



An Roinn Iompair
Department of Transport



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Limerick City
& County Council



Mid West
National Road Design Office

Jacobs

N21 Newcastle West Road Scheme

Traffic Modelling Report

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1. Introduction

1.1 Overview

The Traffic Modelling Report (TMR) outlines and describes the development, calibration and validation of the Local Area Model (LAM). The LAM has been developed to assess the N21 Newcastle West Road Scheme as part of TII's Project Management Guidelines (PMG) Phase 2 Option Selection Process.

The N21 Newcastle West Road Scheme is being assessed separately from the N21 Abbeyfeale Road Scheme, also located on N21 road. That is why it was deemed prudent to develop a combined highway assignment model that can be used for assessing both schemes together and in isolation. The scheme extents of the N21 Newcastle West Road Scheme and the N21 Abbeyfeale Road Scheme are shown in **Figure 1-1** below.

The proposed road schemes on the N21 are on the Trans European Transport Network (TEN-T) and play a significant role in mobility and freight movement across the region. The TEN-T requirement is to provide a road that meets the standard defined by the TEN-T regulations in order to standardise and integrate the TEN-T Core and Comprehensive Road Network within Ireland and the rest of the European Union (EU).

Figure 1-1: Location Map showing extents of the N21 Newcastle West Road Scheme and the N21 Abbeyfeale Road Scheme



The N21 LAM has been developed using VISUM software, making best use of several prior models and the existing traffic data that was made available by different agencies. Transport Infrastructure Ireland's (TII) National Transport Model (NTpM), which is also developed in VISUM software, was an essential part in development of the N21 LAM. The NTpM incorporates all national and regional roads and therefore was the principal network donor model for the N21 LAM.

The traffic model has been developed in accordance with TII's Project Appraisal Guidelines (PAG) for National Roads. These guidelines align with the Department of Transport *Common Appraisal Framework (CAF) for Transport Projects and Programmes*.

The traffic model is central to informing the TII Phase 2 Stage 2 (Project Appraisal Matrix), the identification of the Preferred Option and the Preliminary Business Case/Options Appraisal Report. It is the source of traffic data used for the Environmental (Air Quality and Noise) evaluation and preparation of the subsequent Environmental Impact Assessment Report.

1.2 The Project Appraisal Guidelines

The Traffic Modelling Report forms one of the deliverables for the Project Appraisal of a Major Project, as specified in *PAG Unit 2.0 - Project Appraisal Deliverables* (TII, 2016). A list of the PAG deliverables prepared to date:

- **TII PMG Phase 0 (Scope and Pre-Appraisal)**
 - Project Appraisal Plan (PAP) (Phase 0)
- **TII PMG Phase 1 (Concept & Feasibility)**
 - Project Brief (Phase 1)
- **TII PMG Phase 2 (Option Selection)**
 - Project Brief (Phase 2)
 - Traffic Modelling Plan
 - Traffic Modelling Report
 - Cost Benefit Analysis
 - Project Appraisal Balance Sheet

This report covers the entire model development including data collection, base model development, calibration and validation. The requirements of the TMR are detailed in *PAG Unit 5.4 - Transport Modelling Report (October 2016)*.

1.3 Project Description and History

The N21 Newcastle West Road Scheme that the traffic model has been built to appraise is located on the N21, which is part of the comprehensive TEN-T route network and aims to improve the connectivity to the Mid-West region, which is a strategic priority of the National Planning Framework (NPF) (Project Ireland 2040).

The objective of the TEN-T is to strengthen the social, economic and territorial cohesion of the European Union, and contribute to a single European transport area. It shall demonstrate European added value by contributing to objectives set out in four categories (Regulation 1315/2015), including:

- Cohesion – accessibility to remote, outermost and peripheral regions and a reduction of Infrastructure quality gaps between member states;
- Efficiency – removal of bottlenecks and bridging missing links;
- Sustainability – developing transport solutions that will ensure future transport that is sustainable and economically efficient; and

- Increasing benefits for users – meeting transport needs of users within the Union and in relations with third countries.

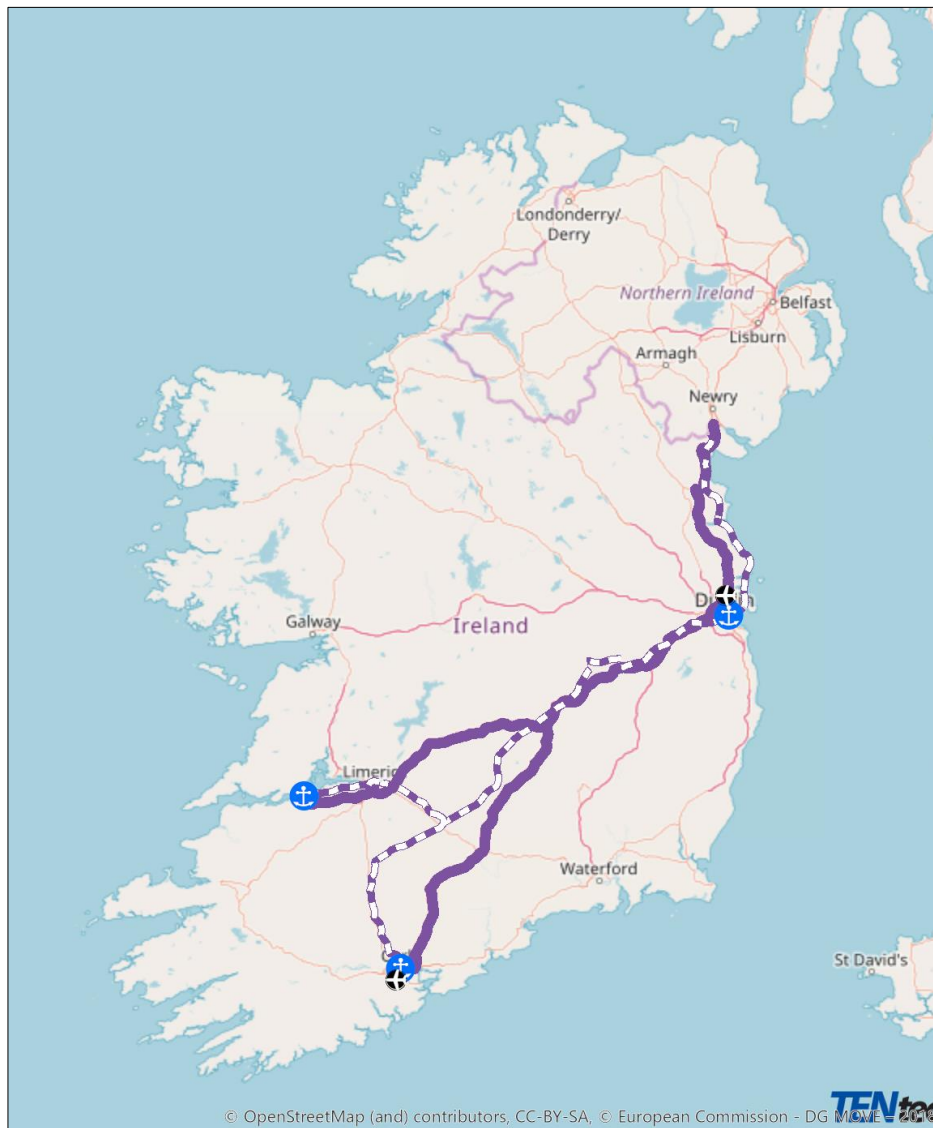
1.3.1 The TEN-T Road Network

The TEN-T Network consists of two layers:

- the Core Network; and
- the Comprehensive Network.

The Core Network in Ireland forms part of one of the major transport corridors, which is referred to as the North Sea-Mediterranean Corridor. This corridor stretches from Ireland through northern France, Netherlands, Belgium, Luxembourg and onto the Mediterranean Sea in the south of France. Figure 1-2 highlights the TEN-T Core Network in Ireland which links the ports of Cork, Dublin, and Belfast, with a spur to the Port of Foynes in Limerick. It also includes the Limerick connection to the Cork – Dublin corridor.

Figure 1-2: Ireland TEN-T Core Road Network



The new TEN-T Core Network will be supported by a Network of Comprehensive routes, feeding into the Core Network at regional and national level. The target for completion of the Comprehensive Network is 2050. The aim is to ensure that progressively, the TEN-T network will contribute to enhancing internal markets, strengthening

economic, social and territorial cohesion and reducing greenhouse gas emissions through better transport efficiency. Figure 1-3 shows the extent of both the Core and Comprehensive Networks in relation to roads, ports and airports within Ireland, including the N21 from Limerick to Tralee connection.

Figure 1-3: TEN-T Core and Comprehensive Road Network Ireland



The N21 National primary route is a main arterial route linking Limerick to Tralee, Killarney and the mid-west of the country. It passes the major villages and towns of Adare, Rathkeale, Newcastle West, Templeglantine, Abbeyfeale, Castleisland and Tralee.

1.4 Historical Need for Improvement

The need for an improvement of the N21 around Newcastle West was identified in several policy documents including the National Development Plan (NDP), Limerick County Development Plan (LCDP) 2010-2016, (as extended), Draft Limerick County Development Plan 2022 – 2028 (Draft LCDP) and Newcastle West Area Plan (NWLAP). It was also identified previously in the National Spatial Strategy (NSS) 2002-2020 and Mid-West Area Strategic Plan (MWASP) 2012-2030 which have now been superseded by the National Planning Framework (NPF) 2040 and the Regional Spatial and Economic Strategy (RSES), respectively.

The recently published NDP and RSES include provisions for the N21 Newcastle West Scheme. Enhanced Regional Accessibility is a core National Strategic Outcome (NSO) of the NDP to ensure that our regions are not linked only to Dublin, but to each other. This enhanced regional connectivity will be a major enabler for balanced regional development. The NDP has listed the N21 Newcastle West Scheme as part of this national road network and have thus included this project in its Strategic Investment Priorities.

The RSES for the Southern Region is aligned with the objectives of the NDP. As such, it also identifies the progression of the N21 Newcastle West Scheme as key to achieving enhanced regional accessibility between the metropolitan areas. The RSES recognises Newcastle West as one of the four Key Towns of the Mid-West Region and the opportunities it presents for significant economic development and population growth within the region. The RSES also identifies the synergies which exist between Newcastle West and other towns such as Abbeyfeale and Listowel and the potential for future partnerships and collaborations.

The NDP and RSES also identify the N21 Tralee to Limerick as an important corridor providing regional accessibility to the South-West Region, particularly in tandem with the N69 Tralee to Tarbert/Port of Foynes. The N21/N69 is identified as a Key Infrastructural Requirement for the development of Tralee and Killarney as Key Towns.

The LCDP designates Newcastle West as a Tier 2 settlement, which is a key service centre. Newcastle West is the largest of the two key settlements that County Limerick identified in the LCDP, with the other being Kilmallock.

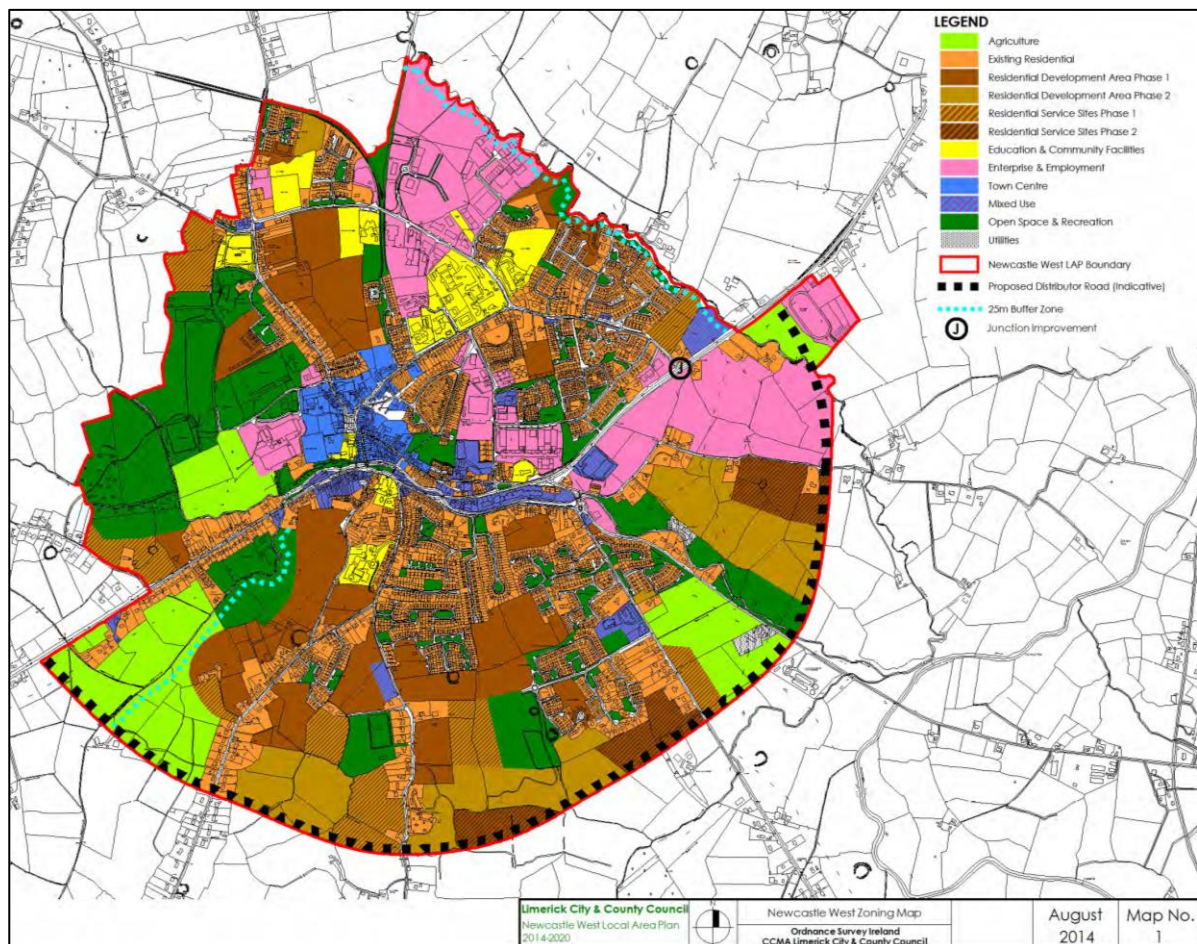
1.5 The N21 Newcastle West Road Scheme

Newcastle West is situated on the N21 Limerick to Tralee National Primary Route approximately 42km south of Limerick city. In 2019, before pandemic, this route was very heavily trafficked (15,000 AADT) with 6% proportion of Heavy Goods Vehicles (HGV).

The section of the N21 under consideration passes through the built-up area of Newcastle West Town within 60 & 50 km/h mandatory speed zones and comprises single carriageway cross section. Four zebra pedestrian crossings provide safe crossing points for pedestrians. A roundabout is located on the intersection of the N21 and R520 / R522 Regional roads. A regional road serves the town known as the R521 northwards to Foynes, and regional roads to the south of the town connect Newcastle West to Kilmallock (R520) and Charleville (R522).

Figure 1-4 illustrates the Newcastle West Local Area Plan (NWLAP) Development Boundary.

Figure 1-4: Newcastle West Zoning Map (Source: Newcastle West Local Area Plan)



There are public and private car parking areas within Newcastle West. Public parking is available on Market Square and off Church Street with pedestrian access through Bridewell Lane. On-street car parking is also available on the Square.

There are a number of industrial facilities in the hinterland of the town, including Pallas Foods. These facilities and the Port of Foynes to the north result in Heavy Goods Vehicles transporting freight and large goods through the urban area of Newcastle West in order to access these regional roads, which has a negative impact on the urban environment. According to TII's Traffic Monitoring Unit (TMU) 2019 data, HGVs account for 6% of the average daily traffic. Within the Townland of Newcastle West, there are a large number of direct accesses onto the N21 from residential and commercial properties and a number of junctions onto the N21 from regional and local roads. This leads to a significant volume of local traffic accessing and egressing the N21 through Newcastle West from these side roads during peak times. This local traffic is in direct conflict with strategic through-traffic, leading to congestion and delay through the town for both local and through-traffic

The existing N21 route through Newcastle West does not provide the level of service necessary to cater for existing and future traffic growth. The existing road pavement width is not enough to accommodate the recommended cross section to cater for existing and projected traffic volumes.

The proposed scheme aims to decongest Newcastle West town centre and segregate the through traffic from local traffic.

2. Data Collection

2.1 Introduction

Traffic data is an essential part of traffic model development. A significant amount of traffic data is required to ensure that the model can replicate the existing traffic patterns and volumes. This data can either be collected as part of regular data collection exercises or bespoke data collection for a particular study. This chapter is focused on describing the different types of traffic data collected and used in the model development, their sources and characteristics such as time, day and year of data. It also describes the reasoning behind selecting the survey types and locations thereof with the focus on model development, calibration and validation.

2.2 Existing Data

The existing data has been collated from many sources such as Transport Infrastructure Ireland's (TII) Traffic Monitoring Units permanent counter data, local data collected by Limerick and Kerry County Councils, and data collected from prior studies in the study area such as N69 Foynes to Limerick, N69 Listowel Bypass and the N20/M20 study. PAG Unit 5.2 – Data Collection (October 2016) recommends using only recent data up to five years old and therefore only data collected from 2015 was considered appropriate for use in the development of the traffic model. However, some non-recommended data was also included to cover more locations.

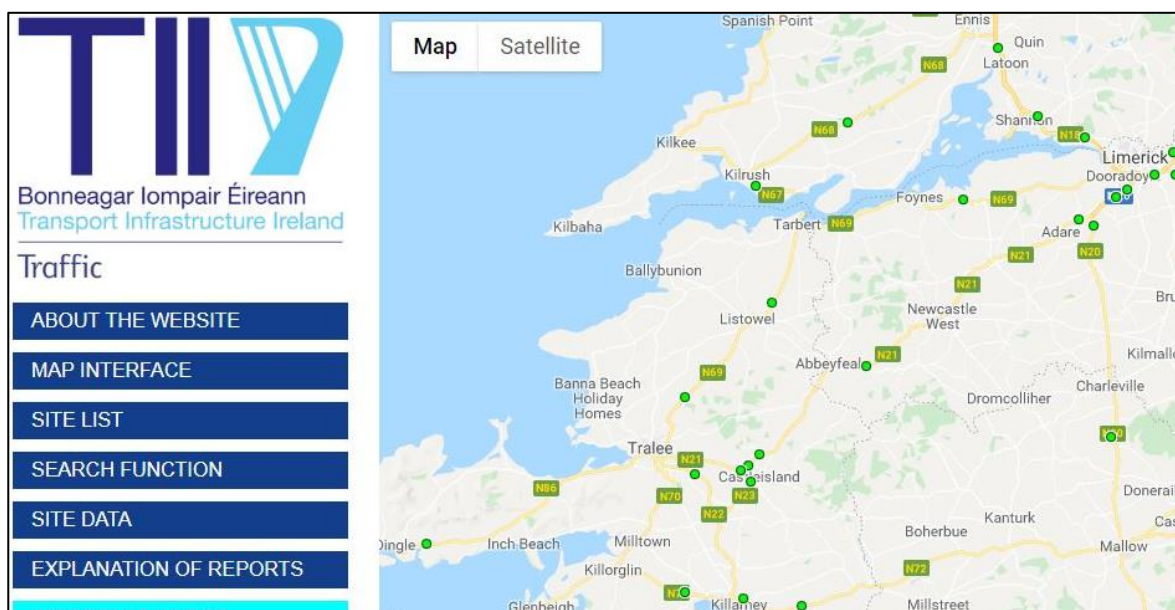
The following sections describe the different sources of existing data.

2.2.1 TII Permanent Traffic Monitoring Units

TII collects traffic count data and maintains an extensive network of permanent traffic counters on selected locations along motorways, national primary and secondary routes and on some important regional roads across the country. These permanent sites are known as Traffic Monitoring Units (TMUs) and work continuously to collect classified traffic data throughout the year.

This database is in the public domain and is available on the TII website to access and download in different formats. This data is available from 2013 onwards and is a credible source for long-term data trend analysis. This data has been used for the derivation of Annual Average Daily Traffic (AADT) expansion factors and to factor the historic count data to 2019 levels. Figure 2-1 shows a screenshot of TII's web-based system.

Figure 2-1: Snapshot of the TII's web-based system showing TMU sites



2.2.2 Local Authority Data

Local Authorities and County Councils also collect a substantial amount of data for regular monitoring and analysis from time to time. Limerick and Kerry county councils have undertaken several traffic studies in the past few years. Some of these studies are directly linked to the current study and the data collected for them is also relevant for the current study.

2.2.3 Census Data

The Irish census 2016 results at Electoral Division (ED) level provide details on population, employment and households with car ownership. These have been employed in travel demand disaggregation from the National Transport Model (NTpM).

2.2.4 Quality Assurance (QA) and Data Checks

The traffic data used in the model has been subjected to rigorous checks, cleaning and refinement as part of the data quality checks regime and QA procedures.

The traffic counts were analysed and compared against the most recent existing data and TII TMU permanent counter data for analysing the data trends. Most of the sites displayed matching data trends and no anomalies were spotted. The sites where no comparable existing data was available but shared the road section with either another ATC or JTC site, were checked for totals and traffic composition.

2.3 COVID-19 Impacts on Data Collection

The COVID-19 pandemic resulted in the Irish Government imposing a national stay at home order and nationwide travel restrictions from March 2020 to help reduce the spread of the virus in Ireland. This therefore made it impossible to collect traffic data in the Spring of 2020, as had been planned at the locations shown in **Figure 2-2**.

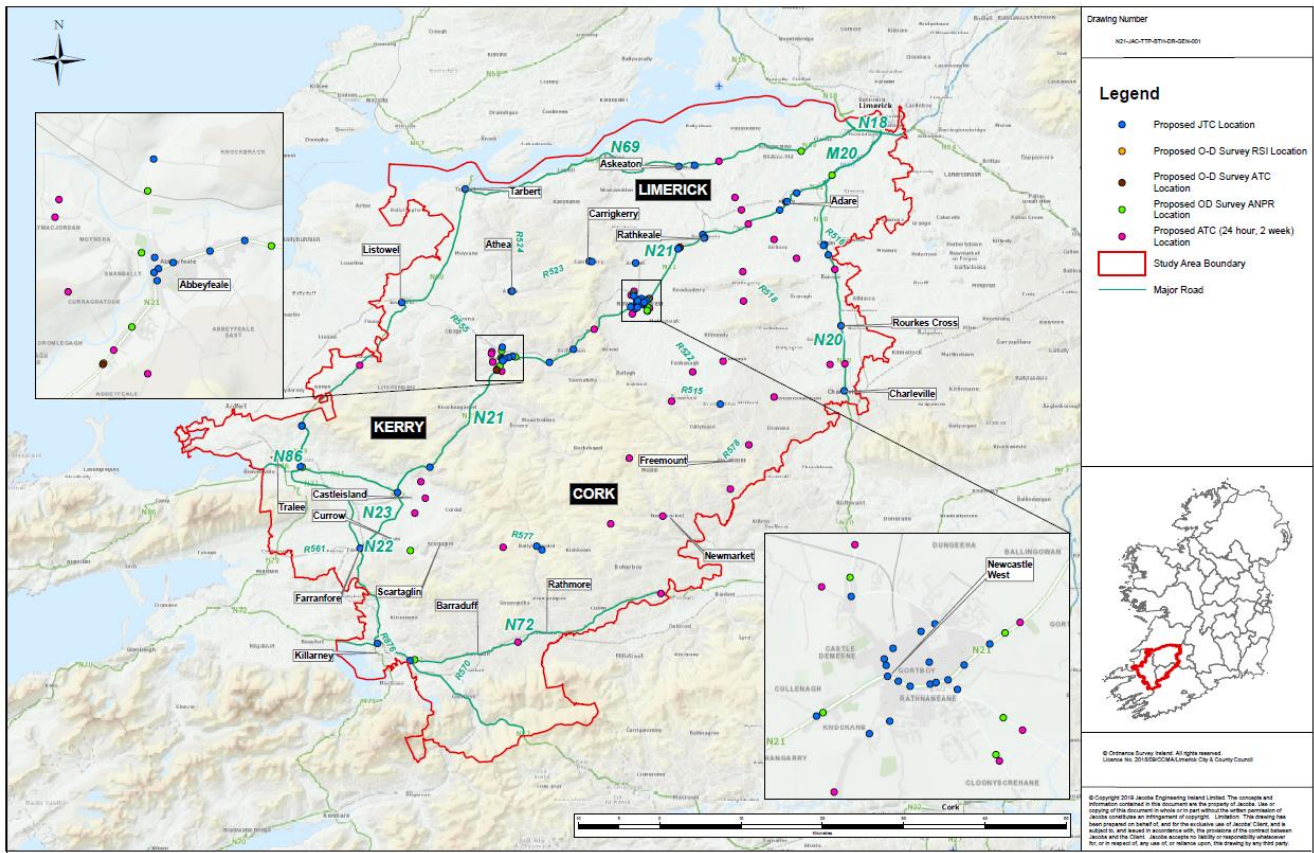
It is essential that base year transport models provide an acceptable representation of typical present-day traffic conditions. Since March 2020, travel patterns and the demand to travel have not been representative of typical conditions. While travel restrictions were briefly relaxed in 2021, the Government continued to advise citizens to work from home where possible and restrictions were still in place for hospitality and for meeting indoors in general. Therefore, restrictions on behaviour and interaction had remained and it is expected that there will be some volatility in travel demand as the country emerges from the COVID-19 pandemic.

Therefore, to mitigate delays to the project, it was agreed that the base model should be developed using all the available historical traffic data. However, this approach did mean that limited traffic data was available during the appraisal process.

2.3.1 Original Data Collection Proposal

The original data collection proposal for the construction of the LAM is presented in **Figure 2-2** below. The data collection programme that was envisaged was more comprehensive than the available data described below, but due to COVID-19 these surveys could not be undertaken.

Figure 2-2 Proposed Data Collection exercise – Spring 2020



2.4 Data Requirements

The study requires a thorough understanding of the forecast traffic volumes on the major national, regional and important local roads within the traffic modelling study area. These roads include national primary routes such as the N21, N69, N20, M7, M20 and parts of the N24. The major regional roads covered are the R526, R518, R519, R520, R521, R522, R523, R524 and parts of the R555 and many local roads such as the L1424, L1420, L1422, L1327, L7006 and L2040. The urban roads within major urban areas, all along the N21 corridor, are also covered in the model development and data collection process.

The typical data requirements are:

- Permanent (long term) traffic counts;
- Classified link counts;
- Classified turning counts;
- Route journey times and spot speeds;
- Origin and Destination (O-D) survey data; and
- Network data including traffic signal settings.

These datasets, either in isolation or combination, are usually used in different components of the traffic model development.

2.4.1 Modelling data quality

In response to the COVID-19 impacts outlined above it was decided to utilise the existing traffic data to support the model development for the traffic, economic and environmental assessments of the N21 Newcastle West Road Scheme. Hence, all the available data sources were collated, reviewed and analysed.

Traffic count data comprises traffic counts of different types:

1. Automatic Traffic Counter (ATC) providing data on traffic flows classified by vehicle classes; and
2. Junction Turning Count (JTC) providing classified turning movements at a junction.

The data used in the development of the base traffic model was not only good quality existing data (i.e., neutral day, neutral month and within the last five years), but also data that was collected either in non-neutral months or data that was more than five years old. Most of the data used is either long-term traffic counts or short-term junction turning counts. These traffic counts, along with 2019 TomTom data have been used in calibrating and validating the traffic model.

The data used for model calibration and validation was graded into three distinct groups based on their collection dates. These are:

- Code-1 (29 sites): All traffic count data collected on a neutral day in a neutral month and between years 2014-2019. This data is considered most suitable from the quality perspective as it is recent and collected on a typical day.
- Code-2 (41 sites): All traffic count data collected on a neutral day in a neutral month but before year 2015 and hence older than desirable. Most of this data was collected in 2014 but is still considered usable with caution and appropriate adjustments.
- Code-3 (24 sites): All traffic count data collected on a neutral day in a non-neutral month and year 2015 or later. This data is useful despite being collected in a non-neutral month of the year because it is still recent. Data collected in non-neutral months is usually not considered but has been used in the development of the N21 with appropriate adjustments. This data was collected between 2016 and 2018.

2.4.2 Data checking and cleaning

All collated traffic data was checked for any anomalies as part of standard data processing and the following checks were made:

- Insufficient or partial data.
- Very low traffic flows (close to zero) on important roads where higher volumes were anticipated.
- Significantly higher flows in comparison to adjacent sites, especially for one vehicle class (e.g., heavy vehicles);
- overlapping counts, with two or more counts on the same road section/junction; in this case the most recent data was kept; and
- Link not in network; this happened in the case of JTCs where one of a junction arms was a minor road, not coded in VISUM.

After the checking and cleaning process, a total of 83 sites were processed for the model calibration and validation as shown in **Figure 2-3** and **Table 2-1**.

Figure 2-3 Location of count sites after data checking and cleaning

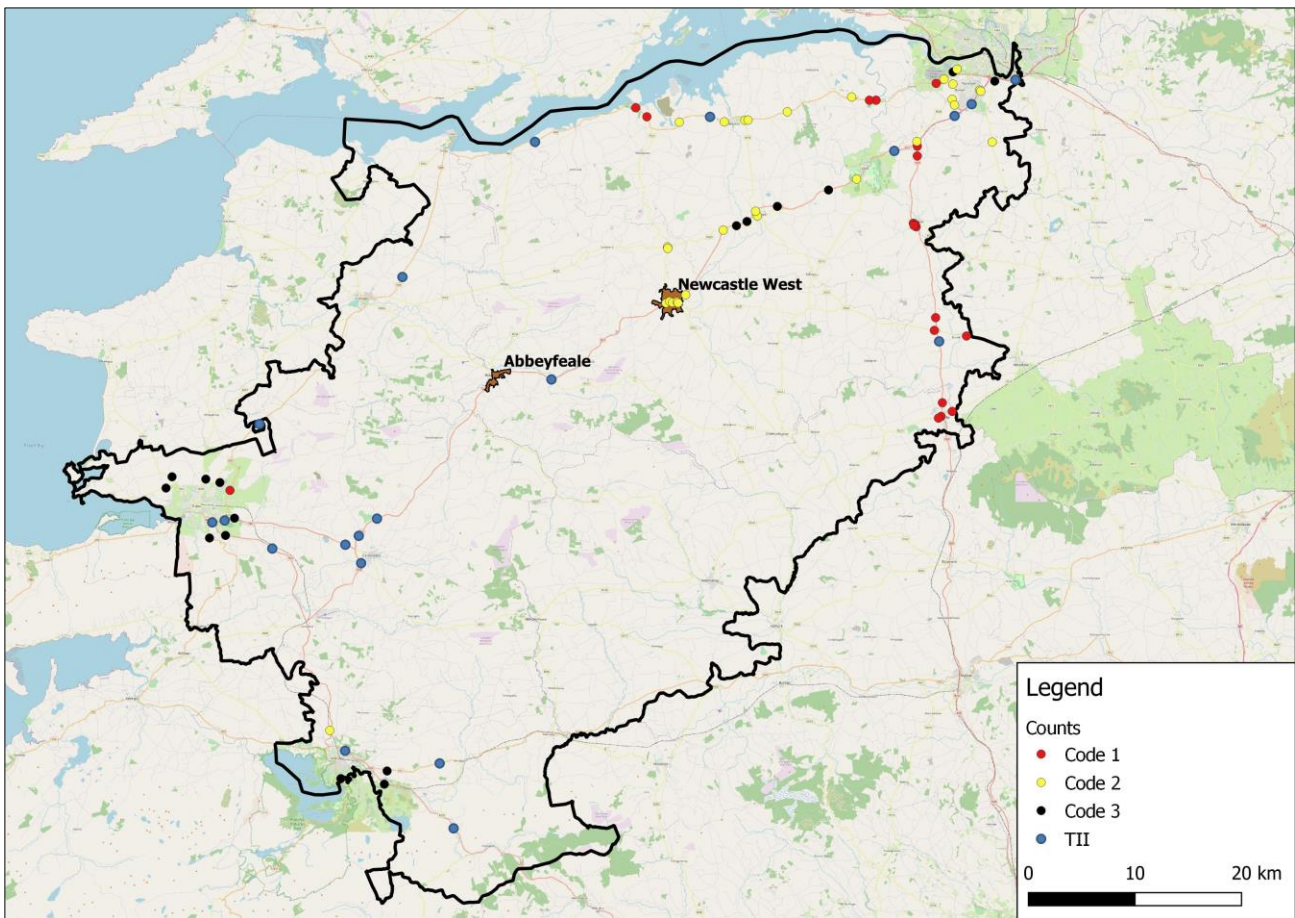


Table 2-1: Data checking and cleaning statistics

	Initial number of sites	Number of sites rejected	Number of sites after data checking and cleaning
TII Traffic Data	21	1	20
Code-1 traffic counts	29	10	19
Code-2 traffic counts	41	13	28
Code-3 traffic counts	24	8	16
Total	115	32	83
	100%	28%	72%

Comparing Figure 2-3 with Figure 2-2 indicates that less data was available than would be considered desirable on the road network around Newcastle West. However, elsewhere there was enough existing data to develop a base year model.

2.4.3 Data processing

Traffic data processing comprised several tasks as outlined below:

1. Extraction of peak flows for peak periods (AM 08:00-09:00, IP average hour 12:00-14:00, PM 16:00-17:00) and Light Vehicles (LV) and Heavy Vehicles (HV) for each count site).
2. Calculation of factors for peak periods and LV and HV vehicles:
 - a. converting traffic flows from years between 2014 and 2018 to 2019 (Code-1, 2 and 3 traffic counts);
 - b. converting traffic flows from non-neutral months to neutral ones (Code 3 traffic counts);
3. Calculation of average AM/IP/PM LV/HV 2019 traffic flows for neutral month.

Extraction of peak flows was undertaken for neutral weekdays (Tuesday, Wednesday and Thursday) for multi day surveys. The traffic projection to 2019 (mentioned in point 2a above) was based on zone-based growth rates published by TII in PAG Unit 5.3 – Travel Demand Projections (October 2016 and May 2019).

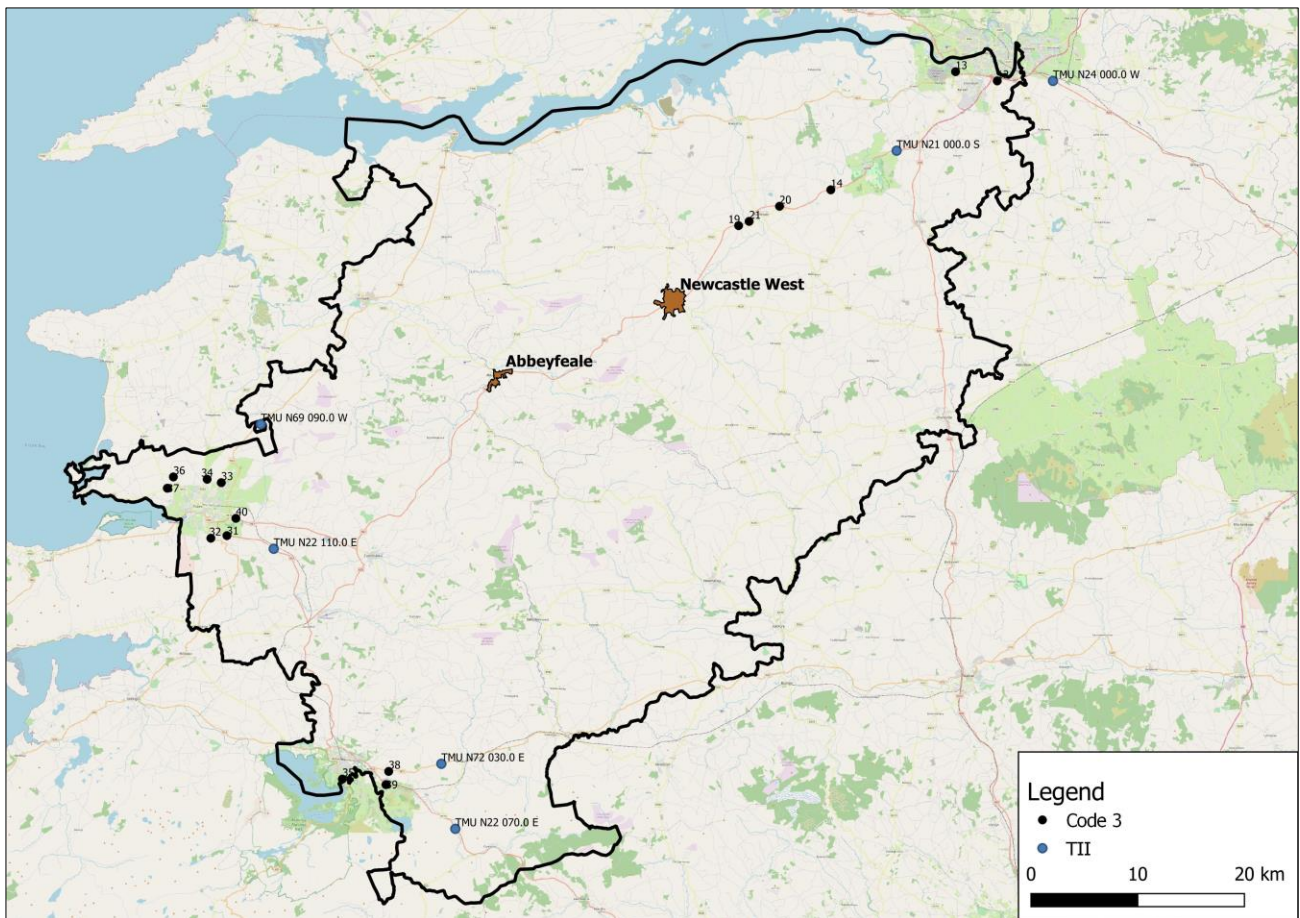
The Central growth rates scenario for years 2013-2030 (from PAG Unit 5.3 (October 2016) was used for traffic counts undertaken in 2014 and 2016-2030 (from PAG Unit 5.3 (October 2019) was used for traffic counts undertaken between 2016 and 2018).

