# APPENDIX A5.1

# TRANSPORTATION

# TRAFFIC MODELLING REPORT

# M7 Osberstown Interchange & R407 Sallins By-Pass Scheme

## Phase 3 Design

## Traffic Modelling Report

November 2013


Designer
Roughan & O'Donovan – AECOM Alliance
Arena House
Arena Road
Sandyford
Dublin 18

Client
Kildare County Council
National Roads Design Office
Maudlins
Naas
County Kildare

# M7 OSBERSTOWN INTERCHANGE & SALLINS BY-PASS SCHEME

# TRAFFIC MODELLING REPORT

**Project No:............ 60241946**

**Made: .................... Declan Keenan**

**Checked: .............. Philip Shiels**

**Approved:............. Shane Dunny**

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# M7 OSBERSTOWN INTERCHANGE & R407 SALLINS BY-PASS SCHEME

# TRAFFIC MODELLING REPORT

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# M7 OSBERSTOWN INTERCHANGE & R407 SALLINS BY-PASS SCHEME

# TRAFFIC MODELLING REPORT

## Glossary of Terms

| | |
|---|---|
| AADT | Annual Average Daily Traffic |
| ATC | Automatic Traffic Count |
| CDP | County Development Plan |
| D | Destination |
| GEH | Geoffrey E. Havers |
| HGV | Heavy Goods Vehicle |
| HV | Heavy Vehicle |
| KCC | Kildare County Council |
| LAM | Local Area Model |
| LAP | Local Area Plan |
| LGV | Light Good Vehicles |
| LV | Light Vehicles |
| MCC | Manual Classified Counts |
| ME | Matrix Estimation |
| NB | Northbound |
| NRA | National Roads Authority |
| NTM | National Traffic Model |
| O | Origin |
| O-D | Origin Destination |
| PAG | Project Appraisal Guidelines |
| PCU | Passenger Car Unit |
| PMG | Project Management Guidelines |
| RSI | Roadside Interview |
| SB | Southbound |
| TEG | Trip End Growth |
| TLD | Trip Length Distribution |
| TMR | Traffic Modelling Report |

# 1.0 Introduction

The traffic model will be referred to as the M7 Local Area Model (LAM) throughout this report.

## 1.1 Overview

This report outlines the development of a traffic model built to assess the impact of the proposed M7 Osberstown Interchange & R407 Sallins Bypass Scheme. The traffic model study area is illustrated in Figure 1-1.

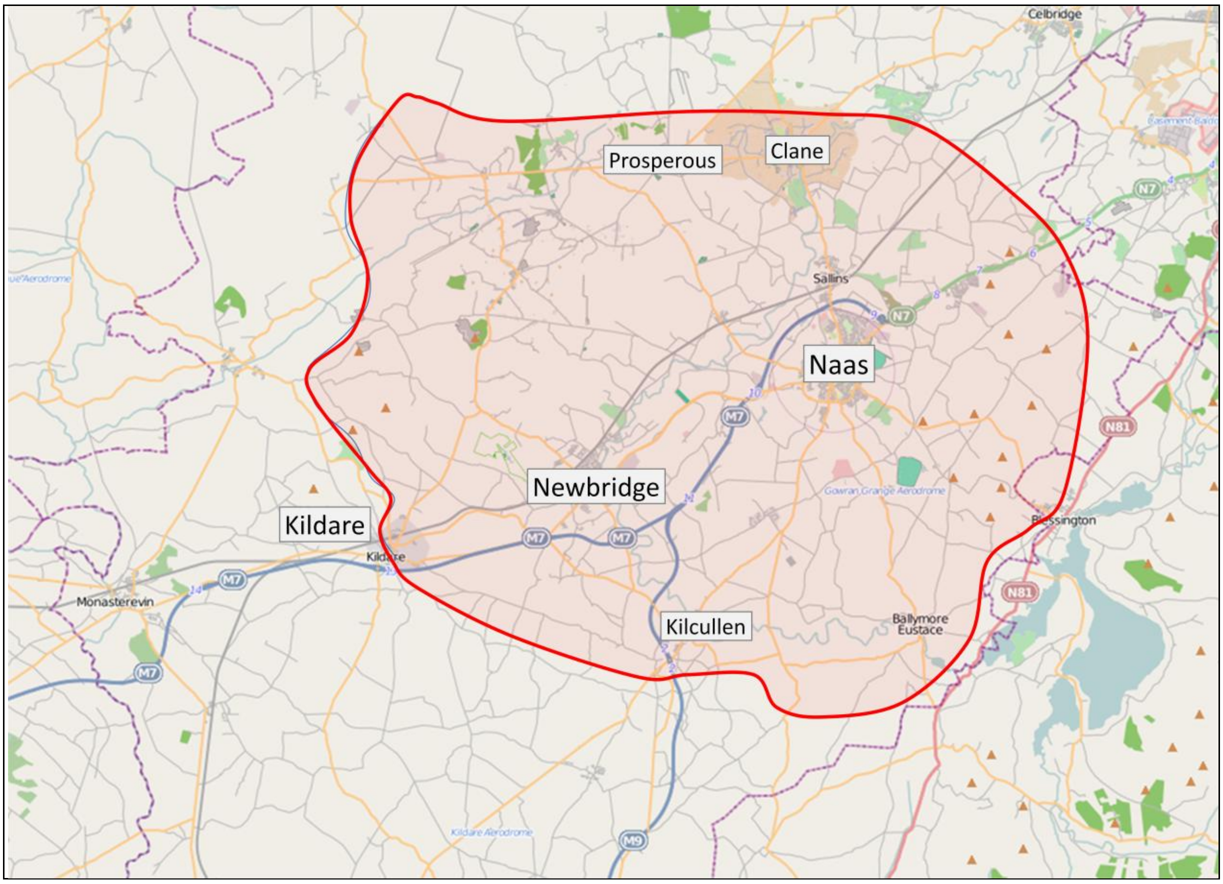


*Figure 1-1: Traffic Model Study Area*

The proposed scheme has been appraised in accordance with the NRA Project Management Guidelines (PMG) 2010 and NRA Project Appraisal Guidelines (PAG) 2011. These guidelines are in compliance with the Department of Transport's Common Appraisal Framework for Transport Projects and Programmes (2009).

## 1.2 Project Appraisal Guidelines

The NRA Project Appraisal Guidelines (PAG) 2011 set out the following deliverables required as part of the appraisal process for major schemes:

- Project Brief;
- Traffic Modelling Report;
- Cost Benefit Analysis;

- Project Appraisal Balance Sheet;
- Business Case; and
- Post Project Review

The purpose of the Traffic Modelling Report (TMR) is to describe the development and application of the traffic model. The report outlines the development of the base year traffic model, the methodology for forecasting future year demands and presents the results of the modelling.

### 1.3 Existing Environment

The existing N7/M7 national primary route commences at the M50 Red Cow Interchange in Dublin and travels southwest to Limerick where it connects to the M20 at the Rossbrien junction. The N7 section runs between the M50 and the Maudlins Interchange (Naas North) and the M7 section of the route commences at the Maudlins Interchange.

There are two existing motorway interchanges along the M7 which allow for access to Naas and Sallins, the aforementioned Maudlins interchange and the Newhall Interchange (Naas South). The Maudlins Interchange is a j-type junction with a single roundabout which caters for all movements. The Newhall Interchange is a grade separated interchange consisting of two roundabouts either side of the M7.

Both the Maudlins and Newhall interchanges are experiencing increasing levels of congestion. In the morning peak hour (08:00 – 09:00) significant queuing occurs on the M7 eastbound off-ramp of the Newhall Interchange (Naas South) with vehicles queuing in the M7 mainline hard shoulder which raises significant safety concerns.

Due to the high traffic flow and the reduction in capacity (lane drop) on the westbound carriageway at the Maudlins Interchange congestion during the evening peak period (16:00 – 19:00) can be quite significant with queuing as far back as the Johnstown Interchange and beyond. Queuing on the westbound off-ramp of the Newhall Interchange also leads to flow breakdown in the southbound traffic stream in the evening peak hour (17:00 – 18:00).

The 'Monread Road' is a local distributor road which runs parallel to the M7 south of the Maudlins Interchange terminating at its roundabout with the R407 Sallins Road and Western Distributor Road. As well as providing local access to a number of retail and residential sites this road caters for regional traffic from the R407 accessing the M7 via the Maudlins Interchange. Currently AADT levels on both the R407 Sallins Road and the 'Monread Road' exceed their design capacity.

The western section of the distributor road, known as the 'Millennium Road', runs parallel to the M7 from its roundabout with the R407 Sallins Road and 'Monread Road' and continues south to the R445 Newbridge Road roundabout. At present regional traffic from Sallins and surrounding areas uses either the Monread Road or Western Distributor Road to access the M7 via the Maudlins or Newhall Interchanges.

### 1.4 Proposed Scheme

The scheme proposed by Kildare County Council (KCC) comprises a new M7 Interchange located at Osberstown between the existing Newhall and Maudlins Interchanges and a regional bypass of Sallins Town. There will be a link road connecting the bypass to Sallins town and another to the south connecting the interchange to the Western Distributor Road.

The proposed scheme would increase connectivity between regional traffic and the M7 motorway, providing direct access for traffic travelling to and from Sallins and surrounding areas. The new interchange would also provide relief to the congested Maudlins and Newhall Interchanges. The scheme is illustrated in figure 1-2.

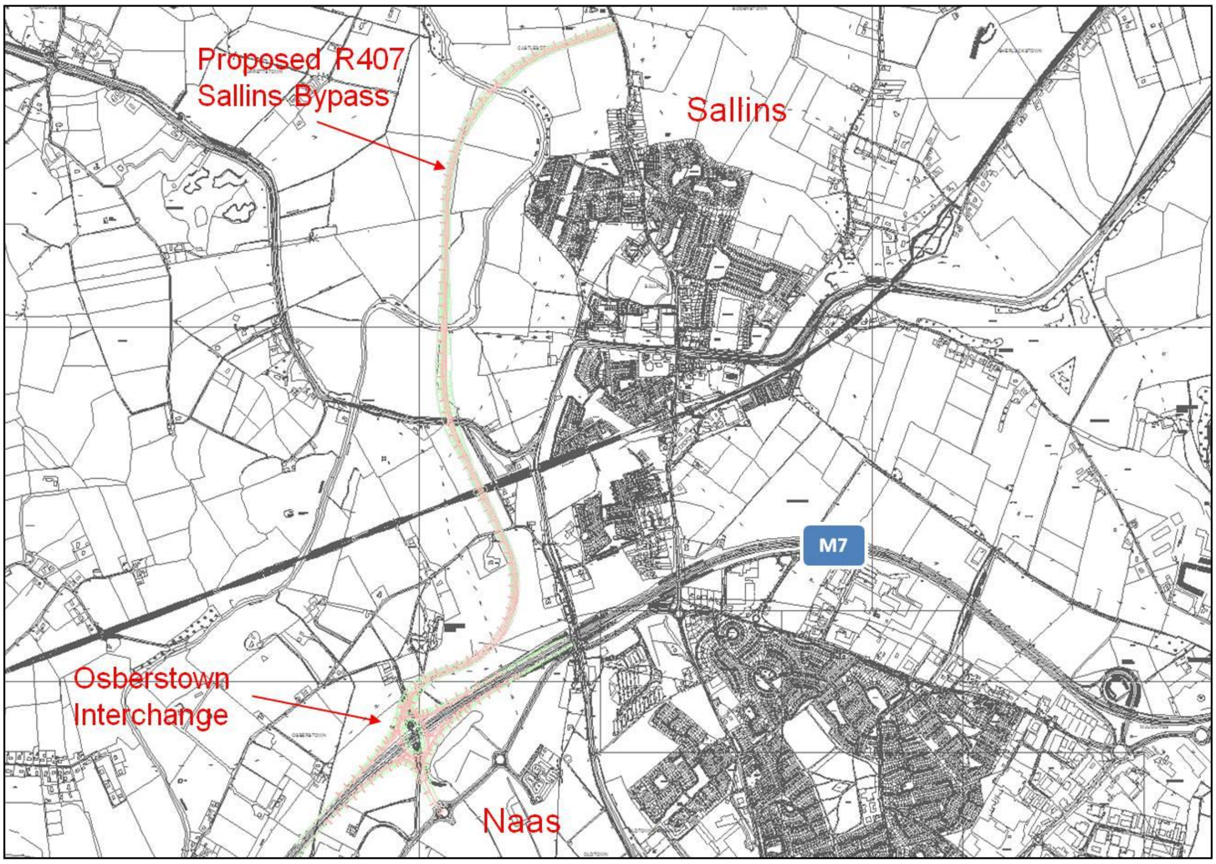


*Figure 1:2: Indicative M7 Osberstown Interchange & Sallins Bypass Alignment*

# 2.0 Data Collection

## 2.1 Introduction

In order to develop a Traffic Model, a significant level of traffic data is required to ensure that the model can replicate existing traffic patterns and volumes. This section of the TMR describes the collection of traffic data for the construction of the Base Year (2012) M7 Local Area Model (LAM).

## 2.2 National Traffic Model

The starting point for the Base Year M7 LAM is the 2010 Base Year National Traffic Model (NTM), which was developed by the National Road Authority (NRA). The NTM a is strategic (macroscopic) traffic model developed using the transportation modelling software VISUM. The model covers the entire national and regional road network and is used by the NRA as a tool in the appraisal of potential road schemes, land-use and policy changes. The NTM provides demand data for Light (Car & LGV) and Heavy (OGV1, OGV2 and PSV) vehicles for the following time periods:

- AM Peak Hour (08:00 – 09:00);
- Average Inter Peak Hour (12:00 – 14:00); and
- PM Peak Hour (17:00 – 18:00).

## 2.3 Data Collection

A summary of the traffic survey that was collated, in addition to the NTM, as part of the development of the 2012 M7 LAM's is outlined below:

- Origin-Destination (O-D) bluetooth surveys were carried out between 17$^{th}$ and 19$^{th}$ April 2012 at 6 sites;
- 11 Automatic Traffic Counts (ATC) carried out between 6$^{th}$ and 12$^{th}$ February 2012;
- 3 NRA Permanent ATC data carried out in 2010/2012;
- 10 Manual Classified Counts (MCC) undertaken over 12 hours (07:00 – 19:00) on Tuesday 7$^{th}$ of February 2012; and
- Journey time surveys (7 routes).

Figures 2-1 to 2-3 illustrate the location of the traffic surveys.

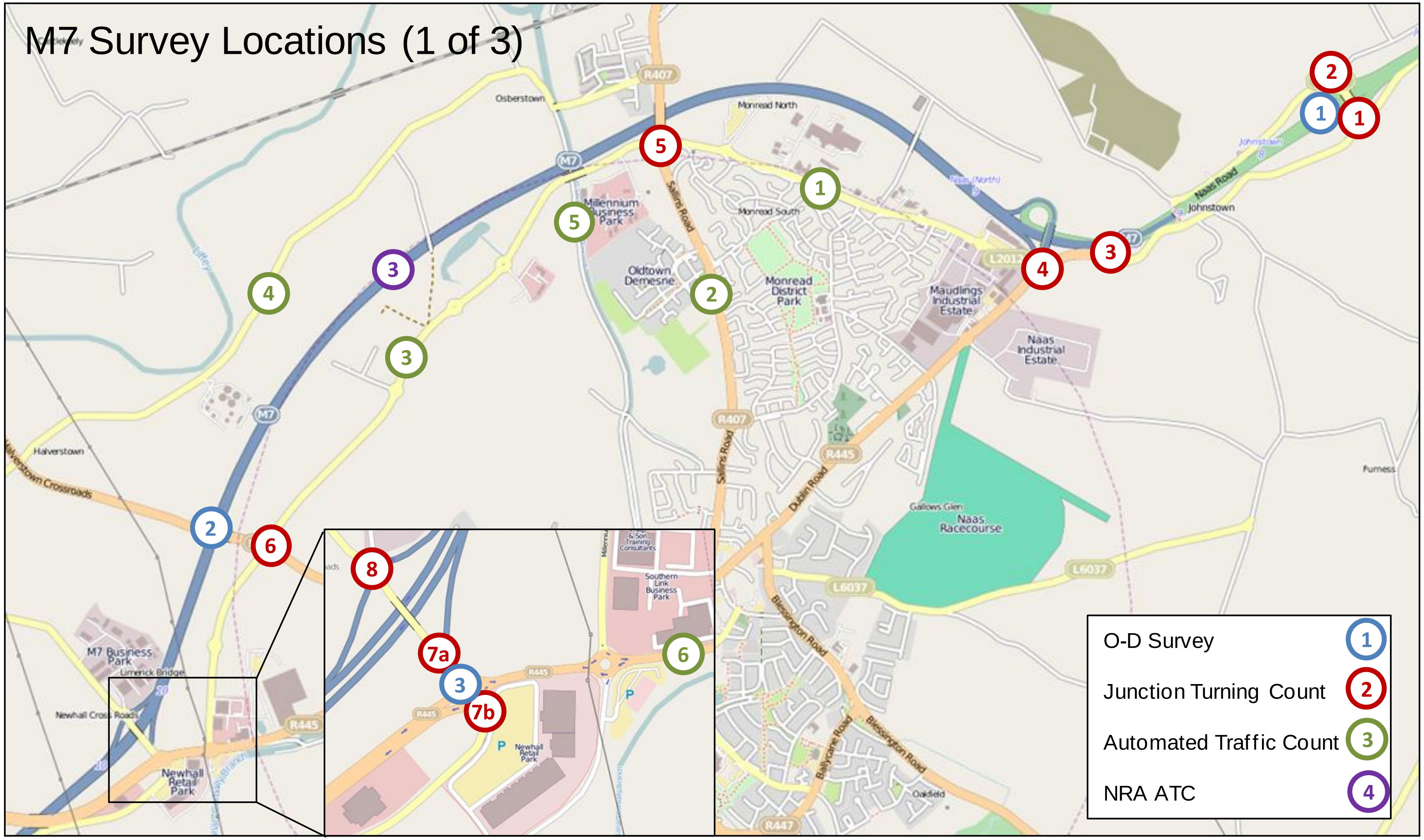


Figure 2-1: Location of O-D, ATC and MCC Surveys

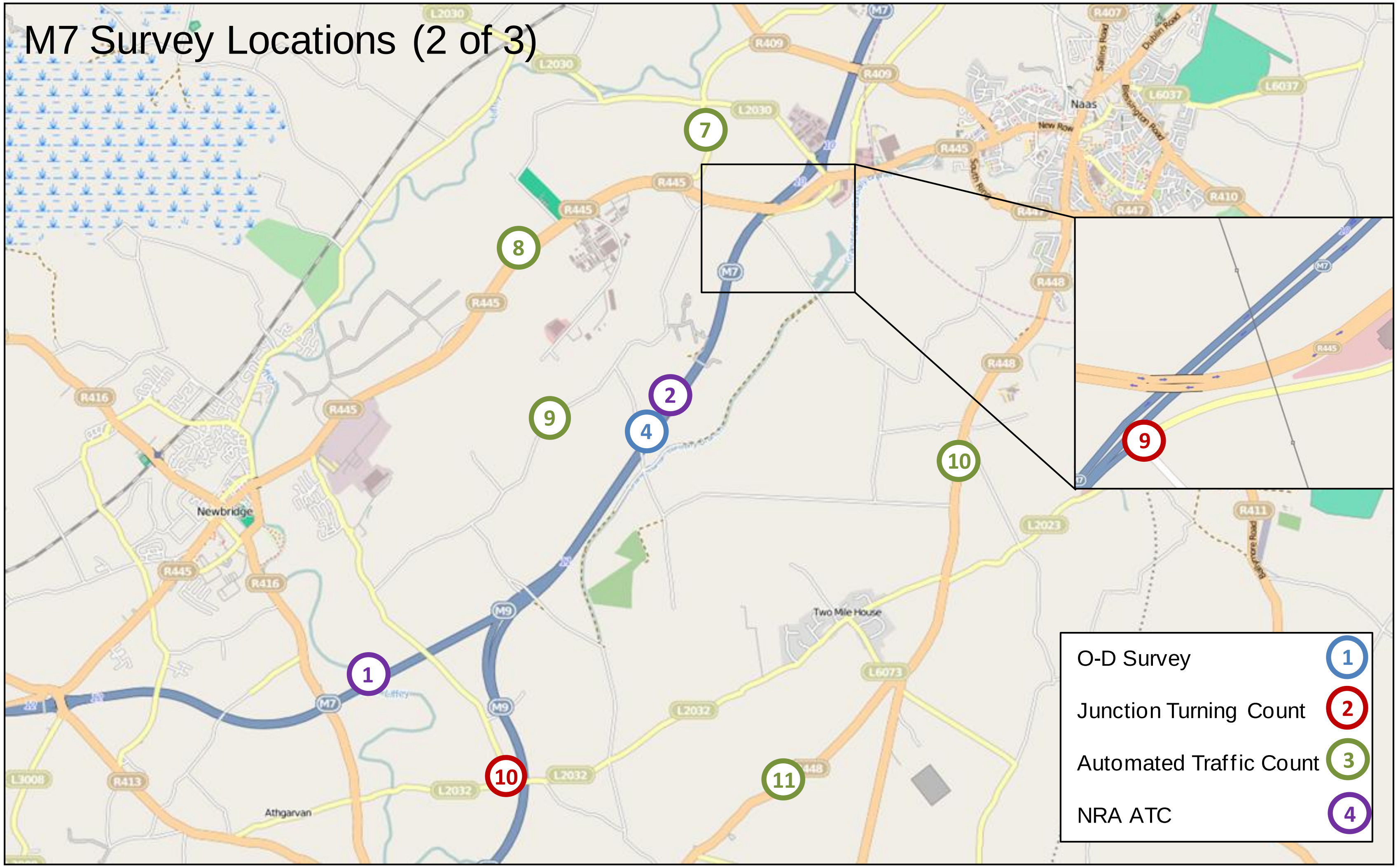


*Figure 2-2: Location of O-D, ATC and MCC Surveys*

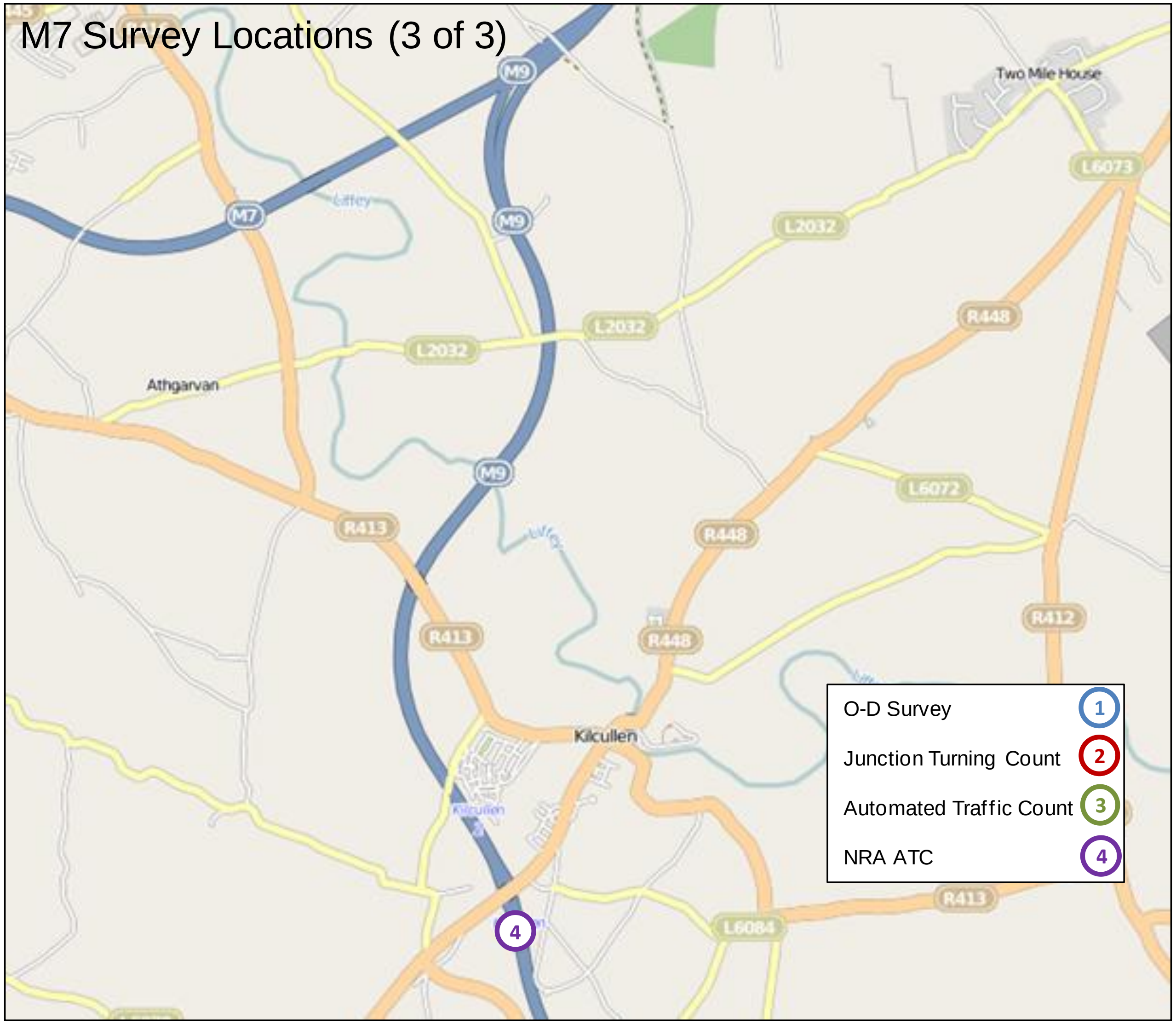


*Figure 2-3: Location of O-D, ATC and MCC Surveys*

### *2.3.1 Origin-Destination Data*

In order to develop forecast traffic levels, it is first required to develop a robust representation of current traffic patterns. Origin-Destination (O-D) surveys were undertaken using a Bluetooth vehicle tracking system which recorded individual Bluetooth ID's at 6 cordon points.

