## Intermodal Logistics Park North Ltd

# INTERMODAL LOGISTICS PARK NORTH (ILPN)

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## Intermodal Logistics Park North (ILPN) Strategic Rail Freight Interchange (SRFI)

**Project reference TR510001**

## Preliminary Environmental Information Report (PEIR)

## Appendix 7.1: Local Model Validation Report

## October 2025

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**Planning Act 2008**

**The Infrastructure Planning (Environmental Impact Assessment) Regulations 2017**

**This document forms a part of a Preliminary Environmental Information Report (PEIR) for the Intermodal Logistics Park North (ILPN) project.**

A PEIR presents environmental information to assist consultees to form an informed view of the likely significant environmental effects of a proposed development and provide feedback.

This PEIR has been prepared by the project promoter, Intermodal Logistics Park North Ltd. The Proposed Development is described in Chapter 3 of the PEIR and is the subject of a public consultation.

**Details of how to respond to the public consultation are provided at the end of Chapter 1 of the PEIR and on the project website:**

**https://www.tritaxbigbox.co.uk/our-spaces/intermodal-logistics-park-north/**

This feedback will be taken into account by Intermodal Logistics Park North Ltd in the preparation of its application for a Development Consent Order for the project.

# Revision Record

| Revision | Description | Author | Date | Quality Check | Date | Independent Review | Date |
|---|---|---|---|---|---|---|---|
| P01 | First Draft | JL | Aug 25 | JP | Aug 25 | AR | Aug 25 |
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# Glossary

| Term | Definition |
|---|---|
| Buffer | Buffer network is a simplified version of the simulation network for away from our area of interest |
| Convergence | The seek for network stability (Wardrop's First Principle of Traffic Equilibrium or User Equilibrium) |
| Delta statistic or % gap | The difference between the costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as a percentage of the minimum costs, usually known as 'Delta' or the '%GAP |
| GEH | Geoffrey E. Havers statistic formula |
| HGV | Heavy Goods Vehicle |
| LGV | Light Goods Vehicle |
| ARR | Analytical Requirements Report |
| ATC | Automatic Traffic Counts |
| DCO | Development Consent Order |
| DfT | Department for Transport |
| GIS | Geographic Information System |
| HAM | Highway Assignment Model |
| ILP | Intermodal Logistic Park |
| LCRTM | Liverpool City Regional Transport Model |
| MCC | Manual classified counts |
| ME | Matrix Estimation |
| MSOA | Middle-layer Super Output Area |
| MSR | Model Specification Report |
| NTEM | National Trip End Model |
| NTRP | National Road Traffic Projections |
| OD | Origin / Destination |
| PCU | Passenger Car Unit |
| PLRM | Parkside Link Road Model |
| PPK | Price per Kilometre |
| PPM | Price per Minute |
| RTM | Regional Transport Models |
| SATURN | Simulation and Assignment of Traffic to Urban Road Networks |
| SHILPM | St Helens Intermodal Logistics Park Model |
| SRFI | Strategic Rail Freight Interchange |
| SRN | Strategic Road Network |
| TA | Transport Assessment |
| TAG | Transport Analysis Guidance |
| TWG | Transport Working Group |
| VDM | Variable Demand Model |

# 1 Introduction

## 1.1 Background

Stantec have been appointed by Tritax via Hydrock, now Stantec, to provide transport modelling support for a Development Consent Order (DCO) application for a proposed Intermodal Logistic Park North (ILP North) near St Helens. The proposed development is within St Helens Council, along the border of both Wigan Metropolitan Borough Council and Warrington Borough Council. It is located to the east of Newton-le-Willows on the eastern edge of the M6 motorway near Junction 22. Figure 1:1 shows the proposed ILP North site boundaries within the local context and surrounding motorways.

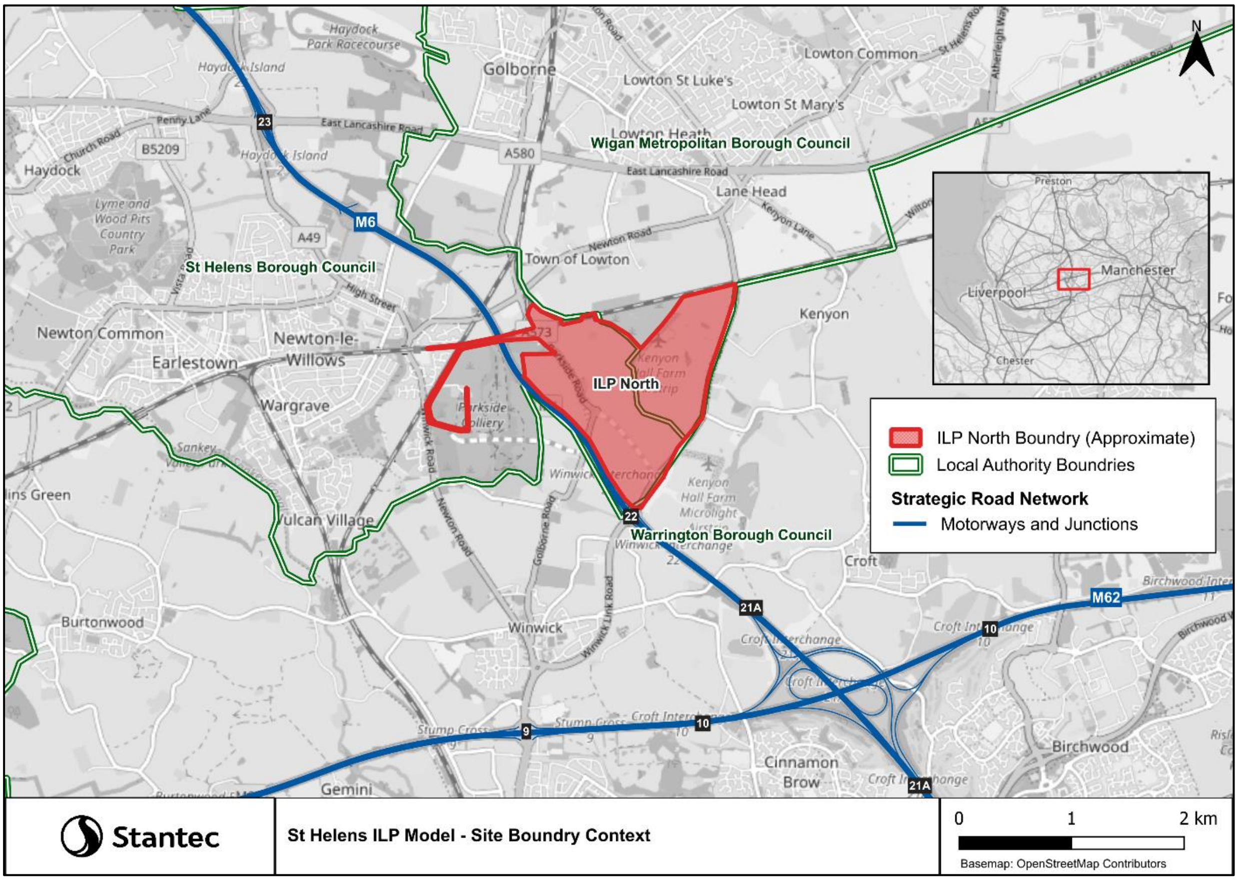


*Figure 1:1: ILP North Main Site Boundaries and Local Authority Boundaries**

**Note: Main Site Order Limits shown correct at the time of preparation of this document but have since been updated as shown in PEIR Figure 1.1*

The Proposed Development (the DCO Site) is a new Strategic Rail Freight Interchange (SRFI). The site will incorporate the following elements:

- An intermodal area (the Railport), where containers are lifted between rail freight wagons and container lorries
- Rail connected buildings: a warehouse or other building either with its own dedicated rail siding or which is sufficiently close to the railport to allow containers to be moved from the rail wagons into the warehouse by overhead cranes or reach stackers, without the need for them to be loaded onto an HGV or Tugmaster vehicle

- Rail served buildings: a warehouse forming part of the SRFI, but which would require containers to be moved from or to the railport by means of an HGV or Tugmaster vehicle
- Rail-accessible buildings with the potential either to be rail-connected or rail-served.

To support the DCO's Transport Assessment (TA), the modelling will seek to assess development traffic impacts at a strategic level including parts of the road network operated and managed by St Helens Borough Council, Warrington Borough Council, Wigan Metropolitan Borough Council, and National Highways.

The modelling will be in the form of a highway assignment model. This model will be referred to as the St Helens Intermodal Logistics Park Model (SHILPM). This report summarises the methodology which has been adopted to build and validate the base year model.

## 1.2 Model Coverage

The model coverage area is shown in Figure 1:2

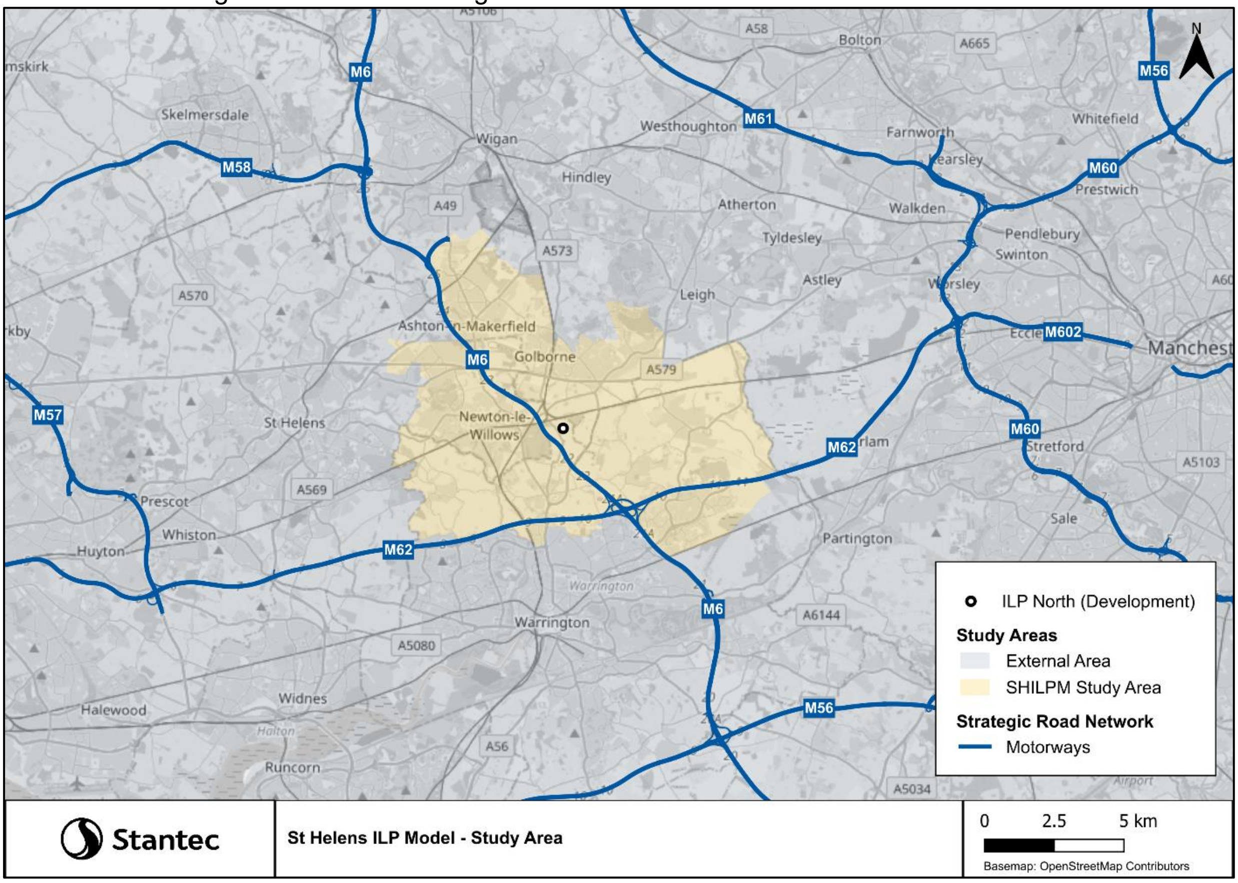


Figure 1:2. It partially covers areas in three Local Authorities, which are St Helens, Wigan, and Warrington. The model will cover the SRN and other main roads in the area, including the M6, M62, and A580. Further details on the model network extents are described in Section 4.1.

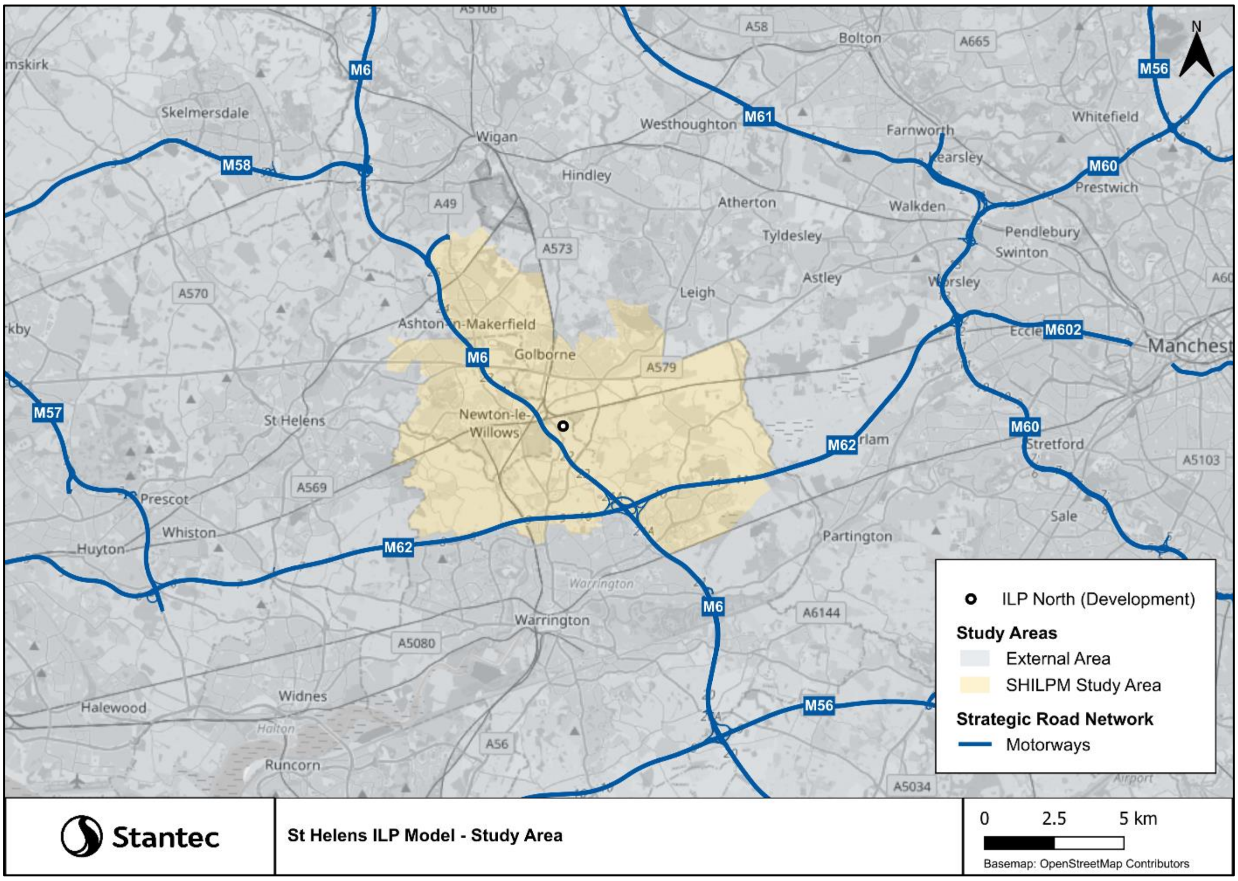


*Figure 1:2: Model Coverage*

## 1.3 Local Context

Figure 1:1 shows the site boundaries for the proposed ILP North, along with the local authority boundaries and surrounding motorway network. The proposed ILP North is located east of Netwton-le-Willows, approximate mid-way between Manchester and Liverpool. The proposed site at the convergence point of several major road and rail links severing the whole of Great Britain. In terms of road infrastructure, the proposed ILP North is situated near the M6 at Junction 22. It is also two miles north of the M62. In terms of rail infrastructure, the site is just west of the West Coast Mainline and south of the Liverpool to Manchester Lines.

The site is located at the tripoint of three local authorities. Most of the site is within the St Helens Borough Council Boundary, with a portion of the north-eastern end of the site being within the Wigan Metropolitan Borough Council boundaries. The site is also situated along the border between St Helens and Warrington Borough Council. Notably, the initial masterplan outline for the site shows the main access points to the development are all within St Helens.

The current land-uses on the site are agricultural. There is a small unpaved airstrip at Keyon Farm Hall which is a private airstrip suitable for light aircraft only. The nearest town is Newton-le-Willows, which has a population of around 24,000 people in the 2021 census.

## 1.4 Modelling Hierarchy

The ILP North development DCO application has used a modelling hierarchy to ensure communication and data can be properly shared between all modelling elements.

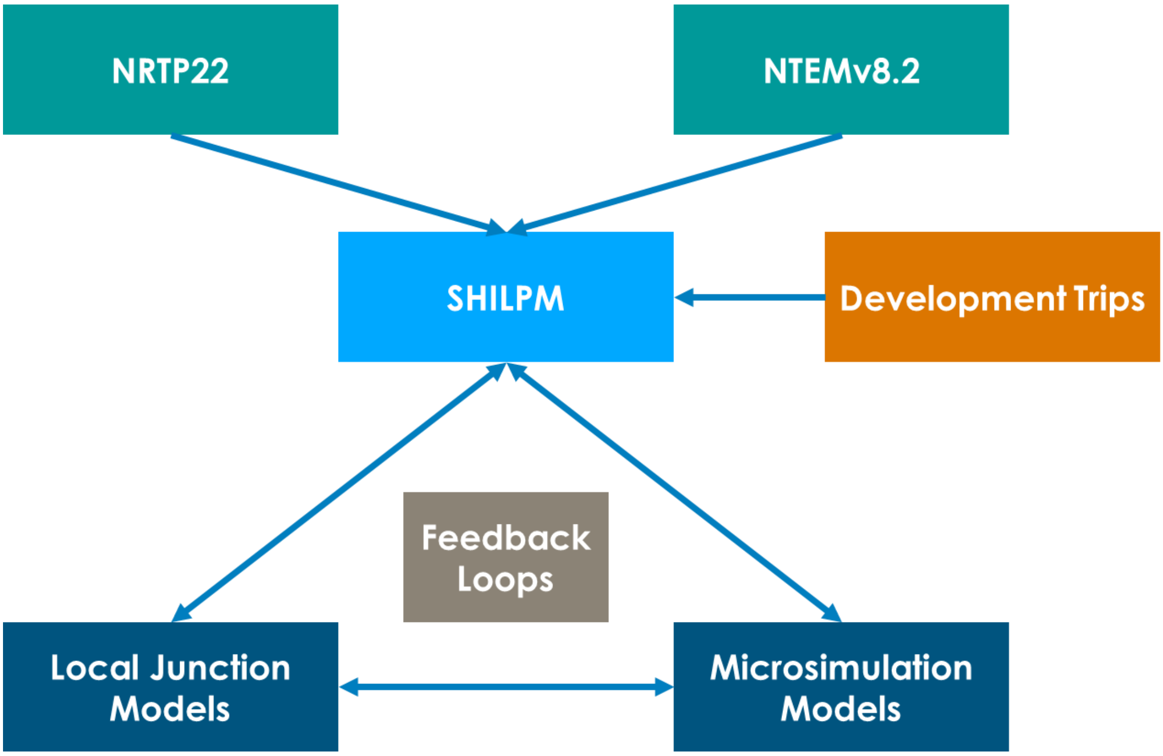


*Figure 1:3: ILP North Modelling Hierarchy*

Figure 1:3 shows the ILP North modelling hierarchy. There are three levels of modelling:

- SHILPM
  - To address substantive route choice across the model
- Microsimulation Models e.g. the Lane Head VISSIM, the Strategic Road Network VISSIM
  - For the assessment of adjacent junctions, where interrelation is expected
- The Local Junction models e.g. LinSIG or Junctions models
  - For the assessment of stand-alone junctions

Each level of modelling has a specific role and feed data into the other levels via feedback loops. This enables each modelling type to be used to its strengths while ensuring a robust range of assessment is undertaken.

## 1.5 Report Structure

This Local Model Validation Report is structured as follows:

- Chapter 2 – Model Overview
- Chapter 3 – Model Data
- Chapter 4 - Network Development
- Chapter 5 – Model Calibration and Validation Overview

- Chapter 6 – Network Assignment Calibration
- Chapter 7 – Matrix Calibration
- Chapter 8 – Assignment Validation Results
- Chapter 9 – SHILPM Base Year Model Build Summary
- Chapter 10 – Statement of Model Suitability

# 2 Model Overview

## 2.1 Model Specification Overview

The model specification and approaches where outlined in the Model Specification Report P02 (February 2025). The Model Specification Report (MSR) describes the strategic traffic modelling approach that will support the Transport Assessment (TA) for the Development Consent Order (DCO) application for a proposed Intermodal Logistic Park North (ILP North) near St Helens.

The purpose of the MSR was to inform stakeholders on how the strategic traffic modelling requirements related to traffic and environment set out within the Analytical Requirements Report (ARR) will be met, taking account of budgetary, programme, political, environmental and spatial constraints. The version of ARR, which provided the basis for this MSR is Version 4 (Stantec, October 2024).

Both the ARR and MSR where reviewed and agreed by the Transport Working Group (TWG) which included representatives from St Helens Council, Wigan Council, Warrington Council and National Highways. This ensured that the key stakeholders had the opportunity to provide comments and allow Stantec to incorporate these where possible into the modelling approach. Deviations from the MSR approach, where necessary, where agreed with the TWG stakeholders as part of the Base Model build process and accompanying regular stakeholder engagement throughout this process.

## 2.2 Model Software

The SHILPM highway assignment model has been developed in SATURN (Simulation and Assignment of Traffic to Urban Road Networks) software package 11.6.03A .

SATURN is a widely used software package for highway assignment modelling. At a basic level the model is made up of a highway network (supply) and a matrix of trips (demand). In broad terms the network is made up of a series of junctions (known as nodes) and sections of road between junctions (known as links). The model area is split into a number of zones and a matrix is developed to represent all trips between each of these zones. Zones are connected to the network using a series of connectors, otherwise known as zone centroid connectors, which reflect points where trips from a zone are loaded on to the network. The trip matrix is then assigned to the network.

One of the main benefits of using SATURN for the assignment process is that it is applicable to both urban and rural networks and can model peak hour congestion in sufficient detail. As a combined simulation and assignment model, SATURN also has the advantage that it enables detailed junction modelling. The assignment model predicts routes that drivers will choose and the way that traffic demand interacts with the available road capacity based on perceived costs of travel by competing routes. The underlying principle used in the adopted assignment algorithm is Wardrop’s First Principle of Traffic Equilibrium. Wardrop’s First Principle states that:

*"Traffic arranges itself on networks such that the cost of travel on all routes used between each OD pair is equal to the minimum cost of travel and all unused routes have equal or greater cost".*

The aim of the assignment model is to reach equilibrium such that costs and flows are in balance under the assumption that individual users will seek to minimise their costs of travel through the network.

## 2.3 Existing Traffic Models

A review of existing traffic models was undertaken as part of the Analytical Requirements Report P04 (Stantec, October 2024). The following models were identified in the review:

- Parkside Link Road Model
- St Helens SATURN Model
- Warrington Multi Model Transport Model 2016
- Liverpool City Region Transport Model
- Trans Pennine South Regional Traffic Model (2nd Generation)

Based on this review, the Parkside Link Road Model (PLRM) was identified to be updated and extended for the development of the SHILPM. The PLRM was chosen as the modelling base for the SHILPM model because the PLRM provides good coverage in the scheme area and has been used (and accepted by St Helens Council) as evidence for a recent planning application in the scheme area. It was also the recommended modelling base in the Mott MacDonald review undertaken for St Helens Council.

