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7 Traffic and Transportation

7.1 Introduction

This chapter of the EIAR assesses the potential traffic and transportation impacts of the Glenamuck District Roads Scheme. It outlines the development of the traffic models used to analyse the Glenamuck District Roads Scheme and the future year traffic growth factors used to generate projected Annual Average Daily Traffic (AADT) on all key roads in the study area. Existing and projected traffic figures are presented for both the Do-Nothing and Do-Something scenarios. These figures provide a basis for the engineering design presented in Chapter 5 and the air quality and climate and the noise and vibration assessments presented in Chapters 8 and 9 respectively. An overall commentary on the predicted changes in traffic, public transport, pedestrian and cyclist environmental conditions are all discussed in this chapter and provide a setting for all the other assessments undertaken in this EIAR.

The Glenamuck District Roads Scheme is a cited objective of the Dun Laoghaire-Rathdown County Council Development Plan 2016-2022 under the Plan's '6-year roads objectives' and the proposed scheme forms part of the Kiltiernan-Glenamuck Local Area Plan (LAP) (2013) as road infrastructure to support the development of LAP lands for between 2,600-3,000 residential units and bypass road for the Village Core of Kiltiernan. In the absence of the proposed scheme the existing road infrastructure which is largely rural in nature would be required to convey the flows from increased development in the area.

7.2 Methodology

7.2.1 Assessment Framework Methodology

The Glenamuck District Roads Scheme required transport modelling and assessments to be undertaken at three levels of modelling, from strategic macro-modelling, local area micro-simulations and to local junction models. This transport modelling approach has been developed in accordance with; -

- Transport Infrastructure Irelands' (TII's) Project Appraisal Guidelines (PAG) 2016;
- National Roads Authority's (NRA, now TII) Traffic and Transport Assessment Guidelines (May 2004);
- NRA's (now TII) Environmental Impact Assessment of National Road Schemes – A Practical Guide (November 2008); and
- industry best practices.

The National Transport Authority's (NTA) Eastern Regional Model (ERM) which is part of the NTA's Regional Modelling System provides a multi-modal forecasting capability that is particularly well suited for the assessment of large-scale developments such as the proposed Glenamuck District Roads Scheme. Section 7.2.2 gives a brief summary of the NTA's Regional Modelling System (RMS), however a more detailed outline of the RMS is given in **Section 4** of the Modelling Report in **Appendix 7-1**. For the strategic modelling, the ERM was used to develop a comprehensive understanding of Glenamuck / Kiltiernan local area encompassing mode share and trip origin / destination analyses and the impact on strategic road and public transport infrastructure.

For a more detailed assessment within the area, a Local Area Model (LAM) was developed for each assessment year to build on the zonal detail provided by the ERM inside the Glenamuck local area (which is too coarse for detailed assessment) and to provide the required means of testing a high number of scenarios (since the ERM run times are impractical when testing many options and scenarios as is required for Glenamuck at a local level).

This LAM acted as an *Assignment Model*, which replicated demand responses where they might be expected as a direct result of a scheme. The demand responses considered here comprise changes in trip rates, choice of destination and travel mode. Section 5 of the Modelling Report in **Appendix 7-1** outlines the overall Local Area Model approach and methodology further.

The final part of the transport modelling approach was deriving traffic flows from the LAM and applying them to TRANSYT junction models to optimise junctions designs and geometry, refinement and junction operation. Section 6 of the Modelling Report in **Appendix 7-1** summarises the junction modelling methodology. Figure 7.1 summarises the overall transport modelling approach to be undertaken for the Glenamuck District Roads Scheme.

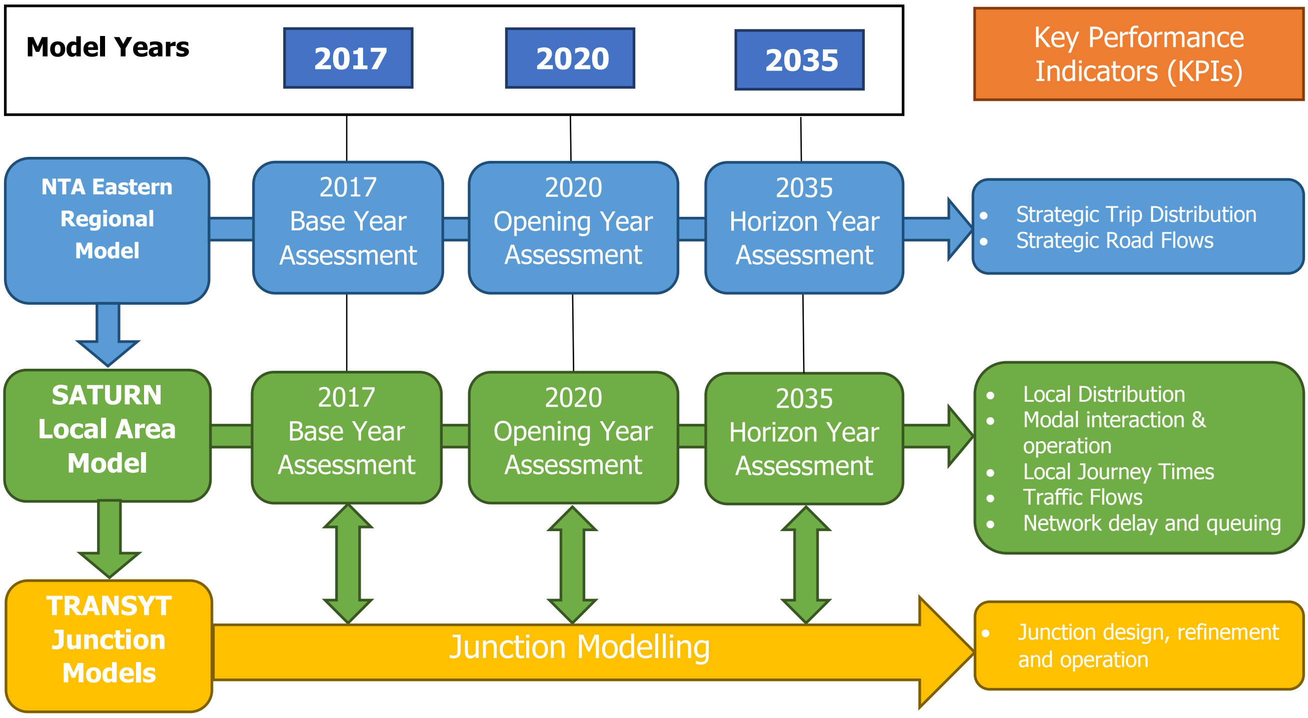

Figure 7.1: Proposed Glenamuck District Roads Scheme Transport Modelling Approach

7.2.2 Regional Modelling System - Eastern Regional Model

The Regional Model System (RMS) was developed by the National Transport Authority (NTA) to support its transport functions and to provide a consistent framework for transport assessment and appraisal nationally. The RMS has a hierarchical structure with three main components. These are the National Demand Forecasting Model (NDFM), the five Regional Multi-modal Models and the Appraisal Modules. The National Demand Forecasting Model provides consistent demand forecasts for input into each Regional Multi-modal Model. The Regional Multi-modal Models are strategic multi-modal, network-based transport models and include all the main surface modes of travel (including travel by car, bus, rail, Luas, walking, and cycling). They are complemented by the Appraisal Modules, which provide a full suite of appraisal tools in line with national guidance.

The National Demand Forecasting Model

The NDFM's function is to estimate levels of trip making to/from Census Small Areas (circa 10,000 nationally) as a function of a set of 63 planning variables associated with population, schools, and employment locations. Trip making estimates are produced for an average 24-hour weekday, so journeys (or tours) which involve leaving and returning home for some purpose (e.g. going to work) are represented as two trip legs in (usually) separate time periods. The NDFM includes car ownership models to segment trip making by car availability, which has a strong bearing on mode choice.

The NDFM's outputs are expressed as Trip Ends which may be at the Tour level (as described above) or at the One-Way level, which would generally mean the trip starts and ends at non-home-based locations. The Trip End outputs produced by the NDFM are then used by the regional models, including the East Regional Model, to estimate what associated travel takes place on the road, public transport, and active modes networks. That then allows conditions on those transport networks to be assessed.

The East Regional Model

A regional model is comprised of the following key elements:

- **Trip End Integration:** The Trip End Integration module converts the 24-hour trip ends output by the NDFM into the appropriate zone system and time period disaggregation for use in the Full Demand Model (FDM)

- **The Full Demand Model (FDM):** The FDM processes travel demand and outputs origin-destination travel matrices by mode and time period to the assignment models. The FDM and assignment models run iteratively until an equilibrium between travel demand and the cost of travel is achieved.

- **The Assignment Model:** The Road, Public Transport, and Active Modes assignment models receive the trip matrices produced by the FDM and assign them in their respective transport networks to determine route choice and the generalised cost for origin and destination pair. The Road Model assigns FDM outputs (passenger cars) to the road network and includes capacity constraint, traffic signal delay and the impact of congestion. The Public Transport Model assigns FDM outputs (person trips) to the PT network and includes the impact of capacity restraint, such as crowding on PT vehicles, on people's perceived cost of travel. The model includes public transport networks and services for all PT sub-modes that operate within the modelled area.

- **Secondary Analysis:** The secondary analysis application can be used to extract and summarise model results from each of the regional models.

Figure 7.2 below provides an overview of the structure of the NTA Regional Modelling System, including the above components.

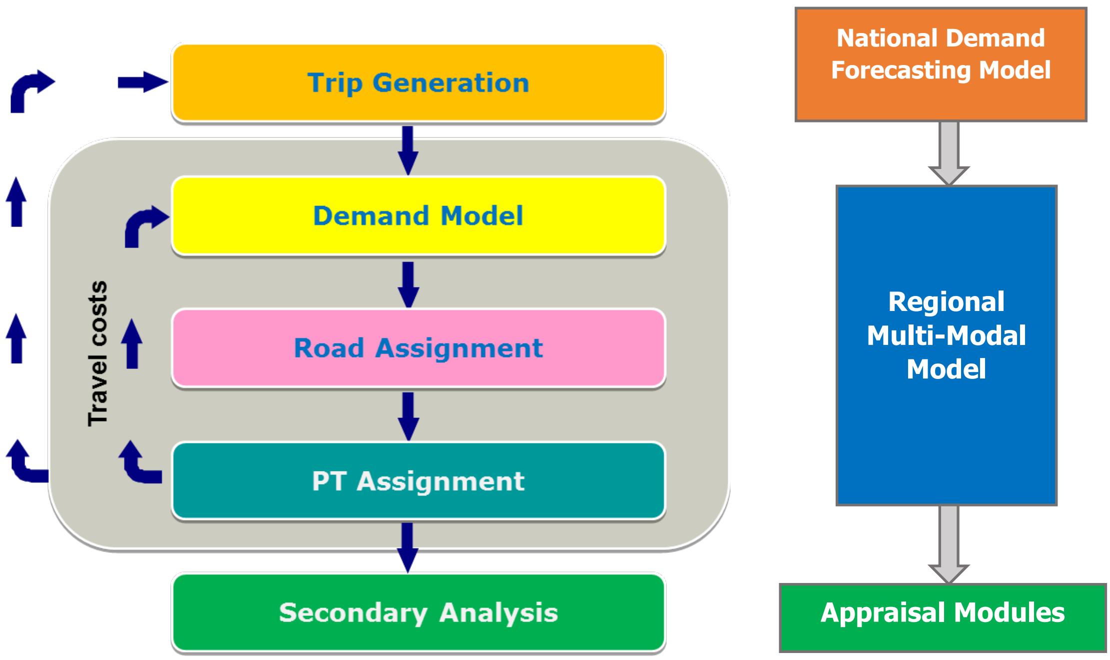

Figure 7.2: Basic Model Structure of Regional Model System

Application of ERM & Network Assumptions

As shown in Figure 7.1 this assessment was tested for the years 2017, 2020 and 2035 by inputting the relevant planning data for each plot into the NTA National Demand Forecasting Model. Within each forecast year, the appropriate transport network were also input to the model based on the NTA Greater Dublin Area Strategy for 2035.

Table 7.1 below shows the main infrastructural items (which would have a potentially significant impact within the Glenamuck-Kiltiernan LAP lands). Although the table only shows the main measures, it should be noted that all other schemes such as road and bus services changes and a fully realised cycle network are included by 2035. In 2020, committed infrastructure such as Luas Cross City and Phoenix Park Tunnel are in place. In 2035 the complete suite of GDA Strategy measures and infrastructure are in place.

Table 7.1 Transport Network Measures Assumptions by Year

Transport Measures by Year	2020	2035
Luas Cross City	✓	✓
Phoenix Park Tunnel Link	✓	✓
Luas Green Line Enhancement		✓
Bus Connects: Core Radial Bus Network		✓
Bus Connects: Core Orbital Bus Network		✓
Bus Connects: Core Regional Bus Network		✓
N11 Widening		✓
New Metrolink		✓
DART Expansion Programme		✓
DART Frequency of 5 Minutes		✓
M50 Widening		✓
M50 Demand Management Strategy		✓

The ERM acted as a donor model for the more detailed LAM, supplying strategic trip distributions and roads flows at the LAM boundary extents which is explained further in Section 7.4.3.

7.2.3 Key Performance Indicators (KPIs)

Both ERM and LAM models were used to provide Key Performance Indicators (KPIs) to inform on the performance of the transport network for all modes at a strategic and local level.

The following KPIs were assessed in the ERM:

- Strategic Trip Distribution; and
- Strategic Road Flows.

The following KPIs were assessed in the LAM:

- Local Distribution;
- Modal Interaction & Operation;
- Local Journey Times;

- Traffic Flows; and
- Network Delay and Queuing.

The following KPIs were assessed in the TRANSYT Models:

- Degree of Saturation (%);
- Total Junction Delay;
- Max. Mean Queue Lengths; and
- Optimised Traffic Signal Timing.

Table 7.2 summarises the various KPIs and their proposed uses in the transport modelling assessment for the proposed Glenamuck District Roads Scheme.

Table 7.2 Summary of Key Performance Indicators in Assessment

Modelling Stage:	Key Performance Indicator	Purpose in Assessment
ERM	Strategic Trip Distribution	- LAM Calibration
	Strategic Road Flows	- LAM Calibration - Wider Area Effects
LAM	Local Distribution	- Trip Distribution - Turning Proportions
	Modal Interaction	- Scheme's effects Bus Routes
	Local Journey Times	- LAM Validation - Scheme Appraisal
	Traffic Flows	- Demand Flows for TRANSYT
	Network Delays and Queuing	- Scheme Appraisal - Problem Junction Identification for TRANSYT
TRANSYT	Degree of Saturation	- Junction Design - Junction Operation
	Total Junction Delay	- Junction Design - Junction Operation
	Max. Mean Q. Lengths	- Junction Design - Junction Operation
	Signal Timing	- Junction Design - Junction Operation

7.2.4 Data Collection

In order to develop a traffic model, a significant level of traffic data is required to ensure that the model replicates existing traffic patterns and volumes. This section outlines the collection of data for the construction of the Base Year (2017) Glenamuck LAM.

A summary of the traffic surveys data that were collated to inform the development of the Base Year (2017) LAM are outlined in Table 7.3 below. Figure 7.3 to Figure 7.8 illustrate the location of the traffic surveys.

Table 7.3 Traffic Survey Data

Survey Type	Description
Traffic Counts	**Automatic Traffic Counts** (ATC) surveys were carried out at 7 sites in Carrickmines / Glenamuck / Kiltiernan area 24 hours a day over a one-week period from Monday 6th to Monday 13th November 2017.
	Junction Turning Movement Count (JTC) surveys were carried out at 9 locations from 07:00 to 19:00 on Tuesday 7th, Thursday 9th and Saturday 11th November 2017.
	Junction Turn Counts – Pedestrian Counts (JTC – PED) were carried out at 9 locations from 07:00 to 19:00 on Tuesday 7th, Thursday 9th and Saturday 11th November 2017.
	Data from 4 Transport Infrastructure Ireland **Permanent ATC's** for 2017.
Queue Length Surveys	**Queue Length** surveys were carried out at 9 JTC locations from 07:00 to 19:00 on Tuesday 7th, Thursday 9th and Saturday 11th November 2017.
Journey Time	**Journey Time** survey data was collected through the Bluetooth methodology. A minimum sample rate of 20% was required as part of these surveys.

Automatic Traffic Counts

The Automated Traffic Counts (ATCs) captured the traffic flows passing given points on the road network and classified the flow into different vehicle classifications, such as Cars, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV). Traffic flow data, extracted from the ATC survey sites (7 ATC survey sites indicated in Figure 7.3) undertaken over the one-week period from Monday 6th to Monday 13th November 2017, is presented in Table 7.4 below.

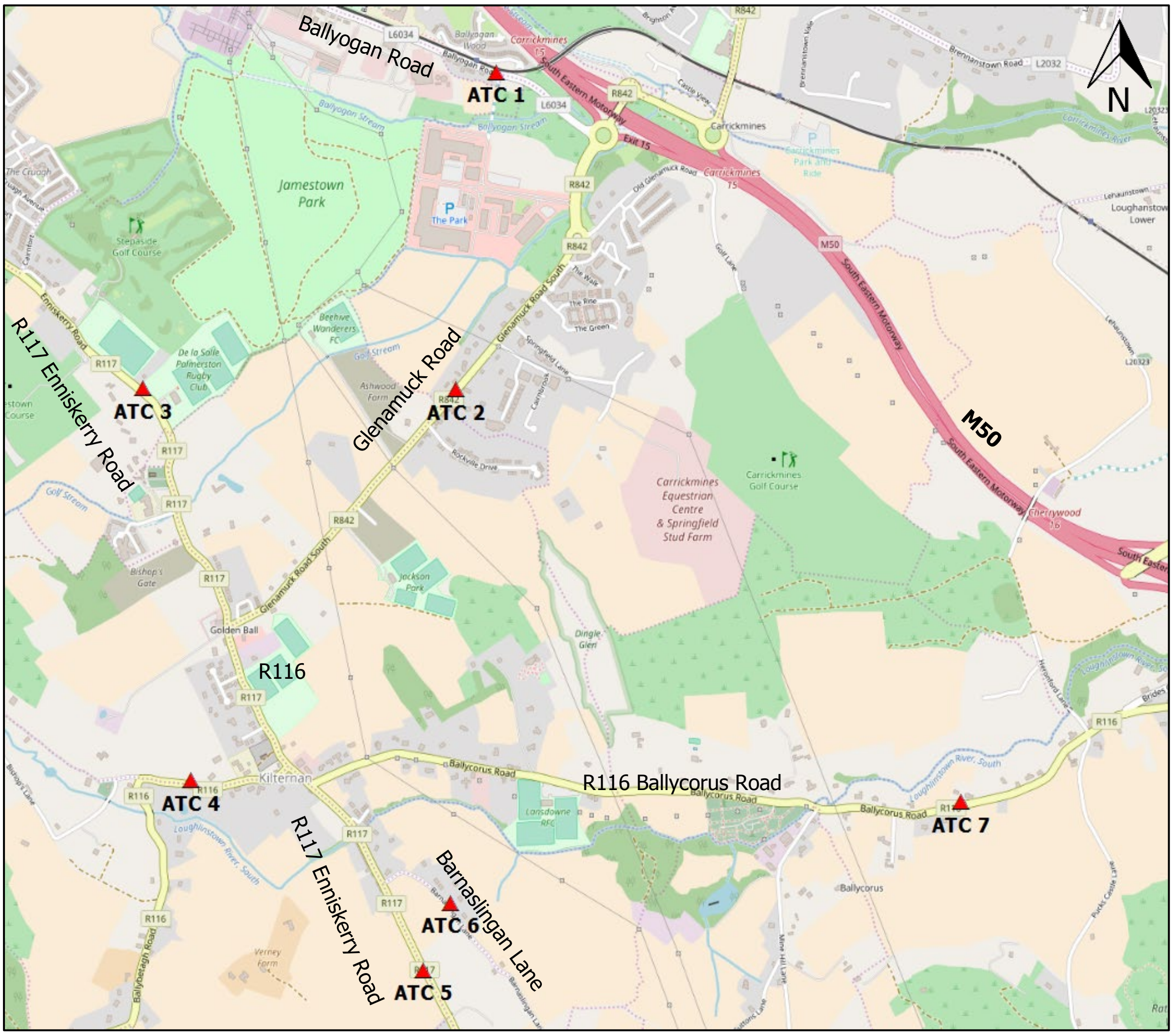

Figure 7.3: Overview of ATC Survey Locations

Table 7.4 also provides annual average estimates of both weekday (Mon – Fri) and 7-day traffic flow based on the ATC Surveys. The following estimates are presented:

- 2017 Annual Average Weekday Traffic (AAWT); and
- 2017 Annual Average Daily Traffic (AADT).