The conversion of non-neutral month to neutral month (mentioned in point 2b above) was based on the data from TII sites located near the site from which non-neutral month traffic data was used. The six TII sites and the sites that were adjusted using that counter site are presented in Table 2-2 and Figure 2-4.

Table 2-2: TII sites used for factoring traffic counts conducted in non-neutral month

No	TII site	Site name	Date of survey	Code	No in App. A
1	TMU N24 000.0 W	3153-IRE Lot 3 JTC Report Site 21 v2	02/28/2017	3	12
		3153-IRE Lot 3 JTC Report Site 23 v3	02/28/2017	3	13
2	TMU N21 000.0 S	3227 - IRE Foynes to Limerick - ATC Site 5 Week 2	01/22/2018	3	14
		JTC Rathkeale N21 Jn 3	01/19/2016	3	20
		JTC Rathkeale N21 Jn 7	01/19/2016	3	21
		JTC Rathkeale N21 Jn 10	01/19/2016	3	19
3	TMU N72 030.0 E	MHC-771-16_Site 7 NTA	02/04/2017	3	38
		MHC-771-16_Site 25 NTA	02/04/2017	3	35
4	TMU N22 070.0 E	MHC-771-16_Site 8 NTA	02/04/2017	3	39
5	TMU N22 110.0 E	MHC-771-16_Site 9 NTA	02/04/2017	3	40
		MHC-771-16_Site 10 NTA	02/04/2017	3	31
		MHC-771-16_Site 11 NTA	02/04/2017	3	32
6	TMU N69 090.0 W	MHC-771-16_Site 23 NTA	02/04/2017	3	34
		MHC-771-16_Site 22 NTA	02/04/2017	3	33
		MHC-771-16_Site 29 NTA	02/04/2017	3	36
		MHC-771-16_Site 30 NTA	02/04/2017	3	37

Figure 2-4: Location of Code 3 count sites and TII sites used for factor calculation



2.4.4 Final traffic data set

The final traffic data set covers 83 sites, with traffic data broken down by:

- period: AM 08:00-09:00, IP average hour 12:00-14:00, PM 16:00-17:00; and
- vehicle classes: Light Vehicles (LV) and Heavy Vehicles (HV).

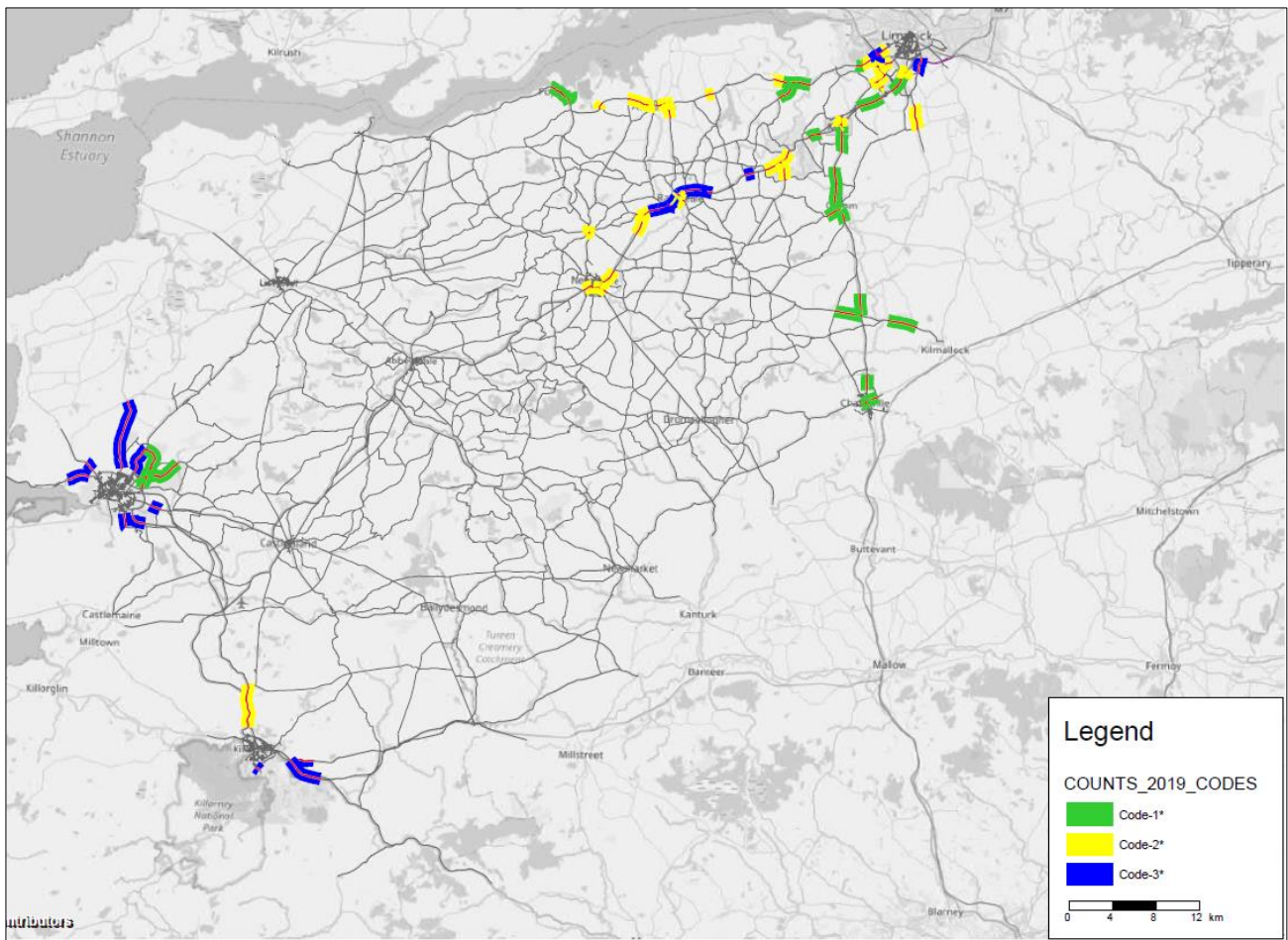
A detailed summary of sites within the study area is presented in Appendix B Summary of traffic count sites.

The 83 sites contained traffic counts (ATC and JTC) for both directions and therefore flow targets were incorporated on a total of 282 links in the transport model.

Figure 2-5 shows the location of all Code-1, Code-2 and Code-3 data.

Data from JTC traffic counts was converted to link flows for the purpose of model calibration and validation.

Figure 2-5: Map showing location of Code-1, Code-2 and Code-3 data within study area



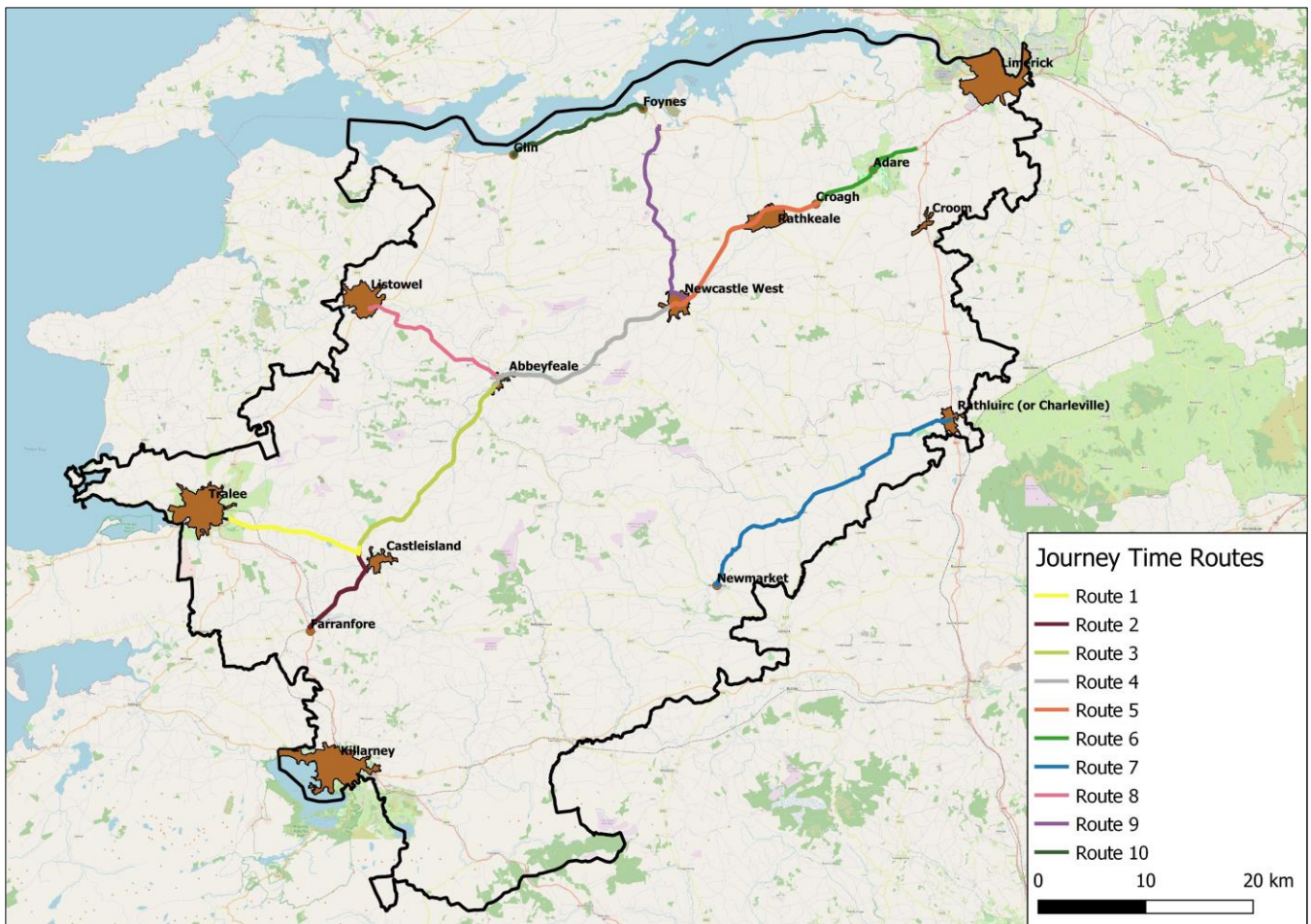
2.5 TomTom data for Journey Times

Alternative methods for collecting journey time data were explored for this study and data from TomTom was found to be most effective and efficient with respect to time input, total cost and higher accuracy. This method involves probing TomTom data between a fixed pair of points that forms the pre-defined journey route, in specific time intervals and on specific neutral days (Tuesday, Wednesday and Thursday) in neutral months of year 2019. A forthcoming CAF 'journey time reliability' benefit guideline recommends collection of data over 30 consecutive days in a neutral month, but TomTom data has been collected for a whole year. The long duration of the data collection ensures robustness and consistency, since the traffic counts and all other datasets have only been considered during neutral days of the week: Tuesday, Wednesday and Thursday.

2.5.1 Journey Time Routes

Ten journey time routes covering key traffic routes in the study area on the N21, N23, N69, R555 and R521 were selected for the collection of journey time data. **Figure 2-6** shows the routes where data was collected in both directions.

Figure 2-6: Map showing ten journey time routes



2.6 Summary of Data Collection

Due to travel restrictions introduced to reduce the spread of COVID-19, it was impossible to collect the traffic data originally envisaged. Therefore, it was decided to collate all existing available historical traffic data and use the data considered most suitable for traffic model calibration and validation.

The historic traffic data collated is less comprehensive than the data collection initially planned. In particular, there were no available traffic counts in the area of Abbeyfeale and only a few around Newcastle West, which meant that there was a lack of calibration and validation targets in the vicinity of the schemes that the model would be used to appraise. The factoring of historical traffic data could result in over or underestimation of traffic flows in 2019.

Targeted traffic surveys, undertaken in April 2021, as travel restrictions began to ease, were used to assess the robustness of the traffic model, as discussed further in Section 4.7.

3. Model Development

3.1 Overview

The N21 LAM has three modelled time periods, which were derived after analysis of the three TII TMU permanent counter sites on N21 in the study area. Data from November 2018 was used to determine the AM and PM peak periods as shown in Table 3-1 below. Only weekday data was considered, with Events and Holidays excluded.

Table 3-1: AM and PM peak periods based on November 2018

TII TMU Location	AM peak	PM peak
TMU N21 000.0 S	07:47	16:43
TMU N21 040.0 S (closest site)	07:37	16:35
TMU N21 065.0 N	07:53	16:46

The times shown in **Table 3-1** are the start of the busiest hour. Based on the above, the following time periods were selected for the model:

- AM: between 08:00 and 09:00;
- Inter-Peak (IP): an average hour between 12:00 and 14:00; and
- PM: between 16:00 and 17:00.

All three time-periods in the traffic model refer to an average weekday in a neutral month in 2019.

3.2 Study Approach

The study approach was to develop a detailed highway assignment model making best use of all the existing models such as TII's National Transport Model (NTpM).

The study area and model extents were carefully selected to cater for both the N21 Abbeyfeale Road Scheme and the N21 Newcastle West Road Scheme as a combined package, since both schemes are on the N21 national primary road and may be progressed simultaneously. The road network has also been carefully selected to facilitate the modelling requirements of both the N21 Abbeyfeale Road Scheme and the N21 Newcastle West Road Scheme. The wide area LAM covers the N21 corridor from Limerick city in the north to Killarney in the south. This includes all important national, regional and local roads around the N21 corridor.

The zoning in the traffic model has been developed based on TII's NTpM and Geodirectory data. The forecast traffic growth has been adopted from the NTpM zone-based growth factors for Light and Heavy vehicle classes. These growth factors are differentiated by origins and destinations, year ranges and time periods, and include forecast growth to 2050.

3.3 Study Area and Model Extents

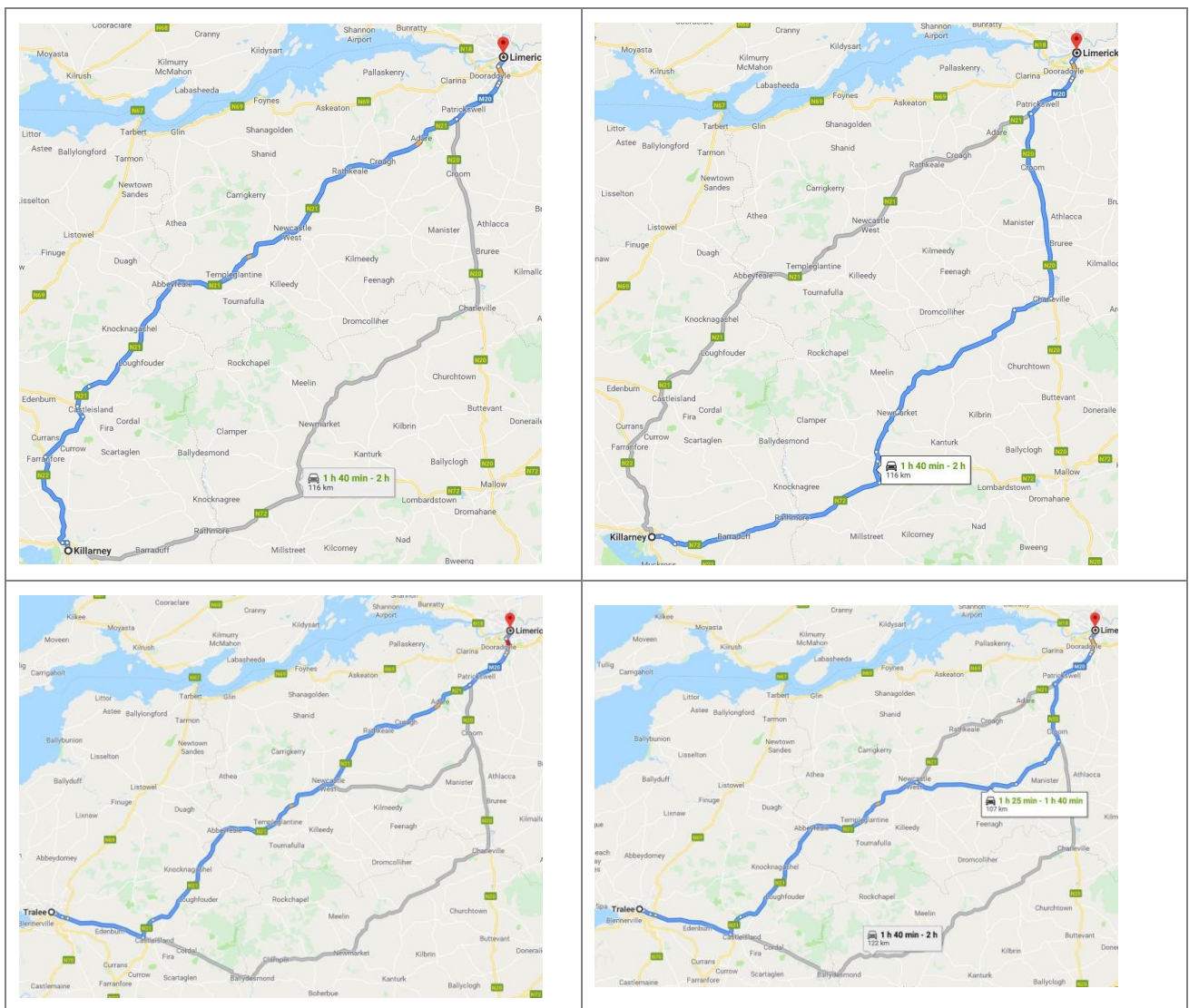
The model extents and study area has been derived from:

- the study area in the Project Appraisal Plans;
- alternative routes to the N21 corridor, including wider N22 Killarney – Limerick via Charleville and N69 Tralee – Limerick routes (**Figure 3-1** below);

- influence of the proposed N69 Foynes to Limerick Road (including Adare Bypass) scheme; and
- the zoning structure and granularity within TII's NTpM and Electoral Divisions.

A scoping exercise to determine the extents of the modelled area was undertaken, based on the interrogation of collated survey data and TII's NTpM. The initial model extents were based on the above criteria. This initial area covered the N21 corridor from Limerick city to Tralee, parts of the M20/N20 from Limerick to Charleville and parts of the N22 from Tralee to Killarney. Further discussions were held with MWRDO and TII in relation to the availability of the strategic traffic reassignment from the traffic model for the N69 Foynes to Limerick Road (including Adare Bypass) scheme as an input to the N21 project model, but it was decided to develop a separate larger N21 project model that incorporates the N69.

Figure 3-1: Screenshots of Google map used for deriving alternate routes around the schemes



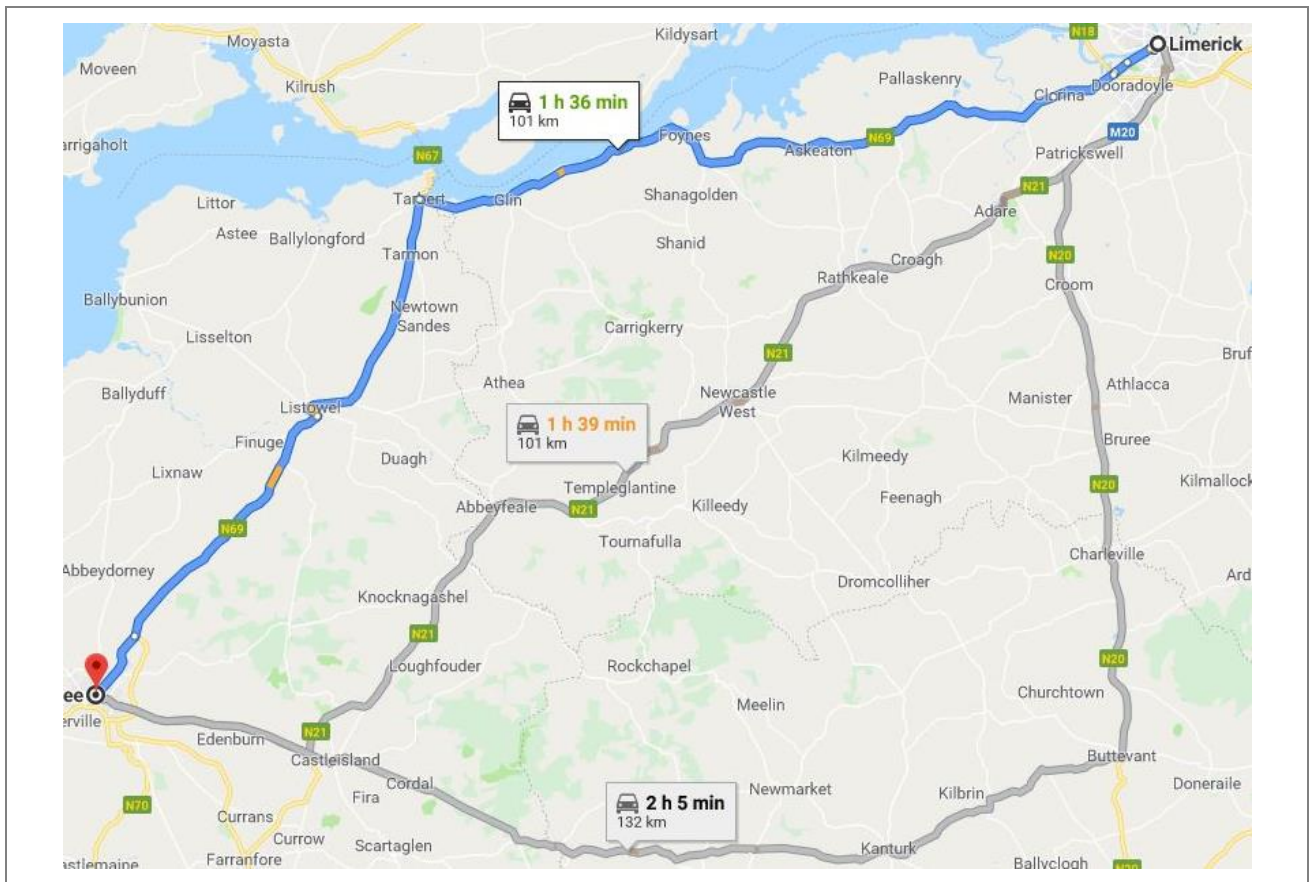
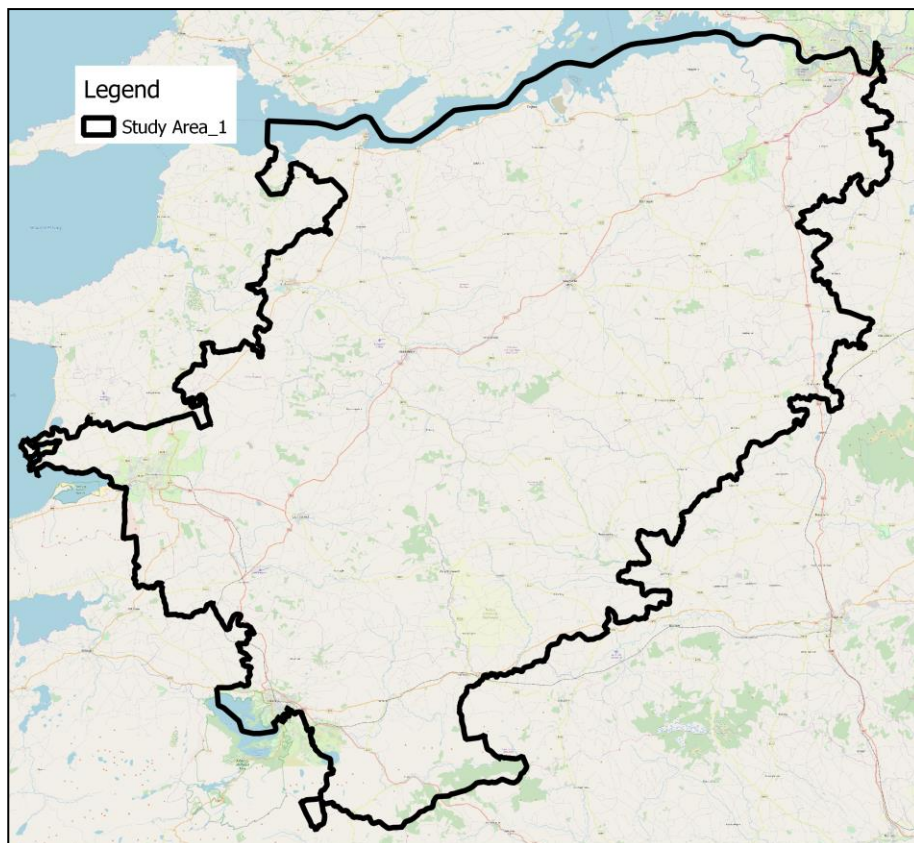


Figure 3-2: Map showing study area boundary for the LAM



3.4 Available Prior Models

There are several national, regional and local level traffic models that have been developed by agencies such as TII, the NTA, and City and County councils. Some of these models are very large and 'live' strategic models that have been created to help assess strategic level interventions, whereas others are more local level. These models represent a structure of national, regional and important local road network and even active modes (walking, cycling) network.

There is no major study that has been undertaken directly on the N21 corridor in the vicinity of either Abbeyfeale or Newcastle West but there are a few undertaken on nearby areas. Those studies are the N69 Foynes to Limerick Road (including Adare Bypass), the N69 Listowel Bypass and the N/M20 Cork to Limerick Road Improvement Scheme. All studies involved development of a strategic traffic model but the model years, network extents, model quality, detailed modelled area and model zoning differed to various extents. The models that were used in the development of the N21 LAM are discussed below.

3.4.1 TII National Transport Model (NTpM)

The NTpM is a multi-modal strategic Variable Demand Model (VDM) that covers the entire Republic of Ireland and Northern Ireland and is used by TII to assess the impact of infrastructure or policy changes at national, regional and local levels. It incorporates national, regional and some important local roads, and has recently been recalibrated using 2016 census and Place of Work, School or College, Census Anonymised Records (POWSCAR) data. Within the NTpM, there are four modules, with three assignment modules (NTM, NRM, and NBM) that are used to assign travel demand matrices to the network, generating travel costs e.g., time, distance, tolls and fares for each mode. The role of the VDM is to assess, if required, the impact of a change in the transport network or change in the cost of travel (e.g., fuel costs, fares) upon the demand for travel (mode switching, induced demand etc.). The four modules are:

- National Traffic Model (NTM)
- National Rail Model (NRM)
- National Bus Model (NBM)
- Variable demand model (VDM)

The N21 LAM has been heavily dependent on NTpM 2016 since it is the main donor model for prior matrices of Light Vehicles and Heavy Vehicles. The NTM represents two periods; an average AM peak hour (07:00-09:00) and an average Inter peak hour (12:00-14:00). It is the only component of NTpM that has been used in the development of the N21 LAM.

3.4.2 National Traffic Model (NTM)

The NTM is a strategic (macroscopic) traffic model developed using VISUM transportation modelling software and forms the road traffic element of the NTpM as outlined above. The model covers the entire national and regional road network and is used by TII as a tool in the appraisal of potential road schemes, land use and policy changes. The NTM provides demand for Light Vehicles (Car and Light Goods Vehicles) and Heavy Vehicles (Other Goods Vehicle 1, Other Goods Vehicle 2 and Buses/Coaches) for the following time periods:

- Average AM peak hour (average hour between 07:00 and 09:00); and
- Average interpeak hour (average hour between 12:00 and 14:00).

3.5 Network Development

The starting point for coding the road network in the 2019 N21 VISUM LAM was the inherited coding from the NTM with slight modifications and changes to suit the current model's requirements. However, remaining network gaps and other inclusions (model expansion) have been coded separately into the model. The NTM covers all the national and regional roads but not all local and important urban roads. These missing roads were coded with the

help of Open Street Map and Google satellite imagery. The Volume Delay Functions (VDF) used in the N21 LAM are derived from the NTM with slight modifications to suit local context.

The road network included all national, regional, important local roads, suburban and urban roads throughout the study area. The network covered Limerick city in the north to Killarney in the south and from Listowel in the west to Charleville/Newmarket in the east. Satellite imagery has been the primary source of junction geometry, banned turns and traffic management restrictions, such as speed limits.

The traffic counts for the Light and Heavy vehicles for all three time periods have been embedded in the model to aid in model calibration and validation. At some locations, the individual total traffic for an arm has been treated as mid-block traffic volume. Care was taken in establishing the new traffic data locations in reference to the exiting data locations but due to the nature of link coding, some links were long enough to have two or more data sets available for embedding. In all such cases, more recent data was used in traffic count coding. Some cases were also encountered where an ATC and one arm of a JTC were available for the same link. In all such cases, longer term and more recent data was used.

3.5.1 Network additions and refinement

Despite the network detail available from the prior models, parts of the N21 LAM network were added and refined to complete the network coding within the study area. The network development was directed by several factors such as:

- Available network from prior models making best use of all network already coded;
- Addition of network coding in less densely coded urban areas;
- Existing data points where usable data was available, but network was not coded;
- New data points where data was proposed and collected, but network wasn't coded; and
- Road links not coded but of interest with respect to junction strategy and public consultation outcomes.

As a result, significant additional network was coded to cater to all requirements and make the model suitable for several scheme evaluation procedures. The Base year model network is shown in **Figure 3-3**.

Network for the purpose of this scheme, was reviewed and adjustments were undertaken to:

- link parameters: maximum speed, number of lanes, capacity;
- junctions – closed/opened turns; and
- adding new important local roads around Newcastle West and Abbeyfeale.

Figure 3-3: Base year (2019) model network



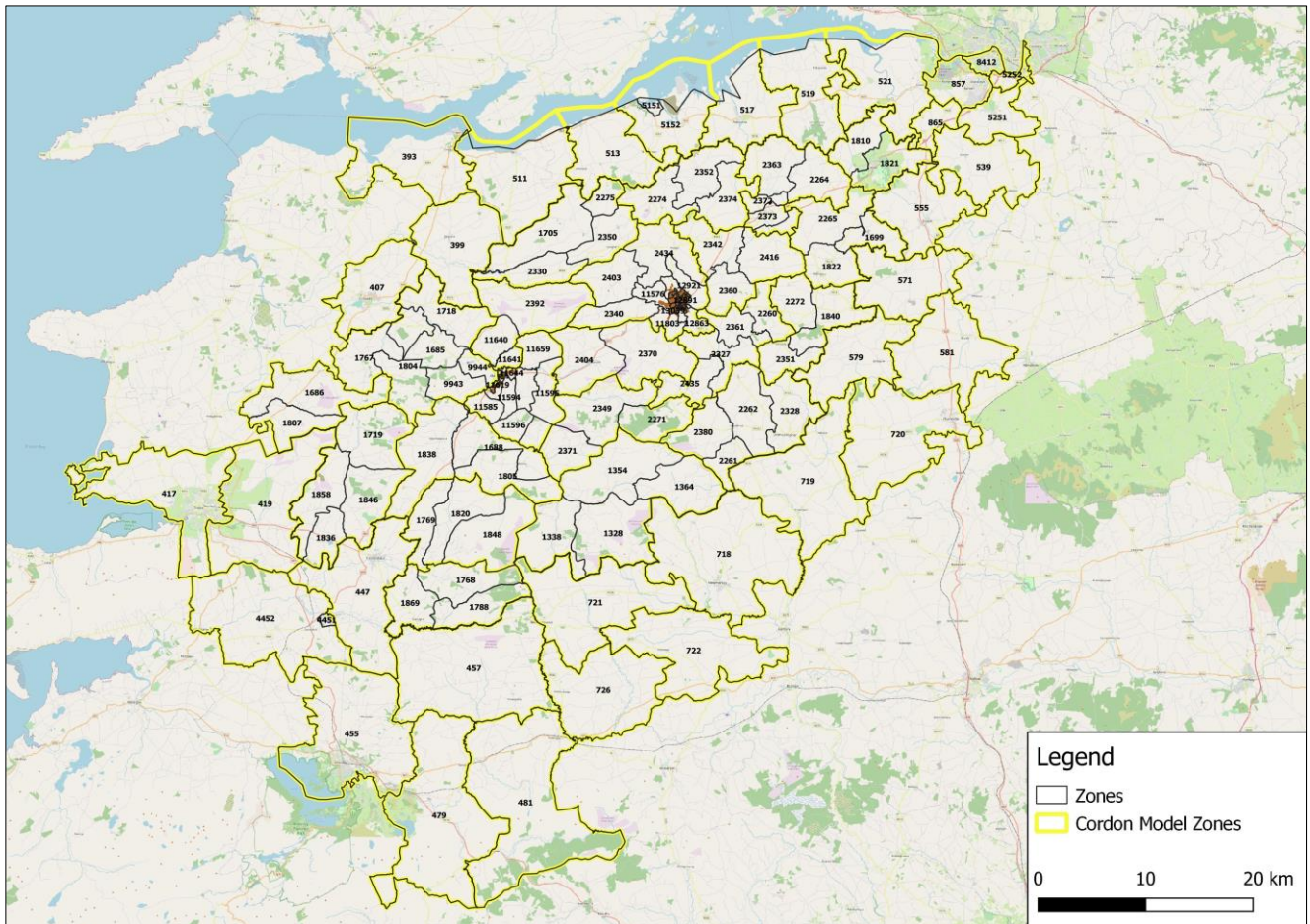
3.5.2 Zoning System

The N21 LAM zoning structure was developed by disaggregating the larger TII NTM zones which are multiples of Electoral Division (ED) level census entities. These larger zones are appropriate for a national level model but N21 LAM zones needed to be smaller in size.

The cordoned NTM had 88 zones in total, with 32 external and 56 internal zones. The internal zones, mainly in the vicinity of Newcastle West and Abbeyfeale, were split into smaller zones. Consequently, there are 149 internal zones in the N21 LAM, which results in a total of 181 zones in the N21 LAM. It is noteworthy that there are two special zones solely representing ports and airports: Foynes Port (zone 515) and Kerry Airport (zone 4451).

Figure 3-4 presents the zoning system before and after adjustment. A detailed summary of the zoning system transformation is presented in Appendix A Summary of zoning system.

Figure 3-4: N21 LAM zoning system before and after the redistribution



3.5.3 Zone Centroids and Connectors

The zone centroids and connectors were carefully selected to represent the zonal centre of gravity in terms of trip generation and attraction hotspots within the zone boundary. The smaller and denser urban zones were relatively straightforward but sparse and wide rural zones were carefully surveyed to locate the best possible location for zone connectors.

All zone connectors were modelled using standard and established method of spigot (or stub) connectors where zones have a virtual location to load trips as compared to a real junction. This method allows zones to avoid overloading all trips to real network, and especially junctions, thereby skewing the traffic flows. Zone centroids and connectors were constantly reviewed and modified where required, especially when new zones were created by splitting the existing ones. Some zone connectors were modified during the calibration stage to minimise the impact of imbalanced trip loading in the network.

3.6 Matrix Development

3.6.1 National Transport Model (NTpM)

The NTpM is a nationwide multimodal strategic model that was developed to help assess strategic road schemes and has been updated to 2016 using the latest census data. This national model was cordoned to create a smaller local model based on the N21 study area and contained 88 zones in total with 56 internal and 32 route zones.

The trip matrices cordoned out from the NTpM were:

- 2016, AM, Light Vehicles;
- 2016, AM, Heavy Vehicles;
- 2016, IP, Light Vehicles; and
- 2016, IP, Heavy Vehicles.

The cordoned matrices were only private transport vehicle trip matrices as represented in **Table 3-2**. The trip purpose based separate matrices of Light vehicles were combined into one since N21 LAM doesn't have a separate user class based on trip purpose. These vehicle matrices were converted to Passenger Car Unit (PCU) matrices using a PCU factor of one for Light Vehicles and 2.4 for Heavy Vehicles. The PCU factor of 2.4 was derived as an average of PCU factors for OGV-1 (1.9) and OGV-2 (2.7).

