	148	3	2%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
C02	A	CAL	FALSE	FALSE	FALSE	216	215	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
C03	A	CAL	FALSE	FALSE	FALSE	173	172	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
C06	A	CAL	FALSE	FALSE	FALSE	34	34	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
D02	A	CAL	FALSE	FALSE	FALSE	544	541	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
D06	A	CAL	FALSE	FALSE	TRUE	424	413	-11	-3%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
D17	A	CAL	FALSE	FALSE	FALSE	236	231	-5	-2%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
D18	A	CAL	FALSE	FALSE	FALSE	401	405	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
D19	A	VAL	FALSE	TRUE	FALSE	347	350	3	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
D20	A	CAL	FALSE	FALSE	FALSE	684	670	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
D21	A	CAL	FALSE	TRUE	FALSE	319	319	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
D22	A	CAL	FALSE	TRUE	FALSE	688	664	-25	-4%	TRUE	TRUE	TRUE	1.0	TRUE	IP	Car
D23	A	CAL	FALSE	TRUE	FALSE	721	701	-20	-3%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
D24	A	CAL	FALSE	TRUE	FALSE	317	311	-6	-2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
D25	A	CAL	FALSE	TRUE	FALSE	724	720	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
D26	A	CAL	FALSE	TRUE	FALSE	285	288	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
D27	A	CAL	FALSE	FALSE	TRUE	448	440	-8	-2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
D28	A	CAL	FALSE	FALSE	FALSE	472	455	-18	-4%	TRUE	TRUE	TRUE	0.8	TRUE	IP	Car
D29	A	CAL	FALSE	FALSE	FALSE	726	737	11	2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
D30	A	CAL	FALSE	FALSE	FALSE	568	562	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
D31	A	CAL	FALSE	FALSE	FALSE	383	387	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car

D33	A	CAL	FALSE	TRUE	FALSE	405	402	-3	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
E04	A	CAL	TRUE	TRUE	FALSE	477	458	-19	-4%	TRUE	TRUE	TRUE	0.9	TRUE	IP	Car
E14	A	CAL	FALSE	TRUE	FALSE	263	262	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
E16	A	CAL	FALSE	FALSE	FALSE	195	195	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
E17	A	CAL	TRUE	FALSE	FALSE	879	872	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
E21	A	CAL	FALSE	FALSE	FALSE	456	464	8	2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
E22	A	CAL	FALSE	FALSE	FALSE	340	332	-8	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
E23	A	CAL	FALSE	FALSE	FALSE	424	419	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
E25	A	CAL	FALSE	TRUE	FALSE	933	863	-70	-8%	FALSE	TRUE	TRUE	2.3	TRUE	IP	Car
E26	A	CAL	FALSE	FALSE	FALSE	717	699	-18	-3%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
E28	A	CAL	TRUE	TRUE	FALSE	392	388	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
E29	A	CAL	TRUE	TRUE	FALSE	782	760	-23	-3%	TRUE	TRUE	TRUE	0.8	TRUE	IP	Car
E30	A	CAL	TRUE	TRUE	FALSE	347	351	4	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
E31	A	CAL	TRUE	TRUE	FALSE	614	608	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
E33	A	CAL	FALSE	TRUE	FALSE	755	738	-18	-2%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
E34	A	CAL	TRUE	FALSE	FALSE	845	825	-20	-2%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
E35	A	CAL	FALSE	FALSE	FALSE	289	288	-1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
E36	A	CAL	TRUE	FALSE	FALSE	481	581	100	21%	FALSE	FALSE	FALSE	4.3	FALSE	IP	Car
E37	A	CAL	TRUE	FALSE	FALSE	423	354	-69	-16%	FALSE	FALSE	FALSE	3.5	TRUE	IP	Car
E38	A	CAL	FALSE	FALSE	FALSE	446	370	-76	-17%	FALSE	FALSE	FALSE	3.7	TRUE	IP	Car
E39	A	CAL	FALSE	FALSE	FALSE	431	431	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
E40	A	CAL	TRUE	FALSE	FALSE	465	474	9	2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
E41	A	CAL	TRUE	TRUE	FALSE	370	373	3	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
E42	A	CAL	FALSE	FALSE	FALSE	240	229	-12	-5%	TRUE	TRUE	TRUE	0.8	TRUE	IP	Car

E44	A	CAL	TRUE	FALSE	FALSE	896	897	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
E46	A	CAL	FALSE	FALSE	FALSE	163	162	-1	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
F03	A	CAL	FALSE	FALSE	FALSE	271	268	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
F07	A	CAL	FALSE	FALSE	FALSE	318	318	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
G09	A	CAL	FALSE	FALSE	FALSE	161	161	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
M1	A	CAL	FALSE	FALSE	FALSE	2514	2494	-20	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
M18	A	CAL	FALSE	FALSE	FALSE	4326	4284	-42	-1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
M500	A	CAL	FALSE	FALSE	FALSE	1133	1131	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
M502	A	CAL	FALSE	FALSE	TRUE	655	651	-4	-1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
M503	A	CAL	FALSE	FALSE	FALSE	2546	2533	-13	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
M504	A	CAL	FALSE	FALSE	FALSE	2008	1998	-10	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
M505	A	CAL	FALSE	FALSE	FALSE	1127	1121	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
M506	A	CAL	FALSE	FALSE	FALSE	1033	1013	-20	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
M508	A	CAL	FALSE	FALSE	FALSE	1925	1900	-25	-1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
M62	A	VAL	FALSE	FALSE	FALSE	1049	1048	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL001	A	CAL	FALSE	TRUE	FALSE	3581	3572	-9	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL002	A	CAL	FALSE	TRUE	FALSE	2140	2143	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL003	A	VAL	FALSE	FALSE	TRUE	2149	2141	-8	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL004	A	CAL	FALSE	FALSE	TRUE	515	515	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL005	A	VAL	FALSE	TRUE	TRUE	2138	2129	-9	0%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL006	A	CAL	FALSE	FALSE	TRUE	974	982	8	1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL007	A	CAL	FALSE	FALSE	TRUE	736	722	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
SL008	A	VAL	FALSE	FALSE	FALSE	4280	4260	-21	0%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL009	A	VAL	FALSE	FALSE	FALSE	2093	2052	-42	-2%	TRUE	TRUE	TRUE	0.9	TRUE	IP	Car

SL010	A	CAL	FALSE	FALSE	FALSE	1896	1895	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL011	A	CAL	FALSE	FALSE	FALSE	971	974	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL012	A	CAL	FALSE	FALSE	FALSE	1449	1447	-2	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL013	A	CAL	FALSE	FALSE	FALSE	303	300	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL014	A	VAL	FALSE	FALSE	FALSE	234	229	-6	-2%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
SL016	A	VAL	FALSE	FALSE	TRUE	1965	2012	47	2%	TRUE	TRUE	TRUE	1.1	TRUE	IP	Car
SL017	A	CAL	FALSE	FALSE	FALSE	465	439	-26	-6%	FALSE	TRUE	TRUE	1.2	TRUE	IP	Car
SL018	A	VAL	FALSE	FALSE	FALSE	1435	1411	-24	-2%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
SL019	A	VAL	TRUE	FALSE	FALSE	1653	1641	-12	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL020	A	CAL	FALSE	FALSE	FALSE	950	949	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL021	A	CAL	FALSE	FALSE	FALSE	104	105	1	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL022	A	CAL	FALSE	FALSE	FALSE	1953	1943	-10	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL023	A	VAL	FALSE	FALSE	FALSE	1080	1078	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL024	A	VAL	FALSE	FALSE	FALSE	482	476	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL025	A	CAL	FALSE	FALSE	FALSE	447	445	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL026	A	VAL	FALSE	FALSE	FALSE	351	348	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL027	A	CAL	FALSE	FALSE	FALSE	1438	1421	-17	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
SL028	A	CAL	FALSE	FALSE	FALSE	931	929	-3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL029	A	VAL	FALSE	FALSE	FALSE	1402	1404	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL030	A	VAL	FALSE	FALSE	FALSE	1226	1279	54	4%	TRUE	TRUE	TRUE	1.5	TRUE	IP	Car
SL031	A	VAL	TRUE	FALSE	FALSE	1011	1002	-10	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL032	A	CAL	TRUE	TRUE	FALSE	1354	1341	-13	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
SL033	A	CAL	TRUE	TRUE	FALSE	405	409	3	1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL034	A	CAL	TRUE	FALSE	FALSE	1473	1469	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car

SL035	A	VAL	TRUE	FALSE	FALSE	797	794	-3	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL036	A	VAL	FALSE	FALSE	FALSE	773	774	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL037	A	CAL	TRUE	TRUE	FALSE	2010	1966	-44	-2%	TRUE	TRUE	TRUE	1.0	TRUE	IP	Car
SL038	A	CAL	TRUE	TRUE	FALSE	2252	2240	-12	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL039	A	CAL	TRUE	FALSE	FALSE	1285	1270	-15	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
SL040	A	CAL	TRUE	FALSE	FALSE	761	759	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL041	A	VAL	TRUE	FALSE	FALSE	1055	1053	-2	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL042	A	VAL	FALSE	FALSE	FALSE	1139	1123	-16	-1%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
SL043	A	CAL	TRUE	FALSE	FALSE	388	385	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL044	A	VAL	TRUE	TRUE	FALSE	399	394	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL045	A	VAL	TRUE	TRUE	FALSE	649	642	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL046	A	CAL	FALSE	TRUE	FALSE	3984	3849	-135	-3%	TRUE	TRUE	TRUE	2.2	TRUE	IP	Car
SL047	A	VAL	FALSE	FALSE	FALSE	165	121	-44	-27%	FALSE	FALSE	FALSE	3.7	TRUE	IP	Car
SL048	A	VAL	FALSE	FALSE	FALSE	757	742	-15	-2%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
SL049	A	CAL	TRUE	TRUE	FALSE	3855	3759	-96	-2%	TRUE	TRUE	TRUE	1.6	TRUE	IP	Car
SL050	A	VAL	FALSE	FALSE	TRUE	1825	1808	-17	-1%	TRUE	TRUE	TRUE	0.4	TRUE	IP	Car
SL051	A	CAL	TRUE	TRUE	FALSE	673	640	-33	-5%	TRUE	TRUE	TRUE	1.3	TRUE	IP	Car
SL052	A	VAL	FALSE	FALSE	FALSE	729	721	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL053	A	VAL	FALSE	FALSE	TRUE	262	258	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL054	A	VAL	FALSE	FALSE	FALSE	1931	1919	-12	-1%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL055	A	CAL	FALSE	FALSE	FALSE	3919	3872	-46	-1%	TRUE	TRUE	TRUE	0.7	TRUE	IP	Car
SL057	A	CAL	FALSE	FALSE	FALSE	362	358	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL058	A	CAL	FALSE	FALSE	FALSE	518	519	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL059	A	CAL	FALSE	FALSE	FALSE	961	960	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car

SL060	A	VAL	FALSE	FALSE	FALSE	289	279	-9	-3%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
SL061	A	VAL	FALSE	TRUE	FALSE	1242	1226	-16	-1%	TRUE	TRUE	TRUE	0.5	TRUE	IP	Car
SL062	A	CAL	FALSE	TRUE	FALSE	560	556	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	IP	Car
SL063	A	CAL	TRUE	TRUE	FALSE	1858	1832	-26	-1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
SL064	A	CAL	FALSE	FALSE	FALSE	3349	3345	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL065	A	VAL	FALSE	FALSE	FALSE	1664	1571	-93	-6%	FALSE	TRUE	FALSE	2.3	TRUE	IP	Car
SL066	A	CAL	TRUE	TRUE	FALSE	2722	2679	-43	-2%	TRUE	TRUE	TRUE	0.8	TRUE	IP	Car
SL067	A	CAL	FALSE	FALSE	FALSE	408	402	-6	-2%	TRUE	TRUE	TRUE	0.3	TRUE	IP	Car
SL068	A	CAL	FALSE	FALSE	FALSE	82	81	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL069	A	CAL	FALSE	TRUE	FALSE	572	576	3	1%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL070	A	CAL	FALSE	TRUE	FALSE	1013	1011	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL071	A	CAL	FALSE	TRUE	FALSE	2175	2149	-27	-1%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car
SL072	A	VAL	TRUE	FALSE	FALSE	2010	2075	65	3%	TRUE	TRUE	TRUE	1.4	TRUE	IP	Car
SL073	A	CAL	FALSE	TRUE	FALSE	1961	1962	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL074	A	CAL	FALSE	FALSE	FALSE	566	568	1	0%	TRUE	TRUE	TRUE	0.1	TRUE	IP	Car
SL075	A	CAL	FALSE	FALSE	FALSE	1312	1311	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	IP	Car
SL076	A	CAL	TRUE	TRUE	FALSE	425	412	-13	-3%	TRUE	TRUE	TRUE	0.6	TRUE	IP	Car

