M11/N11 Corridor Study Needs Assessment Appendices

Appendix A

Traffic Modelling Report

M11/N11 Corridor Study

(J4 M50 – J14 Coynes Cross)

Traffic Modelling Report

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M11/N11 Corridor Study

Final Report

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Chapter 1 Introduction

1.1 Overview

A Local Area Model (LAM) has been developed to inform the Needs Assessment Report for the M11/N11 Corridor Study on behalf of Transport Infrastructure Ireland (TII). This Traffic Modelling Report (TMR) outlines the development, calibration, validation and traffic projections for the LAM.

1.2 Traffic Model Study Area

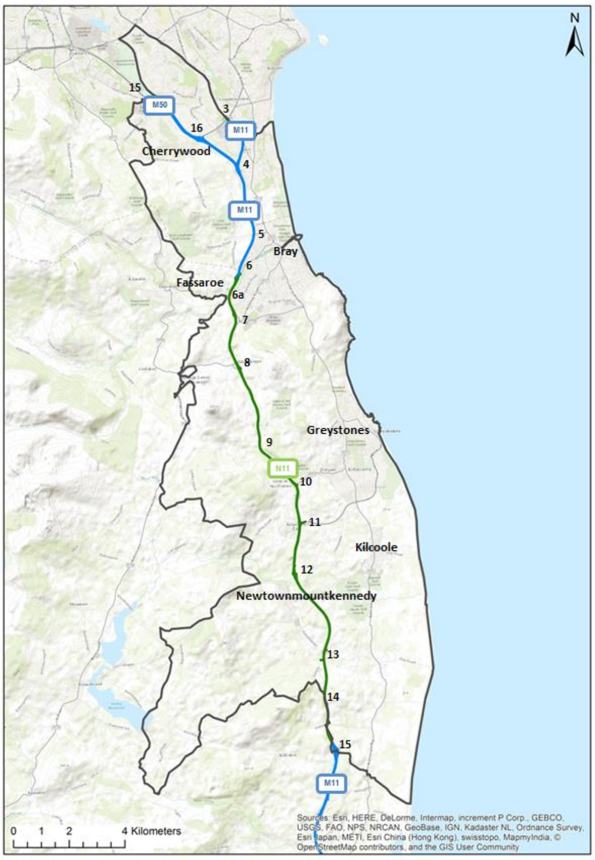
The study area for the M11/N11 Corridor Study is illustrated in Figure 1.1. The section of the M11/N11 under consideration is approximately 22km in length and encompasses the following:

- M11 from Junction 4 (M50/M11) to Junction 6 (Bray Central); and
- N11 from Junction 6 (Bray Central) to Junction 14 (Coyne's Cross).

The M11 section between the M50 and N11 is at present up to the standard required for a TEN-T road in terms of road quality. However, it is included as part of the needs assessment in order to assess its performance from an operational and capacity perspective.

To the east, the study area is physically constrained by the Irish Sea and to the west by the Wicklow Mountains. As a result there is no comparative north-south alternative to the M11/N11 corridor while east-west crossings are also limited. The study area lies within the functional areas of:

- Dun Laoghaire – Rathdown County Council (DLRCC); and
- Wicklow County Council (WCC).



Junction Number	Junction Name
M50 J15	Carrickmines
M50 J16	Cherrywood
M11 J3	Loughlinstown
M11 J4 (M50 J17)	M50/M11
M11 J5	Bray North
M11 J6	Bray Central
N11 J6a	Herbert Rd/R117
N11 J7	Bray South
N11 J8	Kilmacanogue
N11 J9	Glen of the Downs
N11 J10	Delgany
N11 J11	Greystones (Killpedder)
N11 J12	Newtownmountkennedy
N11 J13	Newcastle
N11 J14	Coyne's Cross
M11 J15	Ashford

Figure 1.1: M11/N11 TEN-T Corridor Model Study Area

Chapter 2 Data Collection

2.1 Introduction

In order to develop a Traffic Model, a significant level of traffic data is required to ensure that the model can replicate existing traffic patterns and volumes. This section of the TMR describes the collation of traffic data for the construction of the Base Year (2015) M11/N11 Local Area Model.

2.2 National Transport Model

The starting point for the development of the Base Year LAM was the 2013 Base Year National Transport Model[1] (NTpM), which was developed by Transport Infrastructure Ireland (TII). The NTpM is a strategic multi-modal variable demand model used by TII to assess the impact of infrastructure or policy changes at National, Regional and local level. Within the NTpM there are four modules, which are as follows:

- National Traffic Model (NTM);
- National Rail Model (NRM);
- National Bus Model (NBM); and
- Variable Demand Model (VDM).

The three assignment models (NTM, NRM & NBM) are used to assign the demand for travel represented by the demand matrices to the network, generating travel costs (e.g. time, distance, tolls, fares) for each mode. A brief overview of the Variable Demand Model is provided in the following section.

The role of the Variable Demand Model (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.). Table 5.1.1 of PAG Unit 5.1: Construction of Transport Models provides guidance on when variable demand modelling is required.

The VDM operates at a national level as it requires the full cost of a trip between an origin and destination; therefore any assessment of potential demand responses arising from major schemes proposed within the M11/N11 study area is undertaken within the NTpM and not the LAM. However, any demand responses identified as a result of the proposed scheme are incorporated into the LAM using demand matrix adjustment techniques during the ensuing analysis.

2.3 National Traffic Model

The starting point in the development of the Base Year M11/N11 LAM was the 2013 Base Year National Traffic Model (NTM), which was developed by TII. The NTM is a strategic (macroscopic) traffic model developed using the transportation modelling software VISUM. The model covers the entire National and Regional road network and is used by TII as a tool in the appraisal of potential road schemes, land-use proposals and policy changes. The NTM provides demand data for Light (Car & LGV) and Heavy (OGV1, OGV2 and PSV) vehicles for the following time periods:

- Average AM Peak Hour (07:00 – 09:00); and
- Average Inter Peak Hour (12:00 – 14:00).

The NTM model also provides the basic road network for use in the M11/N11 model.

[1] *TII National Transport Model documentation* - http://www.tii.ie/tii-library/strategic-planning/

2.4 Traffic Surveys

In order to complete the study, a substantial quantum of traffic survey was commissioned within the study area. A summary of the traffic survey data that was collated, as part of the development of the 2015 M11/N11 model, is outlined below:

- 18 Automatic Traffic Counts (ATC) on major links within the local road network carried out between Monday 18th and Sunday 24th of May 2015 including 14 ATC link counts on the M11/N11 and 4 on R761;
- Origin-Destination (O-D) surveys were carried out on Thursday 14th May 2015 at 9 sites from N11 J6 Bray Central to J7 Bray South between 07:00 – 19:00;
- 35 junction turning counts at major junctions within the study area undertaken on Wednesday 13th May 2015 from 07:00 – 19:00;
- Traffic data from 4 TII Traffic Monitoring Units was also examined as part of the model development; and
- A significant quantum of journey time data was also collated using the O-D points shown in Figure 2.1 below.

Figures 2.1 to 2.5 illustrate the location of the traffic surveys.

Figure 2.1 – M11 / N11 Automatic Traffic Counts on major links at OD site locations.

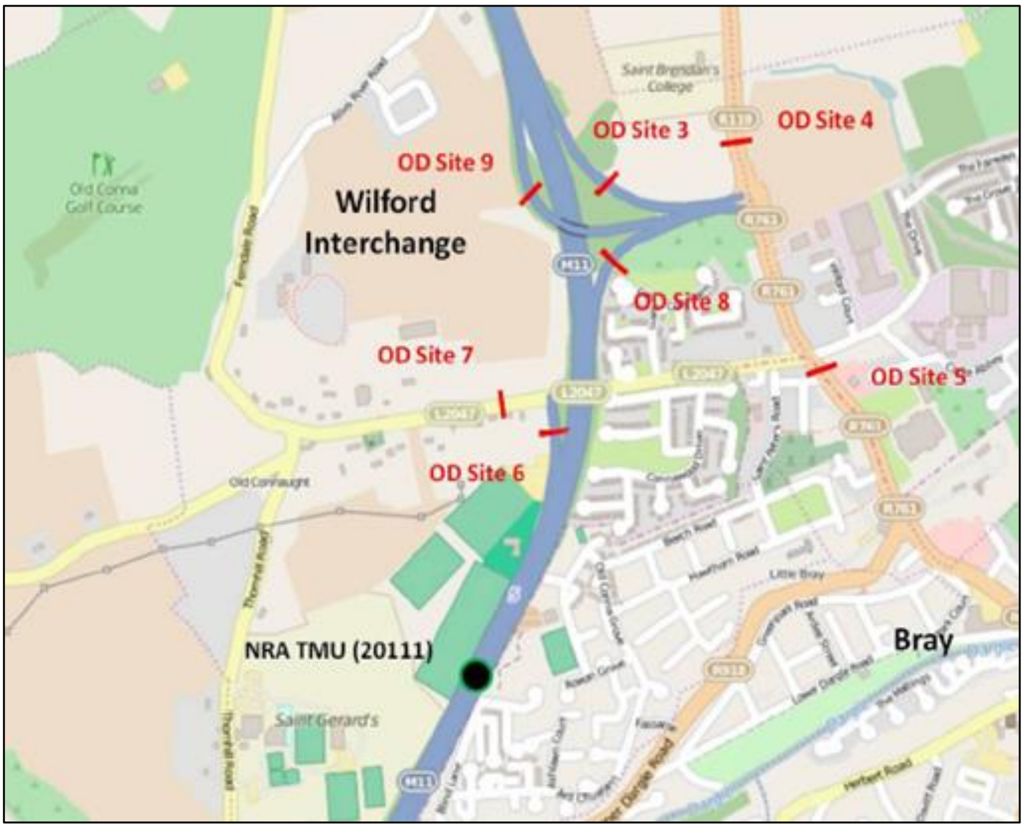


Figure 2.2 – M11 / N11 Automatic Traffic Counts on major links at OD site locations

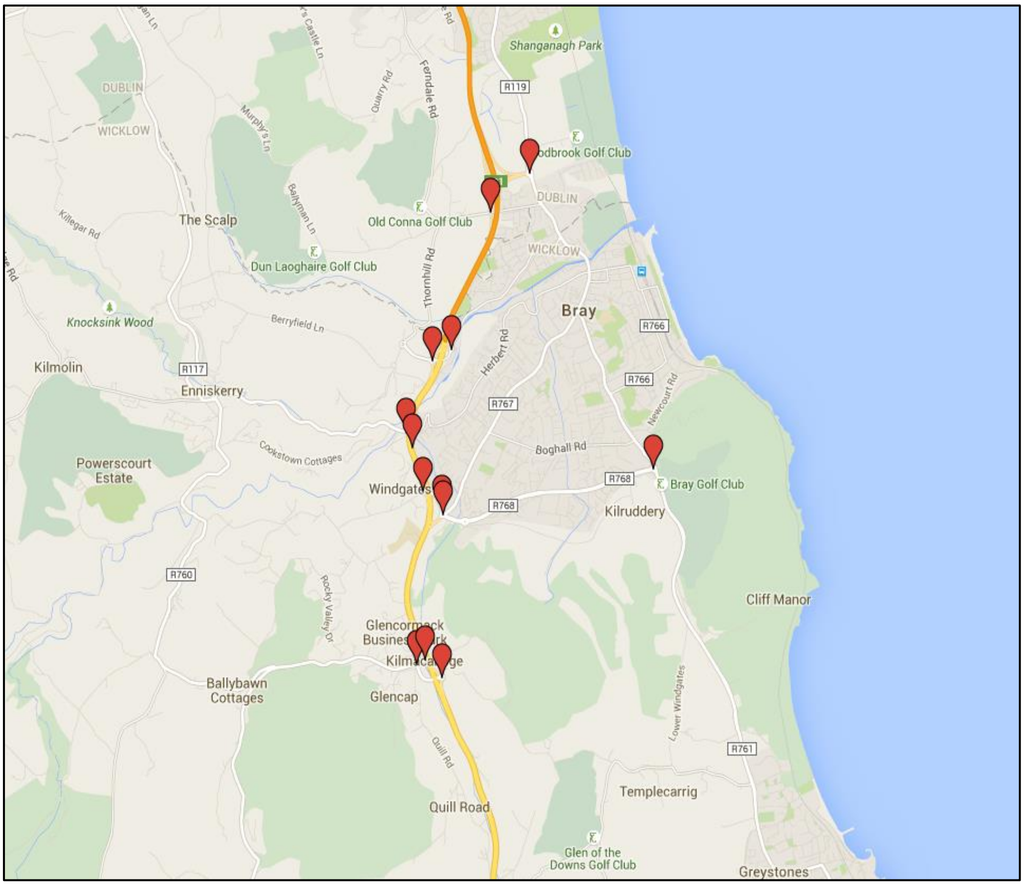


Figure 2.3 – M11 / N11 Traffic Counts at Major Junctions (Study Area North)

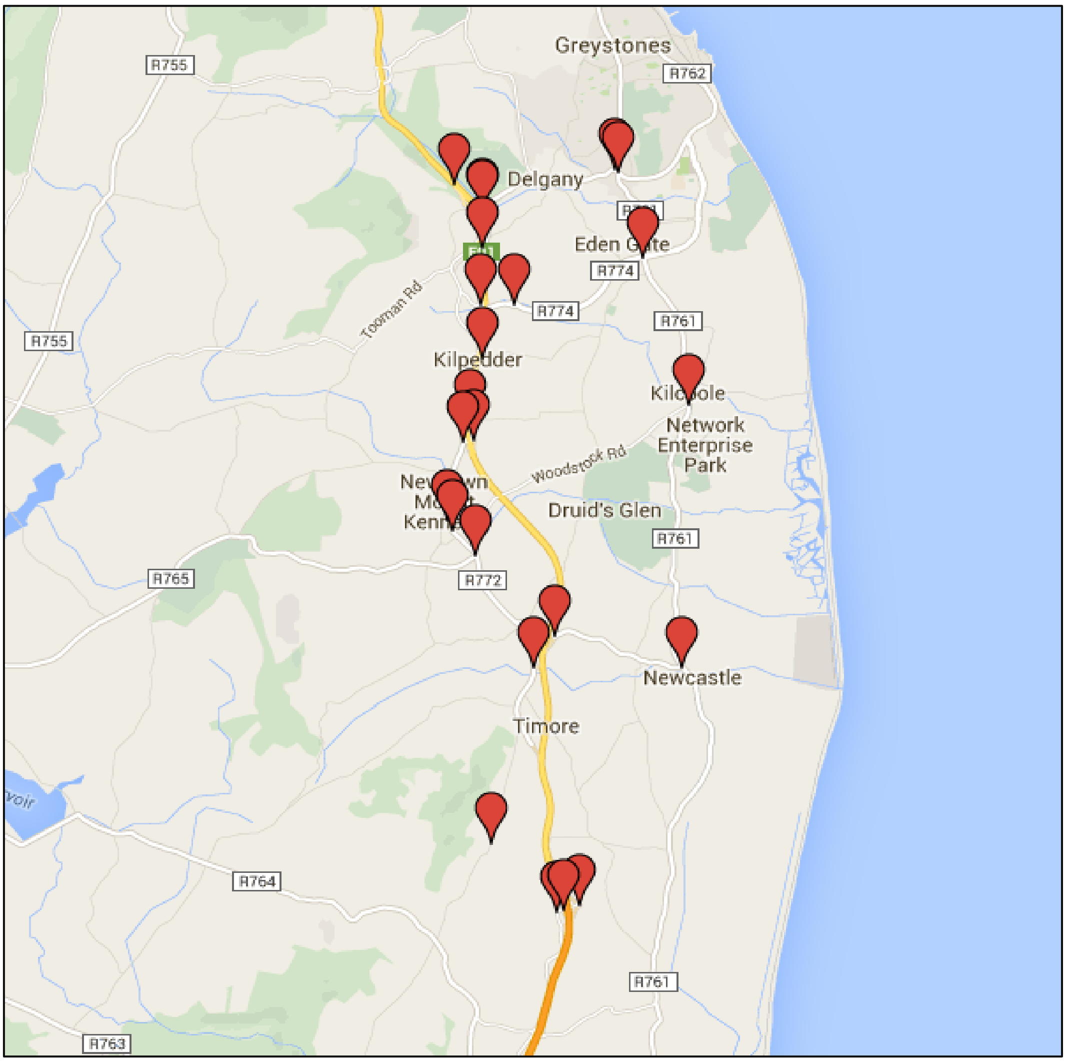


Figure 2.4 – M11 / N11 Traffic Counts at Major Junctions (Study Area South)

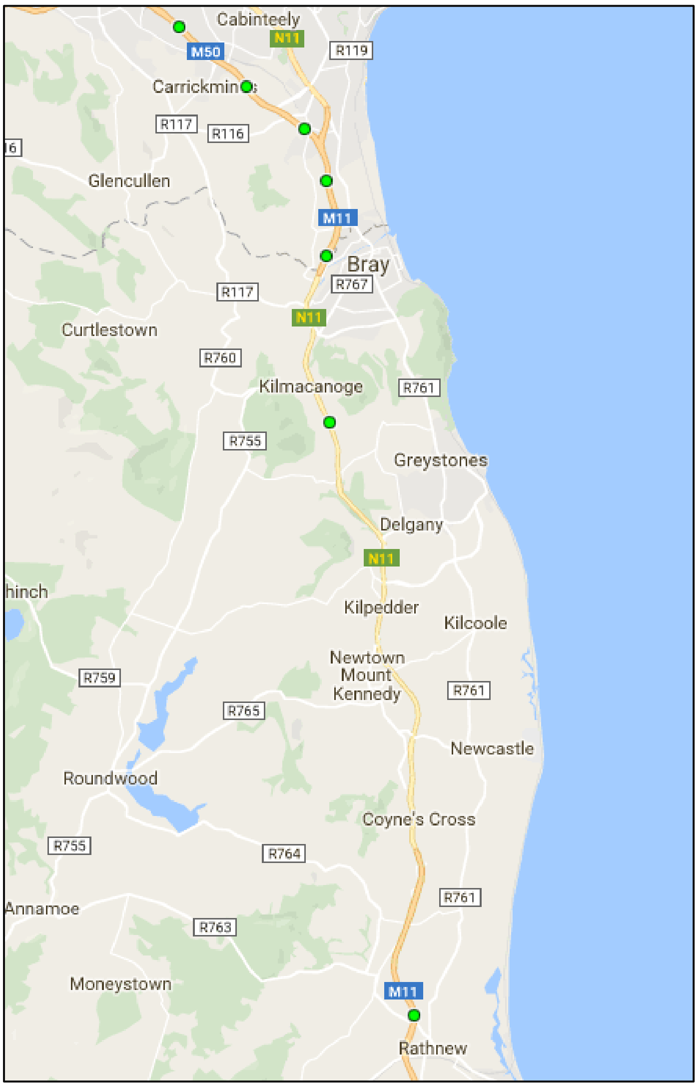


Figure 2.5 – TII TMUs within the M11/N11 Study Area.

2.5 An Post GeoDirectory

An Post supply a geocoded dataset which shows the location of each residence and commercial property in Ireland. The dataset was utilised to assist in the zone splitting process. Figure 2.6 below shows the location of every residence (shown as a red dot) and commercial property (shown as a blue dot) within the study area.

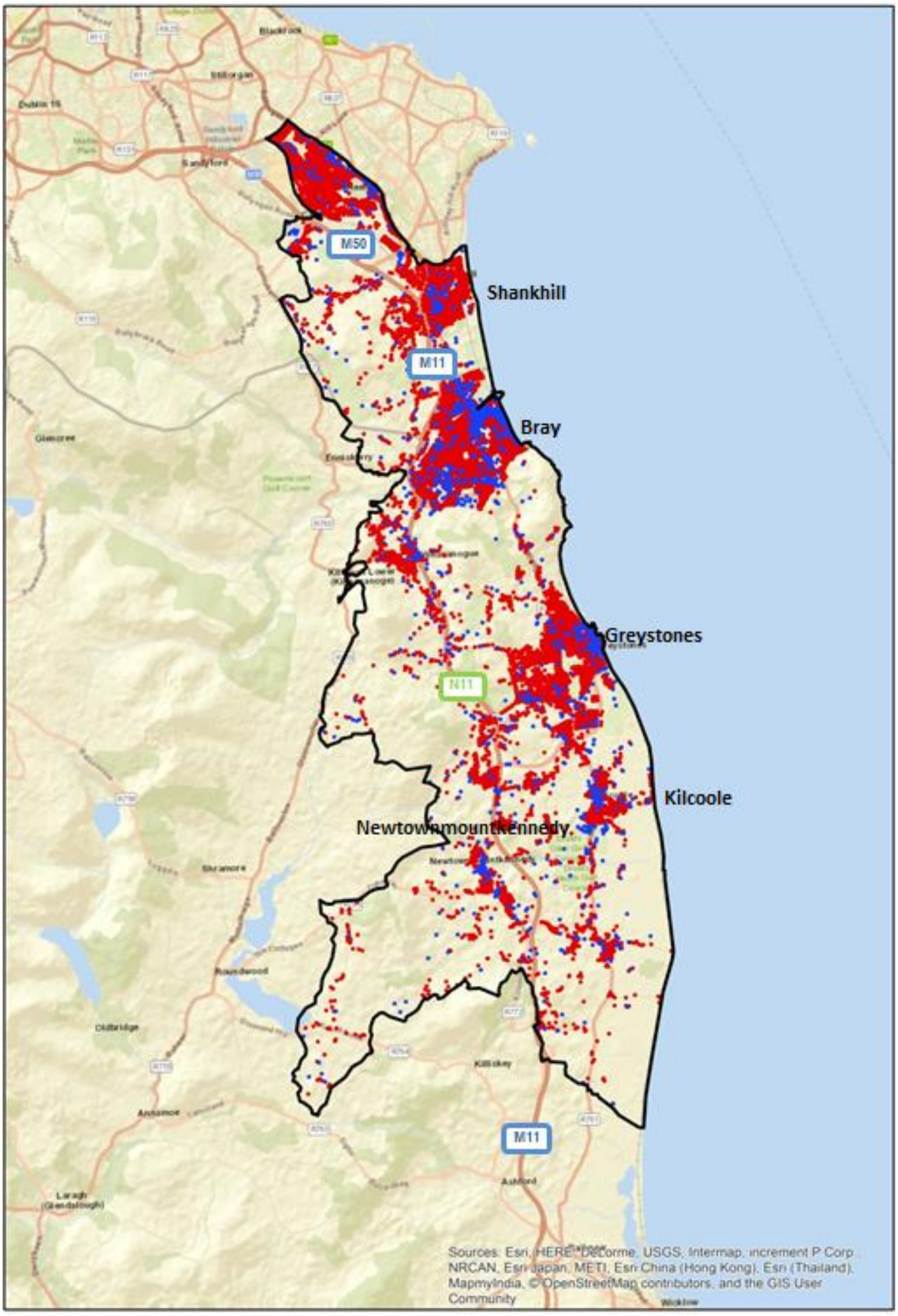


Figure 2.6 – An Post Geocoding Information in the M11/N11 Study Area

Chapter 3 Model Development

3.1 Overview

This section of the report describes the development, calibration and validation of the 2015 M11/N11 LAM's which were developed for the following time periods:

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

Assignment (fixed demand) models were developed using VISUM (V15.00-07).

3.2 Network Development

The TII NTpM was used as a starting point for developing the M11/N11 LAM's. The initial step was to identify the extent of the study area for the LAM. The likely area of influence was identified and cordoned out of the 2013 NTM.

3.2.1 Refinement of the LAM Road Network

Once the study area had been cordoned from the NTM, the road network was further refined to reflect the 2015 road network conditions (i.e. inclusion of further detail such as speed limits, banned turns, addition of local road links between the N11 corridor and the R761, lane provision at junctions etc.). This information was collected through site observations and aerial mapping. The resultant 2015 LAM network is illustrated in Figure 3.1.

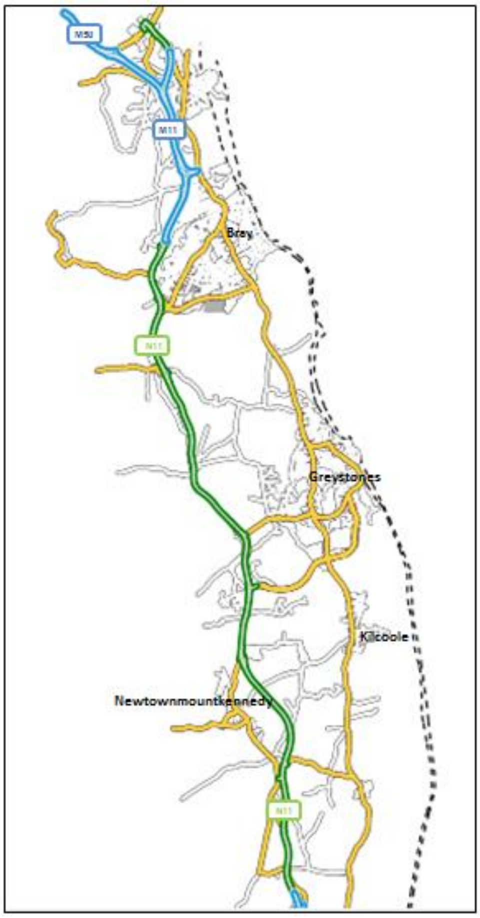


Figure 3.1 - Refined M11/N11 Road Network

3.2.2 Refinement of the LAM Zone Structure

In order to obtain suitable detail within the M11/N11 LAM, a more detailed zoning system than that used in the NTM was required. The zoning system in the NTM is based on the aggregation of Electoral Divisions (EDs), which are quite large for a more local study of the M11/N11 corridor (Figure 3.3). The refined zoning system in the LAM is shown in Figure 3.2.

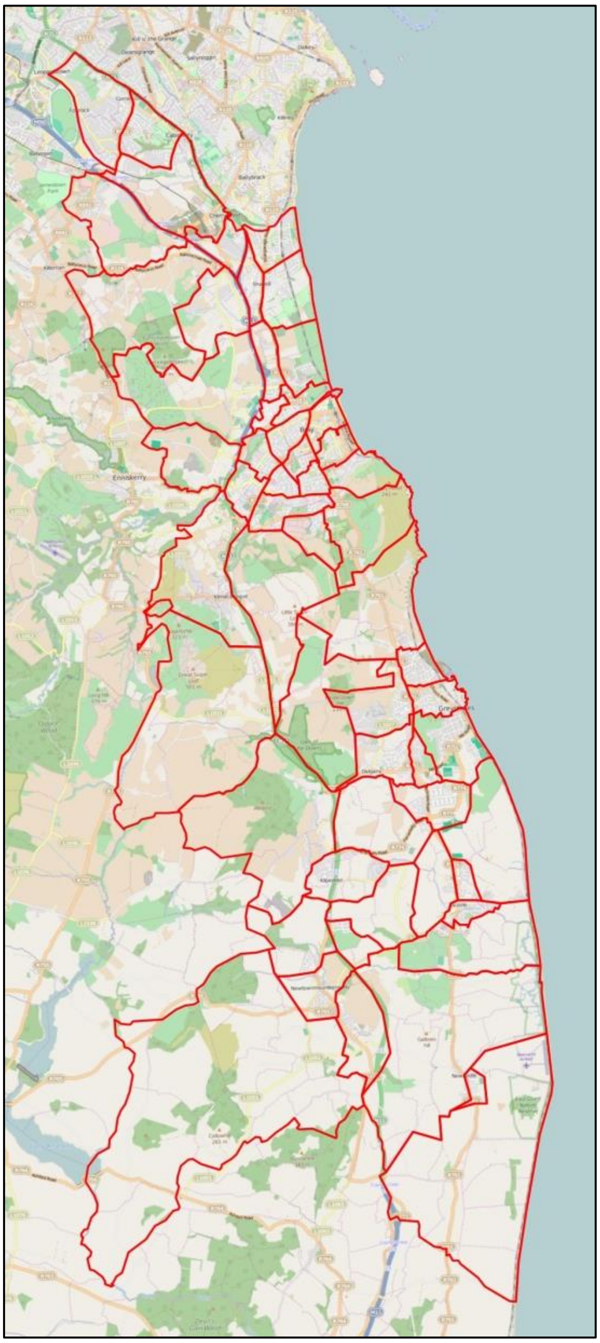


Figure 3.2 – LAM Zone Structure

Figure 3.3 – NTM Zone Structure

This initial zone splitting process was undertaken based on An Post geocoding information. The An Post data shows the location of postal address points (both residential and commercial) and formed the basis for allocation of trip ends for larger zones into relevant subzones and is shown in Figure 2.6 of the previous chapter.

The original model cordoned from the NTM contained 19 zones, which included 4 internal zones and 15 external zones. The disaggregation of the various zones (shown above), produces a model containing a total of 72 zones, including 57 internal zones and 15 external zones, as shown In Figure 3.4 below.

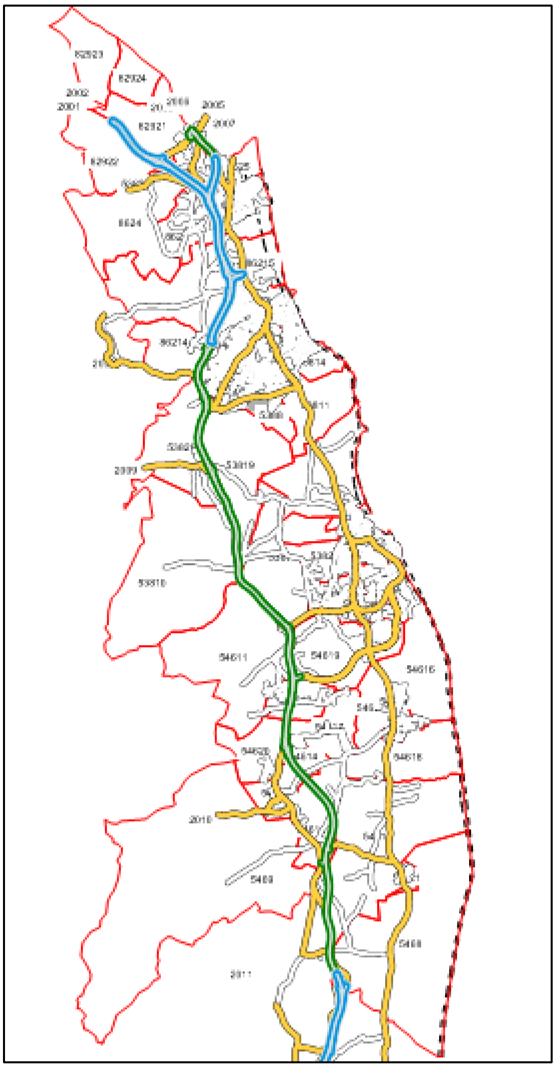


Figure 3.4 - Refined M11/N11 zoning system

3.2.3 Link Travel Times

The total travel time of a trip from origin to destination is a function of both link travel time and junction delay. Link travel times in the network are determined by a predefined volume-delay function (VDF) in VISUM, which describes the relationship between current traffic volumes (q) and the capacity of the link (qmax). The VDF used in this model is based on the Bureau of Public Roads 3 (BPR 3) function:

$$t_{cur} = \begin{cases} t0 * (1 + a * sat^{b}) & \text{, if } sat \leq sat_{crit} \\ t0 * (1 + a * sat^{b}) + (q - q_{max}) * d & \text{, if } sat > sat_{crit} \end{cases}$$

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

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

3.2.4 Junction Delay

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

3.2.4 Matrix Development

The following time periods have been developed for the M11/N11 traffic model:

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

'Prior' AM Peak and PM Peak hour Light and Heavy vehicle matrices were cordoned from the 2013 NTM. The matrices were disaggregated or split to provide a more refined LAM zoning system as discussed in Section 3.1.2 above. The process of zone splitting was undertaken using VISUM, whereby origin and destination trip ends were allocated to the sub-zones based on An Post geocoding information supplied by Wicklow County Council whilst maintaining the equivalent distribution of the larger zones. The An Post data shows the location of postal address points and formed the basis for allocation of trip ends for larger zones into relevant subzones.

The resultant 'Prior' matrices were then adjusted during the calibration process using matrix estimation methods to reflect 2015 demand.

Each of these matrices were then modified during the calibration process using the 2015 traffic survey data ascertained for each peak, using the select link analysis tool in VISUM. Further information on the calibration process is provided in Chapter 4.

3.3 Assignment Model

The assignment model applies the demand for travel, represented by the trip matrices, to the supply, in the form of the road network. The 'generalised cost' of a journey, represented by a combination of time and distance, is compared in a route choice algorithm, and a stable output produced, where ideally, all possible routes between an origin and destination have the same 'cost'. Generalised cost is computed as follows:

*Generalised Cost = Value of Time * Time + Vehicle Operating Cost * Distance*

The economic parameters used in the M11/N11 traffic model are outlined in Table 3.1. These are fully compliant with parameters set out in PAG and in the DTTAS Common Appraisal Framework.

Table 3.1: Generalised Cost Economic Parameters (2015)

Peak hour	User Class	Value of Time (VoT)*		Vehicle Operating Cost (VOC)	
		Cents/sec	*€/hr*	*Cents/metre*	*€/km*
AM and PM	Car	0.5280	19.01	0.0103	0.103
	HGV	0.9032	32.51	0.0416	0.416
Inter	Car	0.5161	18.58	0.0101	0.101
	HGV	0.9319	33.55	0.0370	0.370

**Average 2015 VoT for Commuting, Working & Non-Working Trip Purposes*

For the purpose of the assignment in the VISUM software, a scalar of 1000 is applied to the VoT and VOC. The Route Choice Algorithm selected is based on Equilibrium Lohse. This starts with an 'all or nothing' assignment, and assigns in an iterative fashion, with drivers consecutively including information gained during their last journey for the next route choice. The assignment terminates when a stable solution is calculated.

Chapter 4 Model Calibration

4.1 Introduction

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

4.2 Calibration

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

4.3 Matrix Estimation

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

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

The subject models were calibrated utilising flow bundle analysis, whereby flow bundle matrices were extracted, examined and subsequently adjusted to match observed flows up and downstream of the point at which the flow bundle was taken.

4.3.1 Calibration Criteria and Link Flow Calibration Results

The model calibration process has been undertaken based on the requirements of the TII *PAG Unit 5.2: Construction of Traffic Models* and with reference to the calibration criteria outlined in Table 5.2.2 of that document. The PAG specify the acceptable values for modelled and observed flow comparisons and suggests how calibration should relate to the magnitude of the values being compared. A summary of these targets is shown in Table 4.1.

Table 4.1 - Model Calibration Criteria: Individual Flows

Class Test	Criteria and Measures *Assigned Hourly Flows vs. Observed Flows:*	Guideline
1	Individual flows within 100 vph for flows <700 vph	> 85% of cases
2	Individual flows within 15% for flows 700 – 2700 vph	
3	Individual flows within 400 vph for flows > 2700	

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

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

Where M = Modelled Flow and O = Observed Flow.

Guidance in the Project Appraisal Guidelines sets out the following criteria shown in Table 4.2.

Table 4.2 - Model Calibration Criteria: GEH Values

Criteria and Measure		Requirement
GEH statistic	Individual flows: GEH < 5	> 85% of cases

A total of 23 links flows were used in the calibration process, the results of which are summarised in Tables 4.3 and 4.4. The results in full can be found in Appendix A of this report.

Table 4.3 - Link Calibration Results: Individual Flows

% of Calibration Sites Meeting Individual Flow Criteria				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	100%	100%	100%	>85%
PM Peak	100%	100%	100%	>85%

Table 4.4 - Link Calibration Results: GEH Values

% of Calibration Sites with GEH < 5				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	91%	96%	100%	>85%
PM Peak	96%	96%	96%	>85%

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

4.3.2 Trip Length Distribution

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

To check the output of the matrix estimation process, the trip length distributions (TLD) from before (pre) and after (post) matrix estimation are compared. The trip length distributions for each peak hour for Light Vehicles are represented as histograms in Figure 4.1 to 4.2.