Table 3-2: Private Transport Trip matrices (Vehicles)

Travel Type	Vehicle Type	Trip Purpose	Time Period
Private	Light Vehicles	Commuting	AM
			IP
		Employer's Business (Working)	AM
			IP
		Other (Non-Commuting)	AM
			IP
	Heavy Vehicles	Working	AM
			IP

The original cordoned matrices were converted into 181 zone LAM square matrices based on the Geodirectory data on building premise use of Residential, Commercial and Both (Mixed Use). The origins of Light Vehicle (LV) trips were split into constituent LAM zones based on the proportion of Residential buildings along with 50% of Mixed use, whereas destinations were distributed based on the proportion of Commercial buildings along with 50% of Mixed use. The origins and destinations of Heavy Vehicle (HV) trips, however, were split into LAM zones based on Commercial buildings along with 50% of Mixed use only.

Table 3-3 presents the details of the method used for zonal disaggregation for Lights and Heavy vehicle matrices in the AM and Inter peak periods.

Table 3-3: Method used for NTpM matrix disaggregation to LAM zones

Purpose	AM Peak		Inter Peak	
	Origin disaggregation variable	Destination disaggregation variable	Origin disaggregation variable	Destination disaggregation variable
LV	GeoD Residential + 50% Mixed Use Buildings	GeoD Employment + 50% Mixed Use Buildings	GeoD Residential + 50% Mixed Use Buildings	GeoD Employment + 50% Mixed Use Buildings
HV	GeoD Employment + 50% Mixed Use Buildings	GeoD Employment + 50% Mixed Use Buildings	GeoD Employment + 50% Mixed Use Buildings	GeoD Employment + 50% Mixed Use Buildings

Quality checks were performed throughout the splitting process comparing total trip numbers to ensure that no demand was lost through the distribution.

3.6.2 Base year Matrices (2019)

The NTpM matrices were updated to 2016 following the release of 2016 census data and therefore demand disaggregation from NTpM resulted in 2016 N21 LAM matrices. These cordoned and converted matrices were projected to 2019 since the LAM base year is 2019. This was achieved by using TII zone-based growth factors that were applied to trip ends and later converted back to a 181-zone square matrix. Since the NTpM does not have PM matrices, AM matrices were transposed to produce PM prior matrices for both user classes of Light and Heavy vehicles. The Base year matrices were produced by using 'Central' scenario annual growth rates for the years 2016-2030. These growth rates were applied to the row and column totals of the 2016-year trip matrix to produce target trip ends for the 2019-year matrix.

The cordoned NTpM had two special zones representing Kerry Airport (zone 4451) and Foynes Port (zone 515). The zonal growth factors for these two special zones were not available through published TII growth factors. For the special zone representing Foynes Port, growth factors were based on AADT projections from the 'Foynes to Limerick Road Scheme (including Adare Bypass): Phase 3 – Traffic Modelling Report' produced by Roughan & Donovan and AECOM for Limerick City & County Council. In case of Kerry Airport, a Link-Based Growth Rate was used. That method means that traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the scheme.

The 2019 matrices so produced were the prior matrices and a good starting point for model calibration but needed adjustment during the calibration stage using the Matrix Estimation (ME) process. The ME process is discussed in more detail in Chapter 4: Model Calibration and Validation.

3.7 Assignment Model

VISUM has a variety of assignment algorithms but the most used in assignment models is Equilibrium Lohse. This procedure models the learning process of road users using the network. Starting with an ‘all or nothing’ assignment, drivers consecutively include information gained during their last journey for the next route search. It’s an iterative process where numerous shortest routes are searched whereby the impedance of the searched route is deduced from the impedance of the current volume and the previously estimated impedance.

The Generalised Cost (GC) of a journey, as represented by a combination of time, distance and tolls, is used in a route choice algorithm that produces a stable output where all possible routes between a pair of zones have same cost.

The simplest form of GC can be represented as follows:

$$GC = \text{Value of Time (VoT)} * \text{Time} + \text{Vehicle Operating Cost (VOC)} * \text{Distance} + \text{Tolls}$$

The economic parameters such as Value of Time (VoT) and Vehicle Operating Cost (VOC) as used in 2019 Base year N21 LAM assignment are outlined in **Table 3-4**. These have been derived in part from the NTpM and later adjusted to represent the study area costs using Base model average speeds. These are fully compliant with parameters set out in the *PAG Unit 6.11 National Parameters Values Sheet (October 2019)*.

Table 3-4: 2019 Base year Generalised cost parameters

Peak Hour	User Class (Light (LV), Heavy (HV))	Value of Time (VoT)		Vehicle Operating Cost (VOC)	
		Cents/Min	€/hour	Cents/metre	Cents/km
AM	LV	34.53	20.72	0.01766	17.66
	HV	41.41	24.85	0.01760	17.60
IP	LV	34.55	20.73	0.01766	17.66
	HV	50.15	30.09	0.05162	51.62
PM	LV	51.95	31.17	0.05021	50.21
	HV	49.58	29.75	0.05015	50.15

4. Model Calibration and Validation

4.1 Introduction

The base year model development was followed by model calibration and validation centred on the traffic volume counts and journey time data. It is an important and essential step in traffic model development, which ensures the fitness of purpose of the model for scheme appraisal and option evaluation. The final base year matrices were derived after successful Matrix Estimation (ME) as discussed in section below.

4.2 Matrix Estimation

Matrix estimation is the process by which the number of trips between zone pairs is adjusted to improve the match between assigned and observed flows along a modelled link. This process is undertaken in VISUM using a special suite for matrix estimation tool also referred to as 'TFlow Fuzzy'.

This process is iterative and repeated several times before the best adjusted matrices are extracted. These matrices are checked for Coincidence Ratio (CR) which ideally should not be less than 0.7 for any user class and time period matrix. More detailed analysis of Trip Length Frequency Distribution (TLFD) and a summary of the Coincidence Ratio for both user classes in all three peak periods is discussed in Section 4.4.

4.2.1 Trip Length Frequency Distribution (TLFD) checks

The estimated output matrices are checked to ensure that the ME process has not altered the trip distribution significantly. To increase the flows along a link, the ME process may add a significant number of trips between pairs of zones at either end of the link. This sizeable change could have the effect of creating an excessive number of short distance trips while longer distance trips are unchanged. This would increase the proportion of short distance trips.

This check was performed by plotting the TLFD of the matrices before (pre) and after (post) the ME process and these are compared to spot any large differences. The TLFD for each peak hour for LVs are presented in **Figure 4-1** to **Figure 4-6** and the histograms illustrate that the trip length distribution has not been altered significantly as a result of ME. The Coincidence Ratios for each user class and time period matrix is presented in **Table 4-1**. A desirable range for the coincidence ratio is between 0.7 and 1.0 where a ratio of 1.0 suggests an identical distribution.

Table 4-1: Coincidence Ratio for AM, IP and PM estimated matrices for Light (LV) and Heavy (HV) vehicles

Time Period	User Class	Coincidence Ratio (CR)
AM	LV	0.8
	HV	0.7
IP	LV	0.8
	HV	0.7
PM	LV	0.8
	HV	0.7

Figure 4-1: N21 TLF D Light Vehicles (AM)

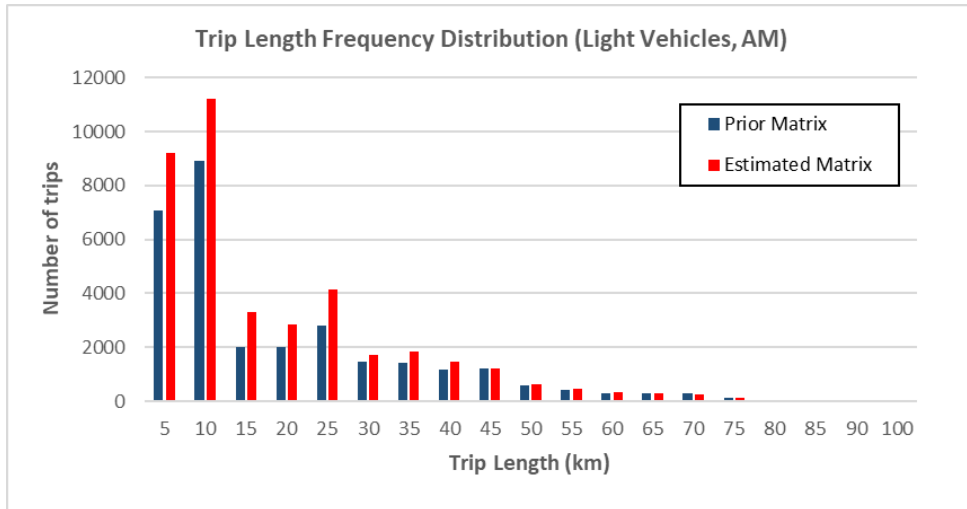


Figure 4-2: N21 TLF D Light Vehicles (IP)

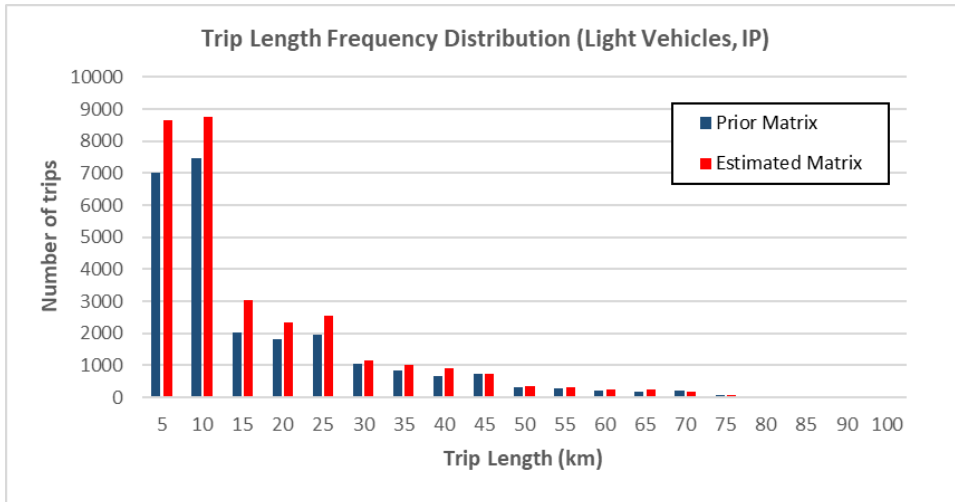


Figure 4-3: N21 TLF D Light Vehicles (PM)

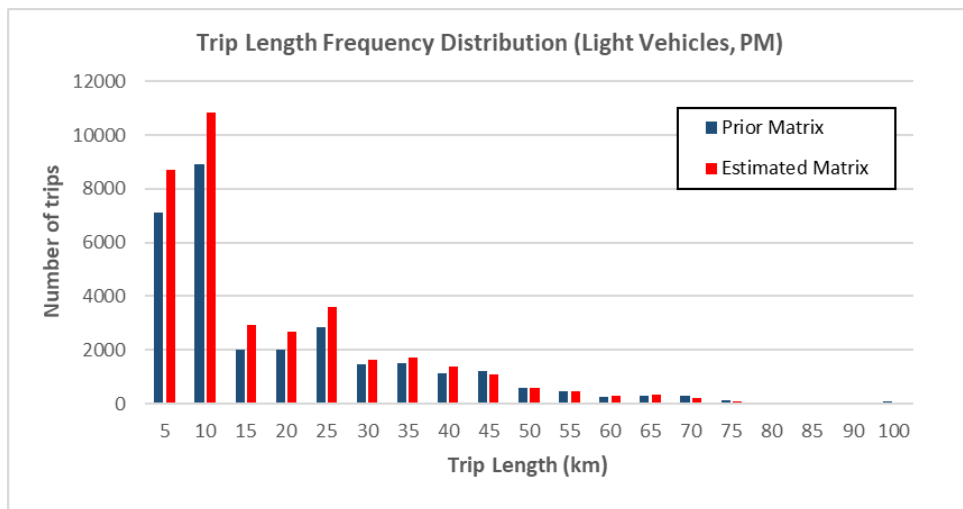


Figure 4-4: N21 TLF D Heavy Vehicles (AM)

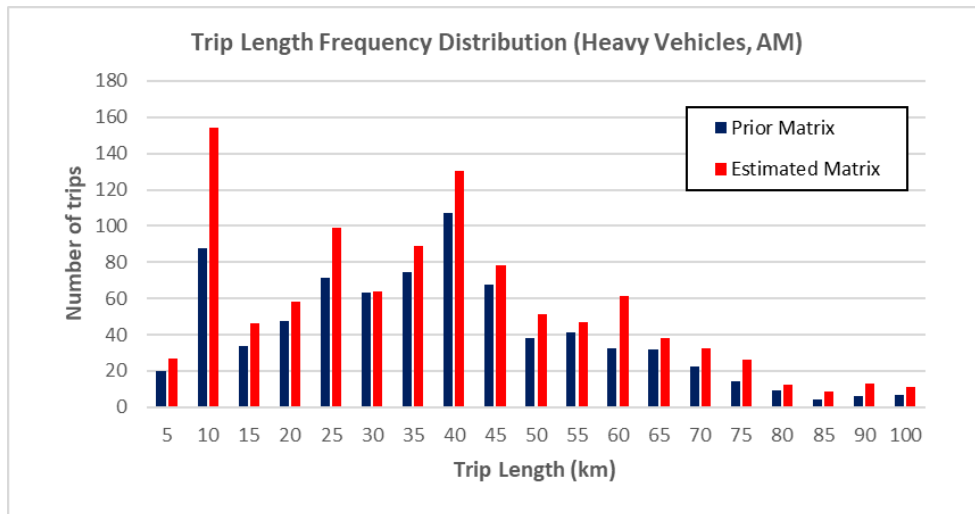


Figure 4-5: N21 TLF D Heavy Vehicles (IP)

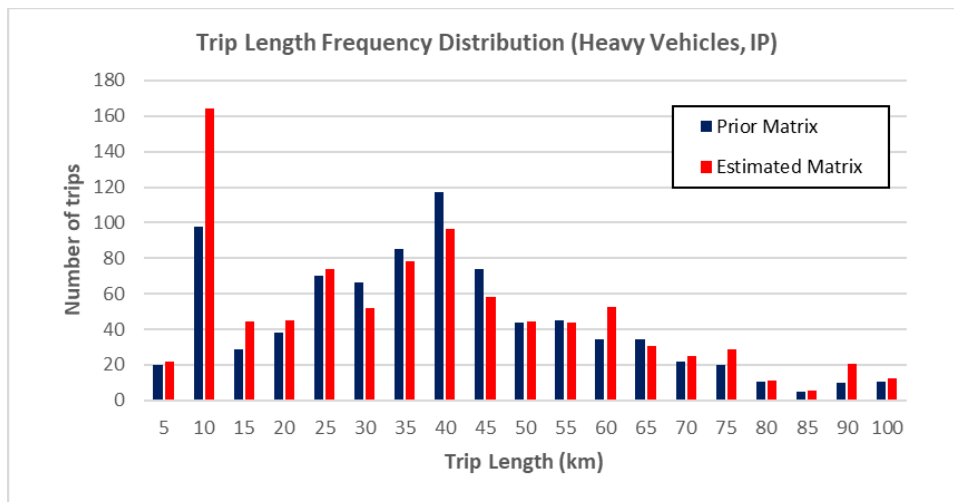
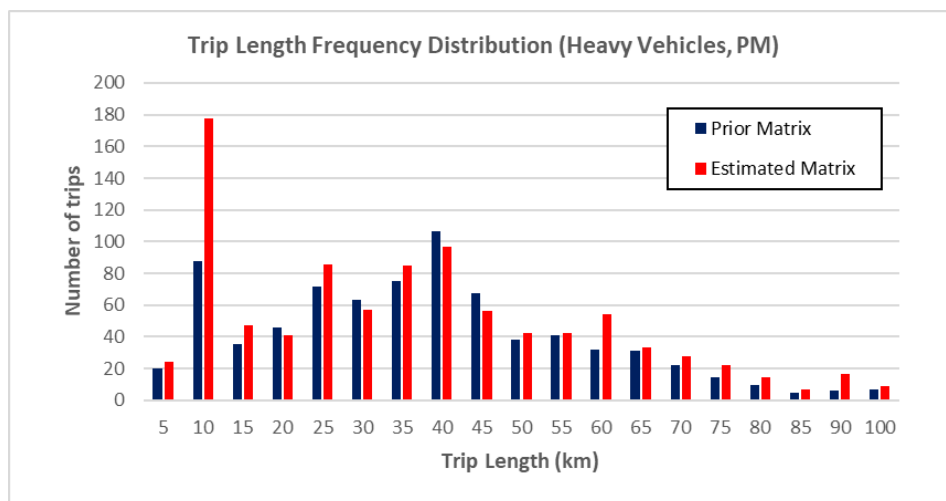


Figure 4-6: N21 TLF D Heavy Vehicles (PM)

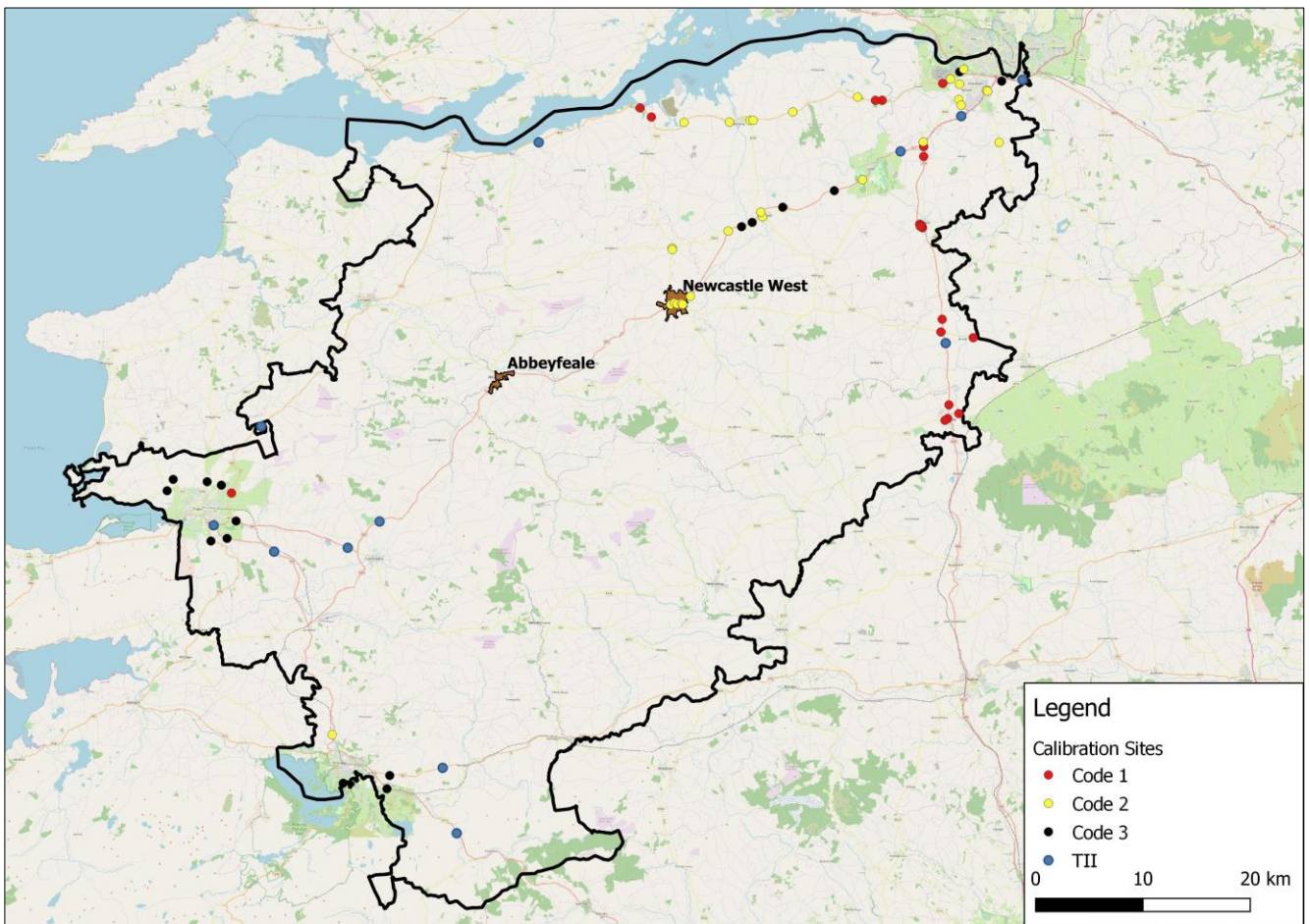


4.3 Model Calibration

The purpose of the model calibration is to ensure that the model assignments and outcomes reflect the existing traffic conditions as realistically as possible. It is an iterative process, whereby the model is continually revised to achieve the most accurate replication of the base year conditions. The model calibration is undertaken using the peak hour traffic counts.

As per TII PAG Unit 5.1 – Construction of Transport Models (October 2016), Calibration is a process of estimation of the parameters of a chosen model by fitting to observations. **Figure 4-7** presents the location of the calibration counts (75 sites in total which is 268 links in the transport model).

Figure 4-7:N21 Location of calibration counts



4.3.1 Calibration criteria

TII PAG Unit 5.1 provides the criteria and associated acceptability guidelines to be used in model calibration. It also suggests how calibration should relate to the magnitude of the values being compared. **Table 4-2** below presents the acceptable calibration criteria. Results are expected to be presented for each user class and time period.

Table 4-2: Model calibration criteria as per TII PAG Unit 5.1

Criteria and Measures		Acceptability Guideline
Assigned Hourly flows compared to observed flows		
1	Individual flows within 100v/h for flows less than 700 v/h	More than 85% of cases
2	Individual flows within 15% for flows between 700 and 2,700 v/h	
3	Individual flows within 400v/h for flows greater than 2,700 v/h	
4	GEH statistic: Individual flows – GEH<5	More than 85% of cases
Modelled journey times compared with observed times		
5	Times within 15% or 1 minute if higher	More than 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 flows and O = Observed flows

4.4 Calibration results

The traffic count data used in the model calibration was distinctly divided into two separate batches:

- Individual calibration counts; and
- Individual validation counts.

4.4.1 Individual Calibration Counts

The Automatic Traffic Counter (ATC) data was used directly as mid-block counts, but Junction Turning Count (JTC) data was also converted to individual mid-block count data due to several incidences of zero tuning movements and issues encountered in Matrix Estimation. Individual calibration count data was also used in the Matrix Estimation. In total, data on 268 links was used for individual calibration and data on 16 links was used for individual validation.

Figure 4-8 and **Table 4-3** present a summary of the individual calibration count data links that satisfy the validation criteria specified in PAG Unit 5.1 and **Table 4-2**. Both user classes of Light and Heavy vehicle satisfy the criterion of volume in all peak periods.

There are links where the GEH statistic exceeds a value of ten for light vehicles in the AM, IP and PM time periods and heavy vehicles in the inter-peak period. With reference to light vehicle comparisons, there are eight instances, from the 268 targets, where the GEH statistic is greater than ten in the AM period. There are seven instances where the GEH statistic is greater than ten in both the interpeak and PM periods. With regards heavy vehicles, there is only one instance where the GEH exceeds ten, which occurs in the interpeak period. Only one link with GEH greater than ten (LV) is located near the proposed N21 schemes – in Newcastle West. The rest of them (including links with GEH>20 – see Appendix C Summary of all individual calibration counts) are near Limerick, remote from the proposed N21 schemes.

A detailed summary of all individual calibration counts is presented in Appendix C Summary of all individual calibration counts.

Figure 4-8: N21 Summary of results for Individual calibration counts (Lights and Heavies in AM, IP and PM)

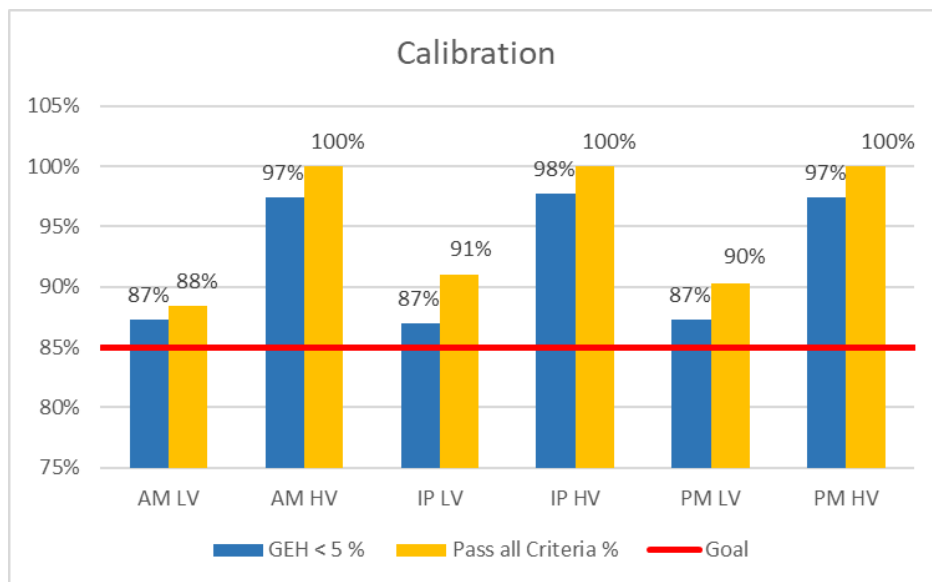


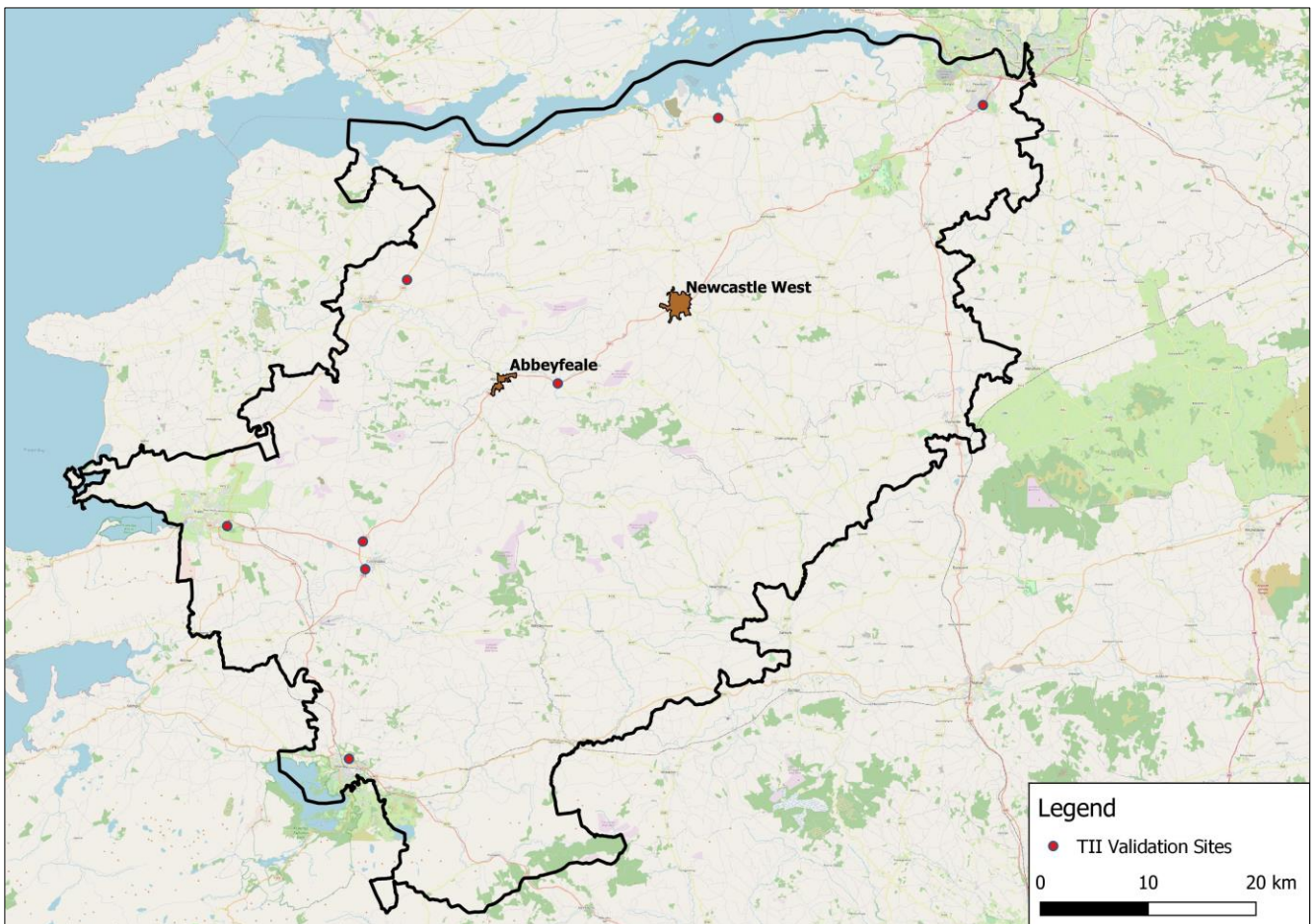
Table 4-3: Summary of results for Individual calibration counts (Lights and Heavies in AM, IP and PM)

Time Period	User Class	Total Links	Links satisfying Volume criterion	Percentage of Links satisfying Volume criterion	Links satisfying GEH criterion	Percentage of Links satisfying GEH criterion	Links satisfying either volume or GEH criterion	Percentage of Links satisfying either volume or GEH criterion
AM	LV	268	237	88%	234	87%	237	88%
	HV	268	268	100%	261	97%	268	100%
IP	LV	268	244	91%	233	87%	244	91%
	HV	268	268	100%	262	98%	268	100%
PM	LV	268	242	90%	234	87%	242	90%
	HV	268	268	100%	261	97%	268	100%

4.5 Model Validation

Model validation is a process to cross check the outcomes from the calibrated model with an independent dataset. The validation process included comparisons of individual link flows and journey route times in the peak time periods. The traffic count data used for validation was selected from the permanent TII TMU counters, giving due attention to the geographical distribution. **Figure 4-9** presents the location of validation counts (eight sites in total which is 16 links in the transport model).

Figure 4-9: Location of validation counts



4.5.1 Validation criteria

TII PAG Unit 5.1 provides the criteria and associated acceptability guidelines to be used in model validation. It also suggests how validation should relate to the magnitude of the values being compared. **Table 4-4** presents the acceptable validation criteria. Results are expected to be presented for each user class and time period.

Table 4-4: Model validation criteria as per TII PAG Unit 5.1

Criteria and Measures		Acceptability Guideline
Assigned Hourly flows compared to observed flows		
1	Individual flows within 100v/h for flows less than 700 v/h	More than 85% of cases
2	Individual flows within 15% for flows between 700 and 2,700 v/h	
3	Individual flows within 400v/h for flows greater than 2,700 v/h	
4	GEH statistic: Individual flows – GEH<5	More than 85% of cases

Criteria and Measures		Acceptability Guideline
Modelled journey times compared with observed times		
5	Times within 15% or 1 minute if higher	More than 85% of cases

4.5.2 Individual Validation counts

Figure 4-10 and Table 4-5 present a summary of the individual validation count data links that satisfy the validation criteria specified in PAG Unit 5.1 and Table 4-4. Both user classes of Light and Heavy vehicle satisfy the volume criterion (minimum of 85% of cases) in all peak periods. Table 4-5 also shows links satisfying either of the two elements for both user classes in all peak periods.

Validation counts that do not meet the GEH statistic criteria (GEH<5) do not exceed a value of 10. The maximum GEH value is 6.11 (IP LV).

A detailed summary of all individual validation counts is presented in Appendix D Summary of all individual validation counts

Figure 4-10: Summary of results for Individual validation counts (Lights and Heavies in AM, IP and PM)

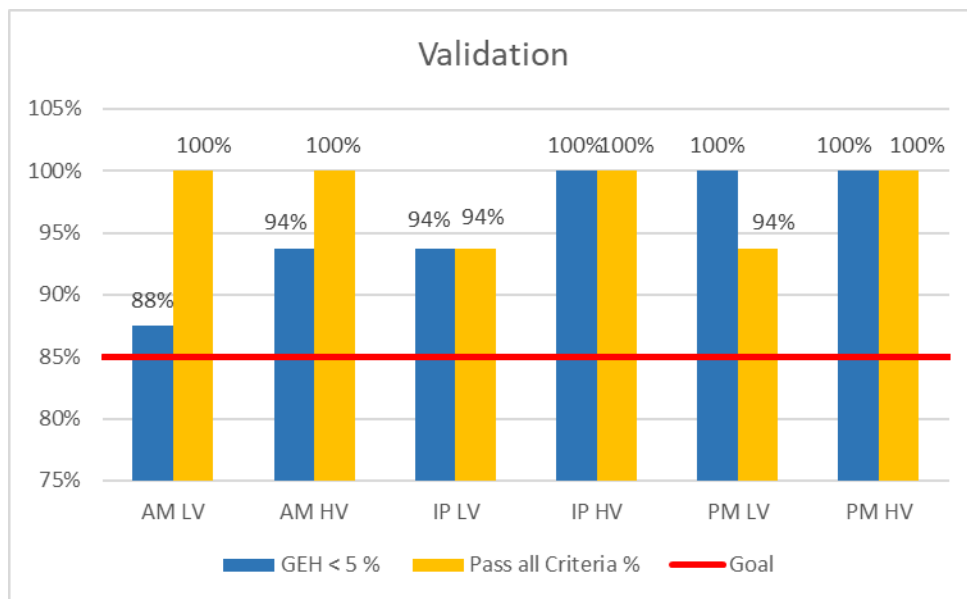


Table 4-5: Summary of results for Individual validation counts (Lights and Heavies in AM, IP and PM)

Time Period	User Class	Total Links	Links satisfying Volume criterion	Percentage of Links satisfying Volume criterion	Links satisfying GEH criterion	Percentage of Links satisfying GEH criterion	Links satisfying either volume or GEH criterion	Percentage of Links satisfying either volume or GEH criterion
AM	LV	16	16	100%	14	88%	16	100%
	HV	16	16	100%	15	94%	16	100%
IP	LV	16	15	94%	15	94%	15	94%
	HV	16	16	100%	16	100%	16	100%
PM	LV	16	15	94%	16	100%	16	100%
	HV	16	16	100%	16	100%	16	100%

4.5.3 Journey time validation

Much of the economic benefits of a road improvement scheme are derived from travel time savings. It is therefore important that the traffic model accurately reflects the speed and journey times observed in the real world. The observed journey time on the network links is also important for network validation, so that the traffic assignments reflect drivers' route choices.

The observed journey times for this study have been gathered through TomTom data that was collected in the period between 2/04/2019 and 28/11/2019. An average journey time for each peak period that was derived from only neutral days (Tuesday, Wednesday and Thursday) excluding events and holidays, was used in the journey time validation. **Figure 4-11** below presents the location of journey time routes.

Quality checks were performed on the TomTom data by comparing it with Google Maps data to identify any significant differences and this confirmed good compatibility (the difference doesn't exceed 20%). Only four cases were observed where the difference exceeded 20%:

- Route 7: Charleville to Newmarket (westbound direction) – AM peak;
- Route 8: Listowel to Abbeyfeale (southeastbound direction) – AM peak;
- Route 6: Adare to Croagh (westbound direction) – PM peak; and
- Route 9: Newcastle West to Foynes (northbound direction) – PM peak.

Route 7 is located at the edge of the modelled area and its impact on the N21 scheme appraisal is unlikely to be significant. Route 8 and Route 9 are routes to Abbeyfeale and Newcastle West and modelled travel times are close to the ones provided by Google Maps, even if they differ from the TomTom data. The same applies to Route 6. This may suggest significant variation in journey times during the modelled period and it was decided to use the data.

The results of the journey time validation for the AM, IP and PM peak periods are presented in Table 4-7 to Table 4-9 and Figure 4-12 to Figure 4-13, respectively. A summary of cases satisfying the criteria specified in Table 4-4 is presented in Table 4-6. Overall, Journey Times satisfy the PAG criteria in all three peak periods. (at least 85% of cases).

There are some routes that differ more 15% or 1 minute if higher. These are:

- Route 1: Castleisland to Tralee (westbound direction);
- Route 2: Castleisland to Farranfore (southbound direction);
- Route 6: Adare to Croagh (westbound direction);
- Route 7: Charleville to Newmarket (westbound direction);
- Route 8: Listowel to Abbeyfeale (southeastbound direction); and
- Route 9: Newcastle West to Foynes (northbound direction).

Two of these routes (Route 8 and 9) are related to the Abbeyfeale and Newcastle Road Schemes but the difference may result from significant variation in journey times during the modelled period based on the comparison with Google Maps data. Other routes are not located in the direct vicinity of proposed schemes.