The locations at which the bluetooth devices were placed to collect data are illustrated in Figure 2-4. These locations were chosen to ensure a closed cordon was used to establish traffic pattern information in the area. The bluetooth devices pick up unique identification numbers of individual electronic items that use bluetooth (mobile phones, laptops, satellite navigation systems and hands free systems)

The O-D surveys were undertaken over a 3 day period between the 17$^{th}$ and the 19$^{th}$ April 2012. For the purpose of the developing the model, the "First seen – Last seen" dataset is utilised. This dataset outputs the Origin of a vehicle as the first time a vehicle is captured when it enters the cordon and Destination as the last time a vehicles is captured leaving the cordon.

In order to develop a robust O-D matrix sample rates were first calculated for each site by comparing the number of vehicles detected with the total AADT captured at the site. Table 2-1 below outlines the average sample rates achieved at each individual site over the 3 day survey period.

*Table 2-1: Average Bluetooth Sample Rates*

| Site Locations | % Sample Rate |
|---|---|
| 1 | 38.4% |
| 2 | 45.5% |
| 3a | 42.4% |
| 3b | 44.6% |
| 3c | 27.5% |
| 4 | 31.6% |

The sample rates outlined above allowed for the development of a full O-D matrix. A summary of the O-D data is provided in Table 2-2 below and shows average 24 hours flows for the 3 day survey.

*Table 2-2: Average Daily flows (24 hour period)*

| Site Location | | No of Trips |
|---|---|---|
| From | To | |
| 1 | 2 | 4450 |
| 1 | 3a | 2120 |
| 1 | 3b | 73 |
| 1 | 3c | 784 |
| 1 | 4 | 17786 |
| | | |
| 2 | 1 | 3975 |
| 2 | 3a | 405 |
| 2 | 3b | 17 |
| 2 | 3c | 158 |
| 2 | 4 | 2838 |
| | | |
| 3a | 1 | 2454 |

| Site Location | | No of Trips |
|---|---|---|
| From | To | |
| 3b | 1 | 61 |
| 3b | 2 | 20 |
| 3b | 3a | 71 |
| 3b | 3c | 244 |
| 3b | 4 | 1874 |
| | | |
| 3c | 1 | 837 |
| 3c | 2 | 153 |
| 3c | 3a | 1894 |
| 3c | 3b | 215 |
| 3c | 4 | 2073 |
| | | |
| 4 | 1 | 20914 |

| | | | | | |
|---|---|---|---|---|---|
| 3a | 2 | 433 | 4 | 2 | 3067 |
| 3a | 3b | 47 | 4 | 3a | 466 |
| 3a | 3c | 2281 | 4 | 3b | 36 |
| 3a | 4 | 422 | 4 | 3c | 2095 |

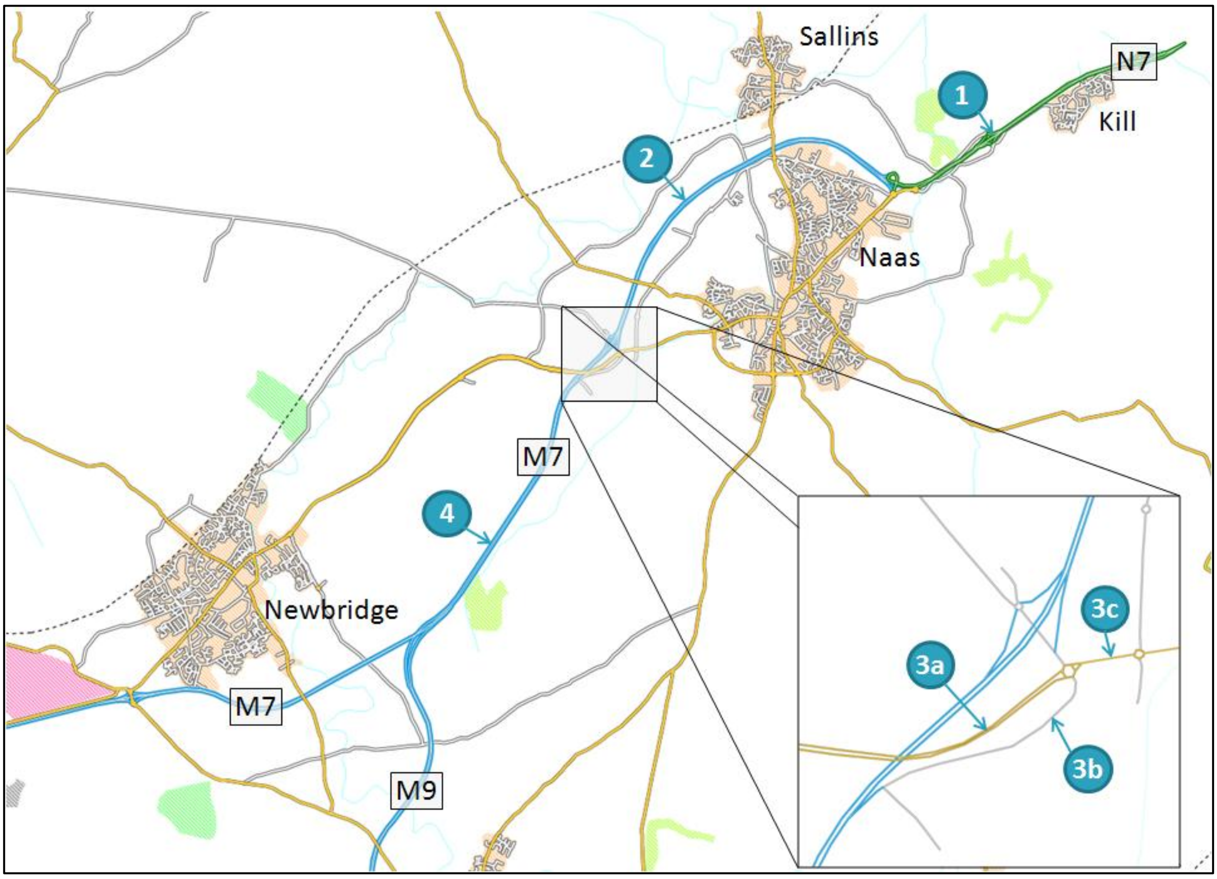


*Figure 2-4: Location of O-D Surveys*

### *2.3.2 Automatic Traffic Counters*

Traffic flow data extracted from the 11 ATC surveys undertaken over a 7 day period between Sunday 6$^{th}$ – Saturday 12$^{th}$ February 2012 are presented in Table 2-2 below. From the ATCs a 7 day Weekly Average Daily Traffic (WADT) flows were extracted. This WADT was converted to Annual Average Daily Traffic (AADT) using data from the permanent NRA traffic counter at on the M7 at Lewistown in accordance with NRA *PAG Unit 16.1: Estimating AADT on National Roads.*

*Table 2-3: Automatic Traffic Count (ATC) Data*

| ATC | ATC Location | Average Weekday 2-Way Flow | | | WADT | AADT | HGV |
|---|---|---|---|---|---|---|---|
| | | AM Peak (8-9am) | Avg. Inter Peak (12-2pm) | PM Peak (5-6pm) | | | |
| 1 | Monread Rd. | 1207 | 1182 | 1362 | 16390 | 16522 | 12% |
| 2 | R407 Sallins Rd. | 1001 | 929 | 1020 | 13036 | 13141 | 9% |
| 3 | Naas North Ring Rd. | 1102 | 758 | 1139 | 10775 | 10862 | 10% |
| 4 | Osberstown | 159 | 95 | 169 | 1423 | 1435 | 11% |

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| 5 | Canal Bank | 186 | 36 | 83 | 588 | 592 | 3% |
| 6 | R445 Newbridge Rd | 1235 | 1163 | 1011 | 14050 | 14164 | 9% |
| 7 | Newhall | 493 | 222 | 316 | 2921 | 2945 | 21% |
| 8 | R445 Littleconnell | 1104 | 986 | 1190 | 13713 | 13824 | 12% |
| 9 | Lewistown | 27 | 21 | 31 | 259 | 261 | 11% |
| 10 | R448 Killashee | 759 | 460 | 667 | 6922 | 6978 | 9% |
| 11 | R448 Brownstown | 463 | 329 | 453 | 4725 | 4764 | 10% |

### *2.3.3 NRA ATC Counters*

A number of NRA permanent ATC sites are located in the study area along the M7 and M9. Data is available for a full year 2011 (M7) and 2010 (M9) at the sites presented in Table 2-3.

*Table 2-4: NRA Permanent ATC Data (2010/2011)*

| NRA ATC | ATC Location | Year | Average Weekday 2-Way Flow | | | AADT | % HGV |
|---|---|---|---|---|---|---|---|
| | | | AM Peak (8-9am) | Avg. Inter Peak (12-2pm) | PM Peak (5-6pm) | | |
| 1 | Great Connell M07-31 | 2010 | 2,995 | 2,289 | 3,450 | 37,946 | 8% |
| 2 | Lewistown M07-35 | 2010 | 4,789 | 3,436 | 5,398 | 58,172 | 9% |
| 3 | Naas Bypass M07-36 | 2010 | 4,466 | 3,368 | 5,019 | 54,805 | 8% |
| 4 | Kilcullen South M09-2 | 2011 | 1,477 | 1,072 | 1,775 | 18,350 | 9% |

### *2.3.4 Manual Classified Counts (MCC)*

Manual classified count (MCC) surveys were undertaken at 10 junctions on Tuesday 7th February 2012 over a 12 hour period (07:00 – 19:00). Traffic flow was disaggregated by vehicle type and recorded in 15min time intervals. The following junctions were surveyed:

- Junction 1: Johnstown – Roundabout on South Side of N7;
- Junction 2: Johnstown – Roundabout on North Side of N7;
- Junction 3: Johnstown Roundabout at Off Ramp from N7 to Naas North & Johnstown Village;
- Junction 4: Maudlins Roundabout;
- Junction 5: Sallins Road Roundabout;
- Junction 6: Carragh Road Millennium Park Roundabout;
- Junction 7: Newhall Interchange – Bundle of Sticks Roundabout;
- Junction 8: Newhall Interchange – Roundabout on North Side of M7;
- Junction 9: M7 On Ramp at Ladytown; and
- Junction 10: Rosetown – Great Connell & Two Mile House Road Junction.

The results of the MCC surveys are provided in Appendix A of this report.

### *2.3.5 Journey Time Surveys*

Journey time information was collected as part of the O-D Bluetooth surveys.

Additional journey time surveys were also carried out in Naas between the Bundle of Sticks Roundabout and the Maudlins Roundabout to ascertain existing delays though Naas. The surveys were undertaken using a GPS data logger, which is carried in the vehicle undertaking the journey time surveys and tracks the position and speed of the vehicle every 2 seconds. Three runs in each direction were carried out during each time period. The results are outlined in Table 2-4 and journey times are illustrated in Figures 2-5 and 2-6.

*Table 2-5: Journey Time Data (Naas)*

| Route | Time Period | Direction | Junction | | Journey Time (sec) |
|---|---|---|---|---|---|
| | | | Start | End | |
| 1 | AM | EB | Bundle of Sticks | Maudlins | **726** |
| | | WB | Maudlins | Bundle of Sticks | **685** |
| | Inter | EB | Bundle of Sticks | Maudlins | **660** |
| | | WB | Maudlins | Bundle of Sticks | **716** |
| | PM | EB | Bundle of Sticks | Maudlins | **749** |
| | | WB | Maudlins | Bundle of Sticks | **937** |
| 2 | AM | EB | Sallins Road | Maudlins | **161** |
| | | WB | Maudlins | Sallins Road | **167** |
| | Inter | EB | Bundle of Sticks | Maudlins | **192** |
| | | WB | Maudlins | Bundle of Sticks | **178** |
| | PM | EB | Bundle of Sticks | Maudlins | **195** |
| | | WB | Maudlins | Bundle of Sticks | **319** |
| 3 | AM | NB | Sallins Road | Sallins | **97** |
| | | SB | Sallins | Sallins Road | **146** |
| | Inter | NB* | Sallins Road | Sallins | **-** |
| | | SB | Sallins | Sallins Road | **164** |
| | PM | NB | Sallins Road | Sallins | **163** |
| | | SB | Sallins | Sallins Road | **155** |
| 4 | AM | SB | M7 (OD1) | M7 (OD4) | **401** |
| | | NB | M7 (OD4) | M7 (OD1) | **531** |
| | Inter | SB | M7 (OD1) | M7 (OD4) | **407** |
| | | NB | M7 (OD4) | M7 (OD1) | **385** |
| | PM | SB | M7 (OD1) | M7 (OD4) | **456** |
| | | NB | M7 (OD4) | M7 (OD1) | **382** |
| 5 | AM | SB | M7 (OD1) | R445 (OD 3a) | **284** |
| | | NB | R445 (OD 3a) | M7 (OD1) | **466** |
| | Inter | SB | M7 (OD1) | R445 (OD 3a) | **310** |
| | | NB | R445 (OD 3a) | M7 (OD1) | **367** |
| | PM | SB | M7 (OD1) | R445 (OD 3a) | **400** |
| | | NB | R445 (OD 3a) | M7 (OD1) | **329** |
| 6 | AM | SB | M7 (OD1) | Newbridge Rd (OD 3c) | **330** |
| | | NB | Newbridge Rd (OD 3a) | M7 (OD1) | **410** |
| | Inter | SB | M7 (OD1) | Newbridge Rd (OD 3c) | **374** |
| | | NB | Newbridge Rd (OD 3a) | M7 (OD1) | **341** |
| | PM | SB | M7 (OD1) | Newbridge Rd (OD 3c) | **404** |
| | | NB | Newbridge Rd (OD 3a) | M7 (OD1) | **374** |
| 7 | AM | NB | M7 (OD4) | Newbridge Rd (OD 3c) | **315** |
| | | SB | Newbridge Rd (OD 3a) | M7 (OD4) | **176** |
| | Inter | NB | M7 (OD4) | Newbridge Rd (OD 3c) | **214** |

| | | | | | |
|---|---|---|---|---|---|
| | | SB | Newbridge Rd (OD 3a) | M7 (OD4) | **185** |
| | PM | NB | M7 (OD4) | Newbridge Rd (OD 3c) | **223** |
| | | SB | Newbridge Rd (OD 3a) | M7 (OD4) | **210** |

** No observed data available for this route in northbound direction.*

The journey time surveys have been used to validate the base year LAM. The details of the validation process are summarised in Chapter 6.

Note: Additional Traffic counts were received post model development and were used to undertake an additional high level validation of the model. This data included:

- One ATC carried out for a 2 week period starting from the 20th November 2012 on the Clane Road,
- 10 Junction turning counts undertaken over 12 hours (07:00-19:00) on Tuesday the 20th November 2012; and
- Journey times surveys conducted along 4 routes on Tuesday the 20th November 2012.

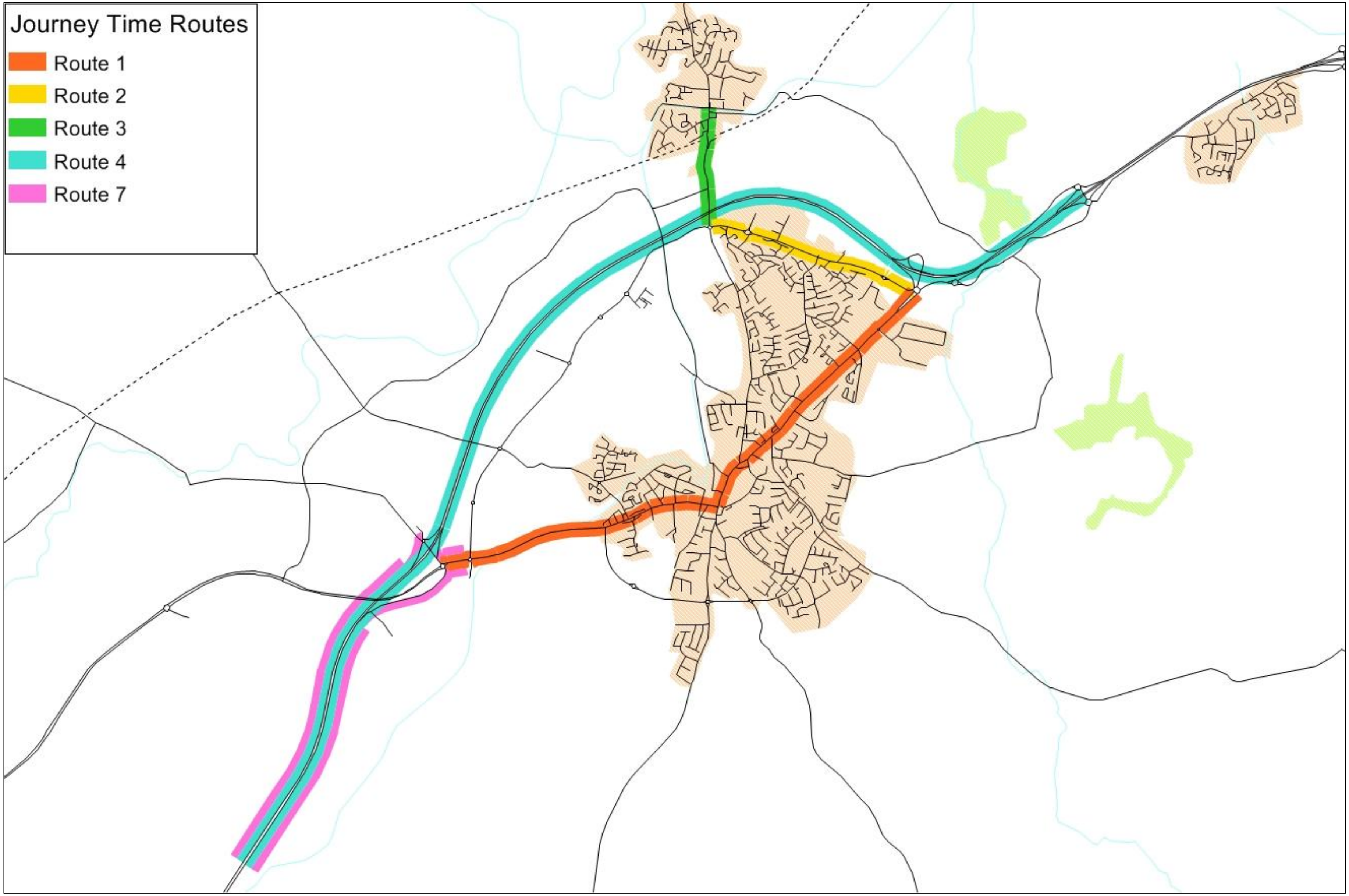


*Figure 2-5: Journey Time Survey Routes (1-4 & 7)*

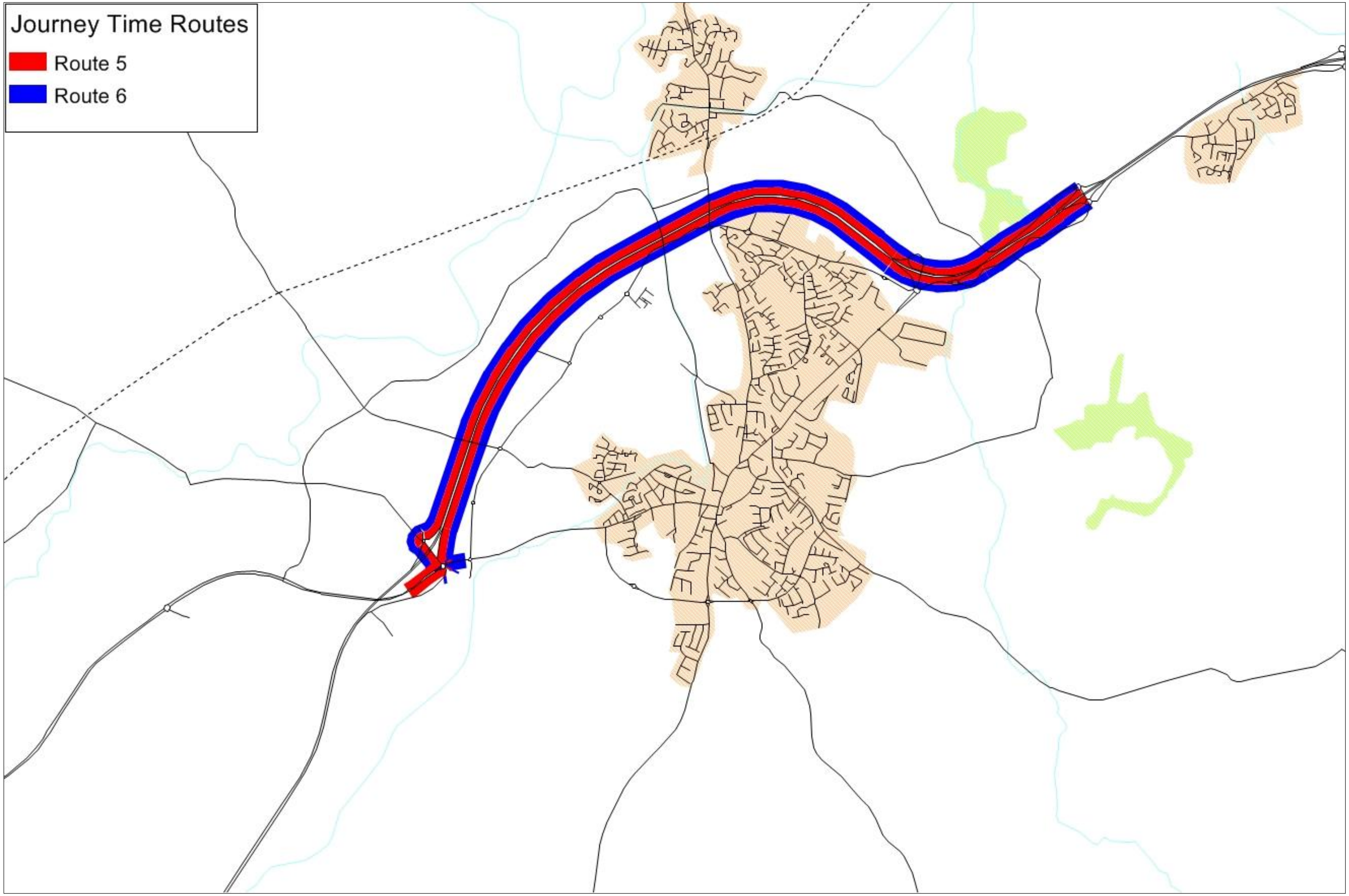


*Figure 2-6: Journey Time Survey Routes (5 & 6)*

# 3.0 Network and Matrix Development

## 3.1 Overview

This section of the report describes the development, calibration and validation of the 2012 M7 Base Year LAM's which have been developed for the following time periods:

- AM Peak Hour (08:00 – 09:00);
- Average Inter Peak Hour (12:00 – 14:00); and
- PM Peak Hour (17:00 – 18:00).

Assignment (fixed demand) models were developed using VISUM (V12.00-06).