## 2.4 Model Year and Time Periods

The model has been developed with a base year of 2024. This is because the data used in the model development was collected in October 2024.

The models have been developed to reflect the worst traffic conditions on a typical weekday. This would represent a period during school term time and avoid large scale events or periods within the year, where traffic conditions may not be typical, such as the Christmas period.

The SHILPM covers the following weekday peak hours:

- **AM Peak -** Peak hour of the morning (AM) peak period (08:00-09:00).
- **Interpeak -** Average hour of the inter-peak (IP) period (average hour 10:00-16:00).
- **PM Peak -** Peak hour of the evening (PM) peak period (17:00-18:00).

## 2.5 Vehicle Types and Travel Purposes

Table 2-1 Table 2-1 summarises the vehicle types and user classes have been included within the model. In summary, the model includes three vehicle classes for cars, light goods vehicles (LGVs), and heavy goods vehicles (HGVs). The car vehicle class is further disaggregated into three car user classes, covering business, commuting, and other travel purposes.

*Table 2-1. Vehicle and User Classes used in the SHILPM.*

| User Class Number | Vehicle Class Number | Vehicle Class | User Class |
|---|---|---|---|
| 1 | 1 | Car | Car Employer Business |
| 2 | | | Car Commuting |
| 3 | | | Car Other |
| 4 | 2 | Light Goods Vehicles (LGVs) | Light Goods Vehicles (LGVs) |
| 5 | 3 | Heavy Goods Vehicles (HGVs) | Heavy Goods Vehicles (HGVs) |

### 2.5.1 Passenger Car Unit (PCU) Factors

Passenger Car Units (PCU) is used as the standard unit for demand and capacity within the model. This allows for the impact of large vehicles which take up more road space and take longer to clear junctions to be accounted for. The PCU equivalent values used within the SHILPM are from TAG Unit M3.1 Section E.7[1].

- Car - 1.0
- LGV – 1.0
- HGV – 2.5

## 2.6 Model Version

The current version of the model is v22.4. This represents the latest version of the SHILPM Base Year Model, and incorporates changes made following several rounds of comments by Transport Working Group (TWG) stakeholders.





**Intermodal Logistic Park (ILP) North, St Helens - Local Model Validation Report**
Appendix A Route Trees

**Intermodal Logistic Park (ILP) North, St Helens - Local Model Validation Report**
Appendix A Route Trees

[1] TAG unit M3-1 highway assignment modelling - GOV.UK

# 3 Model Data

## 3.1 Introduction

This section describes the data used for the development of the SHILPM. This includes both existing data and new data that has been collected for the purposes of the model development. The extent of the data collected was discussed and agreed with the TWG and covered an area wider than the extent of the existing PLRM model. This was partly to allow for possible future extensions of PLRM network and also to allow better coverage should local junction modelling be required in areas not covered by SHILPM. The full agreed data collection scope can be found in *TN002 – Data Collection Scope (12th September 2024)*.

## 3.2 Traffic Data

### 3.2.1 Automatic Traffic Counts

Prior to model development, locations for 28 core ATC surveys, 25 optional local network ATC surveys, and three optional ATC surveys on the M6 motorway were identified for data collection.

Total Traffic Solutions (all non-SRN counts) and Intelligent Data Collection (SRN only) were commissioned to undertake the data collection. In total, 59 ATC survey locations were recorded. All ATC surveys were undertaken between 7th – 18th October 2024. These were undertaken using tubes, secured to appropriate street furniture. For sites on the motorway network, cameras secured to appropriate street furniture away from the mainline carriageway were used. Figure 3:1 shows the location of Automatic Traffic Counts (ATCs) commissioned and used for the development of the SHILPM.

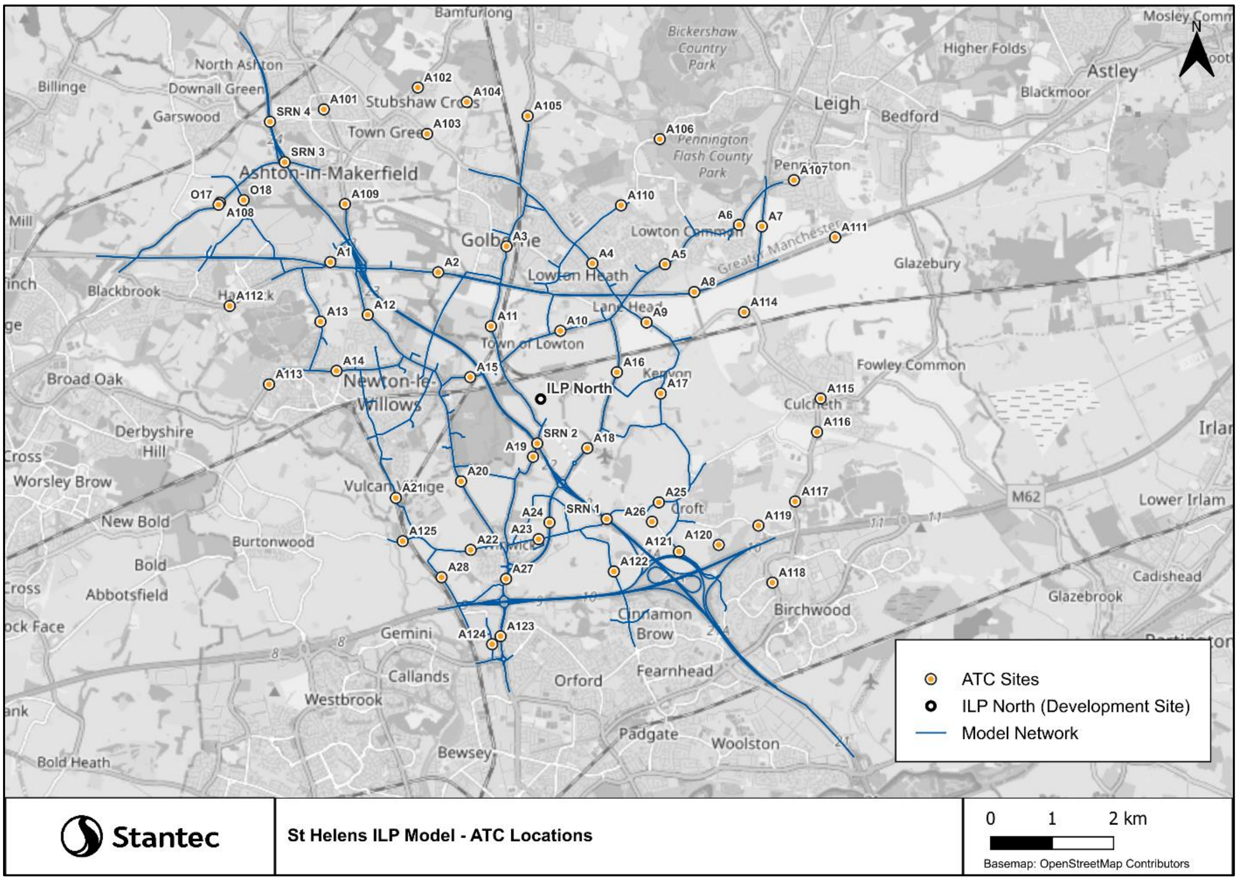


*Figure 3:1: ATC Sites used for the SHILPM Model Development*

### 3.2.2 Manual Classified Turning Counts

Manual classified counts (MCCs) are counts undertaken at junctions, normally utilising video technology and are used to record all turning movements through a junction. Prior to model development, 49 core MCC locations and 33 optional MCC locations were identified.

Figure 3:2 shows the locations of Manual Classified Turning Counts (MCCs) used for the development of the SHILPM. Total Traffic Surveys were commissioned to undertake the MCC surveys. The surveys were undertaken on single days on either Thursday 10th or 17th October (site dependant). The data was fully classified into car, LGV, OGV1, OGV2, PSV, motorcycles and cycles and is recorded in 15-minute periods.

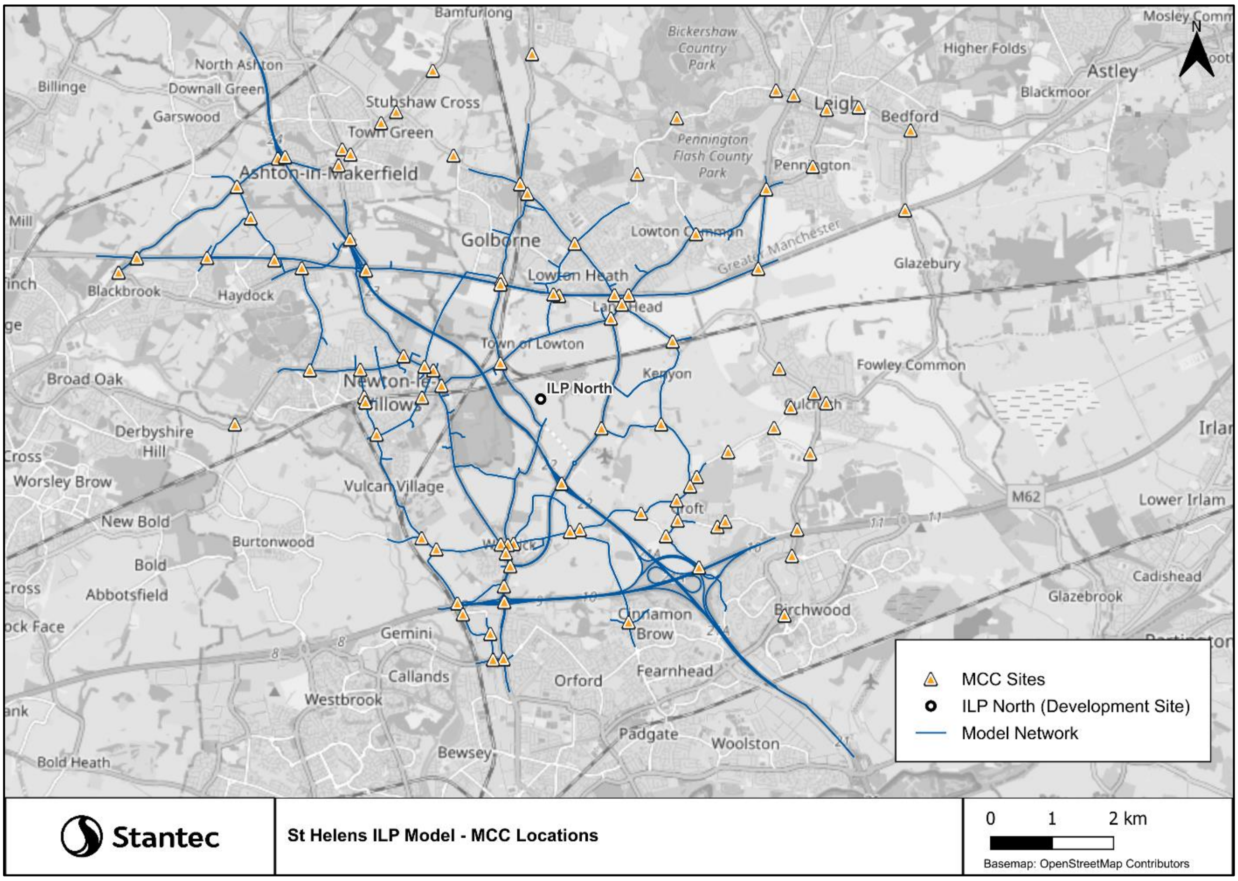


*Figure 3:2: MCC Locations used for SHILPM development*

### 3.2.3 Journey Time Data

Travel time data is required to enable validation of modelled journey times.

To assess the modelled journey times, TomTom journey time data was extracted for the routes shown in Figure 3:3 covering Tuesdays. Wednesdays and Thursdays in the period between Mon 9th September 2024 to Friday 18th October 2024. This covered a six-six-week period including the main ATC and MCC data collection window. This covered the times of 07:00-19:00 in 30minute intervals and was broken down into shorter sections to allow more granular assessment of the routes and where delay occurred.

Figure 3:3 shows the journey time routes for which data was collected to validate modelled journey times. The individual route details are shown in Table 3-1.

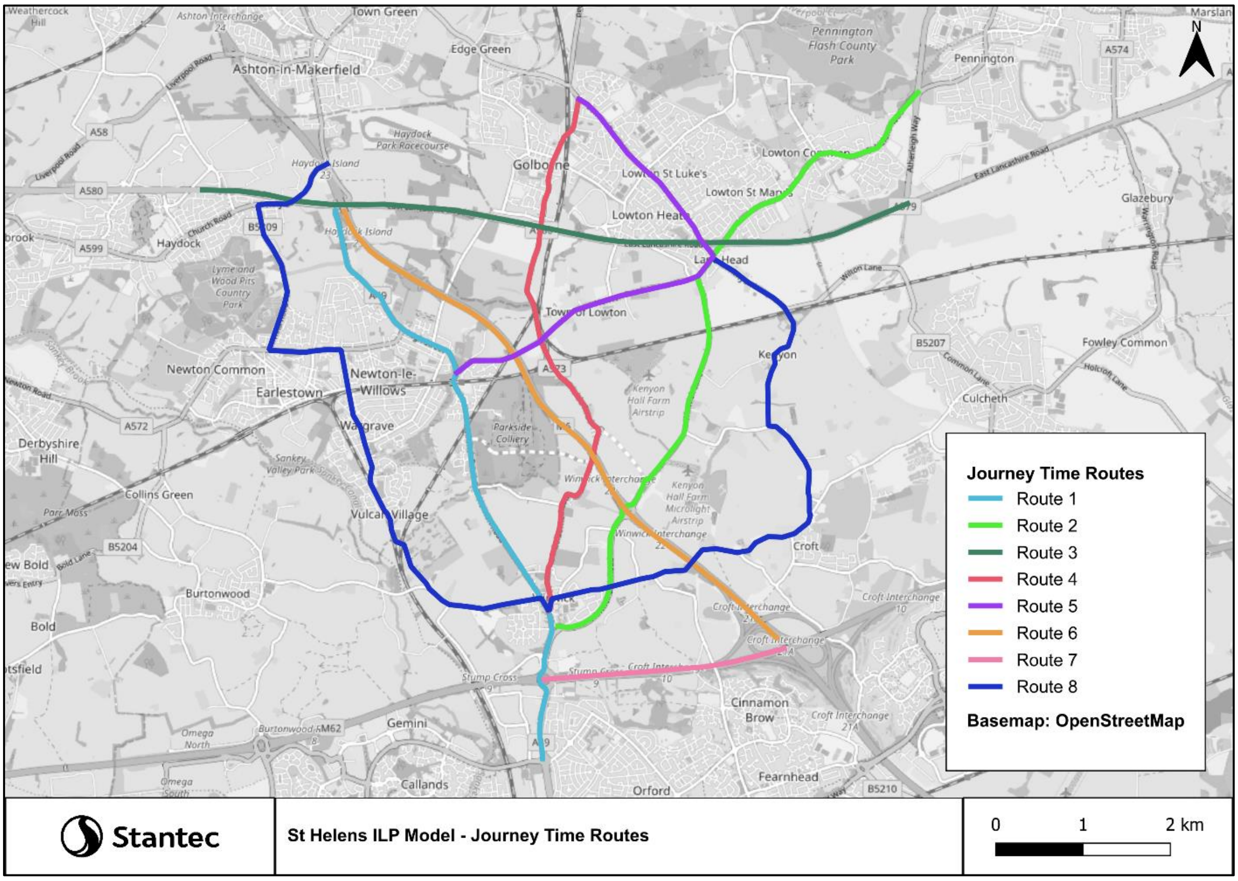


*Figure 3:3: Map of Journey Time Routes used for Validation*

*Table 3-1: Description of Journey Time Routes for Validation*

| Route Number | Route Short Name | Route Detail |
|---|---|---|
| 1 | A49 | A580 East Lancashire Road/M6 roundabout to A49 Winwick Road/Sandy La West/A574 Cromwell Avenue roundabout |
| 2 | A579 | A49 Newton Road/A49 Winwick Link Road/Winwick Park Avenue roundabout to A572 St Helens Road / A759 Atherleigh Way junction |
| 3 | A580 | A580 East Lancashire Road (at the point where Piele Rd passes underneath) to A580 East Lancashire Road (where it crosses the A579 Atherleigh Way) |
| 4 | A573 | A573 Church Street/A573 Ashton Road / Winnard St/B5207 Lowton Road junction to A49 Newton Road/A573 Golborne Road junction |
| 5 | A572/B5207 | A49 Church Street/A572 Southworth Road/A49 Mill Lane junction to A573 Church Street/A573 Ashton Road / Winnard St/B5207 Lowton Road junction |
| 6 | M6 | A580 East Lancashire Road/M6 roundabout to M62 (where the M6 passes underneath) |
| 7 | M62 | A49 Newton Road/M62 roundabout to M62 (where the M6 passes underneath) |
| 8 | South Loop | A49 Lodge Lane/A599 Penny Lane junction to A572 Newton Road/B5207 Kenyon Lane/B5207 Church Lane staggered junction |

### 3.2.4 National Highways WebTRIS Data

Figure 3:4 shows the locations of WebTRIS count sites that has been extracted and used for the model development.

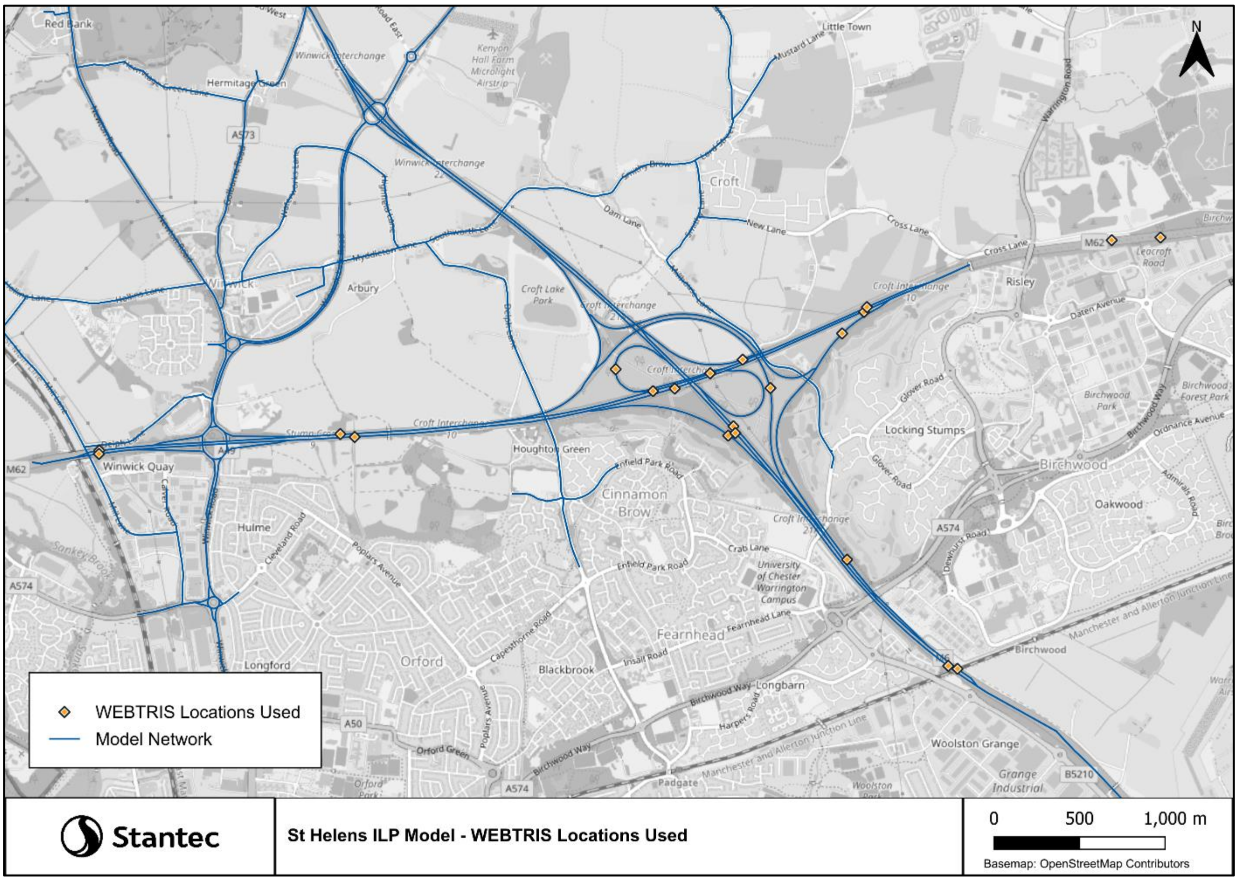


*Figure 3:4: WebTRIS Locations Used*

### 3.2.5 Transport Assessment Data for Other Developments

Two major logistics sites were identified as being completed between the development of the PLRM and the dates of the traffic count collection in October 2024. These were the Florida Fields site (currently occupied by logistics hubs for Amazon and Kelloggs, planning reference: P/2016/0608/HYBR) and the Haydock Green site (currently occupied by Movianto, planning reference: P/2015/0571/HYBR). These are both within the Haydock Lane Industrial Estate. The Transport Assessment data for these developments was obtained to support the matrix calibration and add the appropriate number of trips for these sites to the matrix.

The publicly available Transport Assessment data for both sites were obtained from the St Helens Borough Council Planning Search Tool. Further detail on how these were used in matrix calibration is described in Section 7.2.2.

## 3.3 Traffic Signal Data

Traffic signal data was provided by St Helens Borough Council, Wigan Metropolitan Borough Council, Warrington Borough Council, and National Highways. The data provided the initial signal timing data for input into the SATURN model by period. This includes information on phase movements by stage and inter-green times. Where complete signal information is not available, manual signal optimisation and adjustment was performed where unrealistic delays were noted in the model.

## 3.4 Vehicle Weight and Height Restrictions

Details of the locations of vehicle weight and vehicle height restrictions were provided by St Helens Borough Council, Wigan Metropolitan Borough Council, and Warrington Borough Council. This included the geographical location of restriction and the maximum weight or heigh permissible within the local authority areas. The locations of the restrictions were digitised using GIS and this was subsequently used to identify which model links would be impacted by a weight and/or height restriction.

# 4 Network Development

## 4.1 Network Extent

The model network in shown in Figure 4:1. The model extent includes the entire extent of the previous PLRM network, along with several additional extensions to the original PLRM network, as described in section 4.2.

The SHIPLM network consists of a single detailed simulation area partially covering St Helens, Wigan and Warrington. It also includes main roads and motorways in the area, including the M6 mainline between Junction 25 and Junction 21, the M62 between Junction 9 and immediately east of Junction 10, and the A580. As Variable Demand Modelling (VDM) is not required, no buffer network has been modelled to assign traffic entering or leaving the detailed network area.

The model area is characterised by representation of all trips, with small zones, very detailed network and junction modelling (including flow metering and blocking back). This requires a representation of each junction. This needs to include:

- Junction type (e.g. signal controlled, priority etc.);
- Signal timings where appropriate;
- Lane allocations;
- Priorities;
- Movement capacities

The extent of the network and the specific roads included was agreed with the Transport Working Group with extensions added to the original PLRM model, specifically on the A580 west of the M6 J23, extending the M6 north to north of M6 J24 and extending the network south of the M62 to cover the A49 corridor and the Winwick Quay industrial estate. These changes are detailed in section 4.2.