M.5 PM Screenline Table Comparisons All Vehicles

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	545	538	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
A02	A	CAL	FALSE	FALSE	FALSE	389	381	-8	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
A06	A	VAL	FALSE	FALSE	FALSE	974	987	13	1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
A08	A	CAL	FALSE	FALSE	FALSE	145	136	-10	-7%	FALSE	TRUE	TRUE	0.8	TRUE	PM	All
A1	A	CAL	FALSE	FALSE	TRUE	3314	3257	-57	-2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
A12	A	VAL	FALSE	FALSE	FALSE	694	692	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
A13	A	CAL	FALSE	FALSE	TRUE	781	768	-12	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
A15	A	CAL	FALSE	FALSE	TRUE	791	711	-80	-10%	FALSE	FALSE	TRUE	2.9	TRUE	PM	All
A16	A	CAL	FALSE	FALSE	TRUE	566	548	-18	-3%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
B08	A	CAL	FALSE	FALSE	FALSE	542	529	-13	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
B14	A	CAL	FALSE	FALSE	FALSE	2221	2178	-43	-2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	All
B15	A	VAL	FALSE	FALSE	FALSE	2001	1977	-24	-1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
B16	A	CAL	FALSE	FALSE	FALSE	594	569	-25	-4%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
B17	A	CAL	FALSE	FALSE	TRUE	643	669	26	4%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All

B18	A	CAL	FALSE	FALSE	TRUE	571	494	-76	-13%	FALSE	FALSE	TRUE	3.3	TRUE	PM	All
B19	A	CAL	FALSE	FALSE	TRUE	406	264	-141	-35%	FALSE	FALSE	FALSE	7.7	FALSE	PM	All
B20	A	CAL	FALSE	FALSE	TRUE	1945	1923	-22	-1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
B21	A	CAL	FALSE	FALSE	TRUE	212	213	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	All
C02	A	CAL	FALSE	FALSE	FALSE	351	352	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
C03	A	CAL	FALSE	FALSE	FALSE	327	329	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
C06	A	CAL	FALSE	FALSE	FALSE	86	84	-3	-3%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
D02	A	CAL	FALSE	FALSE	FALSE	663	647	-16	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
D06	A	CAL	FALSE	FALSE	TRUE	841	842	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	All
D17	A	CAL	FALSE	FALSE	FALSE	252	252	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	All
D18	A	CAL	FALSE	FALSE	FALSE	463	464	1	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
D19	A	VAL	FALSE	TRUE	FALSE	544	538	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
D20	A	CAL	FALSE	FALSE	FALSE	836	841	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
D21	A	CAL	FALSE	TRUE	FALSE	601	591	-9	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
D22	A	CAL	FALSE	TRUE	FALSE	1124	1098	-26	-2%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
D23	A	CAL	FALSE	TRUE	FALSE	1039	1033	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
D24	A	CAL	FALSE	TRUE	FALSE	463	472	9	2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
D25	A	CAL	FALSE	TRUE	FALSE	1291	1235	-56	-4%	TRUE	TRUE	TRUE	1.6	TRUE	PM	All
D26	A	CAL	FALSE	TRUE	FALSE	325	302	-23	-7%	FALSE	TRUE	TRUE	1.3	TRUE	PM	All
D27	A	CAL	FALSE	FALSE	TRUE	886	872	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
D28	A	CAL	FALSE	FALSE	FALSE	776	732	-44	-6%	FALSE	TRUE	TRUE	1.6	TRUE	PM	All
D29	A	CAL	FALSE	FALSE	FALSE	946	933	-13	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
D30	A	CAL	FALSE	FALSE	FALSE	853	845	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
D31	A	CAL	FALSE	FALSE	FALSE	460	450	-10	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All

D33	A	CAL	FALSE	TRUE	FALSE	818	782	-35	-4%	TRUE	TRUE	TRUE	1.2	TRUE	PM	All
E04	A	CAL	TRUE	TRUE	FALSE	653	614	-39	-6%	FALSE	TRUE	TRUE	1.6	TRUE	PM	All
E14	A	CAL	FALSE	TRUE	FALSE	839	809	-29	-4%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
E16	A	CAL	FALSE	FALSE	FALSE	321	321	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	All
E17	A	CAL	TRUE	FALSE	FALSE	985	980	-5	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
E21	A	CAL	FALSE	FALSE	FALSE	596	589	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
E22	A	CAL	FALSE	FALSE	FALSE	354	354	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	All
E23	A	CAL	FALSE	FALSE	FALSE	487	503	16	3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
E25	A	CAL	FALSE	TRUE	FALSE	1139	1065	-74	-6%	FALSE	TRUE	TRUE	2.2	TRUE	PM	All
E26	A	CAL	FALSE	FALSE	FALSE	941	926	-16	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
E28	A	CAL	TRUE	TRUE	FALSE	527	498	-30	-6%	FALSE	TRUE	TRUE	1.3	TRUE	PM	All
E29	A	CAL	TRUE	TRUE	FALSE	1438	1330	-108	-8%	FALSE	TRUE	TRUE	2.9	TRUE	PM	All
E30	A	CAL	TRUE	TRUE	FALSE	509	501	-8	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
E31	A	CAL	TRUE	TRUE	FALSE	922	879	-44	-5%	TRUE	TRUE	TRUE	1.5	TRUE	PM	All
E33	A	CAL	FALSE	TRUE	FALSE	829	825	-3	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
E34	A	CAL	TRUE	FALSE	FALSE	1197	1104	-93	-8%	FALSE	TRUE	TRUE	2.7	TRUE	PM	All
E35	A	CAL	FALSE	FALSE	FALSE	371	356	-15	-4%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
E36	A	CAL	TRUE	FALSE	FALSE	543	569	25	5%	TRUE	TRUE	TRUE	1.1	TRUE	PM	All
E37	A	CAL	TRUE	FALSE	FALSE	456	409	-47	-10%	FALSE	FALSE	TRUE	2.3	TRUE	PM	All
E38	A	CAL	FALSE	FALSE	FALSE	450	448	-2	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
E39	A	CAL	FALSE	FALSE	FALSE	475	496	21	4%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
E40	A	CAL	TRUE	FALSE	FALSE	498	538	40	8%	FALSE	TRUE	TRUE	1.8	TRUE	PM	All
E41	A	CAL	TRUE	TRUE	FALSE	480	453	-27	-6%	FALSE	TRUE	TRUE	1.3	TRUE	PM	All
E42	A	CAL	FALSE	FALSE	FALSE	356	309	-47	-13%	FALSE	FALSE	TRUE	2.6	TRUE	PM	All

E44	A	CAL	TRUE	FALSE	FALSE	1195	1075	-120	-10%	FALSE	FALSE	TRUE	3.6	TRUE	PM	All
E46	A	CAL	FALSE	FALSE	FALSE	339	251	-88	-26%	FALSE	FALSE	FALSE	5.1	FALSE	PM	All
F03	A	CAL	FALSE	FALSE	FALSE	582	576	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
F07	A	CAL	FALSE	FALSE	FALSE	466	462	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
G09	A	CAL	FALSE	FALSE	FALSE	318	315	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
M1	A	CAL	FALSE	FALSE	FALSE	4992	5005	14	0%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
M18	A	CAL	FALSE	FALSE	FALSE	9681	9656	-25	0%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
M500	A	CAL	FALSE	FALSE	FALSE	2156	2123	-33	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
M502	A	CAL	FALSE	FALSE	TRUE	1627	1620	-8	0%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
M503	A	CAL	FALSE	FALSE	FALSE	5109	5135	26	1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
M504	A	CAL	FALSE	FALSE	FALSE	4856	4809	-46	-1%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
M505	A	CAL	FALSE	FALSE	FALSE	2225	2164	-61	-3%	TRUE	TRUE	TRUE	1.3	TRUE	PM	All
M506	A	CAL	FALSE	FALSE	FALSE	2547	2489	-58	-2%	TRUE	TRUE	TRUE	1.1	TRUE	PM	All
M508	A	CAL	FALSE	FALSE	FALSE	4299	4369	70	2%	TRUE	TRUE	TRUE	1.1	TRUE	PM	All
M62	A	VAL	FALSE	FALSE	FALSE	2361	2376	16	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL001	A	CAL	FALSE	TRUE	FALSE	5420	5358	-62	-1%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
SL002	A	CAL	FALSE	TRUE	FALSE	2852	2714	-138	-5%	TRUE	TRUE	TRUE	2.6	TRUE	PM	All
SL003	A	VAL	FALSE	FALSE	TRUE	3458	3403	-55	-2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	All
SL004	A	CAL	FALSE	FALSE	TRUE	711	692	-19	-3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL005	A	VAL	FALSE	TRUE	TRUE	4408	4321	-87	-2%	TRUE	TRUE	TRUE	1.3	TRUE	PM	All
SL006	A	CAL	FALSE	FALSE	TRUE	2215	2255	40	2%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
SL007	A	CAL	FALSE	FALSE	TRUE	1640	1642	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL008	A	VAL	FALSE	FALSE	FALSE	5402	5337	-66	-1%	TRUE	TRUE	TRUE	0.9	TRUE	PM	All
SL009	A	VAL	FALSE	FALSE	FALSE	2468	2389	-78	-3%	TRUE	TRUE	TRUE	1.6	TRUE	PM	All

SL010	A	CAL	FALSE	FALSE	FALSE	2344	2349	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL011	A	CAL	FALSE	FALSE	FALSE	1624	1608	-16	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
SL012	A	CAL	FALSE	FALSE	FALSE	2596	2619	23	1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
SL013	A	CAL	FALSE	FALSE	FALSE	663	679	16	2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
SL014	A	VAL	FALSE	FALSE	FALSE	449	431	-18	-4%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
SL016	A	VAL	FALSE	FALSE	TRUE	4192	4050	-142	-3%	TRUE	TRUE	TRUE	2.2	TRUE	PM	All
SL017	A	CAL	FALSE	FALSE	FALSE	1042	968	-74	-7%	FALSE	TRUE	TRUE	2.3	TRUE	PM	All
SL018	A	VAL	FALSE	FALSE	FALSE	3076	2940	-136	-4%	TRUE	TRUE	TRUE	2.5	TRUE	PM	All
SL019	A	VAL	TRUE	FALSE	FALSE	3057	2980	-78	-3%	TRUE	TRUE	TRUE	1.4	TRUE	PM	All
SL020	A	CAL	FALSE	FALSE	FALSE	1651	1643	-8	0%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
SL021	A	CAL	FALSE	FALSE	FALSE	326	328	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL022	A	CAL	FALSE	FALSE	FALSE	3878	3798	-80	-2%	TRUE	TRUE	TRUE	1.3	TRUE	PM	All
SL023	A	VAL	FALSE	FALSE	FALSE	2185	2156	-29	-1%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
SL024	A	VAL	FALSE	FALSE	FALSE	893	873	-20	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL025	A	CAL	FALSE	FALSE	FALSE	932	911	-21	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL026	A	VAL	FALSE	FALSE	FALSE	769	762	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	All
SL027	A	CAL	FALSE	FALSE	FALSE	2818	2751	-67	-2%	TRUE	TRUE	TRUE	1.3	TRUE	PM	All
SL028	A	CAL	FALSE	FALSE	FALSE	1553	1540	-13	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL029	A	VAL	FALSE	FALSE	FALSE	2575	2580	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL030	A	VAL	FALSE	FALSE	FALSE	2340	2355	14	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL031	A	VAL	TRUE	FALSE	FALSE	1692	1629	-63	-4%	TRUE	TRUE	TRUE	1.6	TRUE	PM	All
SL032	A	CAL	TRUE	TRUE	FALSE	2026	1954	-72	-4%	TRUE	TRUE	TRUE	1.6	TRUE	PM	All
SL033	A	CAL	TRUE	TRUE	FALSE	737	721	-16	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
SL034	A	CAL	TRUE	FALSE	FALSE	1435	1413	-21	-1%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All