## 3.2 Network Development

### *3.2.1 Cordoning the NTM*

As outlined above, the NTM was used as a starting point for developing the 2012 M7 LAM's. The initial step was to identify the extent of the study area for the LAM. This area was identified by comparing the difference in flows between the 2040 Do-Nothing Scenario NTM (i.e. without the proposed scheme) and the 2040 Do-Something Scenario NTM (i.e. with the proposed scheme in place). Any links which showed a change in flow as a result of the scheme were included in the LAM network.

This test indicated that the main effects of the scheme were confined to the Naas and Newbridge areas as far North as the R403 (Allenwood to Clane Road) and as far South as the R413 (Kilcullen to Ballymote Road). This area of influence was 'cordoned' out of the 2010 NTM model and is shown in Figure 3-1 below.

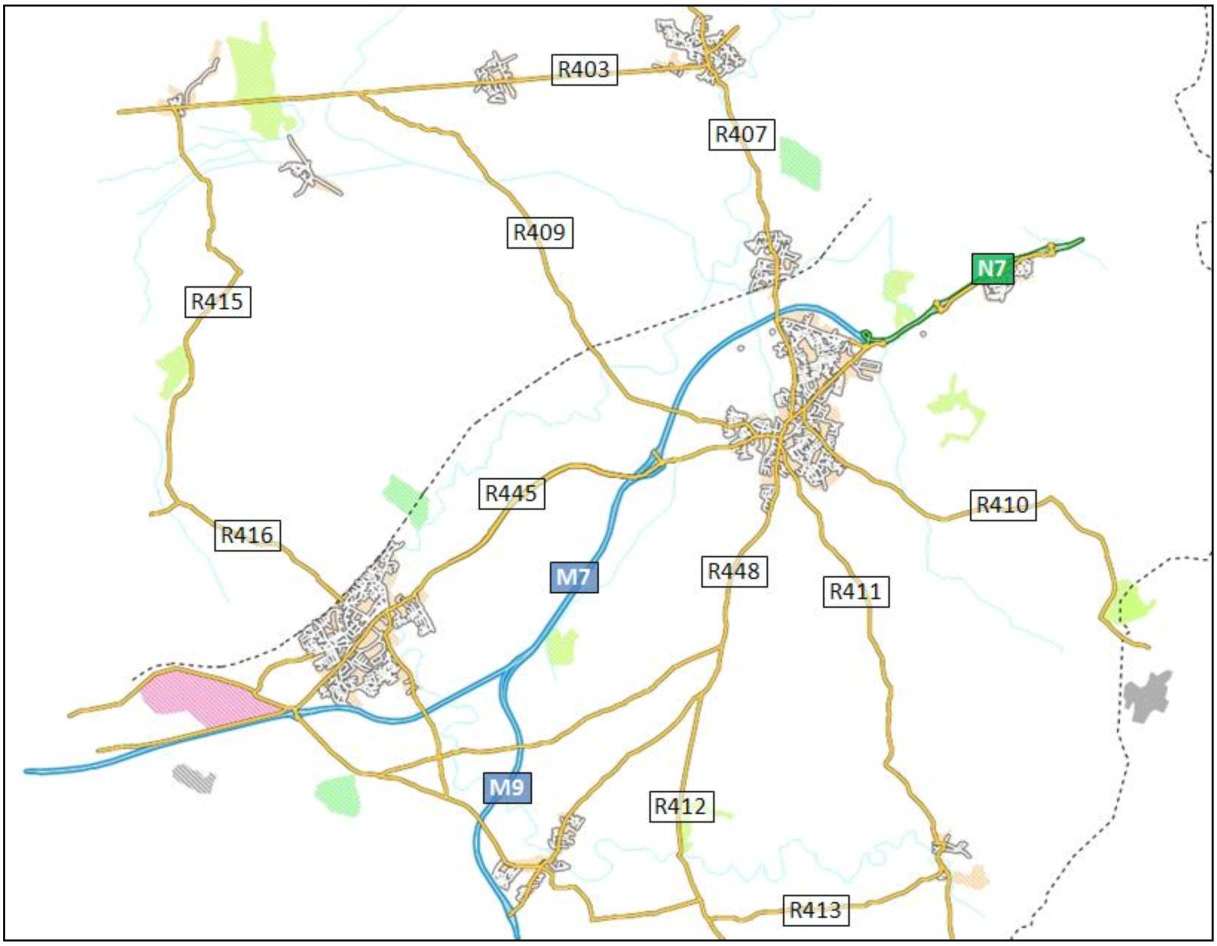


*Figure 3-1: 2010 NTM Cordon LAM Network*

### *3.2.2 LAM Network Refinement*

Following the cordoning process, the road network was further refined to ensure that all network characteristics (i.e. speed limits, banned turns, junction types etc.) were reflective of the 2012 road network. This information was collected through site observations and aerial mapping.

A number of additional local roads which were not included in the 2010 NTM model have been included in the 2012 LAM as they are impacted upon by the proposed scheme. The 2012 LAM network is illustrated in Figure 3-2 below.

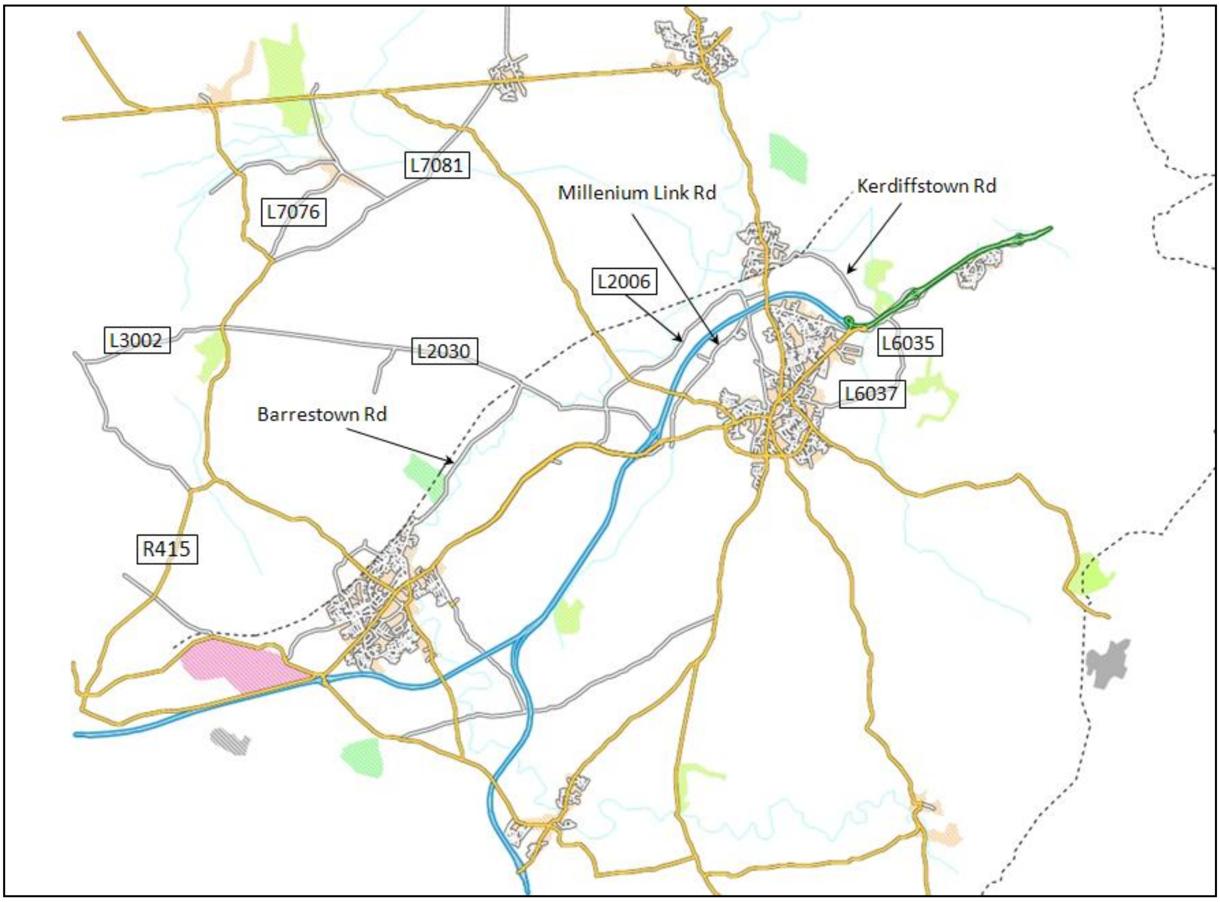


*Figure 3-2: 2012 M7 LAM Network*

### *3.2.3 LAM Zoning System*

The zoning system for the LAM was initially based on the NTM model zoning system. The zoning system cordoned from the NTM model is illustrated in Appendix B.

In order to obtain greater detail within the LAM, the NTM model zones in the study area were further refined in order to improve traffic flows and trip patterns.

The NTM zones which represent Naas and Newbridge were disaggregated into several smaller zones. In total the model contains 49 zones (34 internal and 15 external). The distribution of demand in these disaggregated zones was based on an assessment of the An Post Geo-Coding data which provide data on the location of all residential and commercial postal address points within each zone. The refined zoning system is illustrated in Appendix B.

### *3.2.4 Link Travel Times*

The total travel time of a trip from origin to destination is a function of both link travel time and junction delay. Link travel times in the network are determined by a predefined volume-delay function (VDF) in VISUM, which describes the relationship between current traffic volumes (q) and the capacity of the link ($q_{max}$). The VDF used in this model is based on the Bureau of Public Roads (BPR) function:

$$tCur = t0 * (1 + a * sat^b)$$

where: *t0 = free flow travel time (based on link length (km) and free flow speed (v0))*
*sat = q/(qmax * c)*
*a = 0.1, b = 2, c = 1*

The VDF function is globally applied to all links in the network as the capacity (q) and free flow speed (v0) of each link (input during network development) feed directly into the VDF. A VDF is applied to each link classification in the model based on adjusted a, b and c parameter values which reflect the quality of that road type.

#### *3.2.5 Junction Delay*

A number of key junctions in the model were modelled in detail to reflect existing junction delay. These junctions were modelled using the Intersection Capacity Analysis (ICA) tool in VISUM.
The ICA calculation precisely considers the geometry and signal control of the junction and calculates the capacity of the junction and the turning time (tCur) of each turn according to the Highway Capacity Manual (HCM). The method takes into account the impact of conflicting turns upon junction capacity and therefore provides more realistic results of junction capacity and delay.

Delay at all minor junctions is calculated using the Turns Volume-Delay method, which considers the free-flow turning travel time (t0) of each turn.

### 3.3 Matrix Development

'Prior' AM Peak and Inter Peak hour Light and Heavy vehicle matrices were cordoned from the 2010 NTM. The matrices were disaggregated based on the LAM zoning system to establish 'Prior' matrices for the process.

These 'Prior' matrices were adjusted during the calibration process using the matrix estimation tool to reflect demand in 2012.

As there is no PM Peak Hour NTM an alternative approach to generate the PM Peak Hour 'Prior' matrix was required. The calibrated AM Peak Hour matrices were transposed to give a 'Prior' PM matrix.

Matrices were then modified during the calibration process using the 2012 traffic survey data ascertained for each peak, the select link analysis tool in VISUM and the matrix estimation tool.

### 3.4 Generalised Cost

The assignment model applies the demand for travel, represented by the trip matrices, to the supply, in the form of the road network. The route choice is based on the 'generalised cost' of each route option, represented by a combination of time and distance as follows:

- Generalised Cost = Value of Time * Time + Vehicle Operating Cost * Dist

The economic parameters used in the M7 Widening LAM are outlined in Table 3-1. These are fully compliant with parameters set out in PAG and in the DTTAS Common Appraisal Framework.

*Table 3-1: Generalised Cost Economic Parameters*

| Peak hour | User Class | Value of Time (VoT) | | Vehicle Operating Cost (VOC) | |
|---|---|---|---|---|---|
| | | *Cents/sec* | *€/hr* | *Cents/metre* | *€/km* |
| AM and PM | Car | 0.5169 | 18.61 | 0.0101 | 0.101 |
| | HGV | 0.8826 | 31.77 | 0.0382 | 0.382 |
| Inter | Car | 0.5053 | 18.19 | 0.0101 | 0.101 |
| | HGV | 0.9104 | 32.78 | 0.037 | 0.37 |

**Average VoT for Commuting, Working & Non-Working*

The 'generalised cost' equations used in M7 Widening LAM are set out below:

- AM and PM Peak LV Generalised Cost = 0.5169 * time (sec) + 0.0101 * distance (meters);
- AM and PM Peak HV Generalised Cost = 0.8826 * time + 0.0382 * distance;
- Inter Peak LV Generalised Cost = 0.5053 * time + 0.0101 * distance ; and
- Inter Peak HV Generalised Cost = 0.9104 * time + 0.0370 * distance.

For the purpose of the assignment in the VISUM software a scalar of 1000 is applied to the VoT and VOC.

### 3.5 Assignment Method

The Route Choice Algorithm selected is 'Equilibrium Lohse'. This starts with an 'all or nothing' assignment, and assigns in an iterative fashion, with drivers utilising information gained during their last journey for the next route choice. The assignment terminates when a stable solution is calculated.

# 4.0 Model Calibration/Validation

## 4.1 Introduction

Following the development of the base year model, the process of calibrating and validating the models was undertaken.

## 4.2 Model Calibration

The purpose of model calibration is to ensure that the model assignments reflect the existing travel situation. Calibration is an iterative process, whereby the model is continually revised to ensure that the most accurate replication of the base year conditions is represented.

### *4.2.1 Matrix Estimation*

Matrix Estimation (ME) is the process in which the number of trips assigned along a model link is adjusted to match an observed total. Using transportation modelling software (VISUM in this case) it is possible to perform this operation at numerous locations in a single matrix estimation run, adjusting large sections of the trip matrix to match observed demand.

"TFlow Fuzzy" is the matrix estimation tool provided in VISUM, designed to automatically adjust trip matrices to match modelled volumes to observed volumes along multiple links or turns. Prior to the TFlow Fuzzy process, numerical parameters are set to form tolerance values, calculated as a percentage of the observed volumes, in order to ensure accuracy within the matrix estimation process.

Separate ME runs were carried out for light and heavy vehicles in the AM Peak, PM Peak and Inter Peak Hours. The calibration counts used for the ME process are illustrated in Appendix C.

### *4.2.2 Calibration Criteria and Link Flow Calibration Results*

The model calibration process has been undertaken based on the requirements of The NRA Project Appraisal Guidelines *Unit 5.2: Construction of Traffic Models* and with reference to the calibration criteria outlined in Table 5.2.2 of that document. The PAG specify the acceptable values for modelled and observed flow comparisons and suggests how calibration should relate to the magnitude of the values being compared. A summary of these targets is shown in Figure 4-1 below.

*Table 4-1: Model Calibration Criteria: Individual Flows*

| **Criteria and Measure** | **Guideline** |
|---|---|
| *Assigned Hourly Flows (e.g. links or turning movements) vs. Observed Flows:* | |
| Individual flows within 15% for flows 700 – 2700 vph<br>Individual flows within 100 vph for flows <700 vph<br>Individual flows within 400 vph for flows > 2700<br>Total screenline flows (normally >5 links to be within 5%) | > 85% of cases |

The standard method used to compare modelled values against observations on a link involves the calculation of the Geoff E. Havers (GEH) statistic (Chi-squared statistic), incorporating both relative and absolute errors. The GEH statistic is a measure of comparability that takes account of not only the difference between the observed and modelled flows, but also the significance of this difference with respect to the size of the observed flow. The GEH statistic is calculated as follows:

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

*Where M = Modelled Flow and O = Observed Flow.*

Guidance in the Project Appraisal Guidelines sets out the following criteria:

*Table 4-2: Model Calibration Criteria: GEH Values*

| **Criteria and Measures** | | **Requirement** |
|---|---|---|
| GEH statistic | Individual flows: GEH < 5 | > 85% of cases |
| GEH statistic | Screenline totals: GEH < 4 | All (or nearly all) screenlines |

The links that were used in the model calibration process are illustrated in Appendix C. The results of the calibration exercise are outlined below in Table 4-3 and Table 4-4. The detailed summary tables are included in Appendix D.

*Table 4-3: Calibration Results: Individual Links*

| **Time Period** | **% of Calibration Sites Meeting the flow criteria that: Individual Flows within 15% for flows 700 – 2700 vph Individual flows within 100 vph for flows < 700 vph Individual flows within 400 vph for flows > 2700 vph** | | | |
|---|---|---|---|---|
| | **Link Flows** | | | |
| | Total Traffic | Lights | Heavies | Required |
| **AM Peak** | 90% | 95% | 100% | >85% |
| **Inter Peak** | 97% | 97% | 100% | >85% |
| **PM Peak** | 92% | 92% | 100% | >85% |

*Table 4-4: Calibration Results: GEH Values*

| **Time Period** | **% of Calibration Sites with GEH < 5** | | | |
|---|---|---|---|---|
| | **GEH < 5** | | | |
| | Total Traffic | Lights | Heavies | Required |
| **AM Peak** | 94% | 100% | 87% | >85% |
| **Inter Peak** | 95% | 95% | 100% | >85% |
| **PM Peak** | 92% | 92% | 92% | >85% |

The comparison of modelled and observed flows has identified that the AM, Inter and PM Peak period models match the flow criteria for all user classes. Likewise, the GEH results show that the AM Peak, Inter Peak and PM Peak periods models also match the criteria for all user classes. The results therefore confirm that the models have been calibrated to a standard compliant with the PAG criteria for all user classes and all time periods.

### 4.3 Trip Distance Check

The output trip matrix from the matrix estimation process must be checked to ensure that the process has not significantly altered the trip length distribution. It is possible that in seeking to increase the flow along a particular link, the matrix estimation process might add significant numbers of trips between the two zones at either end of the link in question. This could have the effect of creating excess short distance trips while longer distance trips are unaffected, which in turn would push the trip length distribution toward short trips.

To check the output of the matrix estimation process, the trip length distributions (TLD) from before (pre) and after (post) matrix estimation are compared. The trip length distributions for each peak hour for Light Vehicles are represented as histograms in Figure 4-1 to 4-3. The figures shows that the TLD has not been significantly altered as a result of the ME process.

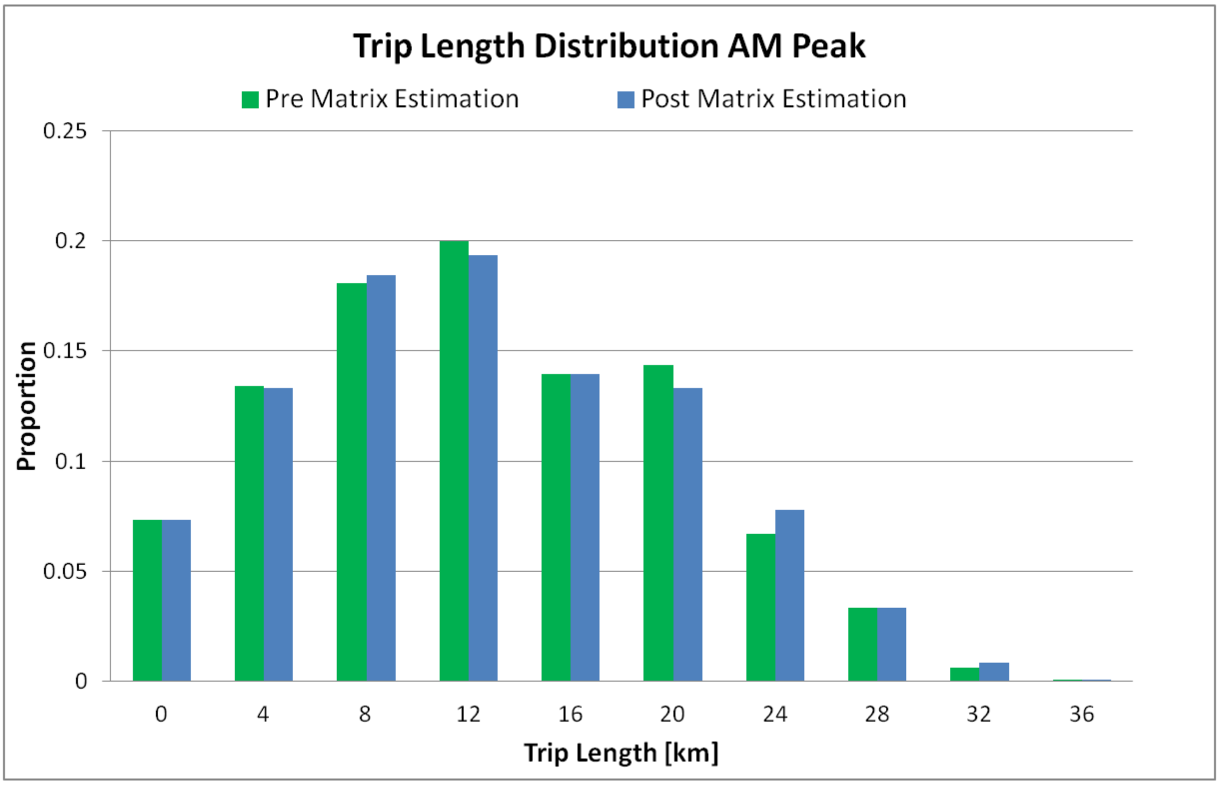


*Figure 4-1: TLD AM Peak Hour (LV)*

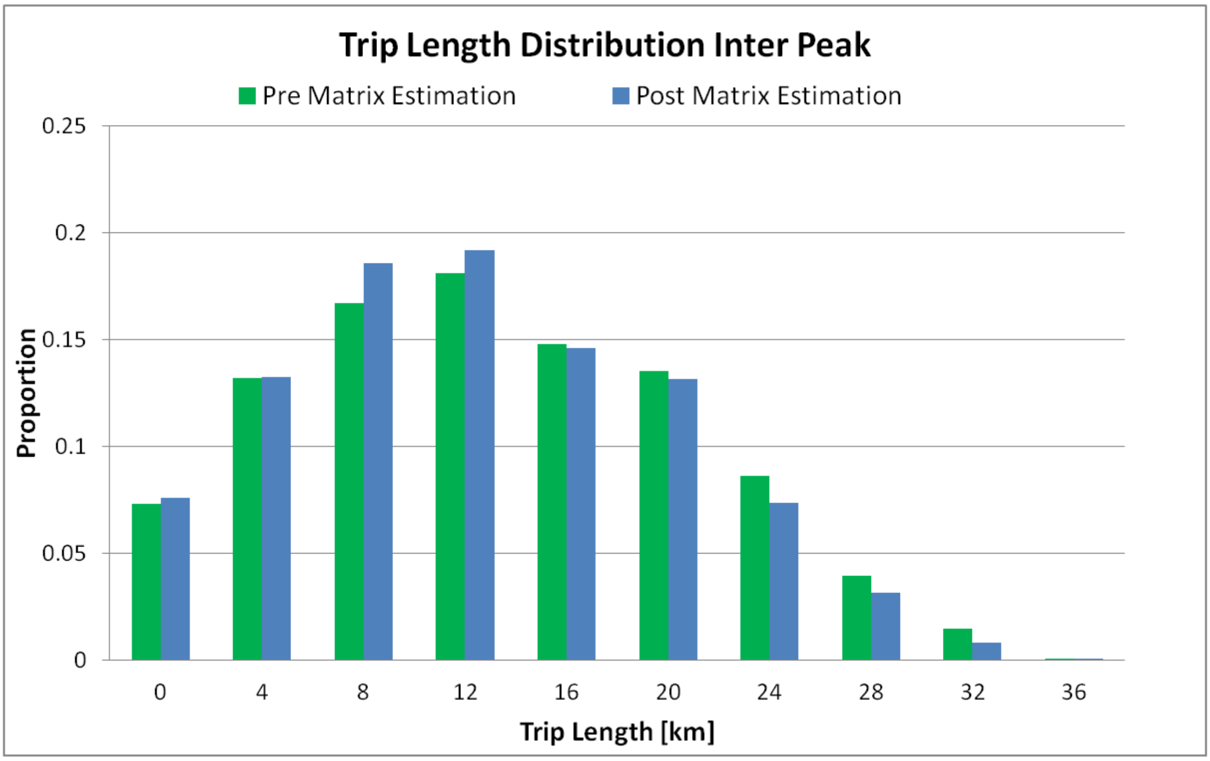


*Figure 4-2: TLD Inter Peak Hour (LV)*

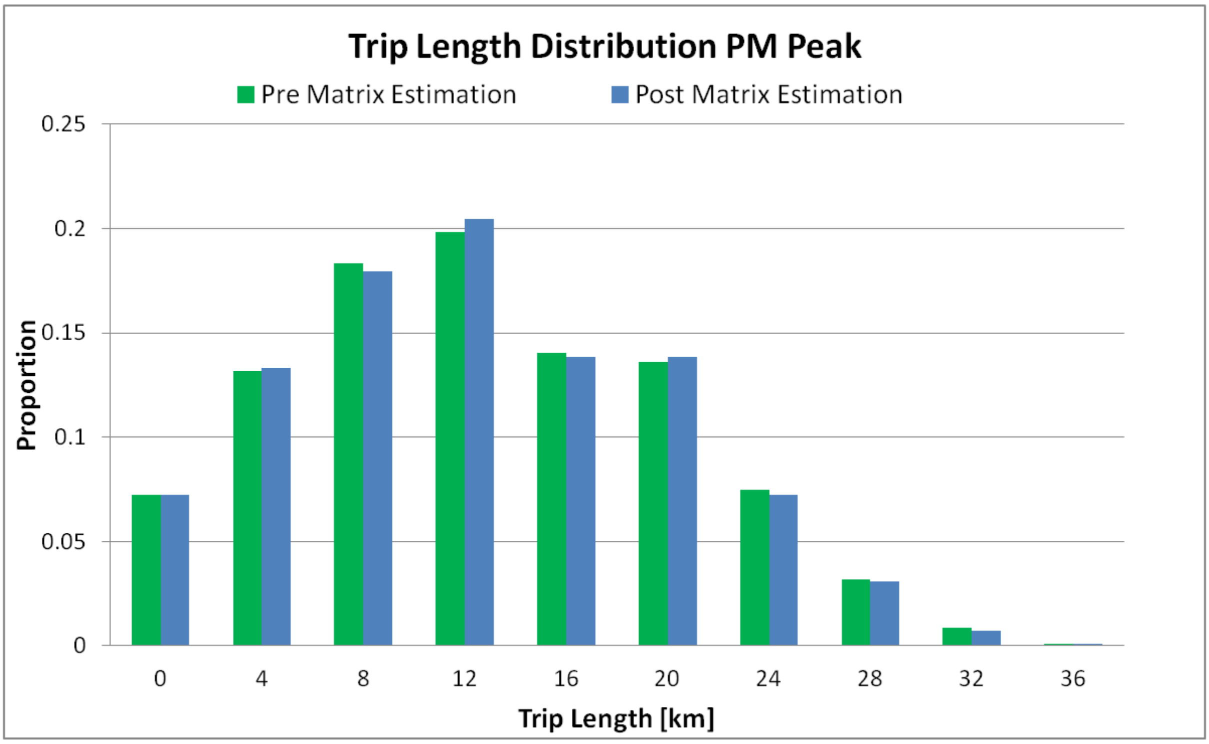


*Figure 4-3: TLD PM Peak Hour (LV)*

## 4.4 Model Validation

### *4.4.1 Overview*

Model validation comprises the comparison of calibrated modelled flows against an independent data set of traffic counts which was not used as part of the calibration process. Validation checks included:

- Link flow validation and statistical criteria;
- Overall model validation (e.g. journey times); and
- Validation of routing through the network.