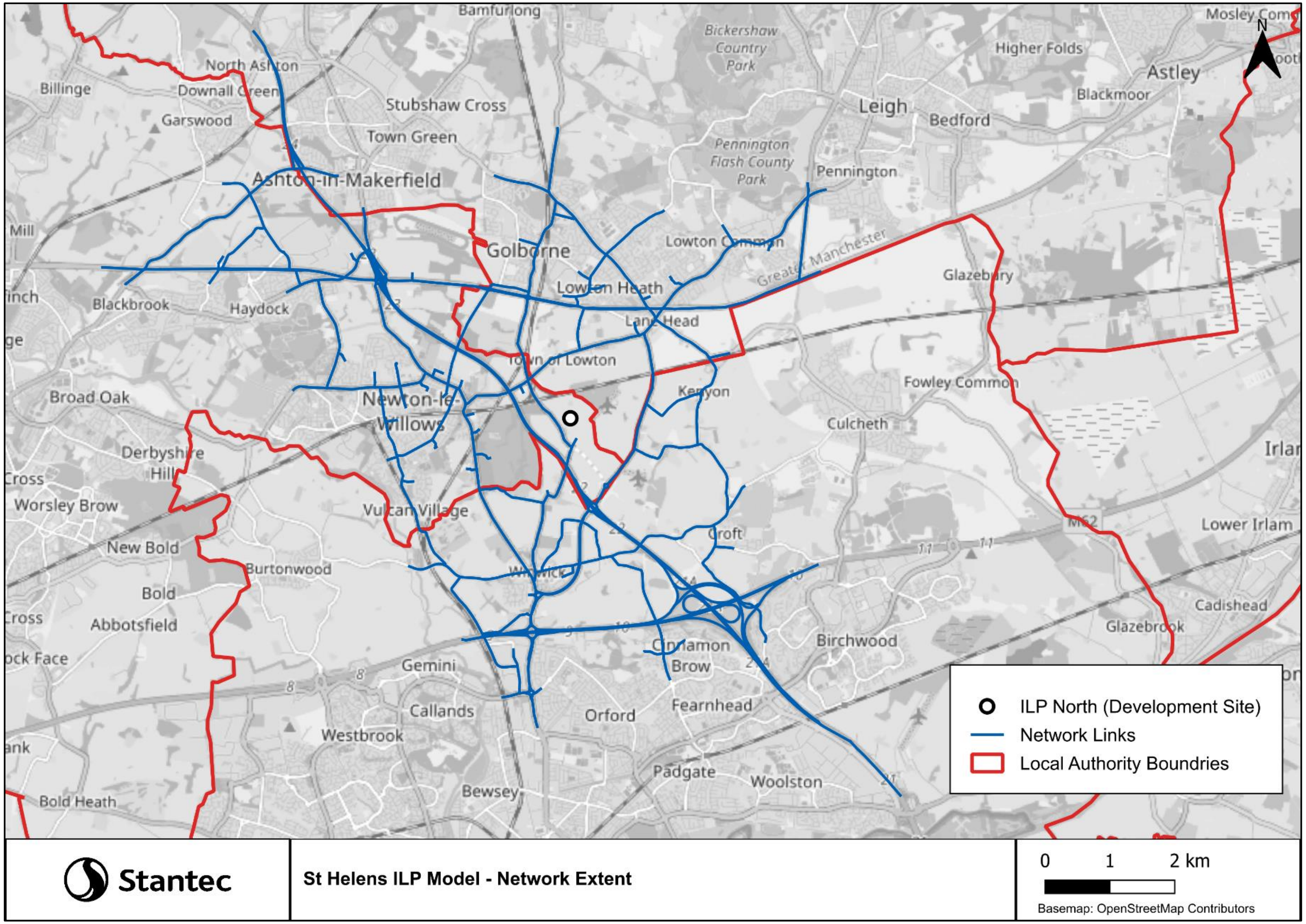


*Figure 4:1: SHILPM Network Extent*

## 4.2 Network Structure and Coding

### 4.2.1 Changes to the PLRM Network Coding

SHILPM's network is based on the network coding used by the PLRM. Network coding within the existing PLRM was enhanced to include any changes within the study area not captured by the PLRM network. Refinement of the PLRM network coding was also undertaken where necessary to improve the representativeness of the network and accurately capture the actual conditions at the time of the count data collection around October 2024. This included the following:

- Updating of junction types and the network structure where changes have occurred.
- Updating of network structure and junction coding where there were inaccuracies identified in the original PLRM network coding.
- Refinement of network coding at M6 Junction 23 (Haydock Island).
- Refinement of lane-turning permissions at junctions and the number of link lanes where necessary.
- Update and refinement of give-way, merge, and opposed turn markers to reflect junction conditions.
- Addition of flared left-turn or right-turn lanes where they were not coded in the PLRM.
- Updates to traffic signal phasing, staging and timing based on data provided by the respective local authorities.
- Updates to network link distances, speeds, and speed flow curves based on review of coding, to be consistent with the National Highways Regional Traffic Models 2 (RTM2) Network Coding Manual.
- Updating the coding of motorway merges/diverges to be consistent with the coding guidelines provided in the National Highways RTM2 Network Coding Manual.
- Changes to the location of links connecting to model zones to be consistent with updates model zoning system, discussed in Section 4.3.
- Additional delay coded where Alder Root Lane passes under a single-lane bridge carrying the West Coast Main Line, to simulate delay associated with giving way on a single-lane.

### 4.2.2 Network Extent Extension

For the SHILPM network, the PLRM network coverage was extended to represent several additional sites as agreed and specified in the Model Specification Report (MSR). These include the following locations and junctions:

- The M6 between Junction 23 and Junction 25
- A580 East Lancashire Road between M6 Junction 23 and the junction with the A58 Liverpool Road and A58 Stanely Bank Way
- A58 Liverpool Road between M6 Junction 24 and the junction with A580 East Lancashire Road
- A49 Winwick Road between M62 Junction 9 and access to the Junction NIE Retail Park. This includes the signalised roundabout between the A49 Winwick Road, A574 Cromwell Avenue, and Sandy Lane West.
- Route between priority junction at Delph Lane and signalised junction at A574 Cromwell Avenue east of the A49 Winwick Road, using Mill Lane and Calver Road.
- Route between priority junction at Southworth Lane and roundabout with Ballater Drive, Endfield Park Road, and Blackbrook Avenue, using Delph Lane and Mill Lane.

### 4.2.3 Junction Types and Saturation Flows

The SHILPM consists of various types of junctions including priority junctions, roundabouts and signal-controlled junctions. Within the model, the main delays to a journey predominantly result from traffic interaction at junctions.

To ensure consistency across the model, turn saturation flows have been coded based on the National Highways Regional Traffic Models 2 (RTM2) Network Coding Manual. As a default, all turn saturation flows used from the RTM2 for priority junctions, signal-controlled junctions, and roundabouts have assumed a standard lane width and average visibility. This was subject amendment as necessary as part of the calibration process.

#### 4.2.3.1 Exploded Roundabouts and Junctions

Large roundabouts have been modelled as ‘exploded’ junctions. This refers to a roundabout is represented by several priority and/or signalised junctions. This is a modelling technique that allows the user to enhance the operational performance of a large roundabout junction. This is in line with the National Highways Regional Transport Model 2 (RTM2) Coding Manual which recommends the use of exploded junctions for roundabouts with an inscribed circle diameter of over 60m.

### 4.2.4 Speed-Flow Curves

Speed-flow curves were used in the SHILPM to model the relationship between traffic flow and delay. A speed-flow curve defines the key determinants of a link’s performance, such as its saturation capacity, the speed that vehicles travel at this level of saturation and the speed that vehicles travel in free-flow conditions. It is appropriate to use speed flow curves within the more rural areas of the model, as these will be better determinants of journey times on rural links.

Speed-flow curves were defined using those specified in the RTM2 Network Coding Manual. These were subject to amendment during the calibration process.

### 4.2.5 Vehicle Class Restrictions

Data on area-wide vehicle weight restrictions and height restrictions imposed by bridges or tunnels were provided by the respective Local Authorities in the model area. Where any weight restriction or height restriction below 5 metres existed on a modelled link, vehicle class restrictions were coded to prevent HGVs from being routed on that link.

## 4.3 Zoning System

### 4.3.1 Model Zones

The zoning system used in the SHILPM is broadly based on the zoning system used in the PLRM. As part of the SHILPM model development, the zone boundaries used in the PLRM were significantly updated to be made contiguous with 2011 census output area boundaries, Middle-layer Super Output Area (MSOA) boundaries, and Local Authority boundaries. The zones were also updated to be largely contiguous with the zones used in the LCRTM, while some zones were also consolidated to assist with applying growth in the forecast scenarios at a later stage.

The benefit of using output areas as the zoning structure is ease of use and comparison with planning data, such as population and employment estimates in both the development of the base model and for model forecasting going forward.

The PLRM model originally consisted of 77 zones. The updated zone system adopted for the SHILPM now consists of 72 zones, shown in Figure 4:2. Of these, 48 zones are internal zones representing the study area around St Helens, Wigan, and Warrington. Among these internal zones, 4 zones have been cut out from the 2011 output area geographies to represent future development sites. The remaining 24 zones are external zones representing the rest of Great Britain. The external zones are more refined in the areas immediately outside the detailed modelled area and become coarser further out.

### 4.3.2 Zone Centroid Connectors

Centroid connectors enable the zones to be linked to the highway network. These are coded using specific entry and exit junctions from local access roads onto the main road network from self-contained residential areas, business parks, retail areas and car parks for example.

For the existing zone centroid connects present in the PLRM network, reviews were taken to determine the appropriateness of the centroid connectors following the zoning system update. Following this, some zone centroid connectors were updated to better match the locations where the traffic from the zones was likely to load.

For zones introduced in the zoning system update for which there was no existing zone connector, judgement was made on where the most appropriate and representative location where traffic would be to load into the model. These connectors were then added to the updated model network.

### 4.3.3 Sector System

For ease of analysis and understanding of the trip making patterns, the zoning system is divided into sectors. The sector system used in SHILPM is broadly based on the sector system used in the PLRM, which have been modified to be contiguous with the updated zone system.

The sector system in the SHILPM is made up 13 sectors, shown in Figure 4:3. As with the zoning system itself, the sectors are more refined within the detailed modelled area, again, becoming coarser further out from the detailed area

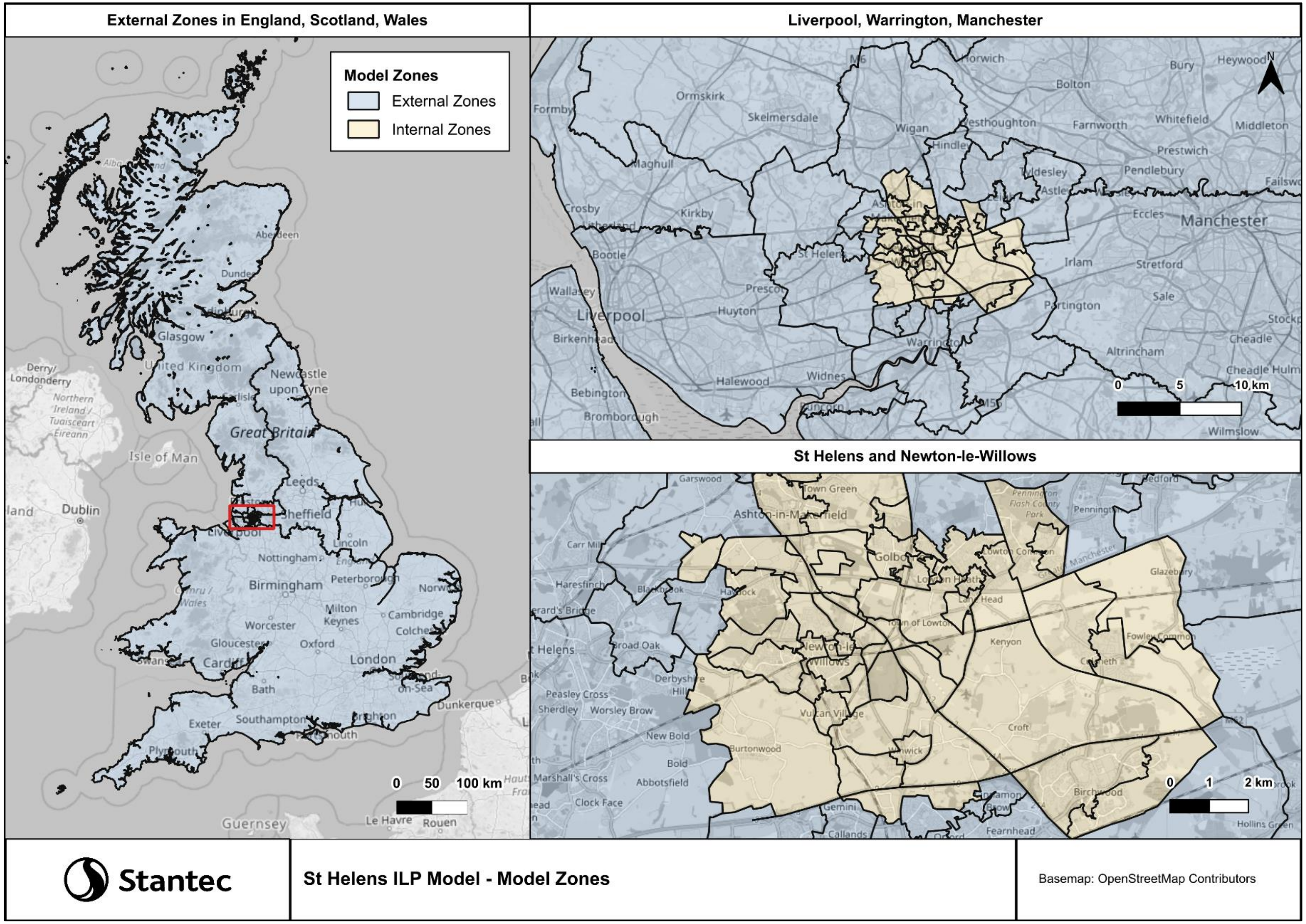


*Figure 4:2: SHILPM Zone System*

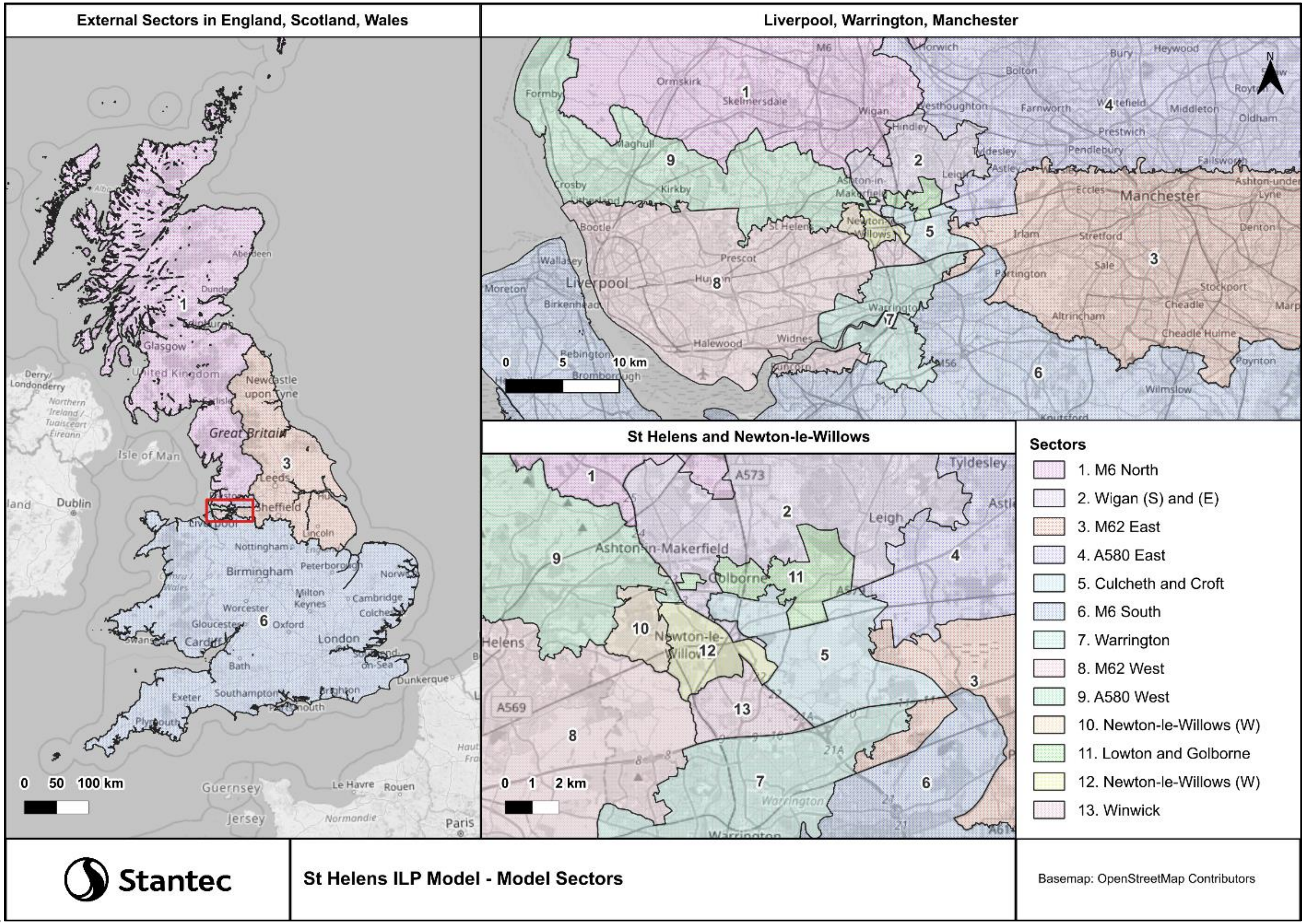


*Figure 4:3: Model Sector System*

# 5 Model Calibration and Validation Overview

## 5.1 Introduction

This section of the report outlines the processes employed to undertake model calibration and validation. Calibration of the model (network and matrices) was undertaken to seek to achieve a robust representation of observed traffic flows and behaviour in the SHILPM. Calibration and validation was carried out in accordance with TAG unit M3.1 (Highway Assignment Modelling).

TAG notes that any adjustments to the model intended to reduce the differences between the modelled and observed data should be regarded as calibration. Validation involves comparing modelled and observed data that is independent from that used in the calibration.

## 5.2 Calibration and Validation Criteria

TAG criteria were used to inform the calibration and validation, which included the following:

- Screenline and individual link flow comparisons
- Journey time comparisons
- Matrix estimation analysis

The main comparisons required for the validation of a highway assignment model as noted in TAG are listed below:

- A check on the quality of the trip matrices – this requires a comparison of assigned flows and counts totalled for each screenline.
- A check on the quality of the assignment – this is demonstrated by comparing flows and counts on individual links.
- A check on the quality of the network and assignment – this is demonstrated by comparing modelled and observed journey times along routes.

### 5.2.1 GEH Statistic

The GEH (Geoffrey Edward Havers) statistic was used to summarise the flow calibration results.

The GEH Statistic is a formula used in traffic modelling to compare two sets of traffic volumes and assess the fit between the observed and modelled flows. It takes account of the fact that when traffic flows are low, the percentage difference between observed and modelled flows may be high but the significance of this difference is small.

A GEH of less than 5.0 is considered to represent a good match between the modelled and observed hourly flows. A GEH value greater than 10 indicates that the match between observed and modelled flows is poor and closer attention is required. TAG recommends aiming for 85% of counts with a GEH below 5.

### 5.2.2 Screenline and Individual Flows

TAG guidance for screenline and individual link flows is in Table 5-1. This section reports on the results of the flow calibration in the for all three time periods.

*Table 5-1: Calibration and Validation Criteria (Standard TAG Criteria)*

| Element | Criteria | Acceptability Guideline | Vehicle Type |
|---|---|---|---|
| **Screenline Flows** | | | |
| Total | Within 5% | All or nearly all screenlines | All vehicle class separately |
| **Individual Link Flows** | | | |
| Roads with flows >2700 | +/- 400 veh/hr | >85% of cases | Car and Total Flow |
| Roads between 2700 & 700 | +/- 15% | >85% of cases | Car and Total Flow |
| Roads < 700 | +/- 100 veh/hr | >85% of cases | Car and Total Flow |
| GEH <5 | | >85% of cases | Car and Total Flow |

### 5.2.3 Journey Times

TAG's journey time acceptability criteria is for modelled times along routes to be within 15% of surveyed times (or 1 minute, if higher than 15%). The acceptability guidelines in TAG state that this should apply to at least 85% of routes.

### 5.2.4 Matrix Estimation Analysis

As part of calibration and validation, matrix estimation was applied to refine the prior matrices. TAG guidance states that the effects of matrix estimation on the prior matrix should not be significant and where large changes are present these should be investigated to understand the importance/impact on the matrix. TAG defines significant changes by the criteria shown in Table 5-2.

*Table 5-2: TAG Matrix Estimation Significance Criteria*

| Measure | Significance Criteria |
|---|---|
| Matrix zonal cell values | Slope within 0.98 and 1.02<br>Intercept near 0<br>$R^2$ in excess of 0.95 |
| Matrix zonal trip ends | Slope within 0.99 and 1.01<br>Intercept near 0<br>$R^2$ in excess of 0.98 |
| Trip Length Distribution | Means within 5%<br>Standard deviations within 5% |
| Sector to sector level matrices | Differences within 5% |

## 5.3 Calibration and Validation Analysis Dashboards

The key SHILPM calibration and validation outputs for flows and journey times are reported in the following sections. The detailed results have been collated into an interactive Power BI app that can be accessed at the following link:

Dashboard

Access to the Power BI dashboard report has been provided to key Transport Working Group stakeholders. Further access can be provided on request to Stantec using the above link.

This dashboard contains information on the following versions of the model;

- Version 13 – Initial discussion with individual TWG member Highway Authorities were held over this version with comments taken on board about areas where model performance could be improved or strengthened in their areas of interest.
- Version 17.4 – An improved version of the model that incorporated many of the suggestions and improvements requested by the TWG members such as Lane Head, the A49 corridor and Haydock Island. Further meetings were held with individual TWG member Highway Authorities to obtain further comments as well as outline areas Stantec were seeking further improvement at e.g. Haydock Island.
- Version 22.4 – This is the version of the model reported in this LMVR and represents the final version of the SHILPM Base Year model. It incorporates as many of the TWG comments and suggestions as practically possible and has a balanced approach to performance trade-offs between areas such as flow and journey time performance.

Each of the Power BI dashboard reports contains a range of interactive filtering, navigation, and data visualisation. This generally takes the form of slicers allowing the user to select options such as the period and user classes that are shown in the visualisations. Where relevant, geographical references are added in the form of an interactive map that shows the location of the count / journey time route.

These dashboards are designed to be referred to alongside the results presented in the following sections within this report and provide further detail.

### 5.3.1 Flow Validation Links and Turns

The validation links dashboard and validation turns dashboard contains comparisons between the observed count data and modelled flows for all validation links and turns. The dashboard pages contain the following information:

- Summary statistics for all validation links and turns, including the number and percentage of these within GEH and TAG guidelines.
- Comparison table between the observed count data and modelled flows for all validation links and turns.
- Interactive reference maps with validation link and turns statistics plotted. The difference between the modelled and observed flows is colour coded on the map based on the direction of difference. Green indicates that either GEH or TAG criteria has been met. The width of link is based on the difference between the modelled and observed flows.

### 5.3.2 Journey Time Validation Dashboards

The journey time validation dashboard contains the validation results for all 8 journey time routes used for model validation. The dashboard includes the following:

- Summary table of the observed and modelled journey times for each route and direction of travel in the respective period, including the absolute and percentage difference.
- Summary table showing the number and percentage of routes achieving the TAG criteria of being within either 15% or 1 minute.
- Interactive map showing journey time routes and validation statistics for each route segment.
- A time-distance graph for each journey time route, showing both observed and modelled journey times along the route.

## 5.4 Screenline and Cordon Definitions

To inform model development, 11 multi-count screenlines were developed alongside 6 single point screenlines. This was to make best use of the available count data. The screenlines used in the model development are summarised in Table 5-3 and shown in Figure 5:1.

In line with good practice guidance, independent data (not used in calibration) was used to inform the validation process.