SL035	A	VAL	TRUE	FALSE	FALSE	778	781	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL036	A	VAL	FALSE	FALSE	FALSE	882	865	-17	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
SL037	A	CAL	TRUE	TRUE	FALSE	3764	3623	-141	-4%	TRUE	TRUE	TRUE	2.3	TRUE	PM	All
SL038	A	CAL	TRUE	TRUE	FALSE	3056	2933	-122	-4%	TRUE	TRUE	TRUE	2.2	TRUE	PM	All
SL039	A	CAL	TRUE	FALSE	FALSE	1703	1543	-160	-9%	FALSE	TRUE	TRUE	4.0	TRUE	PM	All
SL040	A	CAL	TRUE	FALSE	FALSE	1092	1080	-12	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	All
SL041	A	VAL	TRUE	FALSE	FALSE	1224	1195	-29	-2%	TRUE	TRUE	TRUE	0.8	TRUE	PM	All
SL042	A	VAL	FALSE	FALSE	FALSE	1635	1589	-46	-3%	TRUE	TRUE	TRUE	1.2	TRUE	PM	All
SL043	A	CAL	TRUE	FALSE	FALSE	492	464	-29	-6%	FALSE	TRUE	TRUE	1.3	TRUE	PM	All
SL044	A	VAL	TRUE	TRUE	FALSE	538	511	-27	-5%	TRUE	TRUE	TRUE	1.2	TRUE	PM	All
SL045	A	VAL	TRUE	TRUE	FALSE	1061	1011	-50	-5%	TRUE	TRUE	TRUE	1.6	TRUE	PM	All
SL046	A	CAL	FALSE	TRUE	FALSE	6331	6535	204	3%	TRUE	TRUE	TRUE	2.5	TRUE	PM	All
SL047	A	VAL	FALSE	FALSE	FALSE	396	264	-132	-33%	FALSE	FALSE	FALSE	7.3	FALSE	PM	All
SL048	A	VAL	FALSE	FALSE	FALSE	1297	1272	-25	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL049	A	CAL	TRUE	TRUE	FALSE	5766	5637	-129	-2%	TRUE	TRUE	TRUE	1.7	TRUE	PM	All
SL050	A	VAL	FALSE	FALSE	TRUE	3125	3044	-82	-3%	TRUE	TRUE	TRUE	1.5	TRUE	PM	All
SL051	A	CAL	TRUE	TRUE	FALSE	1422	1261	-161	-11%	FALSE	FALSE	FALSE	4.4	FALSE	PM	All
SL052	A	VAL	FALSE	FALSE	FALSE	862	823	-39	-5%	TRUE	TRUE	TRUE	1.4	TRUE	PM	All
SL053	A	VAL	FALSE	FALSE	TRUE	448	454	6	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL054	A	VAL	FALSE	FALSE	FALSE	3018	2969	-49	-2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	All
SL055	A	CAL	FALSE	FALSE	FALSE	5454	5407	-47	-1%	TRUE	TRUE	TRUE	0.6	TRUE	PM	All
SL057	A	CAL	FALSE	FALSE	FALSE	657	627	-30	-5%	TRUE	TRUE	TRUE	1.2	TRUE	PM	All
SL058	A	CAL	FALSE	FALSE	FALSE	1245	1281	36	3%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
SL059	A	CAL	FALSE	FALSE	FALSE	2215	2220	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All

SL060	A	VAL	FALSE	FALSE	FALSE	626	568	-58	-9%	FALSE	TRUE	TRUE	2.4	TRUE	PM	All
SL061	A	VAL	FALSE	TRUE	FALSE	2464	2451	-13	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL062	A	CAL	FALSE	TRUE	FALSE	822	769	-53	-6%	FALSE	TRUE	TRUE	1.9	TRUE	PM	All
SL063	A	CAL	TRUE	TRUE	FALSE	2085	2030	-55	-3%	TRUE	TRUE	TRUE	1.2	TRUE	PM	All
SL064	A	CAL	FALSE	FALSE	FALSE	5756	5612	-143	-2%	TRUE	TRUE	TRUE	1.9	TRUE	PM	All
SL065	A	VAL	FALSE	FALSE	FALSE	3521	3112	-409	-12%	FALSE	FALSE	FALSE	7.1	FALSE	PM	All
SL066	A	CAL	TRUE	TRUE	FALSE	4718	4467	-251	-5%	FALSE	TRUE	FALSE	3.7	TRUE	PM	All
SL067	A	CAL	FALSE	FALSE	FALSE	793	779	-14	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
SL068	A	CAL	FALSE	FALSE	FALSE	205	195	-10	-5%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL069	A	CAL	FALSE	TRUE	FALSE	1154	1150	-4	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	All
SL070	A	CAL	FALSE	TRUE	FALSE	1164	1154	-10	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	All
SL071	A	CAL	FALSE	TRUE	FALSE	5140	5104	-36	-1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	All
SL072	A	VAL	TRUE	FALSE	FALSE	3799	3904	105	3%	TRUE	TRUE	TRUE	1.7	TRUE	PM	All
SL073	A	CAL	FALSE	TRUE	FALSE	3349	3298	-52	-2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	All
SL074	A	CAL	FALSE	FALSE	FALSE	1034	1058	24	2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	All
SL075	A	CAL	FALSE	FALSE	FALSE	2420	2371	-49	-2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	All
SL076	A	CAL	TRUE	TRUE	FALSE	689	630	-59	-9%	FALSE	TRUE	TRUE	2.3	TRUE	PM	All

M.6 PM Screenline Table Comparisons Cars Only

Screenline for Report	Direction	Classification	In Supertram Area	In Innovation Corridor Area	In Pan Northern Connectivity Area	Count	Flow	Difference (Flow - Count)	% Difference	Within 5%	Within 10%	Within var%	GEH	GEH < 4	Time Period	Vehicle
A01	A	CAL	FALSE	FALSE	FALSE	504	498	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
A02	A	CAL	FALSE	FALSE	FALSE	363	357	-6	-2%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
A06	A	VAL	FALSE	FALSE	FALSE	705	707	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
A08	A	CAL	FALSE	FALSE	FALSE	129	120	-10	-7%	FALSE	TRUE	TRUE	0.9	TRUE	PM	Car
A1	A	CAL	FALSE	FALSE	TRUE	2178	2227	49	2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	Car
A12	A	VAL	FALSE	FALSE	FALSE	415	429	14	3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
A13	A	CAL	FALSE	FALSE	TRUE	665	652	-12	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car
A15	A	CAL	FALSE	FALSE	TRUE	710	631	-80	-11%	FALSE	FALSE	TRUE	3.1	TRUE	PM	Car
A16	A	CAL	FALSE	FALSE	TRUE	496	477	-19	-4%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car
B08	A	CAL	FALSE	FALSE	FALSE	494	489	-4	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
B14	A	CAL	FALSE	FALSE	FALSE	1521	1452	-69	-5%	TRUE	TRUE	TRUE	1.8	TRUE	PM	Car
B15	A	VAL	FALSE	FALSE	FALSE	1826	1801	-24	-1%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
B16	A	CAL	FALSE	FALSE	FALSE	456	430	-26	-6%	FALSE	TRUE	TRUE	1.2	TRUE	PM	Car
B17	A	CAL	FALSE	FALSE	TRUE	567	588	21	4%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car

B18	A	CAL	FALSE	FALSE	TRUE	498	433	-65	-13%	FALSE	FALSE	TRUE	3.0	TRUE	PM	Car
B19	A	CAL	FALSE	FALSE	TRUE	305	186	-119	-39%	FALSE	FALSE	FALSE	7.6	FALSE	PM	Car
B20	A	CAL	FALSE	FALSE	TRUE	1304	1278	-26	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
B21	A	CAL	FALSE	FALSE	TRUE	182	184	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
C02	A	CAL	FALSE	FALSE	FALSE	314	316	1	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
C03	A	CAL	FALSE	FALSE	FALSE	300	302	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
C06	A	CAL	FALSE	FALSE	FALSE	70	70	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
D02	A	CAL	FALSE	FALSE	FALSE	593	580	-13	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car
D06	A	CAL	FALSE	FALSE	TRUE	716	720	3	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
D17	A	CAL	FALSE	FALSE	FALSE	234	235	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
D18	A	CAL	FALSE	FALSE	FALSE	432	433	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
D19	A	VAL	FALSE	TRUE	FALSE	486	480	-6	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
D20	A	CAL	FALSE	FALSE	FALSE	754	762	7	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
D21	A	CAL	FALSE	TRUE	FALSE	551	546	-5	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
D22	A	CAL	FALSE	TRUE	FALSE	931	906	-25	-3%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
D23	A	CAL	FALSE	TRUE	FALSE	889	876	-13	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
D24	A	CAL	FALSE	TRUE	FALSE	409	417	8	2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
D25	A	CAL	FALSE	TRUE	FALSE	1120	1074	-45	-4%	TRUE	TRUE	TRUE	1.4	TRUE	PM	Car
D26	A	CAL	FALSE	TRUE	FALSE	291	263	-28	-10%	FALSE	TRUE	TRUE	1.7	TRUE	PM	Car
D27	A	CAL	FALSE	FALSE	TRUE	744	724	-20	-3%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
D28	A	CAL	FALSE	FALSE	FALSE	701	663	-38	-5%	FALSE	TRUE	TRUE	1.4	TRUE	PM	Car
D29	A	CAL	FALSE	FALSE	FALSE	831	820	-11	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
D30	A	CAL	FALSE	FALSE	FALSE	758	750	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
D31	A	CAL	FALSE	FALSE	FALSE	419	409	-9	-2%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car

D33	A	CAL	FALSE	TRUE	FALSE	728	693	-35	-5%	TRUE	TRUE	TRUE	1.3	TRUE	PM	Car
E04	A	CAL	TRUE	TRUE	FALSE	581	542	-40	-7%	FALSE	TRUE	TRUE	1.7	TRUE	PM	Car
E14	A	CAL	FALSE	TRUE	FALSE	802	772	-30	-4%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
E16	A	CAL	FALSE	FALSE	FALSE	292	292	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
E17	A	CAL	TRUE	FALSE	FALSE	920	915	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
E21	A	CAL	FALSE	FALSE	FALSE	543	534	-9	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
E22	A	CAL	FALSE	FALSE	FALSE	324	325	0	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
E23	A	CAL	FALSE	FALSE	FALSE	447	460	13	3%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
E25	A	CAL	FALSE	TRUE	FALSE	986	916	-70	-7%	FALSE	TRUE	TRUE	2.3	TRUE	PM	Car
E26	A	CAL	FALSE	FALSE	FALSE	871	853	-18	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
E28	A	CAL	TRUE	TRUE	FALSE	483	448	-35	-7%	FALSE	TRUE	TRUE	1.6	TRUE	PM	Car
E29	A	CAL	TRUE	TRUE	FALSE	1268	1162	-106	-8%	FALSE	TRUE	TRUE	3.0	TRUE	PM	Car
E30	A	CAL	TRUE	TRUE	FALSE	449	441	-8	-2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
E31	A	CAL	TRUE	TRUE	FALSE	826	783	-42	-5%	FALSE	TRUE	TRUE	1.5	TRUE	PM	Car
E33	A	CAL	FALSE	TRUE	FALSE	742	736	-6	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
E34	A	CAL	TRUE	FALSE	FALSE	1023	938	-85	-8%	FALSE	TRUE	TRUE	2.7	TRUE	PM	Car
E35	A	CAL	FALSE	FALSE	FALSE	341	328	-13	-4%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
E36	A	CAL	TRUE	FALSE	FALSE	490	507	17	3%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
E37	A	CAL	TRUE	FALSE	FALSE	451	398	-53	-12%	FALSE	FALSE	TRUE	2.6	TRUE	PM	Car
E38	A	CAL	FALSE	FALSE	FALSE	403	408	5	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
E39	A	CAL	FALSE	FALSE	FALSE	443	451	8	2%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
E40	A	CAL	TRUE	FALSE	FALSE	446	480	34	8%	FALSE	TRUE	TRUE	1.6	TRUE	PM	Car
E41	A	CAL	TRUE	TRUE	FALSE	435	407	-29	-7%	FALSE	TRUE	TRUE	1.4	TRUE	PM	Car
E42	A	CAL	FALSE	FALSE	FALSE	323	277	-46	-14%	FALSE	FALSE	TRUE	2.6	TRUE	PM	Car