The count locations that were used in the model validation process are illustrated in Appendix C.

### *4.4.2 Validation of Traffic Flows*

The observed and modelled flows were compared at each of the validation sites in accordance with the criteria outlined in *PAG Unit 5.2: Construction of Traffic Models* and with reference to the validation criteria outlined in Table 5.2.3 of that unit. The permissible difference was calculated for each value (based on the observed figure) and compared with that which had been modelled. Validation results are included in Appendix E and are summarised in Tables 4-5 and 4-6 below.

*Table 4-5: Validation Results: Individual Links*

| **Time Period** | **% of Validation Sites Meeting the flow criteria that:<br>Individual Flows within 15% for flows 700 – 2700 vph<br>Individual flows within 100 vph for flows < 700 vph<br>Individual flows within 400 vph for flows > 2700 vph** | | | |
|---|---|---|---|---|
| | **Link Flows** | | | |
| | Total Traffic | Lights | Heavies | Required |
| **AM Peak** | 85% | 90% | 100% | >85% |
| **Inter Peak** | 100% | 100% | 100% | >85% |
| **PM Peak** | 85% | 85% | 100% | >85% |

*Table 4-6: Validation Results: GEH Values*

| **Time Period** | **% of Validation Sites with GEH < 5** | | | |
|---|---|---|---|---|
| | **GEH < 5** | | | |
| | Total Traffic | Lights | Heavies | Required |
| **AM Peak** | 90% | 95% | 95% | >85% |
| **Inter Peak** | 100% | 100% | 100% | >85% |
| **PM Peak** | 95% | 90% | 95% | >85% |

A comparison against the validation counts shows that the AM, Inter and PM Peak period models both exceed the PAG requirements for the validation of traffic flow on links. Likewise, all models meet the GEH criteria of 85%. The results therefore demonstrate that the validation criteria as set out by the NRA are successfully met by all models.

### *4.4.3 Validation of Journey Times*

As part of the validation process, the modelled journey times were compared against the surveyed journey times to ensure the model gave a reasonable representation of existing conditions. The results of the journey time validation are presented in Table 4-7 to 4-9 for the AM, Inter and PM peak hours, respectively.

*Table 4-7: AM Peak Journey Times Validation (sec)*

| Route | Direction | Time Period | Modelled | Observed | Difference | % Diff | Validated |
|---|---|---|---|---|---|---|---|
| 1 | Eastbound | 08:00 – 09:00 | 735 | 726 | 9 | 1% | Yes |
| 1 | Westbound | 08:00 – 09:00 | 652 | 685 | -33 | -5% | Yes |
| 2 | Eastbound | 08:00 – 09:00 | 185 | 161 | 24 | 15% | Yes |
| 2 | Westbound | 08:00 – 09:00 | 165 | 167 | -2 | -1% | Yes |
| 3 | Northbound | 08:00 – 09:00 | 99 | 97 | 2 | 3% | Yes |
| 3 | Southbound | 08:00 – 09:00 | 118 | 146 | -28 | -19% | Yes |
| 4 | Southbound | 08:00 – 09:00 | 386 | 431 | -45 | -10% | Yes |
| 4 | Northbound | 08:00 – 09:00 | 540 | 531 | 9 | 2% | Yes |
| 5 | Southbound | 08:00 – 09:00 | 345 | 286 | 59 | 21% | Yes |
| 5 | Northbound | 08:00 – 09:00 | 440 | 466 | -26 | -6% | Yes |
| 6 | Southbound | 08:00 – 09:00 | 340 | 330 | 10 | 3% | Yes |
| 6 | Northbound | 08:00 – 09:00 | 478 | 414 | 64 | 15% | Yes |
| 7 | Northbound | 08:00 – 09:00 | 305 | 315 | -10 | -3% | Yes |
| 7 | Southbound | 08:00 – 09:00 | 207 | 176 | 31 | 18% | Yes |

*Table 4-8: Inter Peak Journey Times Validation (sec)*

| Route | Direction | Time Period | Modelled | Observed | Difference | % Diff | Validated |
|---|---|---|---|---|---|---|---|
| 1 | Eastbound | 12:00 – 14:00 | 617 | 660 | -43 | -6% | Yes |
| 1 | Westbound | 12:00 – 14:00 | 685 | 716 | -31 | -4% | Yes |
| 2 | Eastbound | 12:00 – 14:00 | 190 | 192 | -2 | -1% | Yes |
| 2 | Westbound | 12:00 – 14:00 | 178 | 178 | 0 | 0% | Yes |
| 3* | Northbound | 12:00 – 14:00 | 107 | - | - | - | - |
| 3 | Southbound | 12:00 – 14:00 | 106 | 164 | -58 | -35% | Yes |
| 4 | Southbound | 12:00 – 14:00 | 361 | 407 | -46 | -11% | Yes |
| 4 | Northbound | 12:00 – 14:00 | 364 | 385 | -21 | -5% | Yes |
| 5 | Southbound | 12:00 – 14:00 | 355 | 310 | 45 | 15% | Yes |
| 5 | Northbound | 12:00 – 14:00 | 342 | 367 | -25 | -7% | Yes |
| 6 | Southbound | 12:00 – 14:00 | 348 | 374 | -26 | -7% | Yes |
| 6 | Northbound | 12:00 – 14:00 | 367 | 341 | 26 | 8% | Yes |
| 7 | Northbound | 12:00 – 14:00 | 215 | 214 | 1 | 0% | Yes |
| 7 | Southbound | 12:00 – 14:00 | 173 | 185 | -12 | -6% | Yes |

** No observed data available for this route in northbound direction.*

*Table 4-9: PM Peak Journey Times Validation (sec)*

| Route | Direction | Time Period | Modelled | Observed | Difference | % Diff | Validated |
|---|---|---|---|---|---|---|---|
| 1 | Eastbound | 17:00 – 18:00 | 725 | 749 | -24 | -3% | Yes |
| 1 | Westbound | 17:00 – 18:00 | 1015 | 937 | 78 | 8% | Yes |
| 2 | Eastbound | 17:00 – 18:00 | 192 | 195 | -3 | -2% | Yes |
| 2 | Westbound | 17:00 – 18:00 | 308 | 319 | -11 | -3% | Yes |
| 3 | Northbound | 17:00 – 18:00 | 106 | 163 | -57 | -35% | Yes |
| 3 | Southbound | 17:00 – 18:00 | 99 | 155 | -56 | -36% | Yes |
| 4 | Southbound | 17:00 – 18:00 | 610 | 562 | 48 | 9% | Yes |
| 4 | Northbound | 17:00 – 18:00 | 385 | 442 | 57 | 13% | Yes |
| 5 | Southbound | 17:00 – 18:00 | 449 | 400 | 49 | 12% | Yes |
| 5 | Northbound | 17:00 – 18:00 | 387 | 329 | 58 | 18% | Yes |
| 6 | Southbound | 17:00 – 18:00 | 462 | 404 | 58 | 14% | Yes |
| 6 | Northbound | 17:00 – 18:00 | 429 | 374 | 55 | 15% | Yes |
| 7 | Northbound | 17:00 – 18:00 | 239 | 223 | 13 | 6% | Yes |
| 7 | Southbound | 17:00 – 18:00 | 298 | 210 | 49 | 23% | Yes |

All models satisfy the PAG requirement that 85% of all modelled journey times are within 15% of observed data or less than 60 seconds. As such the base year model is validated to the requirements of *PAG Unit 5.2: Construction of Transport Models.*

### *4.4.4 Assessment of Traffic Patterns*

Although not required under PAG guidance, the routing of traffic though the study area was checked against the results from the O-D surveys outlined in Section 2.3.1. The patterns were compared based on the percentage split of destinations from each survey location based on the locations shown in Figure 2.4. Whilst no guidelines exist on validation targets, a target of +/- 20% was used as a target deviation limit. Tables 4-10 to 4-12 below show that the AM Peak, Inter Peak and PM Peak model met this target with no O-D pair having a difference in excess of +/- 20%.

*Table 4-10: Comparison of AM Period Traffic Patterns*

| | | **Last Seen** | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3a** | **3b** | **3c** | **4** |
| **First Seen** | **1** | | -18% | 3% | 0% | 0% | 15% |
| | **2** | -19% | | 10% | 0% | -1% | 10% |
| | **3a** | -6% | 5% | | 0% | 0% | 1% |
| | **3b** | - | - | - | - | - | - |
| | **3c** | -13% | -2% | 20% | -2% | | -4% |
| | **4** | 5% | -8% | 2% | 0% | 0% | |

*Table 4-11: Comparison of Inter Peak Period Traffic Patterns*

| | | Last Seen | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3a** | **3b** | **3c** | **4** |
| **First Seen** | **1** | - | -16% | 7% | 0% | -1% | 10% |
| | **2** | -18% | - | 9% | 0% | -2% | 11% |
| | **3a** | -9% | -3% | - | 0% | 15% | -3% |
| | **3b** | 7% | -1% | -3% | - | 10% | -12% |
| | **3c** | -11% | -6% | 8% | -1% | - | 10% |
| | **4** | -1% | -2% | -1% | 1% | 3% | - |

*Table 4-12: Comparison of PM Peak Period Traffic Patterns*

| | | Last Seen | | | | | |
|---|---|---|---|---|---|---|---|
| | | **1** | **2** | **3a** | **3b** | **3c** | **4** |
| **First Seen** | **1** | | -15% | 3% | 0% | 3% | 10% |
| | **2** | -14% | | 16% | 0% | 0% | -1% |
| | **3a** | -6% | -6% | | 1% | 4% | 7% |
| | **3b** | - | - | - | - | - | - |
| | **3c** | 4% | -1% | -9% | -3% | | 10% |
| | **4** | 5% | -10% | 1% | 0% | 5% | |

## 4.5 Review of Travel Patterns

As a final check of the Base Year Models, it was considered prudent to review the travel patterns trough the model to understand dominant movements. A good understanding of the existing travel demand is derived through an analysis of key desire lines from the traffic models. This analysis of desire lines is achieved through the definition of 'sectors' which represent key areas of the traffic models as follows:

- Sector 1 – M9/Kilcullen;
- Sector 2 – Naas;
- Sector 3 – N7 East/Dublin;
- Sector 4 – Newbridge;
- Sector 5 – M7 West; and
- Sector 6 – Clane/Prosperous.

These 6 sectors are illustrated in Figure 4-4

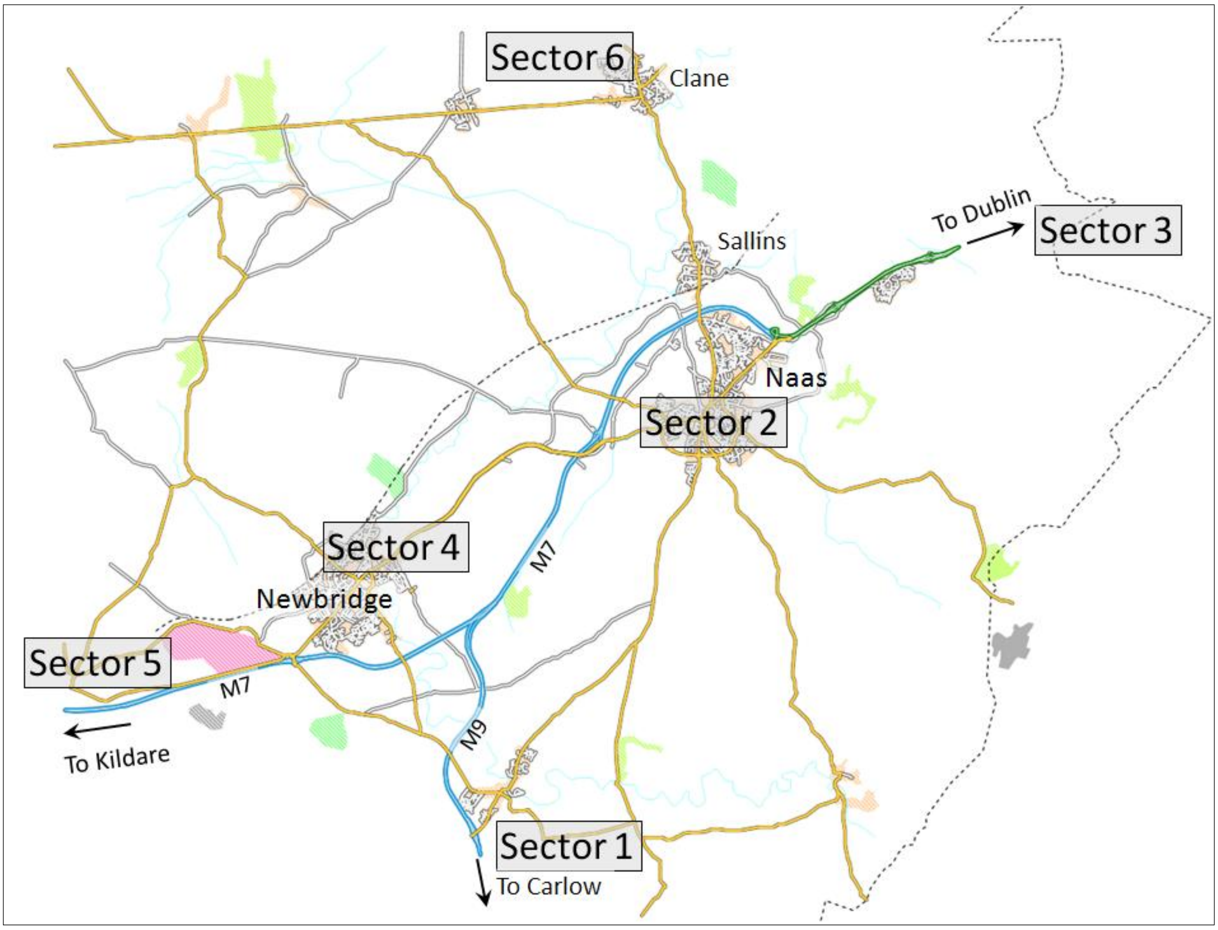


*Figure 4-4: Traffic Model Sectors*

Figures 4-5 to 4-7 illustrate the key desire lines in the study area during the AM Peak, Inter Peak and PM Peak hours. The desire lines highlight the dominance of the demand between Naas and N7 East with a strong by-pass movement of Naas being most evident during the peak periods.

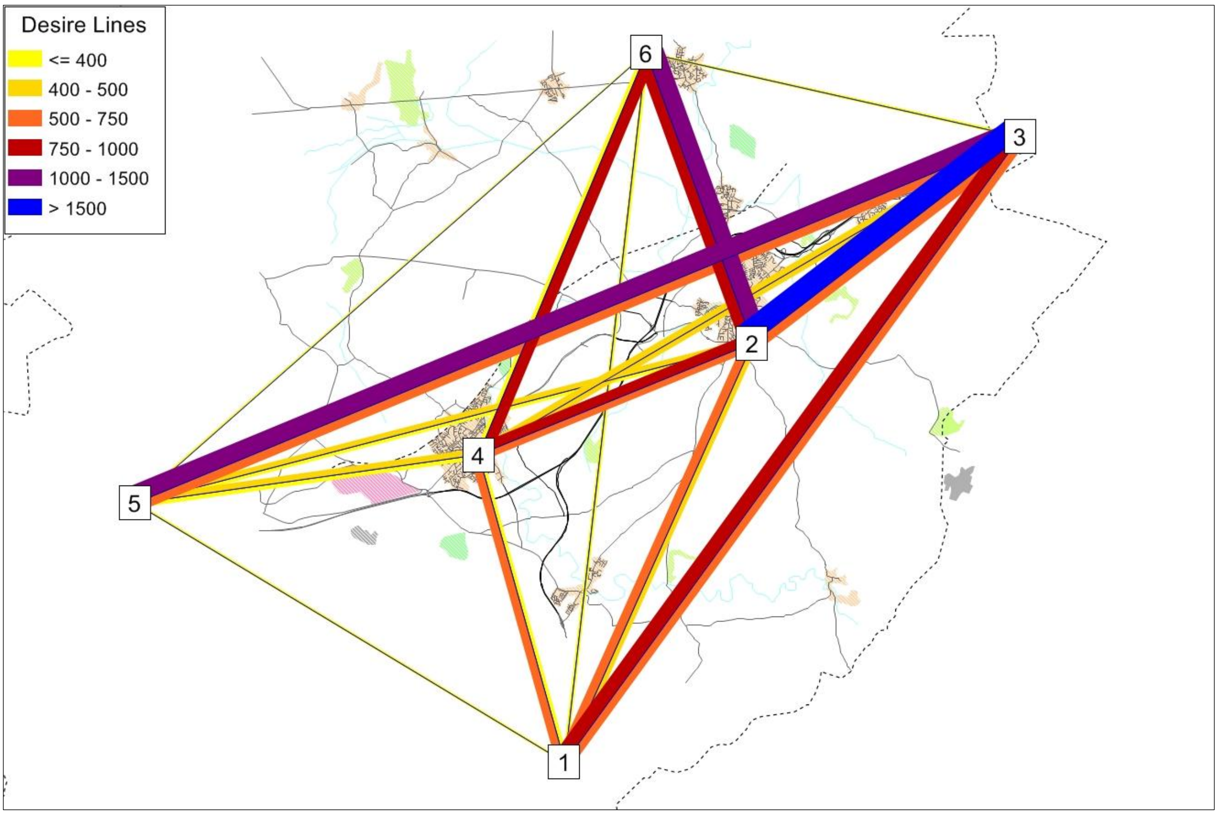


*Figure 4-5: AM Peak Desire Lines (vehs)*

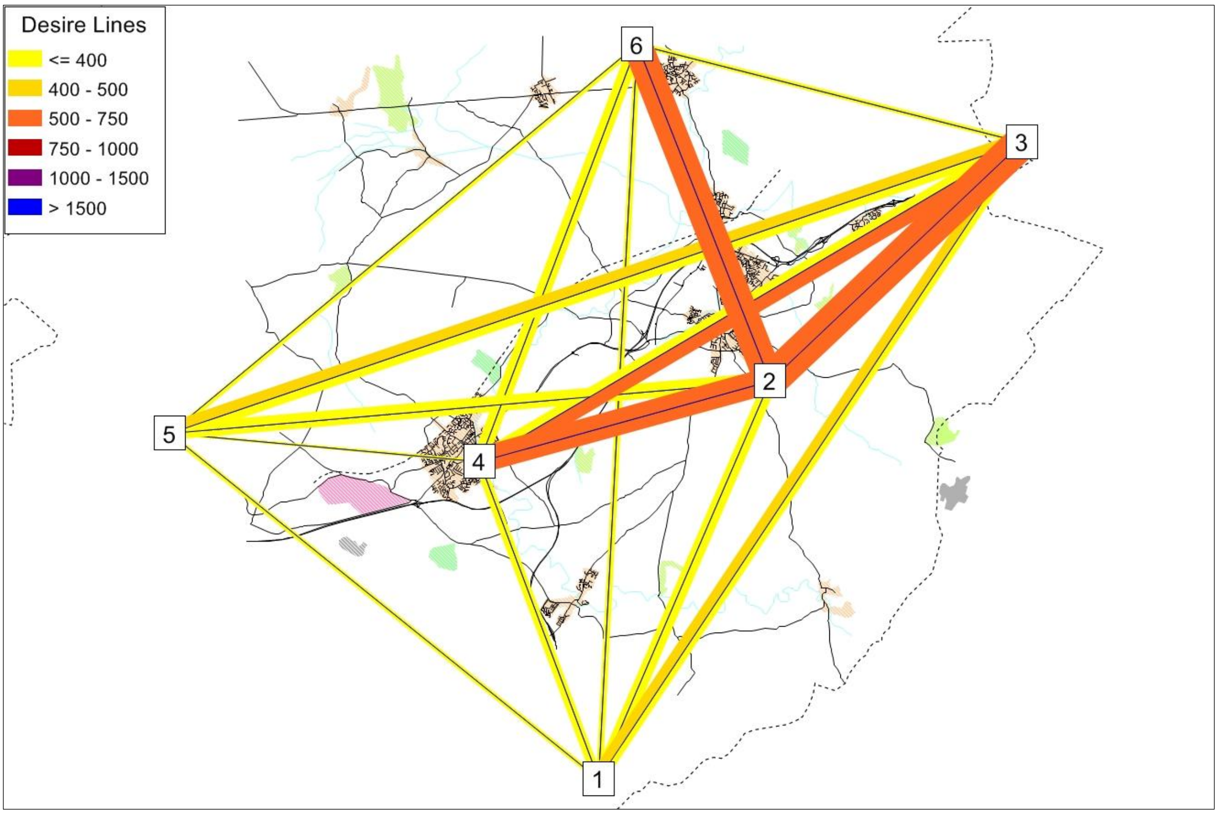


*Figure 4-6: Inter Peak Desire Lines (vehs)*

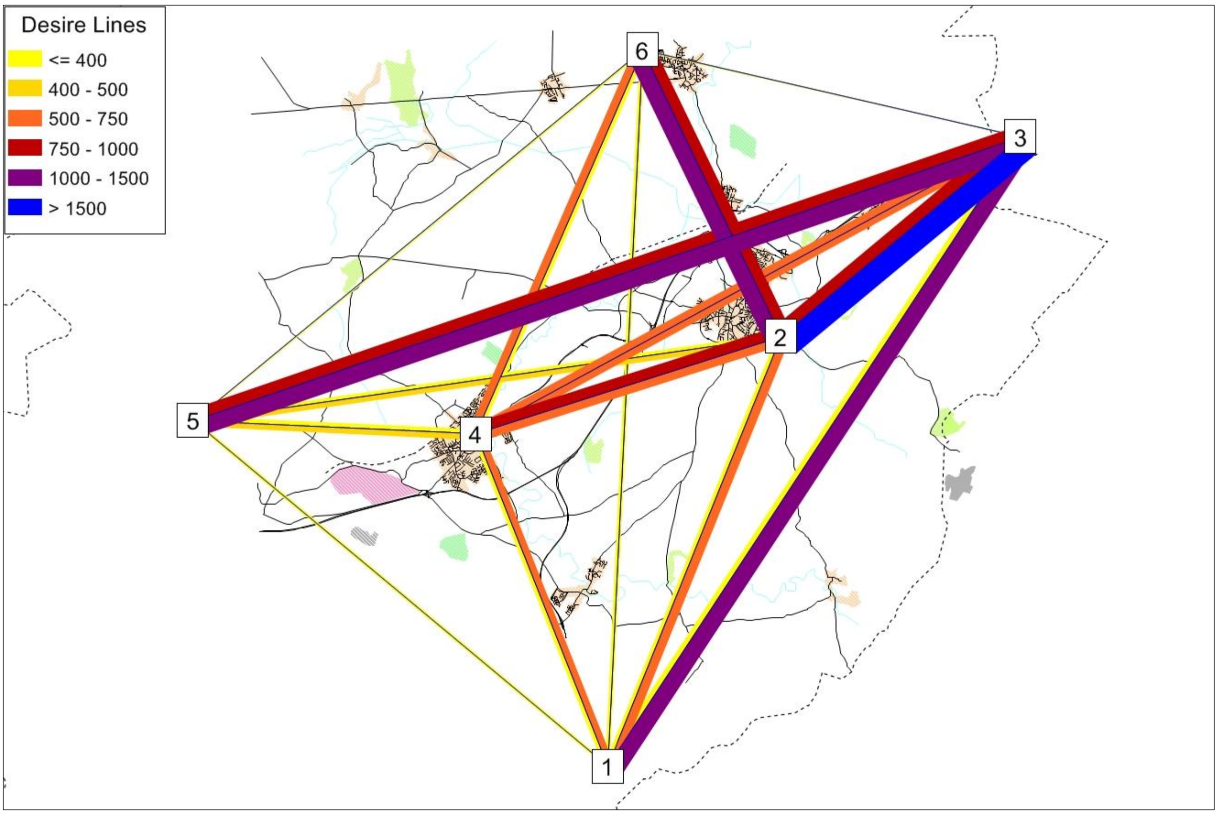


*Figure 4-7: PM Peak Desire Lines (vehs)*

# 5.0 Future Year Model Development

## 5.1 Introduction

This section of the report sets out the development of the future year traffic models for the proposed Opening Year (2015) and Design Year (2030) of the scheme.