*Table 5-3: Screenlines used for model calibration*

| Screenline Number | Location | Number of Points (Bi-Directional) |
|---|---|---|
| **Multiple-Point Screenlines** | | |
| 1 | Outer North East | 3 |
| 2 | Outer East | 3 |
| 3 | South | 3 |
| 4 | Outer South West | 2 |
| 5 | Inner South West | 5 |
| 6 | West | 3 |
| 7 | North West | 2 |
| 8 | Outer North West | 2 |
| 9 | M6 West | 6 |
| 10 | Outer North | 4 |
| 11 | Inner North | 5 |
| **Single-Point Screenlines** | | |
| 12 | M6 North | 1 |
| 13 | A580 East Lancashire Road (East of M6 J23) | 1 |
| 14 | A579 Winwick Lane | 1 |
| 15 | M62 East | 1 |
| 16 | M6 South | 1 |
| 17 | M62 West | 1 |

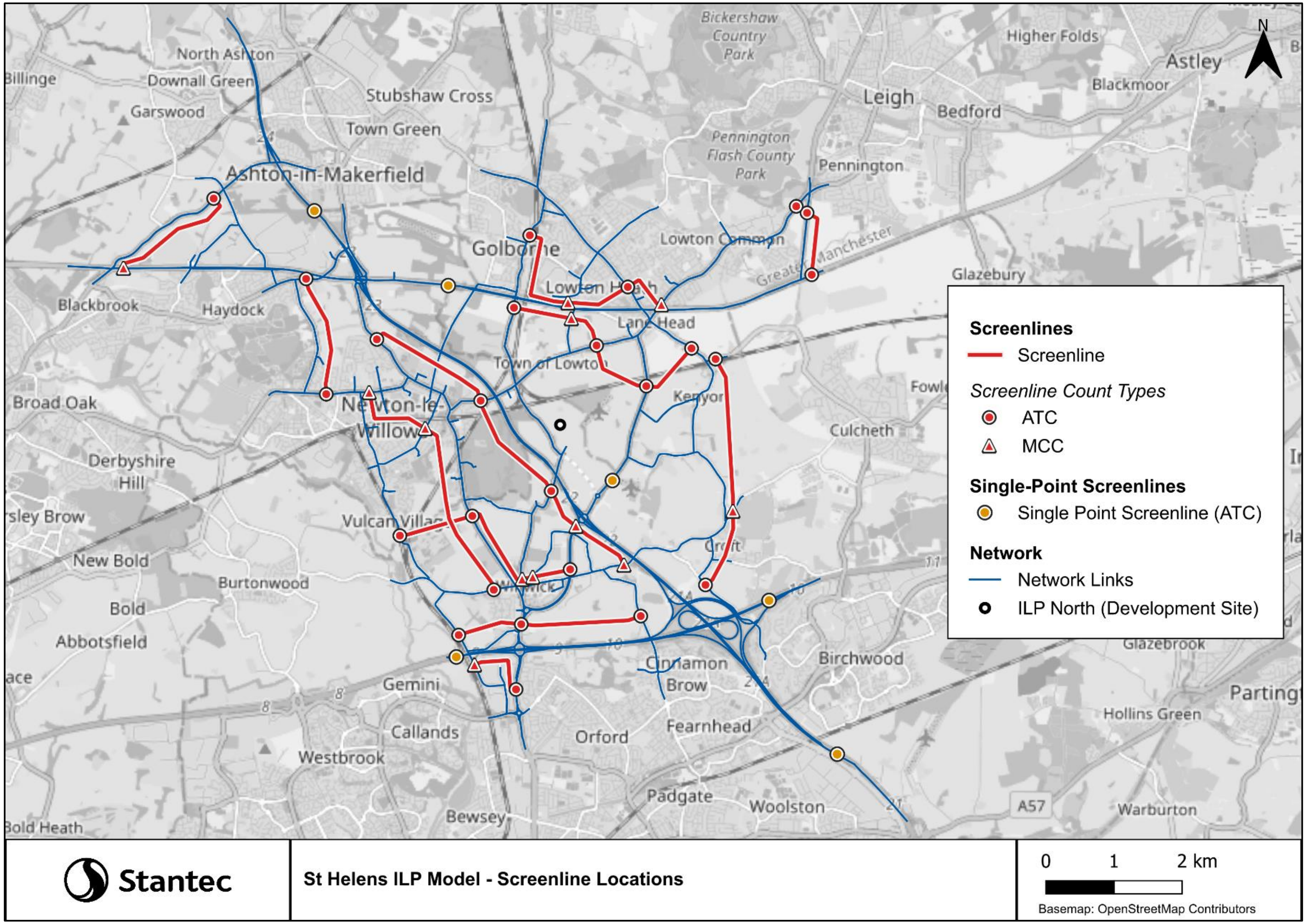


*Figure 5:1: Screenlines used for model calibration*

# 6 Network Assignment Calibration

## 6.1 Introduction

Calibration of the network and matrices was undertaken to demonstrate that the model outputs provide a reasonable representation of observed traffic flows and behaviours in the updated model. The calibration process involved the refinement of the network detail to check that link lengths, link speeds and junction behaviour/operation are well represented. Junction parameters reviewed and amended as part of the calibration process include turn saturation flows and signal timings as appropriate.

## 6.2 Parameters

Generalised cost parameters are used in the model network to determine the minimum cost routes by which traffic is assigned onto the network. Within SATURN, generalised cost coefficients are input by user class. The two parameters required are pence per minute (PPM) and pence per kilometre (PPK). The values of time and values of distance for 2010 and 2015 used to calculate the PPM and PPK coefficients were determined using TAG Data book May 2025 release v2.01. The coefficients are shown in Table 6-1.

*Table 6-1: Generalised Cost Coefficients*

| User Clas s | Class Name | AM | | IP | | PM | |
|---|---|---|---|---|---|---|---|
| | | PPM | PPK | PPM | PPK | PPM | PPK |
| 1 | Car Business | 43.16 | 17:46 | 44.23 | 17:46 | 43.78 | 17:46 |
| 2 | Car Commute | 28.94 | 9.00 | 29.41 | 9.00 | 29.040.81 | 9.00 |
| 3 | Other | 19.97 | 9.00 | 21.27 | 9.00 | 20.91 | 9.00 |
| 4 | LGV | 32.10 | 18.69 | 32.10 | 18.69 | 32.10 | 18.69 |
| 5 | HGV | 67.05 | 58.35 | 67.05 | 58.35 | 67.05 | 58.35 |

## 6.3 Network Calibration

To verify that the modelled network correctly represents the existing situation, numerous checks and adjustments were undertaken as part of the calibration process. These include the following:

- Checks to verify that loading of zone connectors was reasonable
- Link lengths checks including verifying that directional distances were matched and where different, that the differences were reasonable
- Routeing checks through the network by using SATURN's 'built trees' facility
- Verifying that lane designations and turn flares at junctions were correctly coded.
- Verification and adjustment of turn saturation flows at key junctions
- Checking and adjustment of signal timings at signalised junctions

An examination of the SATURN network was undertaken by Stantec and has confirmed that each zone centroid was loaded onto the appropriate link and link length checks confirmed that link lengths were coded correctly. Route Choice Validation

To check the route choice in the model was sensible and realistic, a number of route trees were undertaken showing the routes and proportions using each route between 2 zones. Those reported in this section of the report were specifically reviewed following consultation with all four highways authorities on the TWG following a review of screenline performance to ensure realistic routing performance in light of some of the screenline performance in this area detailed in Section 8 of this report.

The first tree is from Warrington in the South to Lowton in the North and this is shown in Figure 6:1. The vast majority of trips use Golborne Road and Warrington Road to get up to the A580. A small proportion of trips use Winwick Link Road and Winwick Lane and it should be noted that whilst this is a slightly more direct route, for the time period represented by the base model there were extensive roadworks along this route.

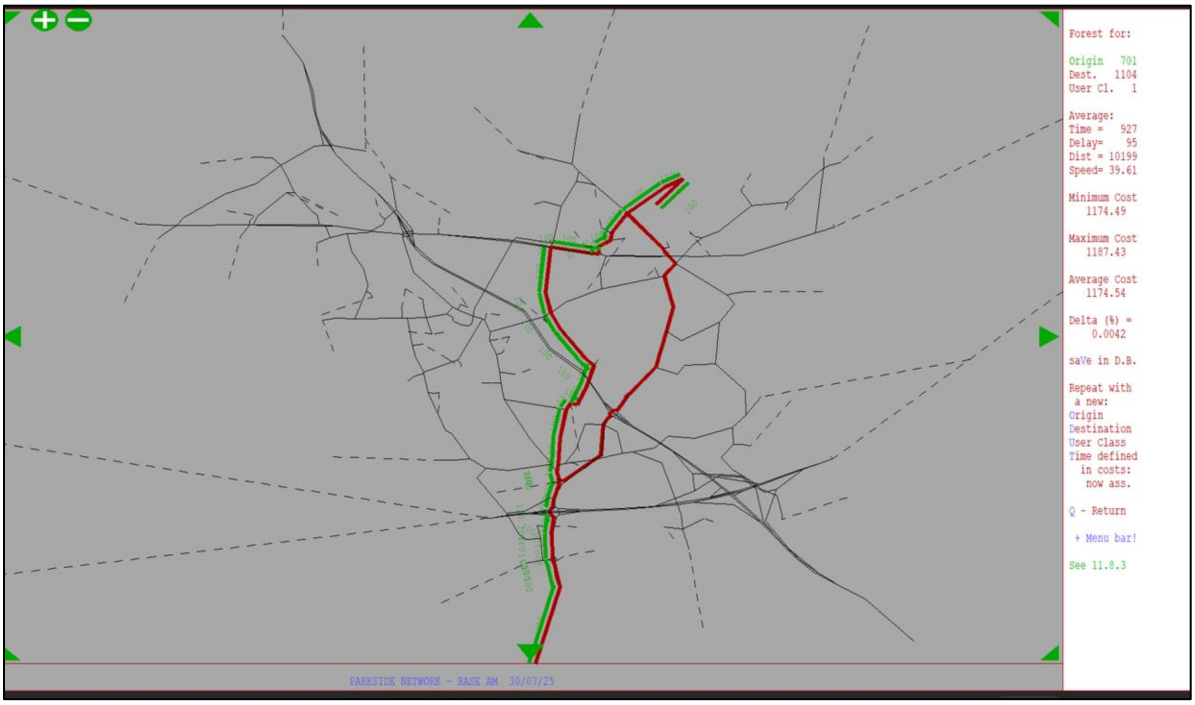


*Figure 6:1: Routing from Warrington to Lowton*

Taking a route from M62 West in the South to Lowton in the North shown in Figure 6:2, nearly all trips use the M62 to go east and then up the M6 and then via Winwick Lane. The alternative routes used by a small proportions of trips are along Golborne Road and Warrington Road, or along Winwick Link Road. Again, it is likely this route choice has been influenced by the roadworks.

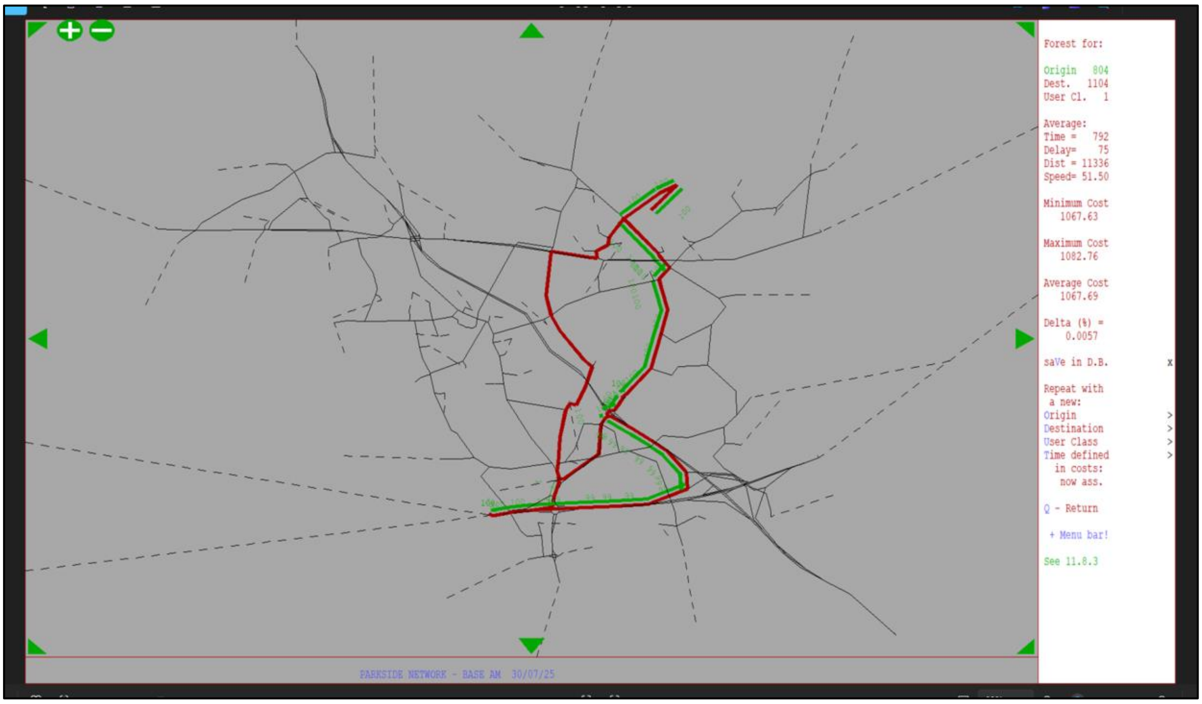


*Figure 6:2: Routing from M62 West to Lowton*

A route from the M62 West but this time to Newton-le-Willows shown in Figure 6:3. There is split between the two main routes which are via Mill Lane, Alder Root Lane and Wargrave Road or via the A49. Both routes are sensible logical choices. It should be noted that some user classes are more inclined to use the A49 than others.

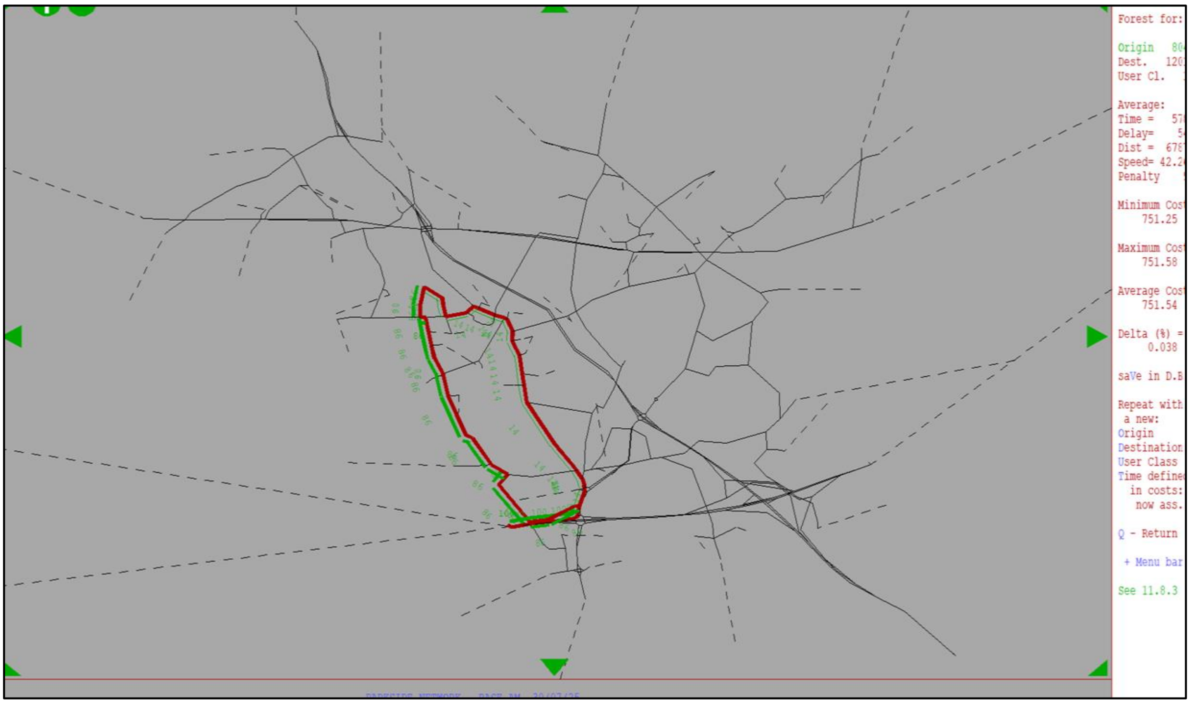


*Figure 6:3: Routing from M62 West to Newton-le-Willows*

The route from Leigh to Ashton-in-Makerfield as shown in Figure 6:4 has multiple routes. This is partly due to the level of congestion within the model around Lane Head. SATURN is unable to coordinate the MOVA operated signals as well as they would be in real life or in an operational model (e.g. VISSIM) meaning that there is likely to be excess delay which results in some rat running to the South.

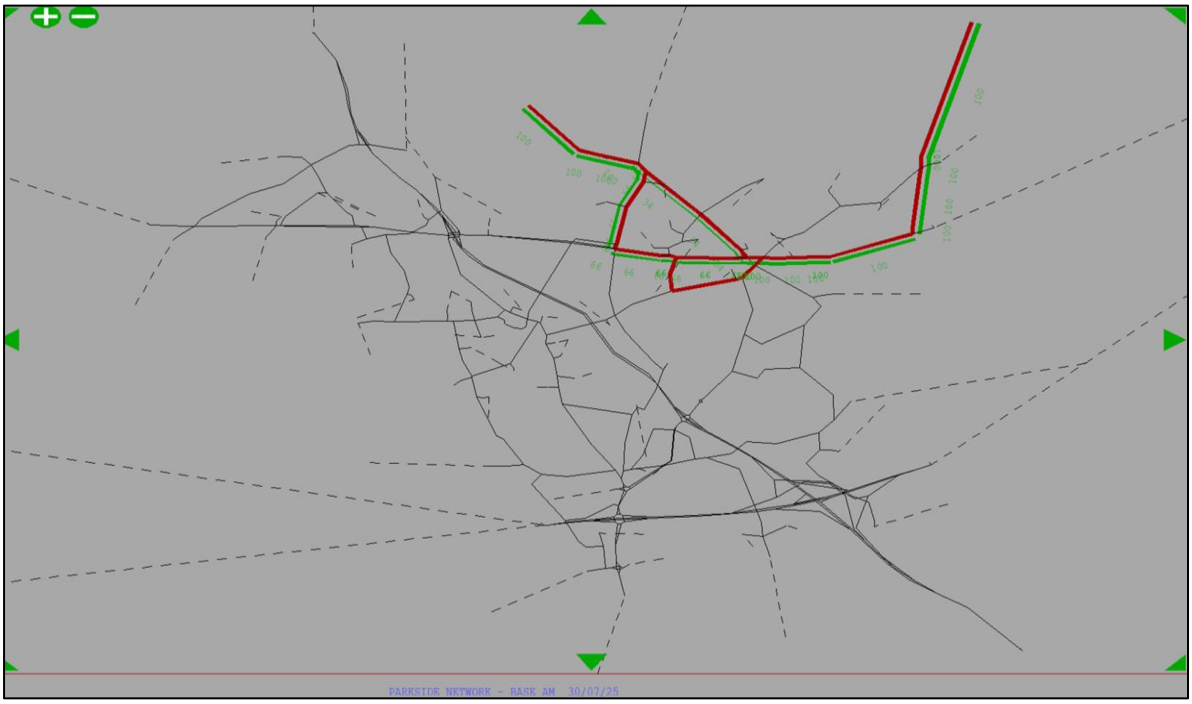

*Figure 6:4: Routing from Leigh to Ashton-in-Makerfield*

A tree for Lowton in the North to the M6s West in the South is shown in Figure 6:5. It shows a similar pattern to the route in the opposite direction with most trips being made via Warrington Road and Golborne Road. The Winwick route is less attractive, likely due to the roadworks.

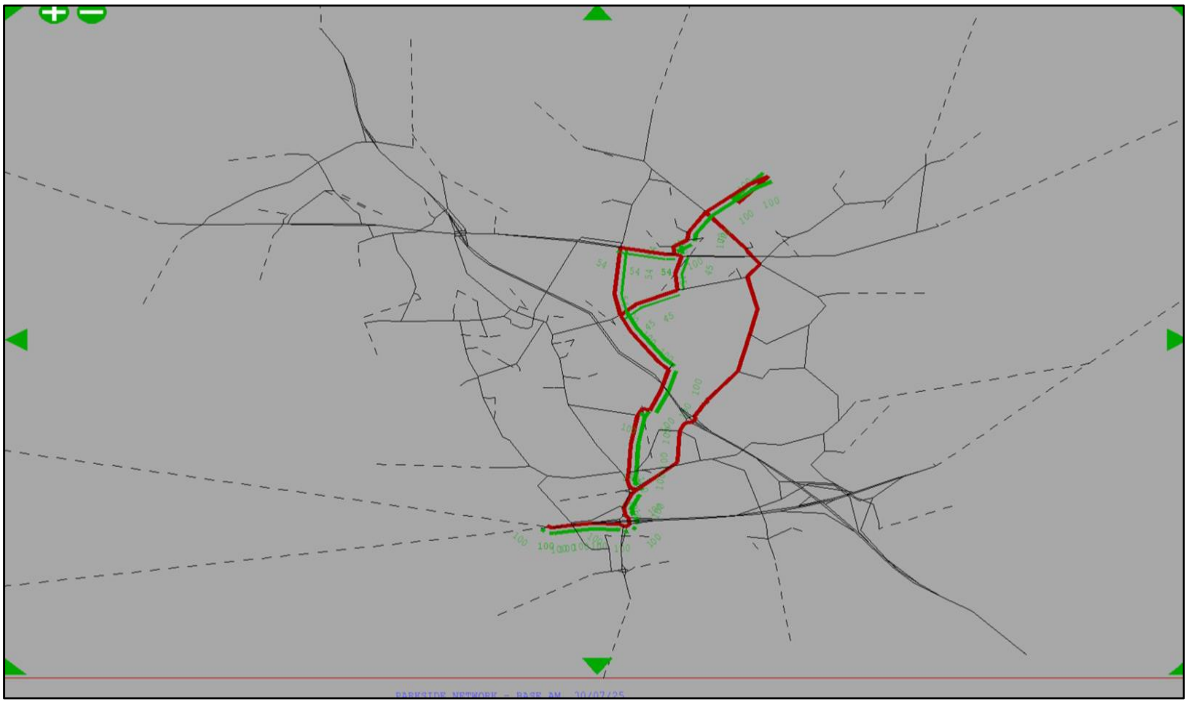

*Figure 6:5: Routing from Lowton to M62 West*

Further route trees are found in the appendices of this document. These have been reviewed in detail against expected and realistic routing patterns and appear to be appropriate across the majority of routes. Where multiple routes exist in trees these have been further reviewed to ensure the routes are all appropriate and carrying appropriate splits of traffic.

# 7 Matrix Calibration

## 7.1 Matrix Rezoning

Origin-destination matrices for the SHILPM are based on the PLRM's base year matrices prior to matrix estimation. As discussed in Section 4.3.1, the PLRM zone boundaries were updated in SHILPM to be contiguous with 2011 census output areas, MSOAs, and local authority boundaries. Therefore, the existing PLRM matrices were rezoned to represent the updated population size and boundaries of the new SHILPM zones.

### 7.1.1 Matrix Rezoning Methodology

Rezoning of the PLRM matrices was performed based on populations recorded in the 2011 census at the output area level. The following process was used:

1. PLRM zones boundaries were updated to be contiguous with output area, MSOA, and local authority boundaries. These formed the newly developed SHILPM zones.
2. Output areas were assigned a corresponding PLRM zone based on which zone the largest overlapping area. As SHILM zones are contiguous with output areas, no specific assignment rules were required.
3. Using the output area assignments, the discrete intersecting areas between the PLRM and SHILPM zones (referred to here as 'split zones') were identified.

4. The population of split zones as a percentage of its corresponding full PLRM zone population was calculated based on 2011 census output areas. This becomes the split zone factor.
5. OD factors for all split zone OD pairs were calculated by multiplying split zone factors for both origin and destination split zones. The OD factor represents the percentage of OD pair trips in the full PLRM matrix that would apply to the split zone OD pair only.
6. These OD factors are applied for all split zone OD pairs, giving the number of trips for each split zone OD pair.
7. The trips for split zone OD pairs are summed by their corresponding full SHILPM zone. This forms the new SHILPM matrix.