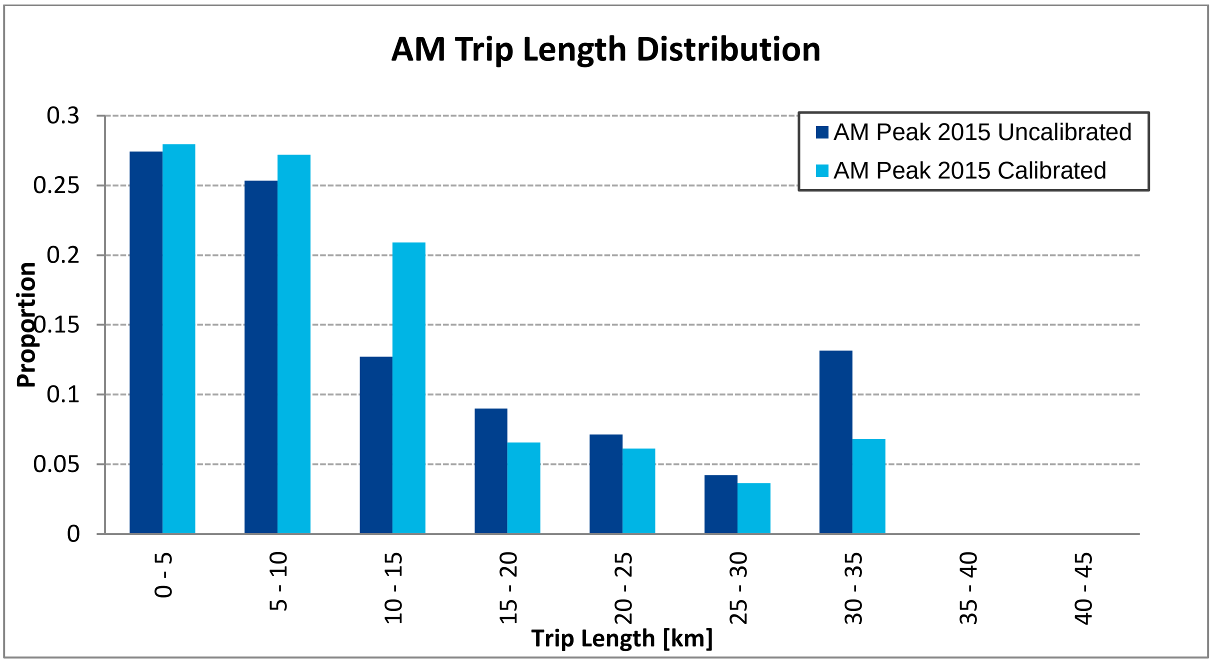


Figure 4.1 - TLD AM Peak Hour (LV)

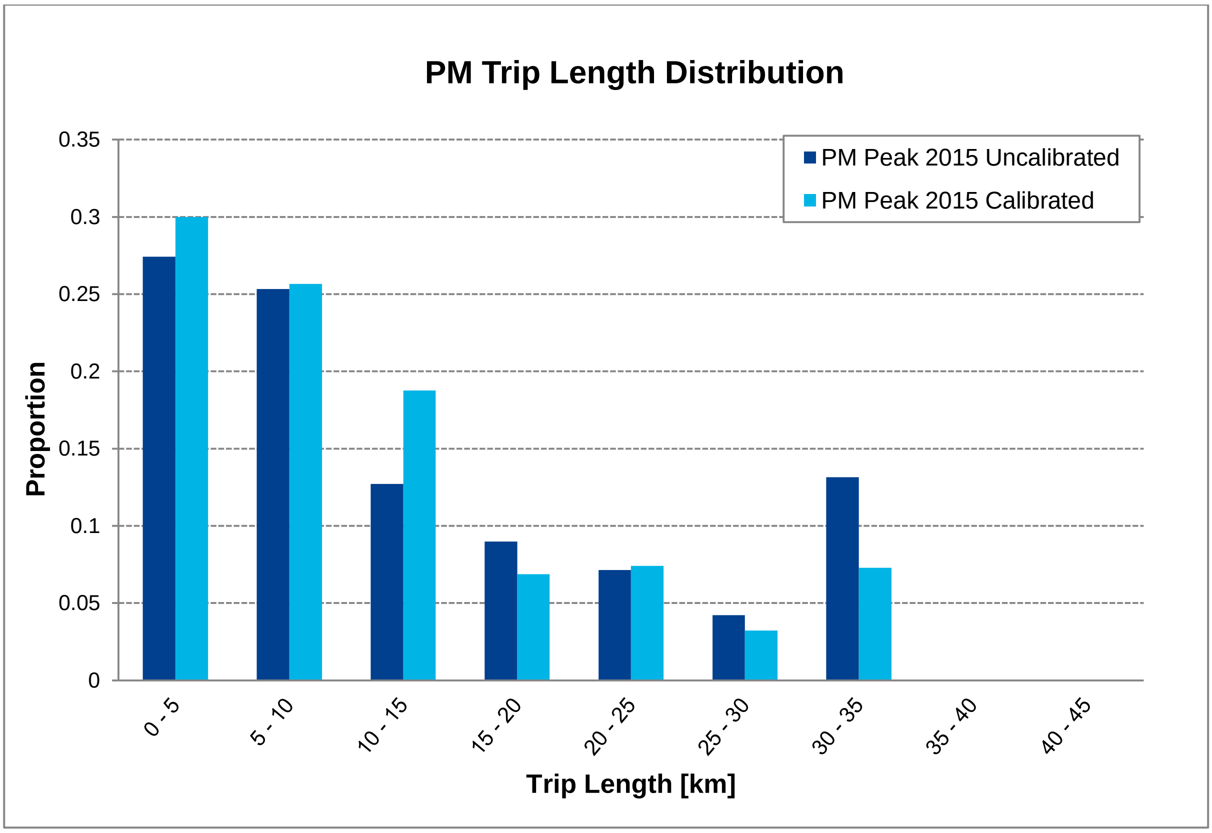


Figure 4.2 - TLD PM Peak Hour (LV)

In Figures 4.1 and 4.2 above, it can be observed that there is a reduction in longer (30-35 KM) trips, combined with a corresponding increase in shorter (10-15KM) trips. This occurs when the strategic level National Transport Model zones are broken down into the more detailed Local Area Model zones and trips reduce in length as there is less distance to travel.

4.4 Model Validation

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

- Additional link flows;
- Turning flow validation;

4.4.1 Validation of Link Flows

The results of the validation check for 14 links are outlined below. The detailed summary tables are included in Appendix A. Using the same criteria as link flow calibration in Section 4.2.1 above, the link flow validation statistics are shown in Tables 4.5 and 4.6.

Table 4.5 - Validation Results: Link Flows

% of Validation Sites Meeting Individual Flow Criteria				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	93%	100%	100%	>85%
PM Peak	93%	93%	100%	>85%

Table 4.6 - Validation Results: GEH Values

% of Calibration Sites with GEH < 5				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	93%	86%	100%	>85%
PM Peak	86%	93%	100%	>85%

The comparison of modelled and observed flows demonstrates that the AM and PM peak period models exceed the flow criteria for all user classes. Likewise, the GEH results show that the AM Peak and PM Peak period models also exceed the criteria for all user classes. Therefore, the model is deemed validated in terms of link flows.

4.3.2 Validation of Turning Flows

The observed and modelled turning volumes for 79 turning flows were compared at each of the validation sites in accordance with the criteria above. The permissible difference was calculated for each value (based on the observed figure) and compared with that which had been modelled. Validation results are included in Appendix A and are summarised in Tables 4.7 and 4.8 below:

Table 4.7: Validation Results: Turning Flows

% of Validation Sites meeting the flow criteria				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	95%	97%	100%	>85%
PM Peak	97%	96%	100%	>85%

Table 4.8: Validation Results: Turning Flow GEH Values

% of Validation Sites meeting the flow criteria				
Time Period	**Link Flows**			**Required**
	Total Traffic	**Lights**	**Heavies**	
AM Peak	82%	85%	99%	>85%
PM Peak	85%	86%	97%	>85%

The comparison against the validation counts shows that all peak period models meet the TII criteria for junction turns. However, in the AM peak, the validation results for total traffic are marginally below the required values but the model is fit for purpose.

Chapter 5 Future Year Model Development

5.1 Overview

This section of the report summarises the development of the future year Local Area Models used to inform the needs assessment of the M11/N11 corridor.

5.2 Future Year Demand

Two future years have been used as part of the needs assessment, 2030 and 2050. These years represent the planned completion of the core and comprehensive TEN-T networks respectively. The projected growth in demand on the National Road network in both 2030 and 2050 is based on the TII National Transport Model (NTpM) 'Central' growth scenario. Full details of the projection of traffic in the NTpM are provided in the *National Transport Model Demographic and Economic Forecasting Report – September 2014*[2]. Table 5.1 provides a summary of the four future year scenarios developed to inform the need assessment study.

Table 5.1: Baseline (Do-Minimum) Scenarios

NTpM Growth Scenario	Year	Peak Hour
TII Central Growth	2030	AM (08:00 – 09:00)
		PM (17:00 – 18:00)
	2050	AM (08:00 – 09:00)
		PM (17:00 – 18:00)

5.3 Demographic Projections

The total population and employment projections for the study area used in the development for TII NTpM for 2030 and 2050 are summarised in Table 5.2. A population growth of approximately 0.95% per annum is projected up to 2030 reducing to 0.3% per annum between 2030 and 2050. Employment grows at 1.2% up to 2030 and reduces significantly to 0.1% per annum beyond 2030.

Table 5.2: NTpM Population & Employment Projections

Demographic	Year			Percentage Growth	
	2015	2030	2050	2015 - 2030	2015 - 2050
Population	85,595	98,522	104,288	15%	21%
Employment	34,869	41,346	41,913	19%	20%

5.4 Travel Demand Projections

The NTpM converts the projected demographics presented in Table 5.2 into peak hour vehicular trips for the study area. Table 5.3 and 5.4 provide a summary of the trip matrix total for the base and future year scenarios in the AM and PM peak hour respectively.

[2] *http://www.tii.ie/tii-library/strategic-planning/*

Table 5.3: TII Growth in AM Peak Hour Trip Demand

Demand	Year			Percentage Growth	
	2015	2030	2050	2015 - 2030	2015 - 2050
Cars	17,154	21,038	22,451	23%	30%
HGV	567	820	1,145	45%	102%

Table 5.4: TII Growth in PM Peak Hour Trip Demand

Demand	Year			Percentage Growth	
	2015	2030	2050	2015 - 2030	2015 - 2050
Cars	17,257	21,126	22,343	22%	29%
HGV	450	650	910	44%	102%

5.5 Future Modal Splits

In order to reflect the level of trip demand that would occur in the Study Area for the forecast year of 2030 it was necessary to ascertain the impacts that future changes in public transport provision would have on the overall level of car based demand in the Study Area.

For this purpose, the NTA provided information on the modal splits for the Study Area of the M11/N11 Study based on their Base Year 2012 and 2035 Do-Minimum Eastern Regional Models.

5.5.1 2035 Do-Minimum Eastern Regional Model

The Do-Minimum scenario for the NTA strategy was provided by the NTA using outputs from the 'Do-Minimum' scenario of their Eastern Regional Model, which includes the following schemes:

- Major completed transport schemes delivered between 2012-2015;
- Luas Cross City;
- Phoenix Park Tunnel; and
- DART frequency increases on the Northern and South Eastern lines;

Further detail on the schemes included in the NTA's 2035 Do-Minimum Eastern Regional Model is provided in the "*Transport Modelling Report for the Transport Strategy for the Greater Dublin Area 2016 to 2035"*, National Transport Authority (October 2015).

5.5.2 Application of Mode Share Data to Forecast Demand

The analysis of the 2035 NTA's Do-Minimum Scenario revealed that all the public transport improvements proposed in the scenario would be in place by 2030.

Whilst the majority of the public transport interventions included in the scenario occur outside the M11/N11 study area any mode share impacts generated by the implementation of the schemes were required to be reflected in the 2030 and 2050 demand matrices. An exercise was therefore undertaken to reflect the reduction in car trip demand associated with the implementation of the public transport interventions in the 2030 and 2050 demand matrices. Tables 5.5 and 5.6 summarise the reduction in car trip demand in the 2030 and 2050 AM and PM peak periods across the study area as a result of the increased public transport provision.

Table 5.5: Impact of committed public transport proposals on 2030 AM/PM Peak Hour Car Demand

Peak Hour	2030 (vehs)	2030 with PT (vehs)	Percentage Reduction in Demand
AM	21,038	20,464	-3%
PM	21,126	20,573	-3%

Table 5.6: Impact of committed public transport proposals on 2050 AM/PM Peak Hour Car Demand

Peak Hour	2050 (vehs)	2050 with PT (vehs)	Percentage Reduction in Demand
AM	22,498	21,980	-2%
PM	22,343	21,745	-3%

5.5.3 Final Demand Matrices

The final 2030 and 2050 AM and PM peak period trip demand matrix totals for the study area are presented in Table 5.7 and Table 5.8 respectively. These represent TII projections with the NTA mode splits resulting from the NTA Do-Minimum scenario taken into account.

Table 5.7: AM Peak Final Trip Demand Matrix Totals

Demand	Year			Percentage Growth	
	2015	2030	2050	2015 - 2030	2015 - 2050
Cars	17,154	20,464	21,980	19%	28%
HGV	567	820	1,146	45%	102%

Table 5.8: PM Peak Final Trip Demand Matrix Totals

Demand	Year			Percentage Growth	
	2015	2030	2050	2015 - 2030	2015 - 2050
Cars	17,257	20,573	21,745	19%	26%
HGV	450	650	910	44%	102%

5.6 Future Year Trip Distribution

A process was set up to assign future year trip end growth in each NTM zone to the associated LAM zones buy allocating growth based on county development plans, local area plans (where available) and previous relevant studies including the following:

- Wicklow County Development Plan (Draft) 2016 – 2022
- Dun Laoghaire Rathdown County Development Plan (Draft) 2016 – 2022
- M50/M11 Corridor study Report (TII, 2012)

Following this process, future year trip distribution was undertaken utilising the furness distribution method. In order to carry out the trip distribution process it was first necessary to 'seed' the cells with no trips in the base year matrices with very small numbers (0.01 vehicles) to allow for future year trips between those specific cells. Otherwise any cell with a zero will remain zero irrespective of the factor applied. As part of the trip distribution process the matrix totals were doubly constrained to the mean of the forecast trip end totals. Adjustments were also made to account for zones where there is expected to be significant increases to trips within the zone, i.e. increased internal traffic. For example, future housing and commercial development in the LAM zone 53816 (Fassaroe area) is expected to generate increased internal traffic as people will be able to live and work in this area.

5.7 Future Year Network Development

A future year 'Do-Minimum' network should include the existing road network plus any committed infrastructure improvements in the study area. As there is no significant road improvements committed currently within the study area, the 'Do-Minimum' future network for the M11/N11 Corridor Study consists of the existing road network, which is assumed to be maintained over time.

The final demand matrices referenced in Section 5.4.3 above were then applied to the future year network to assess the anticipated level of network performance in 2030 and 2050.

5.8 2030 Do-Minimum

The 2030 Do-Minimum traffic volumes for the AM and PM peak periods are provided in Table 5.9. The number of lanes for each section and the practical capacity is also shown.

Table 5.9: 2030 Do-Minimum M11/N11 Peak Hour Demand Flows (Source: 2030 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) – Northbound (vehicles/hour)			PM Peak (17:00 – 18:00) – Southbound (vehicles/hour)		
				Demand Flow	Practical Capacity		Demand Flow	Practical Capacity	
					GDA Average	Link Specific		GDA Average	Link Specific
M50	16 – 17	Cherrywood – M11	2	3,390	3,400	4,600	2,968	3,400	4,600
M11	3 – 4	Loughlinstown – M50	2	2,021	3,400	3,400	1,617	3,400	3,400
	4 – 5	M50/M11 – Bray North	2+1	5,411	5,100	6,300	4,584	5,100	6,300
	5 – 6	Bray North – Bray Central	2	**4,714**	3,400	4,600	**4,085**	3,400	3,850
N11	6 – 6a	Bray Central – Herbert Road/R117	2	**4,855**	3,400	3,550	**4,143**	3,400	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	**4,866**	3,400	3,550	**4,054**	3,400	3,200
	7 – 8	Bray South - Kilmacanogue	2	**3,978**	3,400	3,550	**3,564**	3,400	3,200
	8 – 9	Kilmacanogue – Glen of the Downs	2	3,270	3,400	3,550	3,103	3,400	3,550
	9 – 10	Glen of the Downs - Delgany	2	3,232	3,400	3,550	3,068	3,400	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,796	3,400	3,550	2,888	3,400	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,653	3,400	3,550	2,679	3,400	3,550
	12 – 13	Newtown MK - Newcastle	2	2,040	3,400	3,550	2,160	3,400	3,550
	13 – 14	Newcastle – Coyne's Cross	2	2,125	3,400	3,550	2,366	3,400	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,227	3,400	4,600	2,465	3,400	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

The traffic flow volumes highlighted in red represent the links that are operating at or above 95% of the link specific practical capacity in the 2030 Do-Minimum scenario. The key issues are as follows:

AM Peak Hour

- Volumes on the M11/N11 northbound carriageway exceed capacity from Junction 8 (Kilmacanogue) to Junction 5 (Bray North/Wilford).

PM Peak Hour

- Volumes on the M11/N11 southbound carriageway exceed capacity from Junction 5 (Bray North/Wilford) to Junction 8 (Kilmacanogue).

5.9 2050 Do-Minimum

Table 5.10 present the AM Peak (Northbound) and PM Peak (Southbound) hour flows on the mainline sections of the M11/N11 corridor in the 2050 Do-Minimum scenario. The number of lanes and practical capacity for each section is also shown. The traffic flow volumes highlighted in red show the links that are operating at or above 95% of the link speicific practical capacity in the 2050 Do-Minimum scenario. No additonal sections in 2050 beyond those highlighted in the 2030 assessment operate above practical capacity.

Table 5.10: 2050 Do-Minimum M11/N11 Peak Hour Flows (Source: 2050 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) – Northbound (vehicles/hour)			PM Peak (17:00 – 18:00) – Southbound (vehicles/hour)		
				Demand Flow (vehs)	Practical Capacity		Demand Flow (vehs)	Practical Capacity	
					GDA Average	Link Specific		GDA Average	Link Specific
M50	16 – 17	Cherrywood – M11	2	3,678	3,400	4,600	3,218	3,400	4,600
M11	3 – 4	Loughlinstown – M50	2	2,168	3,400	3,400	1,693	3,400	3,400
	4 – 5	M50/M11 – Bray North	2+1	5,846	5,100	6,300	4,910	5,100	6,300
	5 – 6	Bray North – Bray Central	2	**5,013**	3,400	4,600	**4,300**	3,400	3,850
N11	6 – 6a	Bray Central – Herbert Road/R117	2	**5,038**	3,400	3,550	**4,468**	3,400	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	**5,077**	3,400	3,550	**4,379**	3,400	3,200
	7 – 8	Bray South - Kilmacanogue	2	**3,959**	3,400	3,550	**3,811**	3,400	3,200
	8 – 9	Kilmacanogue – Glen of the Downs	2	3,326	3,400	3,550	3,292	3,400	3,550
	9 – 10	Glen of the Downs - Delgany	2	3,273	3,400	3,550	3,255	3,400	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,915	3,400	3,550	3,089	3,400	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,785	3,400	3,550	2,844	3,400	3,550
	12 – 13	Newtown MK - Newcastle	2	2,084	3,400	3,550	2,261	3,400	3,550
	13 – 14	Newcastle – Coyne's Cross	2	2,209	3,400	3,550	2,488	3,400	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,319	3,400	4,600	2,585	3,400	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

5.10 Network Statistics

Table 5.11 outlines a comparison of the modelled network statistics for the 2015 Base Models and the 2030 and 2050 Do-Minimum models for the AM and PM peak periods. As can be seen from the network statistics, by 2030, in the AM peak the network will experience an increase in vehicle kilometres (23%), travel time (23%) and network delay (34%). In the 2050 AM peak the network will experience a significant increase in vehicle kilometres (34%), travel time (39%) and most significantly network delay (66%).

Similarly, in the 2030 PM peak the network will experience an increase in vehicle kilometres (22%), travel time (23%) but most significantly in network delay (37%). In the 2050 PM peak the network will experience a significant increase in vehicle kilometres (27%), travel time (32%) and most significantly network delay (63%).

Table 5.11: AM & PM Peak Hour Modelled Network Statistics

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM	17,721	4,648	15.74	201,602	997
2030 AM Do-Min	21,284	5,740	16.18	248,432	1,333
2050 AM Do-Min	23,125	6,444	16.72	270,556	1,656
2015 PM	17,706	4,445	15.06	200,448	807
2030 PM Do-Min	21,223	5,451	15.41	244,970	1,102
2050 PM Do-Min	22,655	5,873	15.55	254,009	1,318

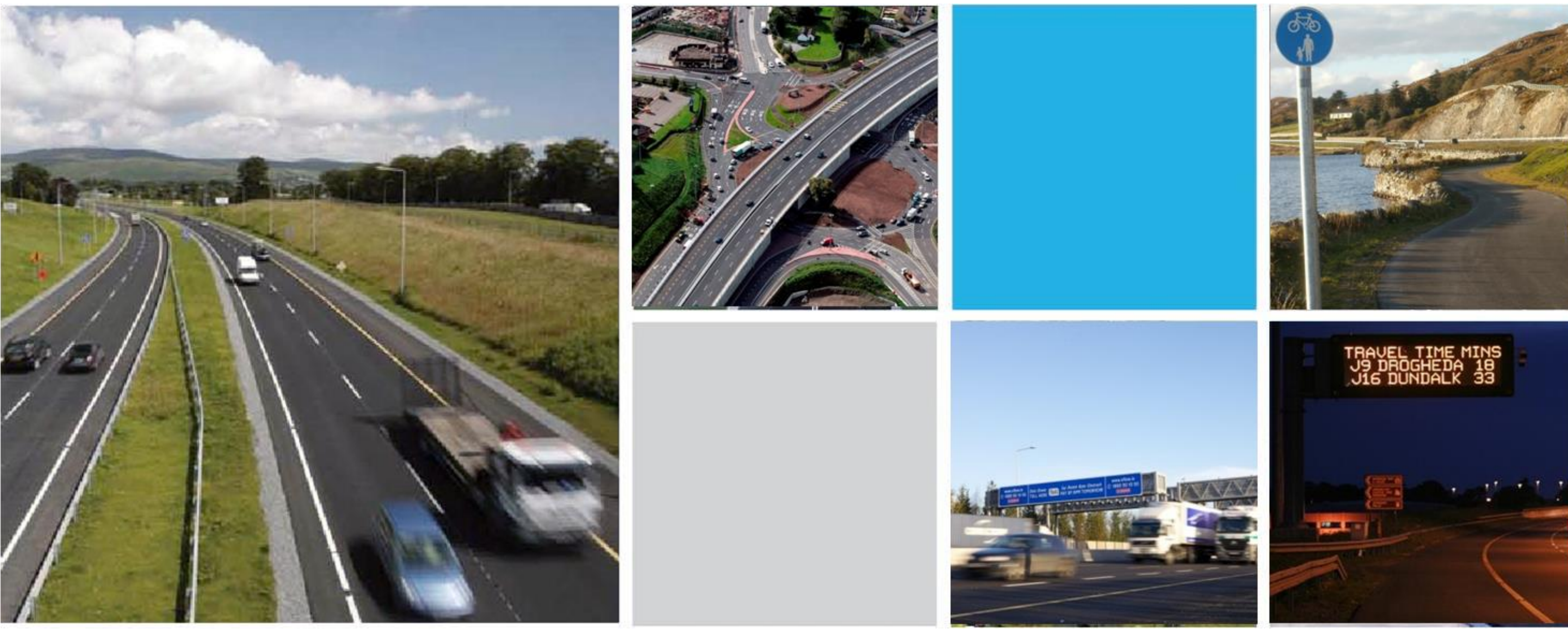
5.11 Summary of Future 'Do-Minimum' Needs Assessment

The needs assessment of the M11/N11 corridor has demonstrated the following:

- The existing capacity of the M11/N11 mainline corridor will need to be increased as far south as Junction 8 (Kilmacanogue) in order to cater for the projected demand in 2030/2050 based on current traffic growth projections;
- There is no need for additional mainline or junction capacity on the N11 between Junction 8 (Kilmacanogue) and Junction 14 (Coynes Cross) based on current traffic growth projections. However, to bring this section of the corridor up to the required standard existing direct accesses and left on / left off junctions should be closed or reconfigured; and
- Upgrades will need to be made to the regional/local road network to provide improved access between the existing M11/N11 mainline junctions and the regional/local road network.

This study has also confirmed the more detailed junction analysis undertaken as part of some of the previous studies which highlighted that the capacity/operation of the existing M11/N11 mainline junctions (6, 6a, 7 and 8) need to be improved to address existing issues at these locations.

Appendices



Appendix A

Calibration & Validation

AM Peak Link Calibration

	NTM AM Total Link Flow Calibration									
	Counts :		23	RESULT =	91%		RESULT =	100%		
	Total Traffic			REQD =	85%		REQD =	85%		
Link Number	Obs	Mod		GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
3508	217	287	-70	4.4	1	1	100	1	70	1.32
3510	200	203	-3	0.2	1	1	100	1	3	1.02
3784	1244	1228	16	0.5	1	2	187	1	-16	0.99
51220	3846	3538	308	5.1	0	2	577	1	-308	0.92
52363	71	48	23	3.0	1	1	100	1	-23	0.68
52441	1453	1382	71	1.9	1	2	218	1	-71	0.95
52632	941	898	43	1.4	1	2	141	1	-43	0.95
52670	3851	3581	270	4.4	1	2	578	1	-270	0.93
52754	1724	1710	14	0.3	1	2	259	1	-14	0.99
52784	1140	1101	39	1.2	1	2	171	1	-39	0.97
52905	1745	1698	47	1.1	1	2	262	1	-47	0.97
52913	949	929	20	0.7	1	2	142	1	-20	0.98
724504088	1777	1660	117	2.8	1	2	267	1	-117	0.93
749747405	1495	1577	-82	2.1	1	2	224	1	82	1.05
749848473	3721	3521	200	3.3	1	2	558	1	-200	0.95
751080053	4168	4010	158	2.5	1	2	625	1	-158	0.96
752699003	1975	2153	-178	3.9	1	2	296	1	178	1.09
2147479948	73	146	-73	7.0	0	1	100	1	73	2.00
2147480163	2053	2047	6	0.1	1	2	308	1	-6	1.00
2147481635	2505	2469	36	0.7	1	2	376	1	-36	0.99
2147481702	2538	2502	36	0.7	1	2	381	1	-36	0.99
2147481718	2064	2117	-53	1.2	1	2	310	1	53	1.03
2147481724	85	75	10	1.1	1	1	100	1	-10	0.88
	39,835	38,880	955	4.8	21			23	-955	0.98

PM Peak Link Calibration

	NTM PM Total Link Flow Calibration									
	Counts :		23	RESULT =	96%		RESULT =	100%		
	Total Traffic			REQD =	85%		REQD =	85%		
Link Number	Obs	Mod		GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
3508	274	287	-13	0.8	1	1	100	1	13	1.05
3510	534	450	84	3.8	1	1	100	1	-84	0.84
3784	2528	2513	15	0.3	1	2	379	1	-15	0.99
51220	2242	2013	229	5.0	1	2	336	1	-229	0.90
52363	56	45	11	1.5	1	1	100	1	-11	0.80
52441	3136	2872	264	4.8	1	2	470	1	-264	0.92
52632	1865	1749	116	2.7	1	2	280	1	-116	0.94
52670	2328	2135	193	4.1	1	2	349	1	-193	0.92
52754	994	1041	-47	1.5	1	2	149	1	47	1.05
52784	2177	2096	81	1.8	1	2	327	1	-81	0.96
52905	1005	1019	-14	0.4	1	2	151	1	14	1.01
52913	1973	1878	95	2.2	1	2	296	1	-95	0.95
724504088	3522	3412	110	1.9	1	2	528	1	-110	0.97
749747405	836	865	-29	1.0	1	2	125	1	29	1.03
749848473	2194	1946	248	5.5	0	2	329	1	-248	0.89
751080053	2488	2370	118	2.4	1	2	373	1	-118	0.95
752699003	3698	3741	-43	0.7	1	2	555	1	43	1.01
2147479948	149	154	-5	0.4	1	1	100	1	5	1.03
2147480163	1331	1267	64	1.8	1	2	200	1	-64	0.95
2147481635	1325	1318	7	0.2	1	2	199	1	-7	0.99
2147481702	1443	1359	84	2.2	1	2	216	1	-84	0.94
2147481718	1203	1131	72	2.1	1	2	180	1	-72	0.94
2147481724	38	54	-16	2.4	1	1	100	1	16	1.42
	37,339	35,715	1,624	8.5	22			23	-1,624	0.96

AM Peak Turn Calibration

NTM AM Total Turn Flow Calibration										
Counts :		149		RESULT =		89%	RESULT =		94%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod	Diff	GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
2000002069	452	348	104	5.2	0	1	100	0	-104	0.77
121890833	17	18	-1	0.2	1	1	100	1	1	1.06
121890833	170	199	-29	2.1	1	1	100	1	29	1.17
121894356	580	497	83	3.6	1	1	100	1	-83	0.86
121891635	170	156	14	1.1	1	1	100	1	-14	0.92
121891957	594	560	34	1.4	1	1	100	1	-34	0.94
121892733	378	428	-50	2.5	1	1	100	1	50	1.13
121892733	52	40	12	1.8	1	1	100	1	-12	0.77
121892444	646	684	-38	1.5	1	1	100	1	38	1.06
121892862	205	215	-10	0.7	1	1	100	1	10	1.05
121605493	635	656	-21	0.8	1	1	100	1	21	1.03
121605493	186	206	-20	1.4	1	1	100	1	20	1.11
121894771	24	8	16	4.0	1	1	100	1	-16	0.33
121890870	356	327	29	1.6	1	1	100	1	-29	0.92
121898192	473	395	78	3.7	1	1	100	1	-78	0.84
121893478	222	203	19	1.3	1	1	100	1	-19	0.91
121897940	445	426	19	0.9	1	1	100	1	-19	0.96
121894049	215	334	-119	7.2	0	1	100	0	119	1.55
121893447	313	316	-3	0.2	1	1	100	1	3	1.01
121891402	568	445	123	5.5	0	1	100	0	-123	0.78
121891402	260	287	-27	1.6	1	1	100	1	27	1.10
121894401	430	325	105	5.4	0	1	100	0	-105	0.76
121895862	1219	1193	26	0.7	1	2	183	1	-26	0.98
121890589	348	321	27	1.5	1	1	100	1	-27	0.92
121894203	175	200	-25	1.8	1	1	100	1	25	1.14
121895931	320	269	51	3.0	1	1	100	1	-51	0.84
121622881	380	313	67	3.6	1	1	100	1	-67	0.82
121891434	937	1027	-90	2.9	1	2	141	1	90	1.10
121606598	243	278	-35	2.2	1	1	100	1	35	1.14
121606598	108	84	24	2.4	1	1	100	1	-24	0.78
121890242	487	473	14	0.6	1	1	100	1	-14	0.97
121897835	248	282	-34	2.1	1	1	100	1	34	1.14
121891058	31	62	-31	4.5	1	1	100	1	31	2.00
121892018	84	86	-2	0.2	1	1	100	1	2	1.02
121892534	69	62	7	0.9	1	1	100	1	-7	0.90
121891057	124	62	62	6.4	0	1	100	1	-62	0.50
121895433	71	84	-13	1.5	1	1	100	1	13	1.18
121895434	115	107	8	0.8	1	1	100	1	-8	0.93
121891476	111	94	17	1.7	1	1	100	1	-17	0.85
121893621	19	14	5	1.2	1	1	100	1	-5	0.74
121893620	354	438	-84	4.2	1	1	100	1	84	1.24
121893620	20	14	6	1.5	1	1	100	1	-6	0.70
121897125	114	91	23	2.3	1	1	100	1	-23	0.80
121897125	223	232	-9	0.6	1	1	100	1	9	1.04
121897606	259	361	-102	5.8	0	1	100	0	102	1.39
121890192	5	0	5	3.2	1	1	100	1	-5	0.00
121890192	12	14	-2	0.6	1	1	100	1	2	1.17
121897488	237	248	-11	0.7	1	1	100	1	11	1.05
121897488	2	0	2	2.0	1	1	100	1	-2	0.00
121893839	9	0	9	4.2	1	1	100	1	-9	0.00
121892073	26	14	12	2.7	1	1	100	1	-12	0.54
121890941	9	0	9	4.2	1	1	100	1	-9	0.00
121892699	260	215	45	2.9	1	1	100	1	-45	0.83
121896733	1062	1054	8	0.2	1	2	159	1	-8	0.99
121896733	181	81	100	8.7	0	1	100	1	-100	0.45
121890227	700	585	115	4.5	1	2	105	0	-115	0.84
121894922	355	301	54	3.0	1	1	100	1	-54	0.85
121893526	306	377	-71	3.8	1	1	100	1	71	1.23
121892821	291	260	31	1.9	1	1	100	1	-31	0.89
121892821	247	282	-35	2.2	1	1	100	1	35	1.14
121892291	204	169	35	2.6	1	1	100	1	-35	0.83
121894272	104	49	55	6.3	0	1	100	1	-55	0.47
121894272	213	228	-15	1.0	1	1	100	1	15	1.07
121893173	360	547	-187	8.8	0	1	100	0	187	1.52
121897587	386	456	-70	3.4	1	1	100	1	70	1.18
121897884	189	107	82	6.7	0	1	100	1	-82	0.57
121891330	768	738	30	1.1	1	2	115	1	-30	0.96
121897588	507	550	-43	1.9	1	1	100	1	43	1.08
121896281	309	361	-52	2.8	1	1	100	1	52	1.17
121896281	84	61	23	2.7	1	1	100	1	-23	0.73
121892466	14	2	12	4.2	1	1	100	1	-12	0.14
121892466	395	347	48	2.5	1	1	100	1	-48	0.88