## 5.2 Future Year Network Development

The future year "Do-Minimum" network includes the 2012 existing network any other committed infrastructure improvements. For the current model, these infrastructure improvements include the M7 Naas to Newbridge By-Pass and Sallins Road Junction. These improvements are included in the Do-Minimum as the proposed Osberstown scheme is dependent on the M7 Naas to Newbridge By-Pass scheme.

The "Do-Something 1" network includes all assumptions in the "Do-Minimum" network with the addition of the proposed Osberstown Interchange. The "Do-Something 2" network consists of all infrastructures in the "Do-Something 1" network with the inclusion of the proposed Sallins Bypass. The "Do-Something 2" is shown in figure 5-1.

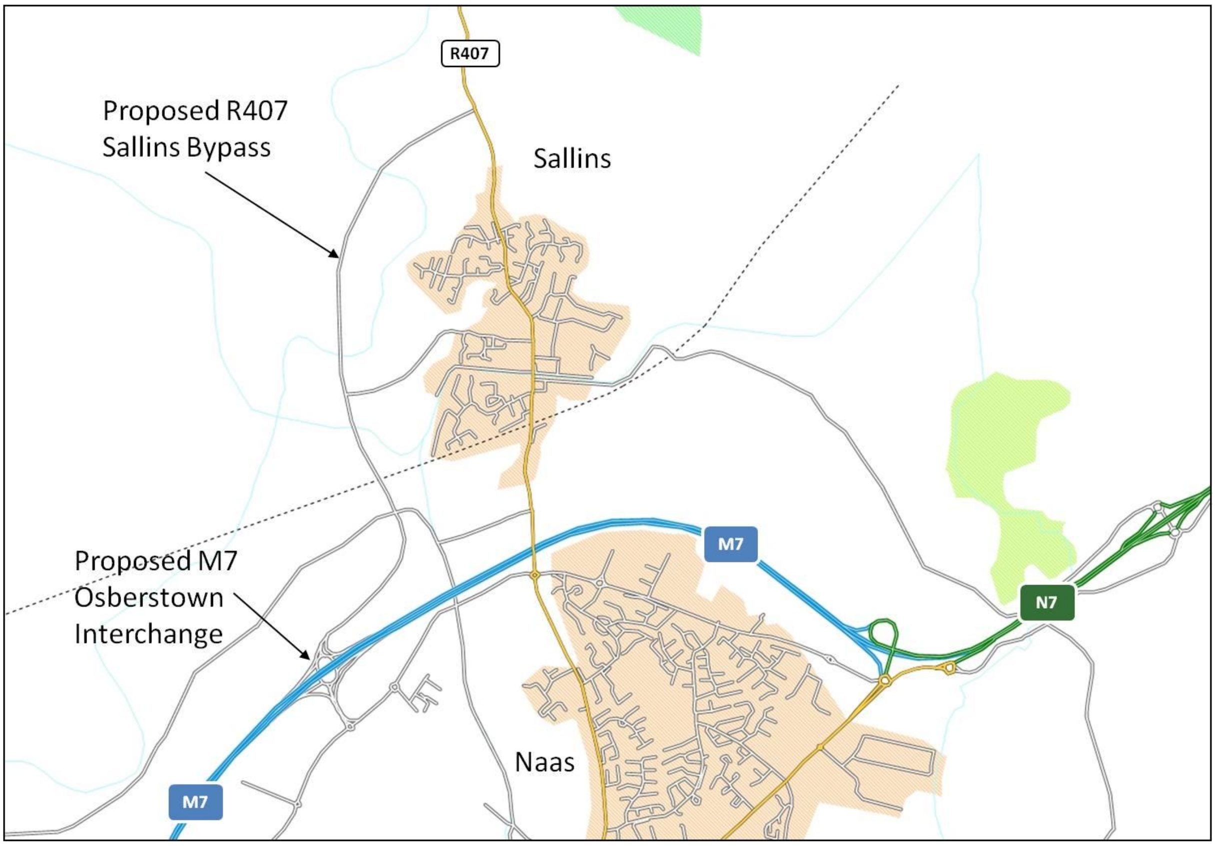


*Figure 5-1: "Do-Something 2" Modelled Network*

The development of traffic growth forecasts for the future year LAM's has been based on the requirements set out in PAG unit 5.4: *Zone-Based Traffic Growth Forecasting*. That guidance sets out separate methodologies for establishing trip end growth for internal and external zones within the LAM.

### *5.2.1 Demographic Growth (NTM)*

The NTM is made up of 874 zones, each of which contains demographic data (population, employment and car ownership) for a base year of 2010 and forecast years of 2025 & 2040. Demographic data is available for three future year growth scenarios namely NRA Low, Medium and High.

The future year traffic forecasts for the NTM are based on demographic and economic projections which have been prepared at a zonal level. The medium growth projections are consistent with aggregate forecasts prepared by the Central Statistics Office scenario M0F1 which assumes zero net-migration. High and Low projections represent upper and lower bounds on anticipated growth over the same period. The NTM uses a Trip Attraction Generation Model (TAGM) to convert these demographic and economic indicators into trip ends for each NTM zone.

The future year growth in traffic in the LAM is based on the forecast growth in population and employment in the LAM. The LAM for the M7 is made up of the following NTM zones located in County Kildare:

- Clane, Staffan and Balraheen: Zone 494;
- Bodenstown: Zone 496;
- Kilmeage and Robertstown: Zone 500;
- Carragh, Donore and Downings: Zone 502;
- Naas Town and Naas Rural, Kill, Kilteen and Rathmore: Zones 504;
- Dunmurry, Feighcullen, Pollardstown and Rathernan: Zone 508;
- Droichead Nua, Ladytown, Morristownbiller and Oldconnel: Zone 510;
- Ballymote Eustace, Carnalway, Killashee and Newtown: Zone 512; and
- Gilltown, Kilcullen and Usk: Zone 514.

A total of 15 external zones (2000-2014) feed traffic into and out of the study area. The zones included in the M7 LAM are illustrated below in Figure 5-2.

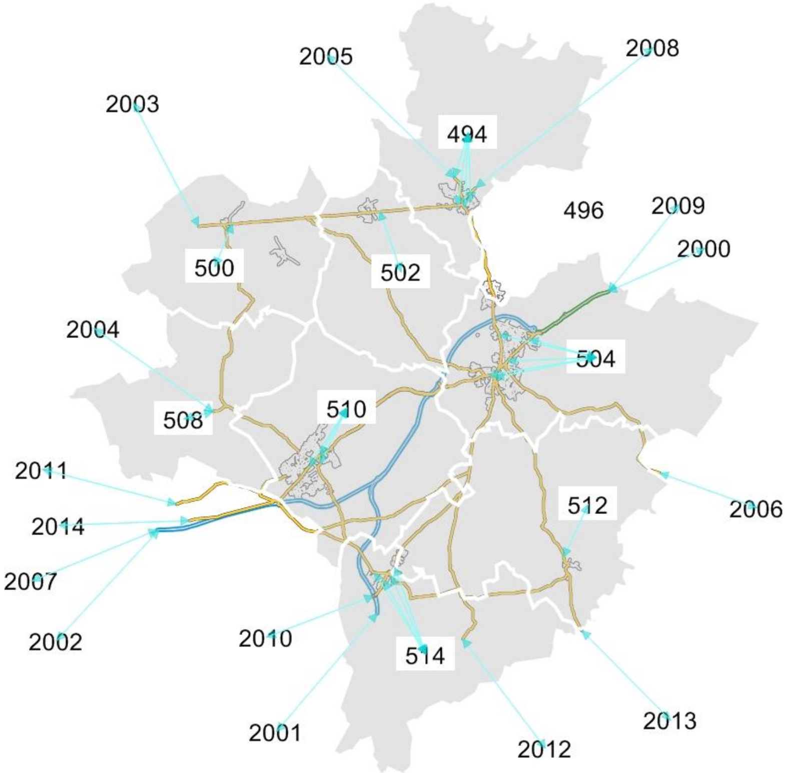


*Figure 5-2: NTM Zones in LAM*

### *5.2.2 Internal Zone Trip End Growth Factors*

The first step was to establish the relationship between the LAM zones and the NTM zones. Following this the origin (O) and destination (D) Trip End Growth (TEG) factors for the zones in the LAM were identified for the AM Peak, Inter Peak and PM Peak hours from PAG Unit 5.4. The TEG factors established for the AM, Inter and PM Peak hours for the NRA low, medium and high growth scenarios are presented in the Appendix F.

### *5.2.3 External Zone Trip End Growth Factors*

The LAM boundary was then cordoned from the both the 2010 Base Year NTM and 2025 and 2040 Do-Nothing NTM, these models where then compared against each other to establish growth factors for each external zone. These growth factors were then annualised to provide annual external TEG factors for the periods 2010–2025 and 2026-2040.

### *5.2.4 Total Growth in LAM*

The total growth in the LAM was established by furnessing the 2012 base year matrices to the forecast 2015 and 2030 target trip ends outlined above. As part of this exercise the matrix totals were doubly constrained to the mean of the origin and destination forecast trip ends totals. Table 5-1 below presents the matrix totals for the NRA medium growth scenario.

*Table 5-1: Total Growth in LAM (vehicles) – NRA Medium Growth*

| Matrix | 2012 | 2015 | 2030 | Growth | | | |
|---|---|---|---|---|---|---|---|
| | | | | 2012 - 2015 | % | 2012 - 2030 | % |
| **AM LV** | 20,196 | 21,041 | 25,384 | 845 | 4.2% | 5188 | 25.7% |
| **AM HV** | 975 | 1,001 | 1,089 | 26 | 2.6% | 114 | 11.6% |
| **Inter LV** | 11,110 | 11,523 | 13,593 | 413 | 3.7% | 2483 | 22.4% |
| **Inter HV** | 1,062 | 1,089 | 1,195 | 27 | 2.5% | 133 | 12.5% |
| **PM LV** | 20,557 | 21,419 | 25,855 | 862 | 4.2% | 5298 | 25.8% |
| **PM HV** | 748 | 768 | 833 | 20 | 2.7% | 85 | 11.4% |

Traffic growth in the LAM that does not have an origin or destination within the study area (i.e. through traffic) was then isolated from the total growth outlined in Table 5-1 above to highlight level of local growth. The results of this exercise are presented in Table 5-2.

*Table 5-2: Total Growth in LAM excluding through traffic (vehicles) – NRA Medium Growth*

| Matrix | 2015 Total Growth | 2015 Through Traffic | Local Growth (2015) | 2030 Total Growth | 2030 Through Traffic | Local Growth (2030) |
|---|---|---|---|---|---|---|
| **AM LV** | 844 | 87 | 757 | 5187 | 513 | 4674 |
| **AM HV** | 22 | 7 | 15 | 108 | 31 | 77 |
| **Inter LV** | 413 | 53 | 360 | 2483 | 333 | 2150 |
| **Inter HV** | 24 | 9 | 15 | 115 | 43 | 72 |
| **PM LV** | 861 | 82 | 779 | 5296 | 503 | 4793 |
| **PM HV** | 18 | 6 | 12 | 83 | 27 | 56 |

### *5.2.5 Reallocation of Future Year Growth*

NRA PAG Unit 5.3 states that *"Within the LAM, there is some flexibility to reallocate growth between different LAM zones within a single NTM zone, although the trip end growth for the collective LAM zones that form the NTM zone should remain consistent with the zone-based trip end growth rates".*

In order to allocate the forecast growth to the disaggregated zones in Naas and its environs which is represented by NTM Zone 504 (as illustrated in Figure 5.3), a study of land use zonings was undertaken using the following documentation:

- Naas Local Area Plan (LAP) 2011 – 2017 (Naas Town Council);
- Kildare County Development Plan (CDP) 2011 – 2017;
- Kildare County Development Plan 2011 – 2017 Variation No.1 (to incorporate small towns) June 2012; and
- Sallins Local Area Plan (LAP)

The review identified a total of 16 zones within Naas Town and its environs where development could potentially occur. The locations of these zones within NTM zone 504 are illustrated in Figure 5.4.

Table 5-3 below outlines the proposed distribution of growth for the 16 zones which represent Naas Town and its environs (50401 to 50416). The actual total growth in trips within the 16 growth areas for Opening Year (2015) and Design Year (2030) during the AM Peak, Inter Peak and PM Peak hours is presented in Table 5-4 to Table 5-6 for Light Vehicles.

*Table 5-3: Allocation of Additional Traffic to Zone 504 Sub-Zones*

| Zone 504 Sub-Zones | Trips | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | AM Peak | | | Inter Peak | | | PM Peak | | |
| | IN | Out | Total | IN | Out | Total | IN | Out | Total |
| **50401** | 1% | 2% | 1% | 1% | 1% | 1% | 2% | 1% | 1% |
| **50402** | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **50403** | 1% | 3% | 2% | 2% | 2% | 2% | 3% | 1% | 2% |
| **50404** | 3% | 1% | 2% | 2% | 2% | 2% | 1% | 3% | 2% |
| **50405** | 2% | 7% | 4% | 5% | 5% | 5% | 8% | 4% | 5% |
| **50406** | 5% | 12% | 8% | 8% | 7% | 7% | 13% | 6% | 9% |
| **50407** | 8% | 11% | 9% | 6% | 5% | 5% | 7% | 5% | 6% |
| **50408** | 2% | 6% | 4% | 4% | 4% | 4% | 7% | 3% | 5% |
| **50409** | 2% | 1% | 2% | 2% | 2% | 2% | 1% | 2% | 1% |
| **50410** | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% | 0% |
| **50411** | 69% | 40% | 57% | 51% | 51% | 51% | 34% | 62% | 51% |
| **50412** | 0% | 1% | 1% | 1% | 1% | 1% | 2% | 1% | 1% |
| **50413** | 1% | 4% | 3% | 3% | 3% | 3% | 5% | 2% | 3% |
| **50414** | 1% | 0% | 1% | 1% | 1% | 1% | 0% | 1% | 1% |
| **50415** | 3% | 3% | 3% | 10% | 11% | 11% | 8% | 6% | 7% |
| **50416** | 3% | 9% | 5% | 6% | 6% | 6% | 10% | 4% | 7% |
| **Total** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** | **100%** |

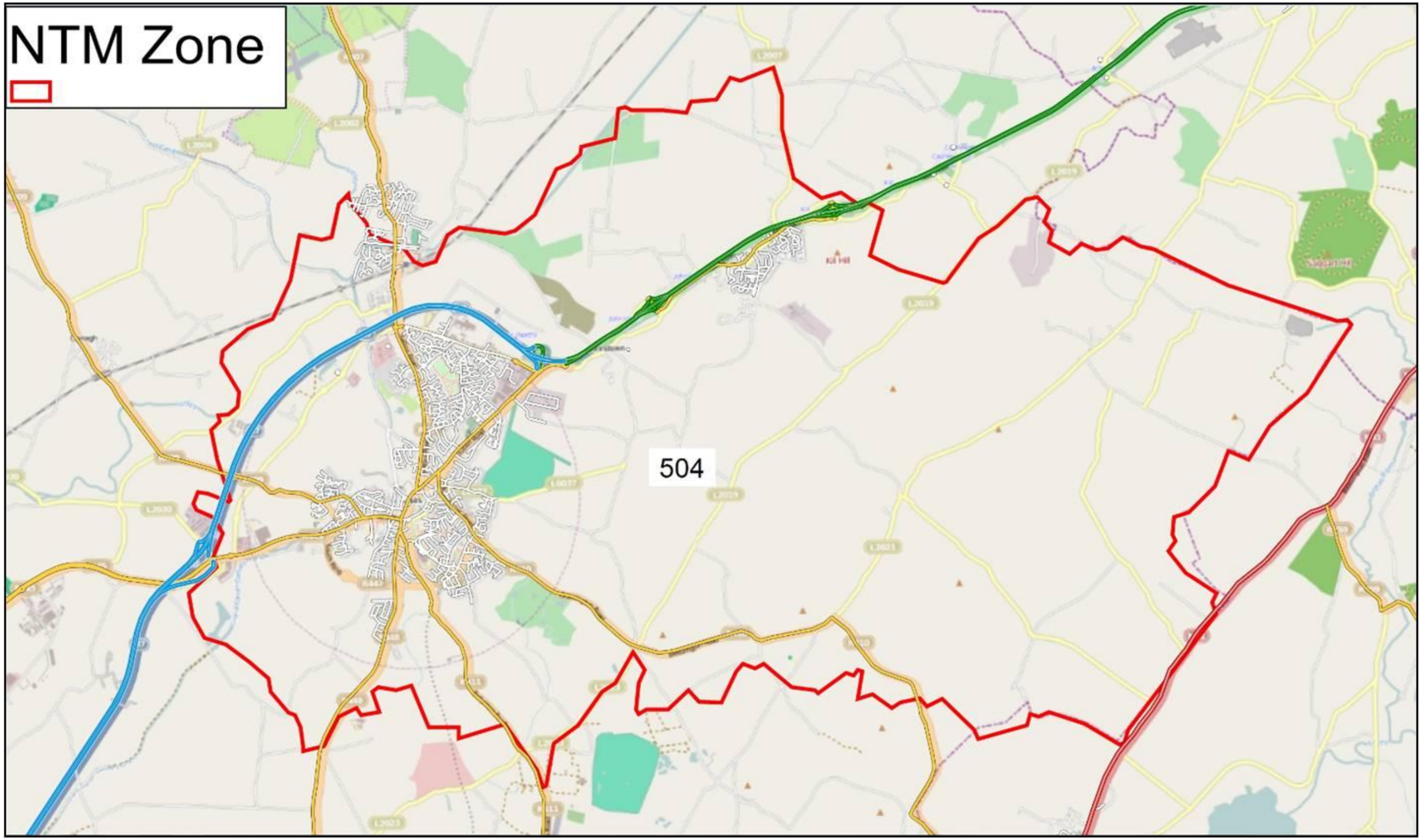


*Figure 5-3: NTM Zone 504*

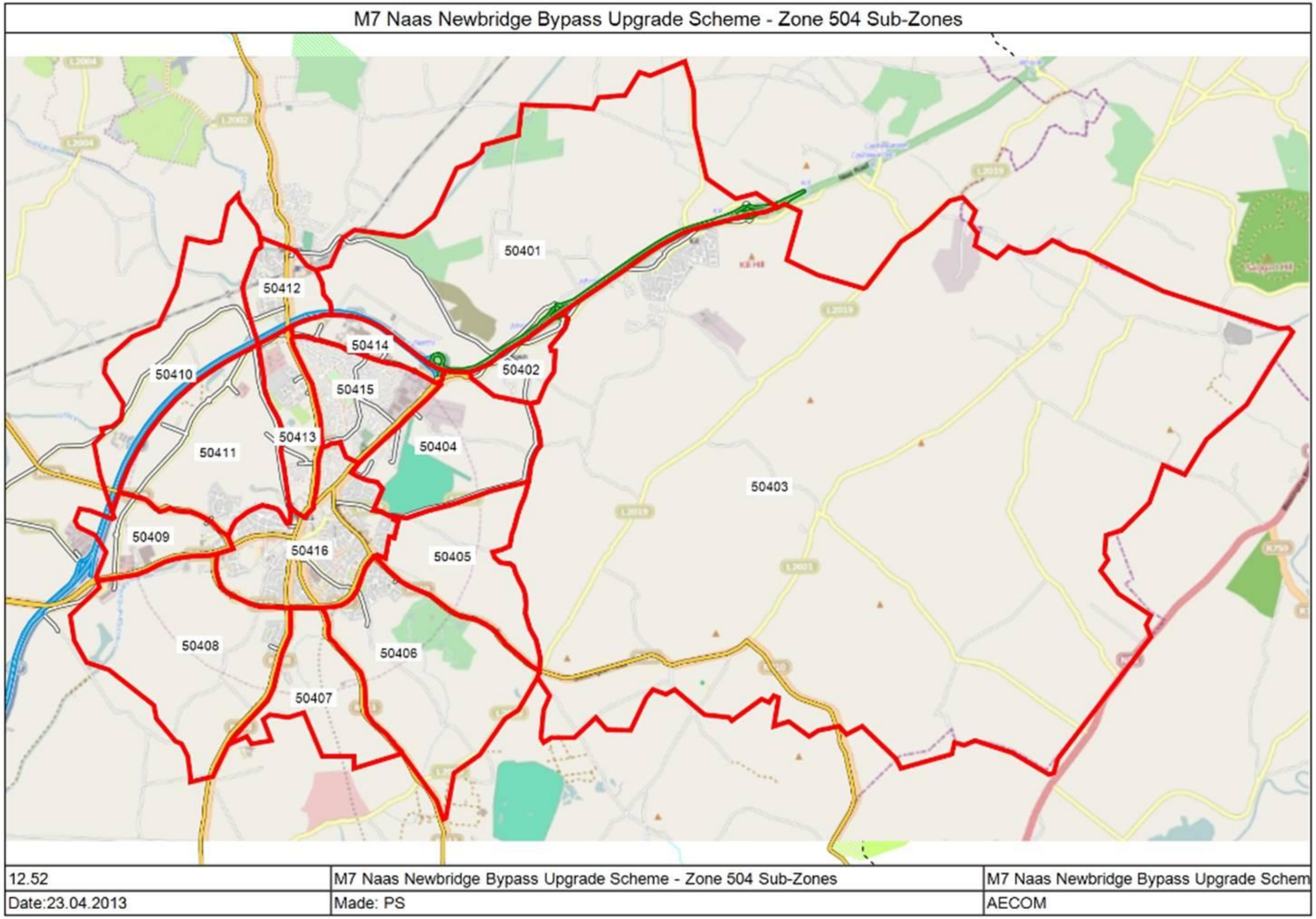


*Figure 5-4:* Zone 504 (Sub-Zones)

The future year target trip ends for the Opening Year, Design Year and Forecast Year scenarios were adjusted to take into account of the reallocation of the additional growth as outlined in Table 5-3 above. The forecast growth within disaggregated zones in Newbridge was allocated evenly across zones.