It should be noted that a seasonality factor of 0.99 for the month of November has been applied to the collected data in line with guidance provided in TII PAG Unit 16.1: Expansion Factors for Short Period Traffic Counts. A graphical summary of the AAWT and AADT information presented in Table 7.4 below is shown in Figure 7.5.

Table 7.4 Automatic Traffic Counter Data 2 Way Flow (2017)

Site	Location	Vehicle per Hour (Two-way Flow)		Vehicles per Day	
		AM	PM	AAWT	AADT
ATC 1	Ballyogan Road	981	940	11,169	10,387
ATC 2	Glenamuck Road	779	734	8,373	7,908
ATC 3	Enniskerry Road	873	818	8,116	7,633
ATC 4	R116	178	139	1,898	1,865
ATC 5	Enniskerry Road (South of Barnaslingan junction)	434	886	6,967	6,504
ATC 6	Barnaslingan Lane	21	26	323	359
ATC 7	Ballycorus Road	202	280	2,374	2,209

ATC survey helped in establishing the AM and PM peak hour periods as seen in Figure 7.4. Below the following time peak hours were determined:

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

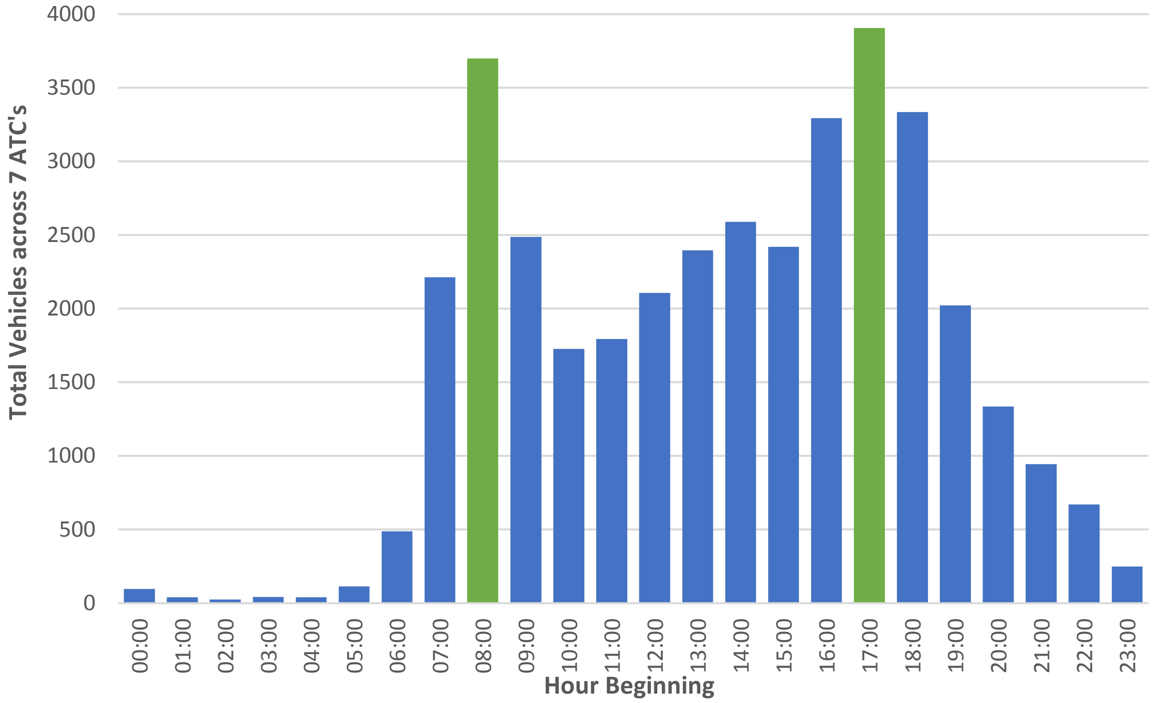

Figure 7.4: Peak Hour Selection

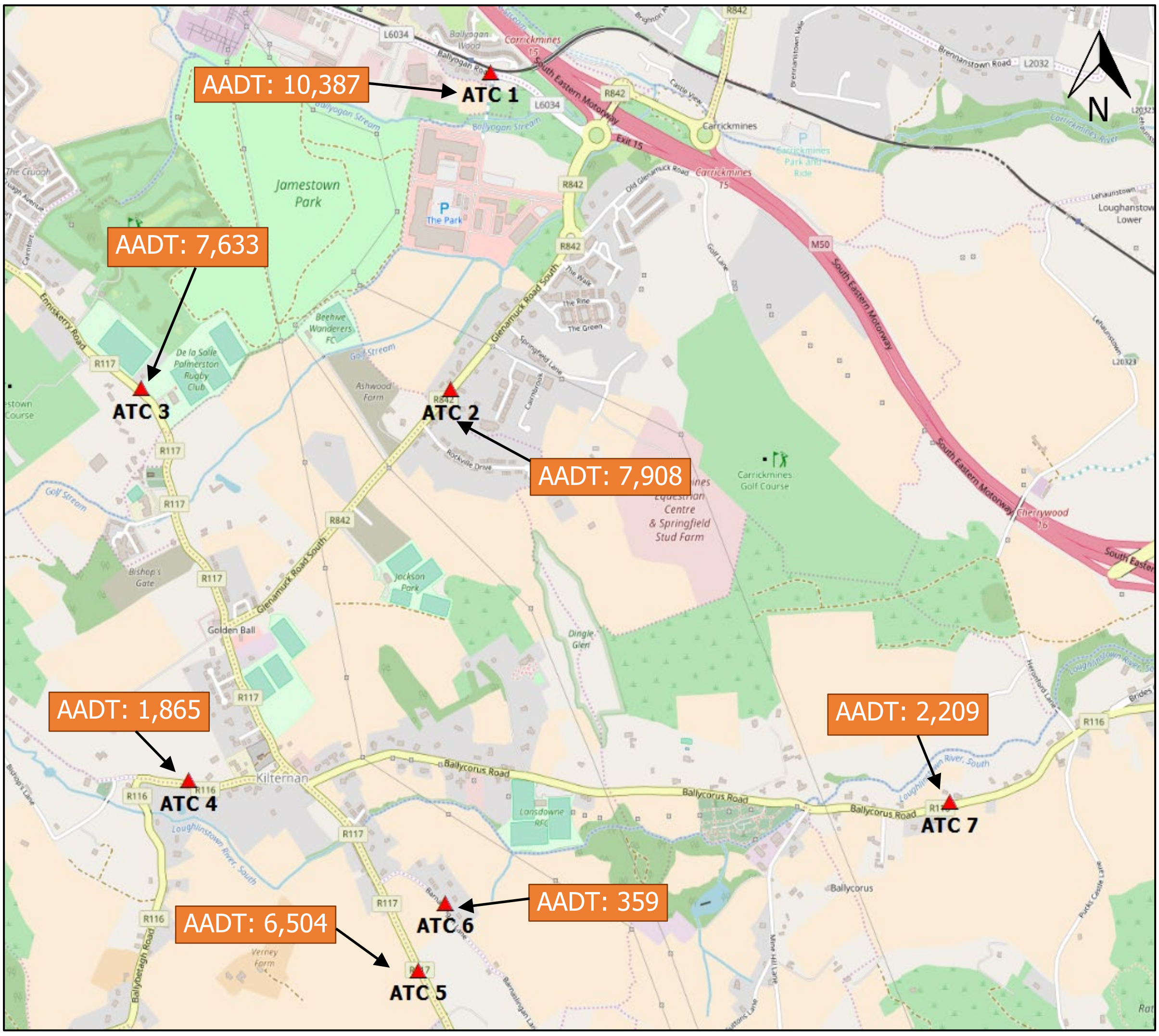

Figure 7.5: Estimated AADT's from ATC surveys within the Study Area

Junction Turning Counts

The Junction Turning Count (JTC) captured the number of vehicles turning at a given junctions and observed which turn movement they took. As with the ATCs they classified the traffic into different vehicle categories. JTC surveys were undertaken at 9 junctions from 07:00 to 19:00 on Tuesday the 7th, Thursday the 9th and Saturday the 11th November 2017. Traffic flows were classified by vehicle type and recorded in 15-minute time intervals. The junctions listed in Table 7.5 below were surveyed (refer to Figure 7.6).

Table 7.5 Junction Turning Movement Counts (2017)

Site	Location
JTC 1	Glenamuck Road North / M50 Roundabout (East)
JTC 2	Glenamuck Road North / M50 Roundabout (West)
JTC 3	Glenamuck Road / M50 / Ballyogan Road Roundabout
JTC 4	Glenamuck Road / The Park Carrickmines
JTC 5	Glenamuck Road / Golf Lane Roundabout
JTC 6	Glenamuck Road / Enniskerry Road
JTC 7	Enniskerry Road / R116

JTC 8	Enniskerry Road / Ballycorus Road
JTC 9	Ballycorus Road / Rathmichael Road / Brides Glen Road

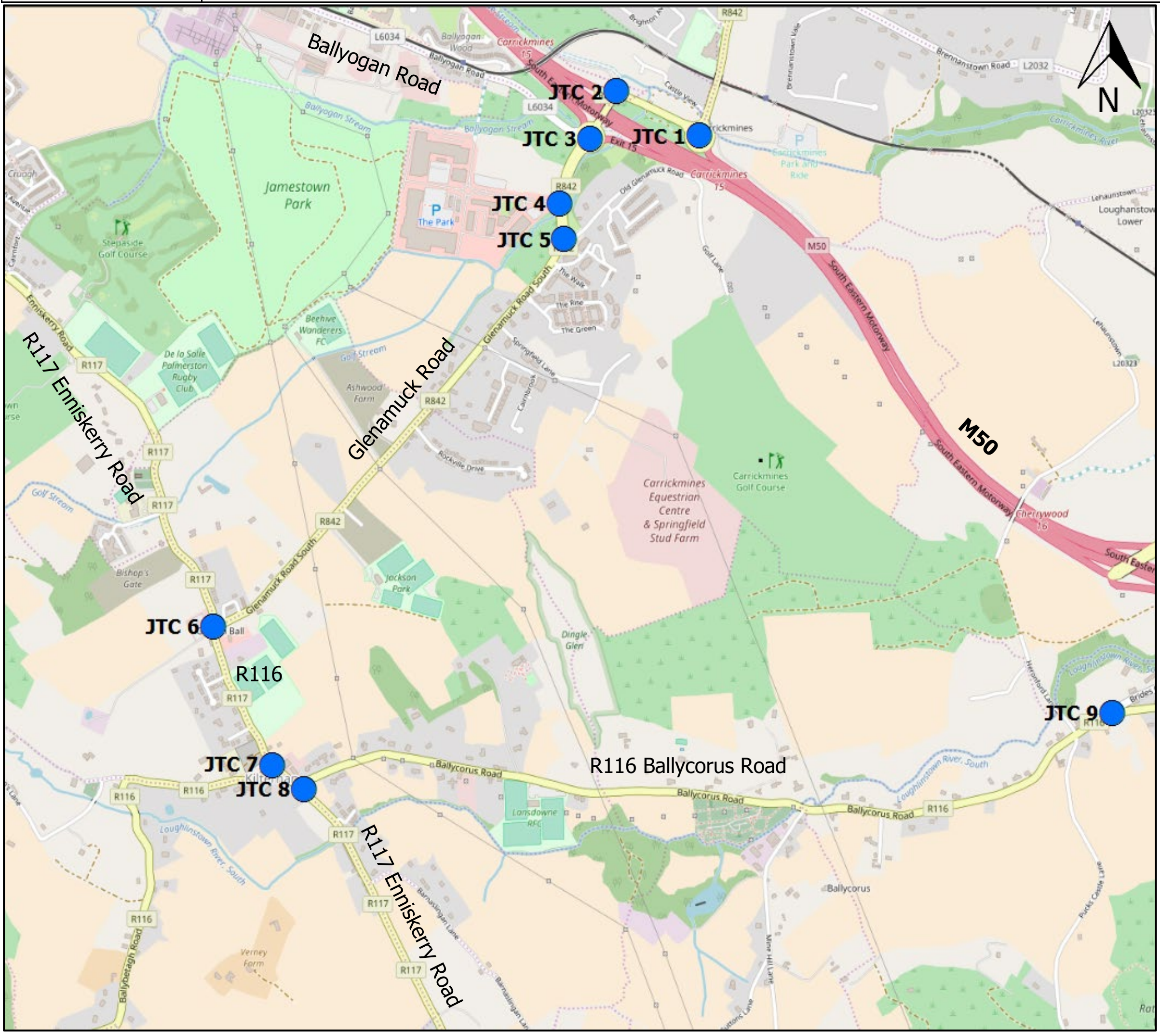

Figure 7.6: Overview of JTC/PED and Queue Length Survey Locations

Bluetooth Surveys

Journey time information was collated from the Bluetooth data in order to ensure that the travel time on existing roads was properly reflected within the base models, thereby ensuring that a robust assignment could be undertaken. These journey times represent an average of journey time surveys captured on Tuesday the 7th, Thursday the 9th and Saturday the 11th November 2017.

The journey times between five Origin-Destination points, these key routes are shown graphically in Figure 7.7. Details of the resultant journey times for the AM and PM periods are presented in Tables in Section 3 of the Modelling Report in **Appendix 7-1**. Journey time data was used to validate the base year models.

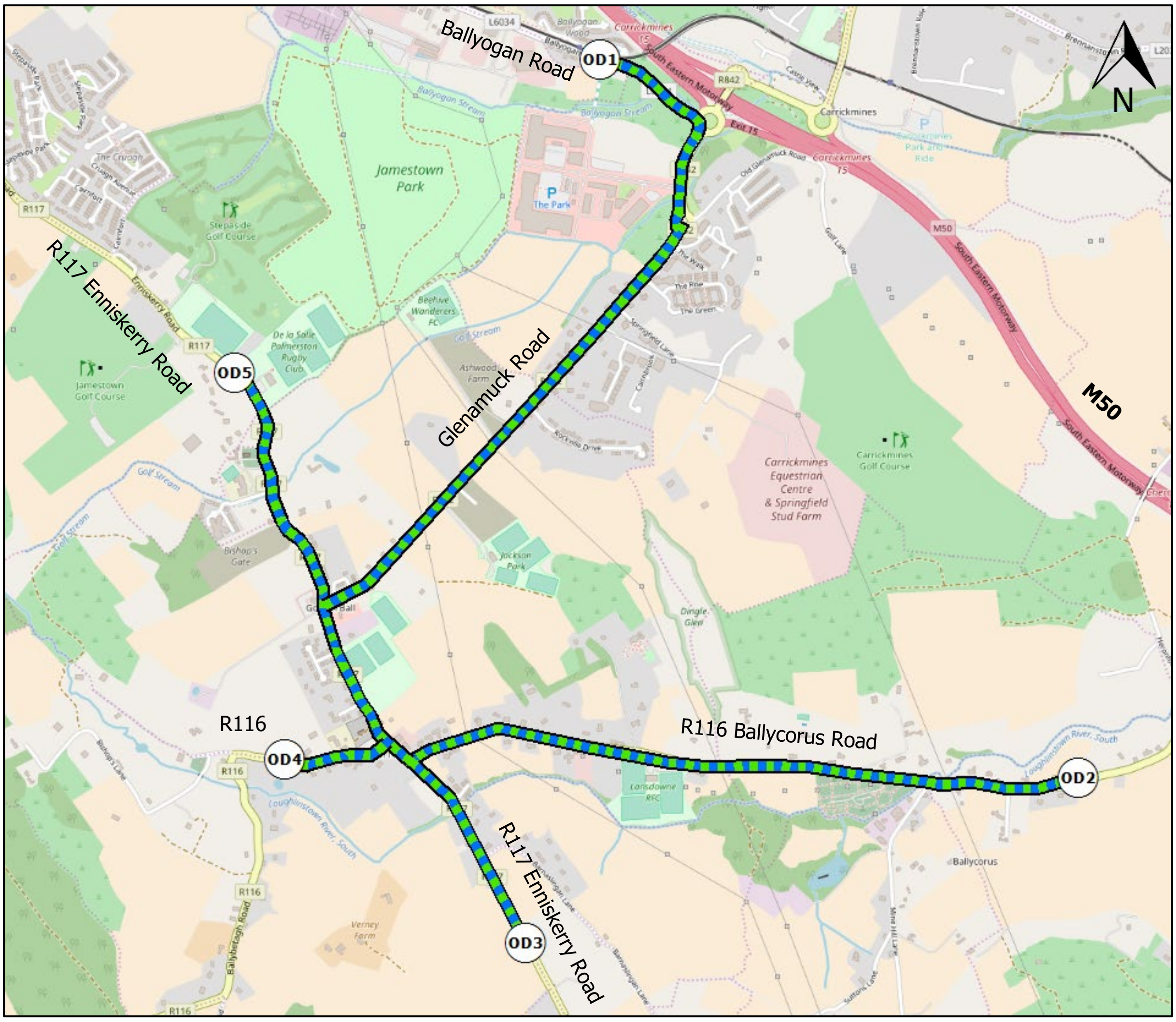

Figure 7.7: Overview of Bluetooth OD Locations & Journey Time Paths

Transport Infrastructure Ireland Traffic Counts

TII has a large number of permanent ATC traffic counts across the national and motorway road network. These Automated Traffic Counts (ATCs) captured the traffic flows passing given points on the road network and classified the flow into different vehicle classifications, such as Cars, Light Goods Vehicles (LGV) and Heavy Goods Vehicles (HGV). AADT traffic flow data, were extracted from 4 traffic count sites near the proposed scheme, as illustrated in Figure 7.8.