121891498	376	393	-17	0.9	1	1	100	1	17	1.05
121891498	292	298	-6	0.3	1	1	100	1	6	1.02
121891499	195	225	-30	2.1	1	1	100	1	30	1.15
121891048	108	63	45	4.9	1	1	100	1	-45	0.58
121891072	243	327	-84	5.0	1	1	100	1	84	1.35
121893996	199	204	-5	0.4	1	1	100	1	5	1.03
121891661	45	0	45	9.5	0	1	100	1	-45	0.00
121891608	369	407	-38	1.9	1	1	100	1	38	1.10
121891608	33	57	-24	3.6	1	1	100	1	24	1.73
121892702	96	115	-19	1.8	1	1	100	1	19	1.20
121891660	27	25	2	0.4	1	1	100	1	-2	0.93
121892947	44	40	4	0.6	1	1	100	1	-4	0.91
121891598	94	79	15	1.6	1	1	100	1	-15	0.84
121894677	53	40	13	1.9	1	1	100	1	-13	0.75
121891629	51	0	51	10.1	0	1	100	1	-51	0.00
121642466	169	163	6	0.5	1	1	100	1	-6	0.96
121621121	513	606	-93	3.9	1	1	100	1	93	1.18
121890684	739	612	127	4.9	1	2	111	0	-127	0.83
121890378	548	422	126	5.7	0	1	100	0	-126	0.77
121895710	575	558	17	0.7	1	1	100	1	-17	0.97
121895710	303	326	-23	1.3	1	1	100	1	23	1.08
121899789	31	12	19	4.1	1	1	100	1	-19	0.39
121899789	123	157	-34	2.9	1	1	100	1	34	1.28
121899789	40	54	-14	2.0	1	1	100	1	14	1.35
2000002261	1	0	1	1.4	1	1	100	1	-1	0.00
2000002257	7	0	7	3.7	1	1	100	1	-7	0.00
2000002265	95	47	48	5.7	0	1	100	1	-48	0.49
2000002265	47	59	-12	1.6	1	1	100	1	12	1.26
2000002277	41	24	17	3.0	1	1	100	1	-17	0.59
2000002282	34	50	-16	2.5	1	1	100	1	16	1.47
2000002288	39	29	10	1.7	1	1	100	1	-10	0.74
2000002288	191	153	38	2.9	1	1	100	1	-38	0.80
2000002297	8	17	-9	2.5	1	1	100	1	9	2.13
2000002297	63	57	6	0.8	1	1	100	1	-6	0.90
2000002307	587	513	74	3.2	1	1	100	1	-74	0.87
121894612	43	55	-12	1.7	1	1	100	1	12	1.28
2000002316	22	0	22	6.6	0	1	100	1	-22	0.00
2000002243	93	90	3	0.3	1	1	100	1	-3	0.97
2000002243	11	34	-23	4.8	1	1	100	1	23	3.09
121895000	39	51	-12	1.8	1	1	100	1	12	1.31
121895000	41	28	13	2.2	1	1	100	1	-13	0.68
2000002468	160	176	-16	1.2	1	1	100	1	16	1.10
2000002468	86	52	34	4.1	1	1	100	1	-34	0.60
2000002478	79	79	0	0.0	1	1	100	1	0	1.00
2000002472	28	33	-5	0.9	1	1	100	1	5	1.18
2000002493	89	96	-7	0.7	1	1	100	1	7	1.08
2000002493	69	38	31	4.2	1	1	100	1	-31	0.55
121892794	565	574	-9	0.4	1	1	100	1	9	1.02
121892794	85	69	16	1.8	1	1	100	1	-16	0.81
2000002518	271	299	-28	1.7	1	1	100	1	28	1.10
2000002518	487	473	14	0.6	1	1	100	1	-14	0.97
121895919	194	199	-5	0.4	1	1	100	1	5	1.03
2000002520	175	200	-25	1.8	1	1	100	1	25	1.14
121892555	2482	2469	13	0.3	1	2	372	1	-13	0.99
121892555	30	27	3	0.6	1	1	100	1	-3	0.90
2000002531	56	29	27	4.1	1	1	100	1	-27	0.52
2000002555	1172	1196	-24	0.7	1	2	176	1	24	1.02
2000002555	44	14	30	5.6	0	1	100	1	-30	0.32
2000002555	443	375	68	3.4	1	1	100	1	-68	0.85
2000002390	24	18	6	1.3	1	1	100	1	-6	0.75
121892925	218	235	-17	1.1	1	1	100	1	17	1.08
121890590	1523	1468	55	1.4	1	2	228	1	-55	0.96
121890590	45	42	3	0.5	1	1	100	1	-3	0.93
2000002557	1234	1192	42	1.2	1	2	185	1	-42	0.97
2000002556	111	79	32	3.3	1	1	100	1	-32	0.71
2000002558	144	116	28	2.5	1	1	100	1	-28	0.81
2000002560	36	25	11	2.0	1	1	100	1	-11	0.69
2000002377	3	0	3	2.4	1	1	100	1	-3	0.00
2000002565	52	49	3	0.4	1	1	100	1	-3	0.94
2000002565	199	204	-5	0.4	1	1	100	1	5	1.03
2000002564	8	0	8	4.0	1	1	100	1	-8	0.00
121891556	1	8	-7	3.3	1	1	100	1	7	8.00
121891556	4	6	-2	0.9	1	1	100	1	2	1.50
2000002549	23	0	23	6.8	0	1	100	1	-23	0.00
2000002571	124	95	29	2.8	1	1	100	1	-29	0.77
2000002573	64	41	23	3.2	1	1	100	1	-23	0.64
2000002573	8	0	8	4.0	1	1	100	1	-8	0.00
	37,649	**36,632**	1,017	5.3	**132**			**140**	**-1,017**	**0.97**

PM Peak Turn Calibration

NTM PM Total Turn Flow Calibration										
Counts :		149		RESULT =		86%	RESULT =		97%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod	Diff	GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
2000002069	252	192	60	4.0	1	1	100	1	-60	0.76
121890833	55	48	7	1.0	1	1	100	1	-7	0.87
121890833	338	244	94	5.5	0	1	100	1	-94	0.72
121894356	673	787	-114	4.2	1	1	100	0	114	1.17
121891635	141	120	21	1.8	1	1	100	1	-21	0.85
121891957	822	689	133	4.8	1	2	123	0	-133	0.84
121892733	266	219	47	3.0	1	1	100	1	-47	0.82
121892733	45	33	12	1.9	1	1	100	1	-12	0.73
121892444	532	544	-12	0.5	1	1	100	1	12	1.02
121892862	340	356	-16	0.9	1	1	100	1	16	1.05
121605493	794	860	-66	2.3	1	2	119	1	66	1.08
121605493	270	289	-19	1.1	1	1	100	1	19	1.07
121894771	17	11	6	1.6	1	1	100	1	-6	0.65
121890870	309	311	-2	0.1	1	1	100	1	2	1.01
121898192	683	550	133	5.4	0	1	100	0	-133	0.81
121893478	337	280	57	3.2	1	1	100	1	-57	0.83
121897940	446	362	84	4.2	1	1	100	1	-84	0.81
121894049	120	68	52	5.4	0	1	100	1	-52	0.57
121893447	397	381	16	0.8	1	1	100	1	-16	0.96
121891402	374	438	-64	3.2	1	1	100	1	64	1.17
121891402	204	202	2	0.1	1	1	100	1	-2	0.99
121894401	594	636	-42	1.7	1	1	100	1	42	1.07
121895862	847	910	-63	2.1	1	2	127	1	63	1.07
121890589	341	412	-71	3.7	1	1	100	1	71	1.21
121894203	223	241	-18	1.2	1	1	100	1	18	1.08
121895931	271	202	69	4.5	1	1	100	1	-69	0.75
121622881	526	613	-87	3.6	1	1	100	1	87	1.17
121891434	789	826	-37	1.3	1	2	118	1	37	1.05
121606598	35	62	-27	3.9	1	1	100	1	27	1.77
121606598	117	113	4	0.4	1	1	100	1	-4	0.97
121890242	340	359	-19	1.0	1	1	100	1	19	1.06
121897835	139	96	43	4.0	1	1	100	1	-43	0.69
121891058	59	80	-21	2.5	1	1	100	1	21	1.36
121892018	51	69	-18	2.3	1	1	100	1	18	1.35
121892534	96	80	16	1.7	1	1	100	1	-16	0.83
121891057	89	80	9	1.0	1	1	100	1	-9	0.90
121895433	109	88	21	2.1	1	1	100	1	-21	0.81
121895434	213	186	27	1.9	1	1	100	1	-27	0.87
121891476	74	100	-26	2.8	1	1	100	1	26	1.35
121893621	45	27	18	3.0	1	1	100	1	-18	0.60
121893620	320	252	68	4.0	1	1	100	1	-68	0.79
121893620	45	27	18	3.0	1	1	100	1	-18	0.60
121897125	93	53	40	4.7	1	1	100	1	-40	0.57
121897125	322	339	-17	0.9	1	1	100	1	17	1.05
121897606	273	226	47	3.0	1	1	100	1	-47	0.83
121890192	7	0	7	3.7	1	1	100	1	-7	0.00
121890192	16	27	-11	2.4	1	1	100	1	11	1.69
121897488	374	390	-16	0.8	1	1	100	1	16	1.04
121897488	8	30	-22	5.0	0	1	100	1	22	3.75
121893839	13	0	13	5.1	0	1	100	1	-13	0.00
121892073	42	27	15	2.6	1	1	100	1	-15	0.64
121890941	19	0	19	6.2	0	1	100	1	-19	0.00
121892699	410	356	54	2.8	1	1	100	1	-54	0.87
121896733	741	794	-53	1.9	1	2	111	1	53	1.07
121896733	463	511	-48	2.2	1	1	100	1	48	1.10
121890227	649	696	-47	1.8	1	1	100	1	47	1.07
121894922	417	443	-26	1.3	1	1	100	1	26	1.06
121893526	581	572	9	0.4	1	1	100	1	-9	0.98
121892821	281	281	0	0.0	1	1	100	1	0	1.00
121892821	94	96	-2	0.2	1	1	100	1	2	1.02
121892291	39	47	-8	1.2	1	1	100	1	8	1.21
121894272	55	71	-16	2.0	1	1	100	1	16	1.29
121894272	189	263	-74	4.9	1	1	100	1	74	1.39
121893173	226	269	-43	2.7	1	1	100	1	43	1.19
121897587	617	698	-81	3.2	1	1	100	1	81	1.13
121897884	330	239	91	5.4	0	1	100	1	-91	0.72
121891330	456	465	-9	0.4	1	1	100	1	9	1.02
121897588	633	720	-87	3.3	1	1	100	1	87	1.14
121896281	310	328	-18	1.0	1	1	100	1	18	1.06
121896281	68	26	42	6.1	0	1	100	1	-42	0.38
121892466	13	39	-26	5.1	0	1	100	1	26	3.00
121892466	394	410	-16	0.8	1	1	100	1	16	1.04
121891498	313	251	62	3.7	1	1	100	1	-62	0.80

121891498	313	251	62	3.7	1	1	100	1	-62	0.80
121891498	195	149	46	3.5	1	1	100	1	-46	0.76
121891499	279	359	-80	4.5	1	1	100	1	80	1.29
121891048	121	118	3	0.3	1	1	100	1	-3	0.98
121891072	242	336	-94	5.5	0	1	100	1	94	1.39
121893996	381	459	-78	3.8	1	1	100	1	78	1.20
121891661	99	71	28	3.0	1	1	100	1	-28	0.72
121891608	228	227	1	0.1	1	1	100	1	-1	1.00
121891608	66	96	-30	3.3	1	1	100	1	30	1.45
121892702	63	65	-2	0.3	1	1	100	1	2	1.03
121891660	38	42	-4	0.6	1	1	100	1	4	1.11
121892947	92	72	20	2.2	1	1	100	1	-20	0.78
121891598	79	53	26	3.2	1	1	100	1	-26	0.67
121894677	98	83	15	1.6	1	1	100	1	-15	0.85
121891629	92	72	20	2.2	1	1	100	1	-20	0.78
121642466	104	95	9	0.9	1	1	100	1	-9	0.91
121621121	621	641	-20	0.8	1	1	100	1	20	1.03
121890684	543	557	-14	0.6	1	1	100	1	14	1.03
121890378	343	348	-5	0.3	1	1	100	1	5	1.01
121895710	830	675	155	5.7	0	2	125	0	-155	0.81
121895710	287	327	-40	2.3	1	1	100	1	40	1.14
121899789	35	22	13	2.4	1	1	100	1	-13	0.63
121899789	214	232	-18	1.2	1	1	100	1	18	1.08
121899789	13	18	-5	1.3	1	1	100	1	5	1.38
2000002261	3	0	3	2.4	1	1	100	1	-3	0.00
2000002257	3	0	3	2.4	1	1	100	1	-3	0.00
2000002265	22	60	-38	5.9	0	1	100	1	38	2.73
2000002265	119	75	44	4.5	1	1	100	1	-44	0.63
2000002277	32	31	1	0.2	1	1	100	1	-1	0.97
2000002282	11	39	-28	5.6	0	1	100	1	28	3.55
2000002288	11	20	-9	2.3	1	1	100	1	9	1.82
2000002288	119	101	18	1.7	1	1	100	1	-18	0.85
2000002297	7	8	-1	0.4	1	1	100	1	1	1.14
2000002297	66	95	-29	3.2	1	1	100	1	29	1.44
2000002307	495	522	-27	1.2	1	1	100	1	27	1.05
121894612	33	34	-1	0.2	1	1	100	1	1	1.03
2000002316	31	0	31	7.9	0	1	100	1	-31	0.00
2000002243	150	128	22	1.9	1	1	100	1	-22	0.85
2000002243	9	20	-11	2.9	1	1	100	1	11	2.22
121895000	66	25	41	6.1	0	1	100	1	-41	0.38
121895000	36	11	25	5.2	0	1	100	1	-25	0.31
2000002468	194	250	-56	3.8	1	1	100	1	56	1.29
2000002468	127	85	42	4.1	1	1	100	1	-42	0.67
2000002478	35	0	35	8.4	0	1	100	1	-35	0.00
2000002472	42	64	-22	3.0	1	1	100	1	22	1.52
2000002493	73	109	-36	3.8	1	1	100	1	36	1.49
2000002493	37	24	13	2.4	1	1	100	1	-13	0.65
121892794	377	369	8	0.4	1	1	100	1	-8	0.98
121892794	40	42	-2	0.3	1	1	100	1	2	1.05
2000002518	151	128	23	1.9	1	1	100	1	-23	0.85
2000002518	340	359	-19	1.0	1	1	100	1	19	1.06
121895919	113	117	-4	0.4	1	1	100	1	4	1.04
2000002520	223	241	-18	1.2	1	1	100	1	18	1.08
121892555	1421	1318	103	2.8	1	2	213	1	-103	0.93
121892555	55	32	23	3.5	1	1	100	1	-23	0.58
2000002531	43	63	-20	2.7	1	1	100	1	20	1.47
2000002555	789	885	-96	3.3	1	2	118	1	96	1.12
2000002555	45	45	0	0.0	1	1	100	1	0	1.00
2000002555	450	415	35	1.7	1	1	100	1	-35	0.92
2000002390	12	52	-40	7.1	0	1	100	1	40	4.33
121892925	483	489	-6	0.3	1	1	100	1	6	1.01
121890590	1144	1244	-100	2.9	1	2	172	1	100	1.09
121890590	44	77	-33	4.2	1	1	100	1	33	1.75
2000002557	829	874	-45	1.5	1	2	124	1	45	1.05
2000002556	85	85	0	0.0	1	1	100	1	0	1.00
2000002558	137	160	-23	1.9	1	1	100	1	23	1.17
2000002560	53	44	9	1.3	1	1	100	1	-9	0.83
2000002377	10	0	10	4.5	1	1	100	1	-10	0.00
2000002565	90	83	7	0.8	1	1	100	1	-7	0.92
2000002565	381	459	-78	3.8	1	1	100	1	78	1.20
2000002564	5	0	5	3.2	1	1	100	1	-5	0.00
121891556	3	5	-2	1.0	1	1	100	1	2	1.67
121891556	16	0	16	5.7	0	1	100	1	-16	0.00
2000002549	7	5	2	0.8	1	1	100	1	-2	0.71
2000002571	155	112	43	3.7	1	1	100	1	-43	0.72
2000002573	117	63	54	5.7	0	1	100	1	-54	0.54
2000002573	22	0	22	6.6	0	1	100	1	-22	0.00
	35,608	**35,694**	-86	0.5	**128**			**145**	**86**	**1.00**

AM Peak Link Validation

NTM AM Total Link Flow Validation										
Counts :		14		RESULT =		93%	RESULT =		93%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod		GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
3790	1249	1192	57	1.6	1	2	187	1	-57	0.95
52041	1871	1867	4	0.1	1	2	281	1	-4	1.00
52401	1646	1617	29	0.7	1	2	247	1	-29	0.98
52456	2051	1972	79	1.8	1	2	308	1	-79	0.96
52718	1164	1032	132	4.0	1	2	175	1	-132	0.89
52938	1065	968	97	3.0	1	2	160	1	-97	0.91
590511931	1229	1364	-135	3.7	1	2	184	1	135	1.11
726245138	746	790	-44	1.6	1	2	112	1	44	1.06
740146667	2673	2433	240	4.7	1	2	401	1	-240	0.91
2147479948	132	112	20	1.8	1	1	100	1	-20	0.85
2147480014	653	608	45	1.8	1	1	100	1	-45	0.93
2147480014	342	443	-101	5.1	0	1	100	0	101	1.30
2147481701	2969	2713	256	4.8	1	2	445	1	-256	0.91
2147481719	2064	2191	-127	2.8	1	2	310	1	127	1.06
	19,854	**19,302**	552	3.9	**13**			**13**	**-552**	**0.97**

PM Peak Link Validation

NTM PM Total Link Flow Validation										
Counts :		14		RESULT =		86%	RESULT =		93%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod		GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
3790	2745	2481	264	5.2	0	2	412	1	-264	0.90
52041	3363	3215	148	2.6	1	2	504	1	-148	0.96
52401	953	1026	-73	2.3	1	2	143	1	73	1.08
52456	3714	3697	17	0.3	1	2	557	1	-17	1.00
52718	2419	2285	134	2.8	1	2	363	1	-134	0.94
52938	2303	1879	424	9.3	0	2	345	0	-424	0.82
590511931	2221	2341	-120	2.5	1	2	333	1	120	1.05
726245138	1477	1399	78	2.1	1	2	222	1	-78	0.95
740146667	1652	1506	146	3.7	1	2	248	1	-146	0.91
2147479948	84	120	-36	3.6	1	1	100	1	36	1.43
2147480014	394	446	-52	2.5	1	1	100	1	52	1.13
2147480014	587	593	-6	0.2	1	1	100	1	6	1.01
2147481701	1729	1552	177	4.4	1	2	259	1	-177	0.90
2147481719	1203	1185	18	0.5	1	2	180	1	-18	0.99
	24,844	**23,725**	1,119	7.2	**12**			**13**	**-1,119**	**0.95**

AM Peak Turn Validation

AM Total Turning Flow Validation										
Counts :		79		RESULT =		82%	RESULT =		95%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod	Diff	GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
2000002072	243	231	12	0.8	1	1	100	1	-12	0.95
2000002065	534	523	11	0.5	1	1	100	1	-11	0.98
2000002066	482	423	59	2.8	1	1	100	1	-59	0.88
2000002071	482	423	59	2.8	1	1	100	1	-59	0.88
2000002070	662	566	96	3.9	1	1	100	1	-96	0.85
2000002070	62	87	-25	2.9	1	1	100	1	25	1.40
2000002069	346	345	1	0.1	1	1	100	1	-1	1.00
2000002068	345	345	0	0.0	1	1	100	1	0	1.00
121895468	207	282	-75	4.8	1	1	100	1	75	1.36
121891052	9	0	9	4.2	1	1	100	1	-9	0.00
121898092	90	67	23	2.6	1	1	100	1	-23	0.74
121892862	54	0	54	10.4	0	1	100	1	-54	0.00
121894501	419	447	-28	1.3	1	1	100	1	28	1.07
121890193	301	316	-15	0.9	1	1	100	1	15	1.05
121890193	15	12	3	0.8	1	1	100	1	-3	0.80
121890515	379	439	-60	3.0	1	1	100	1	60	1.16
121890383	37	14	23	4.6	1	1	100	1	-23	0.38
121896748	180	203	-23	1.7	1	1	100	1	23	1.13
121893478	127	160	-33	2.8	1	1	100	1	33	1.26
121892820	345	260	85	4.9	1	1	100	1	-85	0.75
121895471	482	473	9	0.4	1	1	100	1	-9	0.98
121893943	402	360	42	2.2	1	1	100	1	-42	0.90
121894400	1212	1210	2	0.1	1	2	182	1	-2	1.00
121891012	1219	1192	27	0.8	1	2	183	1	-27	0.98
121898508	170	156	14	1.1	1	1	100	1	-14	0.92
121605492	434	550	-116	5.2	0	1	100	0	116	1.27
121641080	93	24	69	9.0	0	1	100	1	-69	0.26
121891475	102	92	10	1.0	1	1	100	1	-10	0.90
121893878	75	86	-11	1.2	1	1	100	1	11	1.15
121893236	302	316	-14	0.8	1	1	100	1	14	1.05
121892073	313	316	-3	0.2	1	1	100	1	3	1.01
121894922	518	399	119	5.6	0	1	100	0	-119	0.77
121893526	538	554	-16	0.7	1	1	100	1	16	1.03
121890062	522	534	-12	0.5	1	1	100	1	12	1.02
121892991	401	350	51	2.6	1	1	100	1	-51	0.87
121639135	133	134	-1	0.1	1	1	100	1	1	1.01
121892291	144	158	-14	1.1	1	1	100	1	14	1.10
121897587	309	201	108	6.8	0	1	100	0	-108	0.65
121891499	184	154	30	2.3	1	1	100	1	-30	0.84
121894696	293	263	30	1.8	1	1	100	1	-30	0.90
121894696	27	1	26	6.9	0	1	100	1	-26	0.04
121891048	279	305	-26	1.5	1	1	100	1	26	1.09
121891072	4	98	-94	13.2	0	1	100	1	94	24.50
121893802	55	56	-1	0.1	1	1	100	1	1	1.02
121891660	72	16	56	8.4	0	1	100	1	-56	0.22
121892947	51	0	51	10.1	0	1	100	1	-51	0.00
121894678	62	40	22	3.1	1	1	100	1	-22	0.65
121891598	62	40	22	3.1	1	1	100	1	-22	0.65
121891630	67	0	67	11.6	0	1	100	1	-67	0.00
121891630	51	40	11	1.6	1	1	100	1	-11	0.78
121893181	31	25	6	1.1	1	1	100	1	-6	0.81
121893181	126	41	85	9.3	0	1	100	1	-85	0.33
121894677	67	0	67	11.6	0	1	100	1	-67	0.00
121890684	424	323	101	5.2	0	1	100	0	-101	0.76
121890738	511	508	3	0.1	1	1	100	1	-3	0.99
121890738	421	375	46	2.3	1	1	100	1	-46	0.89
121890378	417	513	-96	4.5	1	1	100	1	96	1.23
121899789	206	258	-52	3.4	1	1	100	1	52	1.25
2000002261	170	190	-20	1.5	1	1	100	1	20	1.12
2000002282	33	22	11	2.1	1	1	100	1	-11	0.67
2000002297	10	0	10	4.5	1	1	100	1	-10	0.00
121894612	11	11	0	0.0	1	1	100	1	0	1.00
121891751	40	77	-37	4.8	1	1	100	1	37	1.93
121891751	36	84	-48	6.2	0	1	100	1	48	2.33
121890064	484	482	2	0.1	1	1	100	1	-2	1.00
2000002521	23	20	3	0.6	1	1	100	1	-3	0.87
2000002521	315	305	10	0.6	1	1	100	1	-10	0.97
2000002524	136	128	8	0.7	1	1	100	1	-8	0.94
2000002531	23	21	2	0.4	1	1	100	1	-2	0.91
121892925	7	24	-17	4.3	1	1	100	1	17	3.43
2000002557	401	350	51	2.6	1	1	100	1	-51	0.87
2000002558	83	89	-6	0.6	1	1	100	1	6	1.07
2000002558	55	56	-1	0.1	1	1	100	1	1	1.02
2000002563	33	10	23	5.0	1	1	100	1	-23	0.30
2000002563	21	36	-15	2.8	1	1	100	1	15	1.71
2000002563	19	14	5	1.2	1	1	100	1	-5	0.74
2000002377	115	126	-11	1.0	1	1	100	1	11	1.10
2000002293	18123	17548	575	4.3	1	2	2718	1	-575	0.97
2000002573	0	8	-8	4.0	1	1	100	1	8	#DIV/0!
	36,236	34,905	1,331	7.1	65			75	-1,331	0.96

PM Peak Turn Validation

PM Total Turning Flow Validation										
Counts :		79		RESULT =		85%	RESULT =		97%	
Total Traffic				REQD =		85%	REQD =		85%	
Link Number	Obs	Mod	Diff	GEH	GEH TEST	CLASS TEST	Target Diff	Flow Test	ACT DIFF	FACTOR
2000002072	214	284	-70	4.4	1	1	100	1	70	1.33
2000002065	822	780	42	1.5	1	2	123	1	-42	0.95
2000002066	329	300	29	1.6	1	1	100	1	-29	0.91
2000002071	329	300	29	1.6	1	1	100	1	-29	0.91
2000002070	534	456	78	3.5	1	1	100	1	-78	0.85
2000002070	105	127	-22	2.0	1	1	100	1	22	1.21
2000002069	308	373	-65	3.5	1	1	100	1	65	1.21
2000002068	308	373	-65	3.5	1	1	100	1	65	1.21
121895468	115	96	19	1.8	1	1	100	1	-19	0.83
121891052	9	0	9	4.2	1	1	100	1	-9	0.00
121898092	57	32	25	3.7	1	1	100	1	-25	0.56
121892862	70	0	70	11.8	0	1	100	1	-70	0.00
121894501	232	276	-44	2.8	1	1	100	1	44	1.19
121890193	396	381	15	0.8	1	1	100	1	-15	0.96
121890193	12	9	3	0.9	1	1	100	1	-3	0.75
121890515	454	551	-97	4.3	1	1	100	1	97	1.21
121890383	23	24	-1	0.2	1	1	100	1	1	1.04
121896748	405	442	-37	1.8	1	1	100	1	37	1.09
121893478	85	117	-32	3.2	1	1	100	1	32	1.38
121892820	239	281	-42	2.6	1	1	100	1	42	1.18
121895471	321	359	-38	2.1	1	1	100	1	38	1.12
121893943	279	316	-37	2.1	1	1	100	1	37	1.13
121894400	821	929	-108	3.7	1	2	123	1	108	1.13
121891012	847	910	-63	2.1	1	2	127	1	63	1.07
121898508	141	120	21	1.8	1	1	100	1	-21	0.85
121605492	537	535	2	0.1	1	1	100	1	-2	1.00
121641080	162	55	107	10.3	0	1	100	0	-107	0.34
121891475	186	208	-22	1.6	1	1	100	1	22	1.12
121893878	161	177	-16	1.2	1	1	100	1	16	1.10
121893236	403	381	22	1.1	1	1	100	1	-22	0.95
121892073	397	381	16	0.8	1	1	100	1	-16	0.96
121894922	627	605	22	0.9	1	1	100	1	-22	0.96
121893526	555	611	-56	2.3	1	1	100	1	56	1.10
121890062	483	582	-99	4.3	1	1	100	1	99	1.20
121892991	400	456	-56	2.7	1	1	100	1	56	1.14
121639135	173	152	21	1.6	1	1	100	1	-21	0.88
121892291	323	254	69	4.1	1	1	100	1	-69	0.79
121897587	346	262	84	4.8	1	1	100	1	-84	0.76
121891499	253	171	82	5.6	0	1	100	1	-82	0.68
121894696	251	181	70	4.8	1	1	100	1	-70	0.72
121894696	81	40	41	5.3	0	1	100	1	-41	0.49
121891048	233	278	-45	2.8	1	1	100	1	45	1.19
121891072	9	54	-45	8.0	0	1	100	1	45	6.00
121893802	95	59	36	4.1	1	1	100	1	-36	0.62
121891660	162	112	50	4.3	1	1	100	1	-50	0.69
121892947	92	72	20	2.2	1	1	100	1	-20	0.78
121894678	101	83	18	1.9	1	1	100	1	-18	0.82
121891598	101	83	18	1.9	1	1	100	1	-18	0.82
121891630	112	72	40	4.2	1	1	100	1	-40	0.64
121891630	94	83	11	1.2	1	1	100	1	-11	0.88
121893181	25	24	1	0.2	1	1	100	1	-1	0.96
121893181	142	80	62	5.9	0	1	100	1	-62	0.56
121894677	112	72	40	4.2	1	1	100	1	-40	0.64
121890684	308	312	-4	0.2	1	1	100	1	4	1.01
121890738	546	467	79	3.5	1	1	100	1	-79	0.86
121890738	592	520	72	3.1	1	1	100	1	-72	0.88
121890378	474	481	-7	0.3	1	1	100	1	7	1.01
121899789	222	276	-54	3.4	1	1	100	1	54	1.24
2000002261	131	54	77	8.0	0	1	100	1	-77	0.41
2000002282	62	43	19	2.6	1	1	100	1	-19	0.69
2000002297	11	0	11	4.7	1	1	100	1	-11	0.00
121894612	20	0	20	6.3	0	1	100	1	-20	0.00
121891751	71	141	-70	6.8	0	1	100	1	70	1.99
121891751	58	30	28	4.2	1	1	100	1	-28	0.52
121890064	308	350	-42	2.3	1	1	100	1	42	1.14
2000002521	58	10	48	8.2	0	1	100	1	-48	0.17
2000002521	178	99	79	6.7	0	1	100	1	-79	0.56
2000002524	126	109	17	1.6	1	1	100	1	-17	0.87
2000002531	51	91	-40	4.7	1	1	100	1	40	1.78
121892925	17	10	7	1.9	1	1	100	1	-7	0.59
2000002557	400	456	-56	2.7	1	1	100	1	56	1.14
2000002558	244	298	-54	3.3	1	1	100	1	54	1.22
2000002558	91	59	32	3.7	1	1	100	1	-32	0.65
2000002563	51	26	25	4.0	1	1	100	1	-25	0.51
2000002563	35	48	-13	2.0	1	1	100	1	13	1.37
2000002563	3	7	-4	1.8	1	1	100	1	4	2.33
2000002377	171	329	-158	10.0	0	1	100	0	158	1.92
2000002293	18515	18565	-50	0.4	1	2	2777	1	50	1.00
2000002573	0	4	-4	2.8	1	1	100	1	4	#DIV/0!
	36,814	36,744	70	0.4	67			77	-70	1.00

Appendix B

Practical Capacity

M11/N11 Practical Capacity

In order to refine the practical capacity for the sections of the M11/N11 under consideration an assessment of the two TII TMU counters on the M11/N11 was undertaken; the first on the M11 between Junction 5 (Bray North) and Junction 6 (Bray South), and the second on the N11 between Junction 8 (Kilmacanogue) and Junction 9 (Glen of the Downs).

The flow of traffic during the AM and PM peak periods (06:00 – 09:00 & 16:00 – 17:00) was plotted against speed in order to identify the point when flow breakdown occurs, which, for this study is assumed to be when average speeds reduce to below 80kph (Level of Service D).

Data for each traffic lane for each working day in May 2015 was used as part of the assessment and the flow/speed relationship based on 5 mins time intervals during the peak periods was utilised. Traffic flows within the 85th percentile speed during the peak periods was isolated.

M11 Junction 5 (Bray Central) – Junction 6 (Bray South)

The practical capacity of the section of the M11 between Junction 5 (Bray Central) and Junction 6 (Bray South) was estimated using data from the TII TMU counter (Site No. 20111). Table B.1 provides a summary of the assessment and Figures B1 to B4 illustrate the TMU flow/speed data used as part of the assessment.

Table B.1: Practical Capacity (M11 Junction 5 – Junction 6)

Lane	Northbound	Southbound
	AM Practical Capacity (vehicles/hour)	PM Practical Capacity (vehicles/hour)
Outside	2,688	2,136
Nearside	2,004	1,716
Combined	**4,692**	**3,852**
Average per Lane	**2,346**	**1,926**

It should be noted that the southbound average practical capacity of 1,926 vehicles/hour reconfirms the value quoted in the GDA lane capacity study for this location of 1,900 vehicles/hour.

The capacity of the southbound lanes south of this location is impacted by the combination of several issues between Junction 6 and Junction 8 such as the uphill gradient of the N11, the change to dual carriageway standard with 100km/hr speed limit, a number of direct accesses, and weaving/merging associated with two left on / left off junctions. Therefore the southbound carriageway between Junctions 6 and 8 will have a lower practical capacity.

N11 Junction 8 (Kilmacanogue) – Junction 9 (Glen of the Downs)

The practical capacity of the section of the N11 between Junction 8 (Kilmacanogue) and Junction 9 (Glen of the Downs) in the northbound direction was estimated using data from the TII TMU counter (Site No. 20111). Table B.2 provides a summary of the assessment which is based on the TMU flow/speed data provided (Figures B5 & B6).

Table B.2: Practical Capacity (N11 Junction 8 – Junction 9)

Lane	Northbound
	AM Practical Capacity(vehicles/hour)
Outside	2,004
Nearside	1,533
Combined	**3,537**
Average per Lane	**1,769**

In the southbound direction, south of Junction 8 (Kilmacanogue) peak hour traffic volumes reduce and there are currently no flow breakdown issues in the PM peak hour. Therefore the assessment of the practical capacity in the southbound direction at this location did not yield a practical capacity threshold. However, it is considered reasonable to assume that the southbound practical capacity here is similar to the combined northbound figure of 3,550 vehicles/hour.

Estimation of Practical Capacity of the Various Links in the Study Area

Using the observed data provided above, and our understanding of the existing geometry and operation of the M11/N11 corridor, an estimation of the practical capacity of the outstanding sections along the M11/N11 corridor is provide below and is summarised in Table B.3.

- 2 lane motorways (M50 and M11) – 4,600 (each direction) – based on M11 northbound data;

- 2 lane links (M11 Junction 3 to Junction 4) – 3,400 – based on GDA average in light of lower speed limit and geometry
- 2 lane + 1 auxiliary motorway - 6,300 (each direction), capacity of auxiliary lane assumed to be 1700 in line with GDA average;
- 2 lane dual carriageway:
    - 3,550 (northbound) between Junction 6 and Junction 8 – based on N11 northbound data.
    - 3,200 (southbound) between Junction 6 and Junction 8 based on reduction below 3,550 in light of the local conditions highlighted.
    - 3,550 (both directions) between Junction 8 and Junction 14 – based on N11 northbound data.