## 7.2 Prior Matrix Calibration and Validation

The matrix calibration involved assigning the initial or prior matrices onto the network and checking that observed flows were reasonably replicated. The prior matrix was developed from the existing PLRM matrices as described in Section **Error! Reference source not found.**.

A manual adjustment and factoring process was undertaken at count sites where flows were significantly over-estimated or under-estimated compared to the prior matrix. This addresses any potential issues caused by applying the older trip distribution used in the PLRM matrices.

### 7.2.1 Adjustment of External Trips in Prior Matrices

Manual factoring and adjustments were performed on the number of trips from several external zones entering and leaving the model. Matrices were either factored based on observed calibration counts, or additional trips were added based on observed calibration counts. The entering/leaving flows that were adjusted are shown in Table 7-1.

*Table 7-1: Summary of adjustments made to prior matrices*

| Road Name | To/From | Direction of difference from observed flows | Directions Factored |
|---|---|---|---|
| A579 Atherleigh Road | Leigh | Low | Both Directions |
| A572 St Helens Road | Leigh | Low | Both Directions |
| M62 (East) | Greater Manchester (South), Yorkshire, and North East England | Low | Both Directions |
| A49 Winwick Road | Warrington | Low | Both Directions |
| Alder Lane | Burtonwood | High | Both Directions |
| Millhouse Lane | Birchwood | High | Both Directions |
| M62 (West) | St Helens and Liverpool | Low | Eastbound Only |
| M6 J21A and M62 J10 (Croft Interchange) | Slips for external-to-external flows between M62 East and M6 South. | Low | Both Directions |
| | Slips from M62 Eastbound to M6 Southbound | High | Southbound Only (AM Only) |
| M6 J24 Slip Roads | North West England and Scotland | Low | Both Directions |
| | External-to-external flows between M6 North and Ashton-in-Makerfield. | Low | Both Directions |
| A573 Wigan Road | Platt Bridge and Hindley | High | Northbound |
| | | Low | Southbound |
| Slag Lane | Lowton St Lukes | High | Northbound |

| Road Name | To/From | Direction of difference from observed flows | Directions Factored |
|---|---|---|---|
| | | Low | Southbound |

### 7.2.2 Addition of New Development Trips

During the process of matrix calibration, two major logistics sites were identified as being completed between the PLRM development and traffic count data collection in October 2024. These were the Florida Fields site and the Haydock Green site, both within the Haydock Lane Industrial Estate. To support matrix calibration, trips were added to and from zones representing these sites. Trips were added based on the data and distributions noted in the Traffic Assessments for these schemes. As the traffic assessments did not provide a full distribution across the whole SHILPM area, the distribution of these trips for the whole model extent was approximated based on professional judgement and the nature of these sites as strategic distribution hubs.

### 7.2.3 Prior Matrix Calibration Statistics

Table 7-2 shows the initial statistics of the model against the observed data for the calibration screenlines. While some screenlines were within the criteria, matrix estimation was required to refine the trip matrices to better represent observed travel demand.

*Table 7-2: Prior Matrix Calibration Statistics (All User Classes)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Screenlines (All Directions) | | 32 | 32 | 32 |
| Within 5 DMRB% | Number of Screenlines | 4 | 4 | 5 |
| | % of modelled flows | 13% | 13% | 16% |
| GEH<5 | Number of Screenlines | 8 | 8 | 8 |
| | % of modelled flows | 25% | 25% | 25% |
| GEH<7 | Number of Screenlines | 12 | 12 | 16 |
| | % of modelled flows | 38% | 38% | 50% |

The table shows that the prior matrix showed a poor level of screenline performance. Further investigation showed that there was a mix of high and low modelled flows compared to observed suggesting that there was likely some distribution change between 2016 and 2024 and well as some changes in overall trip levels.

Because of this, it was expected that the Matrix Estimation may need to work harder than some other models to rectify this. In the absence of an ANPR, which was not possible given how porous the network in the model area is, this was viewed as the most sensible approach.

## 7.3 Matrix Estimation Analysis

### 7.3.1 Introduction

While matrix estimation generally improves flow calibration and validation, it should only be undertaken once network issues have been resolved and only when trip matrices are reasonably close to the expected demands, otherwise the matrix estimation process amplifies the network and demand errors. The results of the flow calibration following the matrix estimation process are reported in this section.

Matrix estimation was undertaken for cars, LGVs and HGVs separately, by constraining them to observed count data. Cars were not subdivided, as it is not possible to distinguish between the trip purposes from the count data. All calibration screenline counts were used in this process. As discussed in TAG Unit M3.1 Chapter 8.3.5, counts should be applied at the short screenline level, to reduce the risk of large changes to individual O-D pairs to account for differences between the observed and modelled flows, which may not be due to deficiencies in the trip matrices.

XAMAX defines the maximum balancing factor used to limit excessive changes to the prior matrix. A value of 2 was used for the car and LGV matrices, and 2.5 for the HGV estimation. This reflects the relative confidence in the data used to develop the demand for each of these vehicle classes. A total of 6 loops of matrix estimation were undertaken to generate the final, calibrated trip matrix by period.

### 7.3.2 Post Matrix Estimation Updates

Following the matrix estimation process, several adjustments were made to the matrices to add trips between adjacent external zones at the outer edges of the model network based on observed counts. These adjustments were required as approach used to extend the network extent and redevelop the zoning system meant that trips between adjacent external zones were missing. These adjustments were all performed on the outer edges of the network for external origin-destination pairs that would be routed only though a single junction on the edge of the network. Therefore, this process is suitable to be performed after matrix estimation, as there would be no impact on the modelled flows and routing through the internal model network.

The following locations were adjusted:

- At the roundabout of A49 Winwick Lane, Sandy Lane West, and A574 Cromwell Avenue.
- The total modelled flow arriving or exiting from the northern arm of the roundabout (A49 Winwick Lane) had their turning flows reproportioned between the remaining roundabout arms based on the turning flow percentages observed at the MCC collected at this roundabout.
    - External to external trips between external zones loading at Sandy Lane West, A49 Winwick Road (South), and A574 Cromwell Road, were added based on MCC data.
- At the signalised junction of A579 Atherleigh Way and A572 St Helens Road. External to external trips between external zones loading at A572 St Helens Road (East) and A579 Atherleigh Way (North) were added based on MCC data.
- At the signalised junction of A580 East Lancashire Road, A58 Liverpool Road, and A58 Stanley Bank Way. External to external trips between external zones loading at A58 Stanley Bank (South) and A580 East Lancashire Road (West) were added based on MCC data.

### 7.3.3 Prior and Post Matrix Comparison

The matrices before and after matrix estimation have been compared to assess the impact on the trip length distribution, zonal cell values and trip ends, and sector level matrices using the criteria in Table 5-2.

#### 7.3.3.1 Matrix Totals

The change in demand from the ME process are presented by period, movement type, and vehicle class in Table 7-3, Table 7-4, Table 7-5. Note the following tables show the change after matrix estimation, but before the post-matrix estimation updates described in Section 7.3.2.

*Table 7-3: Change in Matrix Total – AM Period*

| Movement | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Trips | % Diff | Trips | % Diff | Trips | % Diff | Trips | % Diff |
| Internal | -558 | -9% | -21 | -3% | -10 | -2% | -558 | -9% |
| Internal to External | -1338 | -27% | -141 | -13% | -20 | -2% | -1338 | -27% |
| External to Internal | -663 | -17% | -128 | -14% | 129 | 17% | -663 | -17% |
| External | 322 | 3% | 723 | 33% | -990 | -18% | 322 | 3% |
| **Total** | **-2237** | **-8%** | **433** | **9%** | **-890** | **-11%** | **-2237** | **-8%** |

*Table 7-4. Change in Matrix Total – IP Period*

| Movement | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Trips | % Diff | Trips | % Diff | Trips | % Diff | Trips | % Diff |
| Internal | -449 | -9% | -108 | -14% | 60 | 8% | -449 | -9% |
| Internal to External | -859 | -25% | -156 | -18% | 122 | 13% | -859 | -25% |
| External to Internal | -195 | -6% | -189 | -19% | 55 | 7% | -195 | -6% |
| External | 380 | 4% | 379 | 19% | -1365 | -21% | 380 | 4% |
| **Total** | **-1123** | **-5%** | **-74** | **-2%** | **-1128** | **-13%** | **-1123** | **-5%** |

*Table 7-5: Change in Matrix Total – PM Period*

| Movement | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Trips | % Diff | Trips | % Diff | Trips | % Diff | Trips | % Diff |
| Internal | -519 | -7% | -16 | -2% | 41 | 8% | -519 | -7% |
| Internal to External | -563 | -14% | -13 | -2% | 38 | 8% | -563 | -14% |
| External to Internal | -735 | -14% | -67 | -9% | -63 | -10% | -735 | -14% |
| External | -136 | -1% | 329 | 19% | -1242 | -27% | -136 | -1% |

| Movement | Car | | LGV | | HGV | | Total | |
|---|---|---|---|---|---|---|---|---|
| | Trips | % Diff | Trips | % Diff | Trips | % Diff | Trips | % Diff |
| **Total** | **-1953** | **-7%** | **233** | **6%** | **-1226** | **-20%** | **-1953** | **-7%** |

SHILPM was built from the original PLRM model, albeit rezoned as described in Section 5.1. Rezoning was performed to allow a more concise external zone structure and to allow for matching to Census Output Areas which will aid the application of an NTEM constraint at Local Authority Level during forecasting.

The tables show that the Matrix Estimation mainly made changes to movements to and from the internal area. This was expected as there was some internal distribution changes expected between the 2016 PLRM base year and the 2024 SHILPM base year so the changes seen in the tables were expected and acceptable. Due to the porose and rural nature of the network, an ANPR was not possible to address this distribution change at the Prior matrix stage.

#### 7.3.3.2 Sector Movements

Significant changes in the sector matrices due to Matrix Estimation are defined in TAG as changes of greater than 5%. Table 7-6 to Table 7-11 show the absolute change and percentage change in the sector matrices pre and post ME. These comparisons were undertaken prior to the post ME changes outlined in in Section 8.2.2 to allow a fairer assessment of the impact of the ME.

*Table 7-6: Absolute change between prior sector matrices and post-ME sector matrices, AM Peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
| Origin Sector | 1 | 0.00 | -46.37 | -475.13 | -50.13 | -16.74 | 153.80 | -95.18 | 9.57 | -196.49 | 12.25 | -3.68 | 22.19 | -0.29 | **-686.20** |
| | 2 | -83.87 | -28.26 | -111.52 | 51.81 | 11.32 | -92.45 | 3.30 | 12.11 | -35.20 | 37.60 | 45.38 | -4.60 | -0.32 | **-194.70** |
| | 3 | -233.15 | -52.74 | 0.00 | -24.72 | 5.81 | 613.38 | -282.73 | 120.67 | 9.24 | 3.10 | -10.81 | 26.01 | -0.89 | **173.18** |
| | 4 | -64.24 | 48.63 | 6.68 | 9.41 | 11.56 | 23.11 | -17.08 | -15.22 | -36.19 | 5.87 | 29.17 | 6.93 | 0.07 | **8.68** |
| | 5 | -146.77 | 17.13 | -11.75 | 37.48 | 4.19 | -6.88 | -6.85 | 13.09 | -2.78 | 0.29 | 15.34 | 2.51 | 0.18 | **-84.83** |
| | 6 | -392.79 | -5.75 | -17.05 | -15.14 | 5.24 | 0.67 | 16.54 | 628.07 | 16.85 | 28.99 | 1.19 | 38.29 | 3.27 | **308.38** |
| | 7 | -196.83 | -34.21 | 35.50 | -5.78 | -18.99 | -48.63 | -33.28 | 33.64 | -3.49 | 1.05 | -24.11 | -0.71 | 1.07 | **-294.77** |
| | 8 | 11.68 | -131.91 | 33.78 | -118.40 | -18.11 | -240.26 | -33.17 | 91.69 | -9.27 | -0.86 | -44.23 | 35.66 | 13.46 | **-409.95** |
| | 9 | -321.05 | -105.33 | -132.11 | -100.78 | -3.91 | -6.50 | -35.98 | -16.45 | -77.77 | 25.63 | -44.38 | -1.75 | 0.62 | **-819.75** |
| | 10 | -8.51 | -30.11 | -25.27 | -4.39 | -5.49 | -14.75 | -98.15 | -18.30 | -7.95 | 1.64 | -0.14 | -16.51 | 4.20 | **-223.74** |
| | 11 | -88.85 | 30.63 | -32.24 | 109.04 | 27.25 | -90.31 | 29.48 | 50.23 | -37.17 | 1.63 | 50.12 | 29.86 | 1.09 | **80.74** |
| | 12 | 2.83 | -30.66 | -169.75 | -12.57 | -20.78 | -28.99 | -146.06 | -84.41 | 3.68 | 12.00 | -108.07 | 51.02 | 13.56 | **-518.21** |
| | 13 | 0.00 | -1.97 | 8.43 | 1.69 | -2.14 | -3.96 | -27.14 | 9.13 | 1.30 | -1.43 | -4.70 | -11.14 | -0.14 | **-32.08** |
| | **Total** | **-1521.54** | **-370.93** | **-890.45** | **-122.47** | **-20.80** | **258.22** | **-726.32** | **833.81** | **-375.24** | **127.75** | **-98.93** | **177.76** | **35.87** | **-2693.26** |

*Table 7-7: Percentage change between prior sector matrices and post-ME sector matrices, AM Peak. Darker blue colours indicate greater percentage decrease. Darker red colours indicate greater percentage increases.*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -15.05 | -27.24 | -16.11 | -30.81 | 7.03 | -26.23 | 5.59 | -34.24 | 74.50 | -3.35 | 33.99 | -11.18 | **-11.56** |
| | **2** | -15.93 | -5.78 | -50.08 | 17.09 | 17.19 | -25.40 | 3.05 | 41.51 | -38.75 | 24.29 | 12.70 | -4.87 | -16.87 | **-6.94** |
| | **3** | -41.48 | -45.72 | 0.00 | -39.94 | 42.32 | 54.15 | -27.64 | 5.61 | 3.96 | 7.27 | -28.78 | 116.14 | -69.62 | **3.17** |
| | **4** | -24.92 | 57.18 | 10.18 | 29.06 | 110.42 | 18.44 | -22.90 | -11.82 | -12.91 | 34.55 | 126.00 | 133.01 | 22.99 | **0.78** |
| | **5** | -57.59 | 17.48 | -41.68 | 88.81 | 45.36 | -12.92 | -7.48 | 46.86 | -44.83 | 2.88 | 77.49 | 48.37 | 146.79 | **-13.12** |
| | **6** | -14.16 | -7.99 | -1.50 | -23.66 | 31.81 | 0.17 | 13.15 | 49.96 | 6.91 | 15.78 | 3.71 | 41.22 | 27.31 | **4.81** |
| | **7** | -26.42 | -49.36 | 12.16 | -22.27 | -34.23 | -11.46 | -29.60 | 58.35 | -16.54 | 3.50 | -34.19 | -2.86 | 1.34 | **-14.67** |
| | **8** | 5.86 | -53.99 | 1.24 | -44.80 | -22.69 | -13.75 | -9.49 | 59.55 | -7.28 | -1.81 | -34.15 | 21.57 | 16.36 | **-6.50** |
| | **9** | -39.99 | -44.23 | -31.50 | -30.27 | -11.71 | -2.56 | -34.67 | -21.30 | -22.63 | 73.36 | -36.38 | -1.61 | 7.78 | **-28.47** |
| | **10** | -40.00 | -12.88 | -37.24 | -14.16 | -13.30 | -20.13 | -51.99 | -23.43 | -23.76 | 0.46 | -0.18 | -5.49 | 23.31 | **-14.70** |
| | **11** | -51.22 | 3.94 | -35.38 | 78.71 | 85.63 | -22.32 | 13.45 | 92.16 | -37.19 | 3.42 | 31.04 | 34.42 | 71.68 | **3.53** |
| | **12** | 21.96 | -26.78 | -65.65 | -28.93 | -34.75 | -60.22 | -29.63 | -34.27 | 1.51 | 4.06 | -39.03 | 23.72 | 11.35 | **-21.35** |
| | **13** | N/A | -61.43 | 23.91 | 117.00 | -44.66 | -23.70 | -39.64 | 4.94 | 11.32 | -4.79 | -74.76 | -14.06 | -4.53 | **-7.21** |
| | **Total** | **-23.93** | **-13.03** | **-12.46** | **-7.41** | **-4.36** | **3.57** | **-21.87** | **18.06** | **-16.25** | **10.08** | **-6.94** | **14.04** | **10.85** | **-6.69** |

*Table 7-8: Absolute change between prior sector matrices and post-ME sector matrices, Inter-peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -41.88 | -84.69 | -46.58 | 0.56 | 161.88 | -47.49 | -3.39 | -188.44 | 10.63 | -6.52 | 30.69 | -2.25 | **-217.47** |
| | **2** | -56.85 | -105.83 | -47.46 | -126.47 | -22.69 | -28.34 | -20.47 | -4.53 | -34.31 | 43.91 | -54.96 | 2.72 | -0.36 | **-455.64** |
| | **3** | -67.69 | -11.02 | 0.95 | -6.96 | -3.68 | 457.59 | -149.64 | 46.34 | 79.65 | 1.40 | -13.15 | 16.94 | -2.63 | **348.09** |
| | **4** | -179.63 | -54.69 | -5.31 | 0.60 | 5.57 | 9.33 | -17.98 | 5.74 | -75.61 | 7.43 | 42.36 | 17.00 | -2.47 | **-247.67** |
| | **5** | -37.16 | 0.87 | -0.38 | 13.16 | -0.12 | 5.49 | -8.75 | 7.71 | -3.20 | 2.32 | 13.62 | 25.60 | -0.48 | **18.68** |
| | **6** | -556.86 | -26.26 | -140.45 | -24.58 | 2.48 | 0.40 | 79.91 | 567.48 | -0.23 | 31.40 | -11.83 | 69.17 | -4.51 | **-13.88** |
| | **7** | -15.29 | -47.17 | -129.94 | 7.99 | 15.40 | -40.38 | -12.82 | 31.08 | -0.37 | -39.12 | -15.98 | -125.29 | -55.56 | **-427.45** |
| | **8** | 4.77 | -30.88 | -456.71 | -0.69 | -2.54 | -330.12 | 25.87 | 41.78 | -15.66 | -22.11 | -17.18 | 0.90 | -2.32 | **-804.90** |
| | **9** | -194.96 | -82.94 | -115.27 | -77.55 | -3.19 | 4.67 | -10.55 | -5.00 | -50.15 | 20.07 | -27.47 | 12.97 | -0.73 | **-530.10** |
| | **10** | -1.84 | 14.58 | 1.05 | -0.04 | 14.78 | -0.77 | -62.98 | -21.84 | -19.71 | 3.67 | 27.68 | 81.38 | 4.06 | **40.02** |
| | **11** | -32.65 | -64.02 | -20.90 | 30.81 | 2.86 | -10.71 | -46.13 | 1.69 | -14.55 | 3.43 | 98.29 | -0.09 | -0.03 | **-52.01** |
| | **12** | 2.91 | 0.37 | -17.61 | 0.57 | 2.58 | -62.80 | -42.45 | 8.48 | -18.29 | 10.48 | 20.99 | 65.03 | -1.61 | **-31.34** |
| | **13** | 0.00 | 0.35 | -3.36 | 4.07 | 0.00 | -2.38 | -8.23 | 42.04 | 0.67 | 9.96 | 0.00 | 4.90 | 0.00 | **48.02** |
| | **Total** | **-1135.25** | **-448.52** | **-1020.10** | **-225.68** | **12.03** | **163.85** | **-321.71** | **717.58** | **-340.21** | **83.49** | **55.86** | **201.93** | **-68.91** | **-2325.65** |

Table 7-9: Percentage change between prior sector matrices and post-ME sector matrices, Inter-Peak. Darker blue colours indicate greater percentage decrease. Darker red colours indicate greater percentage increases.

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 | 10 | 11 | 12 | 13 | Total |
| Origin Sector | 1 | 0.00 | -12.36 | -15.99 | -16.97 | 3.25 | 6.77 | -19.48 | -2.40 | -35.43 | 107.58 | -3.33 | 53.91 | -42.93 | **-4.55** |
| | 2 | -12.02 | -24.13 | -43.72 | -43.47 | -31.71 | -13.88 | -15.34 | -10.88 | -34.11 | 61.43 | -13.16 | 3.83 | -13.13 | **-18.79** |
| | 3 | -8.40 | -10.30 | 0.66 | -11.78 | -8.99 | 51.74 | -21.52 | 2.15 | 35.57 | 4.85 | -17.05 | 26.16 | -38.71 | **6.57** |
| | 4 | -39.94 | -24.81 | -17.16 | 1.45 | 25.12 | 14.47 | -21.66 | 2.97 | -27.21 | 48.05 | 30.94 | 154.54 | -50.73 | **-15.97** |
| | 5 | -37.75 | 1.28 | -0.99 | 68.86 | -0.29 | 28.51 | -26.50 | 31.52 | -39.38 | 51.29 | 43.48 | 156.19 | -83.92 | **4.65** |
| | 6 | -19.77 | -18.04 | -10.60 | -20.20 | 32.34 | 0.13 | 34.86 | 54.47 | -0.11 | 18.23 | -18.77 | 45.56 | -18.76 | **-0.21** |
| | 7 | -4.73 | -32.07 | -20.59 | 28.55 | 30.79 | -11.15 | -12.28 | 39.55 | -1.30 | -44.64 | -25.46 | -31.52 | -25.08 | **-16.94** |
| | 8 | 5.34 | -29.50 | -17.12 | -0.54 | -8.64 | -18.68 | 16.02 | 41.39 | -18.25 | -35.19 | -19.39 | 0.67 | -6.62 | **-14.75** |
| | 9 | -39.85 | -50.03 | -33.36 | -29.74 | -20.40 | 2.10 | -33.12 | -11.66 | -10.46 | 70.70 | -32.90 | 17.02 | -28.55 | **-23.62** |
| | 10 | -6.22 | 16.00 | 2.61 | -0.24 | 67.33 | -1.65 | -35.88 | -38.04 | -24.18 | 0.89 | 37.52 | 55.37 | 60.85 | **3.33** |
| | 11 | -34.61 | -11.97 | -28.98 | 13.90 | 5.84 | -10.41 | -33.47 | 5.36 | -20.06 | 17.58 | 36.81 | -10.44 | -19.94 | **-3.24** |
| | 12 | 51.95 | 0.35 | -52.32 | 8.55 | 16.96 | -53.64 | -18.57 | 8.19 | -7.25 | 5.57 | 17.89 | 53.50 | -31.63 | **-2.41** |
| | 13 | N/A | 57.05 | -13.15 | 250.82 | N/A | -32.24 | -8.85 | 48.79 | 10.82 | 39.11 | N/A | 21.55 | 0.00 | **17.41** |
| | **Total** | **-19.87** | **-18.17** | **-17.02** | **-15.37** | **3.15** | **2.52** | **-13.69** | **17.50** | **-14.43** | **7.40** | **3.46** | **15.87** | **-21.36** | **-6.52** |