A detailed Technical Paper on the process for allocating the additional future demand in the Naas and environs area is presented in Appendix G.

### *5.2.6 Seeding*

It was necessary to 'seed' the cells with no trips in the base year matrices with very small numbers to allow for future year trips between those specific origins and destinations. Otherwise any cell with a zero value will remain zero irrespective of the factor applied.

Following this the base matrices were 'furnessed' to the forecast origin and destination trip ends. The furnessing process was undertaken again whereby the matrix totals were doubly constrained to the mean of the forecast origin and destination trip end totals.

### *5.2.7 Matrix Totals*

The subsequent trip matrix totals for the NRA low, medium and high growth scenarios following the reallocation of growth and trip distribution process outlined above is shown in Tables 5-4 to 5-6.

*Table 5-4: Matrix Totals NRA Low Growth (Vehicles)*

| Matrix | 2012 | 2015 | 2030 | % Growth | |
|---|---|---|---|---|---|
| | Base | Opening | Design | 2012 - 2015 | 2012 - 2030 |
| **AM LV** | 20196 | 20896 | 24597 | 3.5 | 21.7 |
| **AM HV** | 975 | 995 | 1046 | 2.1 | 7.3 |
| **Inter LV** | 11110 | 11447 | 13140 | 3.3 | 18.3 |
| **Inter HV** | 1062 | 1090 | 1150 | 2.6 | 8.3 |
| **PM LV** | 20557 | 21275 | 25056 | 3.5 | 21.9 |
| **PM HV** | 748 | 761 | 805 | 1.7 | 7.6 |

*Table 5-5: Matrix Totals NRA Medium Growth (Vehicles)*

| Matrix | 2012 | 2015 | 2030 | % Growth | |
|---|---|---|---|---|---|
| | Base | Opening | Design | 2012 - 2015 | 2012 - 2030 |
| **AM LV** | 20196 | 21040 | 25384 | 4.2 | 25.7 |
| **AM HV** | 975 | 1001 | 1089 | 2.7 | 11.7 |
| **Inter LV** | 11110 | 11523 | 13593 | 3.7 | 22.3 |
| **Inter HV** | 1062 | 1098 | 1195 | 3.5 | 12.5 |
| **PM LV** | 20557 | 21419 | 25855 | 4.2 | 25.8 |
| **PM HV** | 748 | 768 | 833 | 2.7 | 11.6 |

*Table 5-6: Matrix Totals NRA High Growth (Vehicles)*

| Matrix | 2012 | 2015 | 2030 | % Growth | |
|---|---|---|---|---|---|
| | Base | Opening | Design | 2012 - 2015 | 2012 - 2030 |
| **AM LV** | 20196 | 21599 | 28878 | 6.9 | 43.0 |
| **AM HV** | 975 | 1028 | 1255 | 5.4 | 28.7 |
| **Inter LV** | 11110 | 11832 | 15635 | 6.5 | 40.7 |
| **Inter HV** | 1062 | 1132 | 1373 | 6.6 | 29.2 |
| **PM LV** | 20557 | 21985 | 29416 | 6.8 | 43.0 |
| **PM HV** | 748 | 790 | 960 | 5.6 | 28.3 |

## 5.3 Future Year Matrix Analysis

The PAG requires a quantitative assessment of the impact of the traffic forecasting process to be undertaken upon the following criteria:

- Trip Length Distribution;
- Trip End Growth; and
- Zone to Zone Growth.

### *5.3.1 Trip Length Distribution*

Trip Length Distribution (TLD) graphs for the AM Peak, Inter Peak and PM Peak (Light Vehicles) are illustrated below for the NRA medium growth scenario. The figures compare the TLD in the 2012 Base Year models and the 2030 Design Year Medium Growth Do-Minimum models.

The purpose of comparing the TLD in the base and future year models is to assess the impact of the trip distribution (furnessing) process. The proportions of trips in the various time bands should be similar between the base and future (e.g. no significant change in short trips).

Overall the TLD is similar between the Base and Design Year models in the AM, PM and Inter Peak with slight changes as a result of the trip distribution process. These changes are not deemed significant. TLD for AM Peak, Inter Peak and PM Peak are shown respectively in Figure 5-5 to 5-7 below.

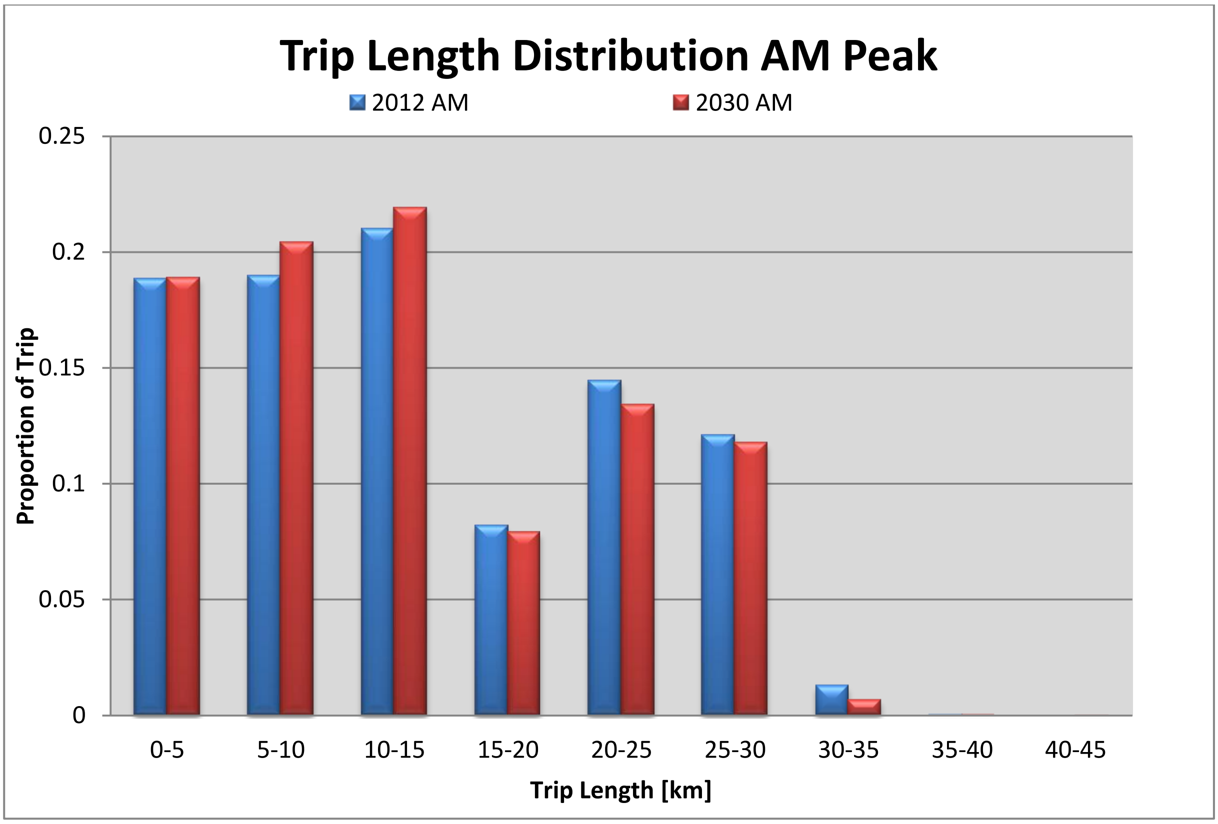


*Figure 5-5: AM Peak TLD (LV)*

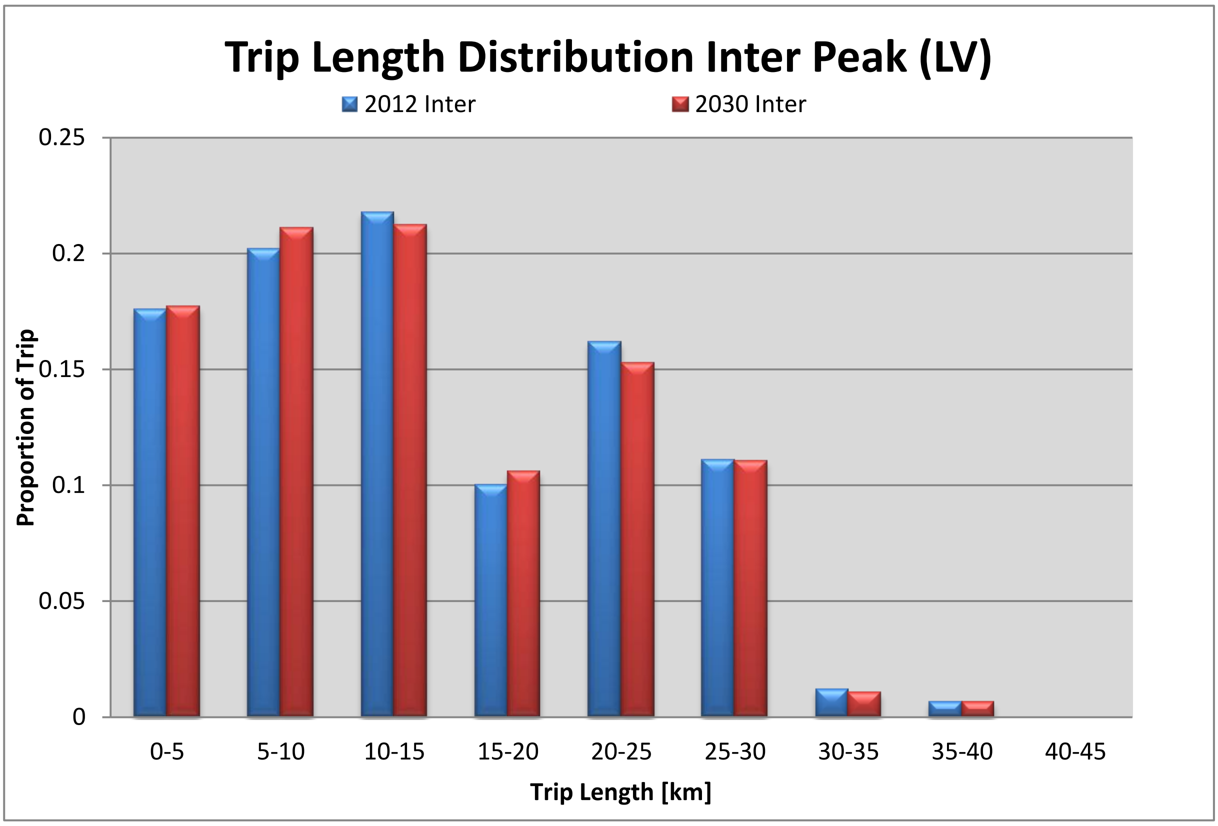


*Figure 5-6: Inter Peak TLD (LV)*

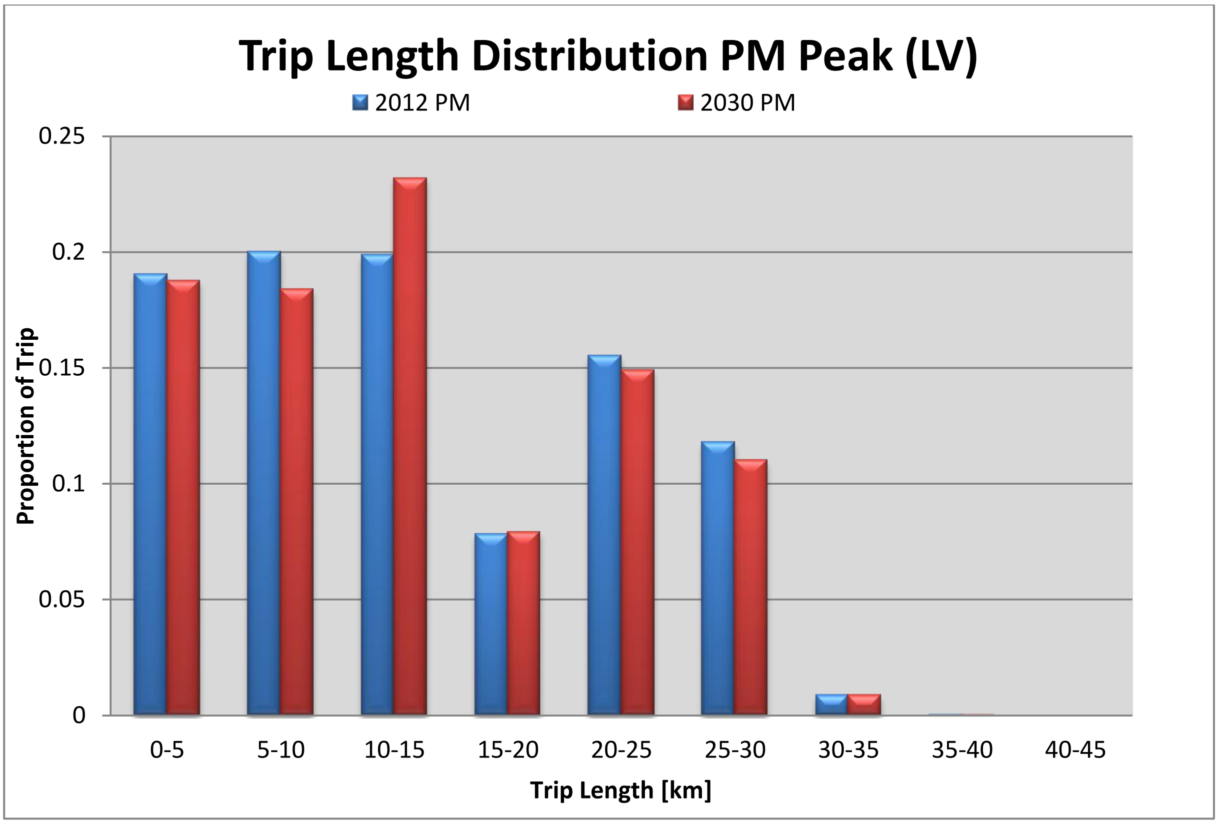


*Figure 5-7: PM Peak TLD (LV)*

### *5.3.2 Trip End Growth*

An assessment of the Trip End Growth (TEG) between the Base and Design Year demand in the AM Peak, Inter Peak and PM Peak was undertaken to assess if there were any significant changes in demand at trip end level when compared to the overall growth between the Base and Design Year demand.

The assessment indicated that the percentage increase between several trip ends in the Base and Design Year demand was significant but that the actual increase in the number of trips was only minor. In order to assess the true magnitude of TEG, the GEH statistic was applied to the Base and Design Year trip ends in order to take account of not only the difference between the Base and Design Year demand, but also the magnitude of the difference.

Figure 5-8 to Figure 5-10 illustrate the GEH (>10) between the Base and Design Year demand in the AM Peak, Inter Peak and PM Peak, respectively. The PAG guidance on the GEH statistic indicates that any GEH statistic above 10 warrants further investigation. The figures show that there are a number of both origin and destination zones with a GEH statistic above 10 in each time period.

A review was undertaken to assess the origin and destination trips end growth whereby a GEH of 10 or more was calculated. As expected the review indicated that the zones with a GEH over 10 were greenfield sites or zones with little development in the Base Year model (in the Naas Town area) which were seeded and assigned a significant demand in the future year model as per the forecasting process set out in Section 5.0 of this report.

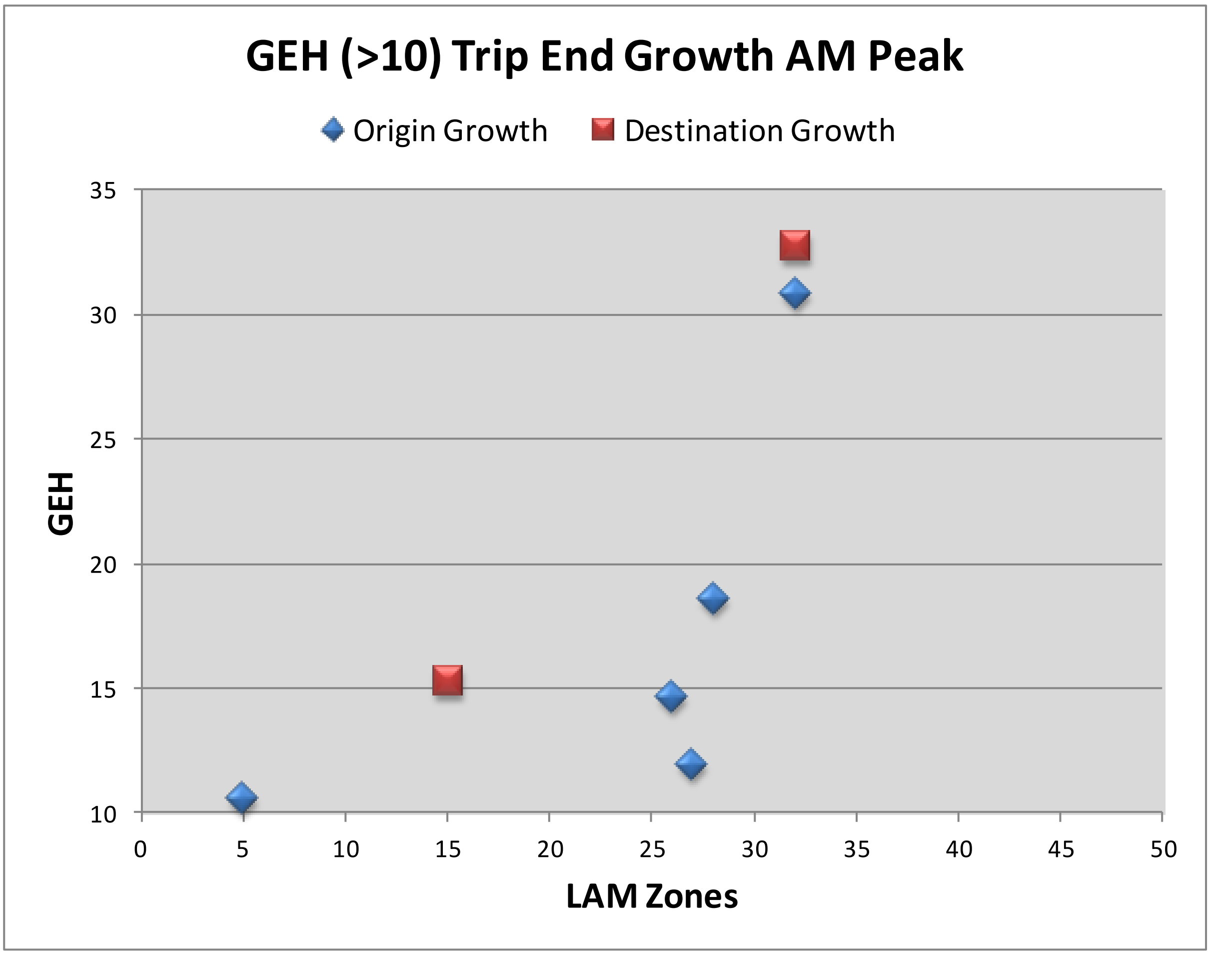


*Figure 5-8: AM Peak TEG (LV)*

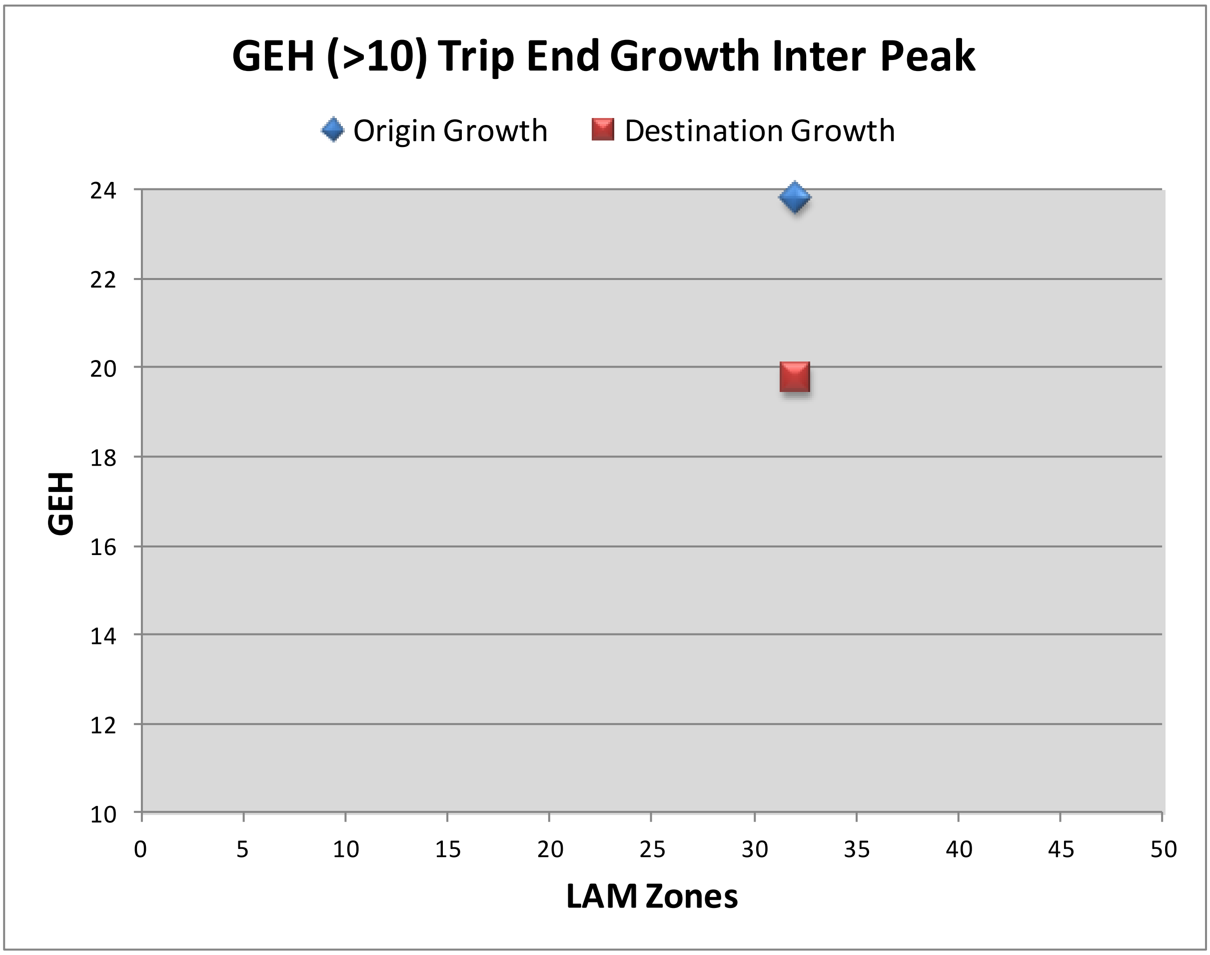


*Figure 5-9: Inter Peak TEG (LV)*

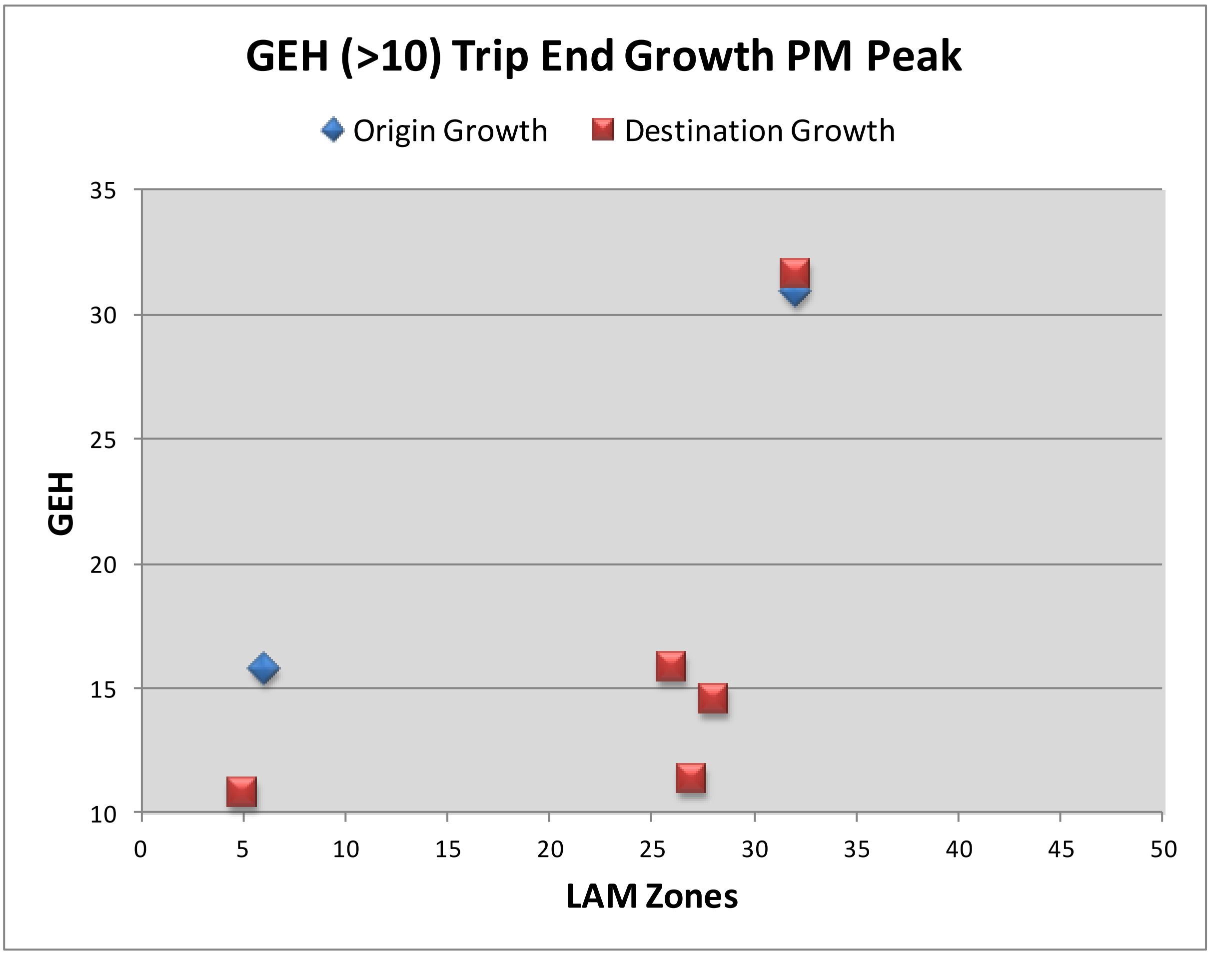


*Figure 5-10: PM Peak TEG (LV)*

### *5.3.3 Zone to Zone Growth*

The same procedure for TEG was also undertaken for zone to zone growth. The GEH statistic for each origin-destination pair was assessed to show any significant outliers or issues in the AM Peak, Inter Peak and PM Peak demand.