Table B.3: Practical Capacity

Road	Junction No.	Junction Name	No. of Lanes	Practical Capacity (vehicles/lane/hour)	
				Northbound	Southbound
M50	16 – 17	Cherrywood – M11	2	4,600	4,600
M11	3 – 4	Loughlinstown – M50	2	3,400	3,400
	4 – 5	M50/M11 – Bray North	2+1	6,300	6,300
	5 – 6	**Bray North – Bray Central**	**2**	**4,600**	**3,850**
N11	6 – 6a	Bray Central – Herbert Road/R117	2	3,550	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	3,550	3,200
	7 – 8	Bray South - Kilmacanogue	2	3,550	3,200
	8 – 9	**Kilmacanogue – Glen of the Downs**	**2**	**3,550**	**3,550**
	9 – 10	Glen of the Downs - Delgany	2	3,550	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	3,550	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	3,550	3,550
	12 – 13	Newtown MK - Newcastle	2	3,550	3,550
	13 – 14	Newcastle – Coyne's Cross	2	3,550	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	4,600	4,600

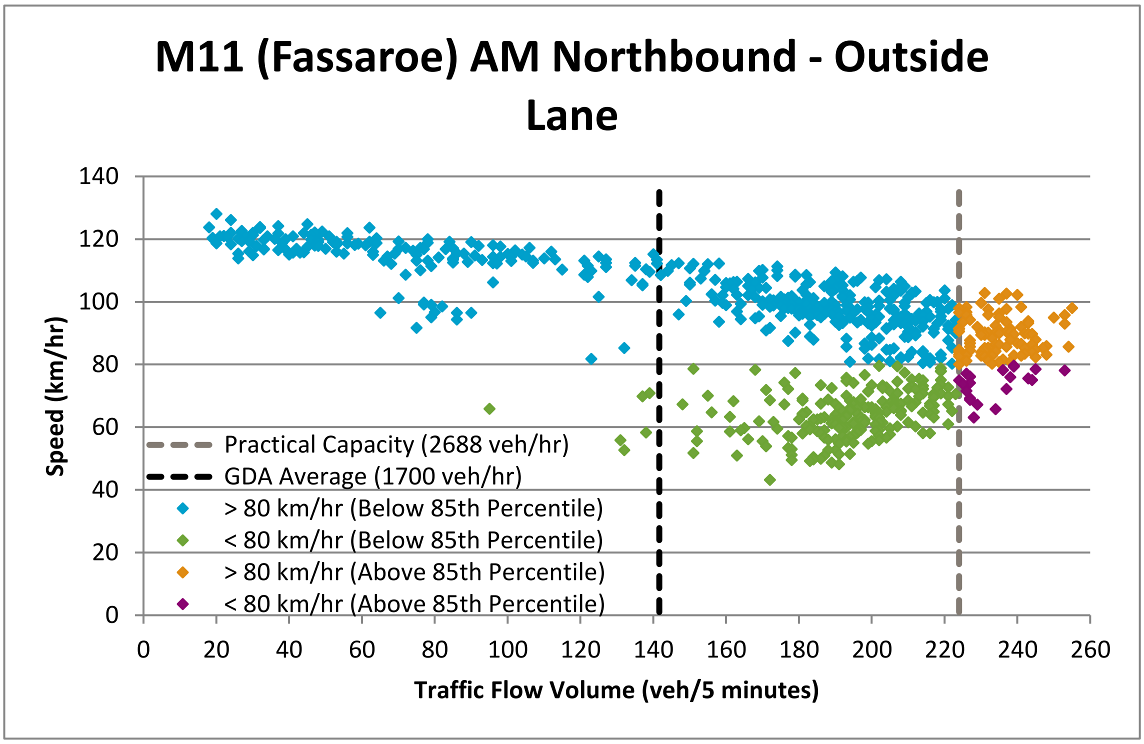


Figure B.1: M11 North of Fassaroe (AM Northbound – Outside Lane)

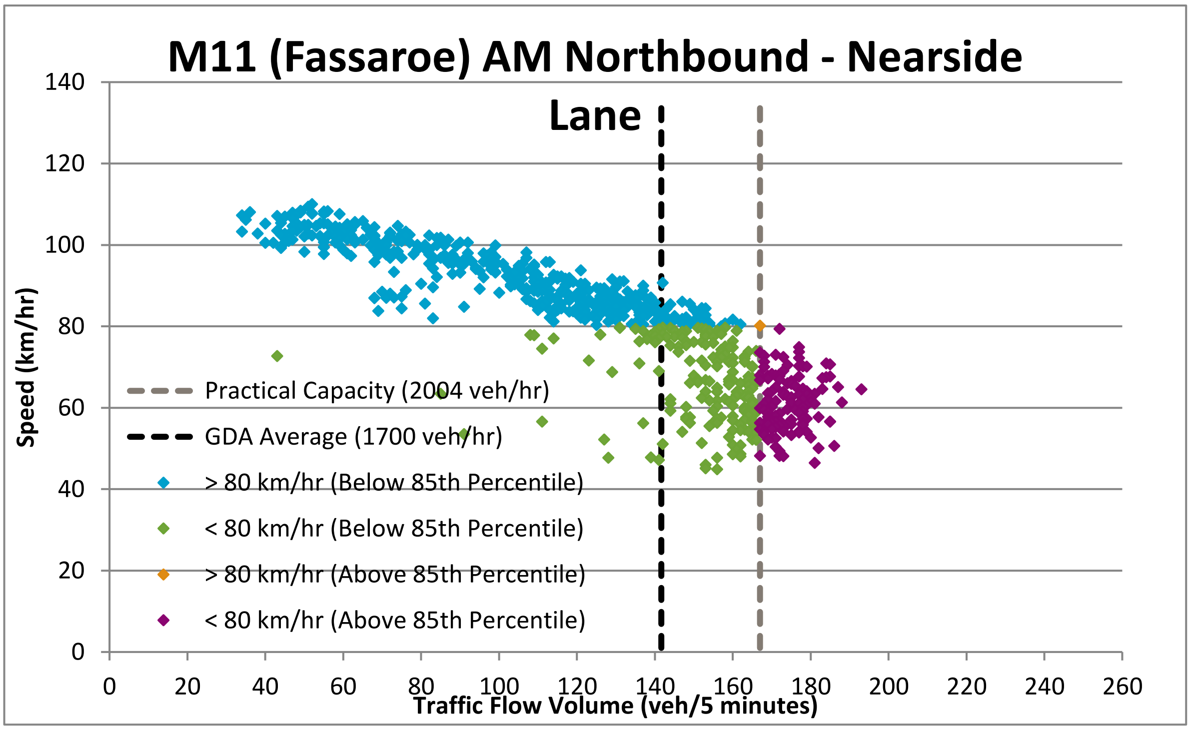


Figure B.2: M11 North of Fassaroe (AM Northbound – Nearside Lane)

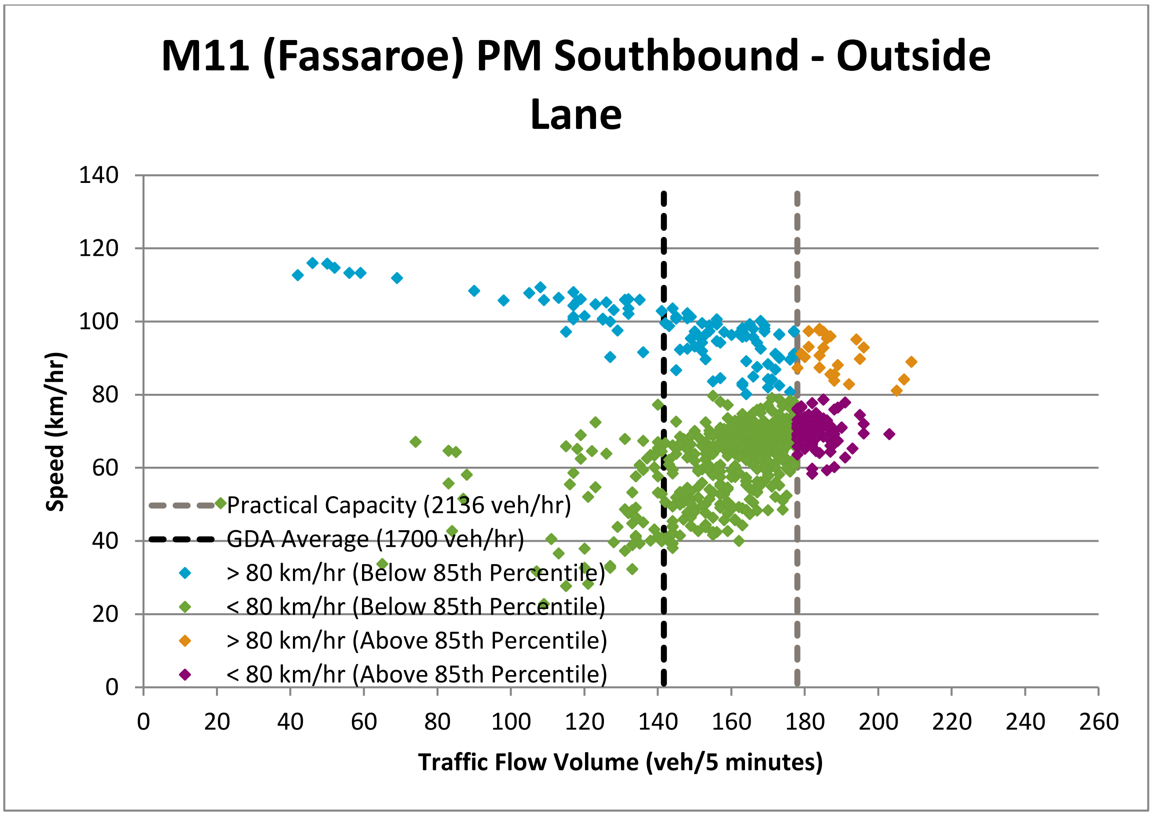


Figure B.3: M11 North of Fassaroe (PM Southbound – Outside Lane)

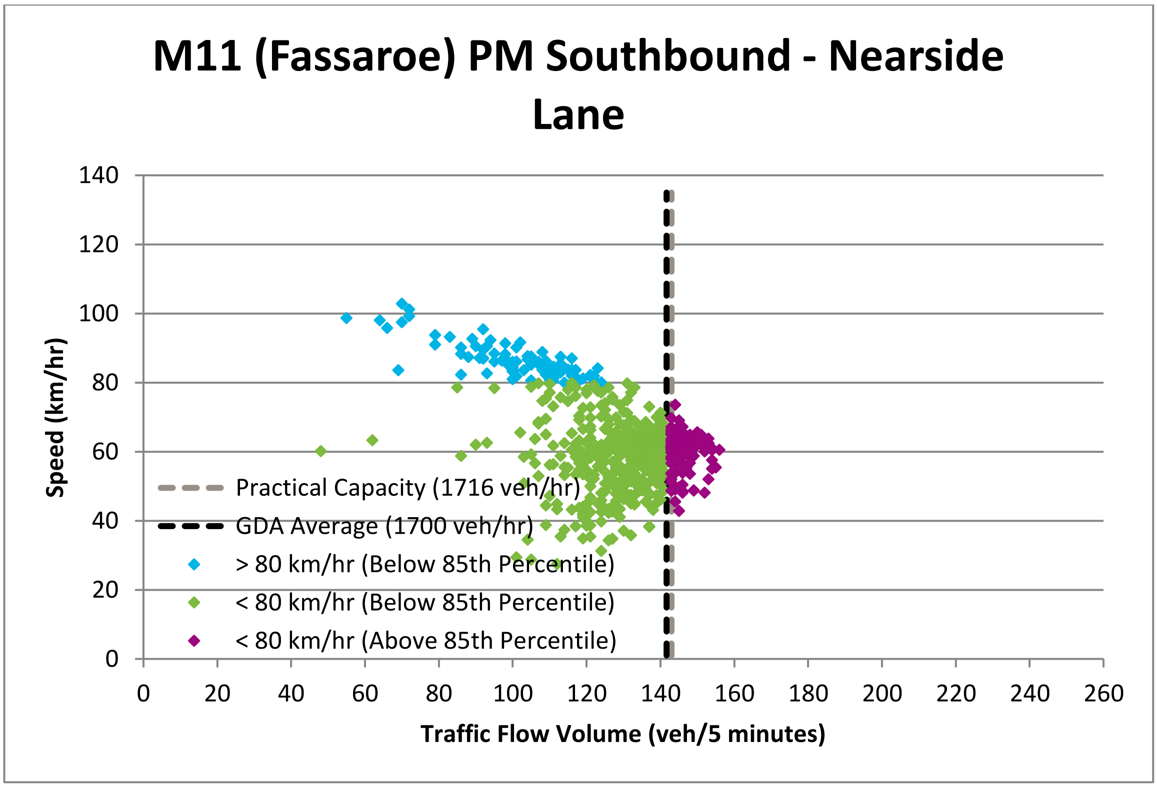


Figure B.4: M11 North of Fassaroe (PM Southbound – Nearside Lane

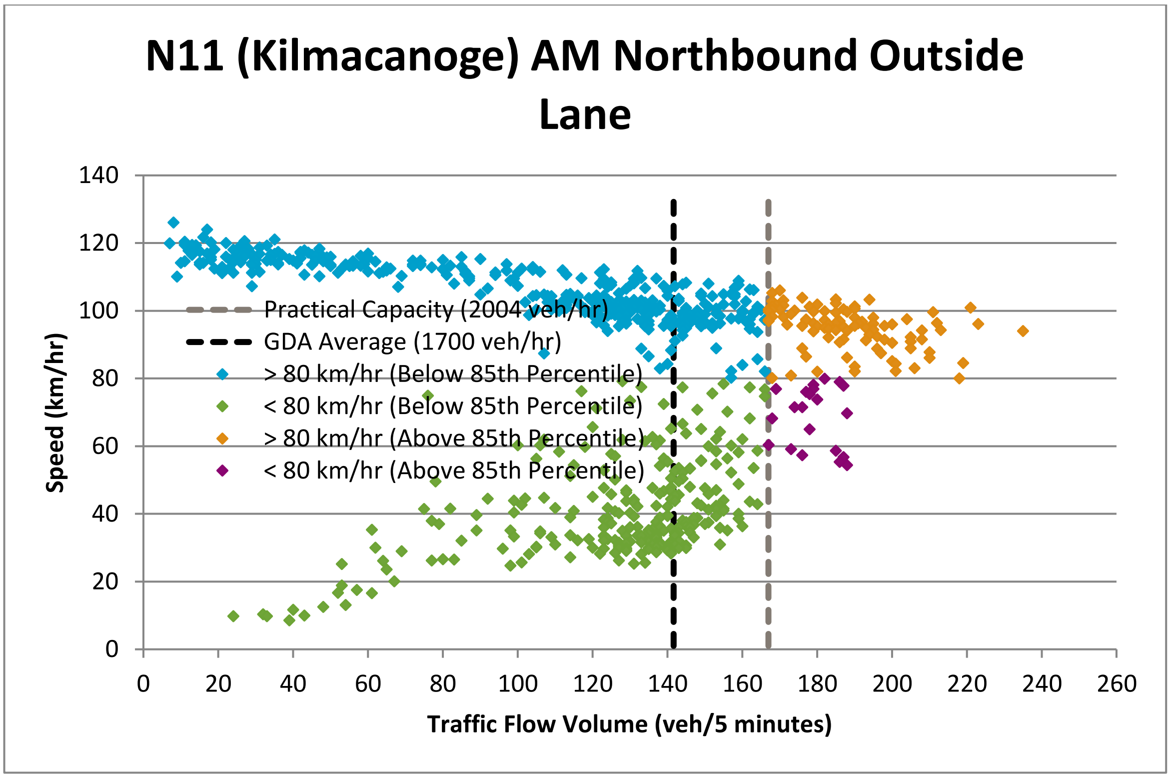


Figure B.5: N11 South of Kilmacanogue (AM Northbound – Outside Lane)

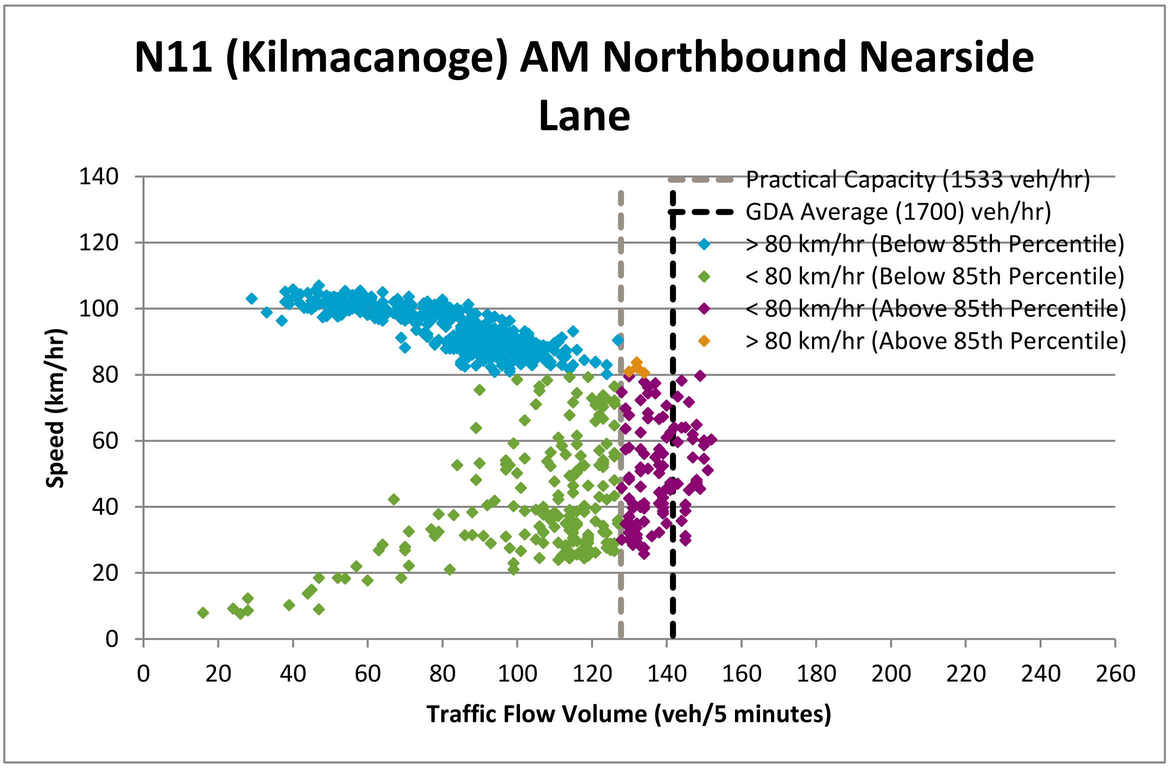


Figure B.6: N11 South of Kilmacanogue (AM Northbound – Nearside Lane)

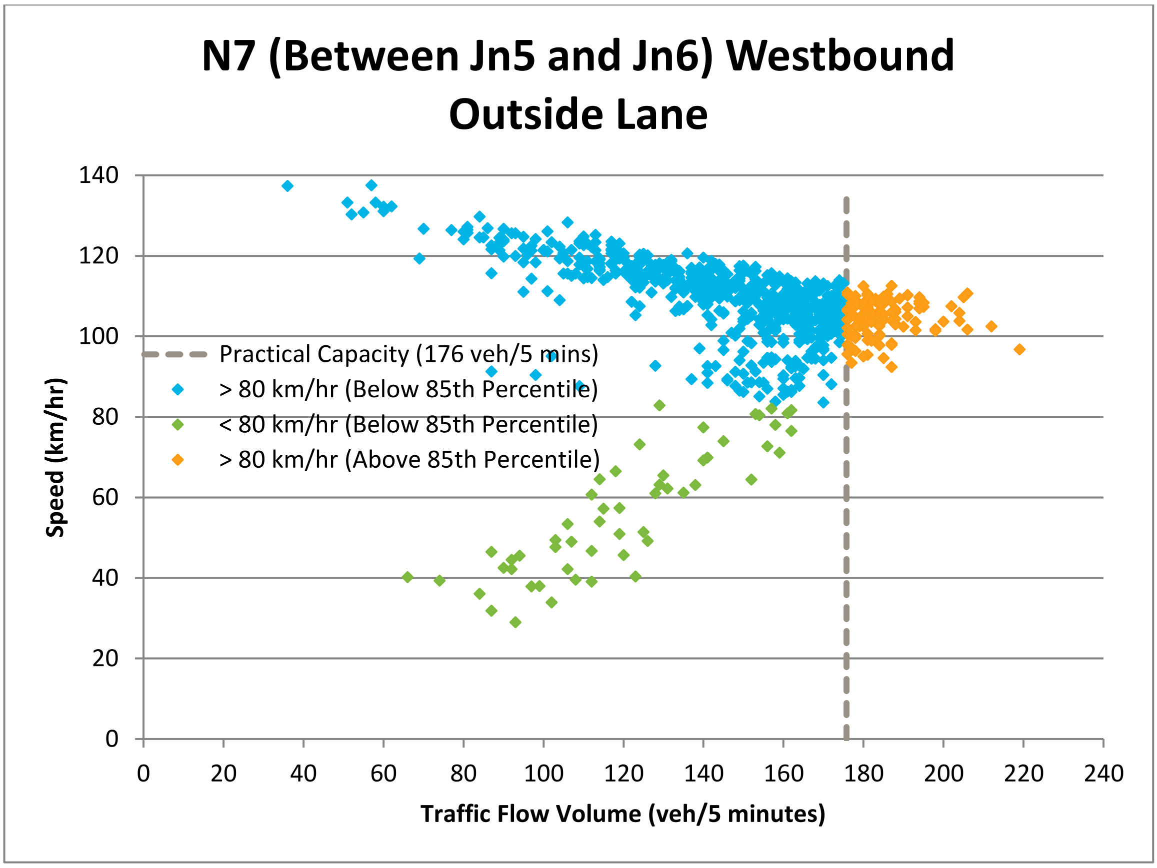


Figure B.7: N7 between Junctions 5 & 6 (PM Westbound – Nearside Lane)

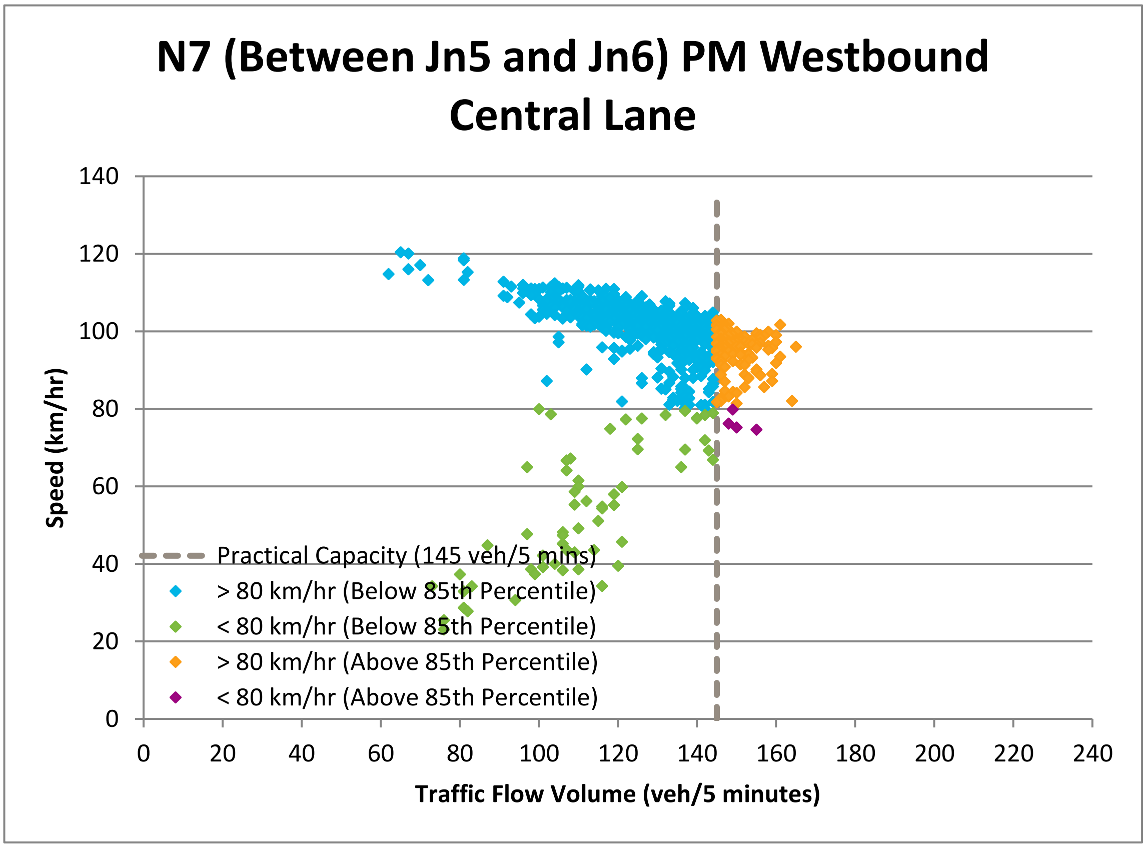


Figure B.8: N7 between Junctions 5 & 6 (PM Westbound – Centre Lane)

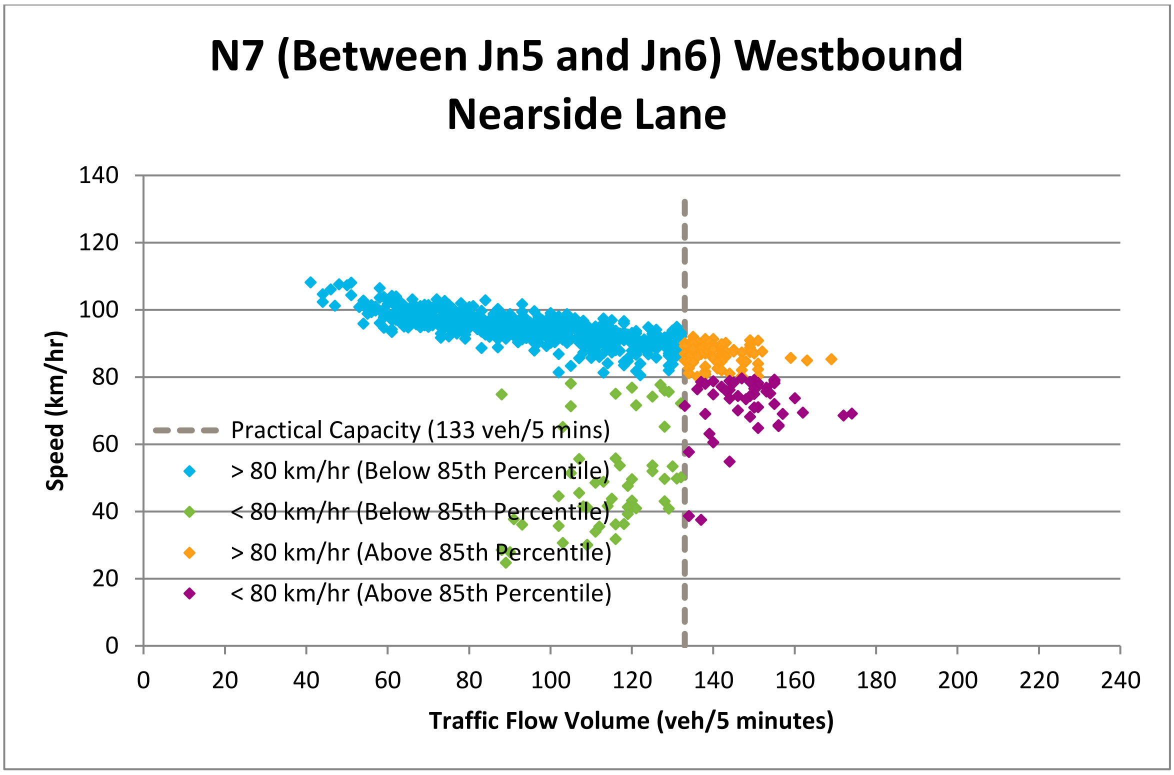


Figure B.9: N7 between Junctions 5 & 6 (PM Westbound – Nearside Lane)

Appendix C

Modelled Flows

Table C.1: 2015 M11/N11 Northbound Peak Hour Flows (Source: 2015 M11/N11 Local Area Model

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	2,811	4,600	1,551	4,600
M11	3 – 4	Loughlinstown – M50	2	1,829	3,400	890	3,400
	4 – 5	M50/M11 – Bray North	2+1	4,640	6,300	2,441	6,300
	5 – 6	Bray North – Bray Central	2	3,902	4,600	2,023	4,600
N11	6 – 6a	Bray Central – Herbert	2	3,985	3,550	2,210	3,550
	6a – 7	Herbert Rd/R117 – Bray South	2	3,979	3,550	2,060	3,550
	7 – 8	Bray South - Kilmacanogue	2	2,905	3,550	1,543	3,550
	8 – 9	Kilmacanogue – Glen of the	2	2,425	3,550	1,348	3,550
	9 – 10	Glen of the Downs - Delgany	2	2,392	3,550	1,307	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,092	3,550	1,126	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,013	3,550	1,253	3,550
	12 – 13	Newtown MK - Newcastle	2	1,613	3,550	1,012	3,550
	13 – 14	Newcastle – Coyne's Cross	2	1,710	3,550	1,031	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	1,698	4,600	1,024	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.2: 2015 M11/N11 Southbound Peak Hour Flows (Source: 2015 M11/N11 Local Area Model)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	1,364	4,600	2,339	4,600
M11	3 – 4	Loughlinstown – M50	2	790	3,400	1,362	3,400
	4 – 5	M50/M11 – Bray North	2+1	2,153	6,300	3,701	6,300
	5 – 6	Bray North – Bray Central	2	1,657	3,850	3,273	3,850
N11	6 – 6a	Bray Central – Herbert	2	1,987	3,200	3,497	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	1,904	3,200	3,159	3,200
	7 – 8	Bray South - Kilmacanogue	2	1,379	3,200	2,855	3,200
	8 – 9	Kilmacanogue – Glen of the	2	1,210	3,550	2,496	3,550
	9 – 10	Glen of the Downs - Delgany	2	1,173	3,550	2,464	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	1,041	3,550	2,294	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	1,110	3,550	2,118	3,550
	12 – 13	Newtown MK - Newcastle	2	903	3,550	1,703	3,550
	13 – 14	Newcastle – Coyne's Cross	2	932	3,550	1,831	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	972	4,600	1,920	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.3: 2030 Do-Minimum M11/N11 Northbound Peak Hour Flows (Source: 2030 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	3,390	4,600	2014	4,600
M11	3 – 4	Loughlinstown – M50	2	2,021	3,400	992	3,400
	4 – 5	M50/M11 – Bray North	2+1	5,411	6,300	3006	6,300
	5 – 6	Bray North – Bray Central	2	4,714	4,600	2444	4,600
N11	6 – 6a	Bray Central – Herbert	2	4,855	3,550	2546	3,550
	6a – 7	Herbert Rd/R117 – Bray South	2	4,866	3,550	2314	3,550
	7 – 8	Bray South - Kilmacanogue	2	3,978	3,550	1875	3,550
	8 – 9	Kilmacanogue – Glen of the	2	3,270	3,550	1665	3,550
	9 – 10	Glen of the Downs - Delgany	2	3,232	3,550	1624	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,796	3,550	1436	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,653	3,550	1633	3,550
	12 – 13	Newtown MK - Newcastle	2	2,040	3,550	1214	3,550
	13 – 14	Newcastle – Coyne's Cross	2	2,125	3,550	1232	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,227	4,600	1234	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.4: 2030 Do-Minimum M11/N11 Southbound Peak Hour Flows (Source: 2030 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	1,813	4,600	2,968	4,600
M11	3 – 4	Loughlinstown – M50	2	890	3,400	1,617	3,400
	4 – 5	M50/M11 – Bray North	2+1	2,704	6,300	4,584	6,300
	5 – 6	Bray North – Bray Central	2	2,150	3,850	4,085	3,850
N11	6 – 6a	Bray Central – Herbert Road/R117	2	2,337	3,200	4,143	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	2,269	3,200	4,054	3,200
	7 – 8	Bray South - Kilmacanogue	2	1,850	3,200	3,564	3,200
	8 – 9	Kilmacanogue – Glen of the Downs	2	1,546	3,550	3,103	3,550
	9 – 10	Glen of the Downs - Delgany	2	1,510	3,550	3,068	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	1,323	3,550	2,888	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	1,402	3,550	2,679	3,550
	12 – 13	Newtown MK - Newcastle	2	1,078	3,550	2,160	3,550
	13 – 14	Newcastle – Coyne's Cross	2	1,095	3,550	2,366	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	1,140	4,600	2,465	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.5: 2050 Do-Minimum M11/N11 Northbound Peak Hour Flows (Source: 2050 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	3,678	4,600	2,206	4,600
M11	3 – 4	Loughlinstown – M50	2	2,168	3,400	1,080	3,400
	4 – 5	M50/M11 – Bray North	2+1	5,846	6,300	3,286	6,300
	5 – 6	Bray North – Bray Central	2	5,013	4,600	2,627	4,600
N11	6 – 6a	Bray Central – Herbert Road/R117	2	5,038	3,550	2,671	3,550
	6a – 7	Herbert Rd/R117 – Bray South	2	5,077	3,550	2,331	3,550
	7 – 8	Bray South - Kilmacanogue	2	3,959	3,550	1,773	3,550
	8 – 9	Kilmacanogue – Glen of the Downs	2	3,326	3,550	1,539	3,550
	9 – 10	Glen of the Downs - Delgany	2	3,273	3,550	1,497	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,915	3,550	1,269	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,785	3,550	1,417	3,550
	12 – 13	Newtown MK - Newcastle	2	2,084	3,550	879	3,550
	13 – 14	Newcastle – Coyne's Cross	2	2,209	3,550	866	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,319	4,600	862	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.6: 2050 Do-Minimum M11/N11 Southbound Peak Hour Flows (Source: 2050 Do-Minimum M11/N11 LAM)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour)		PM Peak (17:00 – 18:00) (vehicles/hour)	
				Demand Flow	Practical Link Specific Capacity	Demand Flow	Practical Link Specific Capacity
M50	16 – 17	Cherrywood – M11	2	2,197	4,600	3,218	4,600
M11	3 – 4	Loughlinstown – M50	2	1,036	3,400	1,693	3,400
	4 – 5	M50/M11 – Bray North	2+1	3,233	6,300	4,910	6,300
	5 – 6	Bray North – Bray Central	2	2,424	3,850	4,300	3,850
N11	6 – 6a	Bray Central – Herbert Road/R117	2	2,510	3,200	4,468	3,200
	6a – 7	Herbert Rd/R117 – Bray South	2	2,316	3,200	4,379	3,200
	7 – 8	Bray South - Kilmacanogue	2	1,862	3,200	3,811	3,200
	8 – 9	Kilmacanogue – Glen of the Downs	2	1,702	3,550	3,292	3,550
	9 – 10	Glen of the Downs - Delgany	2	1,647	3,550	3,255	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	1,523	3,550	3,089	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	1,612	3,550	2,845	3,550
	12 – 13	Newtown MK - Newcastle	2	1,229	3,550	2,261	3,550
	13 – 14	Newcastle – Coyne's Cross	2	1,250	3,550	2,488	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	1,301	4,600	2,585	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.7: 2030 Do-Something Scenario 1 - M11/N11 Northbound Peak Hour Flows

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour) Demand Flow		PM Peak (17:00 – 18:00) (vehicles/hour) Demand Flow		Do-Something Practical Capacity (vehicles/hour)
				DM	DS 1	DM	DS 1	Link Specific
M50	16 – 17	Cherrywood – M11	2	3,390	3,394	2,035	1,916	4,600
M11	3 – 4	Loughlinstown – M50	2	2,021	2,017	1,012	936	3,400
	4 – 5	M50/M11 – Bray North	3+1	5,411	5,411	3,047	2,852	8,600
	5 – 6	Bray North – Bray Central	3	4,714	4,729	2,513	2,299	6,900
N11	6 – 6a	Bray Central – Herbert Road/R117	3	4,855	4,856	2,608	2,397	5,450
	6a – 7	Herbert Rd/R117 – Bray South	3	4,866	4,867	2,380	2,147	5,450
	7 – 8	Bray South - Kilmacanogue	3	3,978	3,984	1,853	1,876	5,450
	8 – 9	Kilmacanogue – Glen of the Downs	2	3,270	3,274	1,636	1,666	3,550
	9 – 10	Glen of the Downs - Delgany	2	3,232	3,237	1,595	1,624	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	2,796	2,797	1,411	1,436	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	2,653	2,653	1,623	1,633	3,550
	12 – 13	Newtown MK - Newcastle	2	2,040	2,040	1,205	1,214	3,550
	13 – 14	Newcastle – Coyne's Cross	2	2,125	2,125	1,227	1,232	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,227	2,227	1,229	1,234	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Table C.8: 2030 Do-Something Scenario 1 - M11/N11 Southbound Peak Hour Flows

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) (vehicles/hour) Demand Flow		PM Peak (17:00 – 18:00) (vehicles/hour) Demand Flow		Do-Something Practical Capacity (vehicles/hour)
				DM	DS 1	DM	DS 1	Link Specific
M50	16 – 17	Cherrywood – M11	2	1,806	1,833	2,968	2,970	4,600
M11	3 – 4	Loughlinstown – M50	2	903	870	1,617	1,617	3,400
	4 – 5	M50/M11 – Bray North	3+1	2,709	2,703	4,584	4,587	8,600
	5 – 6	Bray North – Bray Central	3	2,066	2,159	4,085	4,085	5,750
N11	6 – 6a	Bray Central – Herbert Road/R117	3	2,190	2,346	4,143	4,141	5,000
	6a – 7	Herbert Rd/R117 – Bray South	3	2,081	2,277	4,054	4,057	5,000
	7 – 8	Bray South - Kilmacanogue	3	1,650	1,851	3,564	3,556	5,000
	8 – 9	Kilmacanogue – Glen of the Downs	2	1,479	1,546	3,103	3,094	3,550
	9 – 10	Glen of the Downs - Delgany	2	1,441	1,510	3,068	3,059	3,550
	10 – 11	Delgany – Greystones (Kilpedder)	2	1,331	1,322	2,888	2,888	3,550
	11 – 12	Greystones (Kilpedder)–Newtown	2	1,425	1,402	2,679	2,679	3,550
	12 – 13	Newtown MK - Newcastle	2	1,086	1,078	2,160	2,159	3,550
	13 – 14	Newcastle – Coyne's Cross	2	1,111	1,095	2,366	2,365	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	1,157	1,140	2,465	2,464	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

Appendix D

Option Assessment

Project:	TII TP4 Transport Modelling (M11/N11 Models)	**Job No:**	60266721 – 4.15
Subject:	M11/N11 Corridor Study – Need Assessment Report (Traffic Modelling & Assessment)		
Prepared by:	C. De Courcy/Liam O'Brien	**Date:**	31.03.2017
Checked by:	Philip Shiels	**Date:**	31.03.2017
Approved by:	Colin Acton	**Date:**	31.03.2017

1.0 Introduction

This Technical Note forms an Appendix to the Needs Assessment Report developed as part of the M11/N11 Corridor Study by AECOM-Roughan & O'Donovan on behalf of Transport Infrastructure Ireland (TII). The M11/N11 Corridor Study considers the section of the M11/N11 between Junction 4 (M50/M11) and Junction 14 (Coynes Cross) only. The objectives of the M11/N11 Corridor Study are to:

1. Identify the improvements required to:
   - Bring the section of the corridor (M11/N11 mainline and junctions) up to the appropriate standard;
   - Develop the regional and local road network to support local access and complement the corridor strategy, including the closure of all direct accesses; and
   - Ensure the safe daily operation of the M11/N11 mainline and junctions in the event of the occurrence of incidents.