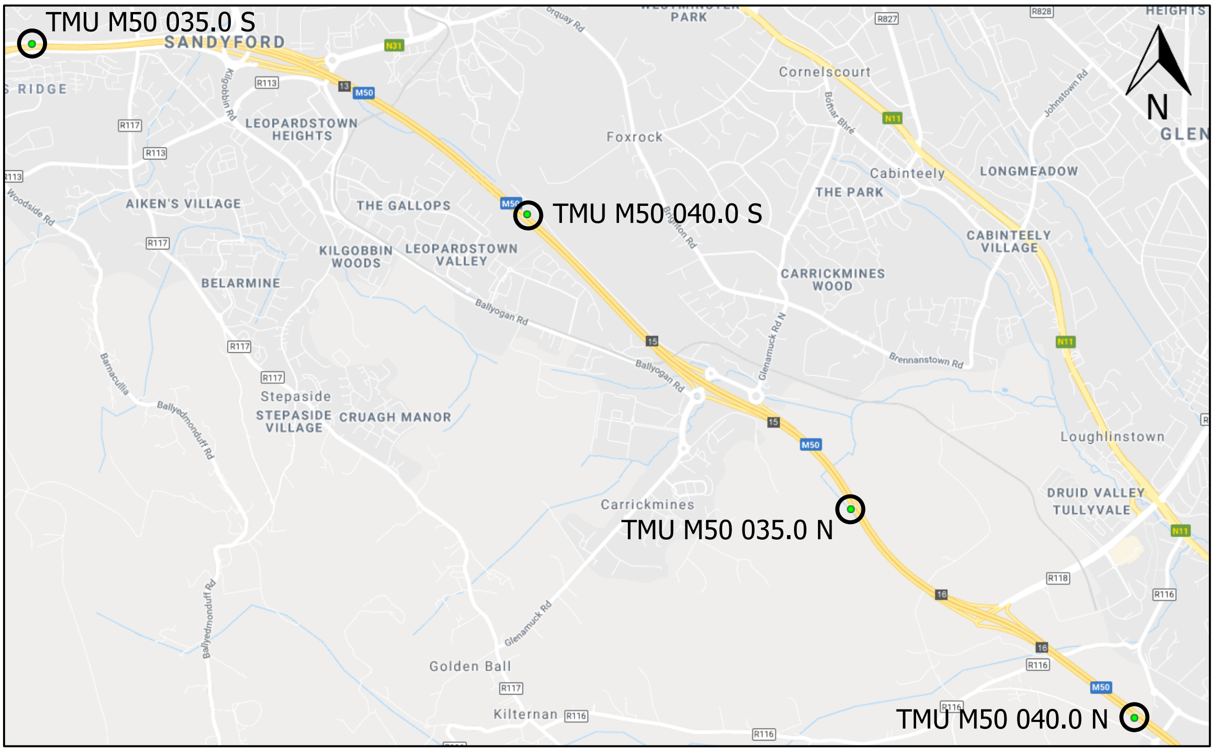

Figure 7.8: Location of TII Permanent ATC's Used in this Assessment

7.2.5 Scenarios Tested

Firstly, the assessment years that were tested as part of this assessment as per TII guidelines:

- Base Year – 2017;
- Opening Year – 2020; and
- Future Horizon Year (15+ years) – 2035

The following is a list of scenarios undertaken as part of this traffic assessment:

Base

- A1 – 2017 Base Traffic Flows (Existing Network)

Do Nothing

- B1 – 2020 Base Traffic Flows (No Glenamuck District Roads Scheme)
- B2 – 2035 Base Traffic Flows & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (No Glenamuck District Roads Scheme)

Do Something

- C1 – 2020 Base Traffic Flows (With Glenamuck District Roads Scheme + Bus Gates)

- C2 – 2035 Base & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (With Glenamuck District Roads Scheme+ Bus Gates)
- C3 – 2035 Base & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (With Glenamuck District Roads Scheme + Bus Gates) + Proposed Complementary Road Infrastructure

An additional scenario was assessed solely in the assessment for a sensitivity test to investigate the efficiency of the Bus Gate. Then the bus gates were removed and compared to modelling results with the Bus Gates still in place. For clarity, each of the 'Do Something' scenarios above (C1 – C3) include for the provision of 24/7 bus gates at the locations illustrated in Figure 7.9 below.

Figure 7.9 illustrates all relevant complementary infrastructure applicable to scenarios undertaken as part of this assessment which are not part of the proposed scheme but planned infrastructure outside the immediate remit of the proposed GDRS. As part of this assessment complementary road infrastructure measures were included into a separate 2035 Do Something scenario in both the Eastern Regional Model and Local Area Model. These additional complementary measures were:

- The Park Development infrastructure to connect the Glenamuck District Roads Scheme with the Ballyogan Road;
- The Golf Lane Link to connect Cherrywood over the M50 to the Glenamuck District Roads Scheme; and
- The roundabout junction at the Glenamuck Road / Golf Lane intersection upgraded to a signalised junction.

For all Do Something scenarios in this assessment a new bus gate was provided on the existing Enniskerry Road where it joins with the Glenamuck Link Distributor Road. This will only allow public transport vehicles, cyclists and pedestrians access to and from Kiltiernan Village from the Enniskerry Road at the bus gate. All other vehicles will not be allowed to make this movement. The junction at the existing Glenamuck Road and the Glenamuck Link Distributor Road will facilitate the movement of public transport from Glenamuck Road (West) and the Glenamuck Link Distributor Road to Glenamuck Road (East), via another bus gate. Public transport vehicles, cyclists and pedestrians will be able to access and egress from Glenamuck Road (East) onto the Glenamuck Link Distributor Road. All other vehicles will not be allowed to access or egress from Glenamuck Road (East) onto the Glenamuck Link Distributor Road. This was again included in all Do Something scenarios.

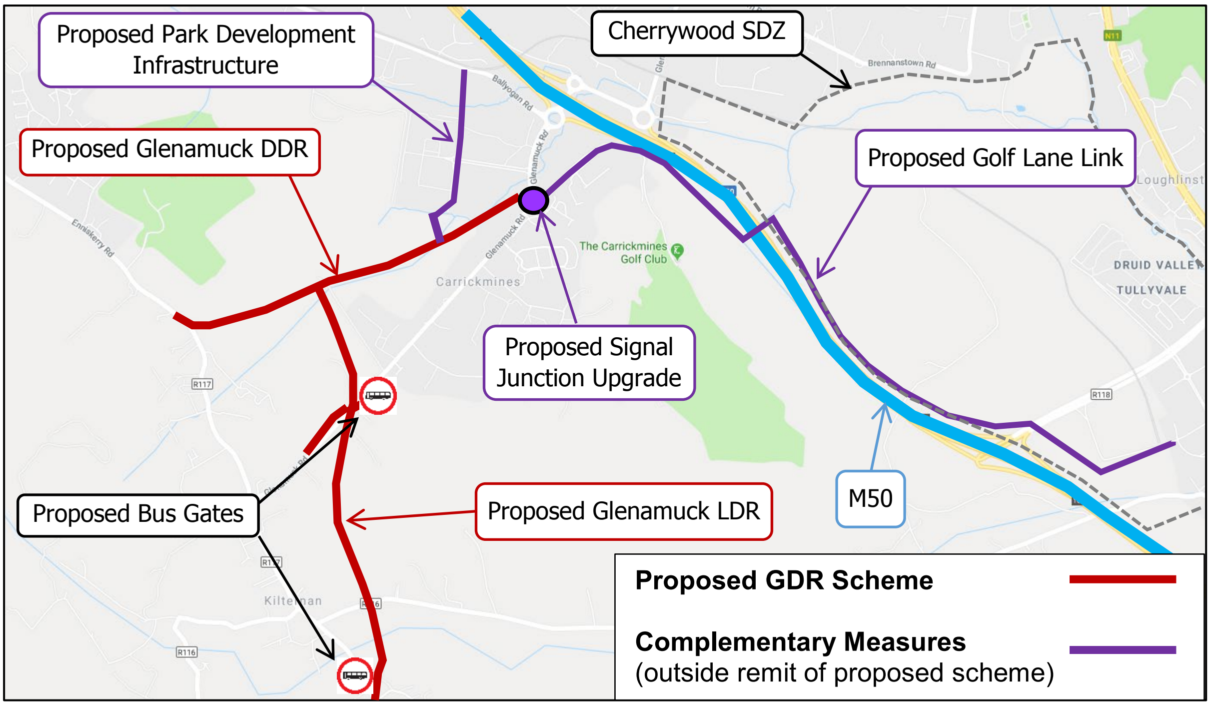

Figure 7.9: Proposed Bus Gates & Complementary Road Infrastructure

7.3 Baseline Environment

7.3.1 Model Development Overview

This section of the report describes the methodology and development of the 2017 Base Year Local Area Model (LAM). As a starting point for the LAM, the SATURN modelling of the local area highway model used in the RPS 2013 Glenamuck transport modelling work was used. The RPS Base, option 4 (network with GDRS) models and demand were used as the basis for the new models.

The same network cordon as the 2013 model was used in the current LAM as shown in Figure 7.10, so as to include the Kiltiernan-Glenamuck LAP area, Junction 13, 14, 15, 16 and 17 of the M50/M11 that traffic may use to access the LAP area, and the routes between the LAP area and these junctions. The model was extended slightly to the south-east, to include routes to and from the M11 via the Loughlinstown roundabout.

Following the extraction of key external flows and growth rates from the NTA's Eastern Regional Model (ERM) the development and refinement progressed towards this assessment's updated Local Area Models. This section summarises the development of the Base and Forecast Model in the AM (08:00-09:00) and PM (17:00-18:00) periods in all scenarios and the assessments to be carried out. Section 7.3.4 details the Calibration and Validation of the Base Models.

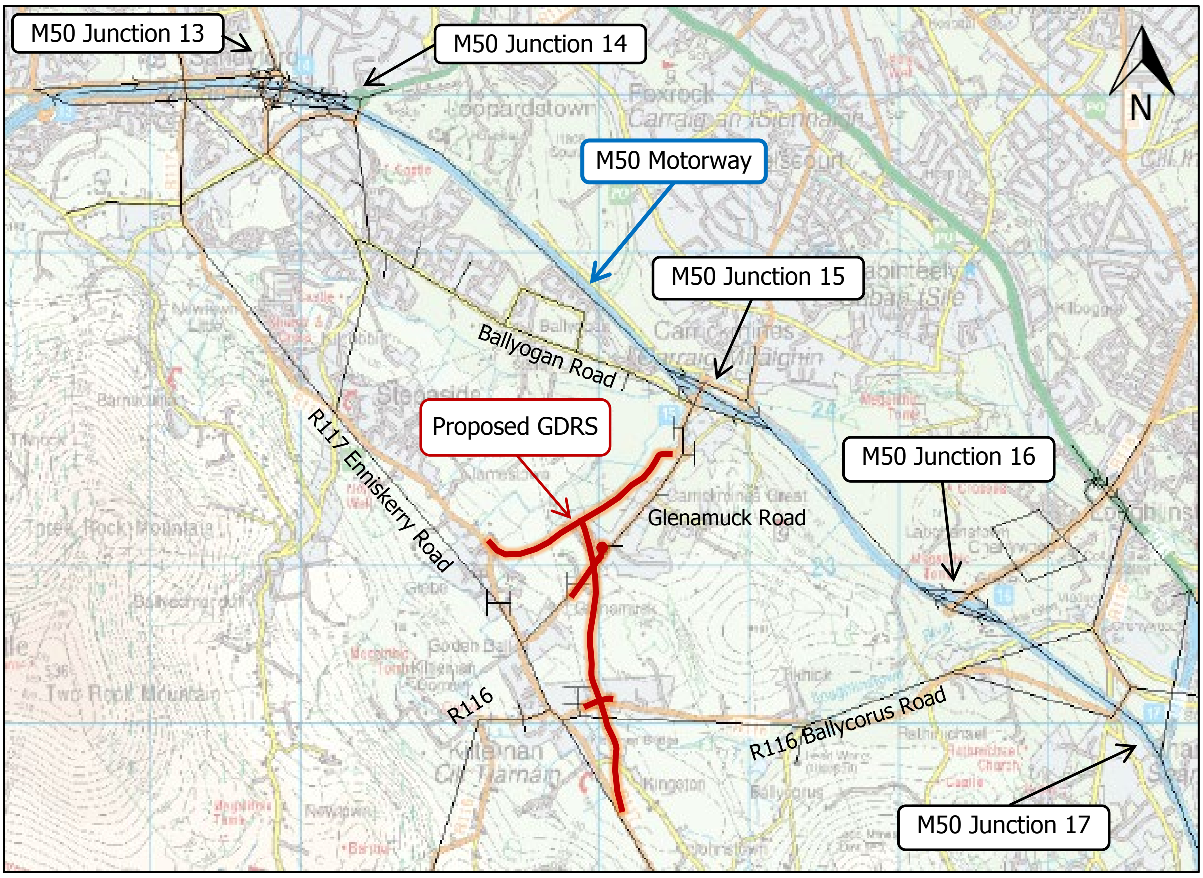

Figure 7.10: Network Extent – Base Year Model
(Scheme not included in Base or Do-Nothing Models)

7.3.2 Network Development

As mentioned previously, the former SATURN modelling of the local area highway model from the RPS 2013 Glenamuck transport model was used as a starting point for developing the updated 2017 LAM. Having adopted the previous extent of the study area, new additional links were required to be coded into the updated network.

The road network was refined to a level of detail that included updating all National Primary, Secondary and Regional roads and all significant local roads throughout the study area to match and reflect existing conditions. This information was collected through site visit observations, topographical surveys, 2017 google street view and aerial mapping where necessary. The information on each link included:

- Link Length;
- Link type, for example, National Regional Road, Local Urban, Local Rural etc.;
- Link capacity;
- Speed limit and free flow speed; and
- Reference to an appropriate speed flow curve.

7.3.3 Matrix Development

Following the refinement and update of the previous 2013 RPS transport model network and zoning system, the development of the Base demand matrices was undertaken. Based on the traffic surveys (Section 7.2.4), the following time periods were required for the LAM demand matrices:

- Morning peak from 08:00 – 09:00 (AM Peak Hour); and
- Evening Peak from 17:00 – 18:00 (PM Peak Hour)

The previous 2013 RPS transport model was used with donor flows and growth rates for external zones from the Dublin Transportation Office's (DTO now NTA) ERM. As a starting point an AM Prior matrix was developed by applying zoned-based growth rates to all internal zones in the LAM for the period from 2012 to 2017. Growth Rates were based on TII's PAG for 'National Roads Unit 5.3 – Travel Demand Projections'. Table 7.6 and Table 7.7 summarises the annualised growth rates for internal zones in the LAM. For external zones flows and growth rates from the cordon ERM were used to match 2017 conditions. The resultant 'Prior' matrices were then adjusted during the calibration process using matrix estimation methods to reflect 2017 demand.

As there was no PM Peak Hour from the older 2013 RPS transport model an alternative approach to generate the PM Peak Hour 'Prior' matrix was adopted. The calibrated AM Peak Hour matrix was transposed to give a 'Prior' PM matrix as a starting point for the calibration process. Each of these matrices were modified during the calibration process using the 2017 traffic survey data ascertained for each peak, using select link analysis and matrix estimation tools.

Table 7.6 Internal Zone-Based Growth Rates (Central Growth)
From PAG Unit 5.3 Growth Rates (2013-2030)

NTM Zone	Light Vehicles AM Period (2013-2030)		Light Vehicles PM Period (2013-2030)		Heavy Vehicles AM Period (2013-2030)		Heavy Vehicles PM Period (2013-2030)	
	Origin	Destin	Origin	Destin	Origin	Destin	Origin	Destin
859	1.0130	1.0127	1.0127	1.0130	1.0238	1.0238	1.0238	1.0238
8292	1.0141	1.0109	1.0109	1.0141	1.0238	1.0238	1.0238	1.0238
862	1.0136	1.0225	1.0225	1.0136	1.0238	1.0238	1.0238	1.0238
8632	1.0098	1.0064	1.0064	1.0098	1.0238	1.0238	1.0238	1.0238
8462	1.0105	1.0116	1.0116	1.0105	1.0238	1.0238	1.0238	1.0238

Table 7.7 Internal Zone-Based Growth Rates (Central Growth)
From PAG Unit 5.3 Growth Rates (2030-2050)

NTM Zone	Light Vehicles AM Period (2030-2050)		Light Vehicles PM Period (2030-2050)		Heavy Vehicles AM Period (2030-2050)		Heavy Vehicles PM Period (2030-2050)	
	Origin	Destin	Origin	Destin	Origin	Destin	Origin	Destin
859	1.0037	1.0028	1.0028	1.0037	1.0148	1.0148	1.0148	1.0148
8292	1.0042	1.0014	1.0014	1.0042	1.0148	1.0148	1.0148	1.0148
862	1.0037	1.0028	1.0028	1.0037	1.0148	1.0148	1.0148	1.0148
8632	1.0027	1.0022	1.0022	1.0027	1.0148	1.0148	1.0148	1.0148
8462	1.0039	1.0027	1.0027	1.0039	1.0148	1.0148	1.0148	1.0148

7.3.4 Model Calibration and Validation

The calibration and validation of the LAM base model followed guidance set out by the 'Project Appraisal Guidelines (PAG) for National Roads Unit 5.1 – The Construction of Transport Models'. The calibration process was carried out on both the network and the base matrix. The following calibration checks were undertaken on the LAM base model:

- Turning proportions at junctions; and
- Flows on individual links.

The following validation checks were undertaken on the LAM base model:

- Journey times along critical routes.

A total of 50 links flows were used in the calibration process. A comparison of modelled and observed flows demonstrated that the AM and PM Peak period models match the flow criteria. PAG specifies the acceptable values for modelled and observed flow comparisons and suggests how calibration should relate to the magnitude of the values being compared. 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:

$$GEH = \sqrt{\frac{(Modelled\ Flow - Observed\ Flow)^2}{0.5(Modelled\ Flow + Observed\ Flow)}}$$

The results therefore confirm that the models have been calibrated to a standard compliant with the PAG criteria in all-time periods.

As part of the validation process, the modelled journey times were compared against the 20 surveyed journey times to ensure the model gave a reasonable representation of existing conditions. All models satisfied the PAG requirement that 85% of all modelled journey times are within 15% of observed data or within 1 minute if higher than 15%. As such, the base year models were considered validated to the requirements of PAG Unit 5.2: Construction of Transport Models in terms of journey times.

In terms of Model convergence, the AM Peak and PM Peak models reached a satisfactory level of convergence as set out by PAG guidance. The criterion that was used to show that the Saturn software reaches a level of convergence was as follows:

- The difference between the costs along the chosen routes and those along the minimum cost routes, summed across the whole network, and expressed as a percentage of the minimum costs, usually known as 'Delta' or the '%GAP' (<0.1%); and

- The percentage (P) of links on which flows, or costs change by less than a fixed percentage (<5%) 2 for four consecutive iterations greater than 98%.

The full calibration and validation of the Local Area Model (LAM) are presented in greater detail in **Section 7** of the Modelling Report prepared by DBFL in **Appendix 7-1**.

7.4 Forecasting and Future Year Traffic Models (2020 & 2035)

7.4.1 Network Development

The future Do-Something network (Figure 7.11) includes the proposed Glenamuck District Roads Scheme (GDRS) in full alongside essential local links proposed in the Kiltiernan-Glenamuck LAP Lands.

An additional future network was developed to include complementary infrastructural measures which are not part of the proposed scheme but planned infrastructure outside the immediate remit of the proposed GDRS. As set out in Section 7.2.5, this future network (Figure 7.12) includes the proposed Glenamuck District Roads Scheme (GDRS) in full alongside proposed future local through link routes within the Kiltiernan-Glenamuck LAP Lands which are outside the proposed GDRS and road infrastructure in the Park Development to connect the GDDR to the Ballyogan Road, the proposed Golf Lane Link and the proposed junction upgrade at the Glenamuck Road / Golf Lane roundabout; again outside the remit of the proposed GDRS but are expected to be implemented between the opening year of 2020 and before 2035.