The GEH statistic on a zone to zone basis for each period is shown in Figures 5-11 to 5-13.The figures show that there is only one GEH statistics greater than 10 in the AM Peak and two in the PM Peak. Once again a review was undertaken to assess the origin and destination zones with a GEH greater than 10. The review, as per the trip end growth review, illustrated that the zones with a high GEH statistic, were undeveloped/greenfield sites in the Base year model which were seeded and assigned a significant demand in the future year model as per the forecasting process set out in Section 5.0 of this report. There was no GEH above 10 in Inter Peak.

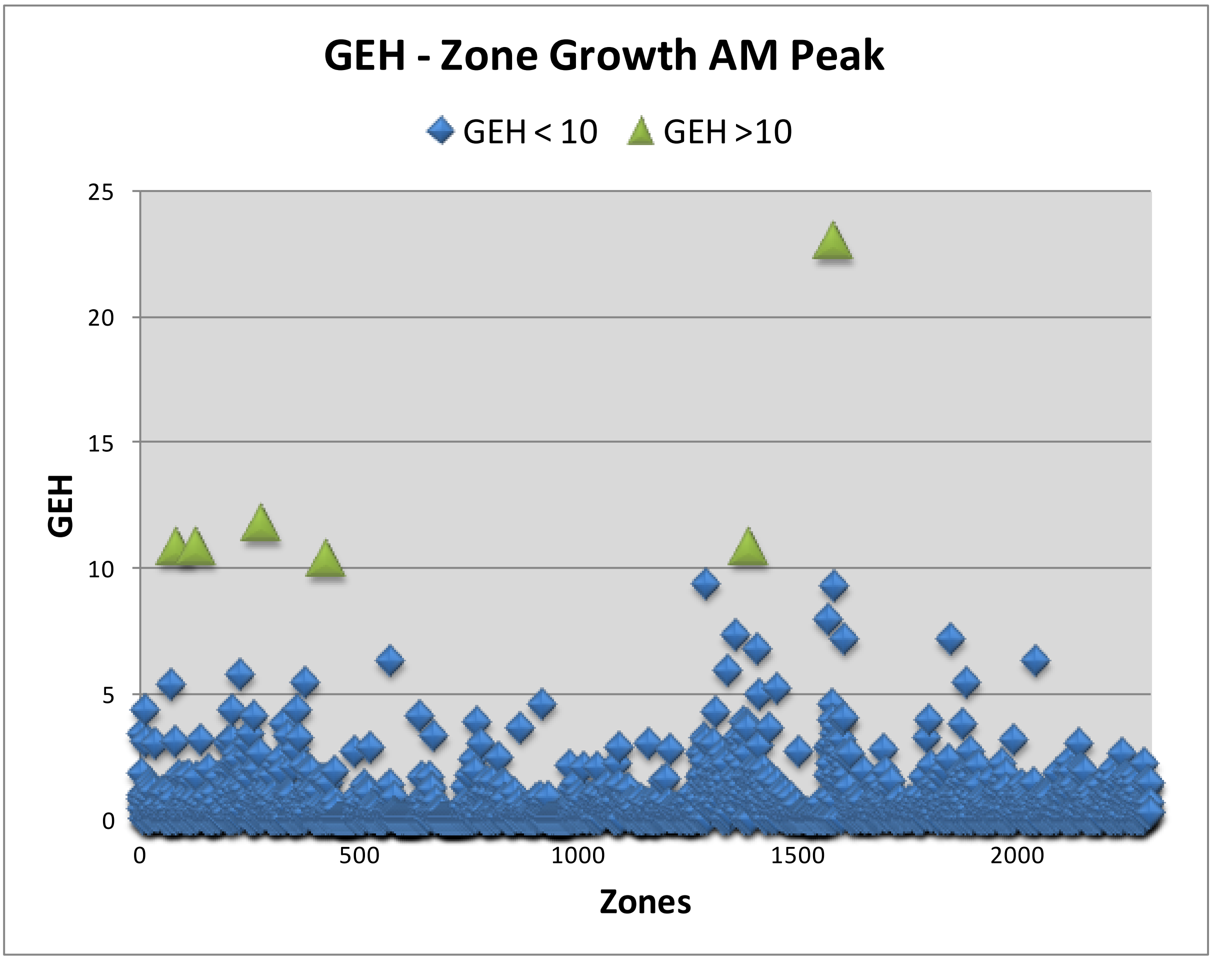


*Figure 5-11: AM Peak Zone to Zone Growth (LV)*

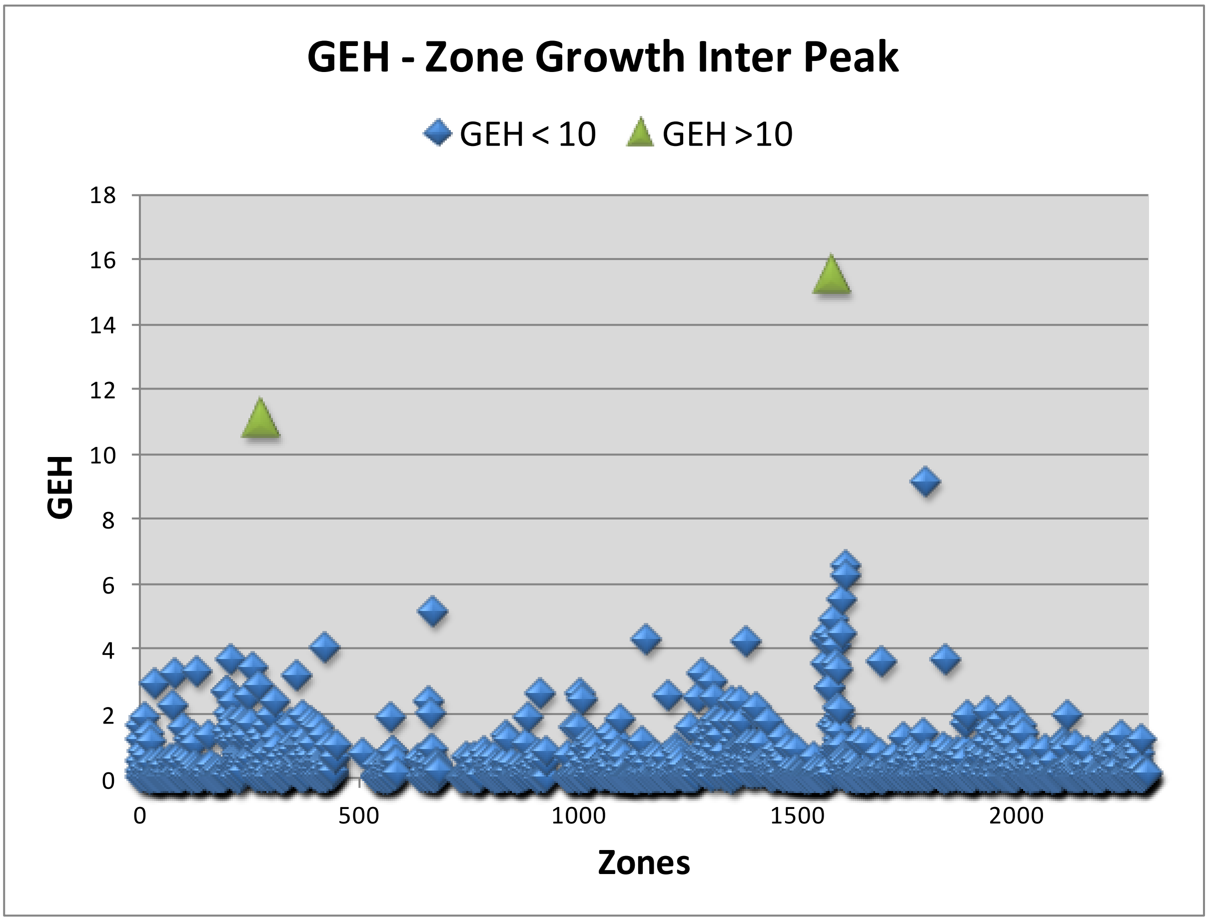


*Figure 5-12: Inter Peak Zone to Zone Growth (LV)*

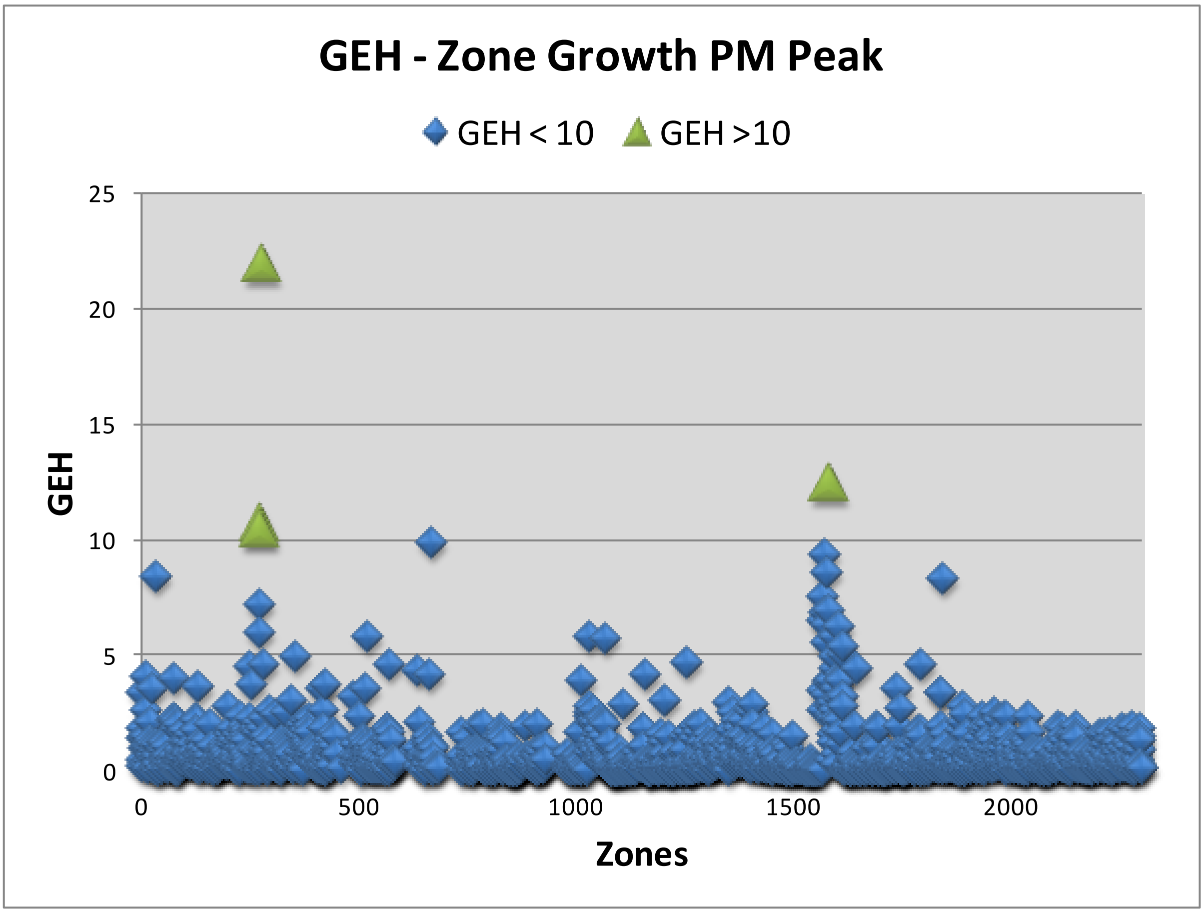


*Figure 5-13: PM Peak Zone to Zone Growth (LV)*

### 5.4 Estimation of Annual Average Daily Traffic (AADT)

To estimate Annual Average Daily Traffic (AADT) a relationship was developed based on regression analysis of local area traffic data to allow the AM Peak hour, average Inter Peak hour and PM Peak hour flows to be converted into AADT values. The AM, PM and Inter Peak Period flows were converted to AADT values using the following formula:

$$(3.2 * x) + (6.5 * y) + (3.2 * z) = AADT$$

*Where:*

*x = AM Peak Hour Flow*

*y = Average Inter Peak Hour Flow*

*z = PM Peak Hour Flow*

The local traffic data that was used to develop this formula was taken from the 7 ATC sites undertaken as part of this study. In order to assess the accuracy of the AM, Inter Peak and PM Peak hour expansion factors to AADT, a comparison of observed and modelled 2012 Base Year AADT has been undertaken in Table 5-7 below.

*Table 5-7: Accuracy of Peak Hour Expansion Factors to AADT*

| ATC | ATC Location | AM | Inter | PM | Observed AADT | Modelled AADT | Accuracy |
|---|---|---|---|---|---|---|---|
| 1 | Monread Rd | 1,207 | 1,182 | 1,362 | 16,390 | 15,902 | -3.00% |
| 2 | R407 Sallins Rd – Link Rd | 1,102 | 758 | 1,139 | 10,775 | 12,101 | 12.30% |
| 3 | R407 Sallins Rd | 1,001 | 929 | 1,020 | 13,036 | 12,507 | -4.10% |
| 4 | R445 Littleconnell | 1,104 | 986 | 1,190 | 13,713 | 13,752 | 0.30% |
| 5 | NRA ATC M9-02 | 1,477 | 1,072 | 1,775 | 18,350 | 17,374 | -5.30% |
| 6 | NRA ATC M7-31 | 2,995 | 2,198 | 3,241 | 37,946 | 34,242 | -9.80% |
| 7 | R445 Newbridge Rd | 1,235 | 1,163 | 1,011 | 14,050 | 14,748 | 5.00% |

The table above shows that the conversion factors used to estimate AADT from the AM, PM and Inter peak hour models leads to accurately estimated Base Year AADT forecasts.

## 5.5 Results

Figure 5-14 to 5-18 highlight the road network and locations where AADT is reported. Results for the NRA Medium Growth scenario are outlined in Table 5-8 for the Opening Year (2015) and Design Year (2030).