2. Identify a phased implementation of the improvements such that operational benefits on the corridor can be realised at an early stage without compromising the long term strategy.

This Technical Note relates only to the improvements required and outlines the various measures which were considered in relation to increasing the capacity of the M11/N11 corridor and regional/local road network in order to meet the future needs. The phased implementation of the recommended measures is dealt with in the main body of the report.

2.0 Objective of Technical Note

The objective of this Technical Note is to identify, test and assess a number of proposed measures to M11/N11 mainline, mainline junctions and regional/local road network which may improve the operation and increase the capacity of the M11/N11 corridor. The findings of this assessment are then used to inform the identification of an Emerging Preferred Strategy for the M11/N11 corridor.

3.0 Proposed Infrastructure Measures

This section describes the proposed infrastructure measures which were considered and assessed using the M11/N11 Local Area Models (LAM) [1]developed as part of the M11/N11 Corridor Study. The proposed measures are grouped into four sub-areas based on the objectives of the study:

1) M11/N11 mainline measures;
2) M11/N11 junction measures;
3) Regional/Local road network measures; and
4) Alternative route measures (i.e. network resilience).

[1] For full detail of the M11/N11 Local Area Models refer to the Traffic Modelling Report.

3.1 M11/N11 Mainline Measures

The 2030 & 2050 Do-Minimum AM and PM Peak hour LAM's identified the need to consider an increase in the capacity of the M11/N11 corridor between Junction 4 (M50/M11) and Junction 8 (Kilmacanogue). Based on this need the Do-Something (DS) scenario presented in Table 3.1 was tested in the LAM's.

Table 3.1: Do-Something Scenario 1 (Mainline)

Scenario Name	Description
DS 1	3 lanes plus an auxiliary lane on the M11 between Junction 4 (M50/M11) and Junction 5 (Bray North) and 3 lanes in each direction on the M11/N11 between Junction 5 and Junction 8 (Kilmacanogue).

It should be noted that while future year modelled flows indicate a need for 3 mainline lanes between Junctions 7 and 8, the merge and diverge flows are such that this is best achieved by the provision of lane gains and lane drops northbound and southbound at Junction 7 such that the third lane between Junctions 7 and 8 is a continuous auxiliary lane.

Considerations should be given at preliminary design stage to ensure that the possibility of maintaining three mainline lanes through Junction 7 is not precluded.

An assessment of the 2030 and 2050 flows on the M11/N11 corridor in DS 1 is provided in Annex A (Tables A1 and A2) for the AM Peak (northbound) and PM Peak (southbound) directions. The tables demonstrate that the increase in capacity of the M11/N11 corridor to Junction 8 (Kilmacanogue) can cater for the projected flows in both 2030 and 2050.

3.2 M11/N11 Mainline Junction Measures

Table 3.2 outlines the various M11/N11 mainline junction measures considered and tested using the M11/N11 LAMs. The geographic location of these measures is provided in Figure 3.15.

Table 3.2: Do-Something Scenarios (Junction Proposals)

Junction	Scenario Name	Description
J5 - Bray North (Wilford)	DS J5a	Increased capacity (Gyratory layout)
	DS J5b	Increased capacity (Dumbbell layout)
J6 - Bray Central (Fassaroe)	DS J6	Increased capacity (roundabouts and merges/diverges)
J6a – Herbert Road / Enniskerry Road	DS J6a	Closure of direct access between N11 and Herbert Road/Enniskerry Road. This proposal forms part of Do—Something L7. Refer to Do-Something L7 in Section 3.3.7 for full details
J7 - Bray South (Kilcroney)	DS J7	Increased capacity (Dumbbell layout), with potential southbound lane drop and lane gain south of J7, and northbound lane drop and lane gain north of J7.

Junction	Scenario Name	Description
J8 – Kilmacanogue	DS J8	Introduction of single southbound lane drop/service road and single northbound lane gain/service road with associated increase in speed limit of 100km/hr

3.2.1 Do-Something J5a (Junction 5 – Bray North)

Do-Something Junction 5a (DS J5a) which is illustrated in Figure 3.1 is one of two upgrade options considered for Junction 5. This gyratory design was proposed by Atkins in the 'Assessment of the N11 Corridor' report (2013) for Bray Town Council.

The proposal includes for the provision of a new northbound off-ramp, northbound on-ramp, gyratory roundabout and a new link road which provides a connection to Ferndale Road. The existing northbound off ramp, which currently provides a connection to Old Connaught Avenue, is closed as part of this proposal.

The link road between the upgraded junction and Ferndale road will now replace the connection previously provided by the northbound off-ramp (this link road will also provide future network resilience in the case of incidents on the M11 mainline or its closure).

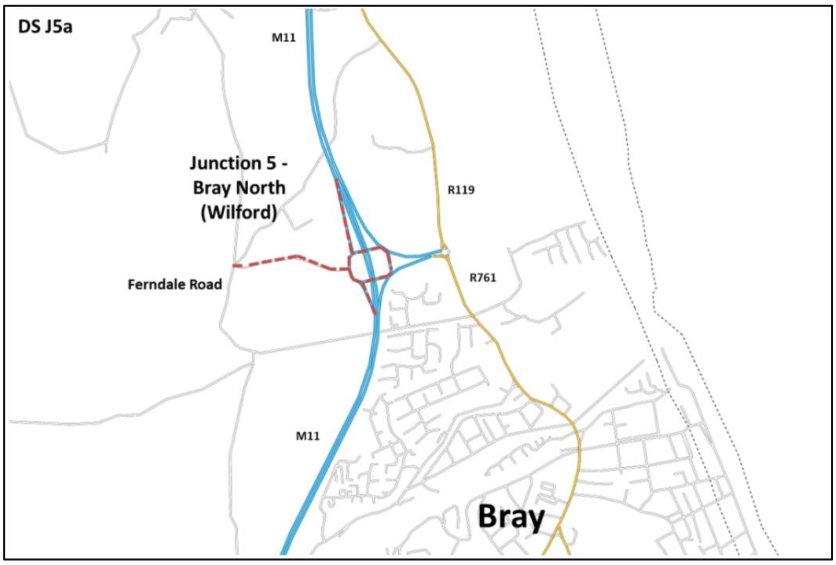


Figure 3.1: Do-Something Scenario J5a

3.2.2 Do-Something J5b (Junction 5 – Bray North)

Do-Something Junction 5b (DS J5b) which is illustrated in Figure 3.2 is the second of the two upgrade options considered for Junction 5. This option allows for a dumbbell arrangement which includes the removal of the existing northbound off-ramp to Old Connaught Avenue, and the provision of a new roundabout on the west side of the junction which will connect the new northbound off-ramp and on-ramp, a new link road to Ferndale Road (seen previously in DS J5a) and a new link to the existing roundabout on the east side of the junction.

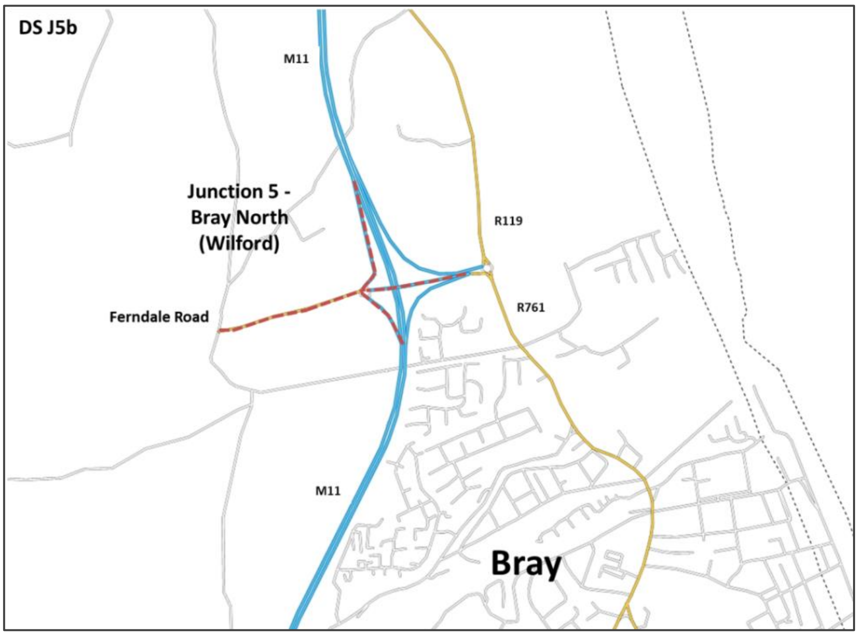


Figure 3.2: Do-Something Scenario J5b

3.2.3 Do-Something J6 (Junction 6 – Bray Central)

Do-Something Junction 6 (DS J6) which is illustrated in Figure 3.3, includes for an upgrade of the existing merges/diverges to the appropriate design standard and an increase in the capacity of the two existing roundabouts of Junction 6.

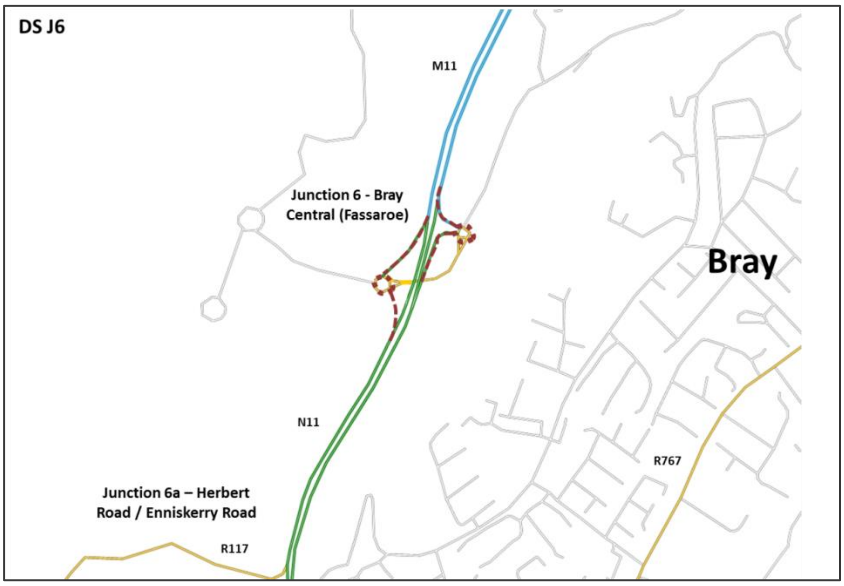


Figure 3.3: Do-Something Scenario J6

3.2.4 Do-Something J6a (Junction 6a Herbert Road/Enniskerry Road)

The existing left on / left off junctions at Herbert Road (southbound) and Enniskerry Road (northbound) are substandard and have a direct impact upon the capacity and operation of the N11 mainline. As the interventions proposed at Junction 6a mainly deals with regional and local roads and do not include a junction test, this proposal forms part of Do-Something L7. Full details of which are provided in Section 3.3.7.

3.2.5 Do-Something J7 (Junction 7 – Bray South)

Do-Something Junction 7 (DS J7) is illustrated in Figure 3.4. This option includes the provision of a new dumbbell arrangement with a longer off ramp and on ramp, and a new roundabout on the west side of the junction which is linked by a new bridge to the existing roundabout, and a new off-ramp and on-ramp for the northbound direction. This option includes the closure of the current northbound on and off-ramps. As part of this proposal, the existing bridge (R768) across the N11 is closed to vehicular traffic.

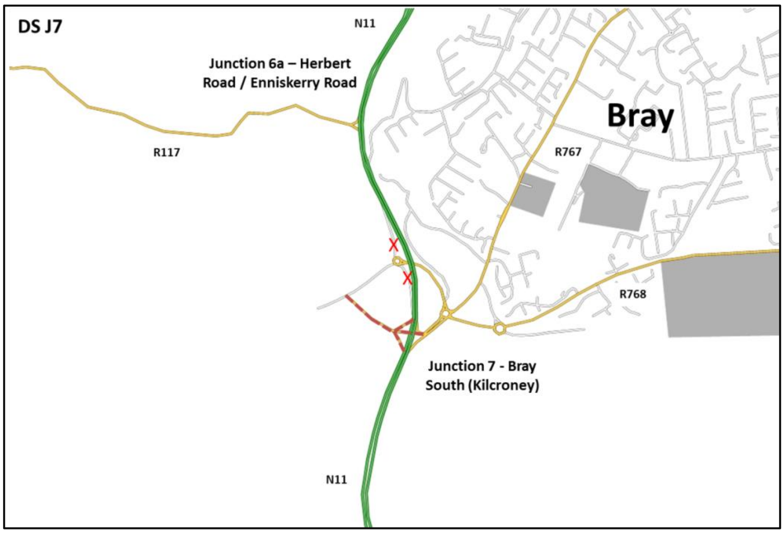


Figure 3.4: Do-Something Scenario J7

3.2.6 Do-Something J8 (Junction 8 – Kilmacanogue)

Do-Something Junction 8 (DS J8) is illustrated in Figure 3.5, this measure includes a new southbound diverge designed to appropriate standard which will incorporate a service road and all accesses. This option also includes a single northbound merge to appropriate standard to incorporate a service road, local junctions and all accesses. This proposal will facilitate the increase of speed limit to 100km/hr in both directions.

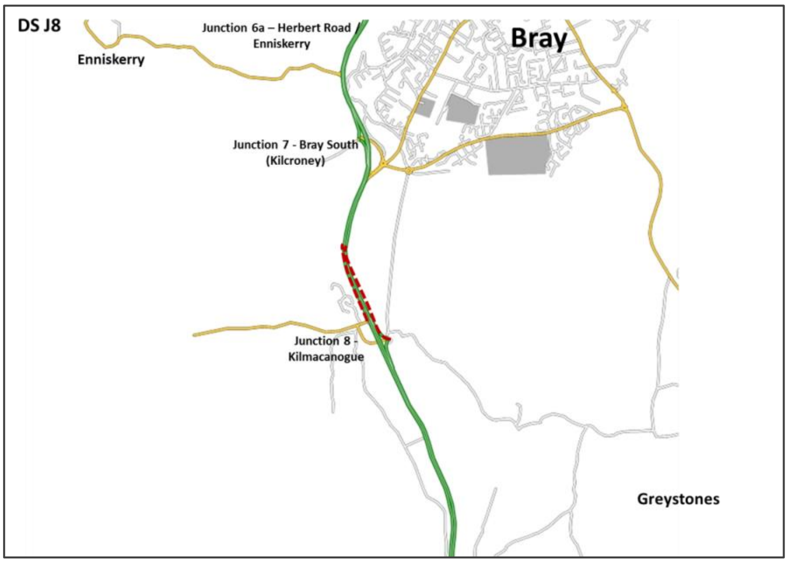


Figure 3.5: Do-Something Scenario J8

3.3 Regional/Local Road Measures

The following sections discuss a number of proposals to improve access between the M11/N11 mainline corridor and the regional/local road network. Many of these proposals were originally identified in the M50/M11/N11 Corridor Strategy[2]. Table 3.3 provides a summary of the measures considered. The geographic location of these measures is provided in Figure 3.15.

Table 3.3: Do-Something Scenarios (Regional/local Road Options)

Scenario Name	Description
DS L1	Link road between Herbert Road and Upper Dargle Road. Provides an additional crossing of the River Dargle allowing more direct access between Junction 6 (Bray Central) and the area of Bray south of the River Dargle
DS L2	Bridge over the N11 (at Junction 6a) between Herbert Road and Enniskerry Road (R117)
DS L3	Link road between Junction 6 (Bray Central/Fassaroe) and Enniskerry
DS L4	Link road between Bray Southern Cross Road (R738) and Junction 8 (Kilmacanogue)
DS L5	North Greystones Link Road
DS L6	Closure of Herbert Road Access to N11 and resulting impact on nearby junctions
DS L7	Provide services roads between Junction 6a and Junctions 6 and 7. Remove direct access onto the N11 at Junction 6a
DS L8	Link road from Rathmichael/Ballycorus Road to M50 Junction 16 (Cherrywood)

3.3.1 Do-Something L1 – Herbert/Dargle Road Link

Do-Something L1 (DS L1) which is illustrated indicatively in Figure 3.6 aims to improve access between the M11/N11 corridor and Bray by providing an additional crossing of the River Dargle in the vicinity of Junction 6. This proposal would reduce traffic on the N11 corridor between Junctions 6 and 7 as vehicles would be able to access the southern areas of Bray via Junction 6.

The provision of this additional crossing of the River Dargle would also have added advantages to traffic movement within Bray, as well as improving the connectivity between Bray and development proposals at Fassaroe.

[2] M50/M11/N11 Corridor Study Final Report, Transport Infrastructure Ireland, January 2012.

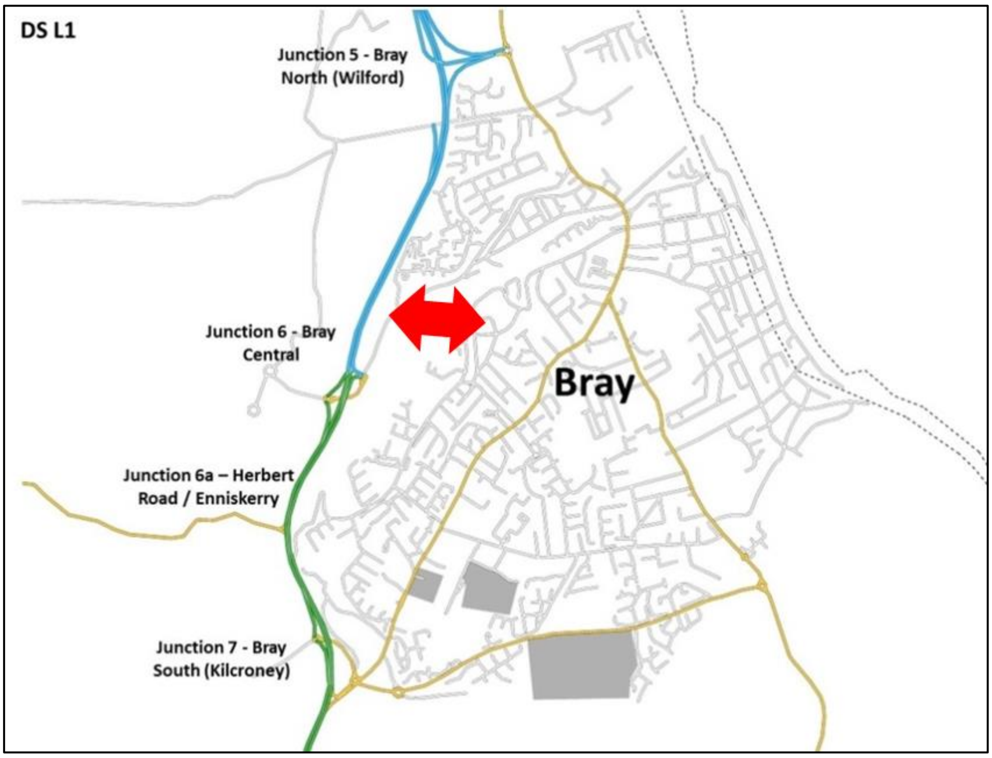


Figure 3.6: Do-Something L1

3.3.2 Do-Something L2 – Bridge Over N11 at Junction 6a

Do-Something L2 (DS L2) which is illustrated in Figure 3.7 provides for a crossing of the N11 at Junction 6a (Herbert Road/Enniskerry Road). The intention of this proposal is to provide direct east-west access between Bray and Enniskerry (the junction currently operates as a left in/left out only junction east and west of the N11). This proposal would remove the need for traffic to utilise Junctions 6 & 7 in order to make a U-turn to access the N11 or Bray/Enniskerry. Direct access to the N11 via Junction 6a is maintained as part of the proposal.

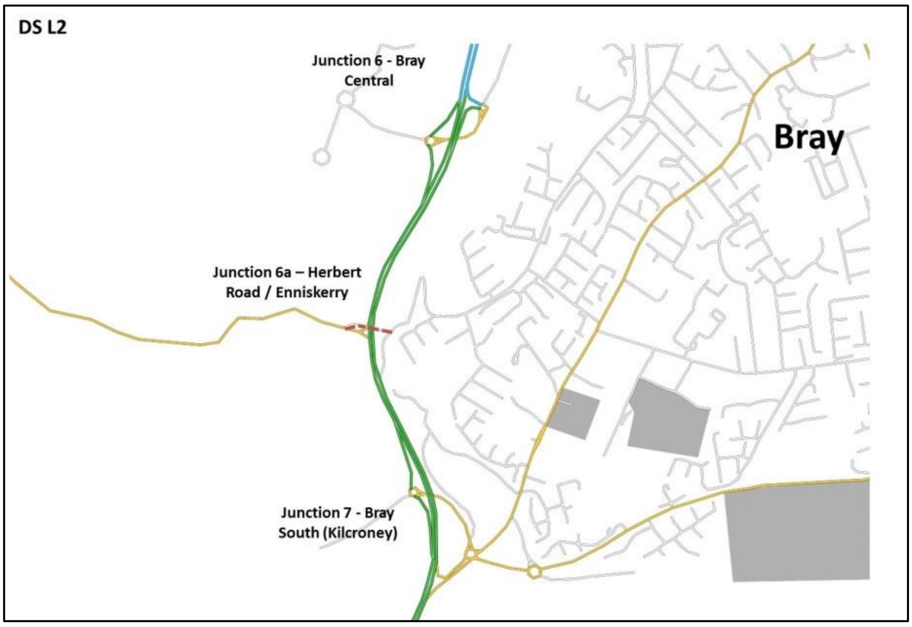


Figure 3.7: Do-Something L2

3.3.3 Do-Something L3 – Enniskerry Link Road

Do-Something L3 (DS L3) which is illustrated in Figure 3.8 aims to improve access between Enniskerry and the M11/N11 corridor/Bray by upgrading the existing local road (Berryfield Lane). Berryfield Lane currently provides a connection between Junction 6 and the R117 north of Enniskerry, however the route is of poor cross section and alignment at present. The intention of this proposal is to provide an alternative route between Enniskerry and the M11/N11 via Junction 6.

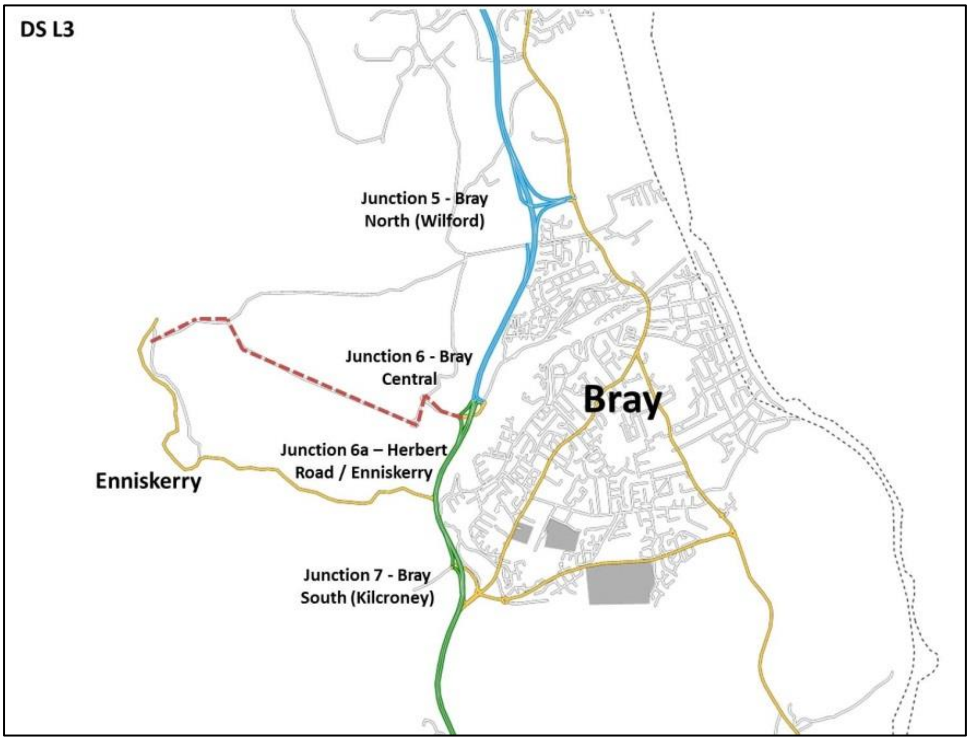


Figure 3.8: Do-Something L3

3.3.4 Do-Something L4 – Kilmacanogue to Bray Southern Cross Link Road

Do-Something L4 (DS L4) which is illustrated in Figure 3.9 provides for a connection between Junction 8 (Kilmacanogue) and Bray Southern Cross Road (R768). The intention of this proposal is to reduce the level of traffic through Junction 7 (Bray South/Kilcroney) and on the N11 between Junction 7 (Bray South/Kilcroney) and Junction 8 (Kilmacanogue). This proposal would also include the Do-Something J8 services road proposals at Junction 8 (Kilmacanogue) as discussed in Section 3.2.6.

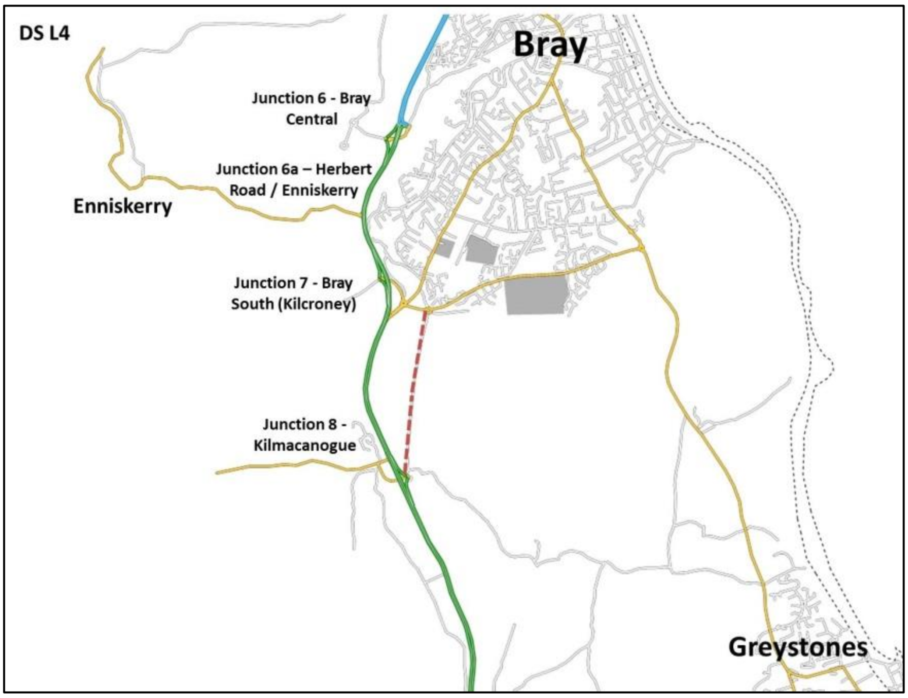


Figure 3.9: Do-Something L4

3.3.5 Do-Something L5 – North Greystones Link Road

Do-Something L5 (DS L5) which is illustrated in Figure 3.10 provides for a new link road from the R761 at Greystones to Ballydonagh Road (as identified in the 'Greystones-Delgany and Kilcoole Local Area Plan 2013-2019' improving access onwards to the N11 at Junction 9 (Glen of the Downs).

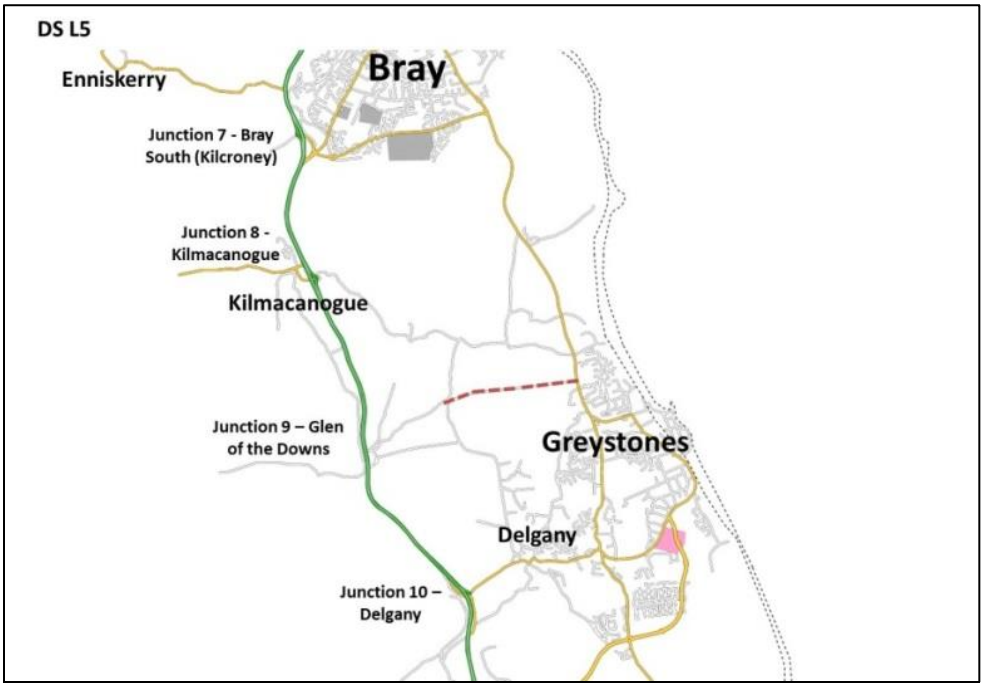


Figure 3.10: Do-Something L5

3.3.6 Do-Something L6 – Closure of Direct Access at Junction 6a between N11 and Herbert Road

Do-Something L6 (DS L6) which is illustrated in Figure 3.11 aims to close access to and from Junction 6a at Herbert Road on the N11 southbound carriageway. The diverge at this location is a tight radius bend and the intention of this proposal is to improve the operation of the southbound section of the N11 between Junctions 6 and 7.

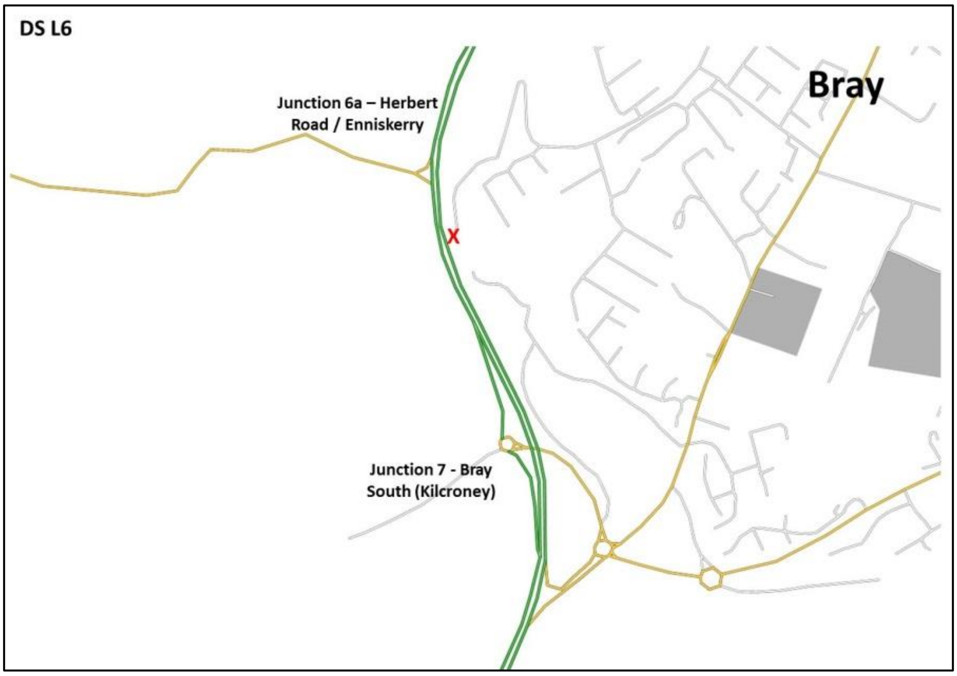


Figure 3.11: Do-Something L6

3.3.7 Do-Something L7 – Closure of Direct Access to N11 at Junction 6a plus Services Roads

Do-Something L7 (DS L7) which is illustrated in Figure 3.12 provides for new service roads adjacent to the N11 connecting Junction 6a to both Junction 6 and Junction 7. On the western side of the N11, Junction 6a (R117 - Enniskerry Road) will be connected to both Junction 6 and 7 via segregated one-way services road and direct access to the N11 will be closed. On the eastern side of the N11, a one-way segregated service road will commence north of Dargle Lane and connect Junction 6a (Herbert Road) to Junction 7. Direct access between the N11 and Junction 6a (Herbert Road) will be closed (as outlined in DS 6a).

The intention of this proposal is to effectively remove direct access onto the N11 at Junction 6a from both Herbert Road and the R117, to allow traffic to join the N11 at junctions of a higher standard that are in line with TEN-T requirements. This will also have the effect of raising the southbound mainline capacity by removing the weaving movements and slower moving vehicles at this location.

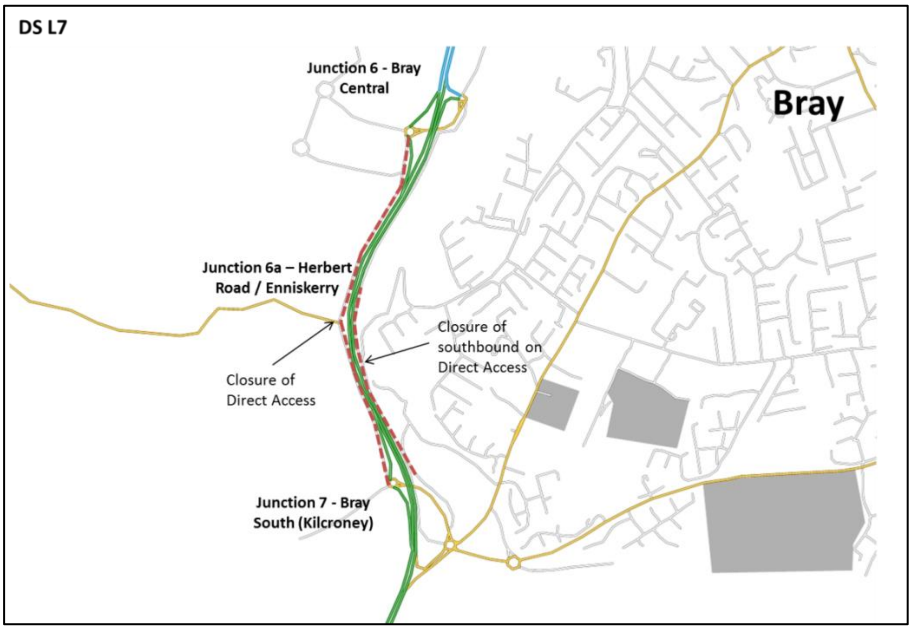


Figure 3.12: Do-Something L7

3.3.8 Do-Something L8 – M50 Cherrywood Junction to Ballycorus Road Link

Do-Something L8 (DS L8) which is illustrated in Figure 3.13 provides for a link road from Rathmichael/Ballycorus Road to M50 Junction 16 (Cherrywood). This proposal provides an alternative route for users travelling from the Shankill area to the M50 by allowing them a more direct route thereby potentially avoiding travelling to this destination via Junction 5 (Bray North/Wilford). It also provides for network resilience in the case of incidents on the M50 or M11.