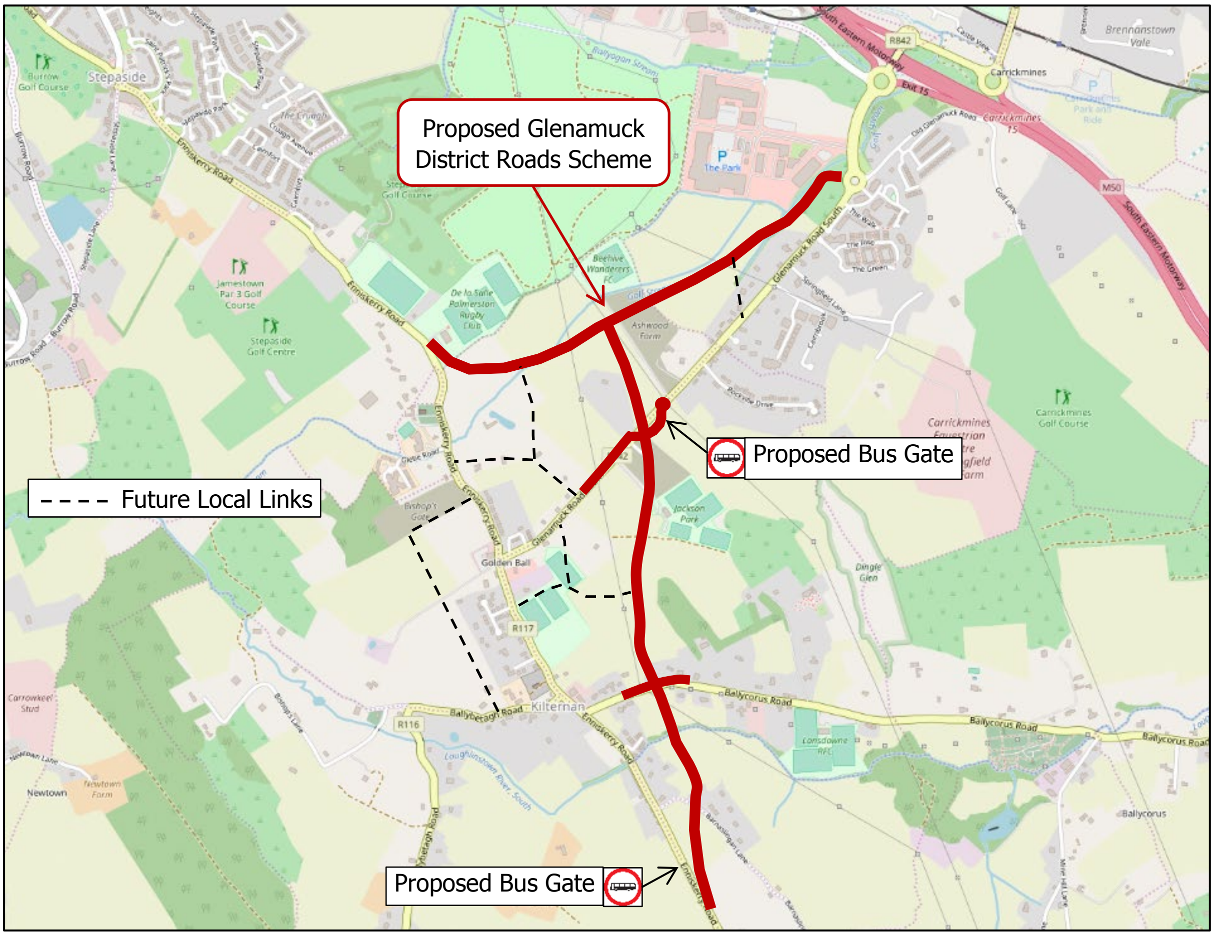

Figure 7.11: Do-Something Road Network

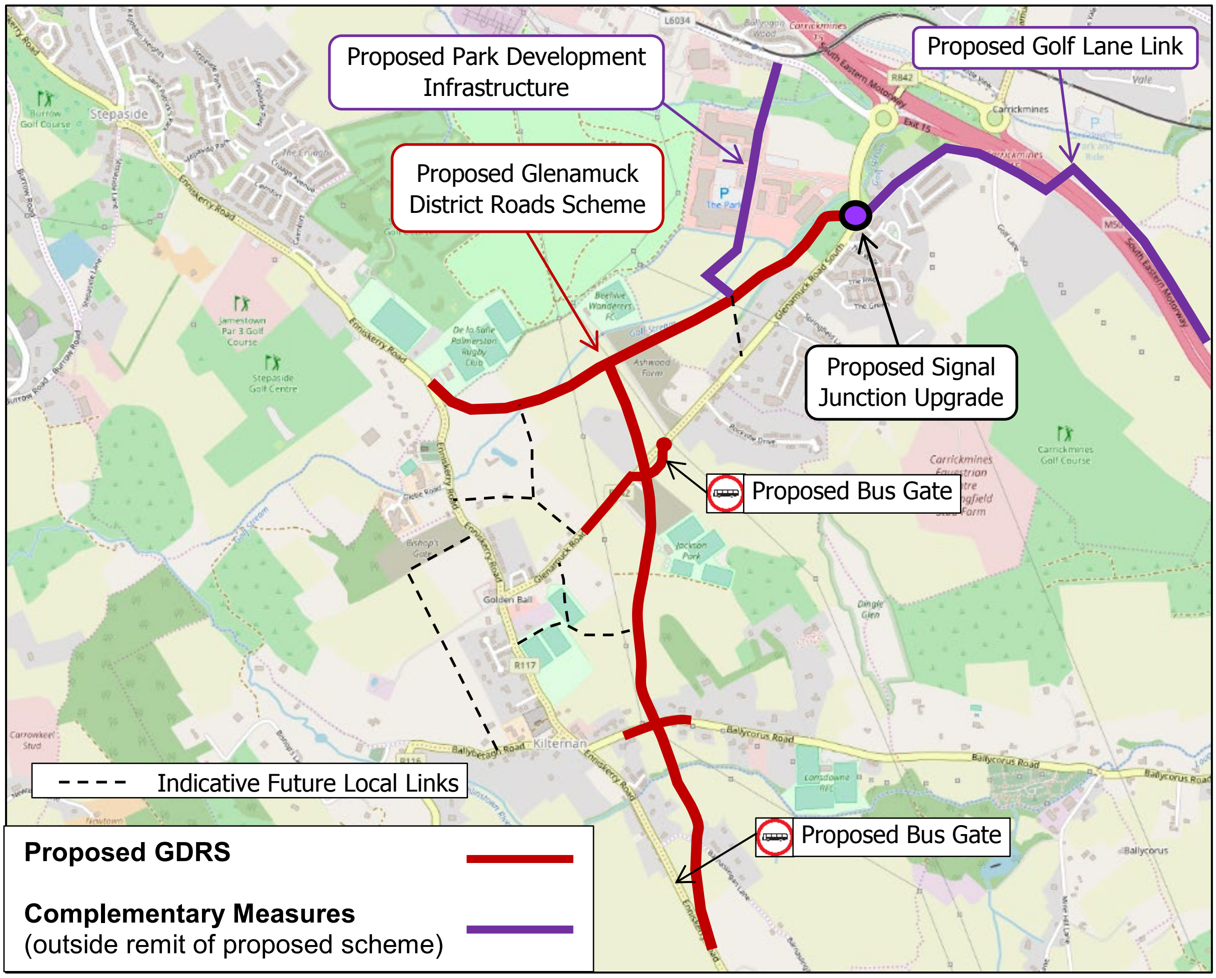

Figure 7.12: Do-Something with Complementary Measures Road Network

7.4.2 Assessment Scenarios

Firstly, the assessment years that were tested as part of this assessment as per TII guidelines:

- Base Year – 2017;
- Opening Year – 2020; and
- Future Horizon Year (15+ years) – 2035

The following is a list of scenarios undertaken as part of this traffic assessment:

Base

- A1 – 2017 Base Traffic Flows (Existing Network)

Do Nothing

- B1 – 2020 Base Traffic Flows (No Glenamuck District Roads Scheme)

- B2 – 2035 Base Traffic Flows & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (No Glenamuck District Roads Scheme)

Do Something

- C1 – 2020 Base Traffic Flows (With Glenamuck District Roads Scheme + Bus Gates)
- C2 – 2035 Base & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (With Glenamuck District Roads Scheme+ Bus Gates)
- C3 – 2035 Base & Local Area Plan Lands Traffic Flows & Committed Developments Traffic Flows (With Glenamuck District Roads Scheme + Bus Gates) + Proposed Complementary Road Infrastructure

An additional scenario was assessed solely in the assessment for a sensitivity test to investigate the efficiency of the Bus Gate. Then the bus gates were removed and compared to modelling results with the Bus Gates still in place.

7.4.3 Traffic Growth Forecasts

Forecasting future demand for the LAM was carried out in a similar approach as the RPS review approach in 2013. The methodology to forecast demand was done by Zone-Based Growth Rates and projections made in the 2013 Glenamuck LAP Transport Study. The methodology for this assessment in calculating growth is based on TII's PAG for 'National Roads Unit 5.3 – Travel Demand Projections'. The process for developing future traffic growth projections is presented in Figure 7.13.

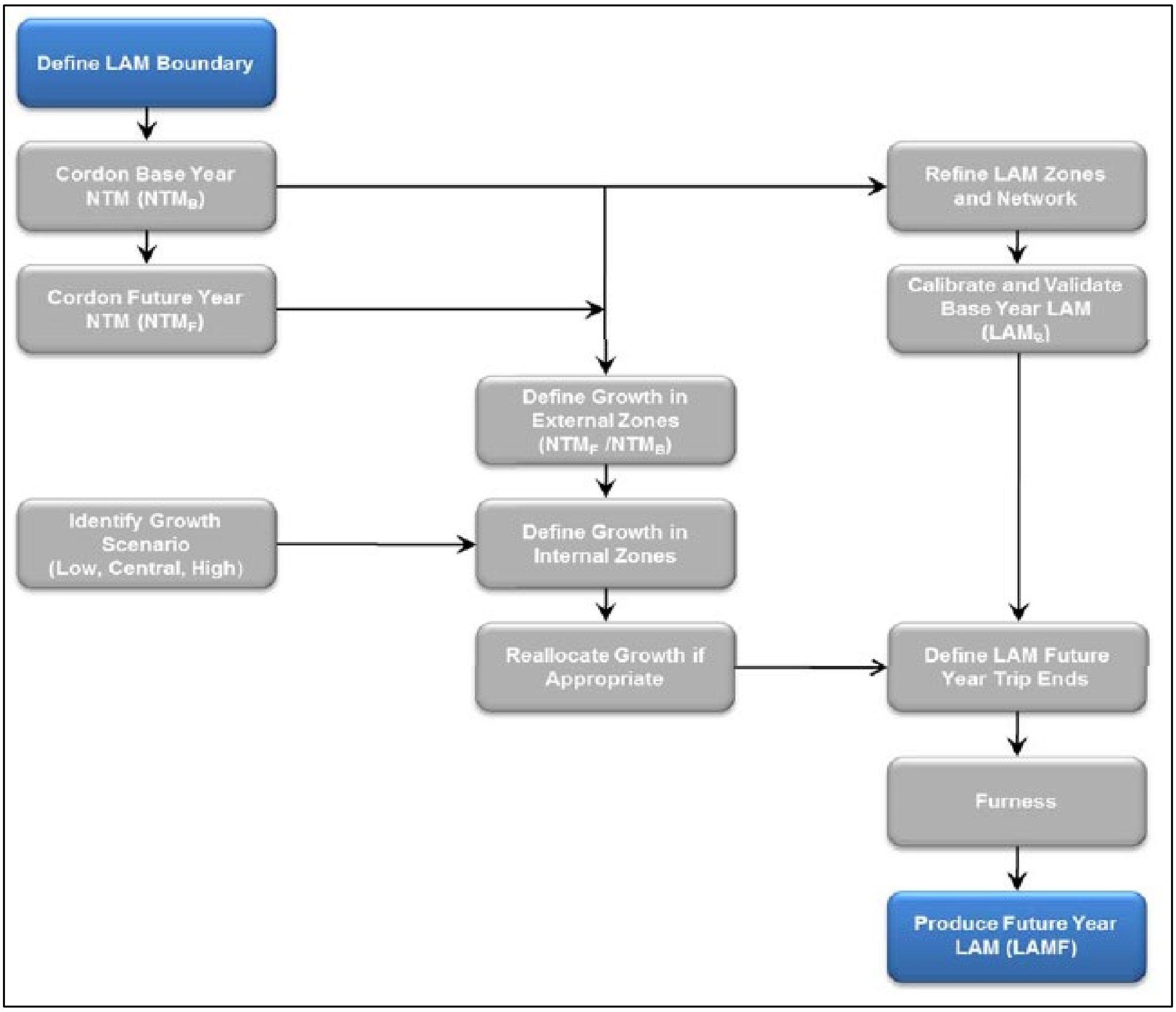

Figure 7.13: Traffic Growth Projection Methodology for Assignment Models

For large schemes such as the GDRS which are supported by assignment models, demand is input in the form of a matrix which allocates demand based on defined trips between geographical zones. In such cases, growth rates should be applied as increases in trip ends at a zonal level. The factoring of origins and destinations at a zonal level leads to the definition of target trip ends. This is then translated into a future year matrix through furnessing, which adjusts the demand matrix such that row and column totals match the target trip ends.

This technique was applied to the background traffic growth on the network. Forecasted traffic flows from the LAP lands were applied in the design year of 2035 and calculations of these traffic flows do not diverge from the trips generated in the previous 2013 RPS transport model, the reason being that the zoning system and the land use has not changed since 2013 LAP transport study.

The future years models developed in this assessment were an opening year 2020 and future horizon year (+15 years) 2035. These years were selected as they complied with guidance provided on forecast assessment years outlined in TII's Traffic and Transport Assessment (TTA) Guidelines 2014.

In this assessment it should be noted that Assignment Models will use zone-based growth rates to produce the initial demand projections for the Do-Something scenarios in the future year model. Assignment Model techniques can then be used to adjust the demand matrices to reflect the demand responses associated with the scheme proposal.

The application of growth to other travel modes requires projections for public transport growth in order to allow a future year Production Attraction (PA) matrix to be developed. This was applied in the previous 2013 LAP traffic growth projections which were again used in this assessment and development of the future demand matrices.

Background Forecasting of Internal Zones

The application of zone-based growth rates requires a different approach for internal and external zones within the Local Area Model (LAM). For internal zones, trip end growth rates for the AM and PM are read from a shapefile that is available from the Downloads page on the TII Publications website. These growth rates are applied to the row and column totals of the base year trip matrix to produce target trip ends for the future year matrix.

The shapefile provides demographic and economic information for each zone in the TII National Transport Model (NTM), in addition to annual growth rates for origin and destination trip ends. The shapefile uses a standard naming convention to identify all variables in the data.

For LAM's where internal zones are smaller than NTM zones, the growth rates for the NTM should initially be applied to all LAM zones within that NTM zone. It is for this reason that it is advisable to ensure that LAM zones are defined as subzones of NTM zones to avoid any overlapping of LAM zones between adjacent NTM zones.

The zoning system in the NTM is based on the aggregation of Electoral Divisions (ED's). ED's are amalgamations of Census Small Areas (CSA's) which the zoning system in the ERM are based. Section 5.4 of the Modelling Report in **Appendix 7-1** outlines further how LAM zones relate closely with the ERM zones and hence correlates with the zones in the NTM.

Background Forecasting of External Zones

To define growth for external zones in the LAM, a cordoning process was necessary within the modelling approach for this assessment. This process involved creating cordon models from strategic donor models as a starting point. Cordon models are generally created from a larger strategic model e.g. the ERM (Strategic, low detail) in this case. The resulting cordon flows at the boundary extents established appropriate extracted Base Year flows and future year growths for external zones for the LAM (in both future years of 2020 and 2035).

Prior to creating the ERM models, the extent of the study area for the (LAM) was established. This study area was based on the previous study area boundary in the RPS 2013 Glenamuck / Kiltiernan LAP transport model. Care was given to ensure the extents of the cordon models were not too tightly drawn and the resultant models were sufficiently large to assess all potential Do Something variants.

Figure 7.14 illustrates the cordon established and the 20 locations along the boundary extent where flows were recorded for the LAM base external zone flows. Table 7.8 lists each of the external zones in the LAM where the extracted flows will be applied and each of their geographical locations they represent along the boundary extent.

Figure 7.14: Cordon Boundary and Link Extent Extraction Locations

Table 7.8 List of External Zones and Representative Route & Location

External Zone No.	Route (Location)
10202	Wattville Road (By Ballybrack)
11003	Barnslingan Lane (By Kiltiernan)
81233	R117 (Enniskerry Road, by Kiltiernan)
99009	R118 (By Ballybrack)
99010	R119 (Dublin Road, by Shankill)
99011	M11/M50 (By Shankill)
99012	R117 (Enniskerry Road, by Kiltiernan)
99013	R116 (Ballybetagh Road, by Kiltiernan)
99014	R113 (By Ballinteer over the M50)
99015	R826 (By Ballinteer)
99016	M50 (By Ballinteer)
99017	R133 (By Ballinteer)
99101	N11 (By Cherrywood)
99102	Glenamuck Road (North of the M50 Jn 5 Interchange)
99103	N31 (By Sandyford)
99104	Drumartin Link Road (By Sandyford)
99105	R117 (By Wedgewood)
99108	Puck's Castle Lane (By Brides Glen)
99109	Ferndale Road (By Rathmicael)
99110	Carrickmines Woods (Joining the M50 Jn 5 Interchange)

Forecasting Future LAP Development Lands

Forecasting traffic flows from the LAP lands were applied only in the future horizon year of 2035 and calculations of these traffic flows remained mostly unaltered from the trips generated in the previous 2013 RPS transport model, the reason being that the zoning system and the land use has not changed since 2013 LAP transport study.

In the previous work in developing the future demand for the LAP Lands, the LAP area was divided into model zones and each of these zones related to the land parcels defined in the Local Area Plan. The previous 2013 RPS modelling work assumed an all-modes rates of trip generation based on older NTA modelling work (Table 7.9). These trip generation rates were applied for the AM peak period. Developing the PM forecast in the LAP lands the assumption was made that for residential and employment trip rates would exchange between generation and attraction figures from those in the AM period. However, as the PM peak period is between 17:00-18:00, education trips were assumed to be zero to reflect the presence of the two primary schools being closed at this time.

Table 7.10 outlines the all-modes trip generation rates assumed for the PM peak period in this assessment.

Table 7.9 All-mode Trip Generation Rates (AM Peak)

Land Use Data	AM Generation (trips per hour)	AM Attraction (trips per hour)
Residential (rate per unit)	0.733	0
Employment (rate per person)	0	0.772
Education (rate per student)	0	1

Table 7.10 All-mode Trip Generation Rates (PM Peak)

Land Use Data	PM Generation (trips per hour)	PM Attraction (trips per hour)
Residential (rate per unit)	0	0.733
Employment (rate per person)	0.772	0
Education (rate per student)	0	0

A modal split was applied to the generation rates to give the resultant highway trip rates on the network. The approach taken to calculate the modal split in described in Section 5.6 of the Modelling Report in **Appendix 7-1** of this report. Table 7.11 summarises the total number of highway trips to and from the LAP highways following the trip generation process as outlined above.

Table 7.11 Highway Trips Generated by the LAP Lands

Trip Type and Period	Volume of Road Trips (Trips/hr)
AM Road Generated Trips	1,878
AM Road Attracted Trips	2,222
PM Road Generated Trips	2,242
PM Road Attracted Trips	1,795

7.5 Predicted Impacts – Construction Phase

7.5.1 Overview

This section outlines the approach and the likely impact on traffic and transportation to the surrounding network during the construction phase of the subject scheme. All elements of work will be supported by appropriate traffic management measures developed in accordance with the requirements of Chapter 8 of the Traffic Signs Manual and the specific requirements of Dun Laoghaire-Rathdown County Council. Chapter 5 of this EIAR outlines the Construction Strategy in greater detail and measures set to ensure that construction traffic impacts are minimised through the control of site access / egress routes and site access locations and any necessary temporary lane closure requirements.

It would be anticipated that vehicles working on the GDDR & northern portions of the GLDR will exit and enter the site at the existing Glenamuck Road / Golf Lane roundabout junction and travel north to/from Junction 15 of the M50 and to/from their respective destination. For vehicles bound for southern portions of the GLDR it is anticipated that the construction vehicles would utilise the Glenamuck Road to access the site near the proposed second site compound. It is noted that exact compound locations, import/export destinations and detailed traffic management and construction routing will be developed by the appointed contractor for the scheme and will be detailed in a Construction Management Plan and Environmental Operating Plan.