E44	A	CAL	TRUE	FALSE	FALSE	1139	1025	-114	-10%	FALSE	TRUE	TRUE	3.5	TRUE	PM	Car
E46	A	CAL	FALSE	FALSE	FALSE	313	221	-92	-29%	FALSE	FALSE	FALSE	5.6	FALSE	PM	Car
F03	A	CAL	FALSE	FALSE	FALSE	503	497	-7	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
F07	A	CAL	FALSE	FALSE	FALSE	411	404	-7	-2%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
G09	A	CAL	FALSE	FALSE	FALSE	229	226	-3	-1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
M1	A	CAL	FALSE	FALSE	FALSE	3689	3705	16	0%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
M18	A	CAL	FALSE	FALSE	FALSE	6844	6735	-109	-2%	TRUE	TRUE	TRUE	1.3	TRUE	PM	Car
M500	A	CAL	FALSE	FALSE	FALSE	1417	1392	-25	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
M502	A	CAL	FALSE	FALSE	TRUE	1183	1171	-12	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
M503	A	CAL	FALSE	FALSE	FALSE	3684	3725	41	1%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
M504	A	CAL	FALSE	FALSE	FALSE	3804	3747	-56	-1%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car
M505	A	CAL	FALSE	FALSE	FALSE	1436	1382	-54	-4%	TRUE	TRUE	TRUE	1.4	TRUE	PM	Car
M506	A	CAL	FALSE	FALSE	FALSE	1812	1782	-30	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
M508	A	CAL	FALSE	FALSE	FALSE	3059	3112	52	2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car
M62	A	VAL	FALSE	FALSE	FALSE	1716	1726	11	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL001	A	CAL	FALSE	TRUE	FALSE	4793	4736	-58	-1%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
SL002	A	CAL	FALSE	TRUE	FALSE	2540	2410	-130	-5%	FALSE	TRUE	FALSE	2.6	TRUE	PM	Car
SL003	A	VAL	FALSE	FALSE	TRUE	3057	3003	-54	-2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	Car
SL004	A	CAL	FALSE	FALSE	TRUE	619	601	-18	-3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL005	A	VAL	FALSE	TRUE	TRUE	3854	3770	-83	-2%	TRUE	TRUE	TRUE	1.4	TRUE	PM	Car
SL006	A	CAL	FALSE	FALSE	TRUE	1693	1731	38	2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car
SL007	A	CAL	FALSE	FALSE	TRUE	1399	1401	1	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
SL008	A	VAL	FALSE	FALSE	FALSE	4822	4750	-72	-2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	Car
SL009	A	VAL	FALSE	FALSE	FALSE	2122	2052	-70	-3%	TRUE	TRUE	TRUE	1.5	TRUE	PM	Car

SL010	A	CAL	FALSE	FALSE	FALSE	2064	2067	2	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
SL011	A	CAL	FALSE	FALSE	FALSE	1473	1455	-18	-1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car
SL012	A	CAL	FALSE	FALSE	FALSE	2221	2247	26	1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car
SL013	A	CAL	FALSE	FALSE	FALSE	569	584	15	3%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
SL014	A	VAL	FALSE	FALSE	FALSE	389	373	-16	-4%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
SL016	A	VAL	FALSE	FALSE	TRUE	2826	2756	-71	-2%	TRUE	TRUE	TRUE	1.3	TRUE	PM	Car
SL017	A	CAL	FALSE	FALSE	FALSE	912	841	-72	-8%	FALSE	TRUE	FALSE	2.4	TRUE	PM	Car
SL018	A	VAL	FALSE	FALSE	FALSE	2660	2523	-137	-5%	FALSE	TRUE	FALSE	2.7	TRUE	PM	Car
SL019	A	VAL	TRUE	FALSE	FALSE	2773	2695	-78	-3%	TRUE	TRUE	TRUE	1.5	TRUE	PM	Car
SL020	A	CAL	FALSE	FALSE	FALSE	1407	1387	-19	-1%	TRUE	TRUE	TRUE	0.5	TRUE	PM	Car
SL021	A	CAL	FALSE	FALSE	FALSE	295	297	2	1%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car
SL022	A	CAL	FALSE	FALSE	FALSE	2855	2780	-75	-3%	TRUE	TRUE	TRUE	1.4	TRUE	PM	Car
SL023	A	VAL	FALSE	FALSE	FALSE	1736	1707	-30	-2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL024	A	VAL	FALSE	FALSE	FALSE	762	742	-20	-3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL025	A	CAL	FALSE	FALSE	FALSE	804	787	-17	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
SL026	A	VAL	FALSE	FALSE	FALSE	690	674	-16	-2%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
SL027	A	CAL	FALSE	FALSE	FALSE	2470	2403	-67	-3%	TRUE	TRUE	TRUE	1.3	TRUE	PM	Car
SL028	A	CAL	FALSE	FALSE	FALSE	1328	1317	-12	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL029	A	VAL	FALSE	FALSE	FALSE	2237	2249	13	1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL030	A	VAL	FALSE	FALSE	FALSE	1949	1966	17	1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
SL031	A	VAL	TRUE	FALSE	FALSE	1512	1453	-59	-4%	TRUE	TRUE	TRUE	1.5	TRUE	PM	Car
SL032	A	CAL	TRUE	TRUE	FALSE	1828	1747	-81	-4%	TRUE	TRUE	TRUE	1.9	TRUE	PM	Car
SL033	A	CAL	TRUE	TRUE	FALSE	655	638	-16	-3%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
SL034	A	CAL	TRUE	FALSE	FALSE	1327	1312	-15	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car

SL035	A	VAL	TRUE	FALSE	FALSE	715	721	5	1%	TRUE	TRUE	TRUE	0.2	TRUE	PM	Car
SL036	A	VAL	FALSE	FALSE	FALSE	822	821	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
SL037	A	CAL	TRUE	TRUE	FALSE	3359	3220	-139	-4%	TRUE	TRUE	TRUE	2.4	TRUE	PM	Car
SL038	A	CAL	TRUE	TRUE	FALSE	2766	2624	-142	-5%	FALSE	TRUE	FALSE	2.7	TRUE	PM	Car
SL039	A	CAL	TRUE	FALSE	FALSE	1490	1339	-151	-10%	FALSE	FALSE	TRUE	4.0	FALSE	PM	Car
SL040	A	CAL	TRUE	FALSE	FALSE	985	977	-8	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL041	A	VAL	TRUE	FALSE	FALSE	1137	1105	-32	-3%	TRUE	TRUE	TRUE	1.0	TRUE	PM	Car
SL042	A	VAL	FALSE	FALSE	FALSE	1519	1475	-44	-3%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
SL043	A	CAL	TRUE	FALSE	FALSE	444	417	-28	-6%	FALSE	TRUE	TRUE	1.3	TRUE	PM	Car
SL044	A	VAL	TRUE	TRUE	FALSE	492	466	-25	-5%	FALSE	TRUE	TRUE	1.2	TRUE	PM	Car
SL045	A	VAL	TRUE	TRUE	FALSE	943	891	-52	-6%	FALSE	TRUE	TRUE	1.7	TRUE	PM	Car
SL046	A	CAL	FALSE	TRUE	FALSE	5602	5654	52	1%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL047	A	VAL	FALSE	FALSE	FALSE	320	214	-106	-33%	FALSE	FALSE	FALSE	6.5	FALSE	PM	Car
SL048	A	VAL	FALSE	FALSE	FALSE	1126	1101	-25	-2%	TRUE	TRUE	TRUE	0.8	TRUE	PM	Car
SL049	A	CAL	TRUE	TRUE	FALSE	5148	5017	-131	-3%	TRUE	TRUE	TRUE	1.8	TRUE	PM	Car
SL050	A	VAL	FALSE	FALSE	TRUE	2739	2669	-70	-3%	TRUE	TRUE	TRUE	1.3	TRUE	PM	Car
SL051	A	CAL	TRUE	TRUE	FALSE	1286	1129	-158	-12%	FALSE	FALSE	FALSE	4.5	FALSE	PM	Car
SL052	A	VAL	FALSE	FALSE	FALSE	795	753	-41	-5%	FALSE	TRUE	TRUE	1.5	TRUE	PM	Car
SL053	A	VAL	FALSE	FALSE	TRUE	378	384	6	2%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL054	A	VAL	FALSE	FALSE	FALSE	2619	2570	-48	-2%	TRUE	TRUE	TRUE	0.9	TRUE	PM	Car
SL055	A	CAL	FALSE	FALSE	FALSE	4821	4777	-44	-1%	TRUE	TRUE	TRUE	0.6	TRUE	PM	Car
SL057	A	CAL	FALSE	FALSE	FALSE	580	554	-26	-5%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
SL058	A	CAL	FALSE	FALSE	FALSE	1098	1133	35	3%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
SL059	A	CAL	FALSE	FALSE	FALSE	1968	1972	5	0%	TRUE	TRUE	TRUE	0.1	TRUE	PM	Car

SL060	A	VAL	FALSE	FALSE	FALSE	548	492	-56	-10%	FALSE	FALSE	TRUE	2.4	TRUE	PM	Car
SL061	A	VAL	FALSE	TRUE	FALSE	2164	2146	-18	-1%	TRUE	TRUE	TRUE	0.4	TRUE	PM	Car
SL062	A	CAL	FALSE	TRUE	FALSE	718	671	-47	-7%	FALSE	TRUE	TRUE	1.8	TRUE	PM	Car
SL063	A	CAL	TRUE	TRUE	FALSE	1911	1861	-50	-3%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
SL064	A	CAL	FALSE	FALSE	FALSE	5124	4974	-150	-3%	TRUE	TRUE	TRUE	2.1	TRUE	PM	Car
SL065	A	VAL	FALSE	FALSE	FALSE	3064	2677	-387	-13%	FALSE	FALSE	FALSE	7.2	FALSE	PM	Car
SL066	A	CAL	TRUE	TRUE	FALSE	4170	3918	-252	-6%	FALSE	TRUE	FALSE	4.0	TRUE	PM	Car
SL067	A	CAL	FALSE	FALSE	FALSE	600	584	-16	-3%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL068	A	CAL	FALSE	FALSE	FALSE	163	153	-10	-6%	FALSE	TRUE	TRUE	0.8	TRUE	PM	Car
SL069	A	CAL	FALSE	TRUE	FALSE	983	982	-1	0%	TRUE	TRUE	TRUE	0.0	TRUE	PM	Car
SL070	A	CAL	FALSE	TRUE	FALSE	1076	1066	-10	-1%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL071	A	CAL	FALSE	TRUE	FALSE	3729	3713	-16	0%	TRUE	TRUE	TRUE	0.3	TRUE	PM	Car
SL072	A	VAL	TRUE	FALSE	FALSE	3489	3585	96	3%	TRUE	TRUE	TRUE	1.6	TRUE	PM	Car
SL073	A	CAL	FALSE	TRUE	FALSE	2934	2883	-51	-2%	TRUE	TRUE	TRUE	1.0	TRUE	PM	Car
SL074	A	CAL	FALSE	FALSE	FALSE	892	914	22	2%	TRUE	TRUE	TRUE	0.7	TRUE	PM	Car
SL075	A	CAL	FALSE	FALSE	FALSE	2170	2121	-49	-2%	TRUE	TRUE	TRUE	1.1	TRUE	PM	Car
SL076	A	CAL	TRUE	TRUE	FALSE	614	551	-63	-10%	FALSE	FALSE	TRUE	2.6	TRUE	PM	Car

Appendix N Journey Time Comparison Table

N.1 AM Journey Time Comparisons

Route	Observed	Observed Range	Modelled	Error	% Error	OK	InnovationCorridor	MassTransit	PanNorthern
B11N	718	107	747.3	29.3	4.1	Y	FALSE	FALSE	TRUE
B11S	746	111	655.9	-90.1	12.1	Y	FALSE	FALSE	TRUE
B12E	443	66	335.3	-107.7	24.3	N	FALSE	FALSE	TRUE
B12W	369	55	326.7	-42.3	11.5	Y	FALSE	FALSE	TRUE
B13E	769	115	509.9	-259.1	33.7	N	FALSE	FALSE	TRUE
B13W	516	77	691.8	175.8	34.1	N	FALSE	FALSE	TRUE
B14N	572	85	601.8	29.8	5.2	Y	FALSE	FALSE	TRUE
B14S	723	108	842.6	119.6	16.5	N	FALSE	FALSE	TRUE
B15E	1118	167	1103.7	-14.3	1.3	Y	FALSE	FALSE	TRUE
B15W	1043	156	1035.9	-7.1	0.7	Y	FALSE	FALSE	TRUE
B1N	431	64	416.7	-14.3	3.3	Y	TRUE	FALSE	TRUE
B1S	674	101	422.3	-251.7	37.3	N	TRUE	FALSE	TRUE
B2E	703	105	705.3	2.3	0.3	Y	FALSE	FALSE	TRUE
B2W	711	106	724.6	13.6	1.9	Y	FALSE	FALSE	TRUE
B3E	675	101	724.7	49.7	7.4	Y	FALSE	FALSE	TRUE
B3W	826	124	734.3	-91.7	11.1	Y	FALSE	FALSE	TRUE
B4N	458	68	461.7	3.7	0.8	Y	FALSE	FALSE	TRUE
B4S	433	65	442.7	9.7	2.2	Y	FALSE	FALSE	TRUE
B5N	663	99	754.8	91.8	13.8	Y	FALSE	FALSE	TRUE
B5S	752	112	753.4	1.4	0.2	Y	FALSE	FALSE	TRUE
B6N	902	135	903.7	1.7	0.2	Y	FALSE	FALSE	TRUE
B6S	1059	158	962.3	-96.7	9.1	Y	FALSE	FALSE	TRUE