Table 4-6: Percentage of cases satisfying criteria under Table 4.4

Criteria and Measure	Percentage AM	Percentage IP	Percentage PM
Times within 15% or 1 minute if higher	85%	90%	85%

Figure 4-11: Map showing journey time routes

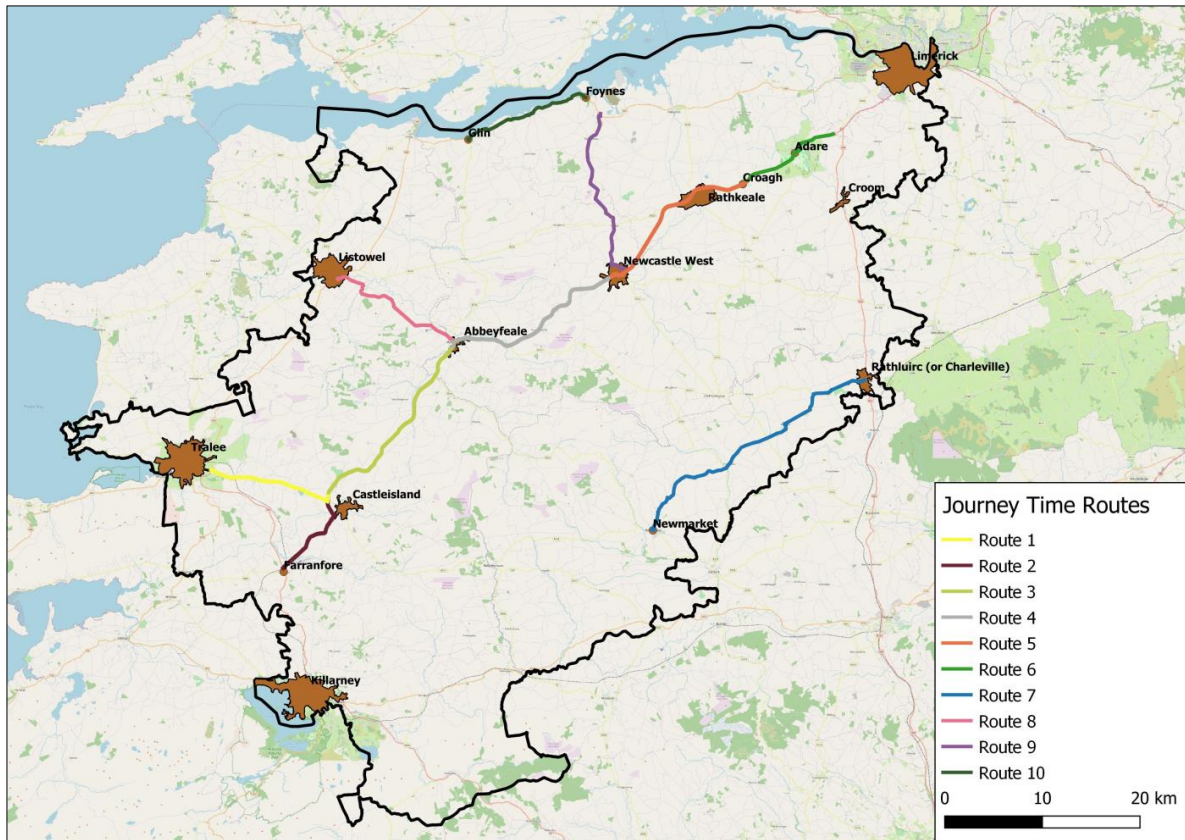


Table 4-7: Results for Journey Time Routes in the AM time period

Journey Route	Direction	Observed Journey Time (mm:ss)	Modelled Journey Time (mm:ss)	Difference (%)	Meets the Criteria (Yes/No)
1	Castleisland-Tralee	10:35	08:30	19.7%	No
1	Tralee-Castleisland	09:01	08:37	4.5%	Yes
2	Farranfore-Castleisland	08:07	07:10	11.7%	Yes
2	Castleisland-Farranfore	08:04	07:08	11.6%	Yes
3	Abbeyfeale-Castleisland	15:14	14:45	3.2%	Yes
3	Castleisland-Abbeyfeale	15:09	14:47	2.4%	Yes
4	Newcastle West-Abbeyfeale	17:57	17:27	2.8%	Yes
4	Abbeyfeale-Newcastle West	18:18	17:41	3.3%	Yes
5	Rathkeale-Newcastle West	18:32	15:46	14.9%	Yes
5	Newcastle West-Rathkeale	16:43	16:23	2.0%	Yes
6	Adare-Croagh	10:35	11:42	10.5%	Yes
6	Croagh-Adare	12:50	13:45	7.2%	Yes

Journey Route	Direction	Observed Journey Time (mm:ss)	Modelled Journey Time (mm:ss)	Difference (%)	Meets the Criteria (Yes/No)
7	Charleville-Newmarket	42:41	28:09	34.1%	No
7	Newmarket-Charleville	29:49	30:15	1.4%	Yes
8	Listowel-Abbeyfeale	20:47	14:11	31.8%	No
8	Abbeyfeale-Listowel	15:24	14:02	8.9%	Yes
9	Newcastle West-Foynes	22:04	19:11	13.0%	Yes
9	Foynes-Newcastle West	20:49	19:32	6.1%	Yes
10	Foynes-Glin	11:58	11:32	3.6%	Yes
10	Glin-Foynes	10:44	11:49	10.1%	Yes

Figure 4-12: Journey time comparison across routes in the AM peak

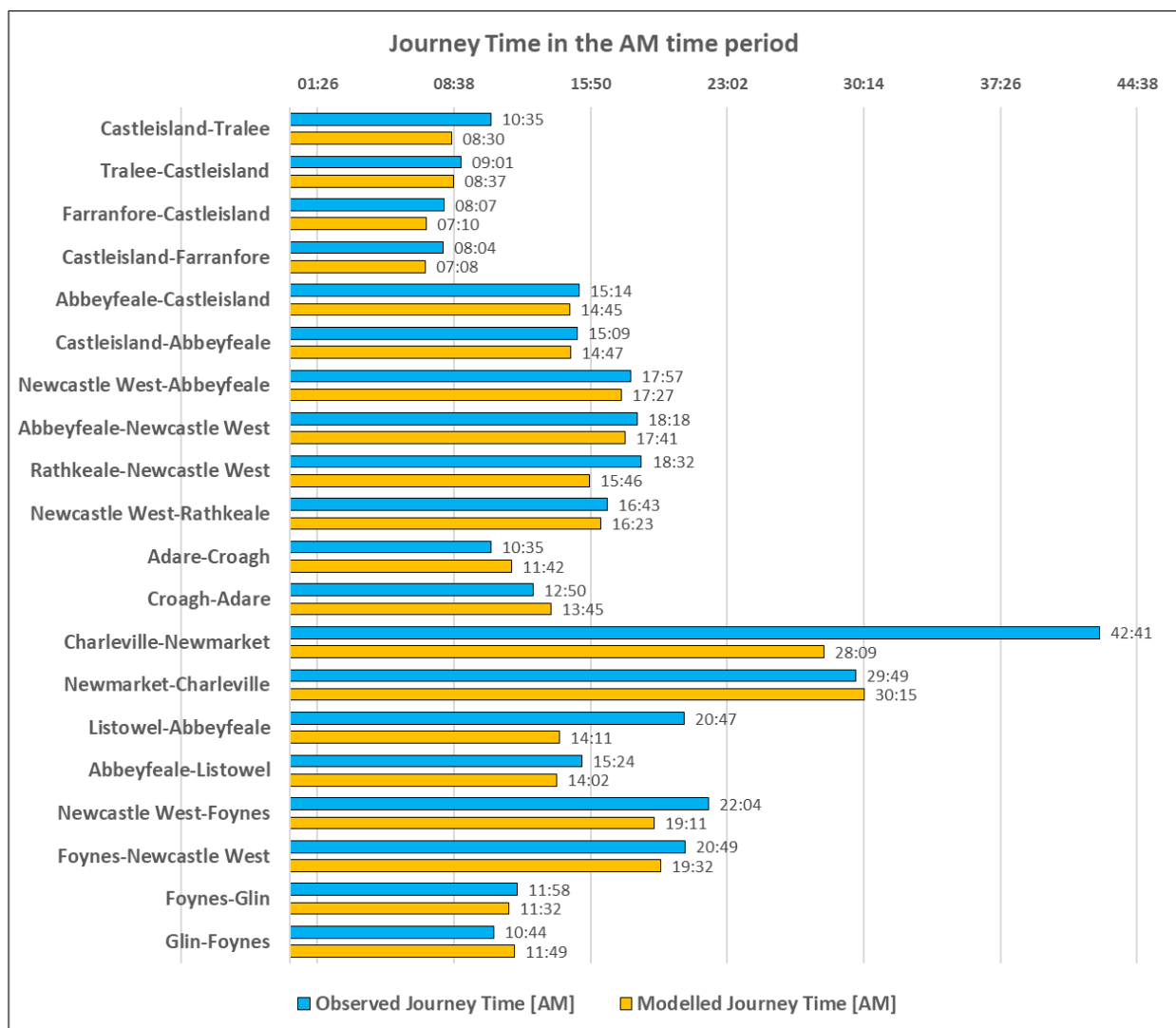


Table 4-8: Results for Journey Time Routes in the IP time period

Journey Route	Direction	Observed Journey Time (mm:ss)	Modelled Journey Time (mm:ss)	Difference (%)	Meets the Criteria (Yes/No)
1	Castleisland-Tralee	09:22	08:18	11.4%	Yes
1	Tralee-Castleisland	09:13	08:21	9.3%	Yes
2	Farranfore-Castleisland	08:15	07:06	13.9%	Yes
2	Castleisland-Farranfore	08:32	07:09	16.2%	No
3	Abbeyfeale-Castleisland	15:36	14:39	6.0%	Yes
3	Castleisland-Abbeyfeale	15:24	14:47	4.1%	Yes
4	Newcastle West-Abbeyfeale	18:36	17:14	7.4%	Yes
4	Abbeyfeale-Newcastle West	18:40	17:32	6.1%	Yes
5	Rathkeale-Newcastle West	17:13	15:28	10.1%	Yes
5	Newcastle West-Rathkeale	16:39	15:42	5.7%	Yes
6	Adare-Croagh	12:14	11:21	7.2%	Yes
6	Croagh-Adare	12:15	11:21	7.4%	Yes
7	Charleville-Newmarket	31:10	28:18	9.2%	Yes
7	Newmarket-Charleville	30:56	28:24	8.2%	Yes
8	Listowel-Abbeyfeale	16:51	14:04	16.5%	No
8	Abbeyfeale-Listowel	16:17	14:05	13.5%	Yes
9	Newcastle West-Foynes	21:12	19:14	9.3%	Yes
9	Foynes-Newcastle West	22:33	19:15	14.7%	Yes
10	Foynes-Glin	12:15	11:32	5.9%	Yes
10	Glin-Foynes	12:28	11:33	7.4%	Yes

Figure 4-13: Journey time comparison across routes in the IP peak

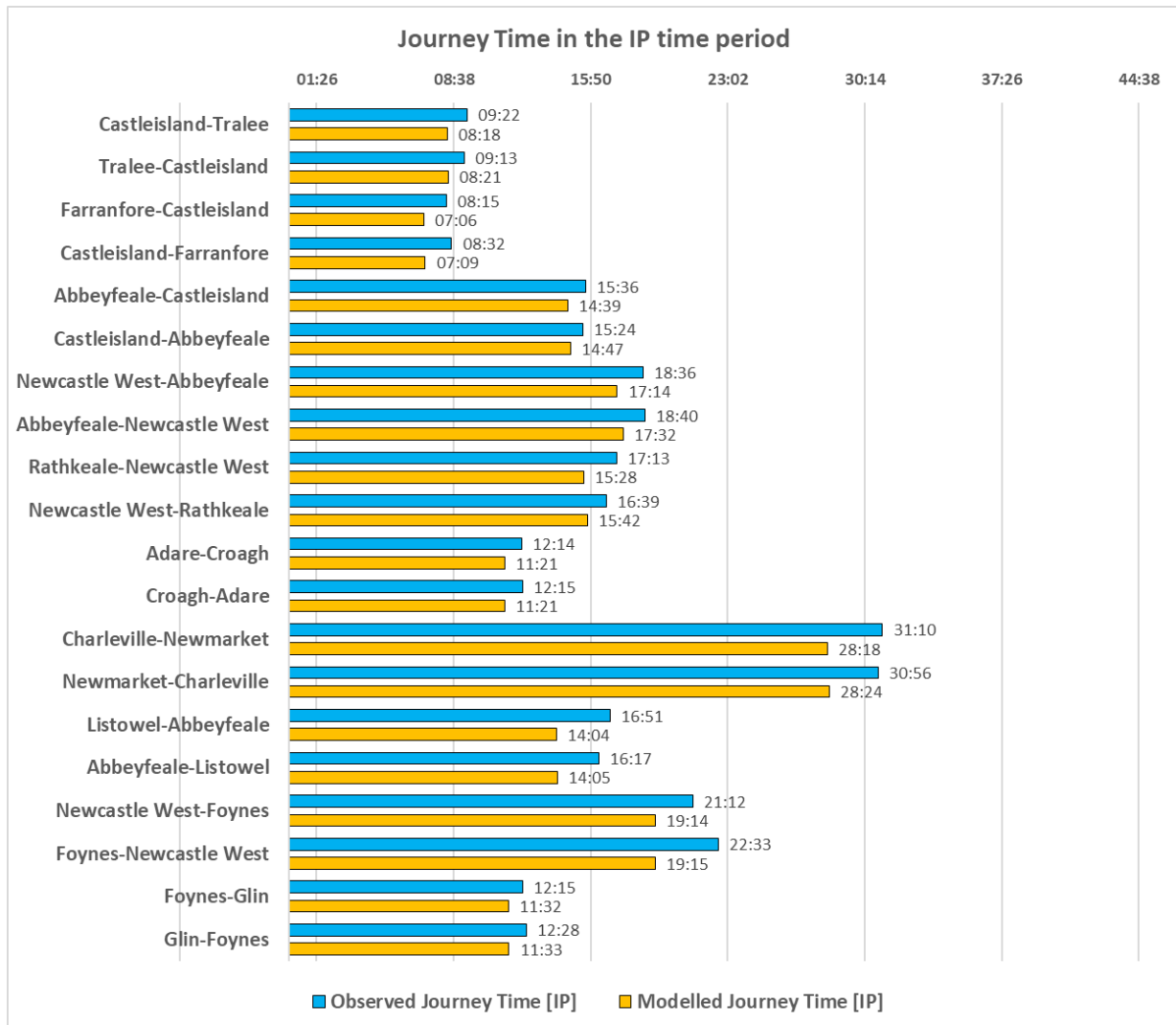
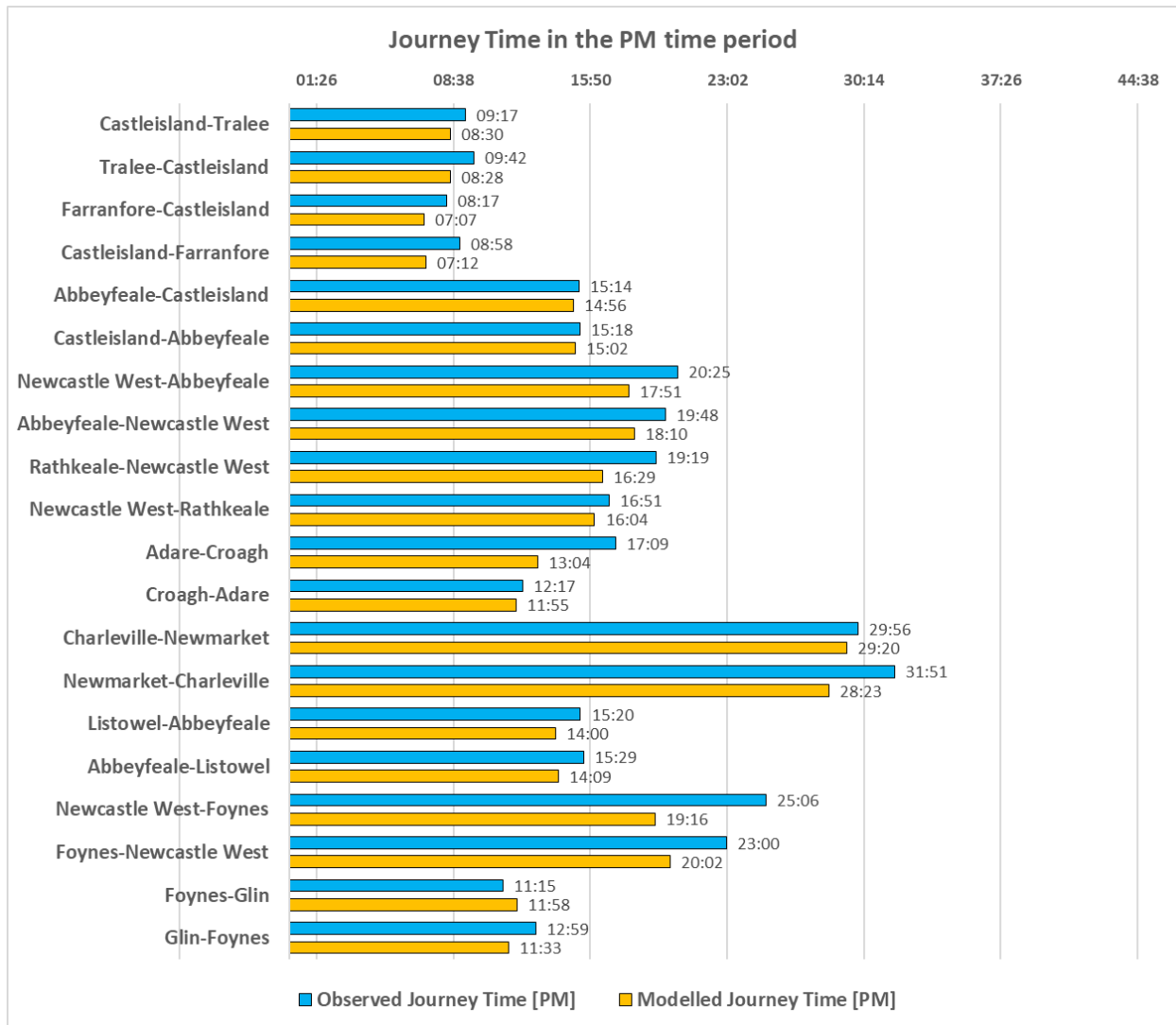


Table 4-9: Results for Journey Time Routes in the PM time period

Journey Route	Direction	Observed Journey Time (mm:ss)	Modelled Journey Time (mm:ss)	Difference (%)	Meets the Criteria (Yes/No)
1	Castleisland-Tralee	09:17	08:30	8.5%	Yes
1	Tralee-Castleisland	09:42	08:28	12.7%	Yes
2	Farranfore-Castleisland	08:17	07:07	14.1%	Yes
2	Castleisland-Farranfore	08:58	07:12	19.7%	No
3	Abbeyfeale-Castleisland	15:14	14:56	2.0%	Yes
3	Castleisland-Abbeyfeale	15:18	15:02	1.7%	Yes
4	Newcastle West-Abbeyfeale	20:25	17:51	12.6%	Yes

Journey Route	Direction	Observed Journey Time (mm:ss)	Modelled Journey Time (mm:ss)	Difference (%)	Meets the Criteria (Yes/No)
4	Abbeyfeale-Newcastle West	19:48	18:10	8.2%	Yes
5	Rathkeale-Newcastle West	19:19	16:29	14.7%	Yes
5	Newcastle West-Rathkeale	16:51	16:04	4.6%	Yes
6	Adare-Croagh	17:09	13:04	23.8%	No
6	Croagh-Adare	12:17	11:55	3.0%	Yes
7	Charleville-Newmarket	29:56	29:20	2.0%	Yes
7	Newmarket-Charleville	31:51	28:23	10.9%	Yes
8	Listowel-Abbeyfeale	15:20	14:00	8.6%	Yes
8	Abbeyfeale-Listowel	15:29	14:09	8.6%	Yes
9	Newcastle West-Foynes	25:06	19:16	23.2%	No
9	Foynes-Newcastle West	23:00	20:02	12.9%	Yes
10	Foynes-Glin	11:15	11:58	6.4%	Yes
10	Glin-Foynes	12:59	11:33	11.1%	Yes

Figure 4-14: Journey time comparison across routes in the PM peak



4.6 Model Convergence

The model assignment procedure requires each model to reach equilibrium through an iterative process. The model is therefore expected to achieve satisfactory convergence to produce results that are representative of the network after several repetitive steps.

The convergence criteria from PAG Unit 5.1 is shown in **Table 4-10** and summary of the model convergence is presented in **Table 4-11** below.

Table 4-10: Convergence measures and acceptability values as per PAG Unit 5.1

Measure of Convergence	Base Model Acceptability Guideline values
Delta and %GAP	<0.1% or at least stable with convergence fully documented and all other criteria met
% of links with flow change (P) <1%	Four consecutive iterations >98%
% of links with cost change (P2) <1%	Four consecutive iterations >98%

VISUM runs eight iterations and GAP Values along with data for P and P2 (flows and costs) are only calculated for iterations six, seven and eight. The calculated P and P2 value results are as follows:

Table 4-11: Summary of Iterations and %Gap in model convergence

User class & Time Period	Iterations	% Gap	Convergence Criteria met (Yes/No)
LV_AM	8	5.63E-06	Yes
HV_AM	8	3.11E-06	Yes
LV_IP	8	3.57E-06	Yes
HV_IP	8	1.53E-06	Yes
LV_PM	8	6.49E-06	Yes
HV_PM	8	3.05E-06	Yes

4.7 Post Appraisal Validation check

As already discussed in Section 2.3, the COVID pandemic that started in Ireland in March 2020 prohibited the collection of the data originally envisaged. The consequence of this is that construction of the base year traffic model was dependent wholly on the availability of existing data that had been collected prior to the start of the pandemic. Figure 2-3 in Section 2.4 shows all the data sites that were available for the construction of the base year traffic model. Figure 4-7 in Section 4.3 highlights the pre-existing data that was used to calibrate the base year traffic model, while Figure 4-9 in Section 4.5 highlights the pre-existing data that was used to validate the base year traffic model.

The purpose of the model calibration and model validation processes is to demonstrate that the traffic model replicates the observed data to a reasonable level of accuracy at most locations. The results of the model calibration exercise set out in Section 4.4 indicates that the base year traffic model provides a good representation of existing traffic levels in the vicinity of the observed data shown in Figure 4-7. However, it should be noted that there are no calibration targets in the vicinity of Abbeyfeale and few calibration targets in the vicinity of Newcastle West. Similarly, the results of the model validation exercise set out in Section 4.5 indicates that the base year traffic model provides a good representation of existing traffic levels in the vicinity of the observed data shown in Figure 4-9. However, it should be noted that with the exception of the validation count on the N21 between Abbeyfeale and Newcastle West, much of the validation data is remote from the location of the two road schemes that the model has been built to appraise.

The lack of calibration and validation targets around Abbeyfeale and Newcastle West does not mean that modelled traffic flows around these settlements are an inaccurate representation of traffic flows in 2019, but because no comparison has been undertaken with observed data there is greater uncertainty as to the robustness of the traffic model in the vicinity of these two settlements. Therefore, there is greater uncertainty in relation to the quantification of benefits and the potential impacts of road schemes in the vicinity of these two settlements.

To provide some additional reassurance that the base year traffic model is a reasonable tool for the appraisal of the proposed N21 Abbeyfeale Road Scheme and the proposed N21 Newcastle West Road Scheme, it was decided to collect some additional traffic data in April 2021, as schools reopened on 12th April and residents were allowed travel within their county. TII's network of TMUs still indicated significantly lower traffic volumes across the National Road network, however.

It was anticipated that the level of traffic observed in April 2021 would generally be lower than was represented in the base year traffic model, because across the National Road network, traffic levels had not returned to the volumes observed before the pandemic started. A comparison of AADT levels in 2019 and 2021 at 21 TMU sites located within the modelled area showed that traffic in 2019 was 36% higher on average than that observed in April 2021.

On the N21 at Abbeyfeale, the April 2021 observed Light Vehicle traffic flows were consistently higher than represented in the 2019 base model: in both directions and in all time periods. This implies that either the base year traffic model underestimated the volume of traffic passing through Abbeyfeale, due to the lack of observed data collected at this location prior to the pandemic, or that travel patterns in April 2021 differed from those prior to the pandemic, with road users making more short distance trips and fewer longer distance trips. That is, in April 2021, the traffic movements were reflective of the longer distance travel restrictions that were still in place. Given the uncertainty with regards the accuracy of the observed data, it was not considered appropriate to adopt the formal PAG criteria in relation to this post appraisal validation check.

If the base year traffic model underrepresents the volume of traffic on the N21 through Abbeyfeale, then the traffic model will tend to underrepresent delays within Abbeyfeale and therefore underrepresent the economic benefits that may arise from diverting traffic from Abbeyfeale. However, this underrepresentation of benefits would apply to all route options and therefore would not materially alter the outcome of the option selection process.

Similarly, any underrepresentation of traffic on the existing N21 would likely result in the volume of traffic diverting from the N21 being understated and therefore the potential impact of any scheme being understated. However, as with the quantification of economic benefits, this underrepresentation of traffic would apply to all options and therefore is not anticipated to materially alter the outcome of the option selection process.

Looking at the comparison on the regional roads, the observed April 2021 data was both higher and lower than the 2019 representation in the base year traffic model. The observed April 2021 data was higher than the 2019 representation in the base year model both at the N21 / R524 junction in the centre of Abbeyfeale and along the R555 towards Listowel. Along the R524, there was greater similarity between the April 2021 traffic data and the 2019 base traffic model, with the observed data being lower than modelled in the AM and IP time periods, but higher in the PM. Given the pattern observed at the TII TMU sites across the region, the modelled representation of the R524 appears to be good.

The traffic volumes observed on the local roads in April 2021 are generally slightly less than the modelled traffic flows on the equivalent links in the base model, which is in line with expectations and given the low levels of traffic on these routes, their representation is considered satisfactory.

Looking at the Heavy Vehicle flows there was strong similarity between the April 2021 observed data and the 2019 modelled flows on the N21, which is in line with expectations. At most TII TMU sites, although the pandemic had reduced the volume of cars on the national road network, freight movements remained broadly consistent between 2019 and 2021. The number of heavy vehicles on other roads in the vicinity of Abbeyfeale was low in both the traffic model and the observed dataset. As such, the representation of heavy vehicles in the Abbeyfeale area in the traffic model is considered very good.

The absolute differences between observed and modelled flows were often small and therefore generally acceptable based on the low GEH values (except JTC Site 1).

In general, it may be concluded that the traffic model is potentially underrepresenting light vehicle traffic in the vicinity of Abbeyfeale, particularly on the N21 and the R555 (which may be due to the lack of historical traffic counts for use in model calibration), but that there is also uncertainty with regards how representative the April 2021 data is of past traffic levels. Irrespective of the reasons for the differences between the observed and modelled traffic flows, the traffic model is still considered suitable for the option selection process.

To the northeast of Newcastle West, the light vehicle observed data collected in April 2021 was between 14% and 34% less than the modelled flows in the 2019 base year traffic model. This is in line with expectations when the April 2021 data was collected, as TII's network of TMU sites indicated that traffic flows in 2019 were typically 36% higher than they were in April 2021. This therefore implies that the volume of traffic represented in the 2019 base model to the east of Newcastle West is likely to be reasonably accurate, despite the limited historic data available during model calibration. To the southwest of Newcastle West, the light vehicle observed data collected in April

2021 is slightly greater than the modelled flows in the 2019 base year traffic model in the southbound direction, but slightly lower than modelled in the northbound direction.

This therefore implies that the modelled traffic flows on the N21 through Newcastle West are likely to be a reasonably accurate representation of traffic levels in 2019 and although there is the potential for some trips on the N21 to be underrepresented, this is unlikely to have a material impact on option selection or the forecasting of the number of vehicles that may use any bypass option.

On the regional roads, there was no consistent pattern when comparing the April 2021 data with the 2019 base year model. In some locations and some time periods, the observed data was higher than is represented in the base year model and at other locations and time periods the reverse is true. Consequently, in the vicinity of Newcastle West, the traffic model may be underrepresenting some trips in some periods, but the modelled traffic levels may be closer to the traffic conditions of 2019 than appears to be the case at Abbeyfeale.

Although the differences in percentage were significant for some cases, the absolute differences were often small and therefore generally acceptable to confirm GEH values.

4.8 Model Calibration and Validation Summary and Conclusions

Despite the implications of the Covid-19 pandemic, a significant amount of existing traffic data was available that had been collected prior to the pandemic and this was used for model calibration and validation. Using the available data collected prior to 2020, the traffic model is calibrated and validated to an acceptable standard and is considered fit for the purpose of option selection. Wide area route choice and journey times are robust, which means the traffic model is a good tool for assessing the strategic implications of the route.

However, the post appraisal validation check that was undertaken using data collected in April 2021 indicates that the traffic model may underrepresent traffic flows on the N21, particularly through Abbeyfeale, and there is a lack of certainty as to what traffic volumes may have used the local roads in the vicinity of Newcastle West and Abbeyfeale. This means that there will be a need to conduct additional traffic surveys once traffic flows are considered closer to "normal". The traffic model can then be adjusted, as required, to ensure that it is an appropriate tool for detailed appraisal and accurately reflects local traffic conditions in both Abbeyfeale and Newcastle West.

5. Future Year Model Development

5.1 Introduction

This section of the report covers the development of future year traffic models for the proposed scheme Opening Year (OY) of 2027, Design Year (DY) of 2042 and Forecast Year (FY) of 2057. The future year models assume that no changes in the network will happen except for schemes identified under the definition of the Do-Minimum in Section 5.4.1. The future year matrices are developed by using zone-based growth factors.

5.2 Future Year Matrix Development

5.2.1 Overview

The development of travel demand matrices for OY, DY and FY is based on the methodology specified in PAG Unit 5.3 – Travel Demand Projections (May 2019). This Unit provides guidance on the preparation of future travel demand projections, primarily for national road scheme modelling and appraisal but is equally applicable to regional and local roads. The PAG sets out the criteria for using the Zonal Growth Rates forecasting methodology when using traffic assignment models. This methodology was specified in the Project Appraisal Plan (PAP) and Traffic Modelling Plan (TMP) and has been used successfully in deriving future growth.

The future year forecast growth in the LAM matrices is derived from the NTpM. The growth for Light and Heavy vehicles in the NTpM is based on different economic and demographic projections. The growth in light vehicles has been derived from demographic data such as population, employment and car ownership, whereas growth in heavy vehicles is based on the projected increase in the size of the national goods vehicle fleet, which in turn is related to forecast increases in Gross Domestic Product (GDP).

It should be noted that the Travel Demand Projections set out in PAG Unit 5.3 and used for the appraisal of this scheme do not take account of the United Kingdom's departure from the European Union on 31 January 2020 and the departure of the UK from the EU Single Market at the end of the transition period set out in the Withdrawal Agreement on 31 December 2020.

Furthermore, these forecasts were prepared before the emergence of COVID-19, which was declared a global pandemic by the World Health Organization in March 2020. This resulted in most countries, including Ireland, to impose restrictions on the mobility of citizens, which has resulted in reduced levels of traffic on all roads across Ireland, including on the N21, during 2020 and 2021. It is assumed that traffic levels will gradually return to previous levels over the coming months or years.

For the purposes of this comparative Phase 2 assessment, the potential impacts of both Brexit and Covid-19 have been ignored, as these events would impact all N21 schemes including the Do Minimum Option. Sensitivity testing with alternative traffic growth scenarios will be undertaken at Phase 3 when the impacts of both Brexit and COVID-19 may be better understood.

In July 2021, TII published an Alternative Future Demand Scenario, which has been included as an Appendix to PAG Unit 5.3. This scenario considers the potential changes in travel demand that may arise if most of the workers who can work from home (estimated to be around one fifth of the workforce) continue to do so for part of the week under a hybrid work pattern. For this scenario, it has been assumed that full-time office workers will, on average, typically spend three days in the office and two days working from home. This assumption would equate to a decrease in commuter demand of around eight per cent across all modes. At Phase 3, PAG Unit 5.3 requires that a Low Growth Sensitivity test and a High Growth Sensitivity test are undertaken and the TII Alternative Future Demand Scenario will also be used to assess the potential impact of the Preferred Option during the Phase 3 work.

The calibrated base year 2019 matrices (see Section 3.6.2) were used for forecasting the 2027, 2042 and 2057 level demand using TII zone-based growth factors that were applied to trip ends and later converted back to 181-zone square matrices. The future matrices were produced using 'Central' scenario growth rates for years 2016-

2030, 2030-2040 and 2040-2050. These growth rates were applied to the row and column totals of the 2019-year trip matrix to produce target trip ends for 2027, 2042 and 2057-year matrices.

The cordoned NTpM had two special zones representing Kerry Airport (zone 4451) and Foynes port (zone 515). The zonal growth factors for these two special zones were not available through published TII growth factors. For the special zone representing Foynes Port, growth factors were based on AADT projections from the study: 'Foynes to Limerick Road Scheme (including Adare Bypass): Phase 3 – Traffic Modelling Report.' Prepared by Roughan & Donovan and AECOM for Limerick City and County Council. In the case of Kerry Airport, a Link-Based Growth Rate was used. That method means that traffic growth is projected using growth rates which describe likely traffic growth that may occur over the appraisal period of the scheme.

5.2.2 Internal Zone Trip End Growth

The internal LAM zones are created from larger NTpM zones and therefore a direct and complete relationship exists between them. This relationship has been used to apply the NTpM zonal growth at both origin and destination level to LAM zones. The growth rate was annualised and applied by time period and user class for each of the forecast years.

5.2.3 External Zone Trip End Growth

The LAM study area boundary was cordoned from the NTpM future year years (2030, 2040 and 2050) and compared against the base year of 2016. As a result, a growth factor for each external zone was identified and annualised. These were adjusted for some of the zones that presented very high values, and normalised before application. The final emerging growth rates were applied to external zones in the same way as the internal zones.

5.2.4 Future Year Trip Distribution

The resulting LAM zonal trip ends were redistributed over the 181 LAM zones and this was achieved by using the Furness distribution method. As part of the process, the matrix totals were doubly constrained to the mean of forecast trip end totals.

The growth factors for each zone varied by the vehicle type such as Light and Heavy vehicles, by time of the day such as AM, IP and PM, by Origin and Destination, and were assumed to vary linearly between 2016-2030, 2030-2040 and 2040-2050.

5.3 Future Year Matrix Analysis

The total growth between Base year 2019 and OY of 2027, DY of 2042 and FY of 2057 for the central growth scenario is presented in Table 5-1 below. This is presented for both Light and Heavy vehicles in all three peak time periods.

Table 5-1: Summary of Base year, OY, DY and FY matrix trip totals in AM, IP and PM peak periods

Time period	2019 Total	2027 Total	2027%	2042 Total	2042%	2057 Total	2057%
AM, LV	39,452	44,325	12%	49,730	26%	54,038	37%
AM, HV	1,060	1,371	29%	1,778	68%	2,307	118%
Total:	40,512	45,696	13%	51,508	27%	56,345	39%
IP, LV	30,892	34,642	12%	39,167	27%	43,169	40%
IP, HV	927	1,207	30%	1,569	69%	2,034	119%
Total:	31,820	35,849	13%	40,736	28%	45,203	42%
PM, LV	37,058	41,790	13%	46,860	26%	50,742	37%
PM, HV	951	1,239	30%	1,614	70%	2,086	119%
Total:	38,010	43,028	13%	48,474	28%	52,828	39%

5.4 Future Year Network Development

The future year road network is a combination of the base year current network with the addition of committed schemes in the study area and proposed N21 scheme options. The committed schemes are defined as the schemes that have been progressed through planning and are either under construction or are programmed into the capital expenditure budget. These schemes constitute the Do-Minimum (DM) Option and a set of proposals for the scheme being appraised constitutes the Do-Something (DS) Option. These two options are discussed in detail in the sections below.