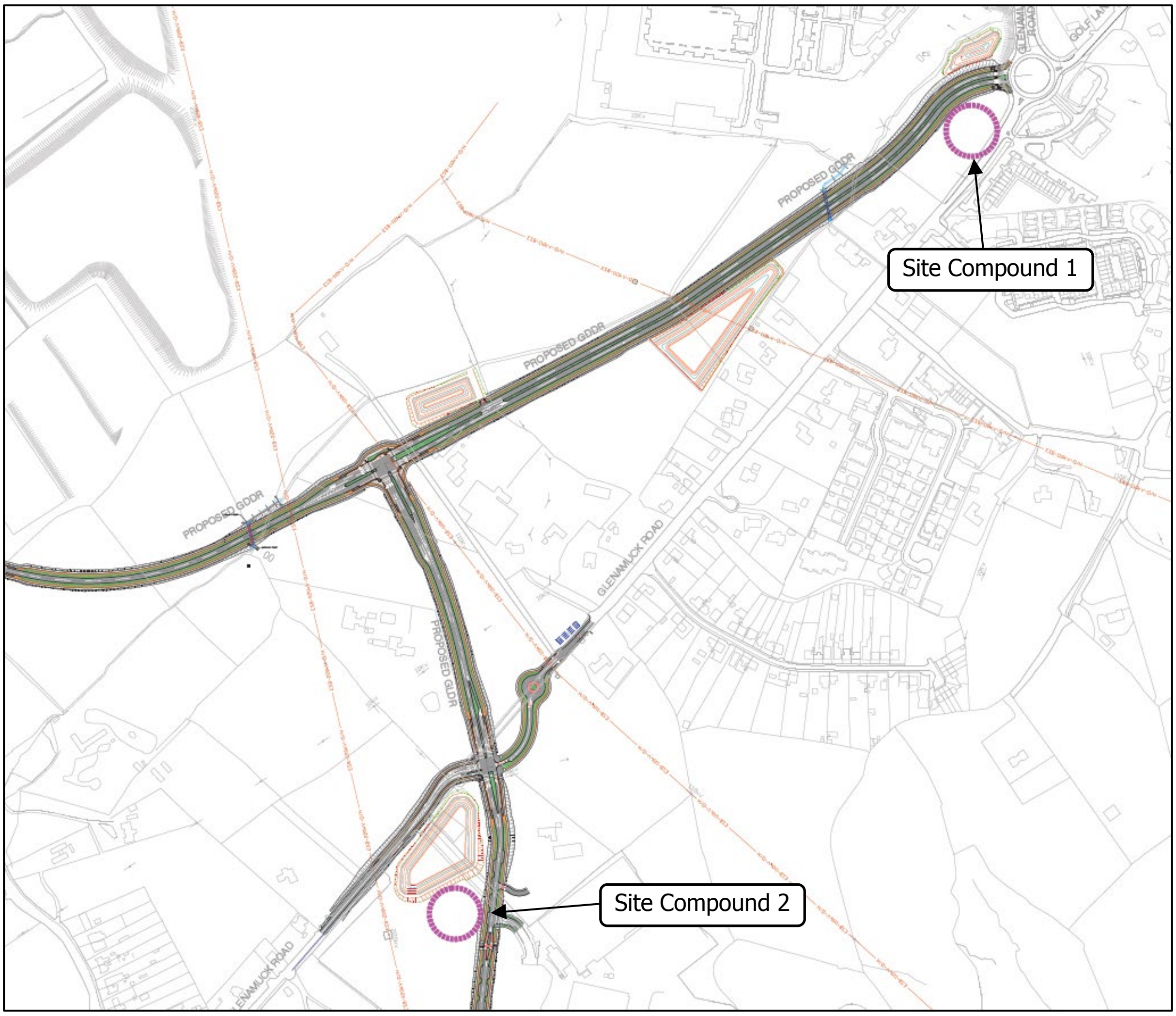

Figure 7.15: Preliminary Site Compound Locations

7.5.2 Existing Conditions

As mentioned in Section 7.2.4, a package of traffic surveys was undertaken in November 2017 to examine the existing traffic conditions on the network. These included 7 ATCs, 9 JTCs and TII permanent ATC counters which provided a baseline AADT flows along the key road corridors as shown in Figure 7.16. All AADT locations were derived from the ATC surveys except six locations 2, 4, 6, 7, 12 and 13. Locations 2, 4, 6 and 7 were deduced from JTC surveys and locations 12 and 13 were from the TII permanent ATC counters. Note that all AADT values are rounded to the nearest 50 vehicles.

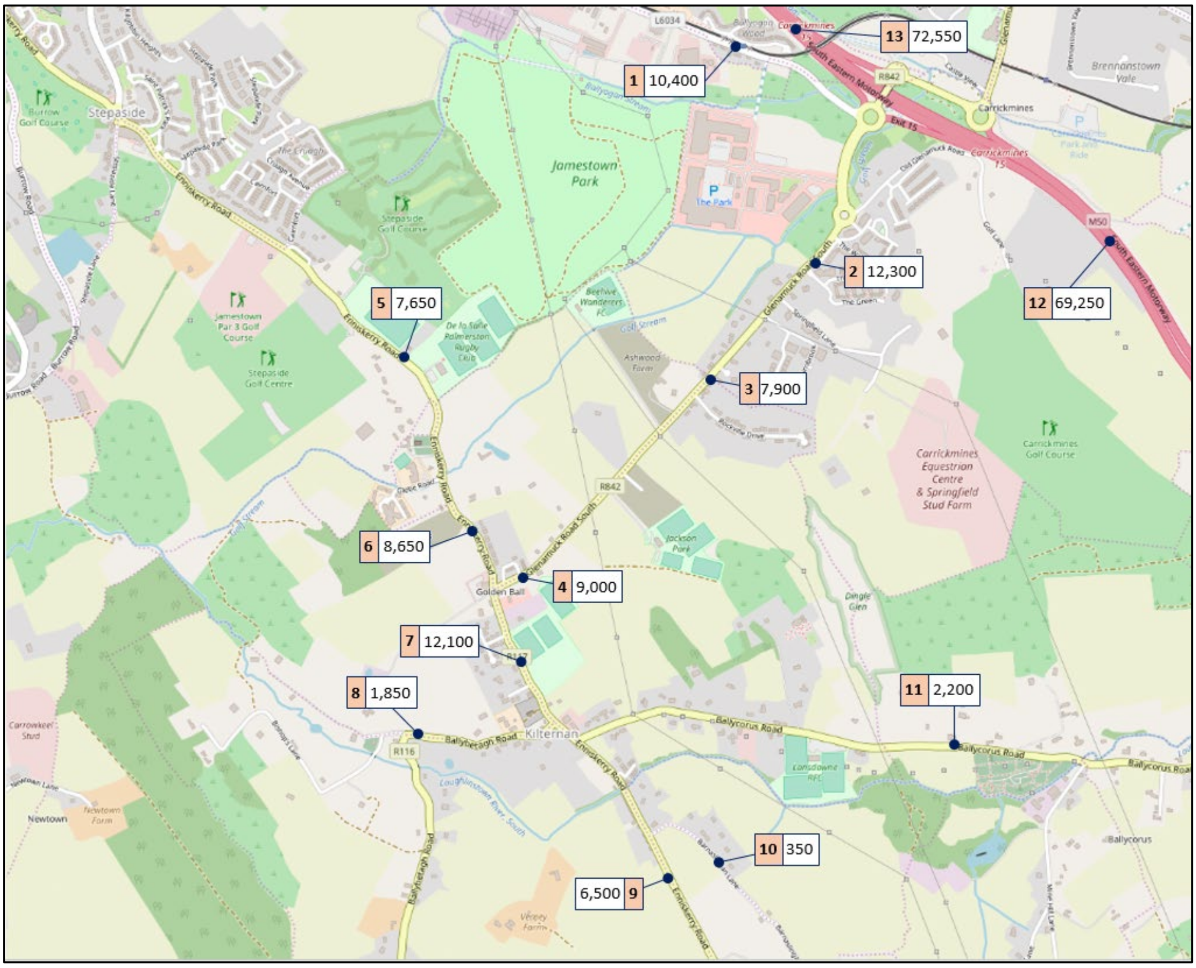

Figure 7.16: 2017 Base AADT Flows

7.5.3 Trip Generation

In relation to trip generation during the construction phase of the scheme the following professional conservative assumptions were made for two-way trip rates (Table 7.12):

Table 7.12 Trip Rates Assumed for the Construction Phase

Trip Generator Type	Trip Rate per Day
Staff (Light Vehicles)	25 – 42 trips
Importation of Materials (Heavy Vehicles)	60 trips (30 arrivals/30 departures)
Exportation of Materials (Heavy Vehicles)	80 trips (40 arrivals/40 departures)

The aforementioned trip rates were based upon professional conservative assumptions utilising experience from similar projects. The rates specified in Table 7.12 would assume the conservative scenario of a peak daily rate for vehicle movements during the construction phase. As parking will be provided on-site construction traffic will consist of the following two principal categories:

- Private vehicles owned and driven by site construction staff and by full time supervisory staff;

- Excavation plant and dumper trucks involved in site development works and material delivery vehicles for the importation and exportation of fill and road materials.

On-site employees will generally arrive before 08:00, thus avoiding the morning peak hour traffic. These employees will generally depart after 16:00. It should be noted that a large proportion of construction workers would arrive in shared transport. Based upon the experience of similar developments, a development of this type and scale would necessitate approximately 30-50 staff on site at any one time, subsequently 25-42 two-way vehicle trips over the day over the period of the construction works.

Deliveries would arrive at a steady rate during the course of the day. An estimated 41,100 m^3 of material will be brought onto the site over the entire duration of the construction stage of the scheme.

The estimated 41,100m^3 of imported material equates to between 4,725 and 5,270 truckloads dependent upon vehicles characteristics. At 3 loads per hour and 10 hours per day this equates to 175 days of importation of fill material as part of the adopted worst-case assessment. Considering the programme for this importation is 18 months, the effect on the local road network is considered negligible.

Similarly, an estimated 69,600 m^3 of material will exported off the site over the entire duration of the construction of the proposed scheme.

The estimated 69,600m^3 of exported material equates to between 8,000 and 8,925 truckloads dependent upon vehicles characteristics. At 4 loads per hour and 10 hours per day this equates to 223 days of importation of fill material as part of the adopted worst-case assessment. Again, considering the programme for this importation is 18 months, the effect on the local road network is considered negligible.

7.5.4 Trip Distribution & Assignment

In relation to the proposed haul routes for materials, it would be anticipated that vehicles working on the GDDR & northern portions of the GLDR will exit and enter the site at the existing Glenamuck Road / Golf Lane roundabout junction and travel north to/from Junction 15 of the M50 and to/from their respective licensed facility. This proposed haul route will bypass local roads around Kiltiernan and surrounding environs. For vehicles bound for southern portions of the GLDR it is anticipated that the construction vehicles would utilise the Glenamuck Road to access the site near the proposed second site compound. It is noted that exact compound locations, import/export locations and detailed traffic management and construction routing will be developed by the appointed contractor for the scheme and will be detailed in a construction management plan and Environmental Operating Plan. All exports/imports of material will be to be a suitably licenced facility.

In terms of trip distribution and assignments, all trips would be assumed to travel to/from the M50 to the site compounds. Assumptions made relating to trip assignment is detailed in Table 7.13 & Table 7.14

7.5.5 Assessment Scope

Two different traffic scenarios have been assessed, namely (a) the 'Base' (Do-Nothing) traffic characteristics and (b) the 'Construction' (Do-Something) traffic characteristics.

The 'Base' traffic scenario takes into account the potential level of traffic that could be generated from the existing flows travelling across the network. The proposed construction traffic is then added to the network's 'Base' traffic flows to establish the 'Construction' traffic flows. In summary, the following scenarios were: -

Do Nothing

- A1 – 2017 Base Traffic Flows

Do Something

- B1 - 2017 Do Nothing (A1) + GDRS Construction Traffic (Northern Portion); and
- B2 - 2017 Do Nothing (A1) + GDRS Construction Traffic (Southern Portion).

7.5.6 Construction Impact

The resulting percentage increase in AADT flows as a result of the construction traffic generated by the scheme were established based on the aforementioned methodology in this Section. At each of the locations specified in **Figure 7.16** the following daily percentage impacts are summarised below in Table 7.13 and Table 7.14:

Table 7.13 2017 Base AADT vs 2017 Base AADT + Construction AADT (Northern Portion)

No.	Location	2017 Base AADT	2017 Base AADT + Construction Traffic (Phase 1)	% Impact
1	Ballyogan Road	10,400	10,440 (+40)	0.39 %
2	Glenamuck Road	12,300	12,322 (-)	0.00 %
3	Glenamuck Road	7,900	7,900 (-)	0.00 %
4	Glenamuck Road	9,000	9,000 (-)	0.00 %
5	R117 Enniskerry Road	7,650	7,650 (-)	0.00 %
6	R117 Enniskerry Road	8,650	8,650 (-)	0.00 %
7	R117 Enniskerry Road	12,100	12,100 (-)	0.00 %
8	R116 Ballybetagh Road	1,850	1,850 (-)	0.00 %
9	R117 Enniskerry Road	6,500	6,500 (-)	0.00 %
10	Barnaslingan Lane	350	350 (-)	0.00 %
11	R116 Ballycorus Road	2,200	2,200 (-)	0.00 %
12	M50 North of Jn 15	72,550	72,628 (+78)	0.11 %
13	M50 South of Jn 15	69,250	69,314 (+64)	0.09 %

Table 7.14 2017 Base AADT vs 2017 Base AADT + Construction AADT (Southern Portion)

No.	Location	2017 Base AADT	2017 Base AADT + Construction Traffic (Phase 2)	% Impact
1	Ballyogan Road	10,400	10,440 (+40)	0.39 %
2	Glenamuck Road	12,300	12,482 (+182)	1.15 %
3	Glenamuck Road	7,900	8,082 (+182)	2.30 %
4	Glenamuck Road	9,000	9,000 (-)	0.00 %
5	R117 Enniskerry Road	7,650	7,650 (-)	0.00 %
6	R117 Enniskerry Road	8,650	8,650 (-)	0.00 %
7	R117 Enniskerry Road	12,100	12,100 (-)	0.00 %
8	R116 Ballybetagh Road	1,850	1,850 (-)	0.00 %
9	R117 Enniskerry Road	6,500	6,500 (-)	0.00 %
10	Barnaslingan Lane	350	350 (-)	0.00 %
11	R116 Ballycorus Road	2,200	2,200 (-)	0.00 %
12	M50 North of Jn 15	72,550	72,628 (+78)	0.11 %
13	M50 South of Jn 15	69,250	69,314 (+64)	0.09 %

7.6 Predicted Impacts – Operational Phase

7.6.1 Scheme Impact – Road Network Assessment

Opening Year AADT (2020)

Forecasted traffic volumes are shown in Table 7.15 for the Do-Nothing and Do-Something Opening Year (2020) scenarios. The traffic flows in each of these scenarios are also illustrated graphically in Figure 7.18 and Figure 7.19 respectively. For comparison purposes the modelled AADT's for 2017 are also shown graphically in Figure 7.17. It should be noted that locations B (for Base and 2020 Do-Nothing) and N are directly supplied from external trip forecasted and provided by the ERM to the LAM. These strategic flows were based on the National Demand Forecasting Model and disaggregated and processed in the ERM as mentioned in Section 7.2.2. These forecasted strategic flows provide planning and industry best statistical probability and numbers in traffic levels and travel distribution prediction and provides a greater level of conservationism in terms of predicting traffic flow and therefore the impact of the proposed scheme.

Table 7.15 AADT Summary for 2020 Opening Year (Vehs) *

ID	Location	2017 Base AADT	2020 Do-Nothing AADT	2020 Do-Something AADT	% Diff 2020 DN vs 2020 DS
A	R117 Enniskerry Road (North of Golden Ball junction)	8650	9050	4700	- 48.1 %
B	R117 Enniskerry Road (South of Kiltiernan Village)	6500	10500	1400	- 86.7 %
C	Barnaslingan Lane	350	500	500	0.0 %
D	Ballycorus Road	2200	4050	4950	+ 22.2 %
E	Glenamuck Road (East of GLDR	12300	13350	2700	- 79.8 %
F	Glenamuck Road (West of GLDR)	9000	10450	1900	- 81.8 %
G	Glenamuck District Distributor Road (West of GDDR/GDLR junction)	-	-	7250	-
H	Glenamuck District Distributor Road (East of GDDR/GDLR junction)	-	-	14000	-
I	Glenamuck District Link Road (South of GDDR/GDLR junction)	-	-	12550	-
J	Glenamuck District Link Road	-	-	10850	-
K	R117 Enniskerry Road / Glenamuck District Link Road	-	-	11900	-
L	Glenamuck District Distributor Road (Adjacent to Park Development)	-	-	13200	-
M	R117 Enniskerry Road (North of GDDR junction)	7650	9000	11950	+ 32.8 %
N	R116 Ballybetagh Road	1850	3550	3550	0.0 %
O	R117 Enniskerry Road (North of Kiltiernan Village)	12100	13000	4950	- 61.9 %
P	Glenamuck District Link Road (South of Ballycorus Road)	-	-	11900	-
Q	M50 South of Junction 15	69250	84350	86050	+ 2.0 %
R	M50 North of Junction 15	72550	88200	87450	- 0.85 %

* All AADT values are rounded up to the nearest 50.

In the 2020 Do-Something scenario the Glenamuck District Roads Scheme is forecast to carry between 7,250 and 14,000 AADT. The flows presented in Table 7.15 highlights a number of impacts as a direct result of the proposed scheme. These include: -

- The proposed scheme diverts road traffic onto its network and away from less suitable and unsafe roads on the network. The proposed scheme acts as an arterial traffic corridor for the local network attracting trips from existing and committed developments;
- There is a reduction in traffic and congestion in Kiltiernan Village (reductions of 86.7% and 61.9% at location B and O respectively which represent a numerical decrease in AADT of 10,500 to 1,400 at location B and 13,000 to 4,950 at location O) and R117 Enniskerry Road (reduces by 48.1% at location A which represent a numerical decrease in AADT of 9,050 to 4,700) where the scheme directs and bypasses traffic from this area;
- Traffic on the existing eastern section of the Glenamuck Road is reduced and congestion is decreased due in part to the proposed scheme and the Bus Gate (this represents a reduction 79.8% or in numeric terms, AADT decreases from 13,350 to 2,700). Similarly, on the southern section of the Glenamuck Road near the Golden Ball junction there is a reduction in traffic and congestion from traffic being redirected to the proposed scheme (which represents a reduction of 81.8% or in numeric terms, AADT decreases from 10,450 to 1,900);
- Traffic on the R116 Ballycorus Road increases before the introduction of the proposed scheme from additional traffic from new development zones such as Cherrywood, Rathmichael and Old Conna from 2017 to the 2020 Do-Nothing scenario (an increase of 84.1% or in numeric terms an increase in AADT of 2,200 to 4,050). With the implementation of the proposed scheme this increases by a further +22.2%. However, the Ballycorus Road has been earmarked in the County Development Plan as a long-term road proposal to be improved to cater for strategic demand;
- With large reductions in traffic volumes in Kiltiernan Village, on Glenamuck Road, the bypassed section of the R117 Enniskerry Road would lead to a safer environment for pedestrians and cyclists along these corridors. Severance is also expected to improve with the decrease in road traffic making a holistic environment for active modes of travel;
- Regarding traffic on the M50, AADT south of Junction 15 of the motorway increases by only 2% in the Do-Something scenario compared to the Do-Nothing scenario. However, north of Junction 15 traffic decreases by 0.85% between the two scenarios; and
- The scheme attracts additional trips from south of the scheme and from Stepaside from time savings for motorists using the scheme.

In summary the Glenamuck District Roads Scheme reduces the level of traffic on the existing road network within the Local Area Plan environ for Kiltiernan-Glenamuck by diverting road traffic onto the proposed scheme's network and enabling traffic to bypass less suitable and unsafe roads on the LAP environ road network. The Kiltiernan Village Centre, Glenamuck Road and the bypassed section of the R117 Enniskerry Road benefit the most from the scheme. The proposed scheme acts as collector road for the local network attracting trips from existing and committed developments. The scheme attracts additional traffic from further origin points due to the time-saving benefit of the scheme. Finally, it has a marginal to slight impact on the M50 and the nearby Junction 15 in terms of traffic.