B7N	662	99	689.1	27.1	4.1	Y	FALSE	FALSE	TRUE
B7S	686	103	665.7	-20.3	3	Y	FALSE	FALSE	TRUE
B8E	1274	191	1228.6	-45.4	3.6	Y	FALSE	FALSE	TRUE
B8W	963	144	1115.8	152.8	15.9	N	FALSE	FALSE	TRUE
B9N	900	135	911.1	11.1	1.2	Y	TRUE	TRUE	TRUE
B9S	1351	202	1161.5	-189.5	14	Y	TRUE	TRUE	TRUE
C1E	1165	174	886.3	-278.7	23.9	N	FALSE	FALSE	FALSE
C1W	1305	195	1111.1	-193.9	14.9	Y	FALSE	FALSE	FALSE
C2E	431	64	390.4	-40.6	9.4	Y	FALSE	FALSE	FALSE
C2W	347	52	370.3	23.3	6.7	Y	FALSE	FALSE	FALSE
C3E	1419	212	1236.5	-182.5	12.9	Y	FALSE	FALSE	FALSE
C3W	1016	152	1062.5	46.5	4.6	Y	FALSE	FALSE	FALSE
C5N	1029	154	854.8	-174.2	16.9	N	FALSE	FALSE	FALSE
C5S	733	110	717.5	-15.5	2.1	Y	FALSE	FALSE	FALSE
C6E	1242	186	1108.2	-133.8	10.8	Y	FALSE	FALSE	FALSE
C6W	1376	206	1229.9	-146.1	10.6	Y	FALSE	FALSE	FALSE
DD1N	1155	173	1192.2	37.2	3.2	Y	FALSE	FALSE	FALSE
DD1S	1076	161	1572.2	496.2	46.1	N	FALSE	FALSE	FALSE
DD2N	1587	238	1851	264	16.6	N	FALSE	FALSE	FALSE
DD2S	1568	235	1462.4	-105.6	6.7	Y	FALSE	FALSE	FALSE
DD3N	1042	156	1099.2	57.2	5.5	Y	FALSE	FALSE	FALSE
DD3S	989	148	1148.8	159.8	16.2	N	FALSE	FALSE	FALSE
D10N	335	50	321.9	-13.1	3.9	Y	FALSE	FALSE	TRUE
D10S	333	49	323.6	-9.4	2.8	Y	FALSE	FALSE	TRUE
D11E	414	62	324.4	-89.6	21.6	N	FALSE	FALSE	TRUE
D11W	293	44	294.9	1.9	0.6	Y	FALSE	FALSE	TRUE
D12E	571	85	568.2	-2.8	0.5	Y	FALSE	FALSE	TRUE
D12W	558	83	584.1	26.1	4.7	Y	FALSE	FALSE	TRUE
D13N	586	87	567.1	-18.9	3.2	Y	FALSE	FALSE	TRUE
D13S	666	99	587.7	-78.3	11.8	Y	FALSE	FALSE	TRUE

D14E	899	134	773.6	-125.4	13.9	Y	FALSE	FALSE	TRUE
D14W	481	72	478	-3	0.6	Y	FALSE	FALSE	TRUE
D15N	719	107	668	-51	7.1	Y	FALSE	FALSE	TRUE
D15S	682	102	700.6	18.6	2.7	Y	FALSE	FALSE	TRUE
D1E	667	100	628.4	-38.6	5.8	Y	FALSE	FALSE	TRUE
D1W	632	94	649	17	2.7	Y	FALSE	FALSE	TRUE
D2N	762	114	715.5	-46.5	6.1	Y	FALSE	FALSE	TRUE
D2S	731	109	730.9	-0.1	0	Y	FALSE	FALSE	TRUE
D3E	1205	180	1367.3	162.3	13.5	Y	TRUE	FALSE	TRUE
D3W	1484	222	1602.7	118.7	8	Y	TRUE	FALSE	TRUE
D4N	597	89	656.6	59.6	10	Y	FALSE	FALSE	TRUE
D4S	1056	158	737.3	-318.7	30.2	N	FALSE	FALSE	TRUE
D5N	412	61	395.5	-16.5	4	Y	FALSE	FALSE	TRUE
D5S	584	87	442.5	-141.5	24.2	N	FALSE	FALSE	TRUE
D6N	1415	212	1449.4	34.4	2.4	Y	FALSE	FALSE	TRUE
D6S	1339	200	1484.4	145.4	10.9	Y	FALSE	FALSE	TRUE
D7E	275	41	281.9	6.9	2.5	Y	FALSE	FALSE	TRUE
D7W	345	51	301	-44	12.8	Y	FALSE	FALSE	TRUE
D8N	488	73	417.7	-70.3	14.4	Y	FALSE	FALSE	TRUE
D8S	343	51	351.9	8.9	2.6	Y	FALSE	FALSE	TRUE
R10E	780	117	715	-65	8.3	Y	TRUE	TRUE	TRUE
R10W	662	99	736.6	74.6	11.3	Y	TRUE	TRUE	TRUE
R11N	1334	200	1271.2	-62.8	4.7	Y	TRUE	TRUE	TRUE
R11S	1758	263	1689.8	-68.2	3.9	Y	TRUE	TRUE	TRUE
R13E	876	131	974.7	98.7	11.3	Y	TRUE	FALSE	FALSE
R13W	1213	181	1059.6	-153.4	12.6	Y	TRUE	FALSE	FALSE
R14E	419	62	421.2	2.2	0.5	Y	TRUE	FALSE	TRUE
R14W	433	65	410.5	-22.5	5.2	Y	TRUE	FALSE	TRUE
R2N	235	35	196.7	-38.3	16.3	Y	TRUE	TRUE	FALSE
R2S	181	27	202.1	21.1	11.7	Y	TRUE	TRUE	FALSE

R3E	797	119	901	104	13	Y	TRUE	TRUE	FALSE
R3W	1049	157	977	-72	6.9	Y	TRUE	TRUE	FALSE
R4E	305	45	284.6	-20.4	6.7	Y	TRUE	TRUE	FALSE
R4W	359	53	304.5	-54.5	15.2	Y	TRUE	TRUE	FALSE
R5E	244	36	281.4	37.4	15.3	Y	TRUE	TRUE	FALSE
R5W	360	54	321.6	-38.4	10.7	Y	TRUE	TRUE	FALSE
R6N	343	51	397.2	54.2	15.8	Y	TRUE	FALSE	FALSE
R6S	247	37	262.2	15.2	6.2	Y	TRUE	FALSE	FALSE
R7N	595	89	560.2	-34.8	5.8	Y	TRUE	FALSE	FALSE
R7S	657	98	655.5	-1.5	0.2	Y	TRUE	FALSE	FALSE
R9N	1389	208	1585.7	196.7	14.2	Y	TRUE	TRUE	TRUE
R9S	2028	304	1863.8	-164.2	8.1	Y	TRUE	TRUE	TRUE
S10N	2489	373	1801.6	-687.4	27.6	N	TRUE	TRUE	FALSE
S10S	1809	271	1712.6	-96.4	5.3	Y	TRUE	TRUE	FALSE
S11N	360	54	166.3	-193.7	53.8	N	FALSE	TRUE	FALSE
S11S	114	17	121.9	7.9	7	Y	FALSE	TRUE	FALSE
S12E	1043	156	691.3	-351.7	33.7	N	FALSE	TRUE	FALSE
S12W	709	106	725	16	2.3	Y	FALSE	TRUE	FALSE
S13N	1471	220	1039.2	-431.8	29.4	N	FALSE	TRUE	FALSE
S13S	709	106	938.2	229.2	32.3	N	FALSE	TRUE	FALSE
S14N	1735	260	1478.8	-256.2	14.8	Y	FALSE	TRUE	FALSE
S14S	1432	214	1467.7	35.7	2.5	Y	FALSE	TRUE	FALSE
S15N	717	107	710.8	-6.2	0.9	Y	TRUE	TRUE	FALSE
S15S	647	97	637.9	-9.1	1.4	Y	TRUE	TRUE	FALSE
S16N	434	65	436.7	2.7	0.6	Y	TRUE	FALSE	FALSE
S16S	423	63	434.8	11.8	2.8	Y	TRUE	FALSE	FALSE
S1N	899	134	1007	108	12	Y	TRUE	TRUE	FALSE
S1S	1411	211	1217.6	-193.4	13.7	Y	TRUE	TRUE	FALSE
S2E	489	73	528.8	39.8	8.1	Y	TRUE	TRUE	FALSE
S2W	1095	164	951.6	-143.4	13.1	Y	TRUE	TRUE	FALSE

S3N	668	100	613.8	-54.2	8.1	Y	TRUE	TRUE	FALSE
S3S	518	77	550.2	32.2	6.2	Y	TRUE	TRUE	FALSE
S4N	567	85	498.2	-68.8	12.1	Y	TRUE	TRUE	FALSE
S4S	382	57	437.4	55.4	14.5	Y	TRUE	TRUE	FALSE
S5E	944	141	882.1	-61.9	6.6	Y	TRUE	TRUE	FALSE
S5W	1120	168	958.8	-161.2	14.4	Y	TRUE	TRUE	FALSE
S6N	1230	184	1049	-181	14.7	Y	TRUE	TRUE	FALSE
S6S	1299	194	1133.1	-165.9	12.8	Y	TRUE	TRUE	FALSE
S7N	2362	354	1998.8	-363.2	15.4	N	TRUE	TRUE	FALSE
S7S	1671	250	1690.1	19.1	1.1	Y	TRUE	TRUE	FALSE
S8N	1269	190	720.2	-548.8	43.2	N	TRUE	TRUE	FALSE
S8S	765	114	856.1	91.1	11.9	Y	TRUE	TRUE	FALSE
S9E	768	115	961.6	193.6	25.2	N	TRUE	TRUE	FALSE
S9W	1185	177	908.4	-276.6	23.3	N	TRUE	TRUE	FALSE
W10E	1100	165	1241.3	141.3	12.8	Y	FALSE	FALSE	FALSE
W10W	984	147	1325.4	341.4	34.7	N	FALSE	FALSE	FALSE
W11E	584	88	830.2	246.2	42.2	N	FALSE	FALSE	FALSE
W11W	526	79	551.9	25.9	4.9	Y	FALSE	FALSE	FALSE
W12N	393	59	434.2	41.2	10.5	Y	FALSE	FALSE	FALSE
W12S	402	60	433.5	31.5	7.8	Y	FALSE	FALSE	FALSE
W1N	547	82	528.1	-18.9	3.5	Y	TRUE	FALSE	FALSE
W1S	463	69	471.4	8.4	1.8	Y	TRUE	FALSE	FALSE
W2E	912	136	945.3	33.3	3.7	Y	FALSE	FALSE	FALSE
W2W	940	141	872.2	-67.8	7.2	Y	FALSE	FALSE	FALSE
W3N	1640	246	1442.9	-197.1	12	Y	FALSE	FALSE	TRUE
W3S	1256	188	1269.6	13.6	1.1	Y	FALSE	FALSE	TRUE
W4E	723	108	901.3	178.3	24.7	N	FALSE	FALSE	FALSE
W4W	811	121	862.1	51.1	6.3	Y	FALSE	FALSE	FALSE
W5E	1049	157	668	-381	36.3	N	FALSE	FALSE	FALSE
W5W	765	114	703.6	-61.4	8	Y	FALSE	FALSE	FALSE