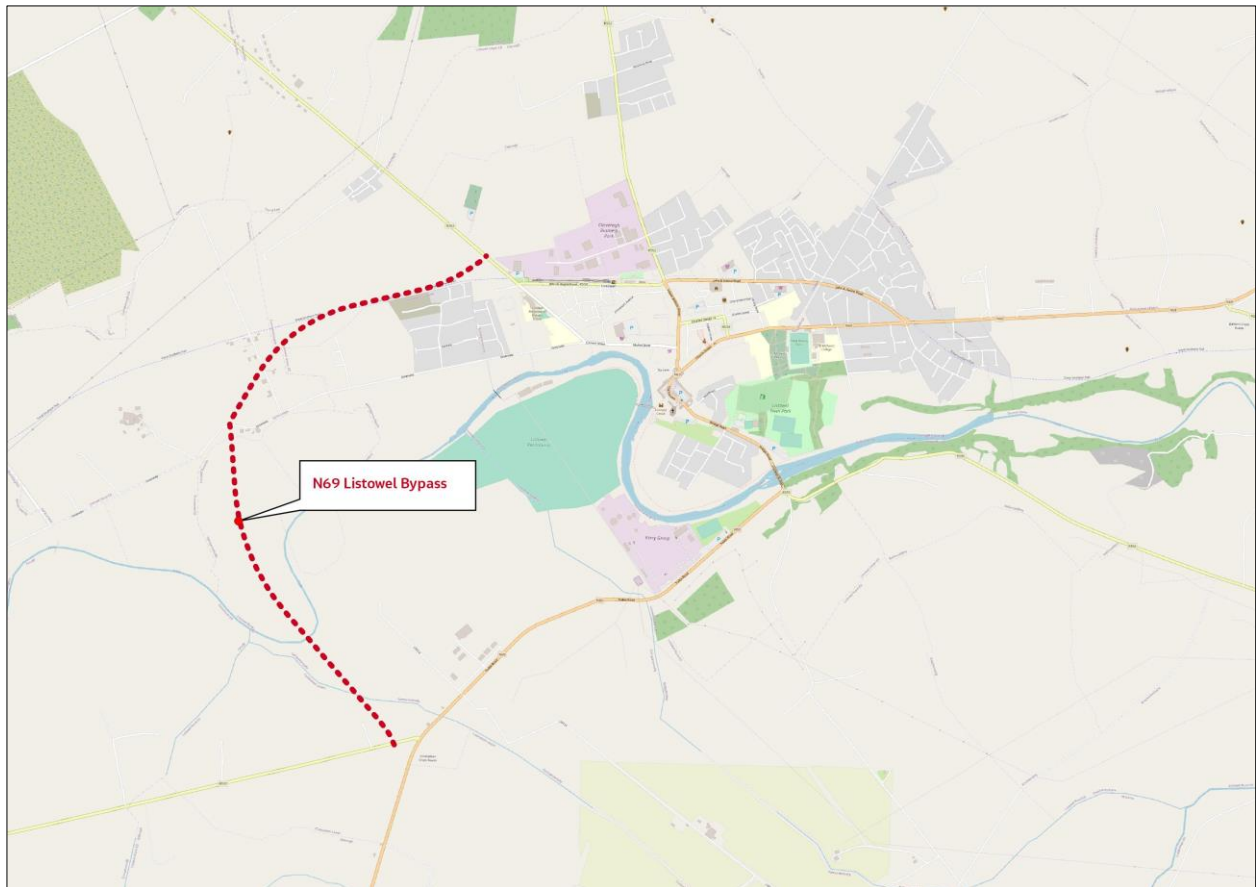
5.4.1 Do-Minimum Option

There are two committed schemes within the study area to be included in Do-Minimum option:

1. N69 Listowel Bypass
2. Abbeyfeale Traffic Management Plan

The first of the schemes involves building bypass of the centre of Listowel linking the N69 to the south with the R553 Ballybunnion Road and reclassifying the R553 John B Keane Road as the N69.

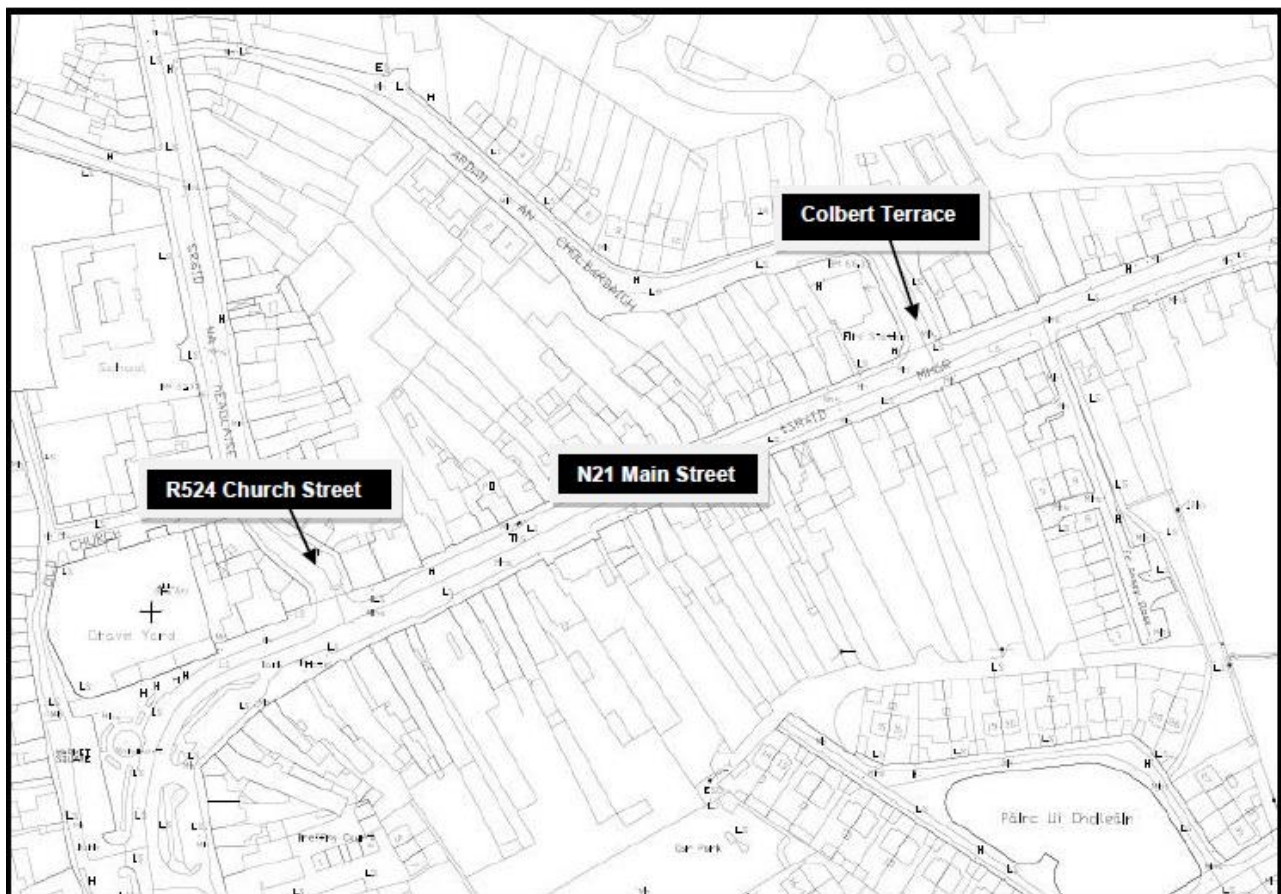
Figure 5-1 N69 Listowel bypass location



The Abbeyfeale Traffic Management Plan, prepared by Limerick City & County Council (LCCC) comprises the following development works important from a traffic modelling perspective:

- Modified traffic lane widths along the N21 within Abbeyfeale town centre with revised parking layout.
Road lane widths were extended to 6.7m in the traffic model.
- New traffic signals junction controls and associated layouts will be installed at the Main Street/Church Street and Main Street/Colbert Terrace junctions with controlled pedestrian crossings on all arms of the proposed traffic signals junctions.
Junctions: Main Street/Church Street and Main Street/Colbert Terrace were coded as signalised in the traffic model.
- Upgrade of mini roundabout junction at Colbert Terrace / Tesco access.
Existing mini roundabout was re-coded as a priority junction.
- Provision of road widening at the junction of Colbert Terrace/ New Street, which involves demolition of one property.
The junction was re-coded in the traffic model.
- Amendments to car parking locations and provisions.
Added one-way access road to the car park in the traffic model.

Figure 5-2 Location of the two main junctions assessed (Source: Abbeyfeale Traffic Management Plan, updated junction analysis report, 2019)



5.4.2 The N21 Newcastle West Road Scheme Do-Something Options

The N21 Newcastle West Road Scheme DS Options includes nine (A-I) dual carriageway options located on the southern and northern sides of the town.

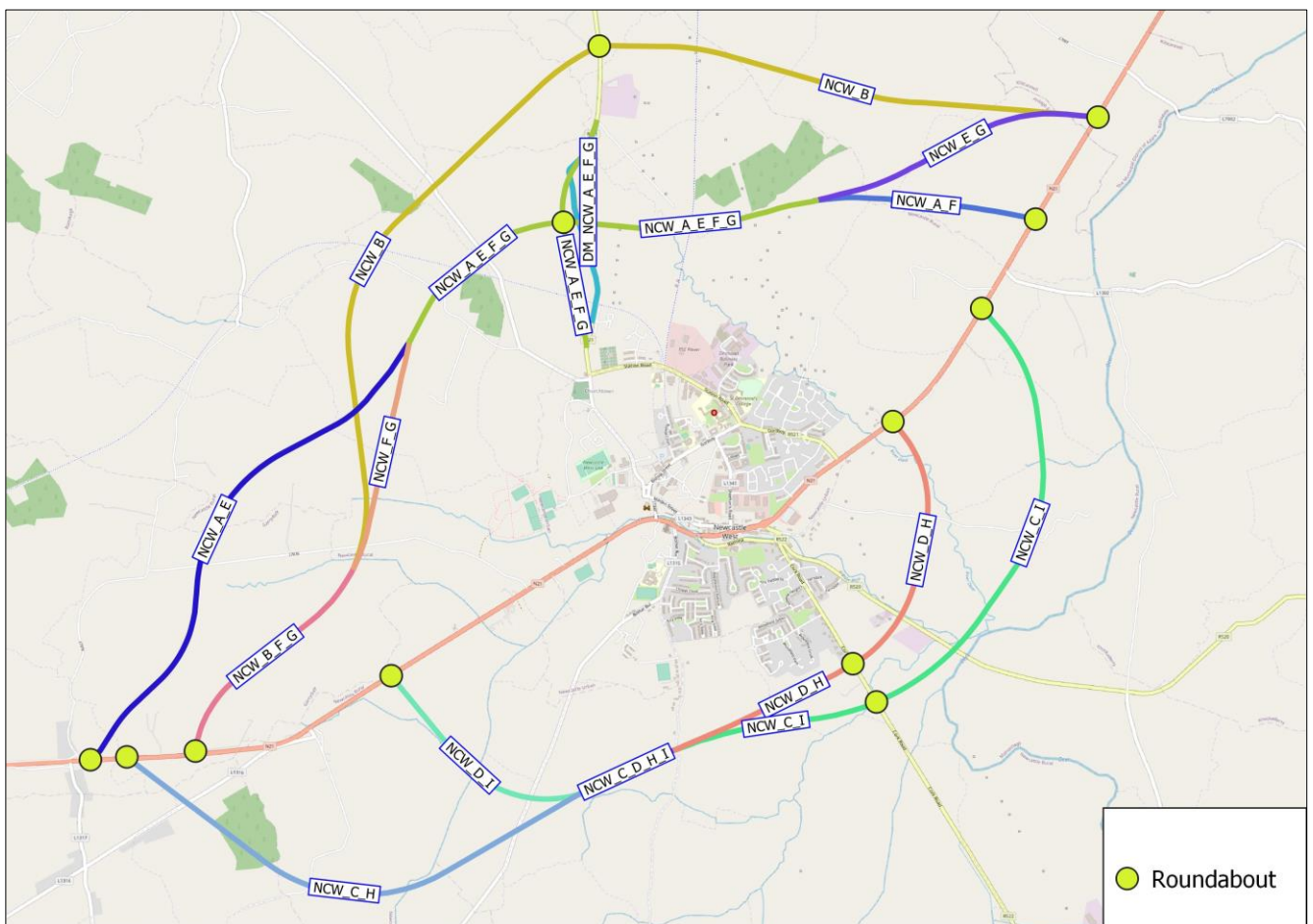
Options connect with the N21 at the East and the West of Newcastle West but the tie in points vary between the different options:

- **the West:**
 - common junction for Option A & E,
 - common junction for Option B, F & G,
 - common junction for Option C & H,
 - common junction for Option D & I,
- **the East:**
 - common junction for Option B, E & G,
 - common junction for Option A & F,
 - common junction for Option D & H,
 - common junction for Option C & I.

Options located on the northern side of Newcastle West (A, B, E, F & G), apart from their junctions with the N21, also have junctions with the regional road R521. Options C, D, H & I, located on the southern side of the town, have an additional junction with the regional road R522.

Figure 5-3 below presents all options of the N21 Newcastle West Road Scheme.

Figure 5-3: The N21 Newcastle West Road Scheme options



5.5 Consideration of Preliminary Junction Strategy

All defined and analysed options for the scheme have the same junction approach. The junctions listed above, located either on the N21 or the R521 or R522 regional roads, are assumed to be roundabouts.

5.6 Estimation of Annual Average Daily Traffic (AADT)

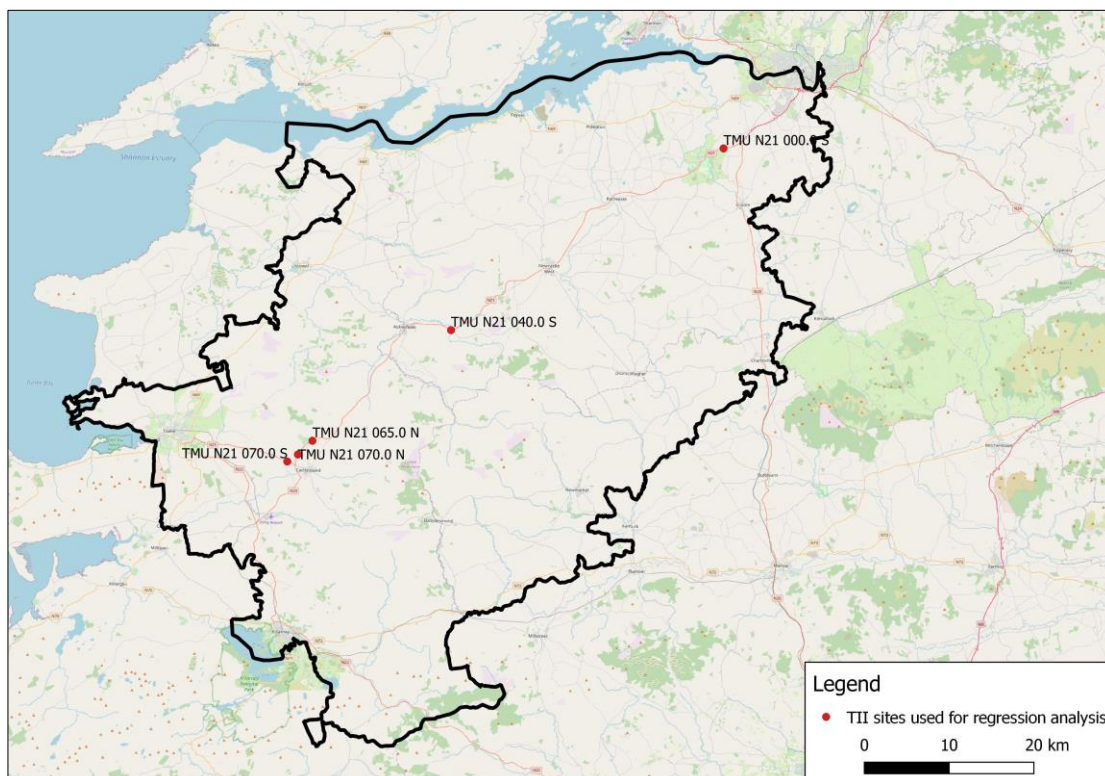
Annual Average Daily Traffic (AADT) is the average number of vehicles, calculated over a period of one calendar year, passing a point on a road each day. It is expressed in terms of vehicles per day. AADT is an essential dataset that is used as an input to scheme appraisal, environmental models, road planning studies, and pavement design.

AADT was estimated using multiple TII TMU sites and regression analysis. Regression analysis is a statistical process used to assess the relationship between a series of influential variables (x) and a particular outcome (y). In this case, regression analysis is used to predict an expected outcome (e.g., estimated AADT) on the basis of variables which are known to be influential e.g., peak hour flows. The regression analysis produces estimated AADT values which are plotted alongside observed AADT values to assess the variation that occurs. The analysis was undertaken in accordance with TII PAG *Unit 16.0 - Estimating AADT on National Roads (October 2016)*.

The following five TII sites were used for regression analysis purpose. All of them are located on the N21 (see the figure below).

1. TMU N21 000.0 S
2. TMU N21 040.0 S
3. TMU N21 065.0 N
4. TMU N21 070.0 N
5. TMU N21 070.0 S

Figure 5-4: TII sites used for regression analysis



Three variables we used: AM Peak, PM Peak and Inter-Peak (IP) flows extracted for a neutral month (November 2019) and neutral day (Tuesday- Thursday). The regression analysis was undertaken in Microsoft Excel using the data analysis tool.

The coefficients calculated are presented the table below. The Coefficient of Determination (r^2) is 0.9969 and indicates very good correlation between the variables. An r^2 value of 0.95 or higher is regarded as a valid statistical result. More details of the regression analysis are presented in Appendix E Regression analysis details.

Table 5-2: Regression analysis results

	Coefficients
AM	-1.56
IP	5.85
PM	10.34

Therefore, the AM, Inter and PM Peak Hour flows were converted to AADT flows using the following formula:

$$(-1.56 * x) + (5.85 * y) + (10.34 * z) = \text{Total AADT}$$

Where:

x = AM Peak Period Total Demand

y = IP Peak Period Total Demand

z = PM Peak Period Total Demand

Although the negative AM coefficient and high PM coefficient is unusual, alternative approaches such as averaging the peak hour flows and altering the site selection to omit data from one or more sites did not yield what could be considered more logical coefficients.

To demonstrate the accuracy of the AM, Inter-peak and PM Peak hour expansion factors to AADT, a comparison of observed and modelled 2019 base year AADT has been undertaken in the table below.

Table 5-3: Accuracy of AM, IP & PM Expansion Factors to AADT

TII TMU	2019 AADT		Accuracy
	Observed	Modelled	
TMU N21 000.0 S	17,106	14,580	-15%
TMU N21 040.0 S	10,732	9,949	-7%
TMU N21 065.0 N	9,478	7,633	-19%
TMU N21 070.0 N	8,271	7,860	-5%
TMU N21 070.0 S	10,325	10,204	-1%

The table above shows that the difference between observed and modelled AADT does not exceed 20%. Therefore, it may be stated that the expansion factors used to estimate AADT from AM, IP and PM peak hour models lead to acceptable modelled AADT forecasts, particularly at site TMU N21 040.0 S, which is located on the N21 between Abbeyfeale and Newcastle West.

Figure 5-8: The N21 Newcastle West Road Scheme - 2042 modelled future AADT and percentage HGV – Option B

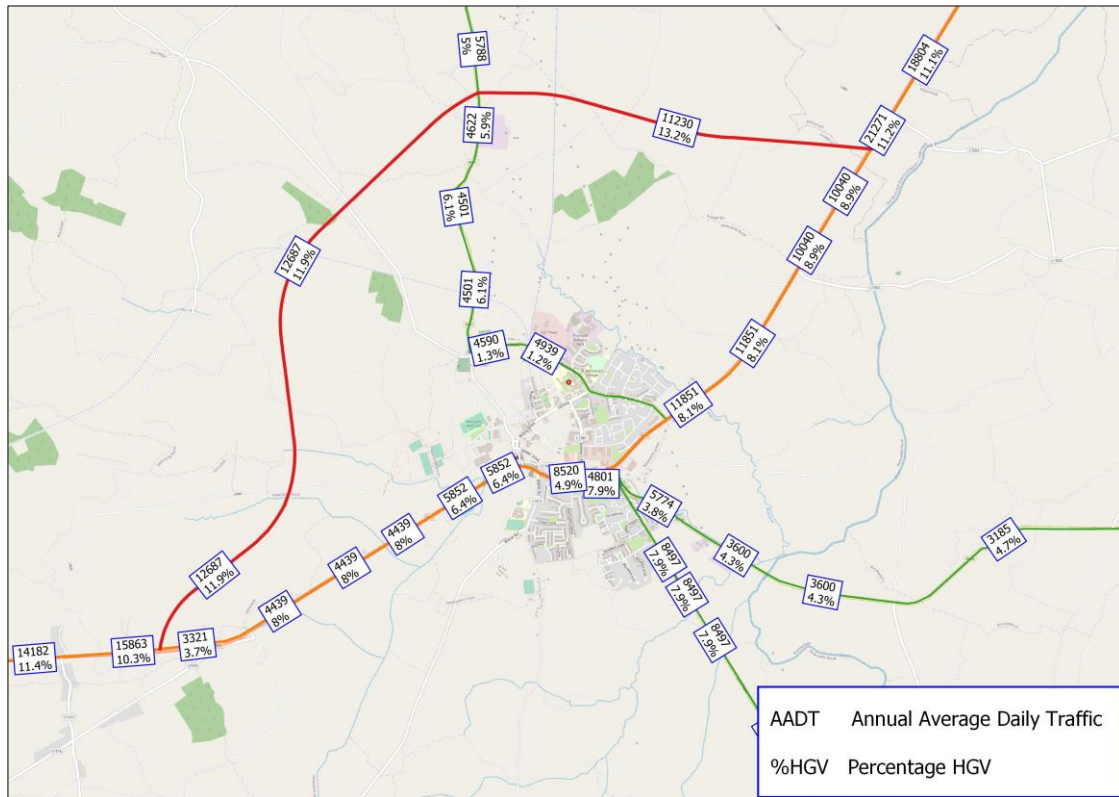


Figure 5-9: The N21 Newcastle West Road Scheme - 2042 modelled future AADT and percentage HGV – Option C

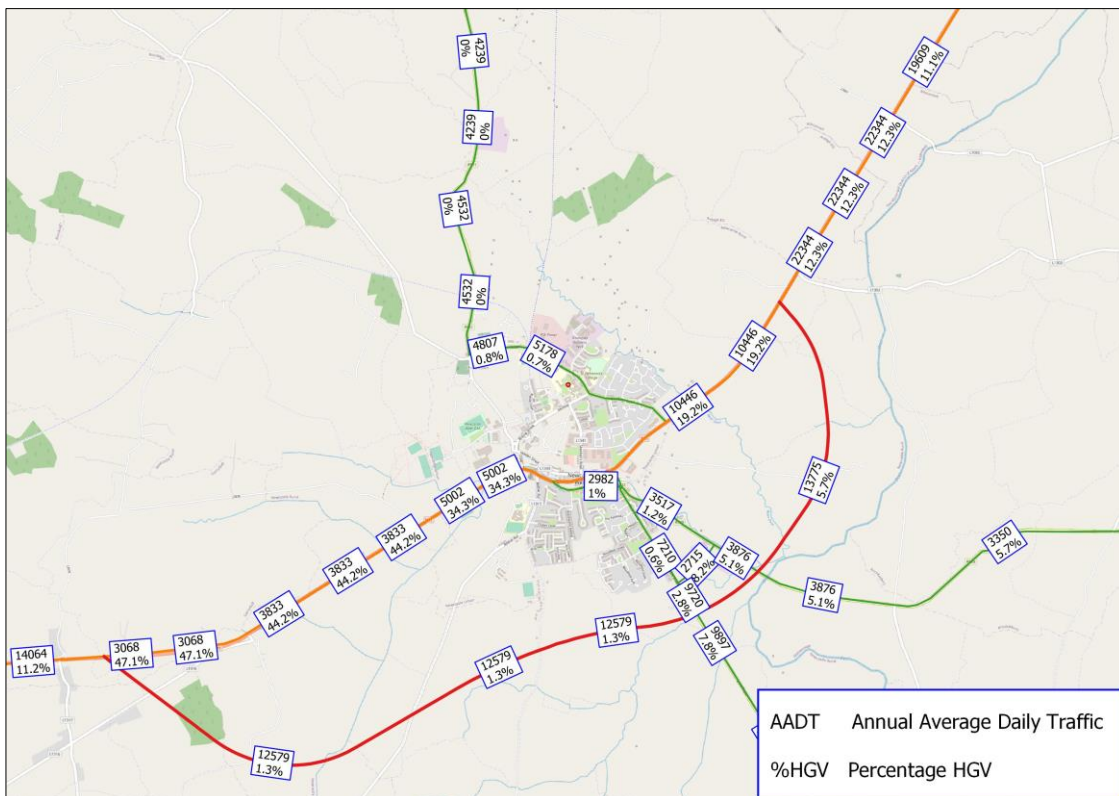


Figure 5-14: The N21 Newcastle West Road Scheme - 2042 modelled future AADT and percentage HGV - Option H

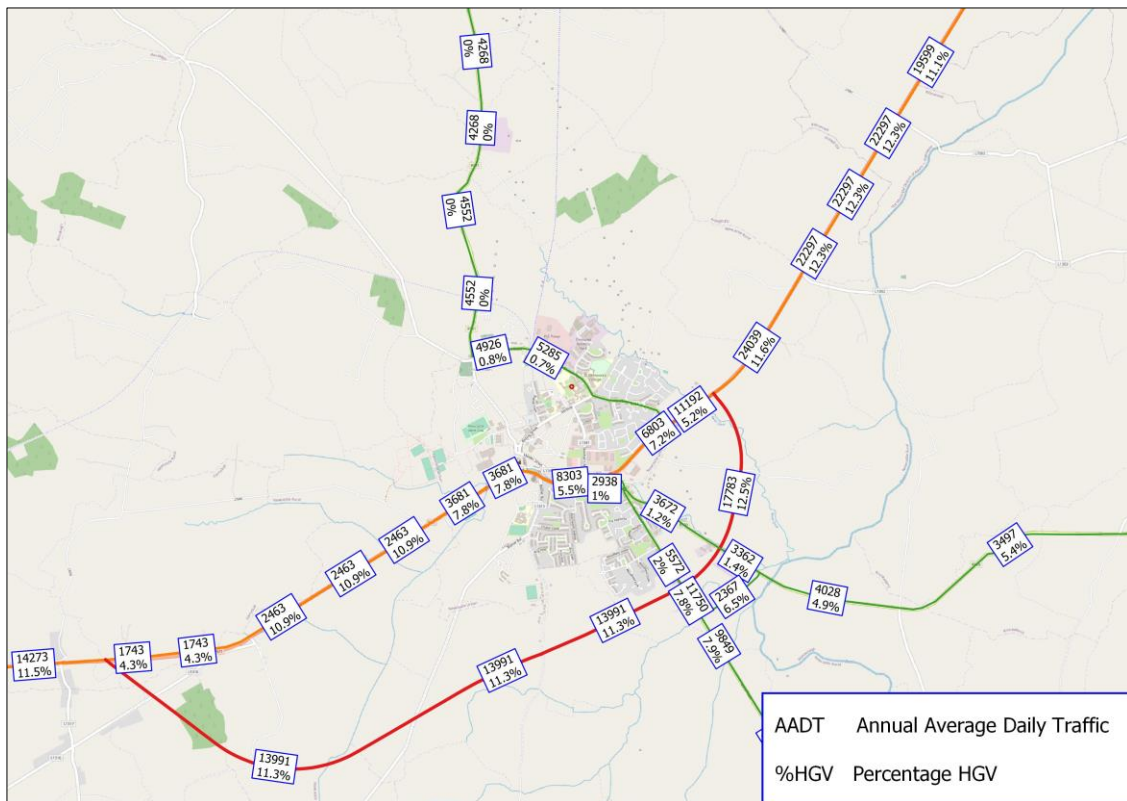
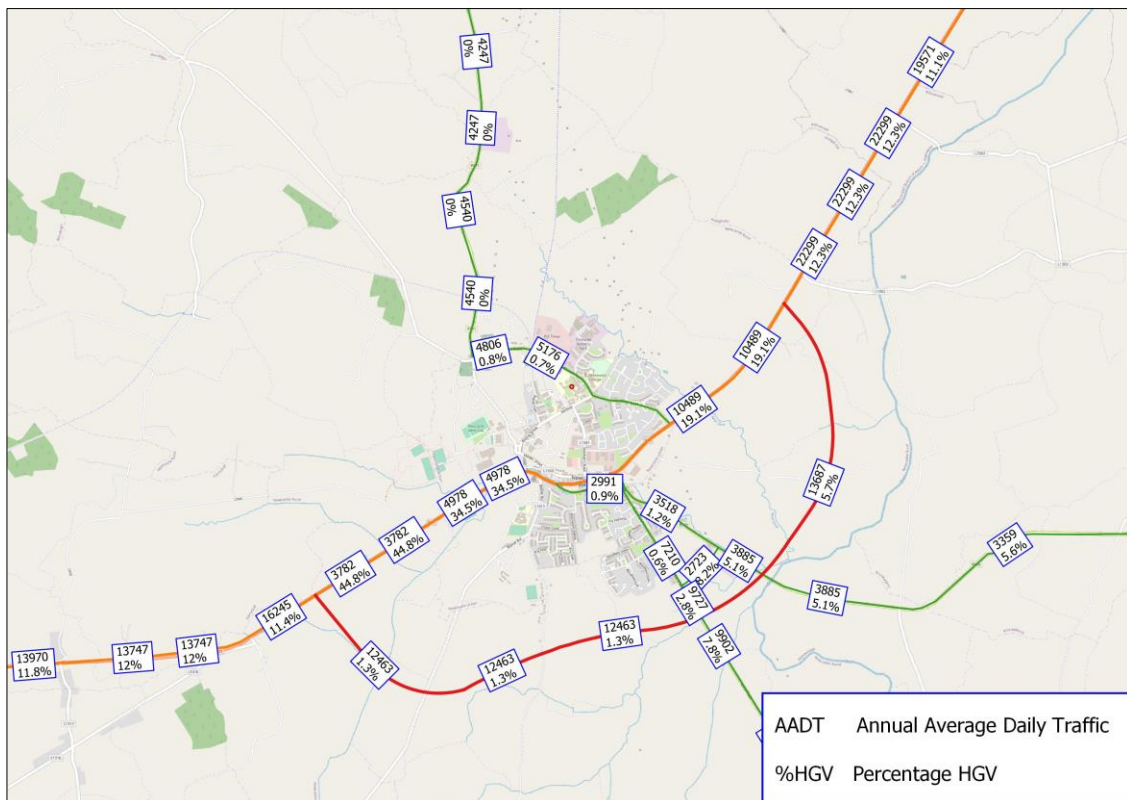


Figure 5-15: The N21 Newcastle West Road Scheme - 2042 modelled future AADT and percentage HGV - Option I



5.8 Network Statistics

The network statistics were extracted from the Do-Something traffic models for the central growth scenario and a comparison was made with the Do-Minimum. The key network statistics comprise the following:

- Total Network Travel Time (hrs) for all vehicles (Modelled User Class – LV and HV);
- Total Network Vehicle Kms (vkms) for all vehicles (Modelled User Class – LV and HV);
- Average Vehicle Speed (kph) for all vehicles (Modelled User Class – LV and HV).

The crucial network statistics are presented for the Do-Minimum along with each set of the N21 Newcastle West Road Scheme Options in **Table 5-4 - Table 5-6** below. These are differentiated by peak time period (AM, IP and PM) for the Design Year of 2042. With reference to values shown for the Do-Minimum option and the Do-Something options, it is highlighted that these statistics relate to the entire modelled network (including side roads) for the option in question and are not specific to the N21 route. Also, as outlined above, all vehicles users (both LV and HV) are considered. In the case of the Average Vehicle Speed presented in the tables below, it is highlighted again that this relates to the entire modelled network. It is noted that an average free flow speed of 100 kph was coded for the Newcastle West bypasses within the Do-Something Options.

Table 5-4: The N21 Newcastle West Road Scheme - Network Statistics 2042 – AM – Central Growth

Option	Total Network Trips (veh)	Total Vehicle kms (vkms)	Total Network Travel Times (vhrs)	Average Vehicle Speed (kph)
Do-Minimum	43,580	704,500	11,882h 27min 20s	53.0
Option A (dual c'way)	43,580	705,187	11,819h 1min 9s	53.1
Option B (dual c'way)	43,580	705,603	11,831h 57min 28s	53.1
Option C (dual c'way)	43,580	705,945	11,828h 48min 49s	53.1
Option D (dual c'way)	43,580	705,700	11,828h 40min 50s	53.1
Option E (dual c'way)	43,580	704,945	11,816h 17min 35s	53.1
Option F (dual c'way)	43,580	705,394	11,822h 25min 32s	53.1
Option G (dual c'way)	43,580	705,164	11,819h 39min 17s	53.1
Option H (dual c'way)	43,580	705,773	11,827h 20min 28s	53.1
Option I (dual c'way)	43,580	705,913	11,829h 56min 56s	53.1

Table 5-5: The N21 Newcastle West Road Scheme - Network Statistics 2042 – IP – Central Growth

Option	Total Network Trips (veh)	Total Vehicle kms (vkms)	Total Network Travel Times (vhrs)	Average Vehicle Speed (kph)
Do-Minimum	33,854	497,728	8,017h 50min 29s	54.2
Option A (dual c'way)	33,854	498,404	7,969h 5min 15s	54.3
Option B (dual c'way)	33,854	498,685	7,980h 20min 6s	54.3
Option C (dual c'way)	33,854	498,973	7,979h 10min 47s	54.3
Option D (dual c'way)	33,854	498,916	7,975h 43min 16s	54.3
Option E (dual c'way)	33,854	498,233	7,966h 53min 48s	54.3

Option	Total Network Trips (veh)	Total Vehicle kms (vkms)	Total Network Travel Times (vhrs)	Average Vehicle Speed (kph)
Option F (dual c'way)	33,854	498,571	7972h 1min 19s	54.3
Option G (dual c'way)	33,854	498,379	7,970h 4s	54.3
Option H (dual c'way)	33,854	498,964	7,974h 47min 5s	54.4
Option I (dual c'way)	33,854	498,928	7,980h 8min 13s	54.3

Table 5-6: The N21 Newcastle West Road Scheme - Network Statistics 2042 – PM – Central Growth

Option	Total Network Trips (veh)	Total Vehicle kms (vkms)	Total Network Travel Times (vhrs)	Average Vehicle Speed (kph)
Do-Minimum	41,027	669,902	11,170h 40min 37s	53.2
Option A (dual c'way)	41,027	670,522	11,092h 12min 34s	53.4
Option B (dual c'way)	41,027	670,938	11,107h 58min 7s	53.4
Option C (dual c'way)	41,027	671,447	11,104h 28min 24s	53.4
Option D (dual c'way)	41,027	671,260	11,101h 4min 10s	53.4
Option E (dual c'way)	41,027	670,279	11,088h 30min 59s	53.4
Option F (dual c'way)	41,027	670,768	11,096h 29min 25s	53.4
Option G (dual c'way)	41,027	670,489	11,093h 5min 11s	53.4
Option H (dual c'way)	41,027	671,319	11,099h 55min 22s	53.4
Option I (dual c'way)	41,027	671,385	11,105h 52min 5s	53.4

5.9 Journey time comparison

A journey time comparison is made between all Do-Something (DS) options and the Do-Minimum (DM) option that starts from the easternmost tie-in to the westernmost tie-in (see **Figure 5-3**). The Do-Something travel times then include not just the new infrastructure, but whatever length of the N21 is used to travel between common points. **Table 5-7** below presents a summary of the journey time comparison.

Table 5-7: The N21 Newcastle West Road Scheme - Design year (2042) Journey Time comparison for DM and DS options

Option		Total Length (km)	Westbound direction			Eastbound direction		
			Journey Time (mm: ss)					
			AM	IP	PM	AM	IP	PM
Do-Minimum	DM	8.0	09:04	09:00	10:05	09:52	09:11	09:31
Option A (dual c'way)	DS	8.5	05:52	05:53	06:05	06:01	05:56	05:58
	DM-DS	-0.5	03:12	03:07	04:00	03:51	03:15	03:33
Option B (dual c'way)	DS	9.4	06:27	06:28	06:40	06:36	06:30	06:32
	DM-DS	-1.3	02:37	02:32	03:25	03:16	02:41	02:59
Option C (dual c'way)	DS	9.9	06:47	06:44	07:00	07:02	06:51	06:54
	DM-DS	-1.8	02:17	02:16	03:05	02:50	02:20	02:37
Option D (dual c'way)	DS	9.5	06:48	06:47	07:05	07:04	06:53	06:56
	DM-DS	-1.4	02:16	02:13	03:00	02:48	02:18	02:35
Option E (dual c'way)	DS	8.2	05:40	05:41	05:53	05:49	05:45	05:45
	DM-DS	-0.2	03:24	03:19	04:12	04:03	03:26	03:46
Option F (dual c'way)	DS	8.7	06:05	06:06	06:19	06:14	06:09	06:10
	DM-DS	-0.7	02:59	02:54	03:46	03:38	03:02	03:21
Option G (dual c'way)	DS	8.5	05:54	05:54	06:06	06:03	05:58	05:59
	DM-DS	-0.4	03:10	03:06	03:59	03:49	03:13	03:32
Option H (dual c'way)	DS	9.5	06:43	06:41	07:01	07:00	06:48	06:51
	DM-DS	-1.4	02:21	02:19	03:04	02:52	02:23	02:40
Option I (dual c'way)	DS	9.9	06:54	06:51	07:06	07:08	06:57	07:00
	DM-DS	-1.9	02:10	02:09	02:59	02:44	02:14	02:31

All analysed Do-Something options in Newcastle West provide an improvement of the journey times across the peak time periods in DY 2042 when compared to the Do-Minimum.