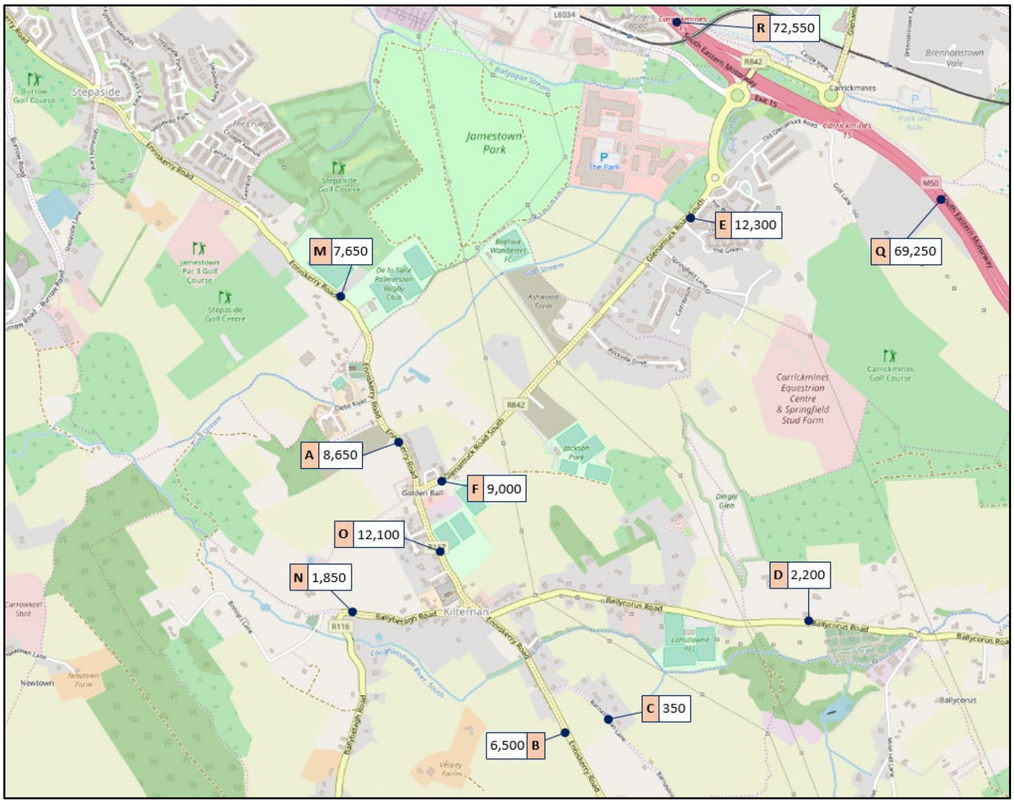

Figure 7.17: 2017 Base AADT

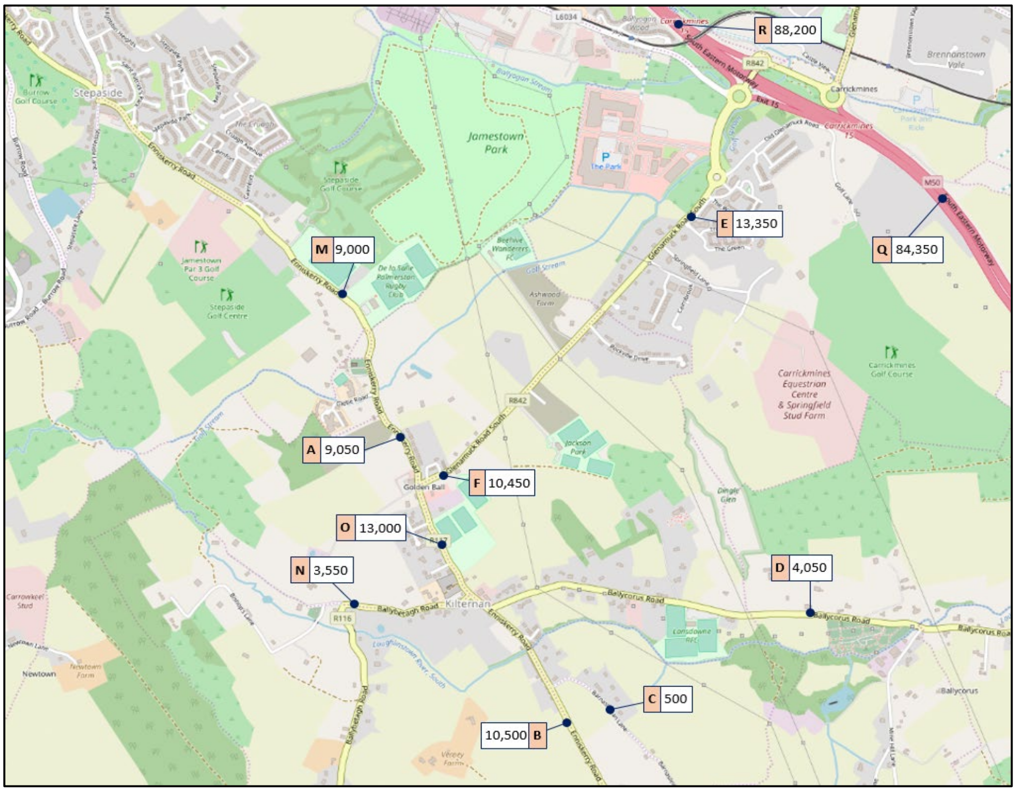

Figure 7.18: 2020 Do-Nothing AADT

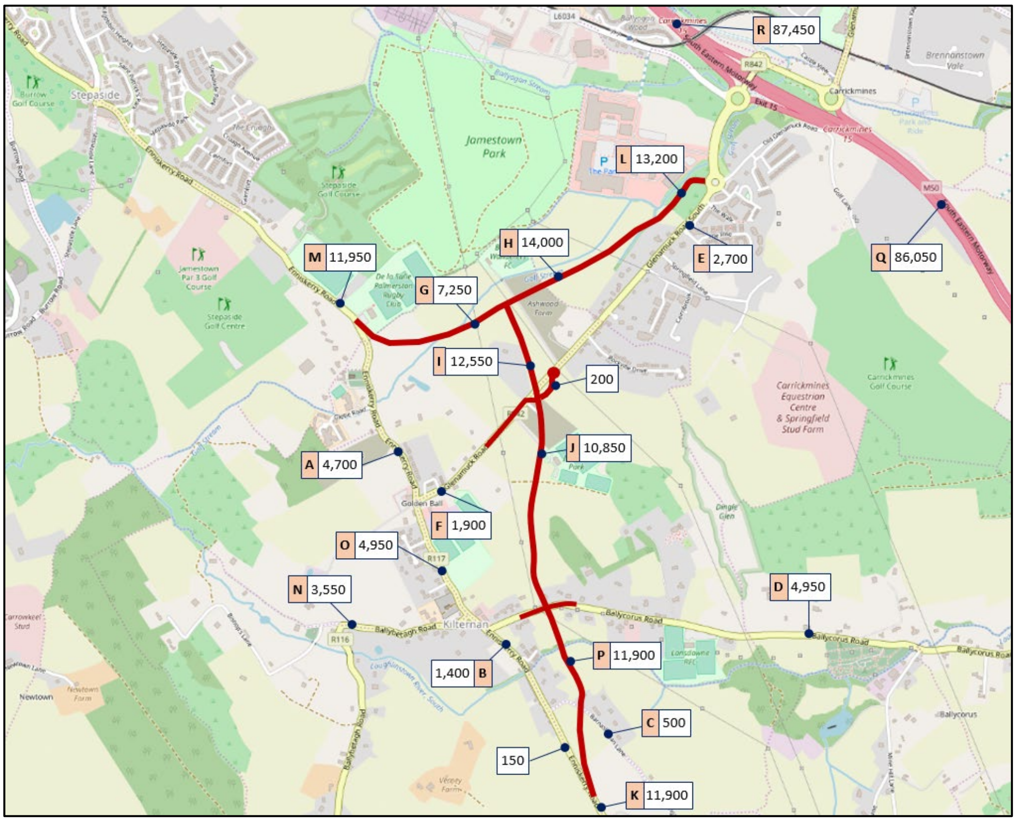

Figure 7.19: 2020 Do-Something AADT

Design Horizon Year AADT (2035)

Forecasted traffic volumes are shown in Table 7.16 for the Do-Nothing and Do-Something Horizon Year (2035) scenarios. The traffic flows in each of these scenarios are also illustrated graphically in Figure 7.20 and Figure 7.21 respectively. Additionally, the modelled forecasted AADT's for 2035 Do-Something with Complementary Measures are also shown graphically in Figure 7.22 and included in Table 7.16.

Table 7.16 AADT Summary for 2035 Design Horizon Year (Vehs) *

ID	Location	2035 Do-Nothing AADT	2035 Do-Something AADT	% Diff 2035 DN vs. 2035 DS	2035 Do-Something + CM AADT	% Diff 2035 DN vs 2035 DS + CM
A	R117 Enniskerry Road (North of Golden Ball junction)	14600	5800	- 60.3 %	5950	- 59.2 %
B	R117 Enniskerry Road (South of Kiltiernan Village)	16900	2050	- 87.9 %	2050	- 87.9 %
C	Barnaslingan Lane	800	800	0.0 %	800	0.0 %
D	Ballycorus Road	7100	11600	+ 63.4 %	11050	+ 55.6 %
E	Glenamuck Road (East of GLDR)	17800	5000	- 71.9 %	5050	- 71.6 %
F	Glenamuck Road (West of GLDR)	13900	5750	- 58.6 %	5650	- 59.4 %
G	Glenamuck District Distributor Road (West of GDDR/GDLR junction)	-	14250	-	14650	-
H	Glenamuck District Distributor Road (East of GDDR/GDLR junction)	-	26450	-	31750	-
I	Glenamuck District Link Road (South of GDDR/GDLR junction)	-	21600	-	20000	-
J	Glenamuck District Link Road	-	20450	-	20450	-
K	R117 Enniskerry Road / Glenamuck District Link Road	-	18450	-	19050	-
L	Glenamuck District Distributor Road (Adjacent to Park Development)	-	26600	-	18400	-
M	R117 Enniskerry Road (North of GDDR junction)	14500	16250	+ 12.1 %	13750	- 5.2 %
N	R116 Ballybetagh Road	6200	6250	+ 0.8 %	6100	- 1.6 %
O	R117 Enniskerry Road (North of Kiltiernan Village)	20800	6200	- 70.2 %	6150	- 70.4 %
P	Glenamuck District Link Road (South of Ballycorus Road)	-	16800	-	17600	-
Q	M50 South of Junction 15	49650	49600	- 0.1 %	46300	- 6.7 %
R	M50 North of Junction 15	39350	39700	+ 0.9 %	39000	- 0.9 %

* All AADT values are rounded up to the nearest 50.

In the 2035 Do-Nothing scenario, the R117 Enniskerry Road is forecast to have an AADT of up to 20,800 vehicles per day. The highest AADT occurs in Kiltiernan's Village Centre. The Glenamuck Road is forecast to have an AADT flow from 13,900 to 17,800 vehicles per day. Similarly, the R116 is expected to have an AADT flow from 6,200 to 7,100 vehicles per day.

In the 2035 Do-Something scenario however, the Glenamuck District Roads Scheme is forecasted to carry between 14,250 and 26,600 AADT (the highest being on the eastern section of the GDDR). Traffic within the LAP lands of Kiltiernan-Glenamuck are forecasted to maintain low levels of AADT compared to the flows on the proposed scheme with increases included from a fully developed LAP lands expected. But, these AADT flows are the same or lower than the 2017 base AADT flows.

The flows presented in Table 7.16 highlights a number of impacts as a direct result of the proposed scheme in the future design year of 2035. These include: -

- The proposed scheme diverts road traffic onto its network and away from less suitable and unsafe roads on the network. The proposed scheme acts as an arterial traffic corridor for the local network attracting trips from existing, committed developments and the fully development LAP lands;

- There is a significant reduction in traffic and congestion in Kiltiernan Village (reductions of 87.9% and 70.2% at location B and O respectively which represent a numerical decrease in AADT of 16,900 to 2,050 at location B and 20,800 to 6,200 at location O) and R117 Enniskerry Road (reduces by 60.3% at location A which represent a numerical decrease in AADT of 14,600 to 5,800) where the scheme directs and bypasses traffic from this area;

- Traffic on the existing eastern section of the Glenamuck Road is reduced and congestion is decreased due in part to the proposed scheme and the Bus Gate (this represents a reduction 71.9% or in numeric terms, AADT decreases from 17,800 to 5,000). Similarly, on the western section of the Glenamuck Road near the Golden Ball junction there is a reduction in traffic and congestion from traffic being redirected to the proposed scheme (which represents a reduction of 58.6% or in numeric terms, AADT decreases from 13,900 to 5,750);

- With large reductions in traffic volumes in Kiltiernan Village, on Glenamuck Road, the bypassed section of the R117 Enniskerry Road would lead to a safer environment for pedestrians and cyclists along these corridors. Severance is also expected to improve with the decrease in road traffic making a holistic environment for active modes of travel;

- Background traffic on the R116 Ballycorus Road is expected to increase from 2020 and again before the introduction of the proposed scheme. Additional traffic from new development zones such as Cherrywood, Rathmichael and Old Conna contribute to this expected growth (in AADT terms 4,050 in 2020 to 7,100 in the 2035 Do-Nothing). With the implementation of the proposed scheme increases further with time saving attraction, AADT increases to 11,050. However, the Ballycorus Road has been earmarked in the County Development Plan as a long-term road proposal to be improved to cater for strategic demand on this corridor after the implementation of the GDRS;

- Regarding traffic on the M50, AADT south of Junction 15 of the motorway decreases slightly by only 0.1% in the Do-Something scenario compared to the 2035 Do-Nothing scenario. However, north of Junction 15 traffic increases by 0.9% between the two scenarios; and

- The scheme attracts additional trips from surrounding environs like Stepaside, Rathmichael, Cherrywood and Enniskerry from time savings for motorists using the scheme.

As a comparison the 2035 Do-Something with the complementary measures that are outside the remit of the GDRS but are assumed as being implemented after the GRDS and before 2035 are forecasted to carry between 14,650 and 31,750 AADT (the highest being on the eastern section of the GDDR to the junction with the proposed Park Development road infrastructure). The 2035 Do-Something with complementary measures shows mostly slight improvements to AADT in the LAP local road network however, reductions in traffic levels occur in the R116 Ballycorus Road (now +55.6% from +63.4%

difference to Do-Nothing with an AADT of 11,050 vehicles per day) and on the M50 with AADT south of Junction 15 of the motorway decreasing by 6.65% (AADT decreases from 49,600 to 46,300 vehicles per day) compared to the other Do-Something scenario and similarly, north of Junction 15 traffic decreases by 1.80% (AADT decreases from 39,700 to 39,000 vehicles per day) between the two Do-Something scenarios.

In summary the Glenamuck District Roads Scheme reduces the level of traffic on the existing road network within the Local Area Plan environ for Kiltiernan-Glenamuck by diverting road traffic onto the proposed scheme's network and enabling traffic to bypass less suitable and unsafe roads on the LAP environ road network. The Kiltiernan Village Centre, Glenamuck Road and the bypassed section of the R117 Enniskerry Road benefit the most from the scheme. AADT traffic figures do increase compared to the 2020 Do Something scenario due to a fully developed LAP lands being assumed. But, these AADT flows are the same or lower than the 2017 base AADT flows. The proposed scheme acts as a link street for the local network attracting trips from existing and committed developments and the fully developed LAP lands. The scheme attracts additional traffic from further origin points due to the time-saving benefit of the scheme. In regard to traffic on the M50 there is a marginal to slight impact on the M50 and the nearby Junction 15. Comparing the two Do-Something scenarios (one being with the complementary measures that are outside the remit of the GDRS but are assumed as being implemented after the GRDS and before 2035) shows mostly slight improvements to AADT in the LAP local road network however, reductions in traffic levels occurring on the R116 Ballycorus Road and the M50.