W6N	661	99	612.4	-48.6	7.4	Y	FALSE	FALSE	TRUE
W6S	629	94	543.8	-85.2	13.5	Y	FALSE	FALSE	TRUE
W7N	959	143	881.8	-77.2	8.1	Y	FALSE	FALSE	FALSE
W7S	1022	153	968.3	-53.7	5.3	Y	FALSE	FALSE	FALSE
W8E	222	33	237.1	15.1	6.8	Y	FALSE	FALSE	FALSE
W8W	200	30	247.3	47.3	23.7	Y	FALSE	FALSE	FALSE
W9N	423	63	464.3	41.3	9.8	Y	FALSE	FALSE	FALSE
W9S	423	63	442.6	19.6	4.6	Y	FALSE	FALSE	FALSE

N.2 IP Journey Time Comparisons

Route	Observed	Observed Range	Modelled	Error	% Error	OK	InnovationCorridor	MassTransit	PanNorthern
B11N	628	94	669.3	41.3	6.6	Y	FALSE	FALSE	TRUE
B11S	592	88	651.5	59.5	10	Y	FALSE	FALSE	TRUE
B12E	357	53	333.3	-23.7	6.6	Y	FALSE	FALSE	TRUE
B12W	333	50	318.8	-14.2	4.3	Y	FALSE	FALSE	TRUE
B13E	488	73	516.2	28.2	5.8	Y	FALSE	FALSE	TRUE
B13W	505	75	500.8	-4.2	0.8	Y	FALSE	FALSE	TRUE
B14N	564	84	615.1	51.1	9.1	Y	FALSE	FALSE	TRUE
B14S	641	96	784.1	143.1	22.3	N	FALSE	FALSE	TRUE
B15E	1002	150	980.4	-21.6	2.2	Y	FALSE	FALSE	TRUE
B15W	1001	150	1000.1	-0.9	0.1	Y	FALSE	FALSE	TRUE
B1N	425	63	399.9	-25.1	5.9	Y	TRUE	FALSE	TRUE
B1S	446	66	405	-41	9.2	Y	TRUE	FALSE	TRUE
B2E	636	95	675.7	39.7	6.2	Y	FALSE	FALSE	TRUE
B2W	674	101	649.9	-24.1	3.6	Y	FALSE	FALSE	TRUE
B3E	624	93	673.9	49.9	8	Y	FALSE	FALSE	TRUE
B3W	622	93	634.9	12.9	2.1	Y	FALSE	FALSE	TRUE
B4N	420	63	441.1	21.1	5	Y	FALSE	FALSE	TRUE
B4S	423	63	440.2	17.2	4.1	Y	FALSE	FALSE	TRUE
B5N	645	96	742.8	97.8	15.2	N	FALSE	FALSE	TRUE
B5S	631	94	706	75	11.9	Y	FALSE	FALSE	TRUE
B6N	830	124	880.9	50.9	6.1	Y	FALSE	FALSE	TRUE
B6S	876	131	933	57	6.5	Y	FALSE	FALSE	TRUE
B7N	657	98	649	-8	1.2	Y	FALSE	FALSE	TRUE
B7S	634	95	635.2	1.2	0.2	Y	FALSE	FALSE	TRUE
B8E	963	144	1090.1	127.1	13.2	Y	FALSE	FALSE	TRUE
B8W	984	147	1093	109	11.1	Y	FALSE	FALSE	TRUE

B9N	918	137	919.4	1.4	0.1	Y	TRUE	TRUE	TRUE
B9S	911	136	906.1	-4.9	0.5	Y	TRUE	TRUE	TRUE
C1E	912	136	869.8	-42.2	4.6	Y	FALSE	FALSE	FALSE
C1W	931	139	903.8	-27.2	2.9	Y	FALSE	FALSE	FALSE
C2E	315	47	314.3	-0.7	0.2	Y	FALSE	FALSE	FALSE
C2W	321	48	326.9	5.9	1.8	Y	FALSE	FALSE	FALSE
C3E	1211	181	1120	-91	7.5	Y	FALSE	FALSE	FALSE
C3W	1023	153	1016.7	-6.3	0.6	Y	FALSE	FALSE	FALSE
C5N	749	112	697.4	-51.6	6.9	Y	FALSE	FALSE	FALSE
C5S	674	101	680.4	6.4	1	Y	FALSE	FALSE	FALSE
C6E	1066	160	1026.2	-39.8	3.7	Y	FALSE	FALSE	FALSE
C6W	1083	163	1009.8	-73.2	6.8	Y	FALSE	FALSE	FALSE
DD1N	1057	158	1138.9	81.9	7.7	Y	FALSE	FALSE	FALSE
DD1S	1061	159	1152.3	91.3	8.6	Y	FALSE	FALSE	FALSE
DD2N	1562	234	1578.7	16.7	1.1	Y	FALSE	FALSE	FALSE
DD2S	1538	230	1454.4	-83.6	5.4	Y	FALSE	FALSE	FALSE
DD3N	955	143	1044.8	89.8	9.4	Y	FALSE	FALSE	FALSE
DD3S	934	140	1063.7	129.7	13.9	Y	FALSE	FALSE	FALSE
D10N	329	49	319.9	-9.1	2.8	Y	FALSE	FALSE	TRUE
D10S	326	48	322.2	-3.8	1.2	Y	FALSE	FALSE	TRUE
D11E	297	44	274	-23	7.7	Y	FALSE	FALSE	TRUE
D11W	287	43	291.9	4.9	1.7	Y	FALSE	FALSE	TRUE
D12E	553	83	569.8	16.8	3	Y	FALSE	FALSE	TRUE
D12W	481	72	541.3	60.3	12.5	Y	FALSE	FALSE	TRUE
D13N	484	72	647	163	33.7	N	FALSE	FALSE	TRUE
D13S	488	73	613.4	125.4	25.7	N	FALSE	FALSE	TRUE
D14E	540	81	521.3	-18.7	3.5	Y	FALSE	FALSE	TRUE
D14W	462	69	463.2	1.2	0.3	Y	FALSE	FALSE	TRUE
D15N	689	103	660.5	-28.5	4.1	Y	FALSE	FALSE	TRUE
D15S	688	103	674.6	-13.4	2	Y	FALSE	FALSE	TRUE

D1E	595	89	577.7	-17.3	2.9	Y	FALSE	FALSE	TRUE
D1W	578	86	603.6	25.6	4.4	Y	FALSE	FALSE	TRUE
D2N	670	100	700.7	30.7	4.6	Y	FALSE	FALSE	TRUE
D2S	684	102	689.3	5.3	0.8	Y	FALSE	FALSE	TRUE
D3E	1176	176	1217.3	41.3	3.5	Y	TRUE	FALSE	TRUE
D3W	1178	176	1239.2	61.2	5.2	Y	TRUE	FALSE	TRUE
D4N	606	90	669.1	63.1	10.4	Y	FALSE	FALSE	TRUE
D4S	703	105	688.8	-14.2	2	Y	FALSE	FALSE	TRUE
D5N	385	57	397.6	12.6	3.3	Y	FALSE	FALSE	TRUE
D5S	415	62	430.6	15.6	3.8	Y	FALSE	FALSE	TRUE
D6N	1201	180	1360.9	159.9	13.3	Y	FALSE	FALSE	TRUE
D6S	1266	189	1453.2	187.2	14.8	Y	FALSE	FALSE	TRUE
D7E	275	41	272.3	-2.7	1	Y	FALSE	FALSE	TRUE
D7W	280	42	278.3	-1.7	0.6	Y	FALSE	FALSE	TRUE
D8N	356	53	324.5	-31.5	8.9	Y	FALSE	FALSE	TRUE
D8S	331	49	337.9	6.9	2.1	Y	FALSE	FALSE	TRUE
R10E	638	95	673.5	35.5	5.6	Y	TRUE	TRUE	TRUE
R10W	644	96	686.5	42.5	6.6	Y	TRUE	TRUE	TRUE
R11N	1215	182	1210.6	-4.4	0.4	Y	TRUE	TRUE	TRUE
R11S	1205	180	1312.7	107.7	8.9	Y	TRUE	TRUE	TRUE
R13E	877	131	954.1	77.1	8.8	Y	TRUE	FALSE	FALSE
R13W	871	130	923	52	6	Y	TRUE	FALSE	FALSE
R14E	451	67	425.2	-25.8	5.7	Y	TRUE	FALSE	TRUE
R14W	439	65	397.2	-41.8	9.5	Y	TRUE	FALSE	TRUE
R2N	214	32	198.6	-15.4	7.2	Y	TRUE	TRUE	FALSE
R2S	164	24	196.9	32.9	20	Y	TRUE	TRUE	FALSE
R3E	810	121	923.6	113.6	14	Y	TRUE	TRUE	FALSE
R3W	826	123	918.4	92.4	11.2	Y	TRUE	TRUE	FALSE
R4E	276	41	286.2	10.2	3.7	Y	TRUE	TRUE	FALSE
R4W	294	44	297.4	3.4	1.1	Y	TRUE	TRUE	FALSE

R5E	236	35	280.3	44.3	18.8	Y	TRUE	TRUE	FALSE
R5W	266	39	305.5	39.5	14.9	Y	TRUE	TRUE	FALSE
R6N	203	30	241.6	38.6	19	Y	TRUE	FALSE	FALSE
R6S	205	30	251.2	46.2	22.5	Y	TRUE	FALSE	FALSE
R7N	486	72	543.4	57.4	11.8	Y	TRUE	FALSE	FALSE
R7S	478	71	536.6	58.6	12.3	Y	TRUE	FALSE	FALSE
R9N	1254	188	1500.6	246.6	19.7	N	TRUE	TRUE	TRUE
R9S	1259	188	1381.6	122.6	9.7	Y	TRUE	TRUE	TRUE
S10N	1546	232	1470.9	-75.1	4.9	Y	TRUE	TRUE	FALSE
S10S	1540	231	1629.3	89.3	5.8	Y	TRUE	TRUE	FALSE
S11N	108	16	115.3	7.3	6.7	Y	FALSE	TRUE	FALSE
S11S	119	17	136.6	17.6	14.8	Y	FALSE	TRUE	FALSE
S12E	740	111	712.9	-27.1	3.7	Y	FALSE	TRUE	FALSE
S12W	669	100	668.9	-0.1	0	Y	FALSE	TRUE	FALSE
S13N	762	114	770.2	8.2	1.1	Y	FALSE	TRUE	FALSE
S13S	805	120	845.2	40.2	5	Y	FALSE	TRUE	FALSE
S14N	1456	218	1456.9	0.9	0.1	Y	FALSE	TRUE	FALSE
S14S	1457	218	1485.8	28.8	2	Y	FALSE	TRUE	FALSE
S15N	674	101	672.3	-1.7	0.3	Y	TRUE	TRUE	FALSE
S15S	579	86	633	54	9.3	Y	TRUE	TRUE	FALSE
S16N	395	59	398.9	3.9	1	Y	TRUE	FALSE	FALSE
S16S	396	59	396.1	0.1	0	Y	TRUE	FALSE	FALSE
S1N	883	132	1020	137	15.5	N	TRUE	TRUE	FALSE
S1S	892	133	989.8	97.8	11	Y	TRUE	TRUE	FALSE
S2E	425	63	532.8	107.8	25.4	N	TRUE	TRUE	FALSE
S2W	428	64	526.1	98.1	22.9	N	TRUE	TRUE	FALSE
S3N	528	79	523.2	-4.8	0.9	Y	TRUE	TRUE	FALSE
S3S	504	75	533.2	29.2	5.8	Y	TRUE	TRUE	FALSE
S4N	423	63	473.6	50.6	12	Y	TRUE	TRUE	FALSE
S4S	376	56	445.7	69.7	18.5	N	TRUE	TRUE	FALSE