The most beneficial appear to be Options A, E, F & G and would improve journey time by 3-4 minutes depending on the time-period. These options are located to the north of Newcastle West and their lengths are slightly greater than that of the Do-Minimum option (by 0.2-0.7 km).

The lowest journey time reductions, 2-3 minutes in comparison with the Do-Minimum Option, are offered by Options C, D, H & I (all located to the south of the town) and Option B. They are longer than Do-Minimum Option by 1.4-1.9 km.

Appendix A. Summary of zoning system

No	No of zone – National Traffic Model	No of zone – Local Area Model
1	393	393
2	399	399
3	407	407
4	413	1686
5		1807
6	415	1685
7		1718
8		1767
9		1804
10		9943
11		9944
12	417	417
13	419	419
14	421	1719
15		1836
16		1846
17		1858
18	423	1769
19		1820
20		1848
21	425	1688
22		1805
23		1838
24	447	447
25	449	1768
26		1788
27		1869
28	455	455
29	457	457
30	479	479
31	481	481
32	511	511
33	513	513
34	517	517

No	No of zone – National Traffic Model	No of zone – Local Area Model
35	519	519
36	521	521
37	531	1705
38		2275
39		2330
40		2350
41	533	2274
42		2352
43		2374
44	535	2264
45		2363
46		2372
47		2373
48	537	1810
49		1821
50	539	539
51	547	2392
52		11640
53		11641
54	549	2340
55		2403
56		2434
57		11576
58		11803
59		12861
60		12863
61		12891
62		12892
63		12893
64		12894
65		12895
66		12921
67		12922
68		12923
69		12924
70		12925

No	No of zone – National Traffic Model	No of zone – Local Area Model
71		12926
72		12927
73		13002
74		13003
75		13004
76		13005
77		13006
78		13031
79		13032
80		13033
81		13034
82		13035
83		13036
84		13037
85		13038
86		13039
87		13040
88		2342
89	551	2360
90		2416
91		1699
92	553	1822
93		2265
94	555	555
95		11585
96		11594
97		11595
98		11596
99		11597
100		11614
101	563	11615
102		11616
103		11617
104		11618
105		11619
106		11620

No	No of zone – National Traffic Model	No of zone – Local Area Model
107		11642
108		11643
109		11644
110		11659
111		11672
112		2370
113	565	2404
114		2260
115		2327
116	567	2361
117		2435
118		1840
119	569	2272
120		2351
121	571	571
122		2271
123	575	2349
124		2371
125		2261
126		2262
127	577	2328
128		2380
129	579	579
130	581	581
131		1328
132		1338
133	717	1354
134		1364
135	718	718
136	719	719
137	720	720
138	721	721
139	722	722
140	726	726
141	857	857
142	865	865

No	No of zone – National Traffic Model	No of zone – Local Area Model
143	4451	4451
144	4452	4452
145	5151	5151
146	5152	5152
147	5251	5251
148	5252	5252
149	8412	8412
150	1001	1001
151	1002	1002
152	1003	1003
153	1004	1004
154	1005	1005
155	1006	1006
156	1007	1007
157	1008	1008
158	1009	1009
159	1010	1010
160	1011	1011
161	1012	1012
162	1013	1013
163	1014	1014
164	1015	1015
165	1016	1016
166	1017	1017
167	1018	1018
168	1019	1019
169	1020	1020
170	1021	1021
171	1022	1022
172	1023	1023
173	1024	1024
174	1025	1025
175	1026	1026
176	1027	1027
177	1028	1028
178	1029	1029

No	No of zone – National Traffic Model	No of zone – Local Area Model
179	1030	1030
180	1031	1031

Appendix B. Summary of traffic count sites

No.	Site name	Survey type	Year	Road no	Code	Calibration/validation
1	248 19302 N-M20 Cork to Limerick ATC Report ATC 1	ATC	2019	N20	1	calibration
2	248 19302 N-M20 Cork to Limerick ATC Report ATC 2	ATC	2019	N20	1	calibration
3	248 19302 N-M20 Cork to Limerick ATC Report ATC 34	ATC	2019	R518	1	calibration
4	248 19302 N-M20 Cork to Limerick ATC Report ATC 4	ATC	2019	N20	1	calibration
5	248 19302 N-M20 Cork to Limerick ATC Report ATC 5	ATC	2019	N20	1	calibration
6	248 19302 N-M20 Cork to Limerick ATC Report ATC 6	ATC	2019	R518	1	calibration
7	248 19302 N-M20 Cork to Limerick ATC Report ATC 7	ATC	2019	N20	1	calibration
8	248 19302 N-M20 Cork to Limerick ATC Report ATC 8	ATC	2019	R515	1	calibration
9	248 19302 N-M20 Cork to Limerick JTC Report Site 1	JTC	2019	R516	1	calibration
10	248 19302 N-M20 Cork to Limerick JTC Report Site 2	JTC	2019	R516	1	calibration
11	248 19302 N-M20 Cork to Limerick JTC Report Site 4	JTC	2019	N20	1	calibration
12	3153-IRE Lot 3 JTC Report Site 21 v2	JTC	2017	R511	3	calibration
13	3153-IRE Lot 3 JTC Report Site 23 v3	JTC	2017	N69	3	calibration
14	3227 - IRE Foynes to Limerick - ATC Site 5 Week 2	ATC	2018	N21	3	calibration
15	3430-IRE Cork _ Limerick ANPR Survey - Site 03	ATC	2019	N20	1	calibration
16	3430-IRE Cork _ Limerick ANPR Survey - Site 10	ATC	2019	R515	1	calibration
17	JTC Court Cross (N69)_Site 1	JTC	2015	N69	1	calibration
18	JTC Court Cross (N69)_Site 2	JTC	2015	N69	1	calibration
19	JTC Rathkeale N21 Jn 10	JTC	2016	N21	3	calibration
20	JTC Rathkeale N21 Jn 3	JTC	2016	N21	3	calibration
21	JTC Rathkeale N21 Jn 7	JTC	2016	N21	3	calibration
22	Limerick ATC Week 1 (ANPR 1 - 5) ANPR 2	ATC	2014	N69	2	calibration
23	Limerick ATC Week 1 (ANPR 1 - 5) ANPR 3	ATC	2014	R521	2	calibration
24	Limerick ATC Week 1 (ANPR 1 - 5) ANPR 4	ATC	2014	N21	2	calibration
25	Limerick ATC Week 1 (ANPR 1 - 5) ANPR 5	ATC	2014	N21	2	calibration
26	Limerick ATC Week 1 (ANPR 11, 1-4) AD 1	ATC	2014	N69	2	calibration
27	Limerick ATC Week 1 (ANPR 11, 1-4) AD 2	ATC	2014	N69	2	calibration
28	MHC-087-17 Classified Junction Count Site 1	JTC	2017	N69	1	calibration
29	MHC-087-17 Classified Junction Count Site 3	JTC	2017	N69	1	calibration
30	MHC-771-16 JTC - Site 21	JTC	2017	N69	1	calibration
31	MHC-771-16_Site 10 NTA	ATC	2017	N22	3	calibration
32	MHC-771-16_Site 11 NTA	ATC	2017	N70	3	calibration
33	MHC-771-16_Site 22 NTA	ATC	2017	R878	3	calibration
34	MHC-771-16_Site 23 NTA	ATC	2017	R556	3	calibration

No.	Site name	Survey type	Year	Road no	Code	Calibration/validation
35	MHC-771-16_Site 25 NTA	ATC	2017	N71	3	calibration
36	MHC-771-16_Site 29 NTA	ATC	2017	R551	3	calibration
37	MHC-771-16_Site 30 NTA	ATC	2017	R558	3	calibration
38	MHC-771-16_Site 7 NTA	ATC	2017	N72	3	calibration
39	MHC-771-16_Site 8 NTA	ATC	2017	N22	3	calibration
40	MHC-771-16_Site 9 NTA	ATC	2017	N21	3	calibration
41	Mungret & Bolands (N69)_Site 3 - A	JTC	2015	N69	1	calibration
42	SC1953 Limerick JTC {Sites 1-10} - Site 3	JTC	2014	N69	2	calibration
43	SC1953 Limerick JTC {Sites 1-10} - Site 4	JTC	2014	N69	2	calibration
44	SC1953 Limerick JTC {Sites 1-10} - Site 5	JTC	2014	R518	2	calibration
45	SC1953 Limerick JTC {Sites 1-10} - Site 6	JTC	2014	N69	2	calibration
46	SC1953 Limerick JTC {Sites 1-10} - Site 8	JTC	2014	N69	2	calibration
47	SC1953 Limerick JTC {Sites 11-20} - Site 11	JTC	2014	R510- R859	2	calibration
48	SC1953 Limerick JTC {Sites 11-20} - Site 13a	JTC	2014	N20	2	calibration
49	SC1953 Limerick JTC {Sites 11-20} - Site 14	JTC	2014	N21	2	calibration
50	SC1953 Limerick JTC {Sites 11-20} - Site 16	JTC	2014	R523	2	calibration
51	SC1953 Limerick JTC {Sites 11-20} - Site 17	JTC	2014	R518- N21 Roundab out	2	calibration
52	SC1953 Limerick JTC {Sites 11-20} - Site 20	JTC	2014	N21	2	calibration
53	SC1953 Limerick JTC {Sites 11-20} - Site 21	JTC	2014	R521/R5 23	2	calibration
54	SC1953 Limerick JTC {Sites 11-20} - Site 22	JTC	2014	N21/R5 21	2	calibration
55	SC1953 Limerick JTC {Sites 11-20} - Site 23	JTC	2014	N21	2	calibration
56	SC1953 Limerick JTC {Sites 11-20} - Site 25	JTC	2014	N21/R5 22 Rtb	2	calibration
57	SC1953 Limerick JTC {Sites 11-20} - Site 26	JTC	2014	R522/R5 20 Rtb	2	calibration
58	SC2074 Ireland ATC 146 - Site 146	ATC	2014	R511	2	calibration
59	SC2074 Ireland ATC 2 - Site 2	ATC	2014	N22	2	calibration
60	SC2074 Ireland Site 200	JTC	2014	R526- R510	2	calibration
61	SC2074 Ireland Site 201	JTC	2014	R510	2	calibration
62	SC2074 Ireland Site 202	JTC	2014	R926- L1144	2	calibration
63	SC2074 Ireland Site 203	JTC	2014	R926- L1144	2	calibration

No.	Site name	Survey type	Year	Road no	Code	Calibration/validation
64	TMU N22 070.0 E	ATC	2019	N22	TII	calibration
65	TMU N22 110.0 E	ATC	2019	N22	TII	calibration
66	TMU N72 030.0 E	ATC	2019	N72	TII	calibration
67	TMU N21 065.0 N	ATC	2019	N21	TII	calibration
68	TMU N69 090.0 W	ATC	2019	N69	TII	calibration
69	TMU M20 095.0 N	ATC	2019	M20	TII	calibration
70	TMU M07 190.0 W	ATC	2019	M07	TII	calibration
71	TMU N21 070.0 S	ATC	2019	N21	TII	calibration
72	TMU N70 145.0 W	ATC	2019	N70	TII	calibration
73	TMU N21 000.0 S	ATC	2019	N21	TII	calibration
74	TMU N20 065.0 N	ATC	2019	N20	TII	calibration
75	TMU N69 045.0 W	ATC	2019	N69	TII	calibration
76	TMU N23 010.0 S	ATC	2019	N23	TII	validation
77	TMU N21 070.0 N	ATC	2019	N21	TII	validation
78	TMU N22 090.0 W	ATC	2019	N22	TII	validation
79	TMU N69 020.0 W	ATC	2019	N69	TII	validation
80	TMU N69 070.0 W	ATC	2019	N69	TII	validation
81	TMU M20 090.0 N	ATC	2019	M20	TII	validation
82	TMU N22 116.0 W	ATC	2019	N22	TII	validation
83	TMU N21 040.0 S	ATC	2019	N21	TII	validation

Appendix C. Summary of all individual calibration counts

(Light vehicles, AM)

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	200001344	262	217	2.9	YES
2	35	200001344	71299	375	274	5.6	NO
3	102	121766075	121768599	2182	1910	6.0	NO
4	102	121768599	121766075	877	1025	4.8	NO
5	191	71492	383553	138	139	0.1	YES
6	191	383553	71492	580	480	4.3	YES
7	364	121768248	2000714938	552	602	2.1	YES
8	364	2000714938	121768248	448	495	2.2	YES
9	367	2000001286	2000001289	602	497	4.5	NO
10	367	2000001289	2000001286	405	539	6.2	NO
11	421	2000714831	2000714900	107	110	0.3	YES
12	421	2000714900	2000714831	52	59	1.0	YES
13	422	121771157	2000714899	207	144	4.7	YES
14	422	2000714899	121771157	75	65	1.2	YES
15	427	121771157	2000714830	84	95	1.2	YES
16	427	2000714830	121771157	77	79	0.2	YES
17	450	395354	121771157	98	94	0.4	YES
18	450	121771157	395354	27	49	3.6	YES
19	470	71526	83724	125	147	1.9	YES
20	470	83724	71526	137	146	0.8	YES
21	471	59737	121776371	371	367	0.2	YES
22	471	121776371	59737	459	511	2.4	YES
23	472	366902	121648061	337	217	7.2	NO
24	472	121648061	366902	138	190	4.0	YES
25	475	393038	121775059	551	566	0.6	YES
26	475	121775059	393038	289	329	2.3	YES
27	479	393975	121766420	267	301	2.0	YES
28	479	121766420	393975	589	690	4.0	NO
29	492	262464	396397	139	156	1.4	YES
30	492	396397	262464	71	89	2.1	YES
31	496	260555	2000714396	184	156	2.2	YES
32	496	2000714396	260555	130	89	3.9	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
33	500	396154	121766606	128	144	1.4	YES
34	500	121766606	396154	225	206	1.3	YES
35	505	225301	121766606	47	29	2.9	YES
36	505	121766606	225301	72	56	2.1	YES
37	520	216964	2000001529	171	237	4.6	YES
38	520	2000001529	216964	335	234	6.0	NO
39	527	177057	2000001528	235	279	2.7	YES
40	527	2000001528	177057	518	574	2.4	YES
41	528	160225	2000001527	296	279	1.0	YES
42	528	2000001527	160225	651	574	3.1	YES
43	529	162936	2000001527	539	574	1.5	YES
44	529	2000001527	162936	243	279	2.2	YES
45	531	4195	160225	301	307	0.4	YES
46	531	160225	4195	721	661	2.3	YES
47	532	4195	394738	581	661	3.2	YES
48	532	394738	4195	296	307	0.7	YES
49	533	177062	121774704	317	616	13.8	NO
50	533	121774704	177062	147	234	6.3	NO
51	534	224017	394738	301	307	0.4	YES
52	534	394738	224017	644	661	0.7	YES
53	540	143958	121774704	147	196	3.8	YES
54	540	121774704	143958	319	370	2.7	YES
55	541	143958	121900536	619	510	4.6	NO
56	541	121900536	143958	219	242	1.5	YES
57	543	86303	392788	45	48	0.4	YES
58	543	392788	86303	200	167	2.4	YES
59	544	109	121768383	530	423	4.9	NO
60	544	121768383	109	599	445	6.7	NO
61	548	32	121772969	545	510	1.5	YES
62	548	121772969	32	558	556	0.1	YES
63	550	459	121772396	282	265	1.0	YES
64	550	121772396	459	465	371	4.6	YES
65	551	459	2000034621	459	371	4.3	YES
66	551	2000034621	459	282	272	0.6	YES
67	552	417	121772395	440	366	3.7	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
68	552	121772395	417	243	216	1.8	YES
69	563	27	121772969	400	365	1.8	YES
70	563	121772969	27	461	417	2.1	YES
71	654	2000714815	2000714816	4	0	2.8	YES
72	654	2000714816	2000714815	10	0	4.5	YES
73	670	139877	121776371	135	123	1.0	YES
74	670	121776371	139877	75	72	0.4	YES
75	671	140524	121899955	447	379	3.3	YES
76	671	121899955	140524	465	462	0.1	YES
77	680	393962	121775658	125	84	4.0	YES
78	680	121775658	393962	37	28	1.6	YES
79	687	128953	394521	695	628	2.6	YES
80	687	394521	128953	373	376	0.2	YES
81	690	394526	121775658	765	706	2.2	YES
82	690	121775658	394526	383	382	0.0	YES
83	700	394467	121899812	1008	894	3.7	YES
84	700	121899812	394467	458	419	1.9	YES
85	702	394063	121770292	994	1025	1.0	YES
86	702	121770292	394063	545	555	0.4	YES
87	712	88964	121774648	491	411	3.8	YES
88	712	121774648	88964	160	131	2.4	YES
89	714	136955	121774985	365	394	1.5	YES
90	714	121774985	136955	356	265	5.2	NO
91	725	39209	121773860	249	221	1.8	YES
92	725	121773860	39209	202	204	0.1	YES
93	733	296765	121769166	439	358	4.0	YES
94	733	121769166	296765	56	68	1.5	YES
95	744	95709	121767515	148	100	4.3	YES
96	744	121767515	95709	98	91	0.7	YES
97	755	157213	121777969	109	94	1.5	YES
98	755	121777969	157213	75	81	0.7	YES
99	756	395980	121765697	261	206	3.6	YES
100	756	121765697	395980	153	144	0.7	YES
101	808	394057	394058	458	416	2.0	YES
102	808	394058	394057	939	882	1.9	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
103	826	77632	121675888	434	351	4.2	YES
104	826	121675888	77632	401	430	1.4	YES
105	851	121774068	2000714822	135	145	0.9	YES
106	851	2000714822	121774068	122	116	0.6	YES
107	899	22	2000714847	503	432	3.3	YES
108	899	2000714847	22	329	297	1.8	YES
109	900	121768383	2000714847	531	297	11.5	NO
110	900	2000714847	121768383	618	432	8.1	NO
111	910	2000034622	2000714856	708	622	3.3	YES
112	910	2000714856	2000034622	453	414	1.9	YES
113	973	121771157	2000714900	58	59	0.1	YES
114	973	2000714900	121771157	125	110	1.4	YES
115	987	2000714903	2000714908	151	152	0.1	YES
116	987	2000714908	2000714903	188	155	2.5	YES
117	1006	2000714918	2000714919	4	0	2.8	YES
118	1006	2000714919	2000714918	18	0	6.0	NO
119	1008	121767515	2000714921	161	129	2.6	YES
120	1008	2000714921	121767515	209	161	3.5	YES
121	1013	121767515	2000714926	243	156	6.1	NO
122	1013	2000714926	121767515	145	116	2.6	YES
123	1028	121775658	2000714939	864	790	2.6	YES
124	1028	2000714939	121775658	394	410	0.8	YES
125	1056	2000714949	2000714957	111	89	2.2	YES
126	1056	2000714957	2000714949	153	156	0.2	YES
127	1063	331728	2000714961	421	358	3.2	YES
128	1063	2000714961	331728	57	68	1.4	YES
129	1618	2000011935	500000736	858	635	8.2	NO
130	1758	500000896	2000011932	268	327	3.4	YES
131	1943	2000001299	2000001342	369	362	0.4	YES
132	1943	2000001342	2000001299	561	557	0.2	YES
133	2003	2000001297	2000001343	344	336	0.5	YES
134	2003	2000001343	2000001297	131	133	0.2	YES
135	2023	121733758	2000001352	167	169	0.2	YES
136	2023	2000001352	121733758	467	388	3.8	YES
137	2544	2000001579	2000001727	353	337	0.9	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
138	2544	200001727	2000001579	169	174	0.3	YES
139	3338	121771047	2000001939	2627	2129	10.2	NO
140	3338	2000001939	121771047	2394	2487	1.9	YES
141	4530	121774836	2000034598	36	0	8.5	NO
142	4530	2000034598	121774836	819	859	1.4	YES
143	4532	121768601	2000034599	950	1025	2.4	YES
144	4532	2000034599	121768601	102	80	2.3	YES
145	4536	121767723	2000034600	86	80	0.7	YES
146	4536	2000034600	121767723	151	166	1.2	YES
147	4839	2000001532	2000714396	147	133	1.2	YES
148	4839	2000714396	2000001532	173	168	0.3	YES
149	5267	2000714396	2000714714	40	46	0.9	YES
150	5267	2000714714	2000714396	12	16	0.9	YES
151	5269	2000001531	2000714716	128	149	1.8	YES
152	5269	2000714716	2000001531	215	244	1.9	YES
153	7017	121773332	2000011930	638	396	10.7	NO
154	7017	2000011930	121773332	1085	954	4.1	YES
155	7019	121778965	2000011931	1465	1320	3.9	YES
156	7019	2000011931	121778965	616	694	3.1	YES
157	107581	95709	108176	7	20	3.5	YES
158	107581	108176	95709	17	36	3.7	YES
159	136964	136967	136968	109	0	14.8	NO
160	160209	160230	160231	1	14	4.7	YES
161	160209	160231	160230	13	17	1.1	YES
162	367435	136956	358444	887	0	42.1	NO
163	450744	129353	412650	5	6	0.5	YES
164	450744	412650	129353	20	27	1.5	YES
165	504657	132700	121776463	169	231	4.4	YES
166	504657	121776463	132700	57	72	1.9	YES
167	505675	134646	259545	41	61	2.8	YES
168	505675	259545	134646	133	111	2.0	YES
169	507492	160225	394719	16	50	6.0	NO
170	507492	394719	160225	81	109	2.8	YES
171	554439840	121773546	121775269	157	179	1.7	YES
172	554439840	121775269	121773546	117	140	2.0	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
173	554441810	121667462	121667463	513	499	0.6	YES
174	554441810	121667463	121667462	451	489	1.8	YES
175	554441831	121651385	121679349	434	457	1.1	YES
176	554441831	121679349	121651385	477	381	4.6	YES
177	554441872	121776462	121779071	157	208	3.8	YES
178	554441872	121779071	121776462	74	84	1.2	YES
179	554441880	121766380	121771394	82	88	0.7	YES
180	554441880	121771394	121766380	72	60	1.5	YES
181	554441884	121770908	121773489	215	162	3.8	YES
182	554441884	121773489	121770908	172	139	2.6	YES
183	554441885	121766379	121777250	135	129	0.5	YES
184	554441885	121777250	121766379	163	182	1.4	YES
185	554443494	121771121	121777439	519	702	7.4	NO
186	554443498	121776759	121779665	113	136	2.0	YES
187	554443498	121779665	121776759	728	586	5.5	NO
188	559778132	121765697	121771966	308	294	0.8	YES
189	559778132	121771966	121765697	128	125	0.3	YES
190	559778135	121765696	121765697	108	128	1.9	YES
191	559778135	121765697	121765696	36	21	2.9	YES
192	559778655	121765696	121777969	117	147	2.6	YES
193	559778655	121777969	121765696	105	128	2.1	YES
194	559779109	121772180	121779141	497	430	3.1	YES
195	559779109	121779141	121772180	575	539	1.5	YES
196	559779873	121647704	121651385	277	248	1.8	YES
197	559779873	121651385	121647704	170	189	1.4	YES
198	559779902	121647704	121668615	144	176	2.5	YES
199	559779902	121668615	121647704	368	336	1.7	YES
200	559783972	121667462	121674536	248	190	3.9	YES
201	559783972	121674536	121667462	160	217	4.1	YES
202	578054026	121772969	121773406	127	97	2.8	YES
203	578054026	121773406	121772969	201	195	0.4	YES
204	578078047	121769002	121771313	350	279	4.0	YES
205	578078047	121771313	121769002	704	761	2.1	YES
206	578078062	121768199	121771313	708	761	1.9	YES
207	578078062	121771313	121768199	359	279	4.5	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
208	587849401	121773407	121777765	171	133	3.1	YES
209	587849401	121777765	121773407	213	179	2.4	YES
210	590522008	121771408	121774485	723	673	1.9	YES
211	590522008	121774485	121771408	652	558	3.8	YES
212	1037614838	121723065	121724902	222	233	0.8	YES
213	1037614838	121724902	121723065	308	329	1.2	YES
214	1273833630	121765608	121773111	59	38	3.0	YES
215	1273833630	121773111	121765608	46	28	3.0	YES
216	1292870043	121766820	121768383	88	41	5.9	NO
217	1292870043	121768383	121766820	105	154	4.3	YES
218	1321681787	121770888	121772246	946	668	9.8	NO
219	1321681787	121772246	121770888	714	944	8.0	NO
220	1331604380	121769477	121773918	524	697	7.0	NO
221	1331604380	121773918	121769477	556	747	7.5	NO
222	1343602197	121766798	121772502	685	656	1.1	YES
223	1343602197	121772502	121766798	446	433	0.6	YES
224	1359355712	121765778	121769433	217	238	1.4	YES
225	1361921652	121765762	121774697	722	354	15.9	NO
226	1361921652	121774697	121765762	875	362	20.6	NO
227	1363985280	121776027	121778194	444	338	5.3	NO
228	1363985280	121778194	121776027	469	280	9.8	NO
229	1367032338	121776243	121771121	566	484	3.6	YES
230	1368449442	121769433	121769001	595	729	5.2	NO
231	1372965212	121768932	121776479	428	331	5.0	YES
232	1372965212	121776479	121768932	768	740	1.0	YES
233	2147475847	121899883	121899888	564	514	2.1	YES
234	2147475847	121899888	121899883	227	251	1.6	YES
235	2147475914	121731419	121899922	358	334	1.3	YES
236	2147475914	121899922	121731419	252	278	1.6	YES
237	2147476177	4198	121777969	110	112	0.2	YES
238	2147476177	121777969	4198	160	143	1.4	YES
239	2147476182	121766798	121900056	57	56	0.1	YES
240	2147476182	121900056	121766798	118	120	0.2	YES
241	2147476184	121766798	121900057	411	403	0.4	YES
242	2147476184	121900057	121766798	588	561	1.1	YES

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
243	2147476814	121771890	121900535	297	278	1.1	YES
244	2147476814	121900535	121771890	495	459	1.6	YES
245	2147476816	121769457	121900536	311	242	4.1	YES
246	2147476816	121900536	121769457	554	510	1.9	YES
247	2147483279	71938	2000714783	322	320	0.1	YES
248	2147483279	2000714783	71938	116	93	2.3	YES
249	2147483281	401655	121723648	140	114	2.3	YES
250	2147483281	121723648	401655	488	455	1.5	YES
251	2147483286	258897	285085	617	433	8.0	NO
252	2147483286	285085	258897	296	378	4.5	YES
253	2147483288	289723	121725389	192	215	1.6	YES
254	2147483288	121725389	289723	180	164	1.2	YES
255	2147483298	160014	174991	367	410	2.2	YES
256	2147483298	174991	160014	544	463	3.6	YES
257	2147483312	88784	154002	495	505	0.5	YES
258	2147483312	154002	88784	541	537	0.2	YES
259	2147483365	265470	2000001580	143	153	0.8	YES
260	2147483365	2000001580	265470	256	264	0.5	YES
261	2147483370	272196	121723498	268	260	0.5	YES
262	2147483370	121723498	272196	298	334	2.0	YES
263	2147483554	140481	121899882	315	405	4.7	YES
264	2147483554	121899882	140481	733	687	1.7	YES
265	2147483613	401580	121901489	348	364	0.8	YES
266	2147483613	121901489	401580	611	439	7.5	NO
267	2147483638	84458	121901497	186	202	1.1	YES
268	2147483638	121901497	84458	218	203	1.1	YES

(Heavy vehicles, AM)

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	2000001344	11	7	1.4	YES
2	35	2000001344	71299	10	4	2.1	YES
3	102	121766075	121768599	91	101	1.0	YES
4	102	121768599	121766075	107	114	0.7	YES
5	191	71492	383553	5	5	0.1	YES
6	191	383553	71492	11	11	0.0	YES
7	364	121768248	2000714938	72	36	4.9	YES
8	364	2000714938	121768248	77	43	4.5	YES
9	367	2000001286	2000001289	18	16	0.4	YES
10	367	2000001289	2000001286	11	16	1.2	YES
11	421	2000714831	2000714900	21	13	1.8	YES
12	421	2000714900	2000714831	18	10	2.2	YES
13	422	121771157	2000714899	14	13	0.2	YES
14	422	2000714899	121771157	14	10	1.2	YES
15	427	121771157	2000714830	5	4	0.5	YES
16	427	2000714830	121771157	3	3	0.0	YES
17	450	395354	121771157	2	4	1.2	YES
18	450	121771157	395354	3	3	0.1	YES
19	470	71526	83724	17	15	0.5	YES
20	470	83724	71526	10	11	0.2	YES
21	471	59737	121776371	56	44	1.7	YES
22	471	121776371	59737	51	48	0.4	YES
23	472	366902	121648061	14	10	1.2	YES
24	472	121648061	366902	14	12	0.7	YES
25	475	393038	121775059	45	54	1.3	YES
26	475	121775059	393038	29	46	2.7	YES
27	479	393975	121766420	46	56	1.4	YES
28	479	121766420	393975	54	64	1.3	YES
29	492	262464	396397	9	15	1.8	YES
30	492	396397	262464	13	18	1.3	YES
31	496	260555	2000714396	20	15	1.2	YES
32	496	2000714396	260555	25	18	1.5	YES
33	500	396154	121766606	25	24	0.2	YES
34	500	121766606	396154	32	26	1.2	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
35	505	225301	121766606	3	3	0.1	YES
36	505	121766606	225301	4	1	1.8	YES
37	520	216964	2000001529	49	32	2.6	YES
38	520	2000001529	216964	42	29	2.1	YES
39	527	177057	2000001528	31	30	0.2	YES
40	527	2000001528	177057	40	31	1.6	YES
41	528	160225	2000001527	48	30	2.9	YES
42	528	2000001527	160225	44	31	2.2	YES
43	529	162936	2000001527	41	31	1.7	YES
44	529	2000001527	162936	32	30	0.4	YES
45	531	4195	160225	48	34	2.1	YES
46	531	160225	4195	44	37	1.2	YES
47	532	4195	394738	44	37	1.2	YES
48	532	394738	4195	48	34	2.1	YES
49	533	177062	121774704	7	24	4.3	YES
50	533	121774704	177062	9	25	3.9	YES
51	534	224017	394738	48	34	2.1	YES
52	534	394738	224017	44	37	1.2	YES
53	540	143958	121774704	9	25	3.9	YES
54	540	121774704	143958	7	24	4.3	YES
55	541	143958	121900536	49	29	3.3	YES
56	541	121900536	143958	43	34	1.5	YES
57	543	86303	392788	0	6	3.4	YES
58	543	392788	86303	2	4	0.9	YES
59	544	109	121768383	29	39	1.8	YES
60	544	121768383	109	47	34	2.1	YES
61	548	32	121772969	30	35	0.9	YES
62	548	121772969	32	46	47	0.2	YES
63	550	459	121772396	23	21	0.5	YES
64	550	121772396	459	14	8	1.8	YES
65	551	459	2000034621	12	8	1.3	YES
66	551	2000034621	459	25	21	0.9	YES
67	552	417	121772395	16	15	0.3	YES
68	552	121772395	417	15	16	0.4	YES
69	563	27	121772969	44	37	1.2	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
70	563	121772969	27	27	29	0.3	YES
71	654	2000714815	2000714816	0	0	0.0	YES
72	654	2000714816	2000714815	0	0	0.0	YES
73	670	139877	121776371	7	12	1.5	YES
74	670	121776371	139877	9	9	0.1	YES
75	671	140524	121899955	51	41	1.5	YES
76	671	121899955	140524	53	46	1.0	YES
77	680	393962	121775658	6	1	2.6	YES
78	680	121775658	393962	7	4	1.1	YES
79	687	128953	394521	90	37	6.6	NO
80	687	394521	128953	76	48	3.6	YES
81	690	394526	121775658	35	37	0.4	YES
82	690	121775658	394526	45	49	0.6	YES
83	700	394467	121899812	32	38	0.9	YES
84	700	121899812	394467	49	49	0.0	YES
85	702	394063	121770292	109	68	4.4	YES
86	702	121770292	394063	90	77	1.4	YES
87	712	88964	121774648	17	19	0.4	YES
88	712	121774648	88964	5	12	2.5	YES
89	714	136955	121774985	9	5	1.7	YES
90	714	121774985	136955	15	5	3.0	YES
91	725	39209	121773860	2	3	0.4	YES
92	725	121773860	39209	5	6	0.3	YES
93	733	296765	121769166	7	9	0.6	YES
94	733	121769166	296765	2	3	0.3	YES
95	744	95709	121767515	8	2	2.4	YES
96	744	121767515	95709	2	1	0.6	YES
97	755	157213	121777969	11	5	2.0	YES
98	755	121777969	157213	3	2	0.9	YES
99	756	395980	121765697	38	26	2.2	YES
100	756	121765697	395980	26	24	0.4	YES
101	808	394057	394058	80	62	2.2	YES
102	808	394058	394057	73	68	0.6	YES
103	826	77632	121675888	32	40	1.4	YES
104	826	121675888	77632	50	45	0.7	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
105	851	121774068	2000714822	9	2	2.8	YES
106	851	2000714822	121774068	12	8	1.4	YES
107	899	22	2000714847	68	34	4.8	YES
108	899	2000714847	22	51	29	3.5	YES
109	900	121768383	2000714847	29	29	0.0	YES
110	900	2000714847	121768383	46	34	1.9	YES
111	910	2000034622	2000714856	34	35	0.1	YES
112	910	2000714856	2000034622	45	41	0.7	YES
113	973	121771157	2000714900	10	10	0.0	YES
114	973	2000714900	121771157	12	13	0.4	YES
115	987	2000714903	2000714908	16	11	1.5	YES
116	987	2000714908	2000714903	5	4	0.6	YES
117	1006	2000714918	2000714919	2	0	2.0	YES
118	1006	2000714919	2000714918	2	0	2.0	YES
119	1008	121767515	2000714921	8	2	2.6	YES
120	1008	2000714921	121767515	8	9	0.2	YES
121	1013	121767515	2000714926	14	8	1.8	YES
122	1013	2000714926	121767515	8	0	3.8	YES
123	1028	121775658	2000714939	38	39	0.1	YES
124	1028	2000714939	121775658	50	53	0.5	YES
125	1056	2000714949	2000714957	26	18	1.7	YES
126	1056	2000714957	2000714949	19	15	0.9	YES
127	1063	331728	2000714961	8	9	0.2	YES
128	1063	2000714961	331728	2	3	0.3	YES
129	1618	2000011935	500000736	65	22	6.5	NO
130	1758	500000896	2000011932	12	17	1.3	YES
131	1943	2000001299	2000001342	14	14	0.1	YES
132	1943	2000001342	2000001299	17	16	0.3	YES
133	2003	2000001297	2000001343	11	11	0.1	YES
134	2003	2000001343	2000001297	12	11	0.1	YES
135	2023	121733758	2000001352	4	6	0.8	YES
136	2023	2000001352	121733758	6	7	0.3	YES
137	2544	2000001579	2000001727	11	12	0.2	YES
138	2544	2000001727	2000001579	7	9	0.5	YES
139	3338	121771047	2000001939	124	118	0.6	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
140	3338	200001939	121771047	109	106	0.3	YES
141	4530	121774836	2000034598	1	0	1.4	YES
142	4530	2000034598	121774836	61	49	1.6	YES
143	4532	121768601	2000034599	73	68	0.6	YES
144	4532	2000034599	121768601	10	9	0.2	YES
145	4536	121767723	2000034600	9	9	0.1	YES
146	4536	2000034600	121767723	11	19	2.0	YES
147	4839	2000001532	2000714396	53	37	2.4	YES
148	4839	2000714396	2000001532	40	35	0.8	YES
149	5267	2000714396	2000714714	36	25	1.9	YES
150	5267	2000714714	2000714396	28	27	0.3	YES
151	5269	2000001531	2000714716	29	27	0.3	YES
152	5269	2000714716	2000001531	30	27	0.6	YES
153	7017	121773332	2000011930	67	14	8.3	NO
154	7017	2000011930	121773332	85	27	7.8	NO
155	7019	121778965	2000011931	79	34	5.9	NO
156	7019	2000011931	121778965	41	32	1.5	YES
157	107581	95709	108176	0	1	1.2	YES
158	107581	108176	95709	0	2	2.0	YES
159	136964	136967	136968	14	0	5.3	NO
160	160209	160230	160231	0	12	4.9	YES
161	160209	160231	160230	0	8	3.9	YES
162	367435	136956	358444	21	0	6.5	NO
163	450744	129353	412650	0	7	3.9	YES
164	450744	412650	129353	3	12	3.3	YES
165	504657	132700	121776463	11	19	2.0	YES
166	504657	121776463	132700	6	13	2.3	YES
167	505675	134646	259545	3	5	1.0	YES
168	505675	259545	134646	6	5	0.5	YES
169	507492	160225	394719	3	4	0.7	YES
170	507492	394719	160225	2	6	2.0	YES
171	554439840	121773546	121775269	8	2	2.4	YES
172	554439840	121775269	121773546	16	9	1.9	YES
173	554441810	121667462	121667463	61	57	0.5	YES
174	554441810	121667463	121667462	47	48	0.1	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
175	554441831	121651385	121679349	49	44	0.7	YES
176	554441831	121679349	121651385	65	55	1.3	YES
177	554441872	121776462	121779071	8	17	2.5	YES
178	554441872	121779071	121776462	3	8	2.0	YES
179	554441880	121766380	121771394	6	5	0.4	YES
180	554441880	121771394	121766380	14	15	0.2	YES
181	554441884	121770908	121773489	20	10	2.5	YES
182	554441884	121773489	121770908	12	4	2.6	YES
183	554441885	121766379	121777250	9	15	1.8	YES
184	554441885	121777250	121766379	9	11	0.7	YES
185	554443494	121771121	121777439	12	16	1.0	YES
186	554443498	121776759	121779665	5	11	2.0	YES
187	554443498	121779665	121776759	10	10	0.1	YES
188	559778132	121765697	121771966	38	32	0.9	YES
189	559778132	121771966	121765697	21	24	0.7	YES
190	559778135	121765696	121765697	9	7	0.8	YES
191	559778135	121765697	121765696	4	0	2.8	YES
192	559778655	121765696	121777969	6	5	0.4	YES
193	559778655	121777969	121765696	9	7	0.8	YES
194	559779109	121772180	121779141	36	38	0.4	YES
195	559779109	121779141	121772180	37	45	1.3	YES
196	559779873	121647704	121651385	4	10	2.3	YES
197	559779873	121651385	121647704	3	10	2.9	YES
198	559779902	121647704	121668615	20	18	0.4	YES
199	559779902	121668615	121647704	29	20	1.8	YES
200	559783972	121667462	121674536	8	12	1.1	YES
201	559783972	121674536	121667462	5	10	1.8	YES
202	578054026	121772969	121773406	7	7	0.2	YES
203	578054026	121773406	121772969	6	11	1.6	YES
204	578078047	121769002	121771313	7	14	2.1	YES
205	578078047	121771313	121769002	10	13	0.9	YES
206	578078062	121768199	121771313	10	13	0.9	YES
207	578078062	121771313	121768199	7	14	2.1	YES
208	587849401	121773407	121777765	8	7	0.5	YES
209	587849401	121777765	121773407	7	11	1.2	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
210	590522008	121771408	121774485	20	16	0.9	YES
211	590522008	121774485	121771408	14	11	0.8	YES
212	1037614838	121723065	121724902	3	8	2.0	YES
213	1037614838	121724902	121723065	2	8	2.8	YES
214	1273833630	121765608	121773111	3	0	2.3	YES
215	1273833630	121773111	121765608	8	2	2.8	YES
216	1292870043	121766820	121768383	1	0	0.6	YES
217	1292870043	121768383	121766820	0	11	4.8	YES
218	1321681787	121770888	121772246	12	8	1.2	YES
219	1321681787	121772246	121770888	9	15	1.7	YES
220	1331604380	121769477	121773918	11	14	0.7	YES
221	1331604380	121773918	121769477	10	17	1.8	YES
222	1343602197	121766798	121772502	32	36	0.7	YES
223	1343602197	121772502	121766798	37	43	0.9	YES
224	1359355712	121765778	121769433	7	13	1.9	YES
225	1361921652	121765762	121774697	32	16	3.2	YES
226	1361921652	121774697	121765762	18	9	2.3	YES
227	1363985280	121776027	121778194	6	2	2.2	YES
228	1363985280	121778194	121776027	6	1	2.8	YES
229	1367032338	121776243	121771121	8	8	0.1	YES
230	1368449442	121769433	121769001	7	15	2.3	YES
231	1372965212	121768932	121776479	19	18	0.3	YES
232	1372965212	121776479	121768932	26	23	0.6	YES
233	2147475847	121899883	121899888	15	16	0.2	YES
234	2147475847	121899888	121899883	15	18	0.7	YES
235	2147475914	121731419	121899922	15	14	0.2	YES
236	2147475914	121899922	121731419	12	14	0.6	YES
237	2147476177	4198	121777969	2	8	2.7	YES
238	2147476177	121777969	4198	7	10	1.1	YES
239	2147476182	121766798	121900056	1	4	1.7	YES
240	2147476182	121900056	121766798	3	4	0.7	YES
241	2147476184	121766798	121900057	36	41	0.8	YES
242	2147476184	121900057	121766798	29	34	0.8	YES
243	2147476814	121771890	121900535	11	4	2.7	YES
244	2147476814	121900535	121771890	5	3	1.1	YES