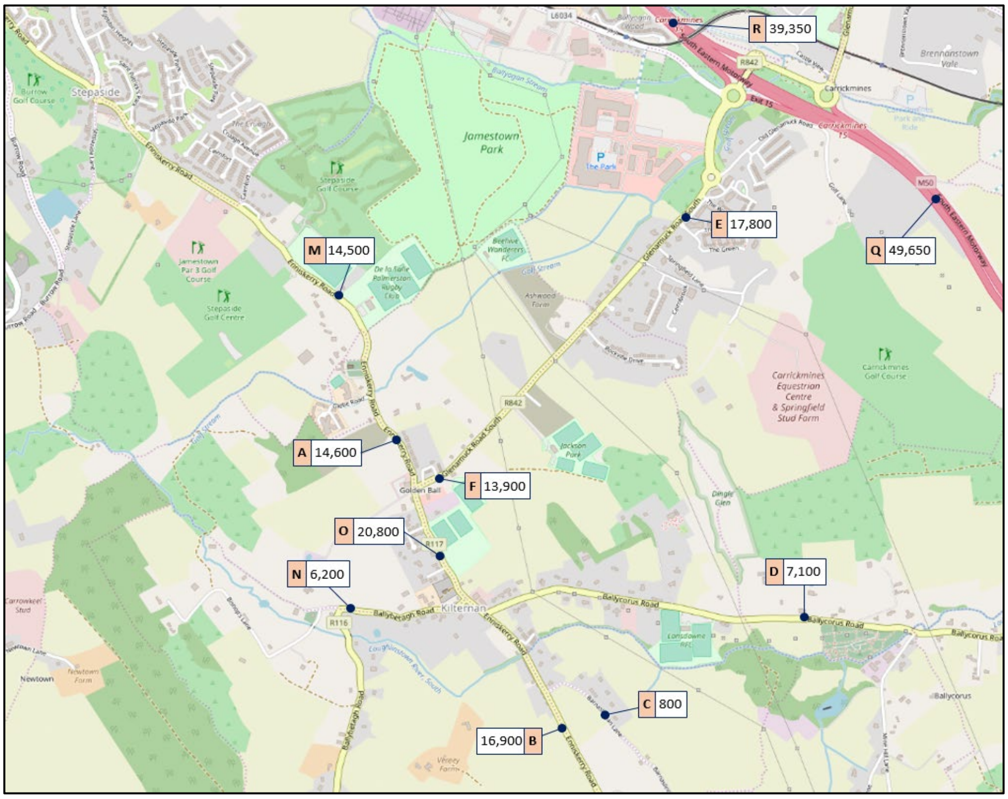

Figure 7.20: 2035 Do-Nothing AADT

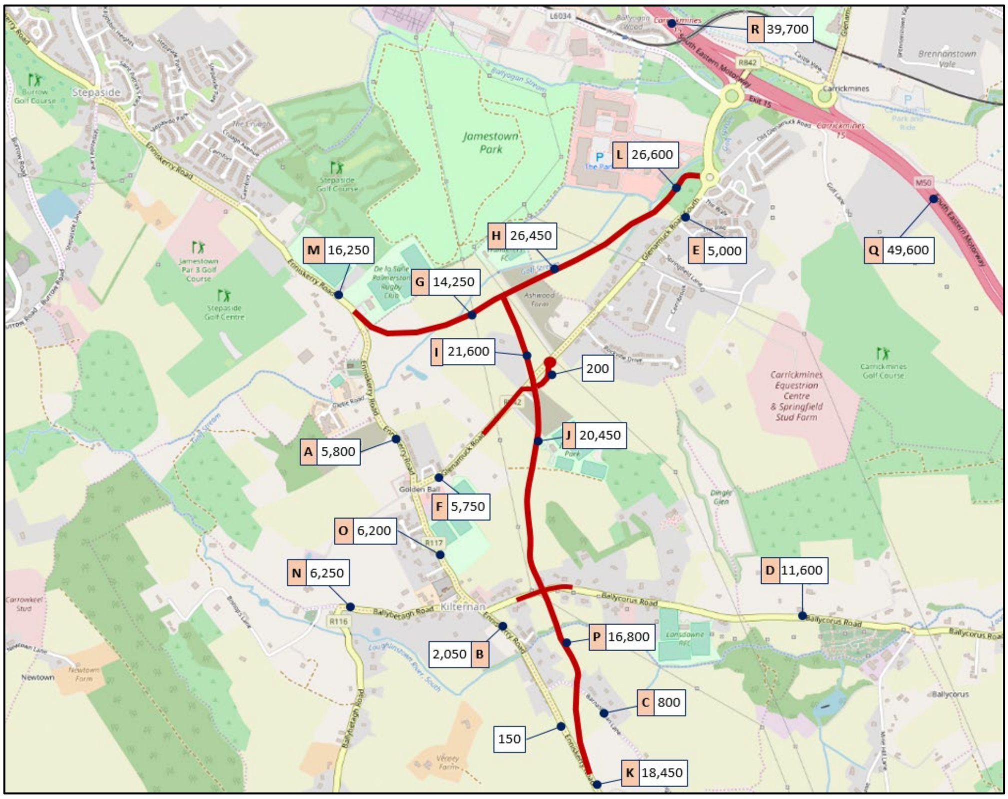

Figure 7.21: 2035 Do-Something AADT

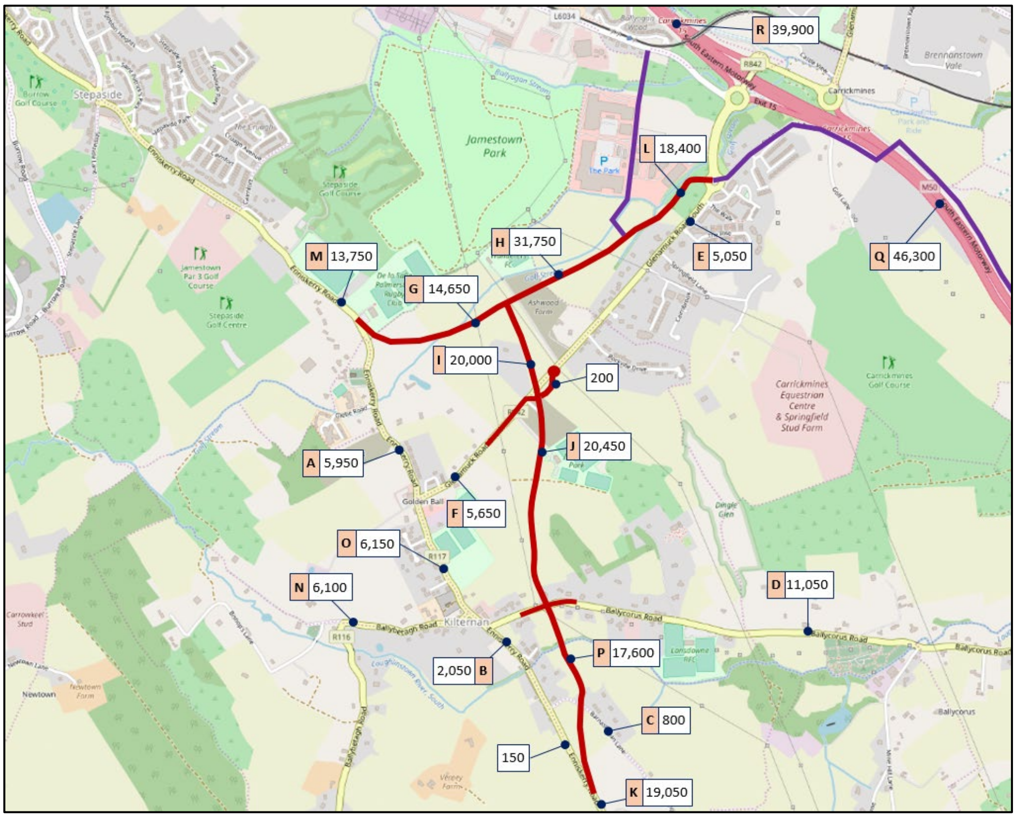

Figure 7.22: 2035 Do-Something with Complementary Measures AADT

7.6.2 Scheme Impact – Delays and Queuing

The section compares the network results for each of the scenarios tested in the LAM. This LAM analysis was developed based on the impacts on the network performance parameters:

- Total Network Travel Time (hrs) for all vehicles;
- Total Network Vehicle Kilometres (hrs) for all vehicles; and
- Total Delays (hrs).

Total delay in this assessment was measured by two SATURN key statistics, Transient Queues and Over Capacity Queues. These types of queuing are defined as follows:

- Transient queues are under capacity queues that form during the red phases of signals; and
- Over-capacity queues are the queues that form due to capacity shortage at a junction where a permanent queue develops and is unable to clear in a single cycle.

These two combined statistics of Transient Queues and Over Capacity Queues to give total delay gives an overview measure of how vehicles perform travelling through the LAM network. Table 7.17 and Table 7.18 summarises the key network statistics for each of the scenarios tested in the AM and PM peak periods, while Figure 7.23 and Figure 7.24 compares delays in each of the scenarios.

Table 7.17 Key LAM Network Statistics for AM Peak Period

Key Statistic (AM Peak Hour)	2017 Base	2020 DN	2020 DS	2035 DN	2035 DS	2035 DS + CM
Includes LAP Flows	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**
Transient Queues (Hours)	303.7	316.9	475.8	367.8	507.3	551.6
Over Capacity Queues (Hours)	2306.3	2571.2	1572.8	3656.3	2267.2	1754.3
Total Delay (Hours)	2610	2888.1	2048.6	4024.1	2774.5	2305.9
Total Travel Times (Hours)	4096.2	4407.1	3838.7	5576.6	4478	3712.6
Travel Distance (km)	107926.5	110008.2	123131.3	97627.4	104495.9	106503.7

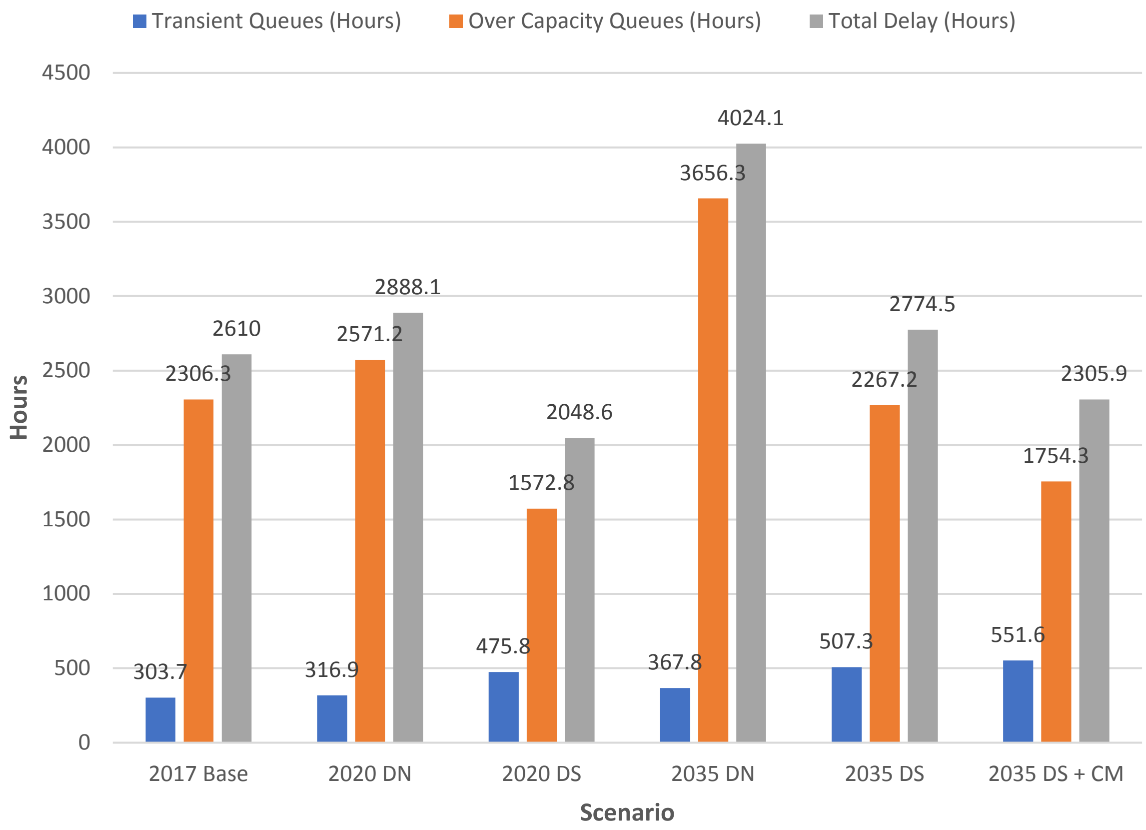

Figure 7.23: LAM Modelled Queues and Total Delay for AM Peak Period

Comparing the AM peak periods in each of the scenarios the trend generally describes that the GDRS improves traffic conditions as there is a reduction in delay in the 2020 and 2035 opening and horizon years and with the complementary measures there is further benefits with greater demand following the development of the LAP lands (with up to 3,000 residential units) and committed developments. Contrasting the 2035 Do-Nothing scenario results with the Do-Something scenarios in 2035, there is a significant reduction in delay across the network, highlighting the benefits of the proposed GDRS and that the existing road network as it stands is unsustainable for catering traffic in the future horizon year of 2035.

Table 7.18 Key LAM Network Statistics for PM Peak Period

Key Statistic (PM Peak Hour)	2017 Base	2020 DN	2020 DS	2035 DN	2035 DS	2035 DS + CM
Includes LAP Flows	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**
Transient Queues (Hours)	319.8	318.8	409.1	442.5	467.5	544.3
Over Capacity Queues (Hours)	2030	2040.6	1557.3	3306.8	2229.2	1571.1
Total Delay (Hours)	2349.8	2359.4	1966.4	3749.3	2696.7	2115.4
Total Travel Times (Hours)	3891	3890.9	4685.5	5385.2	4784	4311.3

Travel Distance (km)	107567.8	106848.4	114833	100523.2	97062.3	99193.9

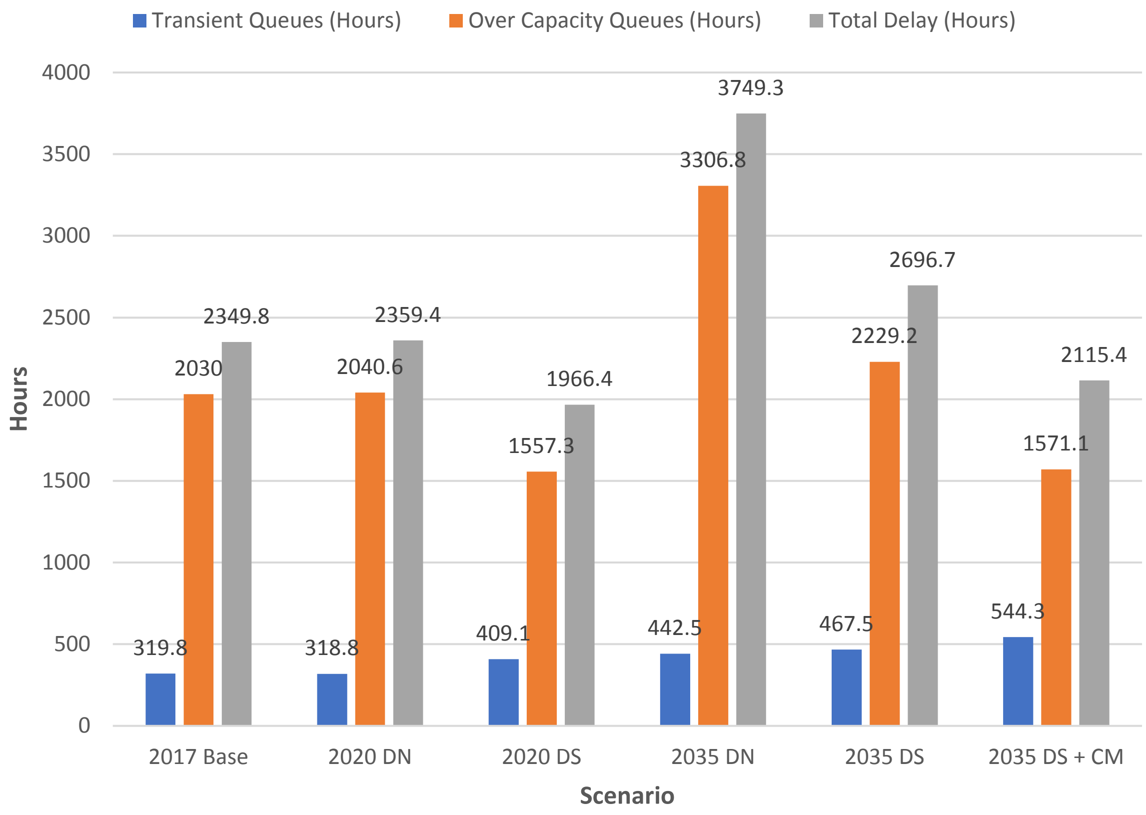

Figure 7.24: LAM Modelled Queues and Total Delay for PM Peak Period

Comparing the PM peak periods in each of the scenarios the trend generally describes that the GDRS improves traffic conditions as there is a reduction in delay in the 2020 and 2035 opening and horizon years comparing the Do-Nothing and Do-Something scenarios. The complementary measures show further improvements with greater demand following the development of the LAP lands (with up to 3,000 residential units) and committed developments compared to the Do-Something scenarios. Contrasting the 2035 Do-Nothing scenario results with the Do-Something scenarios in 2035, there is a significant reduction in delay across the network, highlighting the benefits of the proposed GDRS and that the existing road network as it stands is unsustainable for catering traffic in the future horizon year of 2035.

7.6.3 Scheme Impact – Vehicle Speeds

Investigating the efficiency of the network in each scenario assessed, the average speeds on the network for general traffic and buses are presented in Table 7.19 and Table 7.20 while Figure 7.25 and Figure 7.26 compares average speeds in each of the scenarios.

Table 7.19 LAM General Traffic Average Speed (kph)

Average Speed for Cars (kph)	2017 Base	2020 DN	2020 DS	2035 DN	2035 DS	2035 DS + CM
Includes LAP Flows	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**
AM Peak Period	26.3	24.7	32.3	17.5	27.6	28.7
PM Peak Period	27.6	27.5	28.8	18.7	20.5	24.8

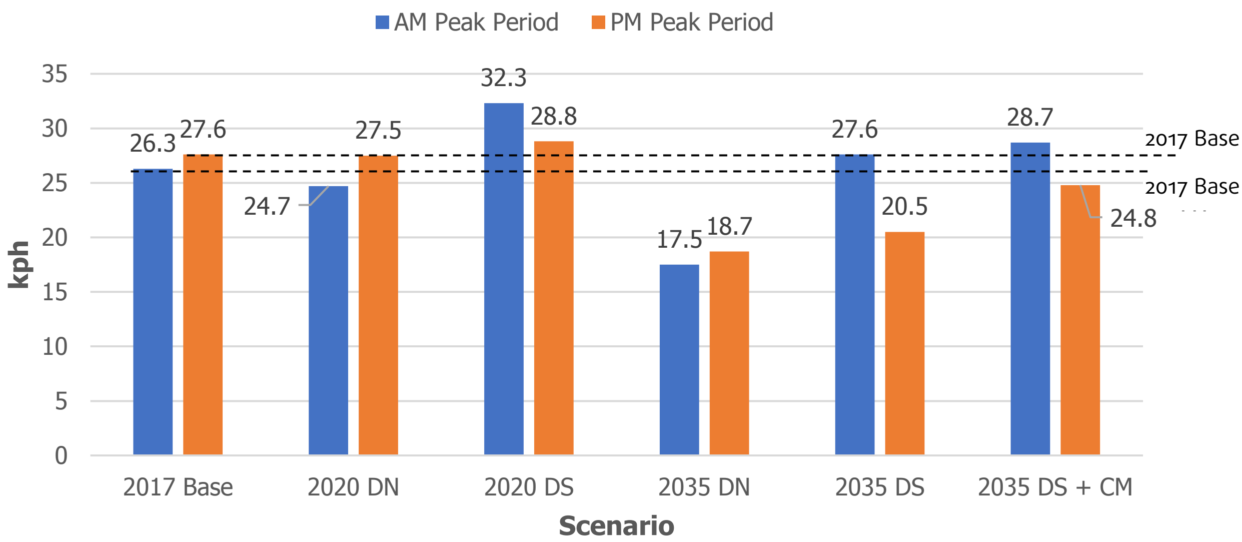

Figure 7.25: Average Speed for General Traffic (kph)

Comparing the average speeds for general traffic, the overall trend is that average speed increases in the AM peak period in the Do-Something scenarios as opposed to a downward trend in the Do-Nothing scenarios. There is a slight decrease between the 2017 base and 2020 Do Nothing, this is correlating to a slight increase in background traffic. Comparing the 2020 and 2035 Do Something there is a noticeable decrease in average speed, this is correlating to an increase in background traffic over a 15-year period, however with the introduction of the complementary measures, average speed is improved. Contrasting the 2035 Do-Nothing scenario results with the Do-Something scenarios in 2035 and the 2017 Base, there is a significant reduction in average speed across the network, however with the introduction of the proposed GDRS average speed improves. This shows that the existing network as it stands is not efficiently catering traffic in the future horizon year of 2035.The PM peak period reflects a similar trend as in the AM peak period.

Comparing the average speeds for bus traffic only, the overall trend is that average speed increases in the AM peak period in all Do-Something scenarios as opposed to a downward trend in the Do-Nothing scenarios. There is a slight decrease between the 2017 base and 2020 Do Nothing, this is correlating to a slight increase in background traffic and the delay paralleled with this increase in traffic. This continues to the 2035 Do-Nothing scenario. High average bus speeds are maintained in the 2035 Do-Something scenarios. This shows that the Do-Something network has a significant benefit for average bus speeds. The PM peak period reflects a similar trend as in the AM peak period.

Table 7.20 LAM Bus Average Speed (kph)

Average Speed for Buses (kph)	2017 Base	2020 DN	2020 DS	2035 DN	2035 DS	2035 DS + CM
Includes LAP Flows	NO	NO	NO	YES	YES	YES
AM Peak Period	27.7	27	46.9	25.9	46.4	42.8
PM Peak Period	33	32	46.2	28.6	33.9	41.4

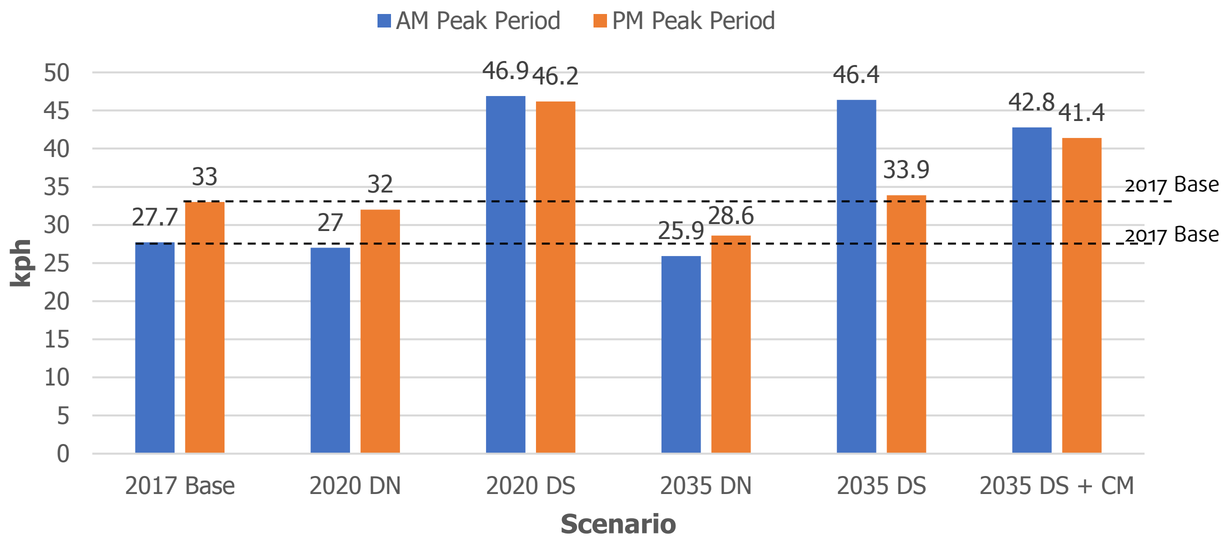

Figure 7.26: Average Speed for Buses (kph)

While comparing the average speeds for Buses, this assessment shows the significant benefit from the introduction to the GDRS and its provision for the Bus Gates. The general trend is that average speed increases with each progressive scenario in the AM peak period especially for with the introduction of the GDRS. The exception being the 2035 Do Something scenario where average speeds decrease. But this changes with the implementation of the Complementary measures. For the PM peak period this is a similar case as in the AM peak period.