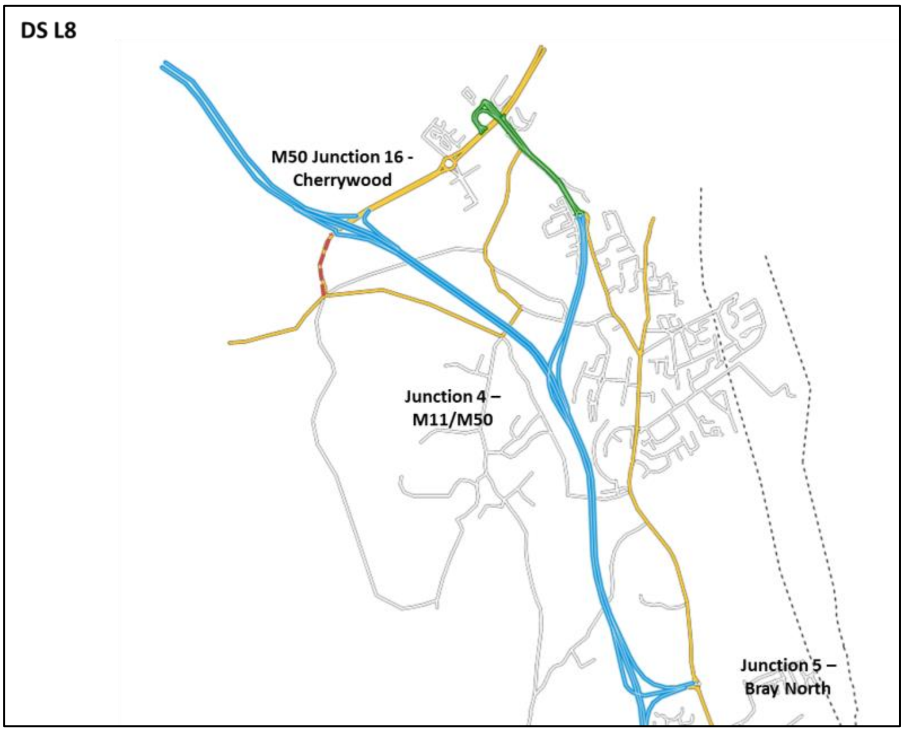


Figure 3.13: Do-Something L8

3.4 Alternative Routes for Incident Management

One of the objectives of the needs assessment is to ensure the safe daily operation of the M11/N11 mainline and junctions in the event of the occurrence of incidents. The unexpected closure of a section of the National Road network particularly one which carries a high volume of traffic can lead to significant delays and wider network impacts. In the event of an unexpected closure an alternative route which provides a safe route to the next junction should be available.

The proposals outlined in Table 3.4, if delivered, would provide an alternative route for traffic if an incident on the M11/M11 required the road to be closed.

Table 3.4: Do-Something Scenarios (Alternative Routes)

Scenario	Description
AR1	Improved local roads to the west of M11 between J4 and J6 (Ferndale Road, part of Thornhill Road plus a new link from Thornhill Road to Fassaroe as per Fassaroe masterplan)
	New link from M50 J16 (Cherrywood) to Rathmichael/Ballycorus Road - (DS L8)
	New local road between Junction 7 & 8 on the east side (Kilmacanogue Link Road) – (DS L4)

3.5 Location of the Do-Something Scenarios

Figure 3.14 depicts the location of each of the proposed measures in the M11/N11 Needs Assessment study area.

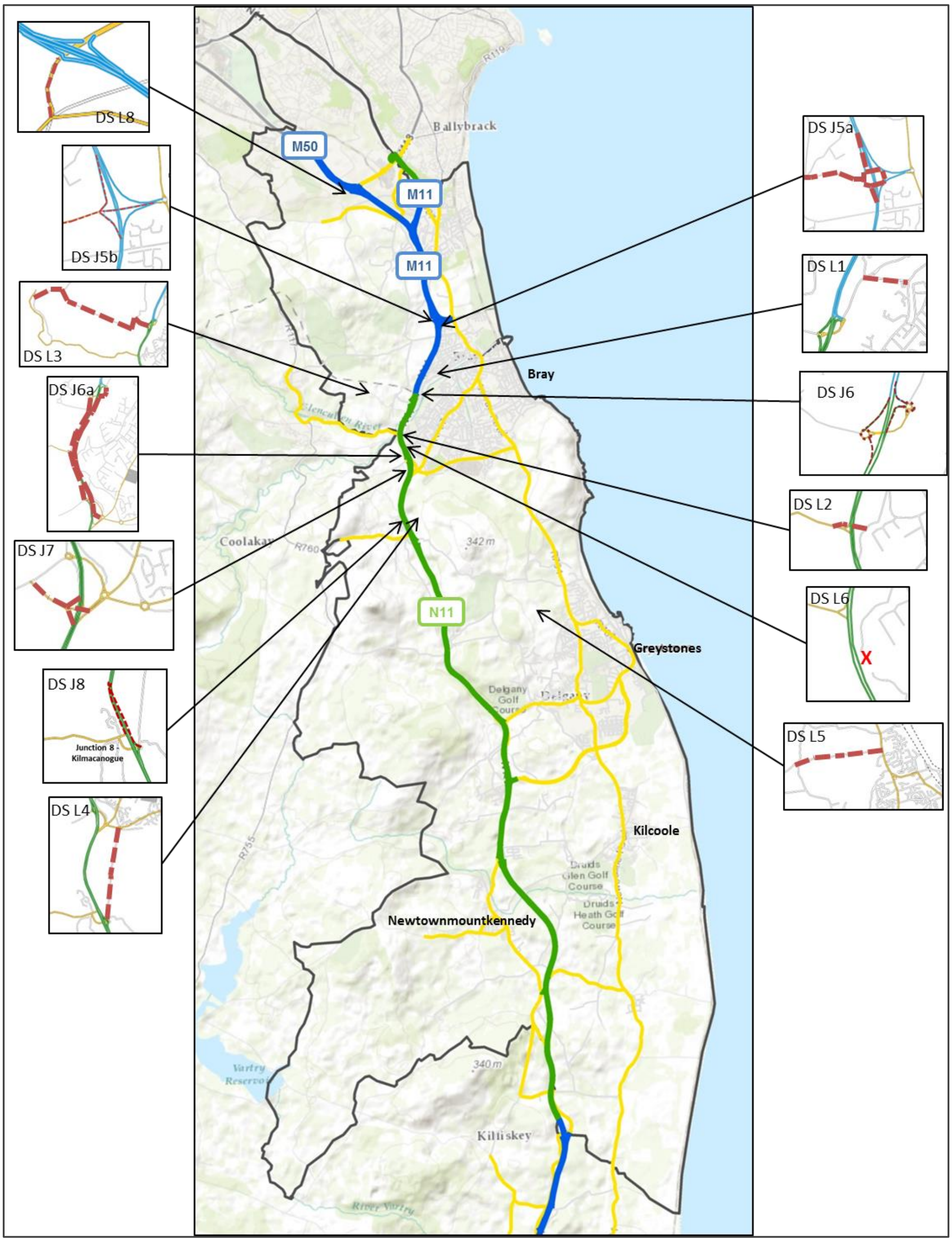


Figure 3.14: Study Area with the Location of Proposed Measures

4.0 Assessment of Proposed Measures

This section presents the impacts of each of the proposed measures. The performance of the various measures is discussed with reference to changes in traffic routing (difference plots), overall network performance (key network statistics) and the impact upon the M11/N11 mainline flows.

Each proposed measure was initially tested using the 2015 LAM's to assess its direct impact in the short term. The results of the 2015 assessment were then used to determine whether the proposed measure provides a notable benefit and is appropriate for further testing in the 2030 LAM's. Finally, the impact of the proposed measure in 2030 was used to inform the overall Emerging Preferred Strategy for the M11/N11 corridor.

4.1 Difference Plots

The difference plots presented in the following sections compare the modelled AM and PM peak static flow volumes for each of the individual 2015 or 2030 Do-Something scenario to their corresponding Do-Minimum volumes. The following points should be noted in the presentation of difference plots:

- The difference plots show the re-assignment (transfer) of traffic from one section of the network to another as a direct result of the proposed measure;
- A red bar indicates a change in flow above the Do-Minimum volume, whilst a green bar indicates a change in flow below the Do-Minimum volumes;
- The thickness of the red or green bar relates to the magnitude of change. The thicker the bar the greater the volume change;
- Do-Something measures J6a and L7 have been combined into one measure for testing (i.e. L7); and
- The impacts of the J8 measures cannot be modelled in the LAMs, as the existing direct accesses that would be served by the proposed services roads are not included in the LAM network.

4.2 Key Network Statistics

The impact of a proposed measure is assessed in relation to its impact upon the performance of the overall network (i.e. all roads included in the modelled network). A proposal may benefit on section on the road network but have a dis-benefit to another section. The network statistics combine both the benefits and dis-benefits (if applicable) of a proposed measure to give an overall indication of the performance of the proposal. The following key network statistics are provided in relation to each of the proposed measures:

- **Total Trips (vehicles per hour)** – Total number of trips assigned to the modelled road network;
- **Total Travel Time (hours)** – Total travel time of each individual trip in the overall network combined;
- **Travel Time per Vehicle (mins)** – Average travel time per vehicle;
- **Total Distance (kilometres)** – Total distance travelled on the modelled road network: and
- **Total Delay (hours)** – Total number of hours of congestion on the modelled road network (total travel time minus free flow travel time).

4.3 Impact Upon M11/N11 Mainline Flows

The impact of a proposed measure in terms of increase or decreasing the flow of traffic on the M11/N11 mainline corridor is provided as part of the assessment.

5.0 2015 Assessment – M11/N11 Mainline Junction Measures

5.1 Junction 5 – Bray North

The AM and PM peak hour modelled flow volumes in DS J5a and DS J5b are compared to the corresponding modelled flow volumes in the Do-Nothing (DN) scenario in the difference plots in Figures 5.1 and 5.2.

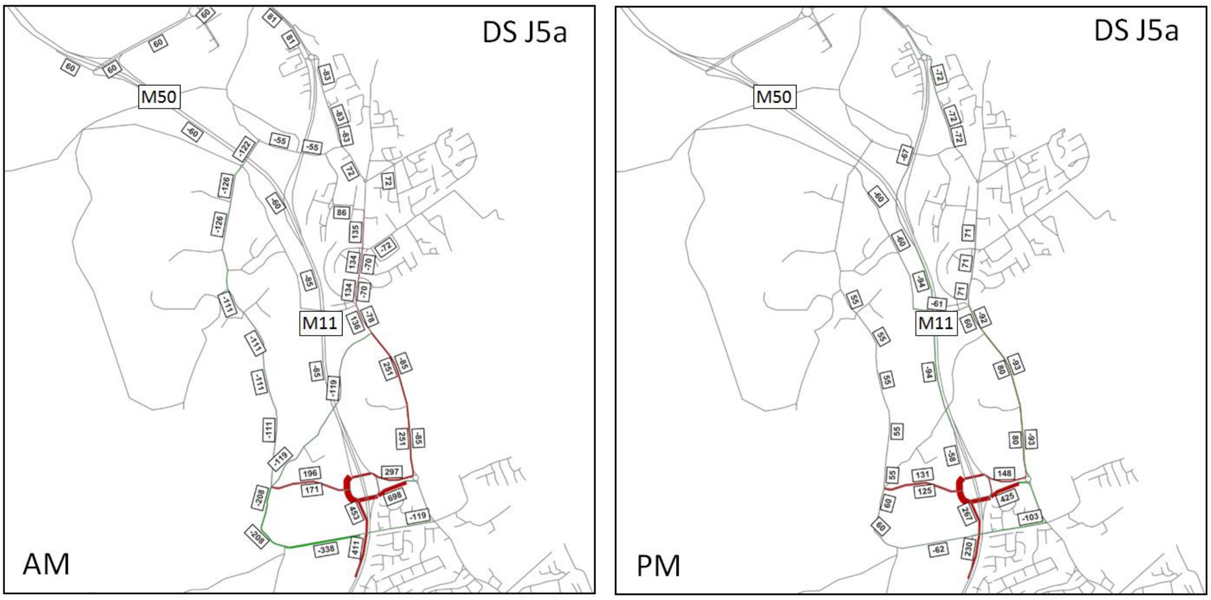


Figure 5.1: DS J5a AM and PM Peak Difference Plots

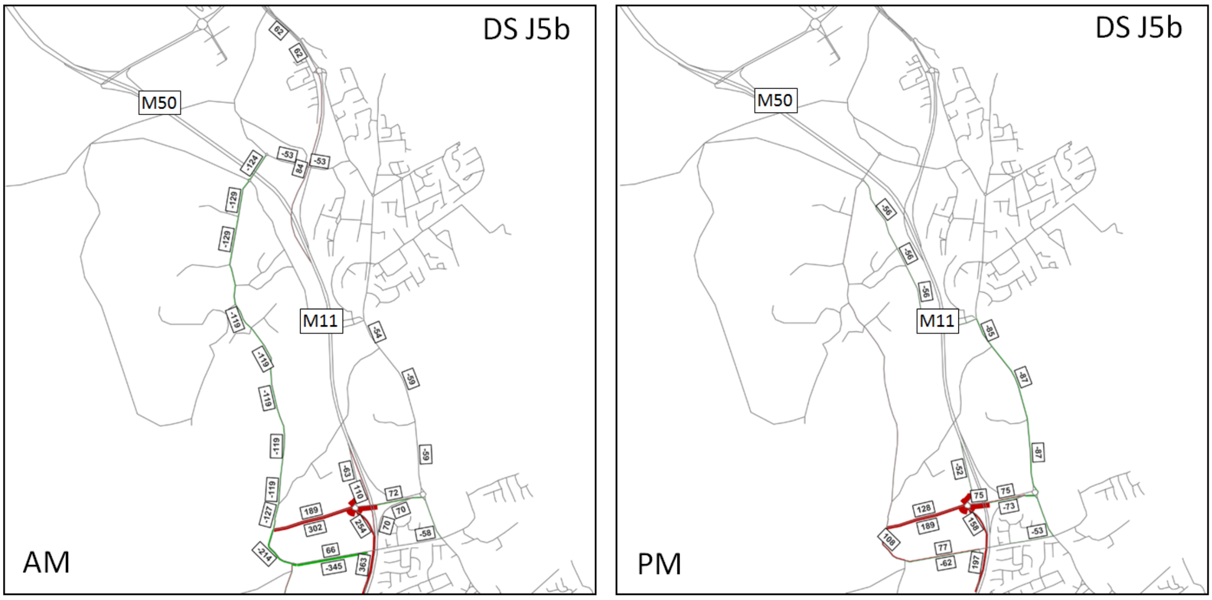


Figure 5.2: DS J5b AM and PM Peak Difference Plots

The closure and relocation of the existing northbound off-ramp and inclusion of the link road between the proposed junction and Ferndale road in both proposals lead to:

- A reduction in traffic on Old Connaught Avenue as traffic now uses the new northbound off ramp and link road to Ferndale Road in both peaks; and

- Changes in flow on both Ferndale Road and the R119 between Bray and Shankill.

5.1.1 Network Statistics

Table 5.1 provides a summary of the key network statistics for both DS J5a and DS J5b scenarios in the AM and PM alongside the Do-Nothing scenario.

Table 5.1: AM & PM Peak Hour Modelled Network Statistics: DS J5a

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS J5a	17,721	4,655	15.76	201,565	1,001
2015 AM DS J5b	17,721	4,655	15.76	201,816	1,001
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS J5a	17,706	4,447	15.07	200,571	806
2015 PM DS J5b	17,706	4,449	15.08	200,754	808

The statistics indicates that neither proposal will have a significant impact upon the overall performance of the network based on 2015 traffic levels. The existing congestion issues on both the M11 mainline and on the regional road network (R761) will not be alleviated by increasing the capacity of this junction.

5.1.2 Impact on M11/N11 Mainline Flows

Referring to Tables C.1 – C.2 (Annex C), both proposals have a negligible impact on the mainline flows of the M11/N11 corridor.

5.1.3 Summary

At present there are no significant congestion/operational issues associated with Junction 5 Bray North (Wilford). Congestion issues in this area are caused not by the limited capacity of the Bray North junction but by the limited capacity of the regional/local road network and by the M11 mainline corridor.

The difference plots and network statistics demonstrated that neither proposal will have a significant impact. Therefore a proposal to upgrade the Bray North junction is not recommended for consideration as part of an Emerging Preferred Strategy. However, future public transport proposals (i.e. Luas extension to Bray) may require the upgrading of the junction and either of the two proposals considered could cater for this, also the link to Ferndale road would provide network resilience in the case on incidents on the M11 mainline corridor.

5.2 Junction 6 – Bray Central

Figure 5.3 depicts the difference plots for the AM and PM peak modelled flow volumes in the DS J6 scenario compared to the corresponding modelled flow volumes in the Do-Nothing scenario. The difference plots indicate that the increase in capacity associated with this proposal only leads to the reassignment of a small number of vehicles on the road network in both peaks.

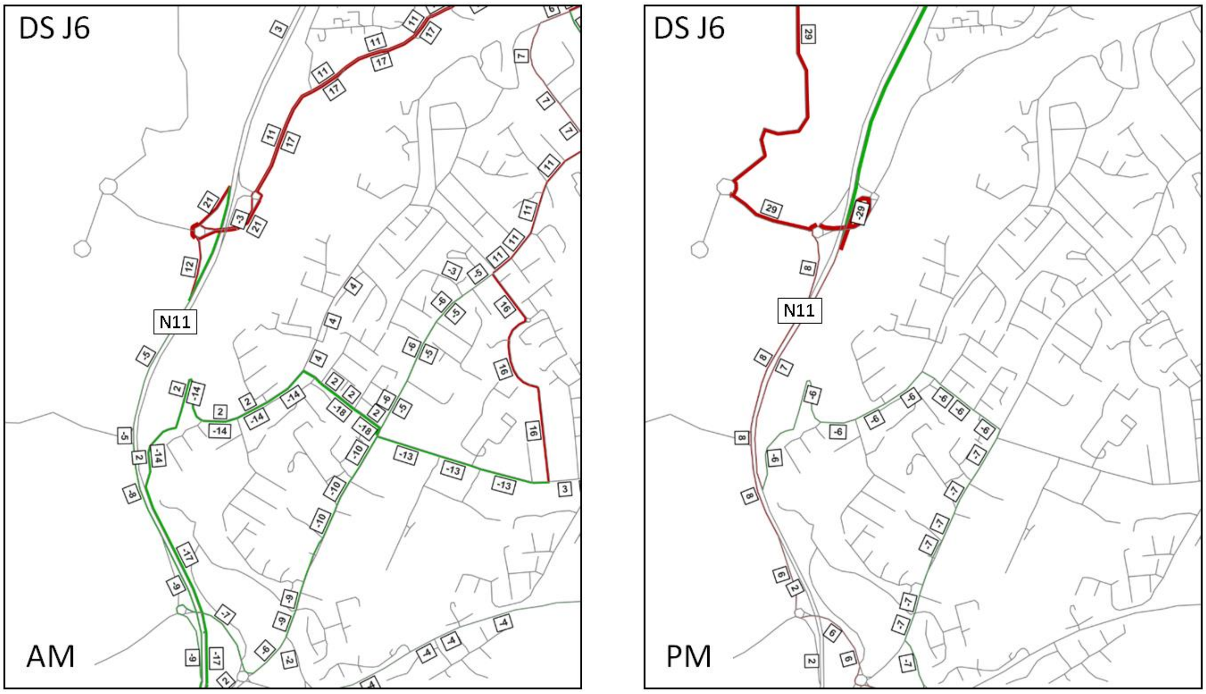


Figure 5.3: DS J6 AM and PM Peak Difference Plots

5.2.1 Network Statistics

Table 5.2 provides a summary of the key network statistics for the DS J6 scenario in the AM and PM alongside the DN scenario. The network statistics show a marginal positive benefit in both peaks.

Table 5.2: AM & PM Peak Hour Modelled Network Statistics: DS J6

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS J6	17,721	4,643	15.72	201,581	992
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS J6	17,706	4,442	15.05	200,469	805

5.2.2 Impact on M11/N11 Mainline Flows

Referring to Tables C.1 – C.2 (Annex C) DS J6 has a negligible impact on the mainline flows of the M11/N11 corridor.

5.2.3 Summary

Do-Something J6 provides for an upgrade of the existing merges/diverges at Junction 6 (Bray Central) to the appropriate design standard and an increase in the capacity of the two existing roundabouts. The difference plots and networks statistics show limited impacts, however the need to bring the merges/diverges up to standard as part of the upgrading on the mainline corridor is the key driver for this proposal. Therefore this proposal is brought forward as part of the Emerging Preferred Strategy.

5.3 Junction 6a – Herbert Road/Enniskerry Road

The proposal forms part of Do-Something L7. Full details of which are provided in Section 6.7.

5.4 Junction 7 – Bray South

Figure 5.4 depicts the difference plots for the AM and PM peak modelled flow volumes in the DS J7 scenario to the corresponding modelled flow volumes in the DN scenario.

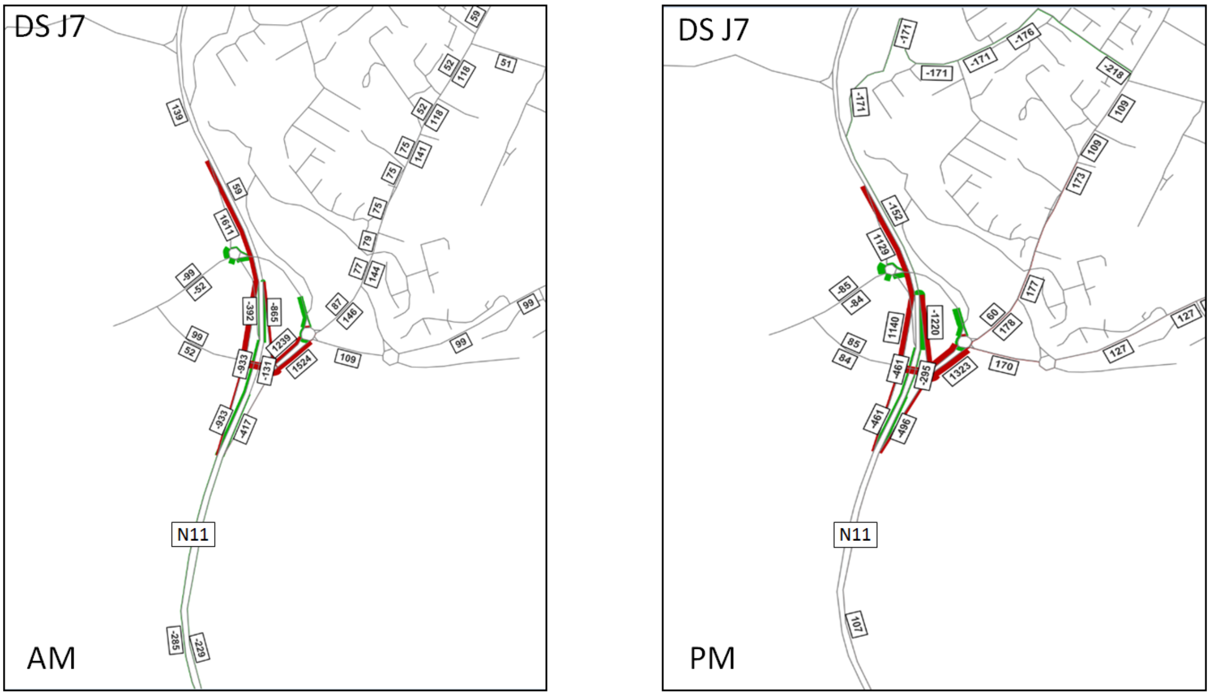


Figure 5.4: DS J7 AM and PM Peak Difference Plots

5.4.1 Network Statistics

Table 5.3 provides a summary of the key network statistics for the proposal in the AM and PM alongside the DN scenario. The statistics show a highly positive impact in both peaks, with both total delay and distance travelled reducing substantially.

Table 5.3: AM & PM Peak Hour Modelled Network Statistics

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS J7	17,721	4,566	15.46	200,234	921
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS J7	17,706	4,388	14.87	200,008	762

5.4.2 Impact on M11/N11 Mainline Flows

Referring to Table C.1 - C.2 (Annex C) DS J7 leads to an increase in flow (approx. 100 vehicles) on the N11 mainline northbound between Junction 6 and Junction 7 in the AM Peak . This is caused by traffic now access the N11 at Junction 7 via Killarney Road instead of Herbert Road. A reduction in traffic (approx. 150 vehicles) on the N11 southbound between Junction 6a and 7 in the PM Peak is also noted, this is also due to traffic reassigning from Herbert Road to Killarney Road.

5.4.3 Summary

At present there are significant congestion issues at Junction 7 – Bray South and this proposal will alleviate this congestion as illustrated by the network statistics. Therefore it is recommended that this proposal be brought forward for further testing in the 2030 LAM's.

5.5 Junction 8 – Kilmacanogue

The local accesses that would be served by the proposed parallel services roads are not included in the LAM network. Therefore no assessment is undertaken based on model outputs. The need for services roads at these locations is both to improve safety on this section of the N11 and to improve the efficiency of the corridor. This will bring this section of the N11 up to the appropriate standard for a TEN-T road and will also allow the current speed limit to be increase to 100kph in both directions. Therefore this proposal is proposed as part of the Emerging Preferred Strategy for the corridor.

6.0 2015 Assessment - M11/N11 Mainline Junction Measures

6.1 Do-Something L1 – Herbert Road/Dargle Road Link

Figure 6.1 depicts the difference plots for the AM and PM peak modelled flows volumes in the Do-Something L1 (DS L1) scenario to the corresponding modelled flow volumes in the DN scenario. The plots shows a reduction in traffic flows on the M11 mainline between Junctions 6 and 7 as traffic is now able to access the areas of Bray south of the River Dargle via Junction 6.

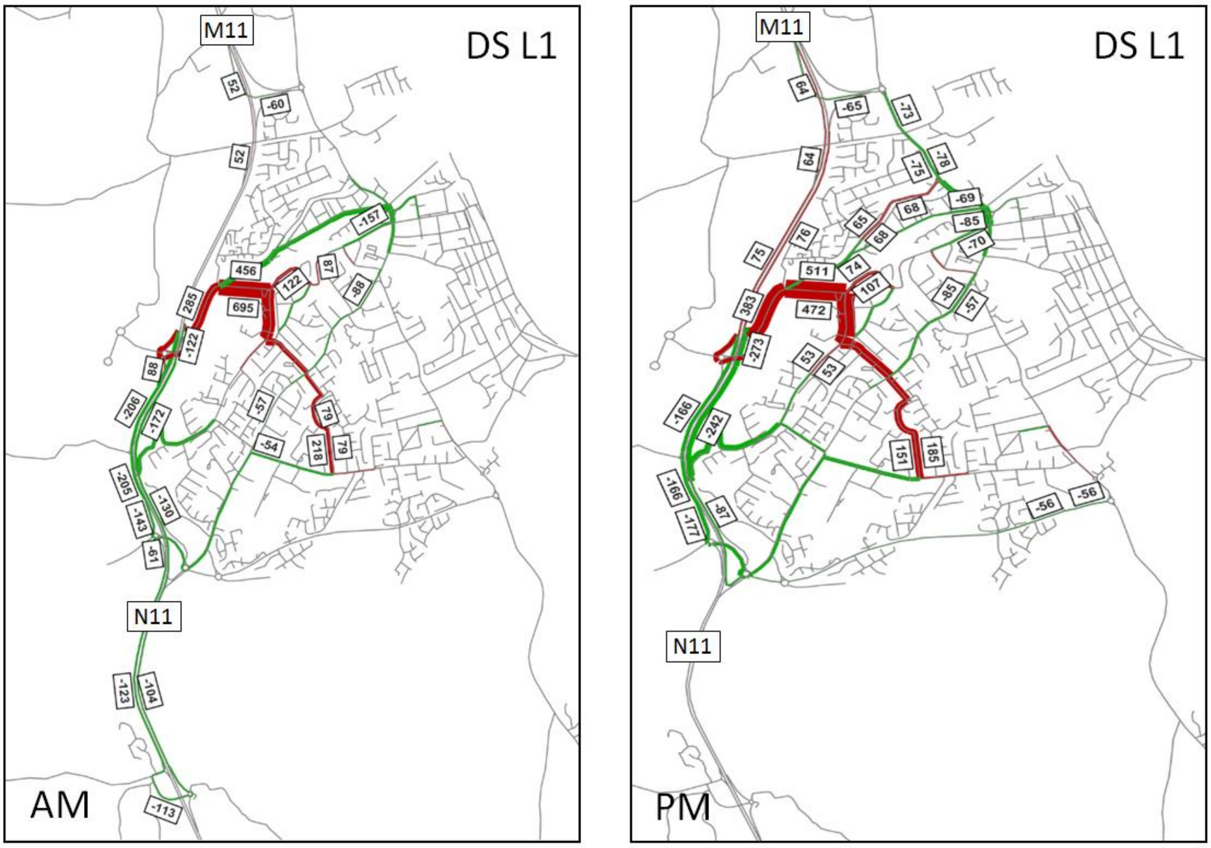


Figure 6.1: DS L1 AM and PM Peak Difference Plots

6.1.1 Network Statistics

Table 6.1 provides a summary of the key network statistics for DS L1 in the AM and PM alongside the Do-Nothing scenario. The statistics show that there are significant reductions in both the total network delay and total distance travelled in the network.

Table 6.1: AM & PM Peak Hour Modelled Network Statistics DS L1

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS L1	17,721	4,502	15.24	200,092	877
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS L1	17,706	4,391	14.88	199,969	762

6.1.2 Impact on M11/N11 Mainline Flows

Referring to Tables C.3 and C.4 of Annex C, DS L1 leads to a reduction in traffic on the N11 mainline between Junctions 6 and 7.

6.1.3 Summary

DS L1 provides for a link road between Herbert and Upper Dargle Road. It provides an additional crossing of the River Dargle and allows access to Junction 6 (Bray Central/Fassaroe). This scenario results in positive improvements to travel time and reduction delay in both the AM and PM peak periods.

The difference plots demonstrate that this scenario is effective in increasing the number of vehicles accessing the N11 via Junction 6 (Fassaroe) rather than continuing down Herbert Road and accessing the N11 via Junction 6a (thereby resulting in less disruption to mainline flow).

However, the precise location for a bridge crossing of the River Dargle will require further consideration. In addition to any benefit to the M11/N11 corridor, the location of the crossing will be influenced by the requirements of public transport, walking and cycling and local trips and the technical feasibility of crossing the river.

6.2 Do-Something L2 - Bridge Over N11 at Junction 6a

Figure 6.2 depicts the difference plots for the AM and PM peak modelled flow volumes in the Do-Something L2 (DS L2) scenario to the corresponding modelled flow volumes in the DN scenario. The proposed bridge over the N11 would carry approximately 1000 vehicles in the AM peak.

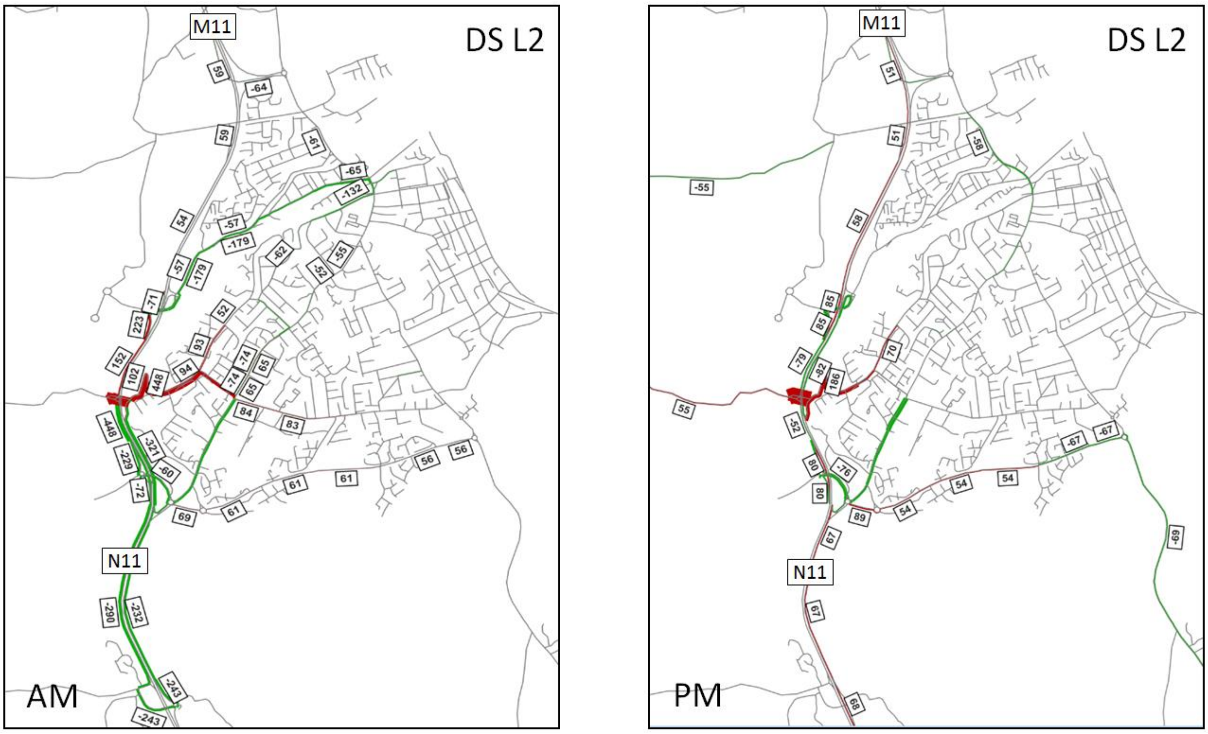


Figure 6.2: DS L2 AM and PM Peak Difference Plots

6.2.1 Network Statistics

Table 6.2 provides a summary of the key network statistics for DS L2 in the AM and PM alongside the DN scenario. The tables show that the proposal would provide benefits most notably in the AM Peak.

Table 6.2: AM & PM Peak Hour Modelled Network Statistics DS L2

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS L2	17,721	4,494	15.22	199,093	884
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS L2	17,706	4,412	14.95	200,068	791

6.2.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C) DS L2 reduces the number of vehicles on the N11 mainline between Junction 6 and 7 , most notably in the AM Peak.

6.2.3 Summary

DS L2 provides for a bridge over the N11 (Junction 6a) between Herbert Road and Enniskerry Road (R117). The network statistics revealed that this scenario results in improvements to travel time and delay for the overall network particularly in the AM Peak. However, providing three junctions in close proximity (<2km) with full turning movements would not be recommend from a safety, operational or efficiency perspective. Therefore it is not recommended to include this proposal in the Emerging Preferred Strategy.

6.3 Do-Something L3 - Enniskerry Link Road

Figure 6.3 depicts the difference plots for the AM and PM peak modelled flows volumes in the Do-Something L3 (DS L3) scenario to the corresponding modelled flow volumes in the DN scenario.