S5E	722	108	816.1	94.1	13	Y	TRUE	TRUE	FALSE
S5W	740	111	867.3	127.3	17.2	N	TRUE	TRUE	FALSE
S6N	842	126	956.4	114.4	13.6	Y	TRUE	TRUE	FALSE
S6S	1004	150	1051.4	47.4	4.7	Y	TRUE	TRUE	FALSE
S7N	1558	233	1692.7	134.7	8.6	Y	TRUE	TRUE	FALSE
S7S	1519	227	1650.9	131.9	8.7	Y	TRUE	TRUE	FALSE
S8N	659	98	722.3	63.3	9.6	Y	TRUE	TRUE	FALSE
S8S	645	96	651.7	6.7	1	Y	TRUE	TRUE	FALSE
S9E	657	98	728.8	71.8	10.9	Y	TRUE	TRUE	FALSE
S9W	646	96	727.1	81.1	12.5	Y	TRUE	TRUE	FALSE
W10E	1003	150	923.4	-79.6	7.9	Y	FALSE	FALSE	FALSE
W10W	996	149	1045.9	49.9	5	Y	FALSE	FALSE	FALSE
W11E	599	90	566.1	-32.9	5.5	Y	FALSE	FALSE	FALSE
W11W	620	93	532	-88	14.2	Y	FALSE	FALSE	FALSE
W12N	397	59	442.9	45.9	11.6	Y	FALSE	FALSE	FALSE
W12S	399	59	441	42	10.5	Y	FALSE	FALSE	FALSE
W1N	487	73	516.1	29.1	6	Y	TRUE	FALSE	FALSE
W1S	431	65	410.5	-20.5	4.8	Y	TRUE	FALSE	FALSE
W2E	940	141	996.1	56.1	6	Y	FALSE	FALSE	FALSE
W2W	952	142	862.6	-89.4	9.4	Y	FALSE	FALSE	FALSE
W3N	1252	187	1312.6	60.6	4.8	Y	FALSE	FALSE	TRUE
W3S	1244	186	1234.2	-9.8	0.8	Y	FALSE	FALSE	TRUE
W4E	692	103	801.5	109.5	15.8	N	FALSE	FALSE	FALSE
W4W	691	103	757.1	66.1	9.6	Y	FALSE	FALSE	FALSE
W5E	789	118	620.3	-168.7	21.4	N	FALSE	FALSE	FALSE
W5W	680	102	663.2	-16.8	2.5	Y	FALSE	FALSE	FALSE
W6N	638	95	578.5	-59.5	9.3	Y	FALSE	FALSE	TRUE
W6S	612	91	542.2	-69.8	11.4	Y	FALSE	FALSE	TRUE
W7N	971	145	864.3	-106.7	11	Y	FALSE	FALSE	FALSE
W7S	984	147	894.7	-89.3	9.1	Y	FALSE	FALSE	FALSE

W8E	209	31	216.8	7.8	3.7	Y	FALSE	FALSE	FALSE
W8W	195	29	215.6	20.6	10.5	Y	FALSE	FALSE	FALSE
W9N	413	62	469.2	56.2	13.6	Y	FALSE	FALSE	FALSE
W9S	408	61	452.5	44.5	10.9	Y	FALSE	FALSE	FALSE

N.3 PM Journey Time Comparison

Route	Observed	Observed Range	Modelled	Error	% Error	OK	InnovationCorridor	MassTransit	PanNorthern
B11N	659	98	697.6	38.6	5.9	Y	FALSE	FALSE	TRUE
B11S	690	103	717.8	27.8	4	Y	FALSE	FALSE	TRUE
B12E	388	58	355.5	-32.5	8.4	Y	FALSE	FALSE	TRUE
B12W	437	65	327	-110	25.2	N	FALSE	FALSE	TRUE
B13E	500	75	664.8	164.8	33	N	FALSE	FALSE	TRUE
B13W	683	102	516.2	-166.8	24.4	N	FALSE	FALSE	TRUE
B14N	735	110	653.1	-81.9	11.1	Y	FALSE	FALSE	TRUE
B14S	721	108	716	-5	0.7	Y	FALSE	FALSE	TRUE
B15E	1008	151	997.5	-10.5	1	Y	FALSE	FALSE	TRUE
B15W	1120	168	1244.9	124.9	11.2	Y	FALSE	FALSE	TRUE
B1N	432	64	427.3	-4.7	1.1	Y	TRUE	FALSE	TRUE
B1S	495	74	436.4	-58.6	11.8	Y	TRUE	FALSE	TRUE
B2E	875	131	815.8	-59.2	6.8	Y	FALSE	FALSE	TRUE
B2W	920	138	721.4	-198.6	21.6	N	FALSE	FALSE	TRUE
B3E	746	111	747.4	1.4	0.2	Y	FALSE	FALSE	TRUE
B3W	703	105	660.1	-42.9	6.1	Y	FALSE	FALSE	TRUE
B4N	416	62	446.4	30.4	7.3	Y	FALSE	FALSE	TRUE
B4S	430	64	496.1	66.1	15.4	N	FALSE	FALSE	TRUE
B5N	913	137	1070.7	157.7	17.3	N	FALSE	FALSE	TRUE
B5S	664	99	727.8	63.8	9.6	Y	FALSE	FALSE	TRUE
B6N	1144	171	908.2	-235.8	20.6	N	FALSE	FALSE	TRUE
B6S	987	148	971.8	-15.2	1.5	Y	FALSE	FALSE	TRUE
B7N	642	96	685.8	43.8	6.8	Y	FALSE	FALSE	TRUE
B7S	624	93	684.1	60.1	9.6	Y	FALSE	FALSE	TRUE
B8E	956	143	1137.8	181.8	19	N	FALSE	FALSE	TRUE

B8W	1325	198	1364.8	39.8	3	Y	FALSE	FALSE	TRUE
B9N	1093	164	1037.7	-55.3	5.1	Y	TRUE	TRUE	TRUE
B9S	941	141	910.2	-30.8	3.3	Y	TRUE	TRUE	TRUE
C1E	1091	163	1048.9	-42.1	3.9	Y	FALSE	FALSE	FALSE
C1W	1073	160	998.3	-74.7	7	Y	FALSE	FALSE	FALSE
C2E	589	88	640.4	51.4	8.7	Y	FALSE	FALSE	FALSE
C2W	351	52	404	53	15.1	Y	FALSE	FALSE	FALSE
C3E	1395	209	1163.5	-231.5	16.6	N	FALSE	FALSE	FALSE
C3W	1041	156	1097.5	56.5	5.4	Y	FALSE	FALSE	FALSE
C5N	919	137	854.7	-64.3	7	Y	FALSE	FALSE	FALSE
C5S	779	117	749.7	-29.3	3.8	Y	FALSE	FALSE	FALSE
C6E	1274	191	1308.8	34.8	2.7	Y	FALSE	FALSE	FALSE
C6W	1338	201	1047.7	-290.3	21.7	N	FALSE	FALSE	FALSE
DD1N	1054	158	1278.9	224.9	21.3	N	FALSE	FALSE	FALSE
DD1S	1045	156	1694.6	649.6	62.2	N	FALSE	FALSE	FALSE
DD2N	1498	224	1688.2	190.2	12.7	Y	FALSE	FALSE	FALSE
DD2S	1494	224	1560.7	66.7	4.5	Y	FALSE	FALSE	FALSE
DD3N	982	147	1085.7	103.7	10.6	Y	FALSE	FALSE	FALSE
DD3S	983	147	1129.4	146.4	14.9	Y	FALSE	FALSE	FALSE
D10N	327	49	321.4	-5.6	1.7	Y	FALSE	FALSE	TRUE
D10S	324	48	326.1	2.1	0.7	Y	FALSE	FALSE	TRUE
D11E	273	41	269.5	-3.5	1.3	Y	FALSE	FALSE	TRUE
D11W	399	45	308.3	-90.7	22.7	N	FALSE	FALSE	TRUE
D12E	688	103	601.2	-86.8	12.6	Y	FALSE	FALSE	TRUE
D12W	500	75	550	50	10	Y	FALSE	FALSE	TRUE
D13N	556	83	706.9	150.9	27.1	N	FALSE	FALSE	TRUE
D13S	594	89	609.1	15.1	2.5	Y	FALSE	FALSE	TRUE
D14E	561	84	553.3	-7.7	1.4	Y	FALSE	FALSE	TRUE
D14W	585	87	543	-42	7.2	Y	FALSE	FALSE	TRUE
D15N	688	103	702.5	14.5	2.1	Y	FALSE	FALSE	TRUE

D15S	757	113	718.9	-38.1	5	Y	FALSE	FALSE	TRUE
D1E	627	94	618.3	-8.7	1.4	Y	FALSE	FALSE	TRUE
D1W	722	108	688.9	-33.1	4.6	Y	FALSE	FALSE	TRUE
D2N	682	102	735	53	7.8	Y	FALSE	FALSE	TRUE
D2S	819	122	738.4	-80.6	9.8	Y	FALSE	FALSE	TRUE
D3E	1486	222	1417.1	-68.9	4.6	Y	TRUE	FALSE	TRUE
D3W	1260	189	1322	62	4.9	Y	TRUE	FALSE	TRUE
D4N	635	95	723.2	88.2	13.9	Y	FALSE	FALSE	TRUE
D4S	709	106	702.7	-6.3	0.9	Y	FALSE	FALSE	TRUE
D5N	374	56	406.2	32.2	8.6	Y	FALSE	FALSE	TRUE
D5S	423	63	443.7	20.7	4.9	Y	FALSE	FALSE	TRUE
D6N	1565	234	1562.6	-2.4	0.2	Y	FALSE	FALSE	TRUE
D6S	1512	226	1649.4	137.4	9.1	Y	FALSE	FALSE	TRUE
D7E	312	46	304.5	-7.5	2.4	Y	FALSE	FALSE	TRUE
D7W	322	48	300.1	-21.9	6.8	Y	FALSE	FALSE	TRUE
D8N	460	69	334.6	-125.4	27.3	N	FALSE	FALSE	TRUE
D8S	486	73	406.8	-79.2	16.3	N	FALSE	FALSE	TRUE
R10E	679	101	731.7	52.7	7.8	Y	TRUE	TRUE	TRUE
R10W	1078	161	923.9	-154.1	14.3	Y	TRUE	TRUE	TRUE
R11N	1545	231	1329.7	-215.3	13.9	Y	TRUE	TRUE	TRUE
R11S	1392	208	1437.3	45.3	3.3	Y	TRUE	TRUE	TRUE
R13E	1079	161	1099.8	20.8	1.9	Y	TRUE	FALSE	FALSE
R13W	1014	152	1074.5	60.5	6	Y	TRUE	FALSE	FALSE
R14E	813	121	432	-381	46.9	N	TRUE	FALSE	TRUE
R14W	458	68	397.8	-60.2	13.1	Y	TRUE	FALSE	TRUE
R2N	469	70	210.6	-258.4	55.1	N	TRUE	TRUE	FALSE
R2S	171	25	188.7	17.7	10.3	Y	TRUE	TRUE	FALSE
R3E	1201	180	1051.2	-149.8	12.5	Y	TRUE	TRUE	FALSE
R3W	978	146	868.9	-109.1	11.2	Y	TRUE	TRUE	FALSE
R4E	300	45	298	-2	0.7	Y	TRUE	TRUE	FALSE

R4W	305	45	302.5	-2.5	0.8	Y	TRUE	TRUE	FALSE
R5E	505	75	304.8	-200.2	39.6	N	TRUE	TRUE	FALSE
R5W	333	50	308.6	-24.4	7.3	Y	TRUE	TRUE	FALSE
R6N	261	39	245.2	-15.8	6.1	Y	TRUE	FALSE	FALSE
R6S	500	75	364.7	-135.3	27.1	N	TRUE	FALSE	FALSE
R7N	698	104	608.2	-89.8	12.9	Y	TRUE	FALSE	FALSE
R7S	588	88	573.8	-14.2	2.4	Y	TRUE	FALSE	FALSE
R9N	1952	292	1689.5	-262.5	13.4	Y	TRUE	TRUE	TRUE
R9S	1681	252	1512.6	-168.4	10	Y	TRUE	TRUE	TRUE
S10N	1923	288	1833.8	-89.2	4.6	Y	TRUE	TRUE	FALSE
S10S	2149	322	1880	-269	12.5	Y	TRUE	TRUE	FALSE
S11N	180	27	136	-44	24.5	Y	FALSE	TRUE	FALSE
S11S	190	28	145.1	-44.9	23.6	Y	FALSE	TRUE	FALSE
S12E	761	114	674.6	-86.4	11.4	Y	FALSE	TRUE	FALSE
S12W	901	135	691.1	-209.9	23.3	N	FALSE	TRUE	FALSE
S13N	1151	172	838.6	-312.4	27.1	N	FALSE	TRUE	FALSE
S13S	1134	170	1042.7	-91.3	8.1	Y	FALSE	TRUE	FALSE
S14N	1435	215	1498.9	63.9	4.5	Y	FALSE	TRUE	FALSE
S14S	1627	244	1570.4	-56.6	3.5	Y	FALSE	TRUE	FALSE
S15N	786	118	686.5	-99.5	12.7	Y	TRUE	TRUE	FALSE
S15S	681	102	634.5	-46.5	6.8	Y	TRUE	TRUE	FALSE
S16N	413	62	440.1	27.1	6.6	Y	TRUE	FALSE	FALSE
S16S	407	61	440	33	8.1	Y	TRUE	FALSE	FALSE
S1N	1306	196	1116.8	-189.2	14.5	Y	TRUE	TRUE	FALSE
S1S	1209	181	1060.1	-148.9	12.3	Y	TRUE	TRUE	FALSE
S2E	1034	155	570.3	-463.7	44.8	N	TRUE	TRUE	FALSE
S2W	707	106	773.9	66.9	9.5	Y	TRUE	TRUE	FALSE
S3N	518	77	551.4	33.4	6.5	Y	TRUE	TRUE	FALSE
S3S	932	139	737.6	-194.4	20.9	N	TRUE	TRUE	FALSE
S4N	555	83	541.9	-13.1	2.4	Y	TRUE	TRUE	FALSE