7.6.4 Scheme Impact – Strategic Impacts on the M50

A strategic impact assessment was undertaken on the following junctions on the M50: -

- Junction 13 (Sandyford, Dundrum Interchange);
- Junction 14 (Stillorgan, Dun Laoghaire Interchange);
- Junction 15 (Kiltiernan, Leopardstown Interchange); and
- Junction 16 (Loughlinstown, Cherrywood Interchange).

Strategic level flows using the National Transport Authority's (NTA) Eastern Regional Model (ERM) were compared for each scenario and analysed at key locations based on the TII permanent ATC traffic counter locations as specified in Figure 7.8. It should be noted that between the 2020 and 2035 Do-Nothing scenarios there is a marked decrease in AADT. The reason for this is that the NTA ERM model for 2035 includes a full suite of transport measures (mentioned in Section 7.2.2) included in it to reflect the GDA Transport Strategy which includes large public transport infrastructural projects (like the Metrolink, Core Bus corridors and new Luas lines), a fully realised cycle network and TII's Demand Management Measures on the M50 to reduce traffic on the motorway and address future capacity. The combination of all of these reduces demand on the M50 corridor. Changes between the Do-Nothing (DN) and Do-Something (DS) scenarios at each model year reflects the impact on the M50 by the proposed GDRS.

This assessment found that there were marginal differences in AADT flow on the M50 at key locations from the proposed scheme as outlined in Table 7.21. Comparing the 2020 Do-Nothing and 2020 Do-Something, AADT flows in the locations between Junctions 12-13 and 16-17 presented have a small increase in flows and a decrease in flow between Junctions 14 and 15. There was 2% increase in AADT for the opening year 2020 between junctions 15 and 16.

For the model year 2035 the impact at the locations between M50 Junctions 12-13, 14-15 and 15-16 were slight or marginal. However, AADT between junction 16 and 17 showed a 9.15% decrease in flow as trips to and from zones south of the proposed GDRS were diverted onto the scheme. The major difference with the inclusion of the complementary measures was a 6.75% decrease in AADT flow to the Do-Nothing scenario between junctions 15 and 16, mostly due to traffic using the proposed Golf Lane Link as an alternative to travel on the M50. The Modelling Report in **Appendix 7-1** outlines in further detail on the strategic impacts on these junctions on the M50.

Table 7.21 Base and Forecasted Strategic Flows at M50 Traffic Counter Locations

Counter ID	Location Between M50 Junctions	2017 Base	2020 DN	2020 DS	2020 % Diff DN vs DS	2035 DN	2035 DS	2035 % Diff DN vs DS	2035 DS + CM	2035 % Diff DN vs DS+CM
TMU M50 035.0 S	12 13	74500	85550	86000	+0.53%	30650	29950	-0.22%	30750	+0.00%
TMU M50 040.0 S	14 15	72550	88200	87450	-0.85%	39350	39700	+0.89%	39000	-0.89%
TMU M50 035.0 N	15 16	69250	84350	86050	+2.02%	49650	49600	-0.10%	46300	-6.75%
TMU M50 040.0 N	16 17	49500	60850	60900	+0.08%	36600	33250	-9.15%	33450	-8.60%

7.6.5 Scheme Impact – Public Transport

The impacts of the proposed scheme on public transport are considered to be positive in both the short and longer term. The proposed scheme will have a positive impact in terms of reducing traffic volumes on the local network particularly on the existing Glenamuck Road, and Kiltiernan Village with the implementation of the bus gates, thereby improving bus journey times and their reliability for existing and potential additional future bus services. The proposed scheme will also facilitate increased accessibility and connectivity with the Carrickmines Luas Stop on the Greenline.

7.6.6 Scheme Impact – Benefits of the Bus Gates

A sensitivity assessment was undertaken to investigate the overall benefits of the Bus gates as part of the GDRS. The primary finding from this sensitivity test was that overall bus speeds decrease significantly in scenarios where the bus gates are not included compared to scenarios which have implemented the two bus gates. Table 7.22 summarises the results from the sensitivity test and Figure 7.27 illustrates this graphically.

Table 7.22 LAM Bus Average Speed (kph) with No Bus Gates Sensitivity Test

Average Speed for Buses (kph)	2017 Base	2020 DN	2020 DS	2035 DN	2035 DS	2035 DS + CM	2020 DS	2035 DS	2035 DS + CM
Includes LAP Flows	**NO**	**NO**	**NO**	**YES**	**YES**	**YES**	**NO**	**YES**	**YES**
AM Peak Period (With Bus Gate)	27.7	27	46.9	25.9	46.4	42.8	-	-	-
PM Peak Period (With Bus Gate)	33	32	46.2	28.6	33.9	41.4	-	-	-
AM Peak Period (Without Bus Gate)	-	-	-	-	-	-	38.9	38.6	38.9
PM Peak Period (Without Bus Gate)	-	-	-	-	-	-	23.1	20.5	35.7

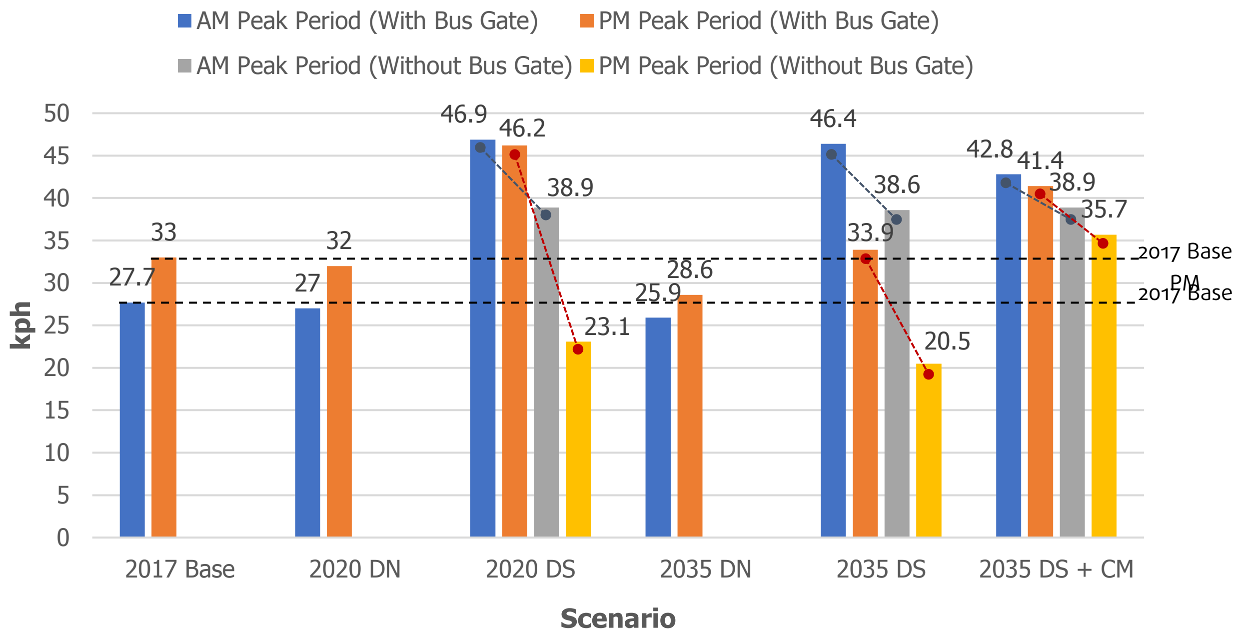

Figure 7.27: Average Speed for Buses (kph) with No Bus Gates Sensitivity Test

In terms of AADT, the eastern section of Glenamuck Road without the bus gate, AADT figures are forecasted to be in the range of 10,900-12,950 vehicles per day in the 2035 Do-Something. The highest being on the end section connecting with the roundabout which compares to an AADT figure of 5,000 vehicles per day with scenarios with the bus gate in the same model year. These AADT figures for the scenario without the bus gate are unsuitable and unsustainable for this type of road.

7.6.7 Scheme Impact – Pedestrians and Cyclists

Careful consideration has been given as part of the scheme design to the provision of new cyclist and pedestrian facilities and their integration into the wider existing and future proposed networks. Segregated cycle tracks and footways are to be provided along the entire scheme on the GDDR and GDLR, on both sides of the carriageway. Further, provisions are made for cycle and pedestrian facilities to be provided at all key junctions on the scheme.

The proposed scheme has been designed to provide alternative cycle and pedestrian connectivity for the Glenamuck-Kiltiernan lands and support the transportation needs of future demand from the implementation of the Local Area Plan proposals. For cyclists, connection to the existing 11C secondary cycle route (south from Goatstown Cross on Drummartin Link Road / Kilgobbin Road / Ballyogan Road to Carrickmines) can be achieved. Future cycle connections would be achieved with the following routes as illustrated with Figure 7.28: -

- Proposed 11E secondary route (from Dundrum along Sandyford Road / Enniskerry Road to Stepaside (and rural route onward to Enniskerry and the Wicklow Mountains), with spur north into Dundrum Village)
- Proposed D1 rural cycle route (Dublin - Kiltiernan - The Scalp - Enniskerry - Djouce: the main access route from Dublin to the Wicklow Mountains for recreational cyclists); and
- Proposed D4 rural cycle route (cycle route along the R116, Shankill to Rockbrook)

In general, the proposed scheme will have a positive impact in terms of enhancing the existing pedestrian and cyclist environment and adding new amenity walking and cycling routes to the area. Along the local road network particularly on the existing Glenamuck Road, and in Kiltiernan Village, the pedestrian and cyclist environment will benefit from the resulting reduction in traffic levels from traffic diverted from the proposed scheme. The reduction in traffic along the existing Glenamuck Road and Kiltiernan Village along the Enniskerry Road in particular will provide considerable relief from severance and will enhance existing facilities and afford opportunities to provide new pedestrian and cycle facilities, such as a feeder cycle route along the Glenamuck Road (**Figure 7.28**).

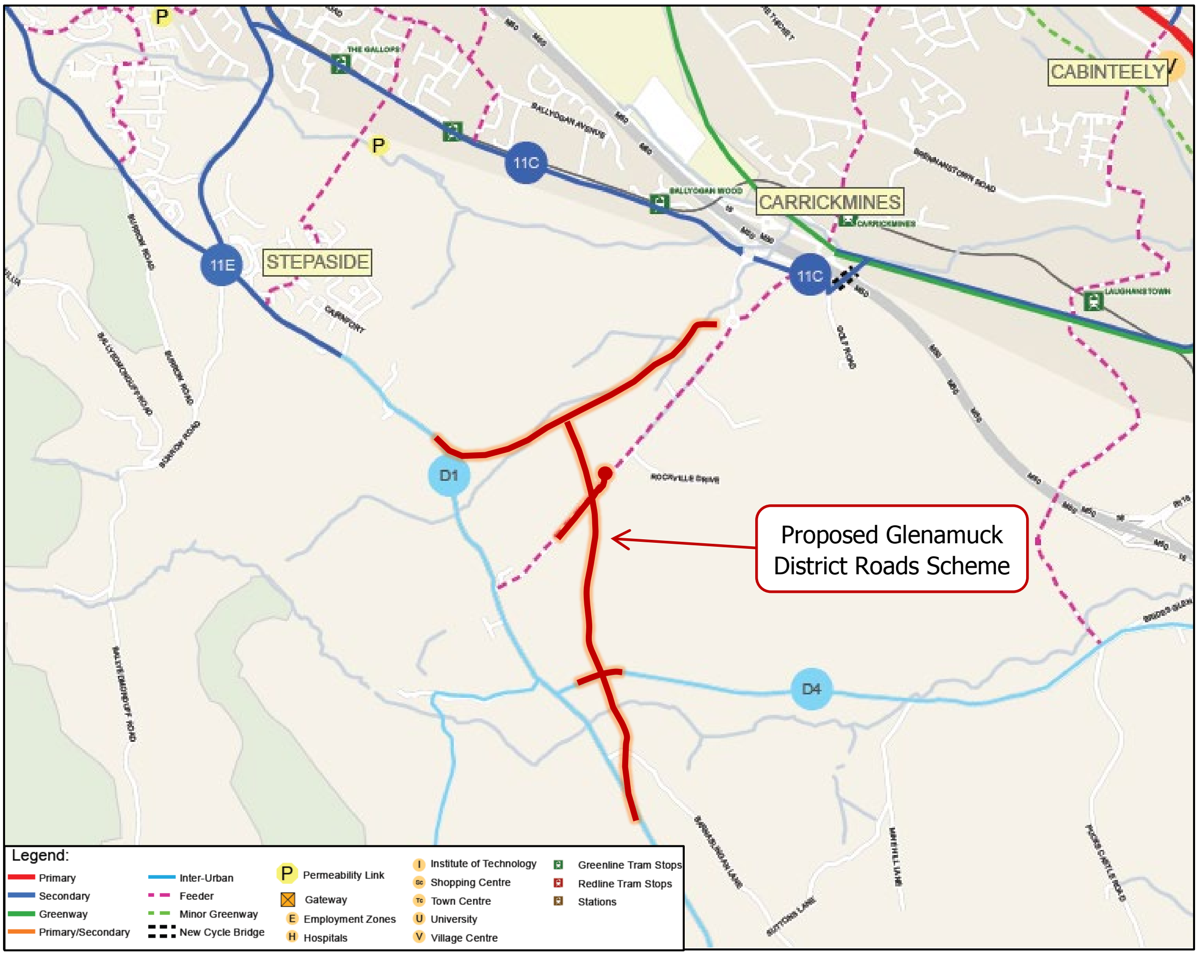

Figure 7.28: Proposed Scheme within the Proposed Cycle Network
(Source: 2013 NTA Cycle Network Plan)

7.7 Mitigation Measures

7.7.1 During Construction Phase

As indicated in Chapter 5, construction of the proposed scheme will cause temporary short-term traffic impacts on the local road network. Enforcement of a Construction Management Plan will ensure that construction traffic impacts are minimised through the control of site access / egress routes and site access locations and any necessary temporary lane closure requirements.

7.7.2 During Operational Phase

A number of specific mitigation measures have been incorporated into the scheme designs to ensure that the proposed scheme provides adequate traffic capacity to avoid any traffic congestion issues arising. Additional, provisions for cyclist and pedestrian safety and enhanced connectivity with the local network were also integrated into the scheme designs. Traffic forecasted to be diverted away from the Village core of Kiltiernan, the bypassed section of the R117 Enniskerry Road and Glenamuck Road following completion of the scheme, are expected to provide considerable relief representing a significant opportunity for environmental improvements in these areas.

Further provisions for public transport (bus) were included in the designs of the proposed scheme with the inclusion of the bus gates which should provide priority and increased service quality and reliability for bus services within the Kiltiernan-Glenamuck LAP area.

During the traffic analysis, increased AADT flows were forecasted on the R116 Ballycorus Road and the R117 Enniskerry Road onto the proposed scheme. As a mitigation measure these flows would meet signalised junction on the proposed scheme (these being where the GDDR meets the R117 Enniskerry Road and where the R116 Ballycorus Road meets the GDLR). Additional green time within the traffic signal staging can be reallocated at these locations to meet the demand on affected arms at the junctions.

7.8 Residual Impacts

7.8.1 Traffic and Transportation

The opening of the proposed Glenamuck District Roads Scheme will see changes to the local and regional roads and traffic flows. The modelling work undertaken to assess the traffic impacts of the proposed scheme indicates that there will be an overall traffic benefit associated with the proposed scheme. Further, the proposed scheme will provide benefits to existing and new public transport services and walking and cycling routes on the adjoining local and regional road network. The proposed scheme is expected to have the following residual impacts on: -

Traffic Impacts

The Glenamuck District Roads Scheme reduces the level of traffic on the existing road network within the Local Area Plan environ for Kiltiernan-Glenamuck by diverting road traffic onto the proposed scheme's network and enabling traffic to bypass less suitable and unsafe roads on the LAP environ road network. The Kiltiernan Village Centre, Glenamuck Road and the bypassed section of the R117 Enniskerry Road benefit the most from the scheme. 2035 AADT traffic figures do increase compared to the 2020 Do Something scenario due to a fully developed LAP lands being assumed. However, these AADT flows are the same or lower than the 2017 base AADT flows. The proposed scheme will act as a link street for the local network attracting trips from existing and committed developments and the fully developed LAP lands. The scheme will attract additional traffic from further origin points due to the time-saving benefit of the scheme. In regard to 2035 traffic levels on the M50, there is a marginal to slight impact on the M50 and the nearby Junction 15 with the proposed scheme. Comparing the 2035 Do-Something and the 2035 Do-Something with Complementary Measures scenarios (complementary measures are outside the remit of the GDRS but are assumed as being implemented after the GRDS and before 2035) shows mostly slight improvements in AADT in the LAP local road network and reductions in traffic levels occurring on the R116 Ballycorus Road and the M50.

Public Transport Impacts

The impacts of the proposed scheme on public transport are considered to be positive in both the short and longer term. The proposed scheme will have a positive impact in terms of reducing traffic volumes on the local network particularly on the existing Glenamuck Road, and Kiltiernan Village with the implementation of the bus gates, thereby improving bus journey times and their reliability for existing and potential additional future bus services. The proposed scheme will also facilitate increased accessibility and connectivity with the Carrickmines Luas Stop on the Greenline.

Pedestrian and Cyclist Impacts

The proposed scheme will have a positive impact in terms of enhancing the existing pedestrian and cyclist environment and adding new amenity walking and cycling routes to the area. Along the local road network particularly on the existing Glenamuck Road, and Kiltiernan Village, the pedestrian and cyclist environment will benefit from the resulting reduction in traffic levels from traffic diverted onto the proposed scheme. The reduction in traffic along the existing Glenamuck Road and Kiltiernan Village along the Enniskerry Road in particular will provide considerable relief from severance and afford opportunities to existing and provide new pedestrian and cycle facilities

7.8.2 Air Quality

Dust from the construction phase of the scheme would contribute to a reduction of air quality. **Chapter 8** outlines the impacts on air quality within the study area based on traffic figures undertaken as part of this traffic modelling framework.

7.8.3 Noise and Vibration

The proposed Glenamuck District Roads Scheme will result in a short term increase of construction traffic related noise and vibration. **Chapter 9** outlines the impacts on noise and vibration to the study area based on traffic figures undertaken as part of this traffic modelling framework.

7.9 Difficulties Encountered

Difficulties encountered in this overall assessment was primarily calculating the future number of units in different zones within the Kiltiernan-Glenamuck Local Area Plan in the absence of detailed proposals for these lands. Preliminary number of units, densities per zone, etc. may differ from what would be permitted in the future. However, DBFL approached this with consultation with DLRCC to give realistic estimates of densities and the number of units in each zone.

7.10 References

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