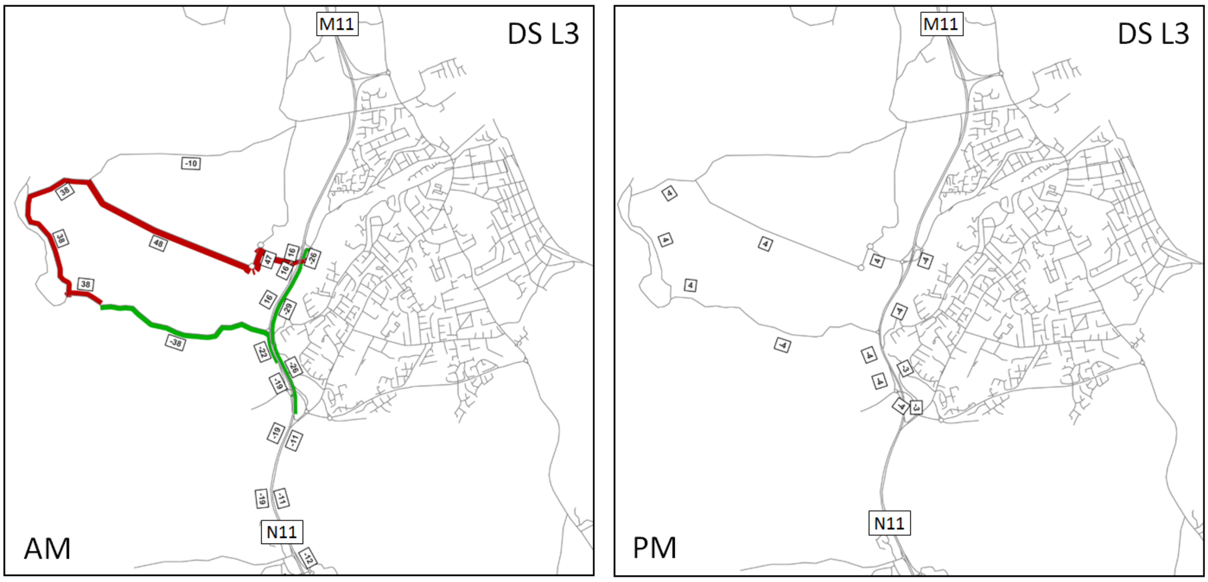


Figure 6.3: DS L3 AM and PM Peak Difference Plots

6.3.1 Network Statistics

Table 6.3 provides a summary of the key network statistics DS L3 in the AM and PM alongside the DN scenario. The statistics indicated that the impact of the proposal is negligible.

Table 6.3: AM & PM Peak Hour Modelled Network Statistics: DS L3

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS L3	17,721	4,636	15.70	201,548	985
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS L3	17,706	4,444	15.06	200,450	806

6.3.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C) the impact of DS L3 on the mainline flows is negligible.

6.3.3 Summary

DS L3 provides for a link road between Junction 6 (Bray Central/Fassaroe) and Enniskerry. This scenario provides only marginal improvements in travel time and delay in the AM and PM peaks. Closer inspection of the difference plots shows that the traffic volumes using this link are relatively low and furthermore there are no improvements to the mainline flow when compared to the Do-Nothing scenarios.

Finally, from a financial feasibility perspective, this option is dependent on private sector funding and therefore not guaranteed to progress. Therefore, for the above reasons it is not considered a viable option to be included as part of an Emerging Preferred Strategy for the M11/N11 corridor.

6.4 Do-Something L4 – Kilmacanogue to Bray Southern Cross Link

Figure 6.4 depicts the difference plots for the AM and PM peak modelled flow volumes in the Do-Something L4 (DS L4) scenario to the corresponding modelled flow volumes in the DN scenario.

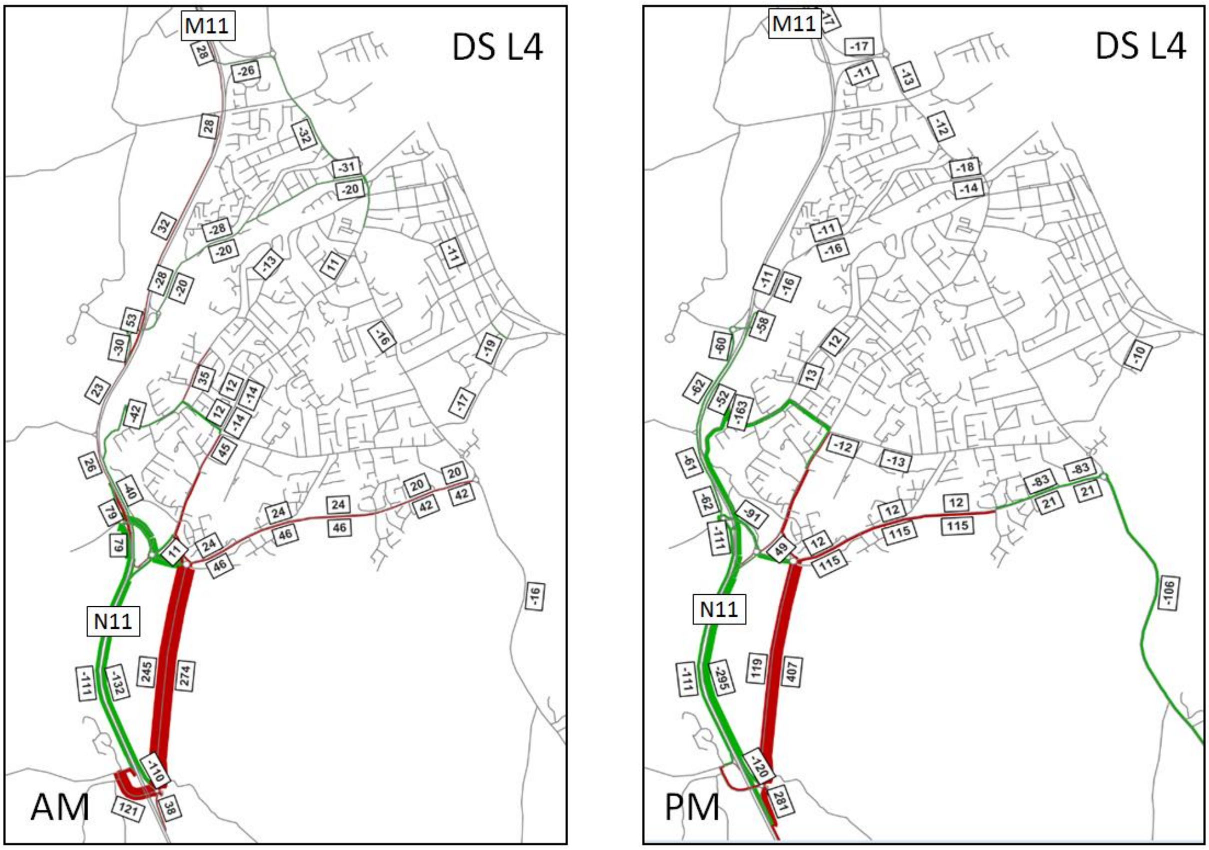


Figure 6.4: DS L4 AM and PM Peak Difference Plots

6.4.1 Key Network Statistics

Table 6.4 provides a summary of the key network statistics for DS L4 in the AM and PM alongside the Do-Nothing scenario. The statistics show that benefits are provided in both peaks as a result of the proposal.

Table 6.4: AM & PM Peak Hour Modelled Network Statistics: DS L4

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS L4	17,721	4,578	15.50	201,808	924
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS L4	17,706	4,394	14.89	199,752	772

6.4.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C) DS L4 reduces the volume of traffic on the N11 mainline though Junction 7 and on the mainline between Junction 7 and 8 by approximately 100 vehicles northbound in the AM and approximately 300 vehicles southbound in the PM.

6.4.3 Summary

This scenario provides for a link road between Bray Southern Cross Road and Junction 8 (Kilmacanogue). This proposal shows positive improvements in travel time and delay in the in both peaks. The difference plots demonstrate that the new link is successful in attracting traffic away from the mainline between Junction 7 and Junction 8 thereby proving beneficial to the corridor along this section (in addition to being beneficial to the study area as a whole as demonstrated by the network statistics). It is recommended that this option is brought forward to the 2030 assessment.

6.5 Do-Something L5 – Greystones Link Road

Figure 6.5 depicts the difference plots for the AM and PM peak modelled flow volumes in the Do-Something L5 (DS L5) scenario to the corresponding modelled flow volumes in the DN scenario. The plots show that the proposal leads to an increase in traffic volumes on the N11 mainline between Junction 7 and Junction 9 and reduction in traffic on the R761 Bray-Greystones Road.

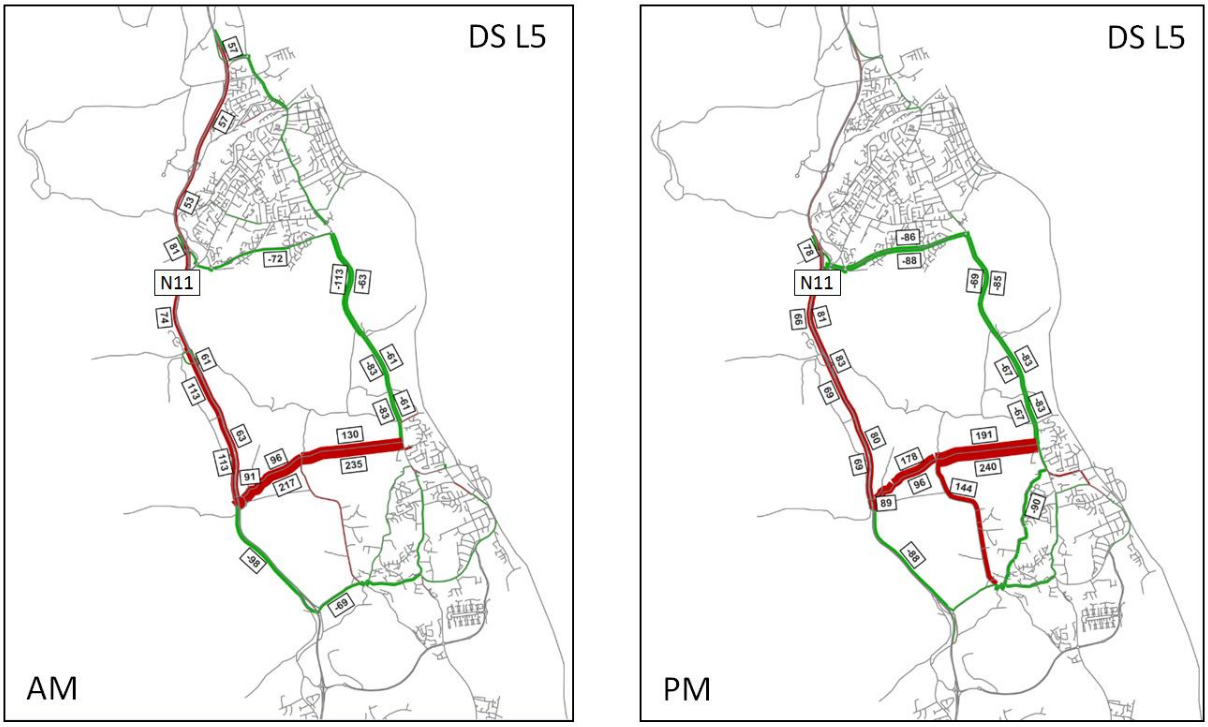


Figure 6.5: DS L5 AM and PM Peak Difference Plots

6.5.1 Network Statistics

Table 6.5 provides a summary of the key network statistics for DS L5 in the AM and PM alongside the DN scenario. The statistics indicate that the proposal provide overall benefits to the network in both peaks.

Table 6.5: AM & PM Peak Hour Modelled Network Statistics: DS L5

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DS L5	17,721	4,563	15.45	201,772	907
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DS L5	17,706	4,411	14.95	200,741	769

6.5.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C), DS L5 leads to a small increase in traffic volumes on the N11 mainline between Junctions 7 and 9 during both peak hours. Traffic volumes between Junction 9 and 10 reduce by approximately 100 vehicles.

6.5.3 Summary

DS L5 provides for a new link road from the R761 at Greystones to Ballydonagh Road (Greystones Link Road) improving access onwards to the N11 at Junction 9 (Glen of the Downs). When considered in isolation there is a small increase in traffic volumes between Junctions 8 and 9 with a subsequent reduction along the Bray Southern Cross Road. This equates to a 4% increase in flows on the N11 between Junctions 8 and 9.

However when considered with the Junction 7 upgrade in place traffic continues to use the R761/R768 Bray Southern Cross. This road is of a good standard and the link flow is comfortably below the capacity. Therefore this proposal is not recommended for inclusion in the Emerging Preferred Strategy.

6.6 Do-Something L6 - Closure of Direct Access at Junction 6a between N11 and Herbert Road

Figure 6.6 depicts the difference plots for the AM and PM peak modelled flow volumes in the Do-Something L6 (DS L6) scenario to the corresponding modelled flow volumes in the DN scenario. The lots shows that the closure of access to Herbert Road form the N11 leads to an increase in traffic between Junction 6a and 7 and also a transfer of the traffic from the N11 to the reginal/local road network through Bray.

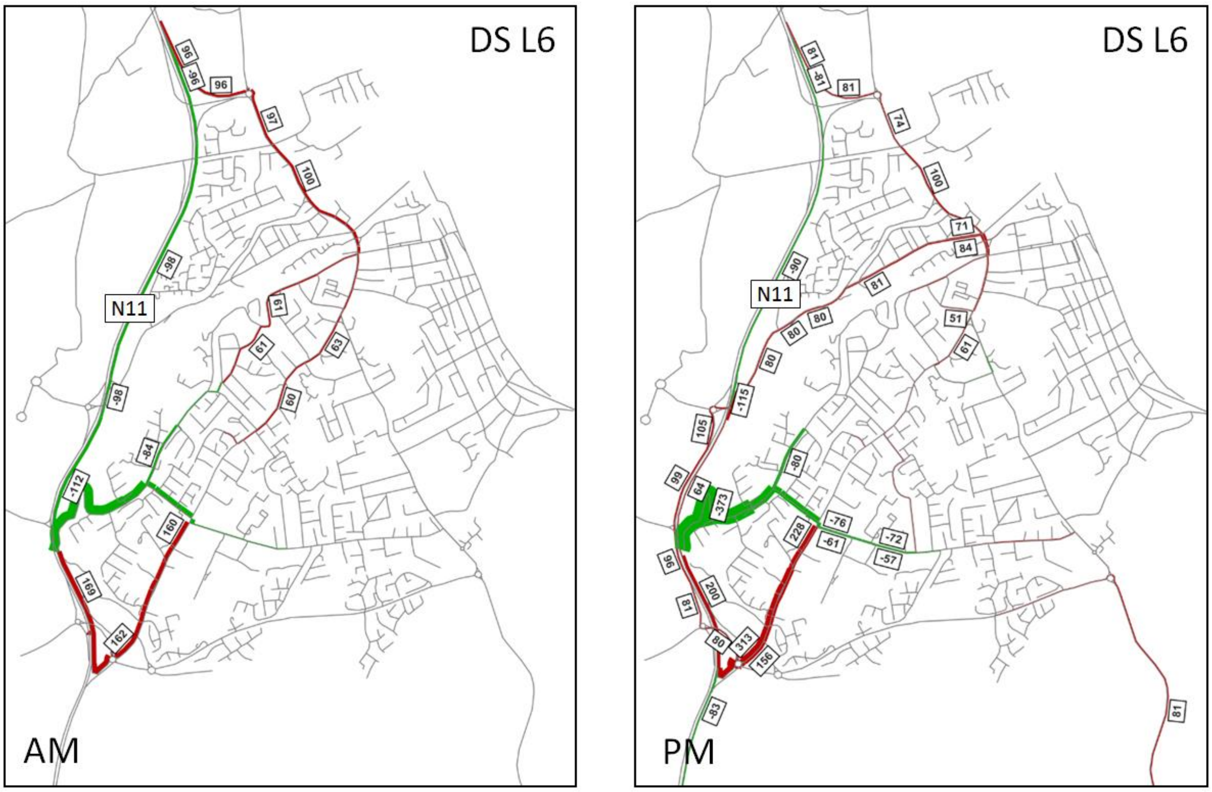


Figure 6.6: DS L6 AM and PM Peak Difference Plots

6.6.1 Key Network Statistics

Table 6.6 provides a summary of the key network statistics for DS L6 in the AM and PM alongside the DN scenario. The statistics show that this proposal has a negative impact upon the performance of the overall network particularly during the PM Peak as vehicles must now continue southbound along the N11 to use Junction 7 in order to access Bray.

Table 6.6: AM & PM Peak Hour Modelled Network Statistics: DS L6

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DSL6	17,721	4,667	15.80	201,558	1,014
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DSL6	17,706	4,528	15.35	200,953	875

6.6.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C) DS L6 leads to an increase in traffic volumes on the N11 mainline between Junction 6a and 7 in the AM Peak and Junction 6 and 7 in the PM Peak.

6.6.3 Summary

DS L6 provides for the closure of direct access between Herbert Road and the N11 on the eastern side of the N11. The intention of the scenario is to reduce the level of traffic weaving and remove direct access in order to improve the efficiency and safety of this section of the N11. The network statistics clearly demonstrated the negative impacts of this proposal in terms of travel time and delay while the difference plots highlighted the increased pressure on the local and regional network. In its current form (i.e. as presented in this note) the closure of Herbert Road as an isolated proposal is not considered viable.

A modified form of this scenario allowing traffic from Herbert Road to access Junction 7 via a local service road is considered viable and is included as part of the Do-Something L7 proposal.

6.7 Do-Something L7 – Closure of Direct Access to N11 at Junction 6a plus Services Roads

Figure 6.7 below depicts the difference plots for the AM and PM peak modelled flows volumes in the Do-Something L7 (DS L7) scenario to the corresponding modelled flow volumes in the DN scenario.

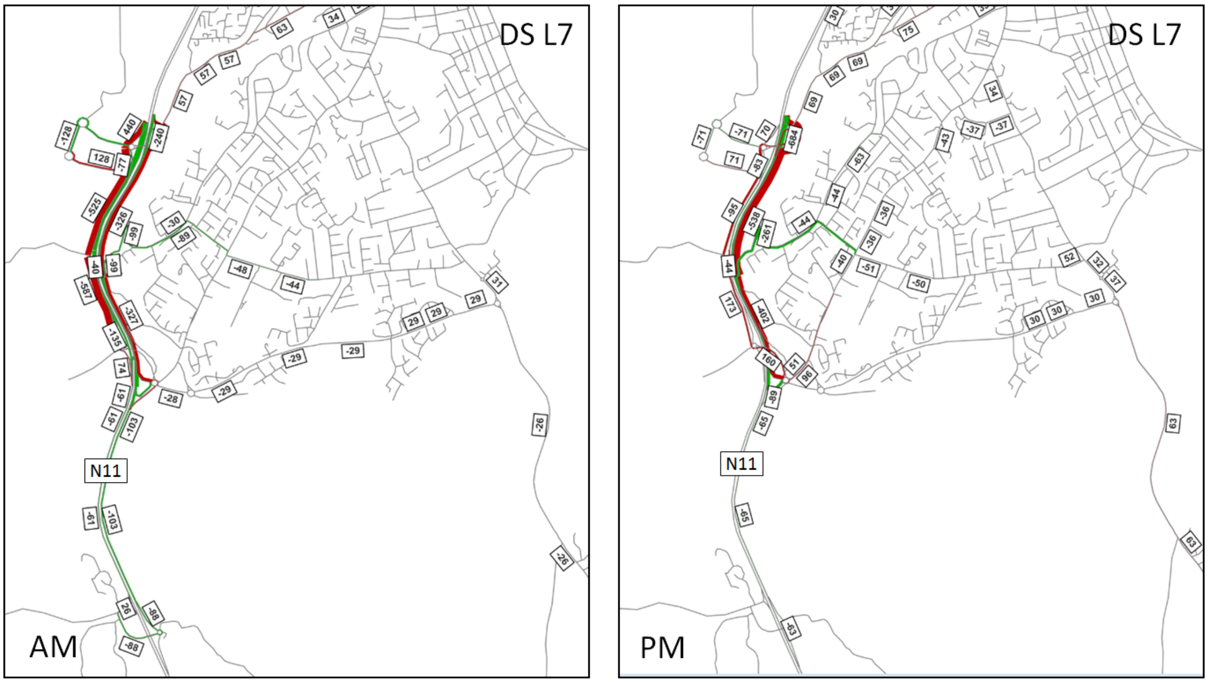


Figure 6.7: DS L7 AM and PM Peak Difference Plots

6.7.1 Network Statistics

Table 6.7 provides a summary of the key network statistics for DS L7 with the DN scenario included for comparison purposes. The statictics indicate that this proposal when considerd in isolation has a slightly negative imapct in the AM Peak and slighty positive impact in the PM Peak.

Table 6.7: AM & PM Peak Hour Modelled Network Statistics: DS L7

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DSL7	17,721	4,665	15.80	201,411	1,005
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DSL7	17,706	4,451	15.08	200,909	797

6.7.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C) DS L7 would significantly reduce traffic volumes on the N11 mainline between Junction 6 and 7 as traffic between the N11 and Herbert Road/Enniskerry Road uses the proposed service roads.

6.7.3 Summary

Do-Something L7 provides for one-way parallel service roads connecting Junction 6a to Junctions 6 and 7 on the western side of the N11 and to Junction 7 on the eastern side of the N11. This option resulted in marginal changes to the overall performance of the overall network. However, the assessment does not take into account the safety benefits and improved efficiency associated with the proposal. Therefore, it is recommended that this proposal is brought forward for consideration as part of the 2030 assessment.

6.8 Do-Something L8 – M50 Cherrywood Junction to Ballycorus Road Link

Figure 6.8 below illustrates the difference plots for the AM and PM peak modelled flows volumes in the Do-Something L8 (DS L8) scenario to the corresponding modelled flow volumes in the DN scenario. The plots show the reassignment of traffic from the Shankill area and limited impact upon the M11/N11 corridor.

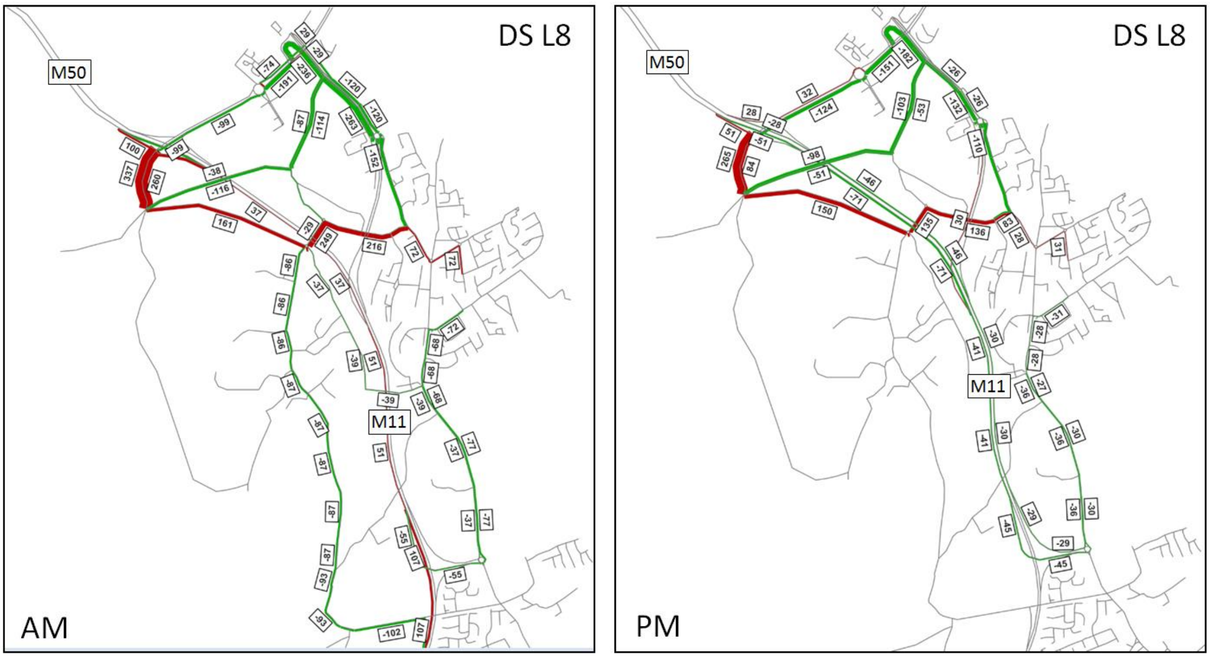


Figure 6.8: DS L8 AM and PM Peak Difference Plots

6.8.1 Network Statistics

Table 6.8 provides a summary of the key network statistics for DS L8 and the DN scenario. The statistics shows a slightly postive benefit in both peak hours, with a reduction in delay and travel distance noted.

Table 6.8: AM & PM Peak Hour Modelled Network Statistics: DS L8

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	17,721	4,648	15.74	201,602	997
2015 AM DSL8	17,721	4,619	15.64	200,879	984
2015 PM DN	17,706	4,445	15.06	200,448	807
2015 PM DSL8	17,706	4,420	14.98	199,803	794

6.8.2 Impact on M11/N11 Mainline Flows

Referring to Table C.3 and C.4 (Annex C), DS L8 as a negligible impact on the N11 mainline flows.

6.8.3 Summary

DS L8 provides for a link road from Rathmichael/Ballycorus Road to M50 Junction 16 (Cherrywood). This proposal provides an alternative route for users travelling from the Shankill area to the M50 by allowing them a more direct route thereby potentially avoiding travelling to this destination via M11 Junction 5 (Bray North/Wilford).

As the network statistics have demonstrated, this scenario results in only minor benefits in travel time and reduction in delay. The difference plots have shown that the introduction of the link provides a shorter route to the M50 for traffic in Shankill.

In the PM peak the reduction of the U-turn movement down to Wilford Junction is also apparent. This scenario is unlikely to show benefits for the current situation although is likely to be very beneficial should an incident occur on the M11/N11 corridor. The relatively low benefits of this scenario (in terms of the travel time and delay improvement) are outweighed by the new link's contribution to network resilience in providing an alternative route to the M50. For these reasons it is recommended that this scenario be included for consideration in an Emerging Preferred Strategy.

6.9 2015 Assessment Summary

The results of the 2015 analysis indicated that some options should be excluded from further assessment due to a limited or negative impact. The remaining options which had a positive influence were tested in the 2030 model. A summary of the proposal considered is provided in Table 6.9.

Table 6.9: Measure Brought Forward to 2030 Assessment

Scenario	Included in 2030 Assessment	Assessment Summary
J5	x	No further assessment
J6	✓	Included in Emerging Preferred Strategy
J7	✓	Further assessment in 2030 LAM
J8	✓	Included in Emerging Preferred Strategy
L1	✓	Further assessment in 2030 LAM
L2	x	No further assessment (minimal benefit to N11 corridor)

Scenario	Included in 2030 Assessment	Assessment Summary
L3	x	No further assessment (minimal benefit to N11 corridor)
L4	✓	Further assessment in 2030 LAM
L5	x	No further assessment (minimal benefit to Glen of the Downs)
L6	x	Negative impact on N11 corridor – No further assessment
L7	✓	Further assessment in 2030 LAM
L8	✓	Included in Emerging Preferred Strategy (network resilience)

7.0 2030 Assessment

The proposals assessed against the 2015 Do-Nothing LAM's which were considered beneficial to M11/N11 corridor were then tested against the 2030 Do-Minimum (DM) LAM's in order to assess their suitably for inclusion in the Emerging Preferred Strategy. The 2030 Do-Minimum scenario assumes that the widening of the M11/N11 corridor is in place based on the assessment of M11/N11 mainline capacity discussed in Section 3.1. The following proposals are assessed against the 2030 Do-Minimum scenario:

- Do-Something J7 - Junction 7 Bray South;
- Do-Something L1 - Herbert Road/Dargle Road Link;
- Do-Something L4 - Kilmacanogue to Bray Southern Cross Link; and
- Do-Something L7 - Closure of Direct Access to N11 at Junction 6a plus Services Roads.

It is assumed that both DSJ6 (Junction 6 – Bray Central), DS J8 (Kilmacanogue Service Roads) and DS L8 (M50 Cherrywood Junction to Ballycorus Road Link) will form part of the Emerging Preferred Strategy and therefore do not require further assessment.

7.1 Do-Something J7 - Bray South

Figure 7.1 depicts the difference plots for the AM and PM peak modelled flow volumes in the DS J7 scenario to the corresponding Do-Minimum modelled flow volumes in 2030.

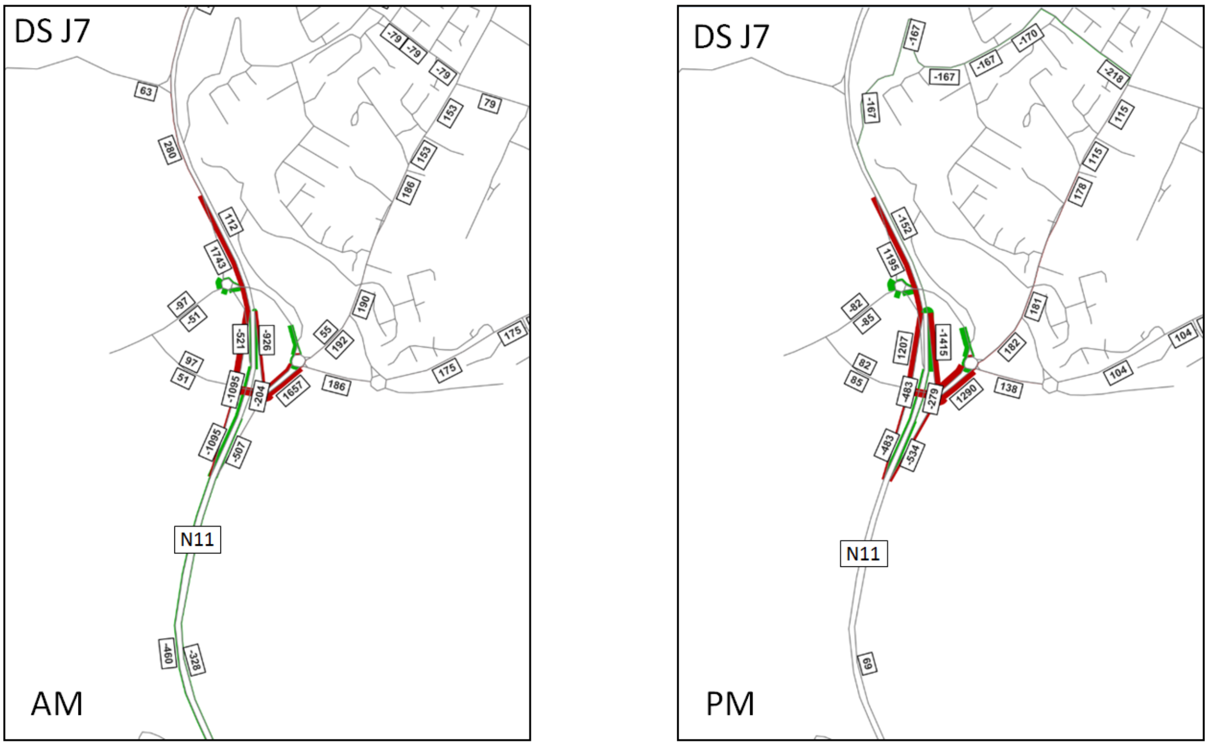


Figure 7.1: DS J7 AM and PM Peak Difference Plots

7.1.1 Network Statistics

Table 7.1 provides a summary of the key network statistics for DS J7 in the AM and PM alongside the 2030 DM scenario. The statistics indicate the the proposal provides positve benefits in both the AM and PM peaks.

Table 7.1: AM & PM Peak Hour Modelled Network Statistics: DS J7

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DM	21,284	5,740	16.18	248,432	1,333
2030 AM DS J7	21,284	5,548	15.64	246,480	1,180
2030 PM DM	21,223	5,451	15.41	244,970	1,102
2030 PM DS J7	21,223	5,380	15.21	244,591	1,049

7.1.2 Impact on M11/N11 Mainline Flows

Referring to Table C.5 - C.6 (Annex C) DS J7 leads to an increase in flow (approx. 200 vehicles) on the N11 mainline northbound between Junction 6 and Junction 7 in the AM Peak . This is caused by traffic now access the N11 at Junction 7 via Killarney Road instead of Herbert Road. A reduction in traffic (approx. 150 vehicles) on the N11 southbound between Junction 6a and 7 in the PM Peak is also noted, this is also due to traffic reassigning from Herbert Road to Killarney Road.

7.1.3 Summary

The network statistics indicate that the upgrading of Junction 7 is required regardless of the upgrading of the M11/N11 mainline. It is therefore recommend that this proposal form part of the Emerging Preferred Strategy.

7.2 Do-Something L1 – Herbert Road/Dargle Road Link

Figure 7.2 depicts the difference plots for the AM and PM peak modelled flow volumes in the DS L1 scenario to the corresponding DM modelled flow volumes in 2030. The plots show that volumes on the N11 between Junction 6 and 7 reduce as a result of this proposal. The plots also show an increase in traffic on the M11 between Junction 5 and 6 in the PM peak and a reduction in flow on the R761.

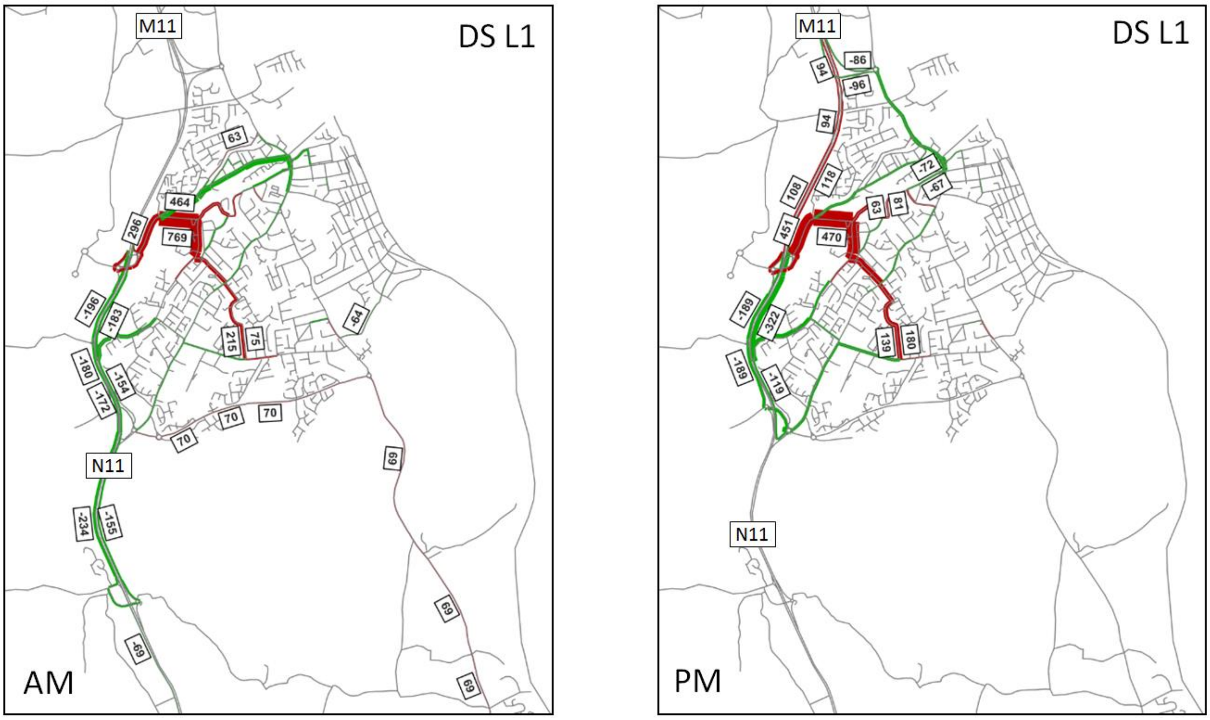


Figure 7.2: 2030 DS L1 AM and PM Peak Difference Plots

7.2.1 Network Statistics

Table 7.2 provides a summary of the key network statistics for DS L1 in the AM and PM alongside the DM scenario. The statistics indicate the proposal provide benefits in both the AM and PM Peaks,with a redcution tin total delay and distance travelled noted.

Table 7.2: AM & PM Peak Hour Modelled Network Statistics: DS L1

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DM	21,284	5,740	16.18	248,432	1,333
2030 AM DSL1	21,284	5,603	15.79	246,172	1,233
2030 PM DM	21,223	5,451	15.41	244,970	1,102
2030 PM DSL1	21,223	5,389	15.23	244,495	1,051

7.2.2 Impact on M11/N11 Mainline Flows

As illustrated in the difference plots and referenced in Tables C.5 and C6 (Annex C), this proposal will reduce traffic volumes on the N11 between Junction 6 and 7 in both the AM and PM peaks.

7.2.3 Summary

The difference plots and network statistics indicate that the proposed Herbert Road/Dargle Road link is beneficial to both the M11/N11 corridor and to the wider network. It is therefore recommended that this proposal form part of the Emerging Preferred Strategy.