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
245	2147476816	121769457	121900536	58	34	3.5	YES
246	2147476816	121900536	121769457	42	29	2.3	YES
247	2147483279	71938	2000714783	19	7	3.2	YES
248	2147483279	2000714783	71938	1	3	1.5	YES
249	2147483281	401655	121723648	1	5	2.1	YES
250	2147483281	121723648	401655	2	5	1.4	YES
251	2147483286	258897	285085	12	12	0.1	YES
252	2147483286	285085	258897	7	9	0.9	YES
253	2147483288	289723	121725389	3	2	0.6	YES
254	2147483288	121725389	289723	4	2	0.9	YES
255	2147483298	160014	174991	15	15	0.0	YES
256	2147483298	174991	160014	24	17	1.6	YES
257	2147483312	88784	154002	34	28	1.1	YES
258	2147483312	154002	88784	22	22	0.1	YES
259	2147483365	265470	2000001580	9	8	0.4	YES
260	2147483365	2000001580	265470	13	11	0.4	YES
261	2147483370	272196	121723498	24	29	0.9	YES
262	2147483370	121723498	272196	22	27	1.0	YES
263	2147483554	140481	121899882	19	25	1.3	YES
264	2147483554	121899882	140481	33	33	0.0	YES
265	2147483613	401580	121901489	18	22	0.8	YES
266	2147483613	121901489	401580	22	19	0.7	YES
267	2147483638	84458	121901497	20	10	2.6	YES
268	2147483638	121901497	84458	20	11	2.4	YES

(Light vehicles, IP)

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	2000001344	193	156	2.8	YES
2	35	2000001344	71299	146	141	0.4	YES
3	102	121766075	121768599	729	665	2.4	YES
4	102	121768599	121766075	774	778	0.2	YES
5	191	71492	383553	272	232	2.5	YES
6	191	383553	71492	254	212	2.8	YES
7	364	121768248	2000714938	409	434	1.2	YES
8	364	2000714938	121768248	362	386	1.3	YES
9	367	2000001286	2000001289	271	330	3.4	YES
10	367	2000001289	2000001286	296	334	2.1	YES
11	421	2000714831	2000714900	67	74	0.8	YES
12	421	2000714900	2000714831	82	83	0.1	YES
13	422	121771157	2000714899	128	85	4.1	YES
14	422	2000714899	121771157	145	128	1.4	YES
15	427	121771157	2000714830	76	106	3.1	YES
16	427	2000714830	121771157	67	85	2.0	YES
17	450	395354	121771157	50	64	1.8	YES
18	450	121771157	395354	59	76	2.1	YES
19	470	71526	83724	60	67	0.9	YES
20	470	83724	71526	68	74	0.7	YES
21	471	59737	121776371	198	226	1.9	YES
22	471	121776371	59737	175	206	2.3	YES
23	472	366902	121648061	166	165	0.1	YES
24	472	121648061	366902	182	177	0.3	YES
25	475	393038	121775059	200	225	1.7	YES
26	475	121775059	393038	210	242	2.1	YES
27	479	393975	121766420	204	233	2.0	YES
28	479	121766420	393975	208	236	1.9	YES
29	492	262464	396397	72	98	2.8	YES
30	492	396397	262464	64	89	2.9	YES
31	496	260555	2000714396	151	98	4.7	YES
32	496	2000714396	260555	154	89	5.9	NO
33	500	396154	121766606	100	105	0.5	YES
34	500	121766606	396154	118	120	0.1	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
35	505	225301	121766606	49	37	1.9	YES
36	505	121766606	225301	41	29	2.1	YES
37	520	216964	2000001529	165	164	0.1	YES
38	520	2000001529	216964	174	156	1.4	YES
39	527	177057	2000001528	220	268	3.1	YES
40	527	2000001528	177057	204	246	2.8	YES
41	528	160225	2000001527	271	268	0.2	YES
42	528	2000001527	160225	236	246	0.6	YES
43	529	162936	2000001527	225	246	1.4	YES
44	529	2000001527	162936	242	268	1.6	YES
45	531	4195	160225	287	301	0.8	YES
46	531	160225	4195	245	311	4.0	YES
47	532	4195	394738	233	311	4.8	YES
48	532	394738	4195	271	301	1.8	YES
49	533	177062	121774704	130	269	9.9	NO
50	533	121774704	177062	145	248	7.4	NO
51	534	224017	394738	287	301	0.8	YES
52	534	394738	224017	242	311	4.2	YES
53	540	143958	121774704	146	184	2.9	YES
54	540	121774704	143958	132	222	6.7	NO
55	541	143958	121900536	246	295	3.0	YES
56	541	121900536	143958	255	276	1.3	YES
57	543	86303	392788	60	30	4.4	YES
58	543	392788	86303	63	42	2.9	YES
59	544	109	121768383	419	368	2.6	YES
60	544	121768383	109	609	371	10.8	NO
61	548	32	121772969	440	424	0.7	YES
62	548	121772969	32	605	579	1.1	YES
63	550	459	121772396	359	326	1.8	YES
64	550	121772396	459	280	230	3.2	YES
65	551	459	2000034621	282	238	2.7	YES
66	551	2000034621	459	361	330	1.7	YES
67	552	417	121772395	267	265	0.1	YES
68	552	121772395	417	279	255	1.4	YES
69	563	27	121772969	482	398	4.0	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
70	563	121772969	27	384	360	1.2	YES
71	654	2000714815	2000714816	3	0	2.4	YES
72	654	2000714816	2000714815	5	0	3.2	YES
73	670	139877	121776371	45	41	0.7	YES
74	670	121776371	139877	54	45	1.3	YES
75	671	140524	121899955	267	270	0.2	YES
76	671	121899955	140524	261	259	0.1	YES
77	680	393962	121775658	49	45	0.6	YES
78	680	121775658	393962	59	49	1.3	YES
79	687	128953	394521	352	295	3.2	YES
80	687	394521	128953	322	296	1.5	YES
81	690	394526	121775658	356	305	2.8	YES
82	690	121775658	394526	332	321	0.6	YES
83	700	394467	121899812	458	323	6.9	NO
84	700	121899812	394467	438	356	4.1	YES
85	702	394063	121770292	381	381	0.0	YES
86	702	121770292	394063	398	422	1.2	YES
87	712	88964	121774648	226	202	1.6	YES
88	712	121774648	88964	213	178	2.5	YES
89	714	136955	121774985	212	223	0.7	YES
90	714	121774985	136955	241	248	0.5	YES
91	725	39209	121773860	117	104	1.2	YES
92	725	121773860	39209	144	115	2.6	YES
93	733	296765	121769166	140	117	2.0	YES
94	733	121769166	296765	124	89	3.4	YES
95	744	95709	121767515	131	72	5.8	NO
96	744	121767515	95709	129	88	4.0	YES
97	755	157213	121777969	60	62	0.2	YES
98	755	121777969	157213	56	64	1.0	YES
99	756	395980	121765697	147	120	2.4	YES
100	756	121765697	395980	116	105	1.0	YES
101	808	394057	394058	282	293	0.7	YES
102	808	394058	394057	307	300	0.4	YES
103	826	77632	121675888	229	253	1.5	YES
104	826	121675888	77632	224	244	1.3	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
105	851	121774068	2000714822	122	118	0.4	YES
106	851	2000714822	121774068	123	115	0.7	YES
107	899	22	2000714847	339	333	0.3	YES
108	899	2000714847	22	350	278	4.1	YES
109	900	121768383	2000714847	412	278	7.2	NO
110	900	2000714847	121768383	594	333	12.1	NO
111	910	2000034622	2000714856	571	441	5.8	NO
112	910	2000714856	2000034622	508	412	4.5	YES
113	973	121771157	2000714900	83	83	0.0	YES
114	973	2000714900	121771157	84	74	1.2	YES
115	987	2000714903	2000714908	135	141	0.5	YES
116	987	2000714908	2000714903	129	117	1.1	YES
117	1006	2000714918	2000714919	19	0	6.2	NO
118	1006	2000714919	2000714918	20	0	6.3	NO
119	1008	121767515	2000714921	92	70	2.5	YES
120	1008	2000714921	121767515	177	140	2.9	YES
121	1013	121767515	2000714926	233	143	6.5	NO
122	1013	2000714926	121767515	145	88	5.3	NO
123	1028	121775658	2000714939	395	350	2.3	YES
124	1028	2000714939	121775658	381	371	0.5	YES
125	1056	2000714949	2000714957	107	89	1.8	YES
126	1056	2000714957	2000714949	104	98	0.6	YES
127	1063	331728	2000714961	142	117	2.2	YES
128	1063	2000714961	331728	117	89	2.8	YES
129	1618	2000011935	500000736	352	365	0.7	YES
130	1758	500000896	2000011932	94	188	7.9	NO
131	1943	2000001299	2000001342	251	278	1.7	YES
132	1943	2000001342	2000001299	275	286	0.7	YES
133	2003	2000001297	2000001343	134	139	0.4	YES
134	2003	2000001343	2000001297	152	145	0.6	YES
135	2023	121733758	2000001352	223	197	1.8	YES
136	2023	2000001352	121733758	218	203	1.0	YES
137	2544	2000001579	2000001727	191	188	0.2	YES
138	2544	2000001727	2000001579	191	196	0.3	YES
139	3338	121771047	2000001939	1062	1095	1.0	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
140	3338	2000001939	121771047	1252	1355	2.8	YES
141	4530	121774836	2000034598	30	0	7.7	NO
142	4530	2000034598	121774836	268	304	2.1	YES
143	4532	121768601	2000034599	353	381	1.5	YES
144	4532	2000034599	121768601	98	73	2.8	YES
145	4536	121767723	2000034600	83	73	1.2	YES
146	4536	2000034600	121767723	101	77	2.5	YES
147	4839	2000001532	2000714396	146	124	1.9	YES
148	4839	2000714396	2000001532	148	131	1.4	YES
149	5267	2000714396	2000714714	30	36	1.1	YES
150	5267	2000714714	2000714396	35	35	0.0	YES
151	5269	2000001531	2000714716	118	129	1.0	YES
152	5269	2000714716	2000001531	113	135	2.0	YES
153	7017	121773332	2000011930	631	476	6.6	NO
154	7017	2000011930	121773332	537	524	0.6	YES
155	7019	121778965	2000011931	717	772	2.0	YES
156	7019	2000011931	121778965	563	557	0.2	YES
157	107581	95709	108176	6	15	2.9	YES
158	107581	108176	95709	8	26	4.3	YES
159	136964	136967	136968	172	0	18.5	NO
160	160209	160230	160231	1	9	3.6	YES
161	160209	160231	160230	4	10	2.3	YES
162	367435	136956	358444	101	0	14.2	NO
163	450744	129353	412650	6	6	0.2	YES
164	450744	412650	129353	8	21	3.4	YES
165	504657	132700	121776463	80	85	0.5	YES
166	504657	121776463	132700	87	101	1.4	YES
167	505675	134646	259545	54	55	0.1	YES
168	505675	259545	134646	49	53	0.6	YES
169	507492	160225	394719	30	45	2.5	YES
170	507492	394719	160225	23	78	7.7	NO
171	554439840	121773546	121775269	125	145	1.7	YES
172	554439840	121775269	121773546	118	133	1.3	YES
173	554441810	121667462	121667463	431	318	5.8	NO
174	554441810	121667463	121667462	450	327	6.3	NO

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
175	554441831	121651385	121679349	462	313	7.6	NO
176	554441831	121679349	121651385	441	321	6.2	NO
177	554441872	121776462	121779071	61	63	0.2	YES
178	554441872	121779071	121776462	51	51	0.1	YES
179	554441880	121766380	121771394	60	59	0.1	YES
180	554441880	121771394	121766380	50	50	0.0	YES
181	554441884	121770908	121773489	120	98	2.1	YES
182	554441884	121773489	121770908	145	124	1.9	YES
183	554441885	121766379	121777250	118	122	0.4	YES
184	554441885	121777250	121766379	102	106	0.3	YES
185	554443494	121771121	121777439	498	464	1.5	YES
186	554443498	121776759	121779665	115	110	0.4	YES
187	554443498	121779665	121776759	327	317	0.5	YES
188	559778132	121765697	121771966	198	203	0.3	YES
189	559778132	121771966	121765697	102	90	1.2	YES
190	559778135	121765696	121765697	80	109	3.0	YES
191	559778135	121765697	121765696	15	11	1.0	YES
192	559778655	121765696	121777969	92	120	2.7	YES
193	559778655	121777969	121765696	80	109	3.0	YES
194	559779109	121772180	121779141	518	404	5.3	NO
195	559779109	121779141	121772180	661	526	5.6	NO
196	559779873	121647704	121651385	164	133	2.5	YES
197	559779873	121651385	121647704	142	137	0.4	YES
198	559779902	121647704	121668615	191	191	0.0	YES
199	559779902	121668615	121647704	178	181	0.2	YES
200	559783972	121667462	121674536	142	177	2.8	YES
201	559783972	121674536	121667462	123	165	3.5	YES
202	578054026	121772969	121773406	108	70	4.0	YES
203	578054026	121773406	121772969	176	187	0.8	YES
204	578078047	121769002	121771313	283	285	0.1	YES
205	578078047	121771313	121769002	575	483	4.0	YES
206	578078062	121768199	121771313	570	483	3.8	YES
207	578078062	121771313	121768199	284	285	0.0	YES
208	587849401	121773407	121777765	101	81	2.1	YES
209	587849401	121777765	121773407	166	163	0.2	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
210	590522008	121771408	121774485	409	446	1.8	YES
211	590522008	121774485	121771408	478	420	2.7	YES
212	1037614838	121723065	121724902	294	301	0.4	YES
213	1037614838	121724902	121723065	268	270	0.1	YES
214	1273833630	121765608	121773111	42	30	2.0	YES
215	1273833630	121773111	121765608	36	21	2.9	YES
216	1292870043	121766820	121768383	48	45	0.4	YES
217	1292870043	121768383	121766820	40	98	7.0	NO
218	1321681787	121770888	121772246	661	482	7.5	NO
219	1321681787	121772246	121770888	688	603	3.3	YES
220	1331604380	121769477	121773918	441	496	2.6	YES
221	1331604380	121773918	121769477	378	515	6.5	NO
222	1343602197	121766798	121772502	380	375	0.2	YES
223	1343602197	121772502	121766798	363	337	1.4	YES
224	1359355712	121765778	121769433	186	256	4.7	YES
225	1361921652	121765762	121774697	506	263	12.4	NO
226	1361921652	121774697	121765762	551	301	12.1	NO
227	1363985280	121776027	121778194	379	168	12.8	NO
228	1363985280	121778194	121776027	383	266	6.5	NO
229	1367032338	121776243	121771121	319	274	2.6	YES
230	1368449442	121769433	121769001	265	404	7.6	NO
231	1372965212	121768932	121776479	426	391	1.7	YES
232	1372965212	121776479	121768932	410	390	1.0	YES
233	2147475847	121899883	121899888	198	230	2.2	YES
234	2147475847	121899888	121899883	206	234	1.9	YES
235	2147475914	121731419	121899922	248	221	1.8	YES
236	2147475914	121899922	121731419	252	237	1.0	YES
237	2147476177	4198	121777969	105	102	0.3	YES
238	2147476177	121777969	4198	121	111	1.0	YES
239	2147476182	121766798	121900056	58	69	1.4	YES
240	2147476182	121900056	121766798	51	58	0.9	YES
241	2147476184	121766798	121900057	323	300	1.3	YES
242	2147476184	121900057	121766798	347	349	0.1	YES
243	2147476814	121771890	121900535	289	277	0.7	YES
244	2147476814	121900535	121771890	260	241	1.2	YES

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
245	2147476816	121769457	121900536	396	276	6.6	NO
246	2147476816	121900536	121769457	351	295	3.1	YES
247	2147483279	71938	2000714783	144	141	0.2	YES
248	2147483279	2000714783	71938	174	154	1.5	YES
249	2147483281	401655	121723648	187	170	1.3	YES
250	2147483281	121723648	401655	192	176	1.2	YES
251	2147483286	258897	285085	254	257	0.2	YES
252	2147483286	285085	258897	255	256	0.1	YES
253	2147483288	289723	121725389	115	106	0.9	YES
254	2147483288	121725389	289723	124	116	0.7	YES
255	2147483298	160014	174991	302	284	1.0	YES
256	2147483298	174991	160014	259	252	0.4	YES
257	2147483312	88784	154002	354	373	1.0	YES
258	2147483312	154002	88784	379	401	1.1	YES
259	2147483365	265470	2000001580	145	137	0.6	YES
260	2147483365	2000001580	265470	129	115	1.2	YES
261	2147483370	272196	121723498	207	217	0.7	YES
262	2147483370	121723498	272196	208	220	0.8	YES
263	2147483554	140481	121899882	360	357	0.2	YES
264	2147483554	121899882	140481	360	366	0.3	YES
265	2147483613	401580	121901489	326	289	2.1	YES
266	2147483613	121901489	401580	299	266	2.0	YES
267	2147483638	84458	121901497	199	163	2.7	YES
268	2147483638	121901497	84458	237	199	2.6	YES

(Heavy vehicles, IP)

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	2000001344	9	5	1.4	YES
2	35	2000001344	71299	5	4	0.5	YES
3	102	121766075	121768599	90	96	0.6	YES
4	102	121768599	121766075	79	92	1.4	YES
5	191	71492	383553	8	4	1.6	YES
6	191	383553	71492	6	5	0.5	YES
7	364	121768248	2000714938	68	47	2.7	YES
8	364	2000714938	121768248	65	41	3.3	YES
9	367	2000001286	2000001289	11	11	0.1	YES
10	367	2000001289	2000001286	13	11	0.6	YES
11	421	2000714831	2000714900	18	11	1.8	YES
12	421	2000714900	2000714831	16	9	1.9	YES
13	422	121771157	2000714899	9	11	0.6	YES
14	422	2000714899	121771157	10	9	0.3	YES
15	427	121771157	2000714830	2	3	0.4	YES
16	427	2000714830	121771157	2	3	0.5	YES
17	450	395354	121771157	3	3	0.1	YES
18	450	121771157	395354	4	3	0.5	YES
19	470	71526	83724	10	11	0.3	YES
20	470	83724	71526	9	11	0.6	YES
21	471	59737	121776371	44	38	0.9	YES
22	471	121776371	59737	37	40	0.5	YES
23	472	366902	121648061	10	10	0.1	YES
24	472	121648061	366902	12	10	0.7	YES
25	475	393038	121775059	39	45	1.0	YES
26	475	121775059	393038	27	39	2.1	YES
27	479	393975	121766420	37	50	2.0	YES
28	479	121766420	393975	36	47	1.7	YES
29	492	262464	396397	10	17	1.9	YES
30	492	396397	262464	10	17	2.0	YES
31	496	260555	2000714396	25	17	1.7	YES
32	496	2000714396	260555	24	17	1.4	YES
33	500	396154	121766606	22	19	0.6	YES
34	500	121766606	396154	18	18	0.0	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
35	505	225301	121766606	2	2	0.2	YES
36	505	121766606	225301	2	1	0.6	YES
37	520	216964	2000001529	37	22	2.7	YES
38	520	2000001529	216964	32	21	2.1	YES
39	527	177057	2000001528	25	25	0.1	YES
40	527	2000001528	177057	24	23	0.1	YES
41	528	160225	2000001527	48	25	3.8	YES
42	528	2000001527	160225	35	23	2.1	YES
43	529	162936	2000001527	25	23	0.3	YES
44	529	2000001527	162936	24	25	0.3	YES
45	531	4195	160225	48	29	3.1	YES
46	531	160225	4195	35	24	2.1	YES
47	532	4195	394738	35	24	2.1	YES
48	532	394738	4195	48	29	3.1	YES
49	533	177062	121774704	3	14	3.8	YES
50	533	121774704	177062	2	16	4.7	YES
51	534	224017	394738	48	29	3.1	YES
52	534	394738	224017	35	24	2.1	YES
53	540	143958	121774704	2	16	4.7	YES
54	540	121774704	143958	3	14	3.8	YES
55	541	143958	121900536	45	31	2.3	YES
56	541	121900536	143958	45	26	3.2	YES
57	543	86303	392788	1	3	1.2	YES
58	543	392788	86303	1	2	1.0	YES
59	544	109	121768383	49	46	0.4	YES
60	544	121768383	109	42	40	0.3	YES
61	548	32	121772969	49	45	0.6	YES
62	548	121772969	32	41	49	1.1	YES
63	550	459	121772396	12	13	0.4	YES
64	550	121772396	459	12	7	1.5	YES
65	551	459	2000034621	12	7	1.5	YES
66	551	2000034621	459	13	13	0.1	YES
67	552	417	121772395	10	12	0.7	YES
68	552	121772395	417	10	12	0.7	YES
69	563	27	121772969	36	38	0.4	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
70	563	121772969	27	43	40	0.5	YES
71	654	2000714815	2000714816	1	0	1.4	YES
72	654	2000714816	2000714815	0	0	0.0	YES
73	670	139877	121776371	6	9	1.2	YES
74	670	121776371	139877	10	10	0.0	YES
75	671	140524	121899955	44	37	1.1	YES
76	671	121899955	140524	46	38	1.2	YES
77	680	393962	121775658	4	6	1.0	YES
78	680	121775658	393962	5	1	2.7	YES
79	687	128953	394521	80	55	3.1	YES
80	687	394521	128953	67	47	2.7	YES
81	690	394526	121775658	52	56	0.5	YES
82	690	121775658	394526	46	48	0.2	YES
83	700	394467	121899812	43	52	1.3	YES
84	700	121899812	394467	34	47	2.0	YES
85	702	394063	121770292	85	51	4.1	YES
86	702	121770292	394063	75	61	1.7	YES
87	712	88964	121774648	8	10	0.8	YES
88	712	121774648	88964	10	14	1.2	YES
89	714	136955	121774985	11	6	1.6	YES
90	714	121774985	136955	17	7	2.8	YES
91	725	39209	121773860	2	2	0.2	YES
92	725	121773860	39209	2	2	0.1	YES
93	733	296765	121769166	6	6	0.0	YES
94	733	121769166	296765	3	4	0.5	YES
95	744	95709	121767515	8	2	2.5	YES
96	744	121767515	95709	8	2	2.5	YES
97	755	157213	121777969	3	3	0.1	YES
98	755	121777969	157213	3	2	0.9	YES
99	756	395980	121765697	25	18	1.5	YES
100	756	121765697	395980	27	19	1.6	YES
101	808	394057	394058	51	53	0.3	YES
102	808	394058	394057	49	51	0.3	YES
103	826	77632	121675888	34	37	0.5	YES
104	826	121675888	77632	42	38	0.6	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
105	851	121774068	2000714822	8	1	3.2	YES
106	851	2000714822	121774068	8	5	1.2	YES
107	899	22	2000714847	66	39	3.7	YES
108	899	2000714847	22	59	36	3.3	YES
109	900	121768383	2000714847	49	36	1.9	YES
110	900	2000714847	121768383	41	39	0.2	YES
111	910	2000034622	2000714856	49	46	0.4	YES
112	910	2000714856	2000034622	41	39	0.3	YES
113	973	121771157	2000714900	10	9	0.2	YES
114	973	2000714900	121771157	10	11	0.4	YES
115	987	2000714903	2000714908	9	6	1.2	YES
116	987	2000714908	2000714903	7	5	0.9	YES
117	1006	2000714918	2000714919	5	0	3.2	YES
118	1006	2000714919	2000714918	2	0	2.0	YES
119	1008	121767515	2000714921	9	2	3.0	YES
120	1008	2000714921	121767515	9	7	0.9	YES
121	1013	121767515	2000714926	11	6	1.9	YES
122	1013	2000714926	121767515	11	1	4.1	YES
123	1028	121775658	2000714939	55	62	0.9	YES
124	1028	2000714939	121775658	51	48	0.4	YES
125	1056	2000714949	2000714957	19	17	0.4	YES
126	1056	2000714957	2000714949	24	17	1.5	YES
127	1063	331728	2000714961	6	6	0.0	YES
128	1063	2000714961	331728	3	4	0.5	YES
129	1618	2000011935	500000736	73	19	8.0	NO
130	1758	500000896	2000011932	15	18	0.7	YES
131	1943	2000001299	2000001342	16	12	0.9	YES
132	1943	2000001342	2000001299	18	12	1.4	YES
133	2003	2000001297	2000001343	11	11	0.1	YES
134	2003	2000001343	2000001297	13	11	0.5	YES
135	2023	121733758	2000001352	2	4	1.4	YES
136	2023	2000001352	121733758	4	5	0.3	YES
137	2544	2000001579	2000001727	10	10	0.2	YES
138	2544	2000001727	2000001579	9	9	0.1	YES
139	3338	121771047	2000001939	98	88	1.1	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
140	3338	200001939	121771047	126	114	1.1	YES
141	4530	121774836	2000034598	4	0	2.8	YES
142	4530	2000034598	121774836	52	37	2.3	YES
143	4532	121768601	2000034599	57	51	0.8	YES
144	4532	2000034599	121768601	7	6	0.6	YES
145	4536	121767723	2000034600	7	6	0.6	YES
146	4536	2000034600	121767723	8	14	1.9	YES
147	4839	2000001532	2000714396	52	36	2.5	YES
148	4839	2000714396	2000001532	47	33	2.2	YES
149	5267	2000714396	2000714714	40	24	2.8	YES
150	5267	2000714714	2000714396	35	21	2.5	YES
151	5269	2000001531	2000714716	24	21	0.6	YES
152	5269	2000714716	2000001531	22	19	0.6	YES
153	7017	121773332	2000011930	98	16	10.8	NO
154	7017	2000011930	121773332	90	23	8.9	NO
155	7019	121778965	2000011931	94	30	8.1	NO
156	7019	2000011931	121778965	33	28	1.0	YES
157	107581	95709	108176	1	1	0.0	YES
158	107581	108176	95709	1	2	0.6	YES
159	136964	136967	136968	23	0	6.8	NO
160	160209	160230	160231	0	10	4.5	YES
161	160209	160231	160230	0	9	4.2	YES
162	367435	136956	358444	22	0	6.6	NO
163	450744	129353	412650	0	9	4.2	YES
164	450744	412650	129353	0	10	4.4	YES
165	504657	132700	121776463	6	8	0.6	YES
166	504657	121776463	132700	9	15	1.8	YES
167	505675	134646	259545	2	4	1.0	YES
168	505675	259545	134646	2	3	0.4	YES
169	507492	160225	394719	1	4	1.7	YES
170	507492	394719	160225	1	0	0.8	YES
171	554439840	121773546	121775269	6	1	2.6	YES
172	554439840	121775269	121773546	11	6	1.8	YES
173	554441810	121667462	121667463	53	52	0.2	YES
174	554441810	121667463	121667462	41	44	0.4	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
175	554441831	121651385	121679349	38	40	0.3	YES
176	554441831	121679349	121651385	50	45	0.7	YES
177	554441872	121776462	121779071	4	7	1.1	YES
178	554441872	121779071	121776462	4	5	0.5	YES
179	554441880	121766380	121771394	5	3	1.1	YES
180	554441880	121771394	121766380	6	14	2.5	YES
181	554441884	121770908	121773489	8	7	0.5	YES
182	554441884	121773489	121770908	9	4	2.0	YES
183	554441885	121766379	121777250	8	15	2.2	YES
184	554441885	121777250	121766379	7	7	0.0	YES
185	554443494	121771121	121777439	6	9	1.2	YES
186	554443498	121776759	121779665	2	13	4.0	YES
187	554443498	121779665	121776759	6	8	0.7	YES
188	559778132	121765697	121771966	26	22	0.7	YES
189	559778132	121771966	121765697	25	19	1.2	YES
190	559778135	121765696	121765697	7	4	1.1	YES
191	559778135	121765697	121765696	3	0	2.4	YES
192	559778655	121765696	121777969	3	2	0.6	YES
193	559778655	121777969	121765696	6	4	0.7	YES
194	559779109	121772180	121779141	35	39	0.7	YES
195	559779109	121779141	121772180	43	52	1.3	YES
196	559779873	121647704	121651385	9	14	1.4	YES
197	559779873	121651385	121647704	11	12	0.2	YES
198	559779902	121647704	121668615	21	18	0.6	YES
199	559779902	121668615	121647704	18	19	0.1	YES
200	559783972	121667462	121674536	6	10	1.3	YES
201	559783972	121674536	121667462	8	10	0.8	YES
202	578054026	121772969	121773406	7	5	0.9	YES
203	578054026	121773406	121772969	6	10	1.5	YES
204	578078047	121769002	121771313	3	13	3.7	YES
205	578078047	121771313	121769002	6	9	1.1	YES
206	578078062	121768199	121771313	6	9	1.1	YES
207	578078062	121771313	121768199	2	13	4.1	YES
208	587849401	121773407	121777765	8	5	1.2	YES
209	587849401	121777765	121773407	6	10	1.5	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
210	590522008	121771408	121774485	18	11	1.8	YES
211	590522008	121774485	121771408	22	11	2.8	YES
212	1037614838	121723065	121724902	2	7	2.3	YES
213	1037614838	121724902	121723065	2	7	2.4	YES
214	1273833630	121765608	121773111	5	0	3.1	YES
215	1273833630	121773111	121765608	6	1	2.8	YES
216	1292870043	121766820	121768383	1	1	0.2	YES
217	1292870043	121768383	121766820	0	10	4.4	YES
218	1321681787	121770888	121772246	8	8	0.1	YES
219	1321681787	121772246	121770888	7	11	1.3	YES
220	1331604380	121769477	121773918	14	20	1.6	YES
221	1331604380	121773918	121769477	15	17	0.5	YES
222	1343602197	121766798	121772502	46	49	0.4	YES
223	1343602197	121772502	121766798	41	41	0.1	YES
224	1359355712	121765778	121769433	2	14	4.3	YES
225	1361921652	121765762	121774697	20	10	2.5	YES
226	1361921652	121774697	121765762	24	7	4.3	YES
227	1363985280	121776027	121778194	7	2	2.4	YES
228	1363985280	121778194	121776027	8	1	3.4	YES
229	1367032338	121776243	121771121	5	8	1.1	YES
230	1368449442	121769433	121769001	5	10	1.8	YES
231	1372965212	121768932	121776479	20	21	0.3	YES
232	1372965212	121776479	121768932	13	17	0.9	YES
233	2147475847	121899883	121899888	12	14	0.5	YES
234	2147475847	121899888	121899883	13	15	0.4	YES
235	2147475914	121731419	121899922	11	13	0.4	YES
236	2147475914	121899922	121731419	13	13	0.0	YES
237	2147476177	4198	121777969	3	6	1.4	YES
238	2147476177	121777969	4198	1	5	2.2	YES
239	2147476182	121766798	121900056	3	4	0.4	YES
240	2147476182	121900056	121766798	2	3	0.8	YES
241	2147476184	121766798	121900057	40	39	0.2	YES
242	2147476184	121900057	121766798	46	47	0.1	YES
243	2147476814	121771890	121900535	5	5	0.2	YES
244	2147476814	121900535	121771890	3	3	0.1	YES

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
245	2147476816	121769457	121900536	41	26	2.6	YES
246	2147476816	121900536	121769457	42	31	1.8	YES
247	2147483279	71938	2000714783	7	3	1.7	YES
248	2147483279	2000714783	71938	2	3	0.5	YES
249	2147483281	401655	121723648	1	3	1.5	YES
250	2147483281	121723648	401655	1	3	1.6	YES
251	2147483286	258897	285085	7	11	1.2	YES
252	2147483286	285085	258897	7	10	1.1	YES
253	2147483288	289723	121725389	2	2	0.0	YES
254	2147483288	121725389	289723	1	2	0.8	YES
255	2147483298	160014	174991	18	13	1.4	YES
256	2147483298	174991	160014	16	12	1.0	YES
257	2147483312	88784	154002	22	21	0.1	YES
258	2147483312	154002	88784	20	20	0.1	YES
259	2147483365	265470	2000001580	10	9	0.3	YES
260	2147483365	2000001580	265470	9	9	0.1	YES
261	2147483370	272196	121723498	20	23	0.7	YES
262	2147483370	121723498	272196	22	25	0.6	YES
263	2147483554	140481	121899882	14	19	1.1	YES
264	2147483554	121899882	140481	14	19	1.3	YES
265	2147483613	401580	121901489	18	18	0.1	YES
266	2147483613	121901489	401580	13	15	0.6	YES
267	2147483638	84458	121901497	26	11	3.4	YES
268	2147483638	121901497	84458	27	14	3.0	YES

(Light vehicles, PM)