*Table 7-10: Absolute change between prior sector matrices and post-ME sector matrices, PM Peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -121.07 | -98.22 | -3.93 | -14.36 | -422.85 | -58.91 | -20.59 | 37.57 | 3.01 | -58.93 | 4.70 | -30.59 | **-784.17** |
| | **2** | -26.53 | -110.62 | -25.19 | 8.98 | -5.98 | -46.43 | 7.42 | -11.87 | -61.91 | 60.63 | -28.98 | -16.74 | 0.35 | **-256.86** |
| | **3** | 3.31 | -31.24 | -0.67 | -3.81 | -1.68 | 375.42 | -90.60 | 195.30 | -45.36 | -8.13 | -7.95 | -0.57 | -4.14 | **379.89** |
| | **4** | -179.97 | -28.62 | -8.03 | 6.59 | 7.74 | -16.47 | -13.28 | -33.84 | -189.13 | -0.32 | 65.62 | 9.61 | 0.11 | **-379.98** |
| | **5** | -127.18 | -32.86 | -1.85 | 8.05 | -9.01 | -6.03 | -22.53 | -1.34 | -13.85 | 3.71 | 11.94 | 5.52 | 0.00 | **-185.42** |
| | **6** | -803.63 | -39.94 | -424.40 | -45.15 | 1.73 | 0.10 | 35.15 | 657.87 | -164.54 | -8.94 | -5.43 | -6.18 | -2.10 | **-805.46** |
| | **7** | 0.10 | -11.44 | -95.14 | 3.77 | -17.80 | 20.32 | -31.14 | 63.11 | -7.57 | -0.22 | -9.58 | -186.40 | -50.89 | **-322.88** |
| | **8** | 3.01 | -10.49 | -334.26 | -0.63 | -0.04 | 58.12 | 55.92 | 47.91 | -14.65 | -56.69 | -1.37 | -68.89 | -1.10 | **-323.14** |
| | **9** | -233.78 | -44.58 | -60.31 | 9.53 | 0.01 | -19.18 | -3.82 | -1.48 | -80.03 | 32.74 | -38.07 | 26.55 | 0.14 | **-412.29** |
| | **10** | -14.19 | -19.72 | 5.18 | 6.03 | 10.54 | -29.81 | -22.42 | -35.51 | -9.81 | 2.02 | 29.14 | 33.18 | -0.46 | **-45.83** |
| | **11** | -29.54 | -9.37 | -8.09 | 83.49 | -7.13 | -24.89 | 23.30 | 31.62 | -64.24 | 5.30 | 84.99 | 3.68 | 0.00 | **89.12** |
| | **12** | 6.67 | -8.65 | -16.11 | 6.30 | -3.52 | -7.33 | -31.05 | -40.34 | 3.83 | 8.94 | 31.16 | 87.77 | -9.97 | **27.71** |
| | **13** | 0.00 | 0.08 | -6.41 | -0.07 | 0.37 | 0.04 | 1.81 | 76.83 | -0.60 | 1.24 | 0.31 | 0.07 | 0.00 | **73.69** |
| | **Total** | **-1401.73** | **-468.51** | **-1073.50** | **79.15** | **-39.12** | **-118.98** | **-150.15** | **927.69** | **-610.29** | **43.29** | **72.87** | **-107.68** | **-98.65** | **-2945.63** |

*Table 7-6: Absolute change between prior sector matrices and post-ME sector matrices, AM Peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -46.37 | -475.13 | -50.13 | -16.74 | 153.80 | -95.18 | 9.57 | -196.49 | 12.25 | -3.68 | 22.19 | -0.29 | **-686.20** |
| | **2** | -83.87 | -28.26 | -111.52 | 51.81 | 11.32 | -92.45 | 3.30 | 12.11 | -35.20 | 37.60 | 45.38 | -4.60 | -0.32 | **-194.70** |
| | **3** | -233.15 | -52.74 | 0.00 | -24.72 | 5.81 | 613.38 | -282.73 | 120.67 | 9.24 | 3.10 | -10.81 | 26.01 | -0.89 | **173.18** |
| | **4** | -64.24 | 48.63 | 6.68 | 9.41 | 11.56 | 23.11 | -17.08 | -15.22 | -36.19 | 5.87 | 29.17 | 6.93 | 0.07 | **8.68** |
| | **5** | -146.77 | 17.13 | -11.75 | 37.48 | 4.19 | -6.88 | -6.85 | 13.09 | -2.78 | 0.29 | 15.34 | 2.51 | 0.18 | **-84.83** |
| | **6** | -392.79 | -5.75 | -17.05 | -15.14 | 5.24 | 0.67 | 16.54 | 628.07 | 16.85 | 28.99 | 1.19 | 38.29 | 3.27 | **308.38** |
| | **7** | -196.83 | -34.21 | 35.50 | -5.78 | -18.99 | -48.63 | -33.28 | 33.64 | -3.49 | 1.05 | -24.11 | -0.71 | 1.07 | **-294.77** |
| | **8** | 11.68 | -131.91 | 33.78 | -118.40 | -18.11 | -240.26 | -33.17 | 91.69 | -9.27 | -0.86 | -44.23 | 35.66 | 13.46 | **-409.95** |
| | **9** | -321.05 | -105.33 | -132.11 | -100.78 | -3.91 | -6.50 | -35.98 | -16.45 | -77.77 | 25.63 | -44.38 | -1.75 | 0.62 | **-819.75** |
| | **10** | -8.51 | -30.11 | -25.27 | -4.39 | -5.49 | -14.75 | -98.15 | -18.30 | -7.95 | 1.64 | -0.14 | -16.51 | 4.20 | **-223.74** |
| | **11** | -88.85 | 30.63 | -32.24 | 109.04 | 27.25 | -90.31 | 29.48 | 50.23 | -37.17 | 1.63 | 50.12 | 29.86 | 1.09 | **80.74** |
| | **12** | 2.83 | -30.66 | -169.75 | -12.57 | -20.78 | -28.99 | -146.06 | -84.41 | 3.68 | 12.00 | -108.07 | 51.02 | 13.56 | **-518.21** |
| | **13** | 0.00 | -1.97 | 8.43 | 1.69 | -2.14 | -3.96 | -27.14 | 9.13 | 1.30 | -1.43 | -4.70 | -11.14 | -0.14 | **-32.08** |
| | **Total** | **-1521.54** | **-370.93** | **-890.45** | **-122.47** | **-20.80** | **258.22** | **-726.32** | **833.81** | **-375.24** | **127.75** | **-98.93** | **177.76** | **35.87** | **-2693.26** |

*Table 7-7: Percentage change between prior sector matrices and post-ME sector matrices, AM Peak. Darker blue colours indicate greater percentage decrease. Darker red colours indicate greater percentage increases.*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -15.05 | -27.24 | -16.11 | -30.81 | 7.03 | -26.23 | 5.59 | -34.24 | 74.50 | -3.35 | 33.99 | -11.18 | **-11.56** |
| | **2** | -15.93 | -5.78 | -50.08 | 17.09 | 17.19 | -25.40 | 3.05 | 41.51 | -38.75 | 24.29 | 12.70 | -4.87 | -16.87 | **-6.94** |
| | **3** | -41.48 | -45.72 | 0.00 | -39.94 | 42.32 | 54.15 | -27.64 | 5.61 | 3.96 | 7.27 | -28.78 | 116.14 | -69.62 | **3.17** |
| | **4** | -24.92 | 57.18 | 10.18 | 29.06 | 110.42 | 18.44 | -22.90 | -11.82 | -12.91 | 34.55 | 126.00 | 133.01 | 22.99 | **0.78** |
| | **5** | -57.59 | 17.48 | -41.68 | 88.81 | 45.36 | -12.92 | -7.48 | 46.86 | -44.83 | 2.88 | 77.49 | 48.37 | 146.79 | **-13.12** |
| | **6** | -14.16 | -7.99 | -1.50 | -23.66 | 31.81 | 0.17 | 13.15 | 49.96 | 6.91 | 15.78 | 3.71 | 41.22 | 27.31 | **4.81** |
| | **7** | -26.42 | -49.36 | 12.16 | -22.27 | -34.23 | -11.46 | -29.60 | 58.35 | -16.54 | 3.50 | -34.19 | -2.86 | 1.34 | **-14.67** |
| | **8** | 5.86 | -53.99 | 1.24 | -44.80 | -22.69 | -13.75 | -9.49 | 59.55 | -7.28 | -1.81 | -34.15 | 21.57 | 16.36 | **-6.50** |
| | **9** | -39.99 | -44.23 | -31.50 | -30.27 | -11.71 | -2.56 | -34.67 | -21.30 | -22.63 | 73.36 | -36.38 | -1.61 | 7.78 | **-28.47** |
| | **10** | -40.00 | -12.88 | -37.24 | -14.16 | -13.30 | -20.13 | -51.99 | -23.43 | -23.76 | 0.46 | -0.18 | -5.49 | 23.31 | **-14.70** |
| | **11** | -51.22 | 3.94 | -35.38 | 78.71 | 85.63 | -22.32 | 13.45 | 92.16 | -37.19 | 3.42 | 31.04 | 34.42 | 71.68 | **3.53** |
| | **12** | 21.96 | -26.78 | -65.65 | -28.93 | -34.75 | -60.22 | -29.63 | -34.27 | 1.51 | 4.06 | -39.03 | 23.72 | 11.35 | **-21.35** |
| | **13** | N/A | -61.43 | 23.91 | 117.00 | -44.66 | -23.70 | -39.64 | 4.94 | 11.32 | -4.79 | -74.76 | -14.06 | -4.53 | **-7.21** |
| | **Total** | **-23.93** | **-13.03** | **-12.46** | **-7.41** | **-4.36** | **3.57** | **-21.87** | **18.06** | **-16.25** | **10.08** | **-6.94** | **14.04** | **10.85** | **-6.69** |

*Table 7-8: Absolute change between prior sector matrices and post-ME sector matrices, Inter-peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -41.88 | -84.69 | -46.58 | 0.56 | 161.88 | -47.49 | -3.39 | -188.44 | 10.63 | -6.52 | 30.69 | -2.25 | **-217.47** |
| | **2** | -56.85 | -105.83 | -47.46 | -126.47 | -22.69 | -28.34 | -20.47 | -4.53 | -34.31 | 43.91 | -54.96 | 2.72 | -0.36 | **-455.64** |
| | **3** | -67.69 | -11.02 | 0.95 | -6.96 | -3.68 | 457.59 | -149.64 | 46.34 | 79.65 | 1.40 | -13.15 | 16.94 | -2.63 | **348.09** |
| | **4** | -179.63 | -54.69 | -5.31 | 0.60 | 5.57 | 9.33 | -17.98 | 5.74 | -75.61 | 7.43 | 42.36 | 17.00 | -2.47 | **-247.67** |
| | **5** | -37.16 | 0.87 | -0.38 | 13.16 | -0.12 | 5.49 | -8.75 | 7.71 | -3.20 | 2.32 | 13.62 | 25.60 | -0.48 | **18.68** |
| | **6** | -556.86 | -26.26 | -140.45 | -24.58 | 2.48 | 0.40 | 79.91 | 567.48 | -0.23 | 31.40 | -11.83 | 69.17 | -4.51 | **-13.88** |
| | **7** | -15.29 | -47.17 | -129.94 | 7.99 | 15.40 | -40.38 | -12.82 | 31.08 | -0.37 | -39.12 | -15.98 | -125.29 | -55.56 | **-427.45** |
| | **8** | 4.77 | -30.88 | -456.71 | -0.69 | -2.54 | -330.12 | 25.87 | 41.78 | -15.66 | -22.11 | -17.18 | 0.90 | -2.32 | **-804.90** |
| | **9** | -194.96 | -82.94 | -115.27 | -77.55 | -3.19 | 4.67 | -10.55 | -5.00 | -50.15 | 20.07 | -27.47 | 12.97 | -0.73 | **-530.10** |
| | **10** | -1.84 | 14.58 | 1.05 | -0.04 | 14.78 | -0.77 | -62.98 | -21.84 | -19.71 | 3.67 | 27.68 | 81.38 | 4.06 | **40.02** |
| | **11** | -32.65 | -64.02 | -20.90 | 30.81 | 2.86 | -10.71 | -46.13 | 1.69 | -14.55 | 3.43 | 98.29 | -0.09 | -0.03 | **-52.01** |
| | **12** | 2.91 | 0.37 | -17.61 | 0.57 | 2.58 | -62.80 | -42.45 | 8.48 | -18.29 | 10.48 | 20.99 | 65.03 | -1.61 | **-31.34** |
| | **13** | 0.00 | 0.35 | -3.36 | 4.07 | 0.00 | -2.38 | -8.23 | 42.04 | 0.67 | 9.96 | 0.00 | 4.90 | 0.00 | **48.02** |
| | **Total** | **-1135.25** | **-448.52** | **-1020.10** | **-225.68** | **12.03** | **163.85** | **-321.71** | **717.58** | **-340.21** | **83.49** | **55.86** | **201.93** | **-68.91** | **-2325.65** |

*Table 7-9: Percentage change between prior sector matrices and post-ME sector matrices, Inter-Peak. Darker blue colours indicate greater percentage decrease. Darker red colours indicate greater percentage increases.*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -12.36 | -15.99 | -16.97 | 3.25 | 6.77 | -19.48 | -2.40 | -35.43 | 107.58 | -3.33 | 53.91 | -42.93 | **-4.55** |
| | **2** | -12.02 | -24.13 | -43.72 | -43.47 | -31.71 | -13.88 | -15.34 | -10.88 | -34.11 | 61.43 | -13.16 | 3.83 | -13.13 | **-18.79** |
| | **3** | -8.40 | -10.30 | 0.66 | -11.78 | -8.99 | 51.74 | -21.52 | 2.15 | 35.57 | 4.85 | -17.05 | 26.16 | -38.71 | **6.57** |
| | **4** | -39.94 | -24.81 | -17.16 | 1.45 | 25.12 | 14.47 | -21.66 | 2.97 | -27.21 | 48.05 | 30.94 | 154.54 | -50.73 | **-15.97** |
| | **5** | -37.75 | 1.28 | -0.99 | 68.86 | -0.29 | 28.51 | -26.50 | 31.52 | -39.38 | 51.29 | 43.48 | 156.19 | -83.92 | **4.65** |
| | **6** | -19.77 | -18.04 | -10.60 | -20.20 | 32.34 | 0.13 | 34.86 | 54.47 | -0.11 | 18.23 | -18.77 | 45.56 | -18.76 | **-0.21** |
| | **7** | -4.73 | -32.07 | -20.59 | 28.55 | 30.79 | -11.15 | -12.28 | 39.55 | -1.30 | -44.64 | -25.46 | -31.52 | -25.08 | **-16.94** |
| | **8** | 5.34 | -29.50 | -17.12 | -0.54 | -8.64 | -18.68 | 16.02 | 41.39 | -18.25 | -35.19 | -19.39 | 0.67 | -6.62 | **-14.75** |
| | **9** | -39.85 | -50.03 | -33.36 | -29.74 | -20.40 | 2.10 | -33.12 | -11.66 | -10.46 | 70.70 | -32.90 | 17.02 | -28.55 | **-23.62** |
| | **10** | -6.22 | 16.00 | 2.61 | -0.24 | 67.33 | -1.65 | -35.88 | -38.04 | -24.18 | 0.89 | 37.52 | 55.37 | 60.85 | **3.33** |
| | **11** | -34.61 | -11.97 | -28.98 | 13.90 | 5.84 | -10.41 | -33.47 | 5.36 | -20.06 | 17.58 | 36.81 | -10.44 | -19.94 | **-3.24** |
| | **12** | 51.95 | 0.35 | -52.32 | 8.55 | 16.96 | -53.64 | -18.57 | 8.19 | -7.25 | 5.57 | 17.89 | 53.50 | -31.63 | **-2.41** |
| | **13** | N/A | 57.05 | -13.15 | 250.82 | N/A | -32.24 | -8.85 | 48.79 | 10.82 | 39.11 | N/A | 21.55 | 0.00 | **17.41** |
| | **Total** | **-19.87** | **-18.17** | **-17.02** | **-15.37** | **3.15** | **2.52** | **-13.69** | **17.50** | **-14.43** | **7.40** | **3.46** | **15.87** | **-21.36** | **-6.52** |

*Table 7-10: Absolute change between prior sector matrices and post-ME sector matrices, PM Peak. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| Origin Sector | **1** | 0.00 | -121.07 | -98.22 | -3.93 | -14.36 | -422.85 | -58.91 | -20.59 | 37.57 | 3.01 | -58.93 | 4.70 | -30.59 | **-784.17** |
| | **2** | -26.53 | -110.62 | -25.19 | 8.98 | -5.98 | -46.43 | 7.42 | -11.87 | -61.91 | 60.63 | -28.98 | -16.74 | 0.35 | **-256.86** |
| | **3** | 3.31 | -31.24 | -0.67 | -3.81 | -1.68 | 375.42 | -90.60 | 195.30 | -45.36 | -8.13 | -7.95 | -0.57 | -4.14 | **379.89** |
| | **4** | -179.97 | -28.62 | -8.03 | 6.59 | 7.74 | -16.47 | -13.28 | -33.84 | -189.13 | -0.32 | 65.62 | 9.61 | 0.11 | **-379.98** |
| | **5** | -127.18 | -32.86 | -1.85 | 8.05 | -9.01 | -6.03 | -22.53 | -1.34 | -13.85 | 3.71 | 11.94 | 5.52 | 0.00 | **-185.42** |
| | **6** | -803.63 | -39.94 | -424.40 | -45.15 | 1.73 | 0.10 | 35.15 | 657.87 | -164.54 | -8.94 | -5.43 | -6.18 | -2.10 | **-805.46** |
| | **7** | 0.10 | -11.44 | -95.14 | 3.77 | -17.80 | 20.32 | -31.14 | 63.11 | -7.57 | -0.22 | -9.58 | -186.40 | -50.89 | **-322.88** |
| | **8** | 3.01 | -10.49 | -334.26 | -0.63 | -0.04 | 58.12 | 55.92 | 47.91 | -14.65 | -56.69 | -1.37 | -68.89 | -1.10 | **-323.14** |
| | **9** | -233.78 | -44.58 | -60.31 | 9.53 | 0.01 | -19.18 | -3.82 | -1.48 | -80.03 | 32.74 | -38.07 | 26.55 | 0.14 | **-412.29** |
| | **10** | -14.19 | -19.72 | 5.18 | 6.03 | 10.54 | -29.81 | -22.42 | -35.51 | -9.81 | 2.02 | 29.14 | 33.18 | -0.46 | **-45.83** |
| | **11** | -29.54 | -9.37 | -8.09 | 83.49 | -7.13 | -24.89 | 23.30 | 31.62 | -64.24 | 5.30 | 84.99 | 3.68 | 0.00 | **89.12** |
| | **12** | 6.67 | -8.65 | -16.11 | 6.30 | -3.52 | -7.33 | -31.05 | -40.34 | 3.83 | 8.94 | 31.16 | 87.77 | -9.97 | **27.71** |
| | **13** | 0.00 | 0.08 | -6.41 | -0.07 | 0.37 | 0.04 | 1.81 | 76.83 | -0.60 | 1.24 | 0.31 | 0.07 | 0.00 | **73.69** |
| | **Total** | **-1401.73** | **-468.51** | **-1073.50** | **79.15** | **-39.12** | **-118.98** | **-150.15** | **927.69** | **-610.29** | **43.29** | **72.87** | **-107.68** | **-98.65** | **-2945.63** |

*Table 7-11: Percentage change between prior sector matrices and post-ME sector matrices, PM Peak. Darker blue colours indicate greater percentage decrease. Darker red colours indicate greater percentage increases.*

| | | Destination Sector | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** | **Total** |
| **Origin Sector** | **1** | 0.00 | -26.78 | -22.80 | -1.97 | -31.93 | -15.64 | -18.29 | -19.58 | 11.10 | 25.37 | -16.41 | 10.16 | -48.21 | **-15.28** |
| | **2** | -10.78 | -18.44 | -51.34 | 3.98 | -14.29 | -33.42 | 22.92 | -20.12 | -55.76 | 45.48 | -4.86 | -18.58 | 23.71 | **-11.05** |
| | **3** | 0.41 | -35.91 | -0.99 | -9.61 | -4.79 | 36.31 | -11.73 | 8.33 | -10.67 | -15.54 | -18.67 | -0.65 | -65.03 | **6.55** |
| | **4** | -36.72 | -7.70 | -32.99 | 9.21 | 31.53 | -11.50 | -19.87 | -16.93 | -47.56 | -1.72 | 37.53 | 26.02 | 27.88 | **-18.81** |
| | **5** | -47.44 | -36.87 | -19.12 | 20.10 | -38.94 | -23.46 | -48.11 | -4.93 | -55.84 | 42.90 | 36.86 | 33.29 | N/A | **-30.29** |
| | **6** | -23.67 | -38.27 | -29.26 | -24.92 | 16.56 | 0.03 | 18.10 | 52.10 | -32.57 | -3.61 | -31.04 | -3.41 | -4.02 | **-10.14** |
| | **7** | 0.02 | -23.57 | -15.73 | 10.19 | -11.25 | 17.36 | -16.46 | 30.30 | -11.84 | -0.20 | -6.42 | -26.73 | -21.40 | **-10.57** |
| | **8** | 1.36 | -12.08 | -13.24 | -1.01 | -0.20 | 3.54 | 27.17 | 53.56 | -28.38 | -50.35 | -0.89 | -18.79 | -18.81 | **-5.83** |
| | **9** | -38.51 | -30.28 | -32.04 | 5.95 | 0.20 | -5.91 | -7.45 | -3.33 | -24.91 | 71.29 | -22.94 | 16.74 | 42.68 | **-18.59** |
| | **10** | -25.61 | -15.30 | 9.97 | 28.36 | 23.24 | -26.87 | -29.33 | -34.17 | -20.51 | 0.44 | 21.01 | 16.27 | -1.19 | **-3.09** |
| | **11** | -30.65 | -1.27 | -44.50 | 60.32 | -13.41 | -20.78 | 64.17 | 46.35 | -47.67 | 35.55 | 29.26 | 7.49 | N/A | **5.07** |
| | **12** | 60.26 | -6.75 | -38.12 | 58.74 | -5.99 | -44.86 | -23.99 | -15.15 | 1.66 | 3.46 | 12.22 | 41.15 | -47.94 | **1.69** |
| | **13** | N/A | 27.88 | -70.19 | -52.02 | 49.44 | 0.62 | 3.30 | 74.12 | -15.56 | 6.20 | 62.43 | 0.15 | 0.00 | **29.82** |
| | **Total** | **-20.99** | **-15.71** | **-19.62** | **6.67** | **-7.57** | **-1.77** | **-6.89** | **19.00** | **-22.97** | **2.89** | **3.07** | **-4.91** | **-23.06** | **-7.41** |

The overall matrix changes are between 6.5 – 7.5%. This is just over the ‘significant’ threshold defined in TAG. This overall level of change is deemed acceptable given the rezoning exercise. This was based on population sizes within Output Areas, which was viewed as the most robust dataset to split zones. However, it can lead to some distribution issues as it does not always capture trip generators such as large employment locations e.g. business parks or distribution centres that people may travel to and from. It is also noted that much of the change between pre and post ME was on trips to and from the internal area where some redistribution between 2016 and 2024 was expected as noted in Section 8.2.3.1.

It is acknowledged that there are some large sector changes. Analysis of these show that these are often due to large changes between internal to external or external to internal sector movements. Many of these changes are concentrated in Sectors 11, 12 and 13. The absolute changes for these higher percentages were lower levels of trips but because there was a small number of trips in the Prior Matrix, the level of percentage change in some sector-to-sector movements appears large.

Table 7-12 and Table 7-13 show the absolute and percentage change in the sector matrices for the AM Peak period, but sector-to-sector movements where the absolute change is less than 100 trips have been greyed out. This has been done to minimise sector movements with small absolute changes and highlight those where the bulk of the changes is occurring.

The tables suggest that while there are some larger changes in certain sectors, most of the changes at a sector level are less than 100 trips and the larger changes are mostly reductions. This was expected as many links in the prior matrices were shown to be higher than the 2024 observed flows and therefore ME needed to supress trips. This was deemed acceptable due to the nature of having to work from a donor model and the fact than an ANPR was not possible (as detailed earlier in this report) to manually redistribute trips prior to Matrix Estimation, thus requiring the ME to work harder than some other models.