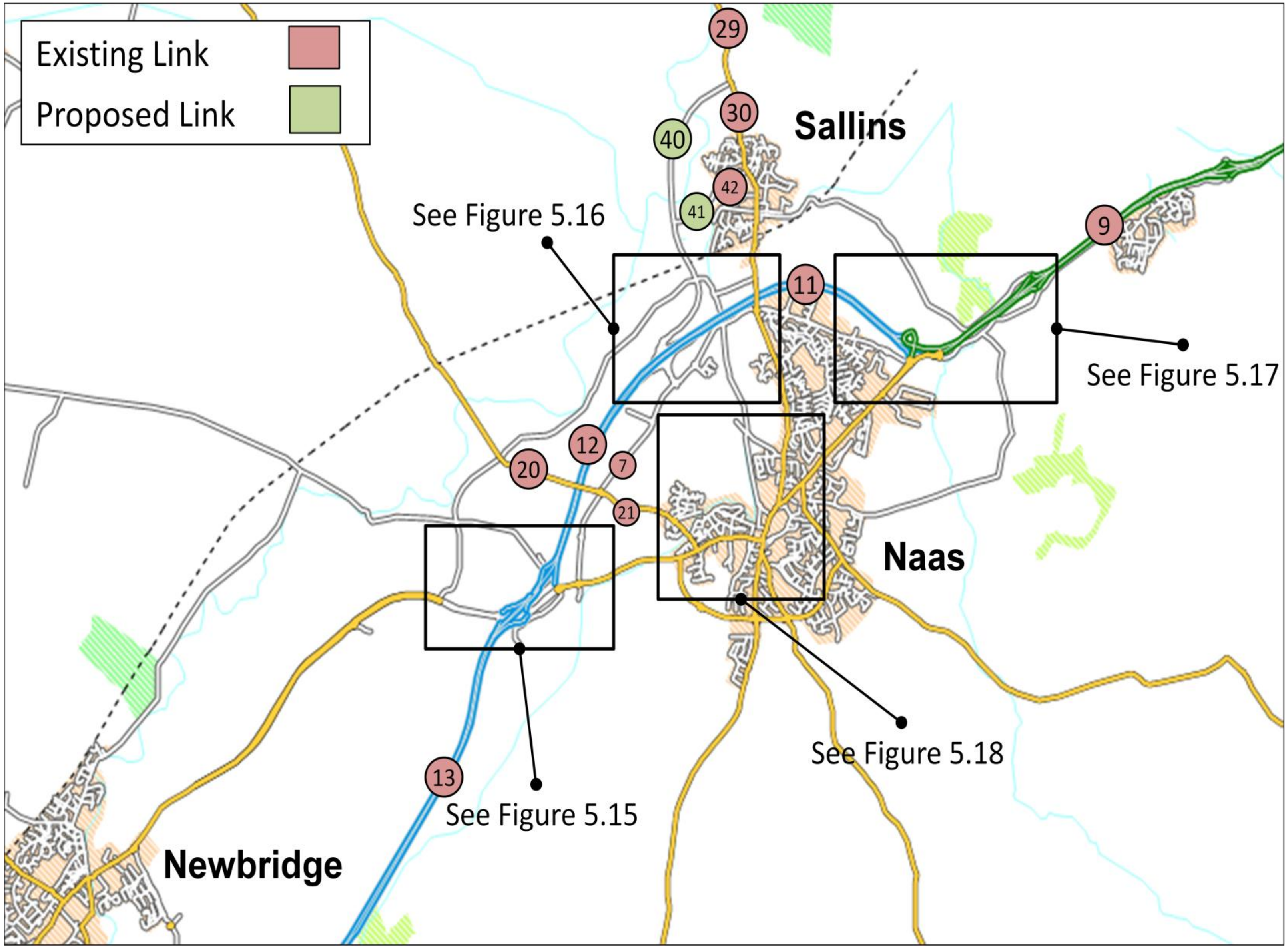


*Figure 5-14:M7 LAM AADT Locations*

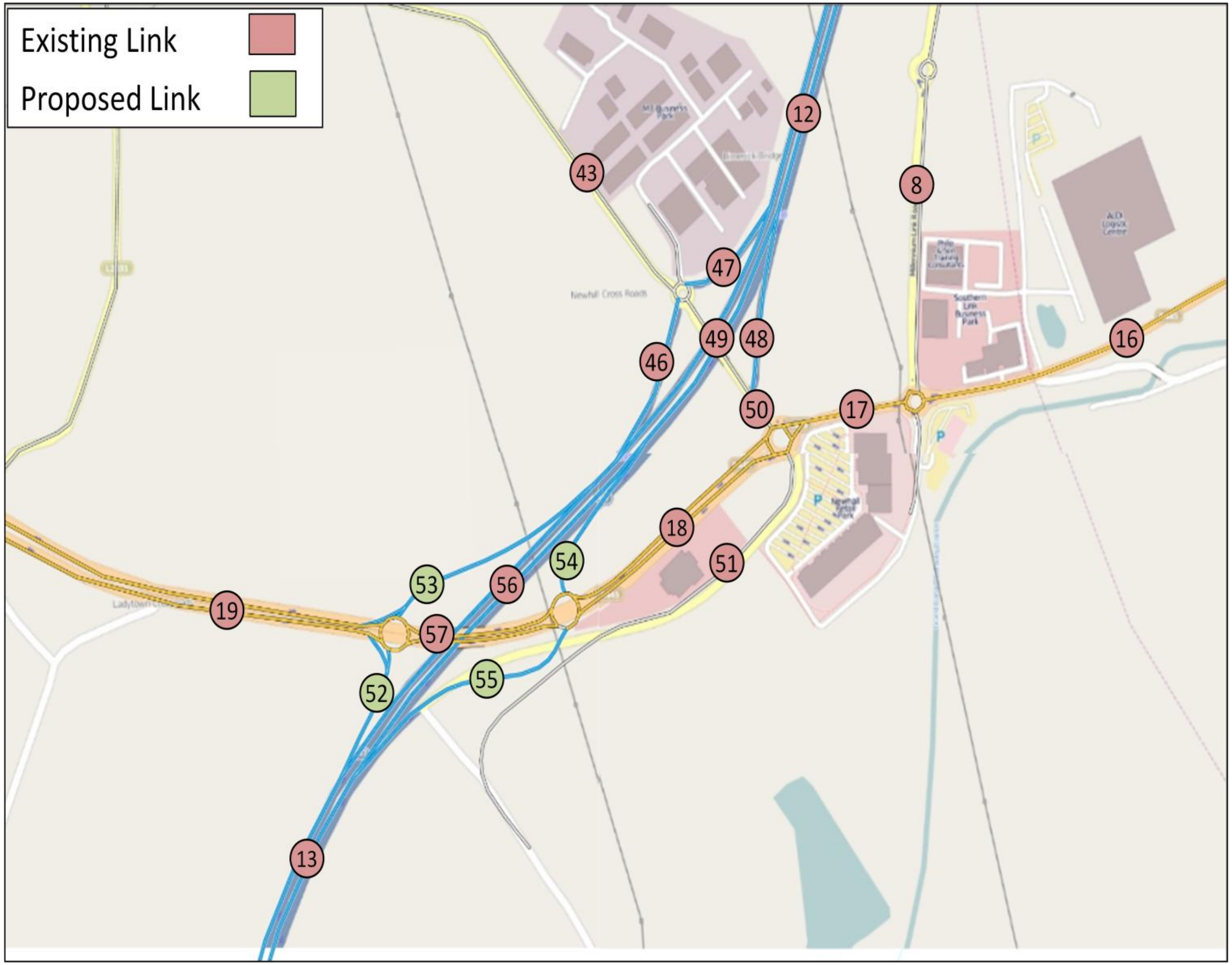


*Figure 5-15: M7 LAM AADT Locations (Newhall Interchange)*


*Figure 5-16: M7 LAM AADT Locations (Osberstown Interchange)*

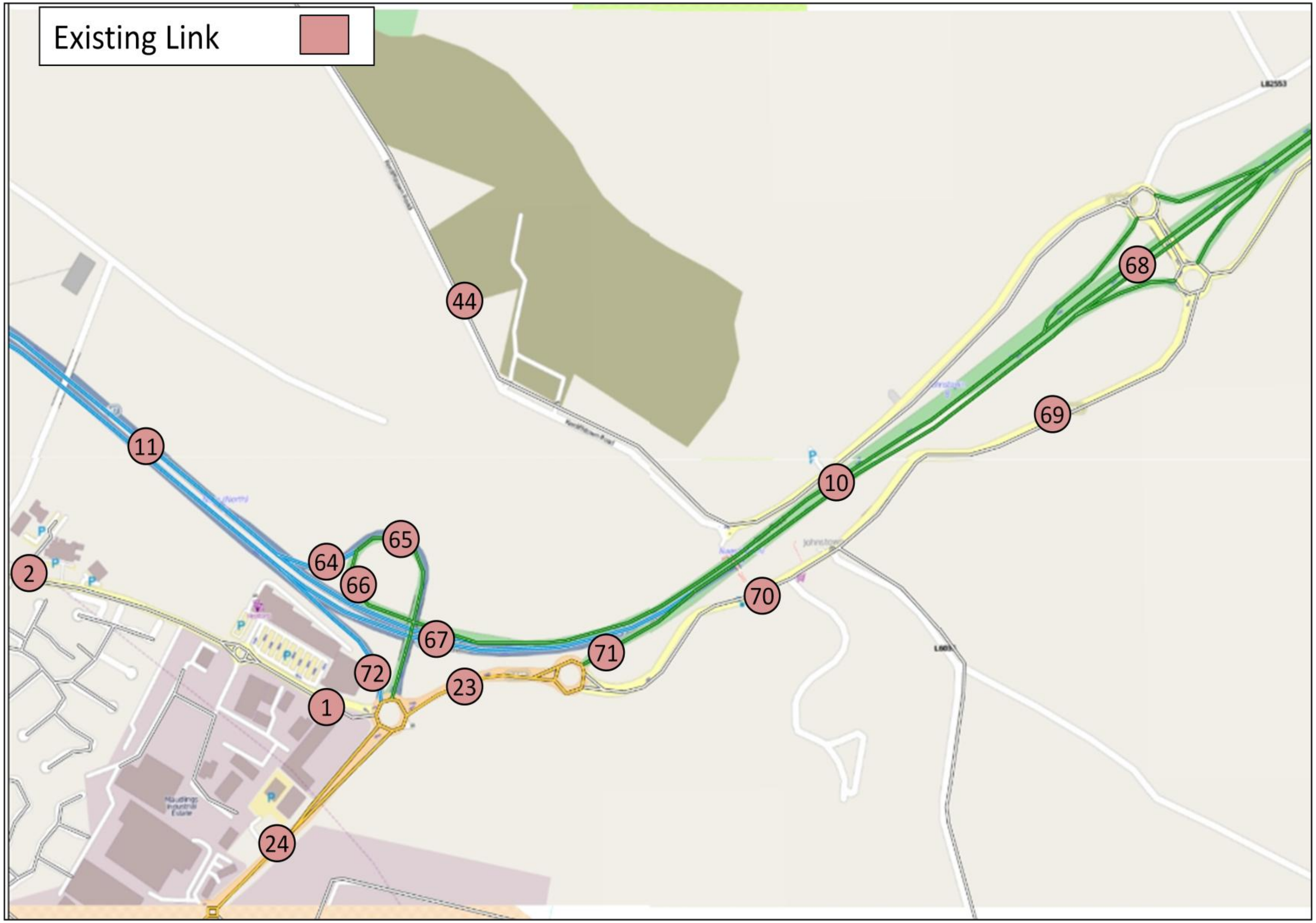


*Figure 5-17: M7 LAM AADT Locations (Maudlins Interchange)*

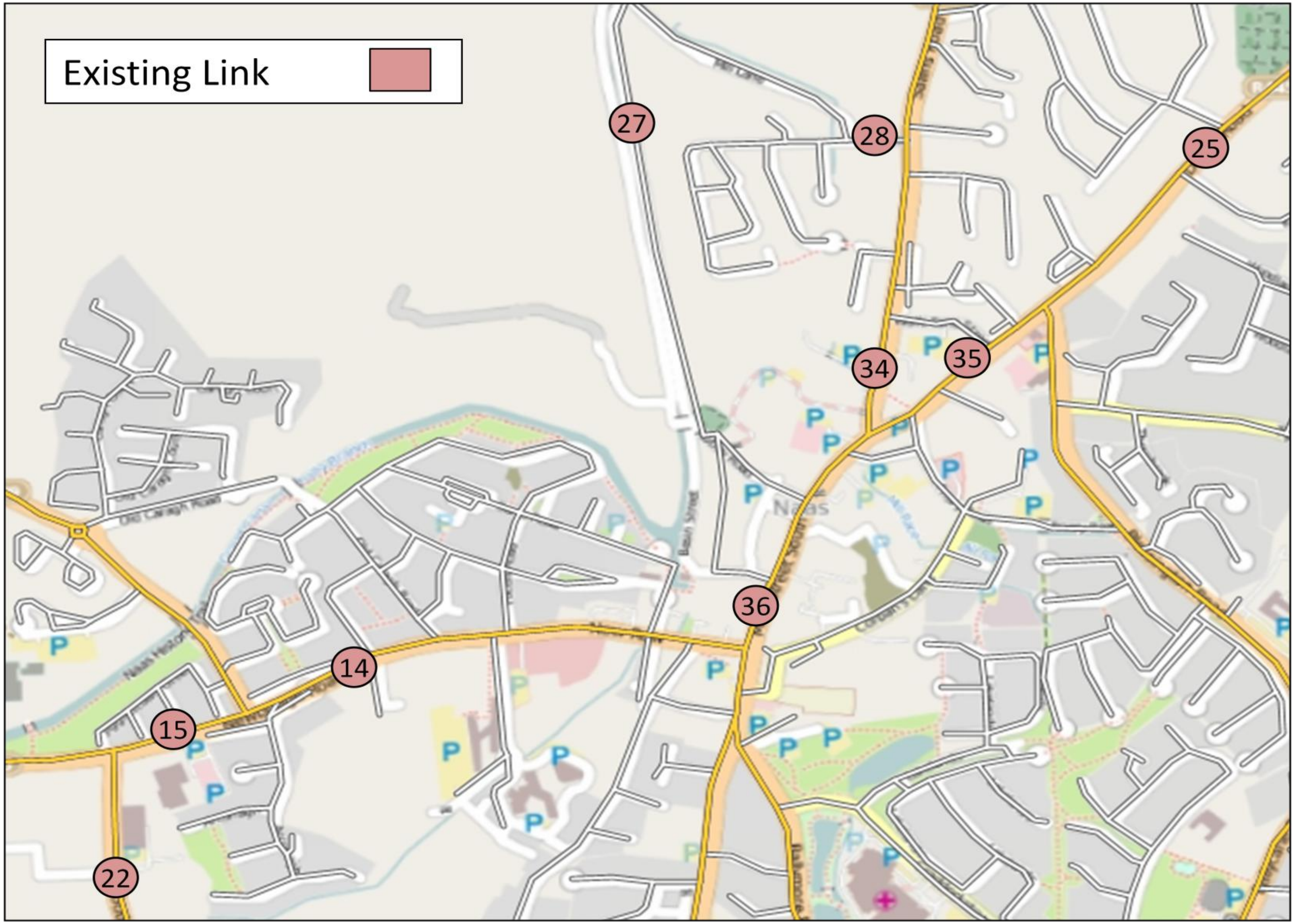


*Figure 5-18: M7 LAM AADT Locations (Naas Town Centre)*

*Table 5-8: 2012, 2015 & 2030 Forecast AADT Values – NRA Medium Growth*

| Link No | Location | AADT Medium Growth Scenario | | | | | | |
|---|---|---|---|---|---|---|---|---|
| | | Base Year 2012 | Opening Year 2015 | | | Design Year 2030 | | |
| | | | DO-MIN | DO-SOME1 | DO-SOME2 | DO-MIN | DO-SOME1 | DO-SOME2 |
| **Western Distributor Link Road** | | | | | | | | |
| 1 | L2012 - Monread Road | 15,550 | 18,350 | 13,700 | 11,200 | 21,450 | 14,550 | 11,700 |
| 2 | R445 - Monread Road | 13,250 | 14,250 | 12,550 | 10,300 | 17,850 | 13,000 | 11,050 |
| 3 | R445 - Monread Road east of Sallins roundabout | 16,100 | 16,550 | 15,450 | 13,150 | 19,400 | 16,300 | 14,200 |
| 4 | Millennium Link Road west of canal | 11,400 | 12,650 | 13,050 | 9,300 | 17,700 | 16,400 | 11,500 |
| 5 | Millennium Link Road east of proposed Osberstown interchange | 10,900 | 12,150 | 13,550 | 10,000 | 16,250 | 17,350 | 13,200 |
| 6 | Millennium Link Road west of proposed Osberstown interchange | 10,900 | 11,900 | 8,100 | 7,900 | 15,400 | 12,200 | 12,150 |
| 7 | Millennium Link Road north of R409 (Caragh Road) | 11,050 | 11,700 | 7,800 | 7,550 | 15,150 | 11,500 | 11,150 |
| 8 | Millennium Link Road north of R445 (Newbridge Road) | 10,100 | 9,350 | 2,900 | 3,000 | 11,650 | 3,850 | 3,900 |
| **M7/N7** | | | | | | | | |
| 9 | N7 Mainline East of Johnstown Junction | 69,600 | 72,000 | 72,000 | 72,000 | 84,550 | 84,550 | 84,550 |
| 10 | N7 Mainline West of Johnstown Junction | 68,600 | 70,900 | 71,700 | 72,800 | 81,750 | 84,000 | 85,050 |
| 11 | M7 Mainline East of Osberstown Interchange | 56,400 | 58,100 | 59,500 | 62,950 | 67,600 | 71,750 | 75,000 |
| 12 | M7 Mainline North of Newhall Interchange | 56,400 | 58,100 | 63,750 | 64,950 | 67,600 | 73,100 | 73,800 |
| 13 | M7 Mainline East of M7/M9 Junction | 54,950 | 56,500 | 57,950 | 58,200 | 64,350 | 66,150 | 66,550 |
| **R445 Newbridge Road** | | | | | | | | |
| 14 | R445 - Newbridge Road east of R409 (Caragh Road) | 7,500 | 7,800 | 8,000 | 8,100 | 9,050 | 9,050 | 9,000 |
| 15 | R445 - Newbridge Road west of R409 (Caragh Road) | 6,300 | 6,700 | 7,000 | 7,000 | 8,800 | 8,900 | 8,750 |
| 16 | R445 - Newbridge Road east of Millennium Link Road | 13,450 | 13,900 | 14,400 | 14,400 | 16,450 | 16,800 | 16,750 |
| 17 | R445 - Newbridge Road | 20,800 | 20,550 | 13,400 | 13,300 | 23,600 | 16,300 | 16,150 |
| 18 | R445 - West of Newhall Interchange (Newbridge Road) | 17,000 | 21,950 | 14,250 | 13,950 | 25,350 | 19,500 | 19,800 |
| 19 | R445 - Dublin Road (West of Newhall Interchange) | 17,000 | 20,250 | 19,950 | 19,900 | 22,300 | 22,150 | 22,450 |
| **R409 Caragh Road** | | | | | | | | |
| 20 | R409 - Caragh Road | 6,450 | 6,950 | 7,350 | 7,000 | 8,800 | 9,250 | 8,450 |
| 21 | R409 - Caragh Road east of Millennium Road | 7,550 | 8,400 | 8,700 | 8,800 | 12,450 | 13,050 | 13,100 |
| **Southern Ring Road** | | | | | | | | |
| 22 | R447 - South Ring | 8,850 | 9,850 | 10,150 | 10,150 | 13,300 | 13,350 | 13,250 |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| **R445 Dublin Road** | | | | | | | | |
| 23 | R445 (Maudlins Interchange) | 13,000 | 14,050 | 12,800 | 11,750 | 17,050 | 14,000 | 13,200 |
| 24 | R445 - Dublin Road (Maudlins Interchange) | 15,650 | 14,600 | 13,500 | 13,600 | 16,950 | 15,150 | 15,250 |
| 25 | R445 - Dublin Road north of R410 (Blessington Road) | 11,000 | 11,600 | 11,150 | 11,250 | 13,200 | 12,750 | 12,750 |
| **Canal Bank** | | | | | | | | |
| 26 | L2006 - Canal Bank | 1,050 | 2,000 | 2,000 | 1,550 | 3,100 | 3,300 | 3,000 |
| 27 | L2006 - Canal Bank south of junction with Mill Lane | 1,050 | 2,100 | 2,000 | 1,550 | 3,050 | 3,250 | 3,000 |
| **Mill Lane** | | | | | | | | |
| 28 | West of R407 | 3,150 | 3,050 | 3,200 | 3,200 | 3,700 | 3,900 | 3,800 |
| **R407 Sallins Road** | | | | | | | | |
| 29 | R407 - Clane Road north of Millicent Road junction | 18,700 | 19,250 | 18,950 | 20,150 | 22,300 | 22,050 | 23,100 |
| 30 | R407 - Clane Road south of Millicent Road junction | 17,700 | 18,200 | 17,950 | 10,750 | 21,350 | 21,100 | 11,800 |
| 31 | R407 - Sallins Road north of Osberstown cottages | 18,600 | 19,100 | 19,400 | 12,550 | 22,000 | 22,650 | 13,750 |
| 32 | R407 - Sallins Road north of Sallins roundabout | 18,000 | 17,650 | 18,300 | 12,050 | 19,200 | 20,100 | 12,350 |
| 33 | R407 - Sallins Road south of Sallins Roundabout | 11,700 | 11,050 | 12,200 | 12,500 | 12,400 | 13,900 | 14,200 |
| 34 | R407 - Sallins Road | 12,500 | 12,050 | 11,350 | 11,500 | 13,550 | 13,050 | 13,000 |
| **Main Street** | | | | | | | | |
| 35 | R445 - Dublin Road south of R410 (Blessington Road) | 9,450 | 10,650 | 10,450 | 10,450 | 12,750 | 12,450 | 12,450 |
| 36 | R445 - Naas Main Street South | 15,500 | 16,550 | 15,850 | 15,550 | 18,550 | 18,150 | 18,000 |
| **Osberstown Road/ Cottages** | | | | | | | | |
| 37 | Osberstown Cottages | 3,450 | 3,950 | 3,500 | 3,000 | 6,150 | 5,450 | 4,750 |
| 38 | L2006 - Osberstown | 2,600 | 2,250 | 1,800 | 1,750 | 3,700 | 2,850 | 2,350 |
| **Proposed R407 Sallins Bypass** | | | | | | | | |
| 39 | Proposed link between Osberstown Interchange & L2006 | - | - | - | 9,700 | - | - | 11,650 |
| 40 | Proposed Sallins Bypass north of Millbank | - | - | - | 8,600 | - | - | 10,450 |
| **Proposed Sallins Link Road** | | | | | | | | |
| 41 | Proposed Link joining new bypass & Millbank | - | - | - | 1,150 | - | - | 1,450 |
| 42 | Millbank Road | - | - | - | 1,100 | - | - | 1,200 |
| **Newhall Cross Roads** | | | | | | | | |
| 43 | L2030 North of the Newhall Interchange | 6,600 | 4,750 | 4,750 | 4,400 | 5,550 | 5,750 | 5,600 |
| **Kerdiffstown Road** | | | | | | | | |
| 44 | L2005 - Kerdiffstown Road | 2,100 | 2,300 | 1,750 | 600 | 3,500 | 2,400 | 1,250 |
| **Osberstown Interchange Link Road** | | | | | | | | |

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| 45 | Proposed link between Osberstown Interchange & Millennium Link Road | - | - | 16,900 | 15,500 | - | 22,400 | 21,950 |
| **Newhall Interchange** | | | | | | | | |
| 46 | M7 Eastbound Off-Slip (Newhall Interchange) | 5,650 | - | - | - | - | - | - |
| 47 | M7 Eastbound On-Slip (Newhall Interchange) | 6,300 | - | - | - | - | - | - |
| 48 | M7 Westbound Off-Slip (Newhall Interchange) | 6,750 | - | - | - | - | - | - |
| 49 | L2030 at Newhall Interchange | 14,250 | 7,650 | 7,700 | 7,300 | 8,950 | 9,150 | 9,050 |
| 50 | L2030 between M7 Off-Slip and R445 | 17,400 | 7,650 | 7,700 | 7,300 | 8,950 | 9,150 | 9,050 |
| 51 | M7 Westbound On-Slip (Newhall Interchange) | 6,400 | 750 | 750 | 750 | 900 | 900 | 900 |
| 52 | M7 Eastbound Off-Slip (Proposed Newhall Interchange) | - | 6,350 | 3,950 | 3,650 | 7,150 | 4,500 | 4,500 |
| 53 | M7 Eastbound On-Slip (Proposed Newhall Interchange) | - | 6,900 | 6,700 | 6,850 | 8,500 | 8,600 | 8,600 |
| 54 | M7 Westbound Off-Slip (Proposed Newhall Interchange) | - | 7,500 | 6,500 | 6,700 | 8,950 | 7,050 | 7,300 |
| 55 | M7 Westbound On-Slip (Proposed Newhall Interchange) | - | 6,450 | 3,450 | 3,150 | 7,100 | 4,150 | 4,150 |
| 56 | M7 Mainline at Newhall Interchange | 43,400 | 43,750 | 50,650 | 51,450 | 50,200 | 57,500 | 57,950 |
| 57 | R445 - Dublin Road (East of Newhall Interchange) | 17,050 | 19,000 | 15,400 | 15,650 | 21,050 | 17,950 | 18,150 |
| **Proposed Osbertown Interchange** | | | | | | | | |
| 58 | M7 Westbound Off-Slip (Proposed Osberstown Interchange) | - | - | 6,000 | 6,600 | - | 6,250 | 7,150 |
| 59 | M7 Westbound On-Slip (Proposed Osberstown Interchange) | - | - | 3,050 | 4,800 | - | 5,150 | 7,350 |
| 60 | M7 Eastbound On-Slip (Proposed Osberstown Interchange) | - | - | 4,600 | 5,500 | - | 5,700 | 6,400 |
| 61 | M7 Eastbound Off-Slip (Proposed Osberstown Interchange) | - | - | 3,350 | 5,350 | - | 5,400 | 7,400 |
| 62 | M7 Mainline at Osberstown Interchange | 56,400 | 58,100 | 53,200 | 52,900 | 67,600 | 61,250 | 60,300 |
| 63 | Osberstown Interchange Flyover | - | - | 7,895 | 13,196 | - | 11,019 | 17,780 |
| **Maudlins Interchange** | | | | | | | | |
| 64 | M7 Eastbound Off-Slip (Maudlins Interchange) | 3,100 | 3,650 | 2,800 | 3,600 | 4,400 | 3,150 | 4,000 |
| 65 | On/Off Slip (Naas North Junction) | 12,500 | 13,900 | 11,200 | 12,000 | 15,950 | 12,150 | 12,900 |
| 66 | N7 Eastbound On-Slip (Maudlins Interchange) | 9,400 | 10,250 | 8,450 | 8,450 | 11,550 | 9,000 | 8,950 |
| 67 | N7 Mainline East of Maudlins Interchange | 49,950 | 50,650 | 54,250 | 56,450 | 58,650 | 65,350 | 67,350 |
| 68 | N7 Mainline at Johnstown Junction | 65,850 | 68,100 | 68,400 | 69,450 | 79,300 | 80,650 | 81,350 |
| 69 | L2014 - East of Johnstown | 3,350 | 3,500 | 3,300 | 3,300 | 4,800 | 3,450 | 3,550 |
| 70 | L2014 - West of Johnstown | 3,750 | 4,000 | 3,800 | 3,800 | 5,400 | 4,350 | 4,400 |
| 71 | N7 Westbound Off-Slip (Maudlins Interchange) | 9,300 | 10,050 | 9,050 | 8,000 | 11,650 | 9,700 | 8,850 |
| 72 | M7 Westbound On-Slip (Maudlins Interchange) | 3,400 | 3,850 | 2,500 | 3,000 | 4,600 | 3,300 | 3,700 |

## 5.6 Network Statistics

Network statistics were extracted from the AM Peak, Inter Peak and PM Peak hour traffic models for the Opening Year 2015 and Design Year 2030 and a comparison was made against the Base Year model. The key network statistics comprise the following:

- Total Vehicle km;
- Total Network Travel Time (hrs);
- Average Vehicle Speed (kph); and
- Average Trip Length (km).

Table 5-9 to Table 5-11 outline the key network statistics for the NRA medium growth scenario for the AM Peak, Inter Peak and PM Peak Periods respectively.

*Table 5-9: AM Peak Network Statistics (All Vehicles)*

| Scenario | Total Vehicle km | Total Network Travel Time (hrs) | Average Network Speed (kph) | Average Trip Length (Km) |
|---|---|---|---|---|
| 2012 Base Year | 280,004 | 4,506 | 62.1 | 13.2 |
| 2015 Opening Year Do-Min | 292,383 | 4,572 | 63.9 | 13.3 |
| 2015 Opening Year Do-Some 1 | 290,563 | 4,506 | 64.5 | 13.2 |
| 2015 Opening Year Do-Some 2 | 291,442 | 4,431 | 65.8 | 13.2 |
| 2030 Design Year Do-Min | 346,567 | 6,141 | 56.4 | 13.1 |
| 2030 Design Year Do-Some 1 | 344,942 | 6,013 | 57.4 | 13.0 |
| 2030 Design Year Do-Some 2 | 345,921 | 5,885 | 58.8 | 13.1 |

*Table 5-10: Inter Peak Network Statistics (All Vehicles)*

| Scenario | Total Vehicle km | Total Network Travel Time (hrs) | Average Network Speed (kph) | Average Trip Length (Km) |
|---|---|---|---|---|
| 2012 Base Year | 175,968 | 2,483 | 70.9 | 14.5 |
| 2015 Opening Year Do-Min | 181,942 | 2,592 | 70.2 | 14.4 |
| 2015 Opening Year Do-Some 1 | 181,129 | 2,551 | 71.0 | 14.4 |
| 2015 Opening Year Do-Some 2 | 181,723 | 2,508 | 72.5 | 14.4 |
| 2030 Design Year Do-Min | 211,859 | 3,147 | 67.3 | 14.3 |
| 2030 Design Year Do-Some 1 | 209,816 | 3,084 | 68.0 | 14.2 |
| 2030 Design Year Do-Some 2 | 210,836 | 3,019 | 69.8 | 14.3 |

*Table 5-11: PM Peak Network Statistics (All Vehicles)*

| Scenario | Total Vehicle km | Total Network Travel Time (hrs) | Average Network Speed (kph) | Average Trip Length (Km) |
|---|---|---|---|---|
| 2012 Base Year | 279,560 | 4,424 | 63.2 | 13.1 |
| 2015 Opening Year Do-Min | 296,089 | 4,373 | 67.7 | 13.3 |
| 2015 Opening Year Do-Some 1 | 293,057 | 4,285 | 68.4 | 13.2 |

| | | | | |
|---|---|---|---|---|
| 2015 Opening Year Do-Some 2 | 294,075 | 4,234 | 69.5 | 13.3 |
| 2030 Design Year Do-Min | 351,287 | 5,896 | 59.6 | 13.2 |
| 2030 Design Year Do-Some 1 | 349,114 | 5,697 | 61.3 | 13.1 |
| 2030 Design Year Do-Some 2 | 348,219 | 5,611 | 62.1 | 13.0 |

The statistics show that there is an increase in total network travel time and total network delay and a subsequent reduction in average vehicle speed between the Base Year and Future Year Do-Minimum scenarios. This reflects the expected increase in traffic congestion on the network with demographic and employment growth, with no supporting infrastructure. The tables show also that the Do-something scenarios will provide benefits for the entire network.

### 5.7 Summary

Base year (2012) traffic models were developed to represent traffic flows and patterns during the AM Peak hour (08:00 – 09:00), average Inter Peak hour (between 12:00 – 14:00) and PM Peak hour (17:00-18:00). These models were developed, calibrated and validated in accordance with the NRA PAG. Future Year traffic forecasts were generated for the scheme Opening Year (2015) and Design Year (2030) in accordance with the NRA PAG. Outputs from these models will be used to inform the economic and environmental assessment of the proposed scheme.

The additional route options offered by the proposed Osberstown Interchange and Sallins Bypass significantly reduces congestion on the Western Distributor Road, Monread Road and R407 Sallins Road through Sallins town with smaller reductions at the Newhall and Maudlins Interchanges. The introduction of the scheme will also see increases in flow along the M7 mainline as vehicles avail of the improved accessibility to Naas and Sallins delivered by the scheme.