S4S	531	80	531.2	0.2	0	Y	TRUE	TRUE	FALSE
S5E	873	130	817.1	-55.9	6.4	Y	TRUE	TRUE	FALSE
S5W	1011	151	952.1	-58.9	5.8	Y	TRUE	TRUE	FALSE
S6N	1321	198	958.8	-362.2	27.4	N	TRUE	TRUE	FALSE
S6S	1710	256	1148.3	-561.7	32.8	N	TRUE	TRUE	FALSE
S7N	1884	282	1971.1	87.1	4.6	Y	TRUE	TRUE	FALSE
S7S	2041	306	2002.9	-38.1	1.9	Y	TRUE	TRUE	FALSE
S8N	727	109	661.7	-65.3	9	Y	TRUE	TRUE	FALSE
S8S	1127	169	1158.1	31.1	2.8	Y	TRUE	TRUE	FALSE
S9E	1030	154	986	-44	4.3	Y	TRUE	TRUE	FALSE
S9W	809	121	860	51	6.3	Y	TRUE	TRUE	FALSE
W10E	1017	152	953.9	-63.1	6.2	Y	FALSE	FALSE	FALSE
W10W	983	147	1136.8	153.8	15.6	N	FALSE	FALSE	FALSE
W11E	544	82	590.8	46.8	8.6	Y	FALSE	FALSE	FALSE
W11W	636	95	614.2	-21.8	3.4	Y	FALSE	FALSE	FALSE
W12N	410	61	440.7	30.7	7.5	Y	FALSE	FALSE	FALSE
W12S	401	60	437.7	36.7	9.1	Y	FALSE	FALSE	FALSE
W1N	510	76	559	49	9.6	Y	TRUE	FALSE	FALSE
W1S	458	69	432	-26	5.7	Y	TRUE	FALSE	FALSE
W2E	920	138	929	9	1	Y	FALSE	FALSE	FALSE
W2W	913	137	873.6	-39.4	4.3	Y	FALSE	FALSE	FALSE
W3N	1278	191	1439.8	161.8	12.7	Y	FALSE	FALSE	TRUE
W3S	1329	199	1403	74	5.6	Y	FALSE	FALSE	TRUE
W4E	735	110	910.8	175.8	23.9	N	FALSE	FALSE	FALSE
W4W	741	111	886.5	145.5	19.6	N	FALSE	FALSE	FALSE
W5E	844	126	663	-181	21.4	N	FALSE	FALSE	FALSE
W5W	733	109	704	-29	4	Y	FALSE	FALSE	FALSE
W6N	650	97	598.3	-51.7	8	Y	FALSE	FALSE	TRUE
W6S	623	93	577.5	-45.5	7.3	Y	FALSE	FALSE	TRUE
W7N	982	147	884.7	-97.3	9.9	Y	FALSE	FALSE	FALSE

W7S	979	146	923.2	-55.8	5.7	Y	FALSE	FALSE	FALSE
W8E	228	34	247.5	19.5	8.6	Y	FALSE	FALSE	FALSE
W8W	208	31	238.7	30.7	14.8	Y	FALSE	FALSE	FALSE
W9N	427	64	467.8	40.8	9.5	Y	FALSE	FALSE	FALSE
W9S	413	62	451.9	38.9	9.4	Y	FALSE	FALSE	FALSE

Appendix O Screenline Reporting - 5%, 10% and GEH

O.1 Prior Assignment

Table 121. Calibration Screenline sites within 5% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	30%	36%	30%	26%	16%	18%
Innovation Corridor	27%	42%	26%	36%	15%	15%
Pan Northern Connectivity	20%	23%	20%	10%	37%	37%
Fully modelled Area	27%	31%	25%	25%	24%	26%

Table 122. Validation Screenline sites within 5% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	14%	36%	50%	21%	21%	36%
Innovation Corridor	20%	30%	30%	0%	20%	30%
Pan Northern Connectivity	10%	30%	40%	10%	30%	0%
Fully modelled Area	35%	40%	39%	22%	35%	38%

Table 123. All Screenline sites within 5% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	27%	36%	34%	25%	17%	22%
Innovation Corridor	26%	41%	26%	32%	16%	17%
Pan Northern Connectivity	18%	25%	25%	10%	35%	28%
Fully modelled Area	29%	33%	28%	24%	27%	29%

Table 124. Calibration Screenline sites within 10% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	52%	56%	56%	46%	36%	34%
Innovation Corridor	52%	70%	50%	55%	39%	50%
Pan Northern Connectivity	43%	50%	33%	23%	63%	53%
Fully modelled Area	46%	53%	43%	41%	45%	44%

Table 125. Validation Screenline sites within 10% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	71%	57%	64%	36%	71%	64%
Innovation Corridor	80%	60%	50%	0%	60%	60%
Pan Northern Connectivity	70%	30%	70%	70%	50%	30%
Fully modelled Area	67%	61%	61%	50%	65%	58%

Table 126. All Screenline sites within 10% for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	56%	56%	58%	44%	44%	41%
Innovation Corridor	55%	68%	50%	47%	42%	51%
Pan Northern Connectivity	50%	45%	43%	35%	60%	48%
Fully modelled Area	51%	55%	47%	43%	50%	47%

Table 127. Calibration Screenline sites with GEH < 4 for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	52%	62%	52%	54%	38%	36%
Innovation Corridor	56%	77%	52%	61%	44%	45%
Pan Northern Connectivity	43%	67%	53%	50%	73%	67%
Fully modelled Area	51%	65%	53%	56%	50%	52%

Table 128. Validation Screenline sites with GEH < 4 for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	64%	64%	79%	64%	64%	71%
Innovation Corridor	90%	70%	70%	50%	70%	70%
Pan Northern Connectivity	50%	50%	50%	70%	50%	10%
Fully modelled Area	57%	67%	63%	64%	64%	61%

Table 129. All Screenline sites with GEH < 4 for Prior Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	55%	63%	58%	56%	44%	44%
Innovation Corridor	61%	76%	54%	59%	47%	49%
Pan Northern Connectivity	45%	63%	53%	55%	68%	53%
Fully modelled Area	52%	65%	55%	58%	54%	54%

O.2 First Calibration Assignment

Table 130. Calibration Screenline sites within 5% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	60%	48%	98%	96%	56%	50%
Innovation Corridor	61%	50%	100%	97%	68%	64%
Pan Northern Connectivity	80%	80%	90%	83%	80%	80%
Fully modelled Area	74%	69%	95%	94%	77%	74%

Table 131. Validation Screenline sites within 5% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	21%	43%	57%	57%	36%	36%
Innovation Corridor	30%	30%	50%	50%	40%	50%
Pan Northern Connectivity	10%	20%	30%	40%	60%	60%
Fully modelled Area	36%	36%	50%	47%	43%	40%

Table 132. All Screenline sites within 5% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	52%	47%	89%	88%	52%	47%
Innovation Corridor	57%	47%	93%	91%	64%	62%
Pan Northern Connectivity	63%	65%	75%	73%	75%	75%
Fully modelled Area	65%	61%	84%	83%	69%	66%

Table 133. Calibration Screenline sites within 10% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	86%	80%	98%	98%	92%	86%
Innovation Corridor	89%	85%	100%	100%	94%	89%
Pan Northern Connectivity	97%	93%	90%	90%	90%	90%
Fully modelled Area	92%	90%	97%	97%	94%	92%

Table 134. Validation Screenline sites within 10% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	71%	93%	86%	86%	86%	93%
Innovation Corridor	80%	90%	80%	60%	70%	80%
Pan Northern Connectivity	60%	70%	50%	50%	60%	60%
Fully modelled Area	67%	74%	69%	69%	67%	64%

Table 135. All Screenline sites within 10% for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	83%	83%	95%	95%	91%	88%
Innovation Corridor	88%	86%	97%	95%	91%	88%
Pan Northern Connectivity	88%	88%	80%	80%	83%	83%
Fully modelled Area	86%	86%	91%	91%	88%	85%

Table 136. Calibration Screenline sites with GEH < 4 for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	88%	86%	100%	100%	94%	94%
Innovation Corridor	88%	86%	100%	100%	92%	92%
Pan Northern Connectivity	97%	100%	90%	93%	90%	90%
Fully modelled Area	93%	93%	97%	97%	94%	94%

Table 137. Validation Screenline sites with GEH < 4 for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	64%	86%	93%	100%	100%	100%
Innovation Corridor	70%	80%	90%	80%	90%	90%
Pan Northern Connectivity	30%	60%	60%	70%	60%	70%
Fully modelled Area	61%	71%	76%	82%	68%	71%

Table 138. All Screenline sites with GEH < 4 for First Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	83%	86%	98%	100%	95%	95%
Innovation Corridor	86%	86%	99%	97%	92%	92%
Pan Northern Connectivity	80%	90%	83%	88%	83%	85%
Fully modelled Area	85%	88%	92%	94%	88%	89%

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Table 139. Calibration Screenline sites within 5% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	58%	48%	88%	88%	60%	50%
Innovation Corridor	61%	48%	98%	95%	71%	62%
Pan Northern Connectivity	80%	77%	83%	80%	83%	70%
Fully modelled Area	75%	69%	92%	91%	80%	75%

Table 140. Validation Screenline sites within 5% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	79%	71%	100%	100%	79%	71%
Innovation Corridor	80%	60%	100%	100%	90%	80%
Pan Northern Connectivity	90%	90%	100%	100%	90%	90%
Fully modelled Area	86%	85%	99%	94%	82%	78%

Table 141. All Screenline sites within 5% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 5%	All	Car	All	Car	All	Car
Mass Transit	63%	53%	91%	91%	64%	55%
Innovation Corridor	63%	50%	99%	96%	74%	64%
Pan Northern Connectivity	83%	80%	88%	85%	85%	75%
Fully modelled Area	78%	73%	94%	91%	80%	75%

Table 142. Calibration Screenline sites within 10% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	86%	74%	92%	92%	96%	92%
Innovation Corridor	89%	80%	100%	100%	95%	94%
Pan Northern Connectivity	93%	93%	90%	87%	87%	83%
Fully modelled Area	91%	88%	96%	96%	96%	94%

Table 143. Validation Screenline sites within 10% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	100%	100%	100%	100%	100%	100%
Innovation Corridor	100%	100%	100%	100%	100%	100%
Pan Northern Connectivity	100%	100%	100%	100%	100%	100%
Fully modelled Area	99%	97%	99%	99%	96%	94%

Table 144. All Screenline sites within 10% for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
Within 10%	All	Car	All	Car	All	Car
Mass Transit	89%	80%	94%	94%	97%	94%
Innovation Corridor	91%	83%	100%	100%	96%	95%
Pan Northern Connectivity	95%	95%	93%	90%	90%	88%
Fully modelled Area	93%	90%	97%	97%	96%	94%

Table 145. Calibration Screenline sites with GEH < 4 for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	92%	86%	96%	98%	96%	98%
Innovation Corridor	89%	85%	100%	100%	94%	95%
Pan Northern Connectivity	97%	97%	90%	90%	90%	90%
Fully modelled Area	93%	91%	96%	97%	95%	96%

Table 146. Validation Screenline sites with GEH < 4 for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	100%	100%	100%	100%	100%	93%
Innovation Corridor	100%	100%	100%	100%	100%	100%
Pan Northern Connectivity	100%	100%	100%	100%	100%	100%
Fully modelled Area	96%	93%	96%	97%	92%	92%

Table 147. All Screenline sites with GEH < 4 for Second Calibration Assignment

Count Site -	AM (0800-0900)		IP		PM (1700-1800)	
GEH < 4	All	Car	All	Car	All	Car
Mass Transit	94%	89%	97%	98%	97%	97%
Innovation Corridor	91%	87%	100%	100%	95%	96%
Pan Northern Connectivity	98%	98%	93%	93%	93%	93%
Fully modelled Area	93%	91%	96%	97%	94%	95%

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