*Table 7-12: Absolute change between prior sector matrices and post-ME sector matrices, AM Peak. Only movements where the absolute changes is 100 trips or above are shown. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | **Destination Sector** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| **Origin Sector** | **1** | | | -475.13 | | | 153.80 | | | -196.49 | | | | |
| | **2** | | | -111.52 | | | | | | | | | | |
| | **3** | -233.15 | | | | | 613.38 | -282.73 | 120.67 | | | | | |
| | **4** | | | | | | | | | | | | | |
| | **5** | -146.77 | | | | | | | | | | | | |
| | **6** | -392.79 | | | | | | | 628.07 | | | | | |
| | **7** | -196.83 | | | | | | | | | | | | |
| | **8** | | -131.91 | | -118.40 | | -240.26 | | | | | | | |
| | **9** | -321.05 | -105.33 | -132.11 | -100.78 | | | | | | | | | |
| | **10** | | | | | | | | | | | | | |
| | **11** | | | | 109.04 | | | | | | | | | |
| | **12** | | | -169.75 | | | | -146.06 | | | | -108.07 | | |
| | **13** | | | | | | | | | | | | | |

*Table 7-13: Percentage change between prior sector matrices and post-ME sector matrices, AM Peak. Only movements where the absolute changes is 100 trips or above are shown. Darker blue colours indicate greater decrease. Darker red colours indicate greater increase*

| | | **Destination Sector** | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3** | **4** | **5** | **6** | **7** | **8** | **9** | **10** | **11** | **12** | **13** |
| **Origin Sector** | **1** | | | -27.24 | | | 7.03 | | | -34.24 | | | | |
| | **2** | | | -50.08 | | | | | | | | | | |
| | **3** | -41.48 | | | | | 54.15 | -27.64 | 5.61 | | | | | |
| | **4** | | | | | | | | | | | | | |
| | **5** | -57.59 | | | | | | | | | | | | |
| | **6** | -14.16 | | | | | | | 49.96 | | | | | |
| | **7** | -26.42 | | | | | | | | | | | | |
| | **8** | | -53.99 | | -44.80 | | -13.75 | | | | | | | |
| | **9** | -39.99 | -44.23 | -31.50 | -30.27 | | | | | | | | | |
| | **10** | | | | | | | | | | | | | |
| | **11** | | | | 78.71 | | | | | | | | | |
| | **12** | | | -65.65 | | | | -29.63 | | | | -39.03 | | |
| | **13** | | | | | | | | | | | | | |

#### 7.3.3.3 Zonal Cell Values and Trip-End Correlation

The correlation of pre vs. post matrix estimation zonal trip ends was checked to ensure that matrix estimation did not significantly affect trip distribution. Table 7-14 shows the relevant statistics for all user classes (Car / LGV / HGV). As stated in TAG, the Correlation coefficient should be as close to 1 as possible and the intercept of the regression line should be close to 0. The values in the tables below are derived from the post-estimation matrices, to which additional targeted adjustments were made to specific areas of the matrix after consultation with the TWG stakeholders around the base model performance.

*Table 7-14 Matrix Estimation Cell Values Analysis*

| Period | Slope | Intercept | Correlation Coefficient |
|---|---|---|---|
| AM | 0.97 | -0.44 | 0.98 |
| IP | 0.93 | 0.03 | 0.98 |
| PM | 0.89 | 0.39 | 0.98 |

At the zonal level, the slope, intercept, and correlation coefficient are meeting, or close to meeting, TAG criteria for slope, intercept and $R^2$ values. It is acknowledged that the IP and PM Peak slope values (0.93 and 0.89 respectively) are below the ≥0.98. As is mentioned elsewhere in this LMVR, this performance was considered acceptable due to the expectation that the Matrix Estimation would need to work harder due to the doner model using a 2016 distribution and the SHILPM data collection being a 2024 dataset.

Table 7-15 presents a summary of the matrix trip ends correlation analysis.

*Table 7-1516 Matrix Estimation Trip End Analysis*

| Period | Slope | Intercept | Correlation Coefficient |
|---|---|---|---|
| AM | 0.95 | -9.97 | 0.99 |
| IP | 0.94 | -5.26 | 0.99 |
| PM | 0.92 | 6.17 | 0.99 |

At the trip-end level, it is noted that the slope values are more closely matched to the 0.95 intercept target value. However, it can be seen that the intercept values are not near 1. This is likely due to changes in distribution compared to the original 2016 base matrices, and the 2024  the traffic count data. In the absence of an ANPR, due to the porous nature of the network, it was not possible to make marked informed updates to the distribution of the prior matrices.

As per TAG guidance, further investigations were undertaken in light of the results in the tables above to understand if the numbers and model performance were acceptable.

As part of the process undertaken to facilitate the expansion of the PLRM that was agreed with the TWG, it was acknowledged that there where existing external zones were split into multiple new zones, interzonal trips between these new zones as previously they would not have loaded into the model. This is due to the fact that external zones did not load into buffer network and rather just into the edges of the model. some trips were added on the very edge junctions of the model where turning flows could be properly identified between external zones. Unfortunately, there was no way to re-add the majority of these other trips for zones not loaded at the last junctions of the network into the matrix. These missing trips were identified along with the expected distributional change between 2026-2024, as the likely route cause of the Matrix Estimation causing higher levels of change than usual.

Overall, while it is acknowledged that the Matrix Estimation is causing a larger than usual change, this is deemed acceptable given the model expansion

#### 7.3.3.4 Trip Length Distribution

Trip length distribution prior and post matrix estimation was checked. This was to check that the matrix estimation process did not materially alter trip patterns in the prior matrices. Matrix estimation can have the tendency to increase short distance trips at the expense of long-distance trips, which needs to be kept to a minimum.

Figure 7:1 to Figure 7:3 shows a comparison of the trip length distributions in the trip matrices prior and post matrix estimation for all periods. These comparisons are taken before the updates to the post-ME matrices described in section 7.3.2, were made, to isolate the provide a fairer assessment of the impact of the matrix estimation process on trip lengths.

Overall, there was no significant change in trip lengths in trips below 10 kilometres. There are slightly larger percentage fall in the number of between 10 and 16 kilometres in the post-ME matrices. The reduction in the number of trips of this length was between 7 and 28 percent, depending on period. Although the trip length changes are more noticeable, this corresponds with the changes in sector movements between internal and external zones, as explained in Section 7.3.3.2.

The largest observed change in trips was for trips between 18 and 20 kilometres. The longest trip path in the model is approximately 19.5km with several of the key external to external routes (e.g. the through M6 route) fall into the sub 16km distance bands. The number of trips within this length increased by between 53 and 182 percent depending on the period. However, the prior matrices only had a small number of trips within this distance band, meaning that despite the large percentage change, only a small absolute number of trips of this length were added.

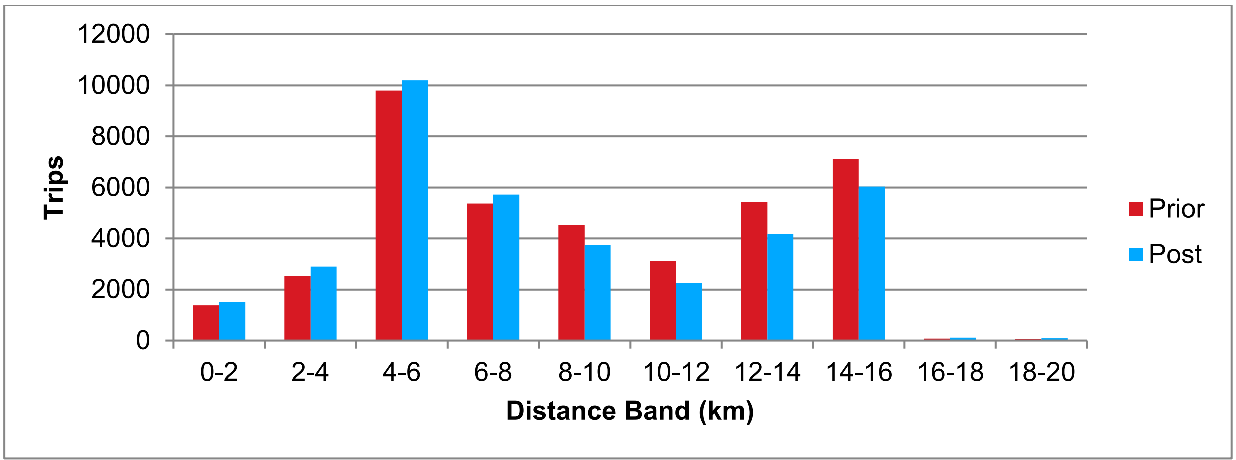


*Figure 7:1: Comparison of Trip Length Distributions between Prior and Post Matrix Estimation, AM Peak*

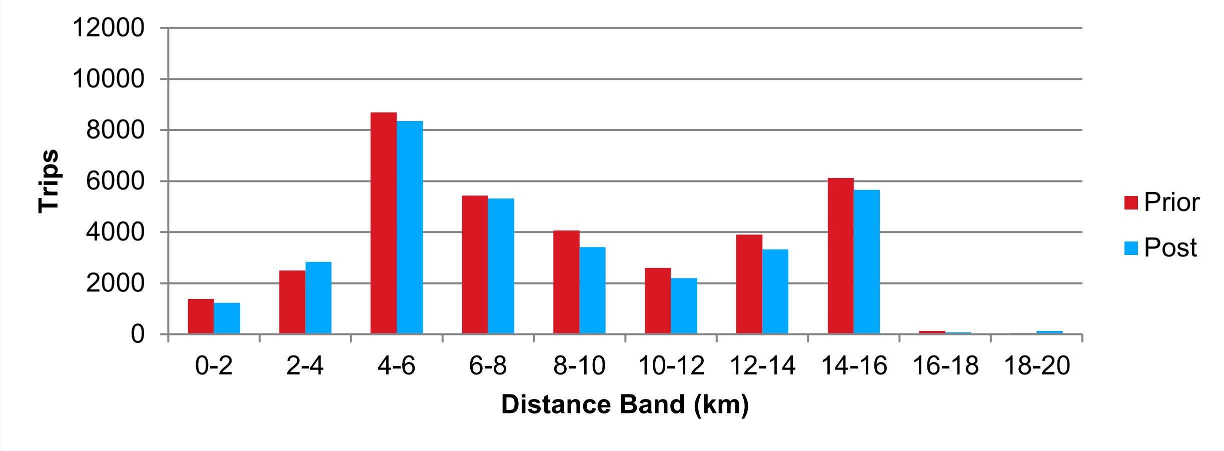


*Figure 7:2: Comparison of Trip Length Distributions between Prior and Post Matrix Estimation, Inter-Peak*

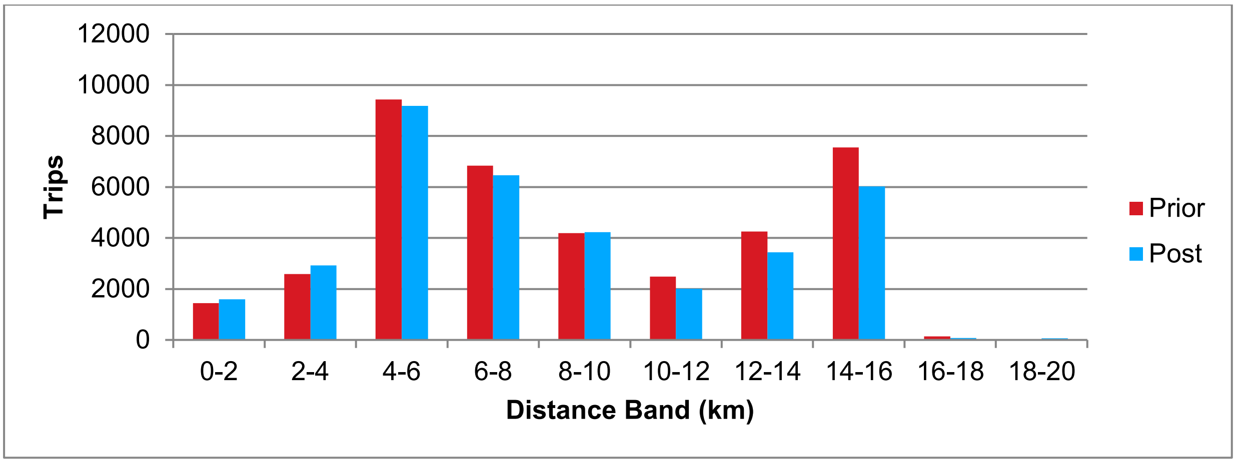


*Figure 7:3: Comparison of Trip Length Distributions between Prior and Post Matrix Estimation, PM Peak*

## 7.4 Matrix Calibration Results

### 7.4.1 Calibration Screenlines

Table 7-17 presents analysis of the matrix estimation results on the screenlines used within the matrix calibration process for total vehicles. The same is presented in Table 7-18 to Table 7-20, but for each individual vehicle class.

*Table 7-17: Post Matrix Calibration Results by Time Period, for Total Vehicles*

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Screenlines (All Directions) | | 32 | 32 | 32 |
| Within TAG | Number of Screenlines | 18 | 22 | 18 |
| | % of modelled flows | 56% | 69% | 56% |
| GEH<5 | Number of Screenlines | 27 | 27 | 28 |

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| | % of modelled flows | 84% | 84% | 88% |
| GEH<7 | Number of Screenlines | 29 | 31 | 31 |
| | % of modelled flows | 91% | 97% | 97% |

*Table 7-18: Post Matrix Calibration Results by Time Period, for Cars*

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Screenlines (All Directions) | | 32 | 32 | 32 |
| Within TAG | Number of Screenlines | 19 | 23 | 18 |
| | % of modelled flows | 59% | 72% | 56% |
| GEH<5 | Number of Screenlines | 25 | 27 | 28 |
| | % of modelled flows | 78% | 84% | 88% |
| GEH<7 | Number of Screenlines | 29 | 28 | 31 |
| | % of modelled flows | 91% | 88% | 97% |

*Table 7-19: Post Matrix Calibration Results by Time Period, for LGVs*

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Screenlines (All Directions) | | 32 | 32 | 32 |
| Within TAG | Number of Screenlines | 26 | 22 | 26 |
| | % of modelled flows | 81% | 69% | 81% |
| GEH<5 | Number of Screenlines | 31 | 32 | 31 |
| | % of modelled flows | 97% | 100% | 97% |
| GEH<7 | Number of Screenlines | 32 | 32 | 32 |
| | % of modelled flows | 100% | 100% | 100% |

*Table 7-20: Post Matrix Calibration Results by Time Period, for HGVs*

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Screenlines (All Directions) | | 32 | 32 | 32 |
| Within TAG | Number of Screenlines | 24 | 26 | 25 |
| | % of modelled flows | 75% | 81% | 78% |
| GEH<5 | Number of Screenlines | 30 | 30 | 30 |
| | % of modelled flows | 94% | 94% | 94% |
| GEH<7 | Number of Screenlines | 30 | 30 | 31 |

| Criteria | | Number / Percentage of Screenlines | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| | % of modelled flows | 94% | 94% | 97% |

The tables show that the screenlines calibrate very well for HGV and LGVs. Calibration at a screenline level is lower for Car. Further investigation was therefore conducted at a link level to understand the model performance.

*Table 7-21: Model Calibration by Period on Individual Calibration Links (All User Classes)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Calibration Links | | 86 | 86 | 86 |
| Within TAG | Number of Links | 76 | 81 | 73 |
| | % of modelled flows | 88% | 94% | 85% |
| GEH<5 | Number of Links | 73 | 77 | 72 |
| | % of modelled flows | 85% | 90% | 84% |
| GEH<7 | Number of Links | 77 | 81 | 75 |
| | % of modelled flows | 90% | 94% | 87% |
| GEH<10 | Number of Links | 83 | 81 | 75 |
| | % of modelled flows | 97% | 94% | 87% |

Table 7-21 presents the summary of the individual calibration points across the three modelled time periods. The criteria for both TAG and GEH statistic ranges are presented. Overall, this shows that the model performance against individual calibration links is significantly better than that for the overall screenlines. Further checks were made looking at the routing across screenlines and these were also deemed acceptable when compared to flows, journey times and the use of google routing data. It should also be noted that the allowed change in TAG across screenlines is 5%, significantly below the change allowed at the individual link level. This is influencing the screenline reporting levels as some links are subject to more than a 5% change. It should also be noted that GEH performance, while not a TAG criterion anymore, is shown to be good with ~85% of screenlines having a GEH of less than 5.

## 7.5 Calibration Summary

Additional trips were added between adjacent external zones at the network edges to correct missing external to external flows which required readding due to the rezoning process. These locations included:

- A49 Winwick Lane roundabout.
- A579 Atherleigh Way and A572 St Helens Road junction.
- A580 East Lancashire Road and A58 junction.

Most matrix total changes occurred in internal area movements, reflecting expected distribution shifts between 2016 and 2024. Overal changes in matrix totals were approximately 6.5-7.5% which is slightly above the TAG threshold of 5%. This was considered appropriate due to the rezoning exercise.

Trip length distribution was considered acceptable with some moderate reductions noted for trips between 10-16km. there where significant percentage increases for trips over 18km but these actually represented small changes to low absolute trip numbers.

At a screenline level, the model shows strong calibration for LGV and HGVs. Car flows show a lower accuracy at screenline level but this is much improved when reviewed at an individual link level. This, coupled with routing checks, gave confidence the modelled flows are appropriate. It should be noted that approximately 85% of screenlines achieved GEH < 5, indicating good model fit.

Therefore, the model is viewed as performing acceptably well in terms of calibration, acknowledging that there may be some weaknesses against guidance in terms of total flow across the screenlines.

# 8 Assignment Validation Results

This section reports on the flow and journey time validation achieved by the SHILPM. The results have been considered with respect to calibration and validation criteria and acceptability guidelines summarised in Section 5.

## 8.1 Assignment Convergence

TAG Unit M3.1 notes that before the results of any traffic assignment are used to influence decisions, the stability or degree of convergence of the assignment must be confirmed at the appropriate level. The importance of achieving convergence at an appropriate level is related to the need to provide stable, consistent, and robust model outputs. This is especially so when model outputs are used to compare ‘with’ and ‘without’ scheme scenarios in cost benefit analysis. It is important to be able to distinguish differences due to the scheme from those associated with different degrees of convergence.

Table 8-1 summarises the convergence measures of proximity and stability given in TAG Unit M3.1 Table 4 for model convergence.

*Table 8-1: Summary of Convergence Measures and Base Model Acceptable Values*

| Measure of Convergence | Base Model Acceptable Values |
|---|---|
| Delta and % Gap | Less than 0.1% or at least stable with convergence fully documented and all other criteria met |
| Percentage of links with flow change (P) < 1% | Four consecutive iterations greater than 98% |
| Percentage of links with cost change (P2) < 1% | Four consecutive iterations greater than 98% |
| Percentage change in total user costs (V) | Four consecutive iterations less than 0.1% (SUE only) |

The results of convergence statistics achieved for all periods of the SHILPM are shown in Table 8-2. This shows that both period models meet the convergence criteria required and demonstrate that the assignment models are stable and robust.

*Table 8-2: Assignment Convergence Statistics*

| Period | Iteration | % Gap / Delta | % Flow | % Cost Delays |
|---|---|---|---|---|
| AM | 1 | 0.0040 | 98.7 | 99.7 |

| Period | Iteration | % Gap / Delta | % Flow | % Cost Delays |
|---|---|---|---|---|
| | 2 | 0.0040 | 98.8 | 99.8 |
| | 3 | 0.0036 | 99.2 | 99.8 |
| | Final | 0.0029 | 99.4 | 100.00 |
| IP | 1 | 0.0061 | 99.8 | 99.7 |
| | 2 | 0.0070 | 98.8 | 99.9 |
| | 3 | 0.0080 | 99.5 | 99.9 |
| | Final | 0.0045 | 99.5 | 99.7 |
| PM | 1 | 0.0044 | 99.5 | 99.6 |
| | 2 | 0.0086 | 99.2 | 99.6 |
| | 3 | 0.0019 | 99.3 | 99.6 |
| | Final | 0.0026 | 99.4 | 99.5 |

## 8.2 Flow Validation

Validation links and turns are used within the assessment process to demonstrate how well the model performs in replicating observed travel patterns in the study area. The counts used within the validation process are independent from those used within the calibration process.

Table 8-3 to Table 8-6 presents the validation statistics for the SHILPM for link flows at a total level and by Vehicle Class.

*Table 8-3: Validation Link Statistics (All User Classes)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Links | | 200 | 200 | 200 |
| Within TAG | Number of Links | 149 | 148 | 140 |
| | % of modelled flows | **75%** | **74%** | **70%** |
| GEH<5 | Number of Links | 135 | 129 | 129 |
| | % of modelled flows | **68%** | **65%** | **65%** |
| GEH<7 | Number of Links | 162 | 164 | 152 |
| | % of modelled flows | **93%** | **94%** | **90%** |
| GEH<10 | Number of Links | 186 | 188 | 180 |
| | % of modelled flows | **93%** | **94%** | **90%** |

*Table 8-4: Validation Link Statistics (Car)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Links | | 200 | 200 | 200 |
| Within TAG | Number of Links | 157 | 162 | 148 |
| | % of modelled flows | **79%** | **81%** | **74%** |
| GEH<5 | Number of Links | 141 | 139 | 131 |
| | % of modelled flows | **71%** | **70%** | **66%** |
| GEH<7 | Number of Links | 166 | 169 | 158 |
| | % of modelled flows | **83%** | **85%** | **79%** |
| GEH<10 | Number of Links | 186 | 189 | 183 |

| Criteria | | AM | IP | PM |
|---|---|---|---|---|
| | % of modelled flows | **93%** | **95%** | **92%** |

*Table 8-5: Validation Link Statistics (LGV)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Links | | 200 | 200 | 200 |
| Within TAG | Number of Links | 196 | 192 | 198 |
| | % of modelled flows | **98%** | **96%** | **99%** |
| GEH<5 | Number of Links | 172 | 177 | 178 |
| | % of modelled flows | **86%** | **89%** | **89%** |
| GEH<7 | Number of Links | 198 | 193 | 195 |
| | % of modelled flows | **99%** | **97%** | **98%** |
| GEH<10 | Number of Links | 200 | 199 | 200 |
| | % of modelled flows | **100%** | **100%** | **100%** |

*Table 8-6 Validation Link Statistics (HGV)*

| Criteria | | Number / Percentage of Links | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Links | | 198 | 199 | 191 |
| Within TAG | Number of Links | 193 | 198 | 191 |
| | % of modelled flows | **97%** | **99%** | **100%** |
| GEH<5 | Number of Links | 159 | 159 | 167 |
| | % of modelled flows | **80%** | **80%** | **87%** |
| GEH<7 | Number of Links | 173 | 179 | 187 |
| | % of modelled flows | **87%** | **90%** | **98%** |
| GEH<10 | Number of Links | 192 | 193 | 191 |
| | % of modelled flows | **97%** | **97%** | **100%** |

The tables show that the validation for LGVs and HGVs is particularly strong with over 95% of all links passing the TAG criteria for these Vehicle Classes. Total and Car present a weaker picture with 70-75% of links passing at a total level and 74-81% passing for the Car Vehicle Class.