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	2000001344	315	231	5.1	NO
2	35	2000001344	71299	164	179	1.1	YES
3	102	121766075	121768599	858	892	1.2	YES
4	102	121768599	121766075	1647	1456	4.8	YES
5	191	71492	383553	421	350	3.6	YES
6	191	383553	71492	231	188	3.0	YES
7	364	121768248	2000714938	472	507	1.6	YES
8	364	2000714938	121768248	570	652	3.3	YES
9	367	2000001286	2000001289	344	427	4.3	YES
10	367	2000001289	2000001286	469	458	0.5	YES
11	421	2000714831	2000714900	123	128	0.4	YES
12	421	2000714900	2000714831	105	103	0.2	YES
13	422	121771157	2000714899	190	117	5.9	NO
14	422	2000714899	121771157	164	136	2.3	YES
15	427	121771157	2000714830	73	87	1.6	YES
16	427	2000714830	121771157	115	131	1.4	YES
17	450	395354	121771157	60	59	0.1	YES
18	450	121771157	395354	100	147	4.2	YES
19	470	71526	83724	128	140	1.1	YES
20	470	83724	71526	103	117	1.4	YES
21	471	59737	121776371	442	468	1.2	YES
22	471	121776371	59737	269	295	1.5	YES
23	472	366902	121648061	226	212	1.0	YES
24	472	121648061	366902	287	205	5.2	NO
25	475	393038	121775059	229	266	2.3	YES
26	475	121775059	393038	457	505	2.2	YES
27	479	393975	121766420	479	575	4.2	YES
28	479	121766420	393975	233	277	2.7	YES
29	492	262464	396397	84	106	2.2	YES
30	492	396397	262464	205	198	0.5	YES
31	496	260555	2000714396	171	106	5.6	NO
32	496	2000714396	260555	281	198	5.3	NO
33	500	396154	121766606	187	199	0.8	YES
34	500	121766606	396154	239	197	2.8	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
35	505	225301	121766606	58	46	1.6	YES
36	505	121766606	225301	58	32	3.9	YES
37	520	216964	2000001529	244	295	3.1	YES
38	520	2000001529	216964	319	309	0.5	YES
39	527	177057	2000001528	423	528	4.8	NO
40	527	2000001528	177057	374	375	0.0	YES
41	528	160225	2000001527	637	528	4.5	NO
42	528	2000001527	160225	424	375	2.5	YES
43	529	162936	2000001527	385	375	0.5	YES
44	529	2000001527	162936	442	528	3.9	YES
45	531	4195	160225	679	612	2.7	YES
46	531	160225	4195	435	406	1.4	YES
47	532	4195	394738	424	406	0.9	YES
48	532	394738	4195	637	612	1.0	YES
49	533	177062	121774704	166	267	6.9	NO
50	533	121774704	177062	279	518	12.0	NO
51	534	224017	394738	679	612	2.7	YES
52	534	394738	224017	435	406	1.4	YES
53	540	143958	121774704	279	335	3.2	YES
54	540	121774704	143958	166	207	3.0	YES
55	541	143958	121900536	298	270	1.7	YES
56	541	121900536	143958	444	485	1.9	YES
57	543	86303	392788	110	94	1.6	YES
58	543	392788	86303	57	43	2.0	YES
59	544	109	121768383	553	450	4.6	NO
60	544	121768383	109	769	448	13.0	NO
61	548	32	121772969	543	509	1.5	YES
62	548	121772969	32	813	709	3.8	YES
63	550	459	121772396	502	476	1.2	YES
64	550	121772396	459	354	274	4.5	YES
65	551	459	2000034621	353	283	3.9	YES
66	551	2000034621	459	515	479	1.6	YES
67	552	417	121772395	337	265	4.1	YES
68	552	121772395	417	433	410	1.1	YES
69	563	27	121772969	653	572	3.3	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
70	563	121772969	27	426	388	1.9	YES
71	654	2000714815	2000714816	2	0	2.0	YES
72	654	2000714816	2000714815	1	0	1.4	YES
73	670	139877	121776371	72	70	0.2	YES
74	670	121776371	139877	95	86	0.9	YES
75	671	140524	121899955	449	400	2.4	YES
76	671	121899955	140524	378	331	2.5	YES
77	680	393962	121775658	67	45	3.0	YES
78	680	121775658	393962	112	73	4.0	YES
79	687	128953	394521	375	405	1.5	YES
80	687	394521	128953	559	542	0.7	YES
81	690	394526	121775658	443	418	1.2	YES
82	690	121775658	394526	626	605	0.8	YES
83	700	394467	121899812	506	456	2.3	YES
84	700	121899812	394467	716	644	2.8	YES
85	702	394063	121770292	495	482	0.6	YES
86	702	121770292	394063	850	931	2.7	YES
87	712	88964	121774648	199	226	1.8	YES
88	712	121774648	88964	314	337	1.3	YES
89	714	136955	121774985	262	323	3.6	YES
90	714	121774985	136955	380	284	5.3	NO
91	725	39209	121773860	139	112	2.4	YES
92	725	121773860	39209	224	198	1.8	YES
93	733	296765	121769166	144	114	2.6	YES
94	733	121769166	296765	170	146	1.9	YES
95	744	95709	121767515	148	87	5.6	NO
96	744	121767515	95709	174	141	2.7	YES
97	755	157213	121777969	76	75	0.1	YES
98	755	121777969	157213	125	94	2.9	YES
99	756	395980	121765697	357	197	9.6	NO
100	756	121765697	395980	203	199	0.3	YES
101	808	394057	394058	803	756	1.7	YES
102	808	394058	394057	395	362	1.7	YES
103	826	77632	121675888	385	358	1.4	YES
104	826	121675888	77632	365	313	2.8	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
105	851	121774068	2000714822	170	199	2.1	YES
106	851	2000714822	121774068	147	128	1.6	YES
107	899	22	2000714847	428	424	0.2	YES
108	899	2000714847	22	484	397	4.1	YES
109	900	121768383	2000714847	552	397	7.1	NO
110	900	2000714847	121768383	751	424	13.5	NO
111	910	2000034622	2000714856	672	552	4.9	NO
112	910	2000714856	2000034622	688	613	2.9	YES
113	973	121771157	2000714900	118	103	1.4	YES
114	973	2000714900	121771157	142	128	1.2	YES
115	987	2000714903	2000714908	177	153	1.9	YES
116	987	2000714908	2000714903	180	170	0.8	YES
117	1006	2000714918	2000714919	14	0	5.3	NO
118	1006	2000714919	2000714918	14	0	5.3	NO
119	1008	121767515	2000714921	146	133	1.1	YES
120	1008	2000714921	121767515	175	152	1.8	YES
121	1013	121767515	2000714926	228	134	7.0	NO
122	1013	2000714926	121767515	225	168	4.1	YES
123	1028	121775658	2000714939	488	463	1.2	YES
124	1028	2000714939	121775658	716	678	1.4	YES
125	1056	2000714949	2000714957	231	198	2.2	YES
126	1056	2000714957	2000714949	107	106	0.1	YES
127	1063	331728	2000714961	147	114	2.8	YES
128	1063	2000714961	331728	166	146	1.6	YES
129	1618	2000011935	500000736	627	534	3.9	YES
130	1758	500000896	2000011932	246	352	6.1	NO
131	1943	2000001299	2000001342	336	383	2.5	YES
132	1943	2000001342	2000001299	401	357	2.3	YES
133	2003	2000001297	2000001343	153	141	1.0	YES
134	2003	2000001343	2000001297	220	229	0.6	YES
135	2023	121733758	2000001352	323	299	1.4	YES
136	2023	2000001352	121733758	225	203	1.5	YES
137	2544	2000001579	2000001727	223	213	0.7	YES
138	2544	2000001727	2000001579	317	321	0.2	YES
139	3338	121771047	2000001939	1938	1958	0.4	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
140	3338	2000001939	121771047	2369	2340	0.6	YES
141	4530	121774836	2000034598	35	0	8.4	NO
142	4530	2000034598	121774836	404	386	0.9	YES
143	4532	121768601	2000034599	505	482	1.0	YES
144	4532	2000034599	121768601	145	109	3.2	YES
145	4536	121767723	2000034600	133	109	2.2	YES
146	4536	2000034600	121767723	124	96	2.7	YES
147	4839	2000001532	2000714396	265	207	3.8	YES
148	4839	2000714396	2000001532	205	172	2.4	YES
149	5267	2000714396	2000714714	6	11	1.8	YES
150	5267	2000714714	2000714396	57	68	1.4	YES
151	5269	2000001531	2000714716	205	221	1.1	YES
152	5269	2000714716	2000001531	138	195	4.4	YES
153	7017	121773332	2000011930	864	705	5.7	NO
154	7017	2000011930	121773332	650	592	2.3	YES
155	7019	121778965	2000011931	985	933	1.7	YES
156	7019	2000011931	121778965	665	764	3.7	YES
157	107581	95709	108176	14	24	2.3	YES
158	107581	108176	95709	7	17	2.9	YES
159	136964	136967	136968	465	0	30.5	NO
160	160209	160230	160231	5	11	2.2	YES
161	160209	160231	160230	6	20	4.0	YES
162	367435	136956	358444	78	0	12.5	NO
163	450744	129353	412650	12	39	5.4	NO
164	450744	412650	129353	9	6	1.0	YES
165	504657	132700	121776463	83	88	0.6	YES
166	504657	121776463	132700	148	198	3.8	YES
167	505675	134646	259545	78	73	0.6	YES
168	505675	259545	134646	59	84	2.9	YES
169	507492	160225	394719	56	95	4.5	YES
170	507492	394719	160225	24	43	3.2	YES
171	554439840	121773546	121775269	232	265	2.1	YES
172	554439840	121775269	121773546	145	150	0.4	YES
173	554441810	121667462	121667463	461	465	0.2	YES
174	554441810	121667463	121667462	368	405	1.9	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
175	554441831	121651385	121679349	462	424	1.8	YES
176	554441831	121679349	121651385	508	458	2.3	YES
177	554441872	121776462	121779071	71	72	0.2	YES
178	554441872	121779071	121776462	59	61	0.3	YES
179	554441880	121766380	121771394	79	81	0.3	YES
180	554441880	121771394	121766380	96	152	5.0	NO
181	554441884	121770908	121773489	118	98	2.0	YES
182	554441884	121773489	121770908	186	141	3.5	YES
183	554441885	121766379	121777250	186	228	2.9	YES
184	554441885	121777250	121766379	104	113	0.9	YES
185	554443494	121771121	121777439	664	851	6.8	NO
186	554443498	121776759	121779665	178	150	2.2	YES
187	554443498	121779665	121776759	392	402	0.5	YES
188	559778132	121765697	121771966	397	325	3.8	YES
189	559778132	121771966	121765697	177	181	0.3	YES
190	559778135	121765696	121765697	128	166	3.1	YES
191	559778135	121765697	121765696	62	21	6.4	NO
192	559778655	121765696	121777969	158	180	1.7	YES
193	559778655	121777969	121765696	127	166	3.2	YES
194	559779109	121772180	121779141	649	537	4.6	NO
195	559779109	121779141	121772180	795	671	4.6	NO
196	559779873	121647704	121651385	138	168	2.4	YES
197	559779873	121651385	121647704	120	149	2.5	YES
198	559779902	121647704	121668615	308	280	1.7	YES
199	559779902	121668615	121647704	191	210	1.4	YES
200	559783972	121667462	121674536	155	205	3.7	YES
201	559783972	121674536	121667462	184	212	2.0	YES
202	578054026	121772969	121773406	159	138	1.7	YES
203	578054026	121773406	121772969	202	153	3.6	YES
204	578078047	121769002	121771313	428	407	1.0	YES
205	578078047	121771313	121769002	738	825	3.1	YES
206	578078062	121768199	121771313	739	825	3.1	YES
207	578078062	121771313	121768199	417	407	0.5	YES
208	587849401	121773407	121777765	138	104	3.1	YES
209	587849401	121777765	121773407	201	178	1.6	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
210	590522008	121771408	121774485	611	614	0.1	YES
211	590522008	121774485	121771408	563	545	0.8	YES
212	1037614838	121723065	121724902	337	352	0.8	YES
213	1037614838	121724902	121723065	344	332	0.6	YES
214	1273833630	121765608	121773111	111	73	4.0	YES
215	1273833630	121773111	121765608	46	29	2.8	YES
216	1292870043	121766820	121768383	38	29	1.6	YES
217	1292870043	121768383	121766820	20	58	6.1	NO
218	1321681787	121770888	121772246	904	887	0.6	YES
219	1321681787	121772246	121770888	890	828	2.1	YES
220	1331604380	121769477	121773918	431	535	4.7	NO
221	1331604380	121773918	121769477	549	736	7.4	NO
222	1343602197	121766798	121772502	453	455	0.1	YES
223	1343602197	121772502	121766798	675	644	1.2	YES
224	1359355712	121765778	121769433	257	347	5.2	NO
225	1361921652	121765762	121774697	737	351	16.6	NO
226	1361921652	121774697	121765762	557	360	9.2	NO
227	1363985280	121776027	121778194	429	190	13.6	NO
228	1363985280	121778194	121776027	394	317	4.1	YES
229	1367032338	121776243	121771121	437	627	8.2	NO
230	1368449442	121769433	121769001	327	401	3.9	YES
231	1372965212	121768932	121776479	658	542	4.7	NO
232	1372965212	121776479	121768932	424	470	2.2	YES
233	2147475847	121899883	121899888	240	275	2.2	YES
234	2147475847	121899888	121899883	352	350	0.1	YES
235	2147475914	121731419	121899922	330	324	0.3	YES
236	2147475914	121899922	121731419	358	348	0.5	YES
237	2147476177	4198	121777969	162	143	1.5	YES
238	2147476177	121777969	4198	143	138	0.4	YES
239	2147476182	121766798	121900056	98	104	0.6	YES
240	2147476182	121900056	121766798	72	74	0.3	YES
241	2147476184	121766798	121900057	609	566	1.8	YES
242	2147476184	121900057	121766798	413	407	0.3	YES
243	2147476814	121771890	121900535	326	330	0.2	YES
244	2147476814	121900535	121771890	228	281	3.3	YES

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
245	2147476816	121769457	121900536	645	485	6.7	NO
246	2147476816	121900536	121769457	384	270	6.3	NO
247	2147483279	71938	2000714783	156	125	2.6	YES
248	2147483279	2000714783	71938	207	233	1.8	YES
249	2147483281	401655	121723648	280	287	0.4	YES
250	2147483281	121723648	401655	158	121	3.1	YES
251	2147483286	258897	285085	284	301	1.0	YES
252	2147483286	285085	258897	418	327	4.7	YES
253	2147483288	289723	121725389	105	102	0.3	YES
254	2147483288	121725389	289723	160	186	2.0	YES
255	2147483298	160014	174991	440	399	2.0	YES
256	2147483298	174991	160014	336	338	0.1	YES
257	2147483312	88784	154002	541	541	0.0	YES
258	2147483312	154002	88784	473	483	0.5	YES
259	2147483365	265470	2000001580	255	246	0.5	YES
260	2147483365	2000001580	265470	177	186	0.7	YES
261	2147483370	272196	121723498	332	357	1.4	YES
262	2147483370	121723498	272196	289	291	0.1	YES
263	2147483554	140481	121899882	620	554	2.7	YES
264	2147483554	121899882	140481	337	431	4.8	YES
265	2147483613	401580	121901489	507	403	4.9	NO
266	2147483613	121901489	401580	350	341	0.5	YES
267	2147483638	84458	121901497	300	236	3.9	YES
268	2147483638	121901497	84458	367	321	2.5	YES

(Heavy vehicles, PM)

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	35	71299	2000001344	14	7	2.1	YES
2	35	2000001344	71299	8	6	0.9	YES
3	102	121766075	121768599	78	89	1.2	YES
4	102	121768599	121766075	79	93	1.5	YES
5	191	71492	383553	7	5	0.9	YES
6	191	383553	71492	4	5	0.6	YES
7	364	121768248	2000714938	74	42	4.2	YES
8	364	2000714938	121768248	82	41	5.3	NO
9	367	2000001286	2000001289	11	11	0.1	YES
10	367	2000001289	2000001286	13	13	0.0	YES
11	421	2000714831	2000714900	15	10	1.4	YES
12	421	2000714900	2000714831	14	8	2.0	YES
13	422	121771157	2000714899	7	10	1.0	YES
14	422	2000714899	121771157	7	7	0.2	YES
15	427	121771157	2000714830	0	3	2.5	YES
16	427	2000714830	121771157	2	2	0.2	YES
17	450	395354	121771157	2	3	0.8	YES
18	450	121771157	395354	3	2	0.4	YES
19	470	71526	83724	12	13	0.4	YES
20	470	83724	71526	9	11	0.6	YES
21	471	59737	121776371	54	34	3.0	YES
22	471	121776371	59737	36	35	0.2	YES
23	472	366902	121648061	11	10	0.3	YES
24	472	121648061	366902	9	7	0.7	YES
25	475	393038	121775059	31	39	1.4	YES
26	475	121775059	393038	30	39	1.5	YES
27	479	393975	121766420	47	50	0.5	YES
28	479	121766420	393975	27	38	1.9	YES
29	492	262464	396397	10	14	1.1	YES
30	492	396397	262464	10	15	1.4	YES
31	496	260555	2000714396	17	14	0.8	YES
32	496	2000714396	260555	15	15	0.0	YES
33	500	396154	121766606	22	16	1.4	YES
34	500	121766606	396154	22	17	1.1	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
35	505	225301	121766606	2	1	0.9	YES
36	505	121766606	225301	2	2	0.1	YES
37	520	216964	2000001529	33	21	2.4	YES
38	520	2000001529	216964	36	18	3.4	YES
39	527	177057	2000001528	16	20	0.9	YES
40	527	2000001528	177057	34	22	2.2	YES
41	528	160225	2000001527	29	20	1.8	YES
42	528	2000001527	160225	22	22	0.1	YES
43	529	162936	2000001527	36	22	2.5	YES
44	529	2000001527	162936	17	20	0.7	YES
45	531	4195	160225	29	23	1.3	YES
46	531	160225	4195	22	26	0.9	YES
47	532	4195	394738	22	26	0.9	YES
48	532	394738	4195	29	23	1.3	YES
49	533	177062	121774704	4	19	4.4	YES
50	533	121774704	177062	1	14	4.8	YES
51	534	224017	394738	29	23	1.3	YES
52	534	394738	224017	22	26	0.9	YES
53	540	143958	121774704	1	14	4.8	YES
54	540	121774704	143958	4	19	4.4	YES
55	541	143958	121900536	52	27	4.0	YES
56	541	121900536	143958	49	24	4.2	YES
57	543	86303	392788	3	3	0.0	YES
58	543	392788	86303	0	2	2.1	YES
59	544	109	121768383	43	43	0.1	YES
60	544	121768383	109	40	36	0.7	YES
61	548	32	121772969	38	39	0.1	YES
62	548	121772969	32	42	46	0.5	YES
63	550	459	121772396	15	13	0.6	YES
64	550	121772396	459	15	9	1.9	YES
65	551	459	2000034621	14	9	1.6	YES
66	551	2000034621	459	12	13	0.3	YES
67	552	417	121772395	12	13	0.2	YES
68	552	121772395	417	9	12	0.8	YES
69	563	27	121772969	37	37	0.0	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
70	563	121772969	27	35	34	0.1	YES
71	654	2000714815	2000714816	0	0	0.0	YES
72	654	2000714816	2000714815	0	0	0.0	YES
73	670	139877	121776371	5	9	1.6	YES
74	670	121776371	139877	10	10	0.0	YES
75	671	140524	121899955	38	29	1.6	YES
76	671	121899955	140524	39	33	1.0	YES
77	680	393962	121775658	3	5	0.8	YES
78	680	121775658	393962	3	1	1.8	YES
79	687	128953	394521	77	42	4.5	YES
80	687	394521	128953	79	47	4.1	YES
81	690	394526	121775658	40	43	0.4	YES
82	690	121775658	394526	40	45	0.8	YES
83	700	394467	121899812	38	43	0.8	YES
84	700	121899812	394467	31	45	2.3	YES
85	702	394063	121770292	73	43	3.9	YES
86	702	121770292	394063	87	63	2.7	YES
87	712	88964	121774648	7	9	0.8	YES
88	712	121774648	88964	14	13	0.4	YES
89	714	136955	121774985	12	6	2.1	YES
90	714	121774985	136955	16	12	1.0	YES
91	725	39209	121773860	3	2	0.9	YES
92	725	121773860	39209	3	3	0.1	YES
93	733	296765	121769166	7	8	0.5	YES
94	733	121769166	296765	4	4	0.1	YES
95	744	95709	121767515	6	2	1.8	YES
96	744	121767515	95709	12	7	1.8	YES
97	755	157213	121777969	2	2	0.2	YES
98	755	121777969	157213	9	2	2.8	YES
99	756	395980	121765697	23	17	1.3	YES
100	756	121765697	395980	22	16	1.4	YES
101	808	394057	394058	77	54	2.8	YES
102	808	394058	394057	50	43	1.0	YES
103	826	77632	121675888	31	29	0.4	YES
104	826	121675888	77632	35	33	0.3	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
105	851	121774068	2000714822	16	6	2.8	YES
106	851	2000714822	121774068	12	7	1.6	YES
107	899	22	2000714847	66	35	4.3	YES
108	899	2000714847	22	57	35	3.3	YES
109	900	121768383	2000714847	42	35	1.1	YES
110	900	2000714847	121768383	40	35	0.8	YES
111	910	2000034622	2000714856	45	42	0.5	YES
112	910	2000714856	2000034622	41	39	0.4	YES
113	973	121771157	2000714900	8	8	0.2	YES
114	973	2000714900	121771157	7	10	1.0	YES
115	987	2000714903	2000714908	9	5	1.4	YES
116	987	2000714908	2000714903	5	4	0.3	YES
117	1006	2000714918	2000714919	2	0	2.0	YES
118	1006	2000714919	2000714918	8	0	4.0	YES
119	1008	121767515	2000714921	11	2	3.5	YES
120	1008	2000714921	121767515	14	10	1.3	YES
121	1013	121767515	2000714926	9	7	0.8	YES
122	1013	2000714926	121767515	14	3	3.6	YES
123	1028	121775658	2000714939	41	47	0.9	YES
124	1028	2000714939	121775658	41	46	0.7	YES
125	1056	2000714949	2000714957	13	15	0.5	YES
126	1056	2000714957	2000714949	15	14	0.3	YES
127	1063	331728	2000714961	7	8	0.5	YES
128	1063	2000714961	331728	4	4	0.1	YES
129	1618	2000011935	500000736	63	16	7.4	NO
130	1758	500000896	2000011932	6	13	2.4	YES
131	1943	2000001299	2000001342	18	15	0.7	YES
132	1943	2000001342	2000001299	21	13	1.8	YES
133	2003	2000001297	2000001343	11	12	0.2	YES
134	2003	2000001343	2000001297	15	13	0.4	YES
135	2023	121733758	2000001352	5	5	0.2	YES
136	2023	2000001352	121733758	4	5	0.5	YES
137	2544	2000001579	2000001727	8	10	0.7	YES
138	2544	2000001727	2000001579	10	11	0.2	YES
139	3338	121771047	2000001939	82	95	1.4	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
140	3338	2000001939	121771047	114	105	0.8	YES
141	4530	121774836	2000034598	7	0	3.7	YES
142	4530	2000034598	121774836	44	34	1.6	YES
143	4532	121768601	2000034599	48	43	0.7	YES
144	4532	2000034599	121768601	10	8	0.5	YES
145	4536	121767723	2000034600	7	8	0.5	YES
146	4536	2000034600	121767723	7	9	0.8	YES
147	4839	2000001532	2000714396	48	30	2.8	YES
148	4839	2000714396	2000001532	47	29	2.9	YES
149	5267	2000714396	2000714714	37	22	2.8	YES
150	5267	2000714714	2000714396	34	22	2.3	YES
151	5269	2000001531	2000714716	21	17	1.0	YES
152	5269	2000714716	2000001531	19	19	0.0	YES
153	7017	121773332	2000011930	105	27	9.7	NO
154	7017	2000011930	121773332	90	30	7.8	NO
155	7019	121778965	2000011931	111	41	8.0	NO
156	7019	2000011931	121778965	24	36	2.2	YES
157	107581	95709	108176	0	5	3.1	YES
158	107581	108176	95709	1	2	1.0	YES
159	136964	136967	136968	23	0	6.8	NO
160	160209	160230	160231	0	9	4.3	YES
161	160209	160231	160230	1	4	1.8	YES
162	367435	136956	358444	26	0	7.2	NO
163	450744	129353	412650	1	4	1.8	YES
164	450744	412650	129353	3	9	2.5	YES
165	504657	132700	121776463	1	4	1.8	YES
166	504657	121776463	132700	11	14	0.7	YES
167	505675	134646	259545	3	5	1.1	YES
168	505675	259545	134646	5	4	0.5	YES
169	507492	160225	394719	0	3	2.3	YES
170	507492	394719	160225	0	4	2.8	YES
171	554439840	121773546	121775269	19	7	3.4	YES
172	554439840	121775269	121773546	12	6	1.9	YES
173	554441810	121667462	121667463	42	41	0.2	YES
174	554441810	121667463	121667462	25	33	1.5	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
175	554441831	121651385	121679349	25	29	0.8	YES
176	554441831	121679349	121651385	37	34	0.4	YES
177	554441872	121776462	121779071	1	5	2.2	YES
178	554441872	121779071	121776462	6	6	0.1	YES
179	554441880	121766380	121771394	4	3	0.7	YES
180	554441880	121771394	121766380	15	14	0.2	YES
181	554441884	121770908	121773489	11	7	1.5	YES
182	554441884	121773489	121770908	5	3	1.2	YES
183	554441885	121766379	121777250	10	15	1.3	YES
184	554441885	121777250	121766379	5	7	0.9	YES
185	554443494	121771121	121777439	8	18	2.7	YES
186	554443498	121776759	121779665	3	7	1.9	YES
187	554443498	121779665	121776759	5	10	1.9	YES
188	559778132	121765697	121771966	20	21	0.2	YES
189	559778132	121771966	121765697	20	16	1.0	YES
190	559778135	121765696	121765697	4	4	0.0	YES
191	559778135	121765697	121765696	6	0	3.5	YES
192	559778655	121765696	121777969	7	3	1.6	YES
193	559778655	121777969	121765696	6	4	0.9	YES
194	559779109	121772180	121779141	36	38	0.4	YES
195	559779109	121779141	121772180	40	46	0.9	YES
196	559779873	121647704	121651385	6	12	2.0	YES
197	559779873	121651385	121647704	8	12	1.3	YES
198	559779902	121647704	121668615	32	20	2.3	YES
199	559779902	121668615	121647704	21	18	0.6	YES
200	559783972	121667462	121674536	1	7	3.0	YES
201	559783972	121674536	121667462	8	10	0.7	YES
202	578054026	121772969	121773406	5	4	0.4	YES
203	578054026	121773406	121772969	6	9	1.0	YES
204	578078047	121769002	121771313	3	11	3.0	YES
205	578078047	121771313	121769002	6	15	2.9	YES
206	578078062	121768199	121771313	7	15	2.5	YES
207	578078062	121771313	121768199	1	11	4.0	YES
208	587849401	121773407	121777765	5	4	0.4	YES
209	587849401	121777765	121773407	6	9	1.0	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
210	590522008	121771408	121774485	18	11	2.0	YES
211	590522008	121774485	121771408	14	12	0.7	YES
212	1037614838	121723065	121724902	3	9	2.6	YES
213	1037614838	121724902	121723065	4	9	1.9	YES
214	1273833630	121765608	121773111	1	1	0.4	YES
215	1273833630	121773111	121765608	3	0	2.2	YES
216	1292870043	121766820	121768383	1	1	0.4	YES
217	1292870043	121768383	121766820	2	8	2.7	YES
218	1321681787	121770888	121772246	8	12	1.3	YES
219	1321681787	121772246	121770888	9	14	1.6	YES
220	1331604380	121769477	121773918	15	19	0.9	YES
221	1331604380	121773918	121769477	20	17	0.6	YES
222	1343602197	121766798	121772502	39	42	0.5	YES
223	1343602197	121772502	121766798	39	40	0.1	YES
224	1359355712	121765778	121769433	2	12	3.7	YES
225	1361921652	121765762	121774697	17	9	2.4	YES
226	1361921652	121774697	121765762	24	11	3.2	YES
227	1363985280	121776027	121778194	5	1	2.1	YES
228	1363985280	121778194	121776027	6	2	1.9	YES
229	1367032338	121776243	121771121	9	9	0.0	YES
230	1368449442	121769433	121769001	9	10	0.2	YES
231	1372965212	121768932	121776479	25	25	0.1	YES
232	1372965212	121776479	121768932	15	15	0.0	YES
233	2147475847	121899883	121899888	12	14	0.6	YES
234	2147475847	121899888	121899883	12	16	1.0	YES
235	2147475914	121731419	121899922	14	13	0.4	YES
236	2147475914	121899922	121731419	12	13	0.2	YES
237	2147476177	4198	121777969	8	6	0.7	YES
238	2147476177	121777969	4198	2	5	1.5	YES
239	2147476182	121766798	121900056	2	4	1.0	YES
240	2147476182	121900056	121766798	3	4	0.4	YES
241	2147476184	121766798	121900057	38	38	0.0	YES
242	2147476184	121900057	121766798	37	40	0.6	YES
243	2147476814	121771890	121900535	6	4	0.7	YES
244	2147476814	121900535	121771890	16	4	3.7	YES

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
245	2147476816	121769457	121900536	29	24	1.1	YES
246	2147476816	121900536	121769457	50	27	3.7	YES
247	2147483279	71938	2000714783	9	3	2.2	YES
248	2147483279	2000714783	71938	3	3	0.1	YES
249	2147483281	401655	121723648	1	4	1.9	YES
250	2147483281	121723648	401655	1	4	1.7	YES
251	2147483286	258897	285085	7	9	0.8	YES
252	2147483286	285085	258897	8	10	0.7	YES
253	2147483288	289723	121725389	2	2	0.2	YES
254	2147483288	121725389	289723	3	2	0.5	YES
255	2147483298	160014	174991	16	12	1.0	YES
256	2147483298	174991	160014	14	13	0.1	YES
257	2147483312	88784	154002	23	23	0.0	YES
258	2147483312	154002	88784	23	23	0.1	YES
259	2147483365	265470	2000001580	11	10	0.4	YES
260	2147483365	2000001580	265470	14	10	1.0	YES
261	2147483370	272196	121723498	25	28	0.6	YES
262	2147483370	121723498	272196	14	19	1.3	YES
263	2147483554	140481	121899882	26	26	0.0	YES
264	2147483554	121899882	140481	16	21	1.3	YES
265	2147483613	401580	121901489	18	17	0.3	YES
266	2147483613	121901489	401580	13	16	0.8	YES
267	2147483638	84458	121901497	20	9	2.8	YES
268	2147483638	121901497	84458	21	10	2.8	YES

Appendix D. Summary of all individual validation counts

(Light vehicles, AM)

No	Link No	From node	To Node	Observed AM LV [veh/hr]	Modelled AM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	180	239	4.1	YES
2	59	2000001712	400408	114	109	0.5	YES
3	149	121769433	121773120	1756	1522	5.8	NO
4	149	121773120	121769433	2041	2193	3.3	YES
5	353	257233	121766408	387	302	4.6	YES
6	353	121766408	257233	336	290	2.6	YES
7	498	258339	121766606	282	262	1.2	YES
8	498	121766606	258339	181	173	0.6	YES
9	1107	121901490	121901493	193	248	3.7	YES
10	1107	121901493	121901490	339	253	5.0	NO
11	1112	121901492	121901498	150	100	4.4	YES
12	1112	121901498	121901492	211	197	1.0	YES
13	1937	2000001290	2000001293	347	409	3.2	YES
14	1937	2000001293	2000001290	493	396	4.6	YES
15	3574	121725157	2000002101	764	826	2.2	YES
16	3574	2000002101	121725157	721	663	2.2	YES

(Heavy vehicles, AM)

No	Link No	From node	To Node	Observed AM HV [veh/hr]	Modelled AM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	6	9	1.0	YES
2	59	2000001712	400408	6	8	0.9	YES
3	149	121769433	121773120	116	114	0.2	YES
4	149	121773120	121769433	103	99	0.4	YES
5	353	257233	121766408	26	27	0.1	YES
6	353	121766408	257233	36	26	1.7	YES
7	498	258339	121766606	33	27	1.1	YES
8	498	121766606	258339	29	27	0.3	YES
9	1107	121901490	121901493	19	11	2.1	YES
10	1107	121901493	121901490	32	10	4.8	YES
11	1112	121901492	121901498	18	1	5.7	NO
12	1112	121901498	121901492	11	1	4.3	YES
13	1937	2000001290	2000001293	13	18	1.2	YES
14	1937	2000001293	2000001290	21	15	1.4	YES
15	3574	121725157	2000002101	33	26	1.2	YES
16	3574	2000002101	121725157	47	31	2.6	YES

(Light vehicles, IP)

No	Link No	From node	To Node	Observed IP LV [veh/hr]	Modelled IP LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	117	148	2.7	YES
2	59	2000001712	400408	127	158	2.6	YES
3	149	121769433	121773120	819	1004	6.1	NO
4	149	121773120	121769433	808	907	3.4	YES
5	353	257233	121766408	265	262	0.2	YES
6	353	121766408	257233	239	223	1.1	YES
7	498	258339	121766606	135	148	1.1	YES
8	498	121766606	258339	129	142	1.1	YES
9	1107	121901490	121901493	200	214	1.0	YES
10	1107	121901493	121901490	173	174	0.1	YES
11	1112	121901492	121901498	110	100	1.0	YES
12	1112	121901498	121901492	121	136	1.4	YES
13	1937	2000001290	2000001293	232	263	1.9	YES
14	1937	2000001293	2000001290	233	266	2.1	YES
15	3574	121725157	2000002101	571	587	0.7	YES
16	3574	2000002101	121725157	578	595	0.7	YES

(Heavy vehicles, IP)

No	Link No	From node	To Node	Observed IP HV [veh/hr]	Modelled IP HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	8	7	0.4	YES
2	59	2000001712	400408	7	9	0.7	YES
3	149	121769433	121773120	90	99	0.9	YES
4	149	121773120	121769433	99	99	0.0	YES
5	353	257233	121766408	35	33	0.3	YES
6	353	121766408	257233	26	30	0.8	YES
7	498	258339	121766606	27	19	1.6	YES
8	498	121766606	258339	27	21	1.2	YES
9	1107	121901490	121901493	25	13	2.8	YES
10	1107	121901493	121901490	17	11	1.7	YES
11	1112	121901492	121901498	12	1	4.6	YES
12	1112	121901498	121901492	14	1	5.0	YES
13	1937	2000001290	2000001293	10	13	0.8	YES
14	1937	2000001293	2000001290	13	13	0.1	YES
15	3574	121725157	2000002101	36	25	2.1	YES
16	3574	2000002101	121725157	32	25	1.3	YES

(Light vehicles, PM)

No	Link No	From node	To Node	Observed PM LV [veh/hr]	Modelled PM LV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	150	123	2.3	YES
2	59	2000001712	400408	182	201	1.4	YES
3	149	121769433	121773120	1510	1704	4.8	YES
4	149	121773120	121769433	1418	1276	3.9	YES
5	353	257233	121766408	404	382	1.1	YES
6	353	121766408	257233	387	322	3.4	YES
7	498	258339	121766606	292	229	3.9	YES
8	498	121766606	258339	315	245	4.2	YES
9	1107	121901490	121901493	311	326	0.8	YES
10	1107	121901493	121901490	238	255	1.1	YES
11	1112	121901492	121901498	188	138	3.9	YES
12	1112	121901498	121901492	163	141	1.7	YES
13	1937	2000001290	2000001293	339	318	1.2	YES
14	1937	2000001293	2000001290	330	374	2.3	YES
15	3574	121725157	2000002101	772	656	4.3	NO
16	3574	2000002101	121725157	893	830	2.1	YES

(Heavy vehicles, PM)

No	Link No	From node	To Node	Observed PM HV [veh/hr]	Modelled PM HV [veh/hr]	GEH	Meets the Criteria (Links volume and GEH)
1	59	400408	2000001712	9	7	0.9	YES
2	59	2000001712	400408	6	9	1.1	YES
3	149	121769433	121773120	83	92	1.0	YES
4	149	121773120	121769433	85	94	0.9	YES
5	353	257233	121766408	27	30	0.6	YES
6	353	121766408	257233	20	28	1.7	YES
7	498	258339	121766606	26	19	1.5	YES
8	498	121766606	258339	17	17	0.1	YES
9	1107	121901490	121901493	18	10	2.2	YES
10	1107	121901493	121901490	14	9	1.5	YES
11	1112	121901492	121901498	9	0	3.9	YES
12	1112	121901498	121901492	11	1	4.3	YES
13	1937	2000001290	2000001293	9	13	1.1	YES
14	1937	2000001293	2000001290	12	16	1.0	YES
15	3574	121725157	2000002101	35	26	1.5	YES
16	3574	2000002101	121725157	27	26	0.2	YES

Appendix E. Regression analysis details