To ensure the model's fitness for purpose, further investigation of where these failing links are located has been undertaken. There are several links that consistently show has no passing. These include:

- Newton Road to the South of Sandy Lane – **Consistently low**
    - This is an area that was part of the extension and rezoning. A review of the route shows that multiple new zones were located along this route and it is likely that some interzonal traffic between these zones is missing. It is not possible to add this traffic in due to the nature of the zone splitting process and lack of other data to enable any synthetic matrix additions. It should be noted however that the calibration count on the Newton Road approach to the Lane Head junction is consistently passing the TAG criteria meaning it is unlikely to be affecting the operation of this junction.
- Lodge Lane – **Consistently low**

  - This is again an area where rezoning occurred due to the model extension and it likely that some trips between it and adjacent new zones are missing from the matrix.
- A58/A580 Junction – A58 Liverpool Road and Stanley Bank Way arms – **Consistently low**
  - These arms were part of the model extension and rezoning. It is again thought that some interzonal trips in this area may be missing due to the nature of using existing distributions and splitting by population as part of the rezoning process. As this location is on the edge of the model, this is viewed as an acceptable area of weakness.
- Western A50 arm of M6 J23 Haydock Island – **Consistently high**
  - This arm is shown to be consistently high in terms of flow in both directions (apart from the westbound flow in the interpeak). Haydock Island was shown to be one of the most sensitive areas of the model during development with extensive work done to ensure that the delay profile on the journey time route along the A580 was acceptable at this junction. The calibration count on the eastern side of this junction passed the TAG criteria in all peaks and the journey time through the junction is consistently good through the junction in terms of profile against observed data. Therefore, the high flows on the western arm are considered acceptable.
- A580 entry flows to Lane Head (IP and PM)– **Consistently high**
  - The A580 entries into the Lane Head junctions are slightly high in the IP and PM peaks models. Further investigation shows that these flows are between 15-18% different to observed. This is just over the TAG criteria and the GEH values for these links is shown to be under 6 in the PM peak and under 7 in the Interpeak. Given that the journey times through this junction are relatively good, these flows are considered acceptable. It is noted that the interpeak eastbound journey time is a slightly high due to delay at Lane Head, but the A580 flow in this direction meets TAG on entry and exit of the Lane Head area
- M6 Junction 21a Slips – Various between peaks
  - A number of the slips were carrying higher than observed flows. Which of the slips this was differs between peaks. Further investigation shows that the M6 counts in the surrounding area generally meet TAG criteria with M62 counts also passing or almost passing (with a difference of <15.5% of observed flow)
- The M62 Eastbound to M6 Northbound slip is shown to be approximately 200 vehicles lower than observed in all peaks. However, the mainline M6 counts to the north of this location ared generally meeting TAG criteria and the M6 journey time route is shown to validate well to observed data. Therefore, this links performance is viewed as acceptable within the wider model
- Southbound A49 (AM Peak Only) – **Low Flow**
  - Investigation of these links showed a discrepancy between the MCC flows and the ATC used for calibration, with the calibration count located between the two MCCs. Liaison with Warrington has been undertaken to discuss this issue and it was agreed that the performance at these was acceptable and that it was better to used observed data rather than a synthetic average of the three counts.

Other areas showing lower or higher flows are mainly in the rural edges of the network and therefore viewed as acceptable as the purpose of the model is to assess traffic routing changes in future years on the key routes.

## 8.3 Turn Validation

Table 8-7 to Table 8-10 presents the validation statistics for the SHILPM for turn flows at a total level and by vehicle class.

*Table 8-7: Validation Turn Statistics (All User Classes)*

| Criteria | | Number / Percentage of Turns | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Turns | | 278 | 279 | 279 |
| Within TAG | Number of Turns | 227 | 247 | 220 |
| | % of modelled flows | 82% | 89% | 79% |

*Table 8-8: Validation Turn Statistics (Car)*

| Criteria | | Number / Percentage of Turns | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Turns | | 278 | 279 | 279 |
| Within TAG | Number of Turns | 245 | 257 | 221 |
| | % of modelled flows | 88% | 92% | 79% |

*Table 8-9: Validation Turn Statistics (LGV)*

| Criteria | | Number / Percentage of Turns | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Turns | | 275 | 277 | 274 |
| Within TAG | Number of Turns | 275 | 277 | 274 |
| | % of modelled flows | 100% | 100% | 100% |

*Table 8-10: Validation Turn Statistics (HGV)*

| Criteria | | Number / Percentage of Turns | | |
|---|---|---|---|---|
| | | AM | IP | PM |
| Number of Validation Turns | | 254 | 262 | 209 |
| Within TAG | Number of Turns | 254 | 262 | 209 |
| | % of modelled flows | 100% | 100% | 100% |

The tables above show the model’s turn validation is good across many periods and vehicle classes. Depending on the period and vehicle class, the percent of modelled turns within TAG criteria was between 79 and 100 percent.

When considering all vehicles, the number of modelled turning flows in the AM peak and PM peak within TAG criteria was just below the 85 percent guideline but were within guidelines for the inter-peak period.

Modelled turning flows for cars were within the TAG criteria in the AM peak and inter-peak period but fell short of the 85% guideline in the PM peak. The turn validation for LGVs and HGVs were by far the strongest, with 100 percent of turns meeting TAG criteria being achieved for both vehicle classes.

Given that strategic models traditionally do not validate well to turning movements, the good performance of the SHILPM model for turning movements is considered to be a strength with good performance at a total level and by vehicle classes.

## 8.4 Journey Time Validation

Observed journey times were based on data from TomTom. Eight journey time routes were used for validating journey times in the SHILPM. Each route was checked in both directions for all three studied time periods. The journey time routes and data are discussed in Section 3.2.3.

Table 8-11, Table 8-12, and Table 8-13 provides a summary of the journey time validation in the AM peak, inter peak, and PM peak respectively.

Routes where the difference between modelled and observed journey times is greater than 15 percent, thereby falling outside of TAG criteria, are shown in red text. Overall, most modelled journey times on the validation routes are within 15 percent of the observed journey times. In total, 93.8 percent of all journey times routes in the AM and PM peaks, and 87.5 percent of journey times routes in the inter-peak period, were within the 15 percent TAG guideline. This means the journey times overall align with the TAG criterion for 85 percent of journey time routes to be within the 15 percent of observed journey times.

The routes which did not meet the TAG guidelines were the following:

- A573 Southbound in the AM Peak.
    - The modelled journey time was 15.3 percent faster than the observed, falling just outside of the TAG guidelines. This is mainly attributed to journey times being too fast around the roundabout with A580 East Lancashire Road and signalised junction with A572 Newton Road.
- A579 Southbound in the inter-peak and PM Peak.
    - The modelled journey times were 17.7 percent slower than observed, with most the excess delay being added at the signalised junctions with A580 East Lancashire Road at Lane Head.
- A580 Eastbound in the inter-peak.
    - The modelled journey times were 19.5 percent slower than observed. As above, the additional journey time can be attributed to the signalised junctions at Lane Head.

*Table 8-11: Journey Time Validation (AM Peak)*

| Route Number | Route Short Name | Direction | Observed Time (Mins) | Modelled Time (Mins | Difference (Mins) | Difference (%) |
|---|---|---|---|---|---|---|
| 1 | A49 | NB | 11.36 | 10.98 | -0.39 | -3% |
| | | SB | 11.96 | 11.64 | -0.32 | -3% |
| 2 | A579 | NB | 11.81 | 12.75 | 0.94 | 8% |
| | | SB | 15.29 | 13.35 | -1.95 | -13% |
| 3 | A580 | EB | 7.89 | 8.82 | 0.93 | 12% |
| | | WB | 12.06 | 11.52 | -0.54 | -5% |

| Route Number | Route Short Name | Direction | Observed Time (Mins) | Modelled Time (Mins | Difference (Mins) | Difference (%) |
|---|---|---|---|---|---|---|
| 4 | A573 | NB | 8.96 | 9.45 | 0.49 | 5% |
| | | SB | 11.47 | 9.71 | -1.76 | -15% |
| 5 | A572/B5207 | NB | 8.87 | 9.43 | 0.56 | 6% |
| | | SB | 11.27 | 12.15 | 0.88 | 8% |
| 6 | M6 | NB | 5.47 | 5.84 | 0.37 | 7% |
| | | SB | 6.59 | 6.93 | 0.34 | 5% |
| 7 | M62 | EB | 1.98 | 1.72 | -0.25 | -13% |
| | | WB | 1.65 | 1.81 | 0.16 | 10% |
| 8 | South Loop | EB | 25.80 | 26.06 | 0.26 | 1% |
| | | WB | 23.45 | 23.38 | -0.07 | 0% |
| | | | **Number of routes where difference is >15%** | | | **1** |
| | | | **Percent of routes where difference is <15%** | | | **93.75%** |

*Table 8-12: Journey Time Validation (Inter Peak)*

| Route Number | Route Short Name | Direction | Observed Time (Mins) | Modelled Time (Mins | Difference (Mins) | Difference (%) |
|---|---|---|---|---|---|---|
| 1 | A49 | NB | 9.72 | 10.90 | 1.17 | 12% |
| | | SB | 9.80 | 10.81 | 1.01 | 10% |
| 2 | A579 | NB | 11.38 | 12.79 | 1.40 | 12% |
| | | SB | 10.44 | 12.30 | 1.85 | 18% |
| 3 | A580 | EB | 7.25 | 8.67 | 1.41 | 20% |
| | | WB | 10.39 | 10.19 | -0.20 | -2% |
| 4 | A573 | NB | 8.92 | 9.26 | 0.34 | 4% |
| | | SB | 9.03 | 9.14 | 0.10 | 1% |
| 5 | A572/B5207 | NB | 8.80 | 9.54 | 0.74 | 8% |
| | | SB | 9.22 | 10.45 | 1.23 | 13% |
| 6 | M6 | NB | 5.52 | 5.91 | 0.39 | 7% |
| | | SB | 5.52 | 5.98 | 0.46 | 8% |
| 7 | M62 | EB | 1.68 | 1.66 | -0.02 | -1% |
| | | WB | 1.64 | 1.78 | 0.14 | 8% |
| 8 | South Loop | EB | 23.40 | 24.68 | 1.27 | 5% |
| | | WB | 22.38 | 22.89 | 0.52 | 2% |
| | | | **Number of routes where difference is >15%** | | | **2** |
| | | | **Percent of routes where difference is <15%** | | | **87.5%** |

*Table 8-13: Journey Time Validation (PM Peak)*

| Route Number | Route Short Name | Direction | Observed Time (Mins) | Modelled Time (Mins | Difference (Mins) | Difference (%) |
|---|---|---|---|---|---|---|
| 1 | A49 | NB | 10.50 | 11.57 | 1.07 | 10% |
| | | SB | 10.57 | 10.63 | 0.06 | 1% |
| 2 | A579 | NB | 16.05 | 14.28 | -1.77 | -11% |
| | | SB | 11.01 | 12.84 | 1.83 | 17% |
| 3 | A580 | EB | 10.18 | 10.31 | 0.13 | 1% |
| | | WB | 9.56 | 10.20 | 0.64 | 7% |
| 4 | A573 | NB | 9.84 | 10.16 | 0.32 | 3% |
| | | SB | 9.59 | 9.54 | -0.05 | -1% |

| Route Number | Route Short Name | Direction | Observed Time (Mins) | Modelled Time (Mins | Difference (Mins) | Difference (%) |
|---|---|---|---|---|---|---|
| 5 | A572/B5207 | NB | 10.84 | 10.12 | -0.73 | -7% |
| | | SB | 11.17 | 12.18 | 1.01 | 9% |
| 6 | M6 | NB | 6.22 | 7.00 | 0.78 | 13% |
| | | SB | 5.48 | 5.83 | 0.35 | 6% |
| 7 | M62 | EB | 1.68 | 1.67 | -0.01 | -1% |
| | | WB | 1.84 | 1.84 | 0.00 | 0% |
| 8 | South Loop | EB | 28.18 | 25.34 | -2.84 | -10% |
| | | WB | 23.37 | 24.89 | 1.52 | 7% |
| | | | **Number of routes where difference is >15%** | | | **1** |
| | | | **Percent of routes where difference is <15%** | | | **93.75%** |

## 8.5 Validation Summary

The model meets the convergence criteria outlined in TAG Unit M3.1, confirming that the traffic assignment is stable and robust across all time periods. This was a key element as good and quick convergence in the base year is a good mitigation against convergence problems in the forecasts.

The models show strong flow validation for LGVs and HGVs with over 95% meeting TAG criteria over the three peak periods. Total Vehicle and car flows were shown to have weaker performance with 70-81% passing the TAG criteria. Areas of potential weakness were assessed and outlined below:

- **Newton Road & Lodge Lane:** Likely missing interzonal trips due to rezoning.
- **A58/A580 Junction:** Edge-of-network location with some missing trips expected.
- **M6 J23 Haydock Island (A50 arm):** High flows accepted due to good journey time validation.
- **A580 into Lane Head:** Slightly high flows (15–18% over), but GEH values acceptable (~7).
- **M6 J21a Slips:** Some inconsistencies between modelled and observed flow but surrounding counts and journey times validate well.
- **A49 Southbound (AM Peak):** Discrepancy between MCC and ATC data; accepted after consultation with Warrington as calibration to ATC is within TAG criteria.

Turn validation performance was strong across periods and vehicle classes. This is considered a key strength for the SHILPM model given the strategic nature of the model.

The journey time validation is shown to be strong for all peaks. Where routes fell outside the TAG criteria, these were investigated with the finding outlined below:

- **A573 Southbound (AM)**: 15.3% faster than observed. Only just outside the observed time and showing good fit to journey time profile
- **A579 Southbound (Inter & PM)**: 17.7% slower due to delays at Lane Head.
- **A580 Eastbound (Inter-Peak)**: 19.5% slower, again due to Lane Head junction delays.

Overall, the model is thought to validate acceptably, understanding that there are necessary trade-offs between journey time validation and link flow validation and acknowledging that there may be some weaknesses against guidance in terms of total flow and car flow in certain areas.

# 9 SHILPM Base Year Model Build Summary

## 9.1 Network Extent and Structure

- The SHILPM network builds upon the previous PLRM network, extending coverage covering an area on the boarder of St Helens, Wigan, and Warrington local authorities.
- It includes key roads like the M6 (south of Junctions 21a to north of Junction 24), M62 (west of Junction 9 – west of Junction 10), and A580.
- No buffer network is used due to the agreed absence of any Variable Demand Modelling (VDM).
- Extensions were agreed with the Transport Working Group, notably around the A580, M6 J24, and A49 corridor.

### 9.1.1 Network Coding Enhancements

- Based on PLRM coding, the SHILPM network was refined to reflect updates as of October 2024.
- Existing PLRM coding was checked and refined as part of the SHILPM build process and bought in line with the National Highways RTM2 Coding Manual including:
  - Updated junction types and lane usage.
  - Updated signal phasing and timings.
  - Updates to Speed Flow curves
  - Adjusted link distances, capacities and speeds per RTM2 guidelines.
  - Added delays for specific constraints (e.g. Alder Root Lane underpass).

### 9.1.2 Network Extensions

- Additional areas modelled include:
  - M6 northern extension up from north of Junction 23 to north of Junction 24, A580 west of M6 junction 23, A58 between M6 Junction 24 and A580, and the A49 corridor to Cromwell Avenue.

### 9.1.3 Junction Types and Modelling

- The model includes priority junctions, roundabouts, and signal-controlled junctions.
- Turn saturation flows follow RTM2 coding standards, with some junctions adjusted further during or post calibration.
- Large and/or signalised roundabouts are modelled as “exploded” junctions for better performance representation.

### 9.1.4 Speed-Flow Curves

- Used to model the relationship between traffic volume and speed.
- The Speed Flow Curves used were based upon the RTM2 Coding Manual specifications and refined during calibration.

### 9.1.5 Vehicle Class Restrictions

- Local Authority data informed restrictions for HGVs on roads with weight/height limits under 5m which was incorporated into the update of the network coding.

## 9.2 Zoning System

### 9.2.1 Model Zones

- **Rezoning Methodology:**
    - PLRM zones were redefined to match census boundaries, forming SHILPM zones.
    - Output areas were assigned to PLRM zones based on overlap.
    - 'Split zones' were identified where PLRM and SHILPM zones intersect.
    - Population-based factors were calculated to proportion OD trips from PLRM to SHILPM zones.
    - These factors were applied to generate the new SHILPM OD matrix

- Updated from PLRM to align with 2011 census, MSOA, and local authority boundaries.
- Now includes 72 zones (48 internal, 24 external), with 4 zones dedicated to future development sites.

### 9.2.2 Zone Centroid Connectors

- Connect zones to the road network via logical access points.
- Existing connectors were reviewed and updated; new ones were added where needed.

### 9.2.3 Sector System

- The model uses 13 sectors for easier analysis of trip patterns.
- Sectors are more detailed within the core model area and coarser further out.

## 9.3 Matrix Development

### 9.3.1 Base Matrices

- Origin-destination (OD) matrices are derived from the 2016 PLRM base year matrices, adjusted to reflect updated zone boundaries aligned with 2011 census output areas, MSOAs, and local authority boundaries.

### 9.3.2 Model Calibration and Validation

- **Purpose**: To ensure the SHILPM accurately reflects observed traffic flows and behaviours, following TAG Unit M3.1 guidelines.
- **Calibration vs. Validation**:
    - *Calibration*: Adjusting the model to match observed data.
    - *Validation*: Comparing modelled data with independent observed data.
- **TAG Criteria Used**:
    - Screenline and link flow comparisons.
    - Journey time comparisons.
    - Matrix estimation analysis.
- **GEH Statistic:**
    - Used to assess flow accuracy.
    - GEH < 5 indicates a good match; TAG recommends 85% of counts meet this threshold.
- **Journey Time Validation**:

    - Modelled times must be within 15% or 1 minute of observed times for at least 85% of routes.
- **Matrix Estimation**:
    - Applied to refine prior matrices.
    - Significant changes are flagged and investigated per TAG criteria.

### 9.3.3 Validation Dashboards

- **Power BI Dashboards**:
    - Interactive tools provided to stakeholders for flow and journey time validation.
    - Include filtering by time period and user class, maps, and visual comparisons.
- **Flow Validation**:
    - Dashboards show observed vs. modelled flows for links and turns.
    - Colour-coded maps indicate compliance with GEH and TAG criteria.
- **Journey Time Validation**:
    - Dashboards cover 8 routes with observed vs. modelled times.
    - Include summary tables, maps, and time-distance graphs.

### 9.3.4 Screenline and Cordon Definitions

- 11 multi-count screenlines and 6 single point screenlines were developed to maximise use of available count data.
- 
- Independent data was used for validation, in line with best practice.

## 9.4 Network Assignment Calibration Overview

- The calibration process ensures the model accurately reflects observed traffic flows and behaviours.
- Some refinement of network details such as link lengths, speeds, and junction operations was also undertaken.
- Junction parameters like turn saturation flows and signal timings were reviewed and adjusted.

### 9.4.1 Generalised Cost Parameters

- Used to determine minimum cost routes for traffic assignment in SATURN.
- Parameters include:
    - **Pence per minute (PPM)**
    - **Pence per kilometre (PPK)**
- Values were derived from the **TAG Data Book (May 2025, v2.01)** and vary by user class.

### 9.4.2 Network Calibration Checks

- Network checks included included:
    - Verifying zone connector loading.
    - Checking link lengths and directional distances.
    - Routeing checks using SATURN route trees which show the routes between two zones.
    - Lane designations and turn flares where reviews.
    - Turn saturation flows and signal timings at key junctions where adjusted where required.

- Confirmation that zone centroids were correctly loaded and link lengths accurately coded.

### 9.4.3 Route Choice Validation

Route trees were analysed to assess the realism of route choices with the following observations made:

- **Warrington to Lowton**: Most trips use Golborne Road and Warrington Road. Winwick Lane is less used likely due to roadworks.
- **M62 West to Lowton**: Majority of traffic used M62 eastbound, M6 northbound, and Winwick Lane with alternatives being less popular.
- **M62 West to Newton-le-Willows**: There are two logical routes; via Mill Lane/Alder Root Lane/Wargrave Road or via A49. Route choice varies by user class but appears logical.
- **Leigh to Ashton-in-Makerfield**: there are multiple routes due to congestion around Lane Head. SATURN's limitations in modelling MOVA signals may cause excess delay at this location leading some some rat-running.
- **Lowton to M62 West**: Similar to the reverse route, with most trips travelling via Warrington Road and Golborne Road. The Winwick route remains less attractive likely due to roadworks.

## 9.5 Prior Matrix Calibration and Validation

- The initial trip matrices were derived from the PLRM model and manually adjusted to better match observed traffic flows.
- Adjustments included:
  - Factoring external trips based on independent counts via Select Link analysis factoring.
  - Adding trips for new logistics developments (Florida Fields and Haydock Green) using Transport Assessment data.

### 9.5.1 Matrix Estimation Process

- Matrix estimation was applied separately for cars, LGVs, and HGVs, based on observed count data.
- A maximum balancing factor (XAMAX) of 2 (cars/LGVs) and 2.5 (HGVs) was used to limit excessive changes.
- Six estimation loops were run to produce final calibrated matrices.

### 9.5.2 Post-Estimation Adjustments

- Additional trips were added between adjacent external zones at the network edges to correct missing external to external flows which required readding due to the rezoning process. These locations included:
  - A49 Winwick Lane roundabout.
  - A579 Atherleigh Way and A572 St Helens Road junction.
  - A580 East Lancashire Road and A58 junction.

### 9.5.3 Matrix Comparison and Impact

- **Matrix Totals**: Most changes occurred in internal area movements, reflecting expected distribution shifts between 2016 and 2024.
- **Sector Movements**:
  - Overall matrix changes were 6.5–7.5%, slightly above TAG's 5% threshold but considered acceptable due to rezoning.

    - Larger percentage changes were noted in sectors 11–13, mainly due to low prior trip volumes.
- **Trip Length Distribution**:
    - No major changes for trips under 10 km.
    - Moderate reductions (7–28%) in 10–16 km trips.
    - Significant percentage increases (53–182%) in 18–20 km trips, though absolute numbers remained low.

### 9.5.4 Calibration Results

- **Screenline Flow Calibration**:
    - Strong calibration for HGVs and LGVs.
    - Car flows showed lower accuracy at screenline level but much improved at individual link level.
- **GEH Statistic**:
    - ~85% of screenlines achieved GEH < 5, indicating good model fit.
- Overall, the model is considered to perform acceptably well at the link level, with some minor weaknesses in total screenline flow calibration.

## 9.6 Assignment Validation Results

### 9.6.1 Assignment Convergence

- The model meets the convergence criteria outlined in TAG Unit M3.1, confirming that the traffic assignment is stable and robust across all time periods.

### 9.6.2 Flow Validation

- **LGVs and HGVs**: Strong performance with over 95% of links meeting TAG criteria.
- **Cars and Total Vehicles**: Weaker performance, with 70–81% of links passing.
- **Areas of potential weakness**:
    - **Newton Road & Lodge Lane**: Likely missing interzonal trips due to rezoning.
    - **A58/A580 Junction**: Edge-of-network location with some missing trips expected.
    - **M6 J23 Haydock Island (A50 arm)**: High flows accepted due to good journey time validation.
    - **A580 into Lane Head**: Slightly high flows (15–18% over), but GEH values acceptable (~7).
    - **M6 J21a Slips**: Some inconsistencies between modelled and observed flow but surrounding counts and journey times validate well.
    - **A49 Southbound (AM Peak)**: Discrepancy between MCC and ATC data; accepted after consultation with Warrington as calibration to ATC is within TAG criteria.

### 9.6.3 Turn Validation

- **Overall**: Strong performance to TAG criteria across periods and vehicle classes.
- **LGVs and HGVs**: 100% of turns met TAG criteria.
- **Cars**: Slightly below 85% in PM peak.
- **Total Vehicles**: AM and PM peaks just below 85%, inter-peak shows strong performance.
- Considered a strength given the strategic nature of the model.

### 9.6.4 Journey Time Validation

- Based on TomTom data across 8 routes assessed in both directions and all time periods.
- **Results**:
    - **AM & PM Peaks**: 93.8% of routes within 15% of observed times.
    - **Inter-Peak**: 87.5% within TAG guidelines.
- **Routes Outside TAG Criteria**:
    - **A573 Southbound (AM)**: 15.3% faster than observed. Only just outside the observed time and showing good fit to journey time profile
    - **A579 Southbound (Inter & PM)**: 17.7% slower due to delays at Lane Head.
    - **A580 Eastbound (Inter-Peak)**: 19.5% slower, again due to Lane Head junction delays.

# 10 Statement of Model Suitability

The SHILPM model represents a robust and comprehensive update to the previous PLRM model, incorporating significant enhancements in network coding, zoning, and matrix development. The network has been extended to cover further network across St Helens, Wigan, and Warrington, with refinements aligned to RTM2 Coding Manual standards.

Zoning has been restructured to reflect 2011 census boundaries, allowing for NTEM constraint at a Local Authority level during forecasting. The calibration and validation processes, using TAG Unit M3.1, demonstrate acceptable performance across vehicle classes, with good compliance in flow validation and strong performance for turn and journey time validation.

Some flow discrepancies in specific areas have been acknowledged and reviewed but the models overall balance of performance is considered to provide a reliable foundation for strategic transport planning and future development assessments given the model’s purpose of modelling strategic vehicle routing.

# Appendix A Route Trees

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