However, the precise location for a bridge crossing of the River Dargle will require further consideration. In addition to any benefit to the M11/N11 corridor, the location of the crossing will be influenced by the requirements of public transport, walking and cycling and local trips and the technical feasibility of crossing the river.

7.3 Do-Something L4 - Kilmacanogue to Bray Southern Cross Link

Figure 7.3 depicts the difference plots for the AM and PM peak modelled flow volumes in DS L4 to the corresponding Do-Minimum modelled flow volumes in 2030.

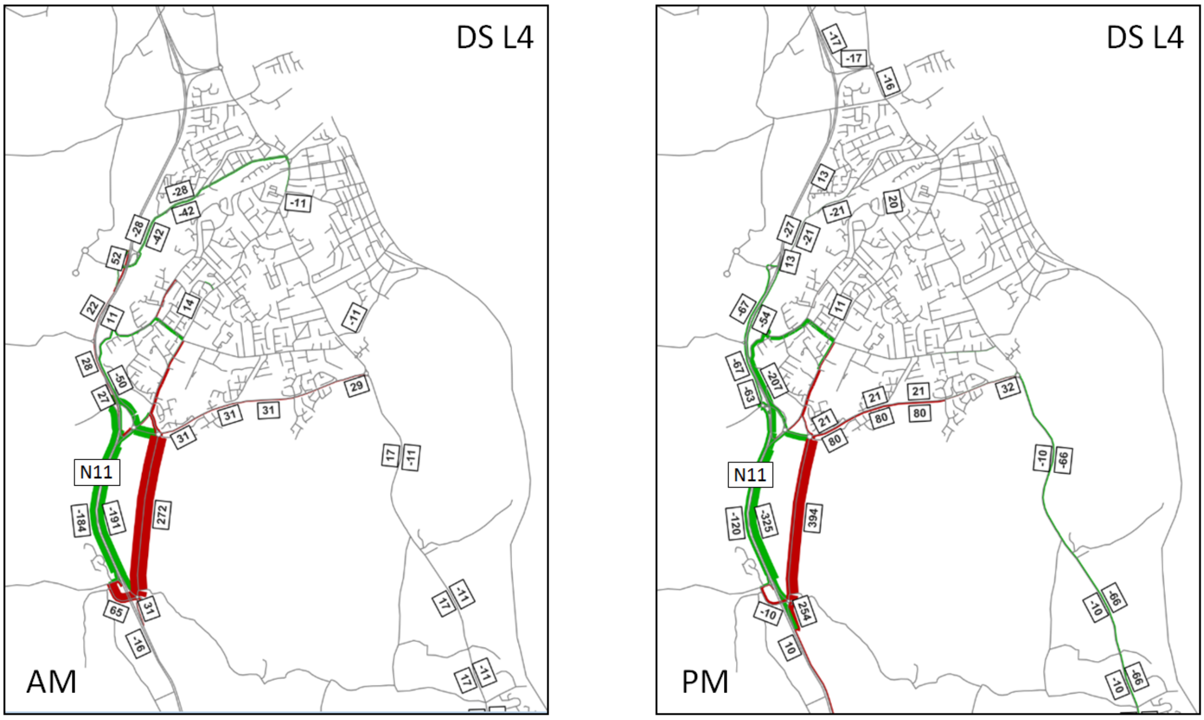


Figure 7.3: DS L4 AM and PM Peak Difference Plots

7.3.1 Network Statistics

Table 7.3 provides a summary of the key network statistics for DS L4 in the AM and PM alongside the Do-Minimum scenario. The statistics indicate the the proposal provides benefits in both the AM and PM Peaks.

Table 7.3: AM & PM Peak Hour Modelled Network Statistics: DS L4

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DN	21,284	5,740	16.18	248,432	1,333
2030 AM DS L4	21,284	5,709	16.09	248,250	1,303
2030 PM DN	21,223	5,451	15.41	244,970	1,102
2030 PM DS L4	21,223	5,404	15.28	244,327	1,067

7.3.2 Impact on M11/N11 Mainline Flows

With reference to Tables C.5 and C6 (Annex C), this proposal will reduce traffic volumes on the N11 between Junction 7 and 8 in both the AM and PM peaks.

7.3.3 Summary

The benefits of the scheme are limited when combined with the increased capacity on the N11 mainline. The increase in capacity of the mainline corridor, improvements to Junction 7 (DS J7) as outlined previously and the services road proposed at Kilmacanogue (DS J8) will have a significant impact on the level of service experienced by drivers between Junction 7 and Junction 8 during both peaks. Therefore it is not recommended that this option is included in the Emerging Preferred Strategy. However it is recognised there is still some merit in this option from the point of view of local accessibility.

7.4 Do-Something L7 - Closure of Direct Access to N11 at Junction 6a plus Services Roads

Figure 7.4 depicts the difference plots for the AM and PM peak modelled flow volumes in the DS L7 scenario to the corresponding DM modelled flow volumes in 2030. The plots show a significant reduction in traffic on the N11 between Junction 6 and 7 as traffic reassigns to the proposed service roads.

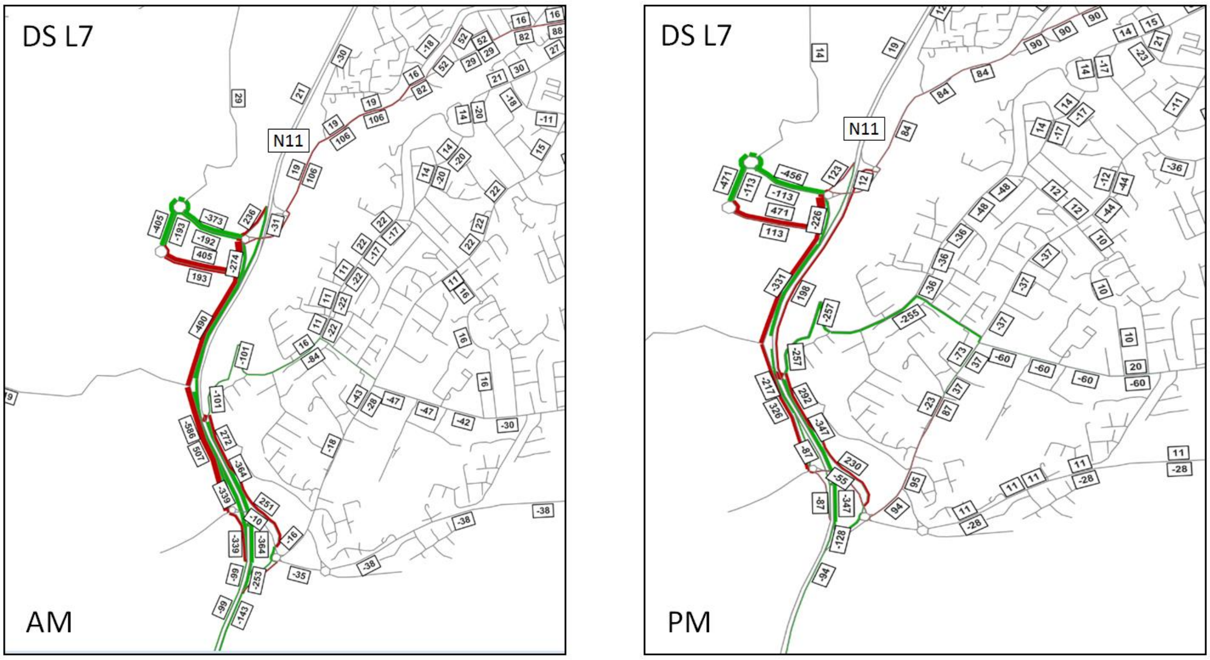


Figure 7.4: DS L7 AM and PM Peak Difference Plots

7.4.1 Network Statistics

Table 7.4 provides a summary of the key network statistics for DS L7 in the AM and PM alongside the 2030 Do-Minimum scenario. The statistics shows that the propsoed measures have a slighty negative impact on the performace on the overall network.

Table 7.4: AM & PM Peak Hour Modelled Network Statistics: DS L7

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DM	21,284	5,740	16.18	248,432	1,333
2030 AM DS L7	21,284	5,760	16.24	247,965	1,349
2030 PM DM	21,223	5,451	15.41	244,970	1,102
2030 PM DS L7	21,223	5,462	15.44	245,133	1,103

7.4.2 Impact on M11/N11 Mainline Flows

Referring to Table C.5 and C.6 (Annex C) DS L7 would significantly reduce traffic volumes on the N11 mainline between Junction 6 and 7 as traffic between the N11 and Herbert Road/Enniskerry Road uses the proposed service roads.

7.4.3 Summary

This proposal resulted in marginal dis-benefits to the overall performance of the network. However, the assessment does not take into account the safety benefits and improved efficiency associated with the proposal. Therefore, it is recommended that this proposal is included as part of the Emerging Preferred Strategy.

8.0 Conclusions and Recommendations

This Technical Note considered and examined the performance of a number of proposed measures in isolation against the 2015 Do-Nothing LAMs. The measures which were considered beneficial were then tested against the 2030 Do-Minimum LAMs. Each proposal was assessed by reference to difference plots, network statistics and impact on the M11/N11 mainline corridor. The viability of the options was discussed and recommendations were made regarding the suitability of each option for inclusion in an Emerging Preferred Strategy for the study area.

In Table 8.1 a summary is provided of the measures suitable for inclusion as part of the Emerging Preferred Strategy for the corridor.

Table 8.1: Measures for the Emerging Preferred Strategy

Scenario	Description
1	3 lanes plus an auxiliary lane on the M11 between Junction 4 (M50/M11) and Junction 5 (Bray North) and 3 lanes in each direction on the M11/N11 between Junction 5 and Junction 8 (Kilmacanogue).
J6	Increased capacity (roundabouts and merges/diverges)
J7	Increased capacity (Dumbbell layout), with southbound lane drop and lane gain south of J7, and northbound lane drop and lane gain north of J7.
L1	Link road between Herbert Road and Upper Dargle Road. Provides another crossing of the Dargle and allows access to Junction 6 (Bray Central/Fassaroe).
L7	Junction 6a (West) – Closure of direct access between Enniskerry Road and the N11. Access maintained through one-way northbound service roads between Junction 7 and 6 connecting to Enniskerry Road. Junction 6a (East) - Closure of direct access between Herbert Road and the N11. New additional diverge between J6 and J7 to a southbound segregated one-way service road accessing Halting site, Dargle Lane, Herbert Road and private accesses, which then connects to Ballywaltrim Lane and then to J7 via local road network.
J8	Introduction of single southbound lane drop/service road and single northbound lane gain/service road with associated increase in speed limit of 100km/hr.
AR1	1. Improved local roads to the west of M11 between J4 and J6 (Ferndale Road, part of Thornhill Road plus a new link from Thornhill Road as per Fassaroe masterplan). 2. New link from M50 J16 (Cherrywood) to Rathmichael/Ballycorus Road (DS L8)

8.1 Emerging Preferred Strategy

Figure 8.5 depicts the difference plots for the AM and PM peak modelled flow volumes in Emerging Preferred Strategy to the corresponding Do-Minimum modelled flow volumes in 2030.

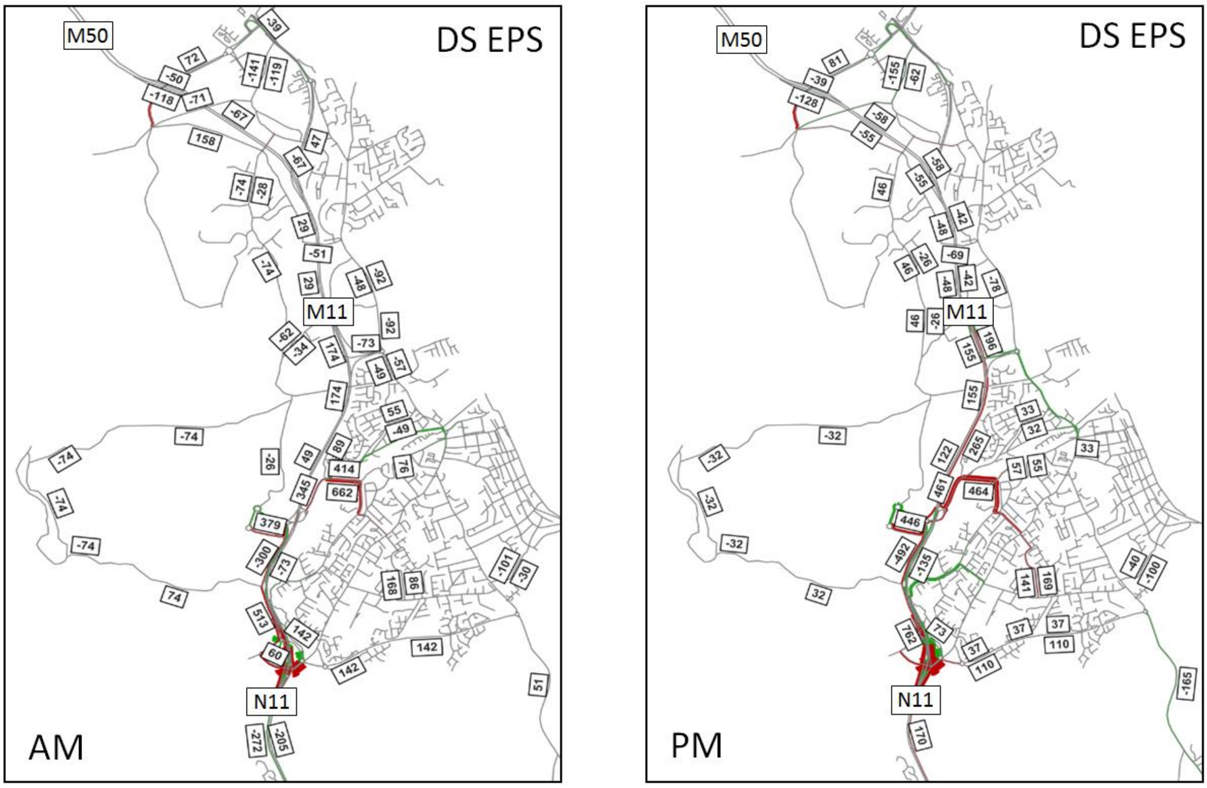


Figure 8.1: Emerging Preferred Strategy AM and PM Peak Difference Plots

8.1.1 Network Statistics

Table 8.2 provides a summary of the key network statistics for the Emerging Preferred Strategy in the AM and PM alongside the 2030 Do-Nothing scenario. The statistics show that the combined elements of the Emerging Preferred Strategy have a sigifnicant postive benefits to the overall performance of the network.

Table 8.1: AM & PM Peak Hour Modelled Network Statistics: Emerging Preferred Strategy

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DN	21,284	6,080	17.14	247,835	1,667
2030 AM EPS	21,284	5,442	15.34	244,156	1,107
2030 PM DN	21,223	5,693	16.09	244,756	1,333
2030 PM EPS	21,223	5,289	14.95	242,990	983

8.1.2 Impact on M11/N11 Mainline Flows

Referring to Table C.5 and C.6 (Annex C) the EPS would reduce traffic volumes on the N11 mainline between Junction 6 and 7 as traffic utilise the Herbert Road/Dargle Road link, the service roads between Junctions 6 and 7 and the improved Junction 7.

8.1.3 Summary

The EPS generates significant benefits to the overall network in both the AM and PM peak as demonstrated by the network statistics. The additional capacity of the mainline corridor combined with improved and more direct access to the regional/local road network though the various proposals, leads to substantial reductions in delay and distance travelled when compared to the 2030 Do-Nothing scenario. Due to the strategic nature of the model, the benefits of the services roads at Kilmacanogue (DS J8) are not included in the above assessment but in practice would add to the overall benefits.

ANNEX A

2030/2050 Mainline Flows

Table A.1: 2030 Do-Something Scenario Mainline - M11/N11 Peak Hour Flows

Road	Junction No.	Junction Name	No. of Lanes	Northbound AM Peak (08:00 – 09:00) (vehicles/hour) Demand Flow		Southbound PM Peak (17:00 – 18:00) (vehicles/hour) Demand Flow		Do-Something Practical Capacity (vehicles/hour)		
				DN	DS 1	DN	DS 1	GDA Average	Link Specific[3] North	Link Specific[3] South
M50	16 – 17	Cherrywood – M11	2	3,390	3,394	2,968	2,970	4,600	4,600	4,600
M11	3 – 4	Loughlinstown – M50	2	2,021	2,017	1,617	1,617	3,400	3,400	3,400
M11	4 – 5	M50/M11 – Bray North	3+1	5,411	5,411	4,584	4,587	6,800	8,600	8,600
M11	5 – 6	Bray North – Bray Central	3	4,714	4,729	4,085	4,085	5,100	6,900	5,750
N11	6 – 6a	Bray Central – Herbert Road/R117	3	4,855	4,856	4,143	4,141	5,100	5,450	5,000
N11	6a – 7	Herbert Rd/R117 – Bray South	3	4,866	4,867	4,054	4,057	5,100	5,450	5,000
N11	7 – 8	Bray South - Kilmacanogue	3	3,978	3,984	3,564	3,556	5,100	5,450	5,000
N11	8 – 9	Kilmacanogue – Glen of the Downs	2	3,270	3,274	3,103	3,094	3,400	3,550	3,550
N11	9 – 10	Glen of the Downs - Delgany	2	3,232	3,237	3,068	3,059	3,400	3,550	3,550
N11	10 – 11	Delgany – Greystones (Kilpedder)	2	2,796	2,797	2,888	2,888	3,400	3,550	3,550
N11	11 – 12	Greystones (Kilpedder)–Newtown	2	2,653	2,653	2,679	2,679	3,400	3,550	3,550
N11	12 – 13	Newtown MK - Newcastle	2	2,040	2,040	2,160	2,159	3,400	3,550	3,550
N11	13 – 14	Newcastle – Coyne's Cross	2	2,125	2,125	2,366	2,365	3,400	3,550	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,227	2,227	2,465	2,464	3,400	4,600	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

[3] *Lower southbound practical capacity due to gradient issue between Junctions 6a & 7 only. (Closure of Junction 6a and improvements at Junction 8 address previous shortcomings.)*

Table A.2: 2050 Do-Something Scenario Mainline - M11/N11 Peak Hour Flows

Road	Junction No.	Junction Name	No. of Lanes	Northbound AM Peak (08:00 – 09:00) (vehicles/hour) Demand Flow		Southbound PM Peak (17:00 – 18:00) (vehicles/hour) Demand Flow		Do-Something Practical Capacity (vehicles/hour)		
				DN	DS 1	DN	DS 1	GDA Average	Link Specific[4] North	Link Specific[4] South
M50	16 – 17	Cherrywood – M11	2	3,678	3,696	3,218	3,255	4,600	4,600	4,600
M11	3 – 4	Loughlinstown – M50	2	2,168	2,042	1,693	1,795	3,400	3,400	3,400
M11	4 – 5	M50/M11 – Bray North	3+1	5,846	5,738	4,910	5,050	6,800	8,600	8,600
M11	5 – 6	Bray North – Bray Central	3	5,013	5,096	4,300	4,333	5,100	6,900	5,750
N11	6 – 6a	Bray Central – Herbert Road/R117	3	5,038	5,308	4,468	4,640	5,100	5,450	5,000
N11	6a – 7	Herbert Rd/R117 – Bray South	3	5,077	5,389	4,379	4,066	5,100	5,450	5,000
N11	7 – 8	Bray South - Kilmacanogue	3	3,959	4,506	3,811	3,776	5,100	5,450	5,000
N11	8 – 9	Kilmacanogue – Glen of the Downs	2	3,326	3,543	3,292	3,255	3,400	3,550	3,550
N11	9 – 10	Glen of the Downs - Delgany	2	3,273	3,503	3,255	3,221	3,400	3,550	3,550
N11	10 – 11	Delgany – Greystones (Kilpedder)	2	2,915	2,967	3,089	3,074	3,400	3,550	3,550
N11	11 – 12	Greystones (Kilpedder)–Newtown	2	2,785	2,808	2,844	2,832	3,400	3,550	3,550
N11	12 – 13	Newtown MK - Newcastle	2	2,084	2,095	2,261	2,259	3,400	3,550	3,550
N11	13 – 14	Newcastle – Coyne's Cross	2	2,209	2,210	2,488	2,488	3,400	3,550	3,550
M11	14 – 15	Coyne's Cross - Ashford	2	2,319	2,320	2,585	2,585	3,400	4,600	4,600

Figures highlighted in red indicate that the section is operating at or above 95% of the link specific practical capacity in the peak hour

[4] *Lower southbound practical capacity due to gradient issue between Junctions 6a & 7 only. (Closure of Junction 6a and improvements at Junction 8 address previous shortcomings.)*

ANNEX B

Network Statistics

ANNEX B: Network Statistics

Table B.1 presents the modelled network statistics for the AM and PM peak hour in relation to the DS 2015 scenarios for junction upgrades. The corresponding 2015 AM and PM peak Do-Nothing Base Year (BY) scenario is also shown for comparison purposes.

Table B.1: AM & Peak Hour Modelled Network Statistics (Do Something Scenarios - Junctions - 2015)

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	**17,721**	**4,648**	**15.74**	**201,602**	**997**
2015 AM DS J5a	17,721	4,655	15.76	201,565	1,001
2015 AM DS J5b	17,721	4,655	15.76	201,816	1,001
2015 AM DS J6	17,721	4,643	15.72	201,581	992
2015 AM DS J7	17,721	4,545	15.39	200,234	921
2015 PM DN	**17,706**	**4,445**	**15.06**	**200,448**	**807**
2015 PM DS J5a	17,706	4,447	15.07	200,571	806
2015 PM DS J5b	17,706	4,449	15.08	200,754	808
2015 PM DS J6	17,706	4,442	15.05	200,469	805
2015 PM DS J7	17,706	4,379	14.84	200,008	762

Table B.2 presents the modelled network statistics for the AM and PM peak periods in the 2015 DS scenarios for the regional and local road options. The corresponding 2015 AM and PM peak Do-Nothing scenario is also shown for comparison purposes.

Table B.2: AM & PM Peak Hour Modelled Network Statistics (DS Scenarios – Regional/Local Roads Options - 2015)

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2015 AM DN	**17,721**	**4,648**	**15.74**	**201,602**	**997**
2015 AM DSL1	17,721	4,502	15.24	200,092	877
2015 AM DSL2	17,721	4,494	15.22	199,093	884
2015 AM DSL3	17,721	4,636	15.70	201,548	985
2015 AM DSL4	17,721	4,578	15.50	201,808	924
2015 AM DSL5	17,721	4,563	15.45	201,772	907
2015 AM DSL6	17,721	4,667	15.80	201,558	1,014
2015 AM DSL7	17,721	4,665	15.80	201,411	1,005
2015 AM DSL8	17,721	4,619	15.64	200,879	984
2015 PM DN	**17,706**	**4,445**	**15.06**	**200,448**	**807**
2015 PM DSL1	17,706	4,391	14.88	199,969	762
2015 PM DSL2	17,706	4,412	14.95	200,068	791
2015 PM DSL3	17,706	4,444	15.06	200,450	806
2015 PM DSL4	17,706	4,394	14.89	199,752	772
2015 PM DSL5	17,706	4,411	14.95	200,741	769
2015 PM DSL6	17,706	4,528	15.35	200,953	875
2015 PM DSL7	17,706	4,451	15.08	200,909	797
2015 PM DSL8	17,706	4,420	14.98	199,803	794

Table B.3 presents the modelled network statistics for the AM and PM peak periods in the 2030 DS scenarios for junctions, as well as the regional and local road options. The corresponding 2030 AM and PM peak Do-Minimum scenario is also shown for comparison purposes.

Table B.3: AM & PM Peak Hour Modelled Network Statistics (DS Scenarios – Junctions, Regional/Local Roads Options and Emerging Preferred Strategy - 2030)

Scenario	Total Trips (Vehs/hr)	Total Travel Time (hrs)	Travel Time per Vehicle (mins)	Total Distance (km)	Total Delay (hrs)
2030 AM DN	**21,284**	**6,080**	**17.14**	**247,835**	**1,667**
2030 AM DS J7	21,284	5,548	15.64	246,480	1,180
2030 AM DSL1	21,284	5,603	15.79	246,172	1,233
2030 AM DSL4	21,284	5,709	16.09	248,250	1,303
2030 AM DS L7	21,284	5,760	16.24	247,965	1,349
2030 AM DS EPS	21,284	5,442	15.34	244,156	1,107
2030 PM DN	**21,223**	**5,693**	**16.09**	**244,756**	**1,333**
2030 PM DS J7	21,223	5,380	15.21	244,591	1,049
2030 PM DSL1	21,223	5,389	15.23	244,495	1,051
2030 PM DSL4	21,223	5,404	15.28	244,327	1,067
2030 PM DS L7	21,223	5,462	15.44	245,133	1,103
2030 PM EPS	21,223	5,289	14.95	242,990	983

ANNEX C

Impact of DS Scenarios upon N11/M11 Mainline Flows - 2015 and 2030

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON MAINLINE FlOWS - 2015

Table C.1: 2015 Do-Something Scenarios (Junctions) M11/N11 Northbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) Flow (vehs/hr)					PM Peak (17:00 – 18:00) Flow (vehs/hr)				
				DN	DS J5a	DS J5b	DS J6	DS J7	DN	DS J5a	DS J5b	DS J6	DS J7
M50	16 - 17	Cherrywood - M11	2	2776	2716	2739	2776	2774	1547	1519	1519	1547	1544
M11	3 - 4	Loughlinstown - M50	2	1800	1774	1884	1800	1805	888	821	902	887	891
	4 - 5	M50/M11 - Bray North	2+1	4576	4491	4622	4576	4580	2434	2340	2422	2435	2435
	5 - 6	Bray North - Bray Central	2	**4160**	**4130**	**4083**	**4164**	**4197**	2028	2075	2042	2028	2066
N11	6 - 6a	Bray Central - Herbert Rd/R117	2	**4027**	**4031**	**4028**	**4022**	**4129**	2285	2306	2288	2293	2267
	6a - 7	Herbert Rd/R117 - Bray South	2	**4089**	**4082**	**4086**	**4081**	**4228**	2201	2220	2204	2209	2208
	7 - 8	Bray South - Kilmacanogue	2	3159	3159	3159	3144	2874	1529	1534	1526	1530	1540
	8 - 9	Kilmacanogue - Glen of the Downs	2	2452	2467	2468	2457	2411	1335	1340	1332	1336	1341
	9 - 10	Glen of the Downs - Delgany	2	2419	2434	2435	2424	2378	1293	1298	1290	1294	1300
	10 - 11	Delgany - Greystones (Kilpedder)	2	2158	2167	2156	2161	2156	1133	1133	1134	1134	1137
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	2034	2037	2033	2035	2032	1248	1248	1248	1248	1248
	12 - 13	Newtown MK - Newcastle	2	1629	1630	1630	1629	1630	1003	1003	1003	1003	1003
	13 - 14	Newcastle - Coynes Cross	2	1711	1711	1711	1711	1711	1027	1027	1027	1027	1027
M11	14 - 15	Coynes Cross - Ashford	2	1698	1698	1698	1698	1698	1024	1024	1024	1024	1024

Figures highlighted in red indicate that the section is operating at or above 95% of the practical capacity in the peak hour

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON M11/N11 MAINLINE FlOWS - 2015

Table C.2: 2015 Do-Something Scenarios (Junctions) M11/N11 Southbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) Flow (vehs/hr)					PM Peak (17:00 – 18:00) Flow (vehs/hr)				
				DN	DS J5a	DS J5b	DS J6	DS J7	DN	DS J5a	DS J5b	DS J6	DS J7
M50	16 - 17	Cherrywood - M11	2	1346	1347	1346	1346	1345	2337	2331	2337	2337	2337
M11	3 - 4	Loughlinstown - M50	2	792	795	795	792	793	1397	1405	1407	1397	1397
	4 - 5	M50/M11 - Bray North	2+1	2138	2142	2141	2138	2138	3734	3737	3744	3734	3734
	5 - 6	Bray North - Bray Central	2	1703	1773	1769	1704	1735	3371	3393	3388	3343	3406
N11	6 - 6a	Bray Central - Herbert Rd/R117	2	2069	2071	2071	2068	2116	**3666**	**3665**	**3663**	**3673**	**3651**
	6a - 7	Herbert Rd/R117 - Bray South	2	2071	2058	2062	2053	2130	**3531**	**3532**	**3529**	**3533**	3379
	7 - 8	Bray South - Kilmacanogue	2	1623	1611	1610	1604	1394	2807	2807	2808	2808	2914
	8 - 9	Kilmacanogue - Glen of the Downs	2	1226	1229	1230	1228	1241	2449	2449	2450	2449	2552
	9 - 10	Glen of the Downs - Delgany	2	1189	1192	1192	1190	1203	2415	2416	2416	2416	2518
	10 - 11	Delgany - Greystones (Kilpedder)	2	1049	1050	1049	1050	1060	2320	2320	2320	2320	2321
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	1113	1114	1113	1113	1115	2121	2121	2121	2121	2125
	12 - 13	Newtown MK - Newcastle	2	907	907	907	907	908	1706	1706	1706	1706	1710
	13 - 14	Newcastle - Coynes Cross	2	936	936	936	936	936	1828	1828	1828	1828	1827
M11	14 - 15	Coynes Cross - Ashford	2	976	976	976	976	976	1917	1917	1917	1917	1916

Figures highlighted in red indicate that the section is operating at or above 95% of the practical capacity in the peak hour

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON MAINLINE FlOWS - 2015

Table C.3: 2015 Do-Something Scenarios (Regional/Local Road Options) M11/N11 Northbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) Flow (vehs/hr)									PM Peak (17:00 – 18:00) Flow (vehs/hr)								
				DN	DS L1	DS L2	DS L3	DS L4	DS L5	DS L6	DS L7	DS L8	DN	DS L1	DS L2	DS L3	DS L4	DS L5	DS L6	DS L7	DS L8
M50	16 - 17	Cherrywood - M11	2	2776	2773	2776	2774	2775	2776	2776	2814	2774	1547	1550	1547	1545	1550	1547	1545	1476	1546
M11	3 - 4	Loughlinstown - M50	2	1800	1797	1800	1804	1804	1799	1800	1813	1794	888	888	887	892	886	888	892	917	887
	4 - 5	M50/M11 - Bray North	2+1	4576	4570	4576	4578	4579	4576	4577	4627	4568	2434	2438	2435	2437	2436	2435	2436	2393	2433
	5 - 6	Bray North - Bray Central	2	**4160**	**4214**	**4162**	**4192**	**4200**	**4158**	**4152**	**4159**	**4197**	2028	2086	2028	2024	2037	2001	2015	2027	2102
N11	6 - 6a	Bray Central - Herbert Rd/R117	2	**4027**	**4179**	**4043**	**4050**	**4051**	**4026**	**3502**	**4027**	**3821**	2285	2206	2285	2223	2301	2384	2190	2285	2119
	6a - 7	Herbert Rd/R117 - Bray South	2	**4089**	**3641**	**4067**	**4115**	**4112**	**4088**	**3502**	**4086**	**3884**	2201	2148	2196	2139	2216	2296	2190	2200	2035
	7 - 8	Bray South - Kilmacanogue	2	3159	2869	3140	3048	3233	3147	3098	3156	3036	1529	1538	1530	1419	1595	1523	1526	1529	1531
	8 - 9	Kilmacanogue - Glen of the Downs	2	2452	2406	2445	2461	2565	2456	2479	2452	2443	1335	1344	1335	1337	1404	1330	1333	1334	1333
	9 - 10	Glen of the Downs - Delgany	2	2419	2372	2412	2428	2321	2423	2446	2419	2409	1293	1303	1293	1296	1276	1290	1293	1293	1291
	10 - 11	Delgany - Greystones (Kilpedder)	2	2158	2165	2158	2158	2151	2154	2165	2158	2179	1133	1135	1133	1135	1135	1131	1132	1133	1136
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	2034	2034	2034	2034	2028	2033	2037	2034	2039	1248	1249	1248	1248	1248	1245	1247	1248	1248
	12 - 13	Newtown MK - Newcastle	2	1629	1631	1629	1631	1630	1629	1629	1629	1631	1003	1004	1003	1003	1004	1003	1003	1003	1003
	13 - 14	Newcastle - Coynes Cross	2	1711	1711	1711	1711	1711	1711	1711	1711	1711	1027	1028	1027	1027	1028	1027	1027	1027	1027
M11	14 - 15	Coynes Cross - Ashford	2	1698	1698	1698	1698	1698	1698	1698	1698	1698	1024	1024	1024	1024	1024	1024	1024	1024	1024

Figures highlighted in red indicate that the section is operating at or above 95% of the practical capacity in the peak hour

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON MAINLINE FlOWS - 2015

Table C.4: 2015 Do-Something Scenarios (Regional/Local Road Options) M11/N11 Southbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes	AM Peak (08:00 – 09:00) Flow (vehs/hr)									PM Peak (17:00 – 18:00) Flow (vehs/hr)								
				DN	DS L1	DS L2	DS L3	DS L4	DS L5	DS L6	DS L7	DS L8	DN	DS L1	DS L2	DS L3	DS L4	DS L5	DS L6	DS L7	DS L8
M50	16 - 17	Cherrywood - M11	2	1346	1344	1346	1344	1345	1346	1346	1343	1344	2337	2337	2337	2337	2337	2337	2337	2291	2337
	3 - 4	Loughlinstown - M50	2	792	793	793	792	792	792	792	790	793	1397	1397	1397	1397	1397	1397	1397	1413	1397
M11	4 - 5	M50/M11 - Bray North	2+1	2138	2137	2139	2137	2137	2138	2138	2134	2137	3734	3734	3734	3734	3734	3733	3734	3704	3734
	5 - 6	Bray North - Bray Central	2	1703	1706	1711	1705	1760	1604	1694	1702	1737	3371	3410	3371	3378	3393	3282	3401	3372	3447
	6 - 6a	Bray Central - Herbert Rd/R117	2	2069	2046	2040	2072	2122	1957	1744	2066	1897	**3666**	**3584**	**3662**	**3614**	**3692**	**3730**	3128	**3665**	3424
	6a - 7	Herbert Rd/R117 - Bray South	2	2071	1750	2045	2031	2107	2240	1744	2068	1941	**3531**	**3556**	**3527**	3325	**3560**	**3730**	3128	**3530**	3444
	7 - 8	Bray South - Kilmacanogue	2	1623	1391	1612	1491	1647	1611	1520	1620	1519	2807	2874	2807	2512	2888	2724	2742	2807	2811
	8 - 9	Kilmacanogue - Glen of the Downs	2	1226	1238	1227	1242	1289	1230	1211	1227	1235	2449	2517	2449	2555	2529	2368	2385	2449	2449
N11	9 - 10	Glen of the Downs - Delgany	2	1189	1200	1190	1205	1162	1193	1174	1189	1198	2415	2484	2415	2521	2327	2336	2353	2415	2415
	10 - 11	Delgany - Greystones (Kilpedder)	2	1049	1061	1049	1052	1064	1050	1043	1049	1061	2320	2317	2320	2327	2312	2295	2300	2320	2324
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	1113	1115	1113	1115	1115	1113	1112	1113	1115	2121	2121	2121	2125	2121	2119	2119	2121	2122
	12 - 13	Newtown MK - Newcastle	2	907	909	907	909	909	907	906	907	909	1706	1707	1706	1710	1706	1704	1705	1706	1708
	13 - 14	Newcastle - Coynes Cross	2	936	937	936	937	936	936	936	936	937	1828	1828	1828	1827	1828	1829	1828	1828	1827
M11	14 - 15	Coynes Cross - Ashford	2	976	976	976	976	976	976	976	976	976	1917	1917	1917	1916	1917	1918	1917	1917	1917

Figures highlighted in red indicate that the section is operating at or above 95% of the practical capacity in the peak hour

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON MAINLINE FlOWS - 2030

Table C.5: 2030 Do-Something Scenarios (Junctions and Regional/Local Road Options) M11/N11 Northbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes (With Widening)	AM Peak (08:00 – 09:00) Flow (vehs/hr)						PM Peak (17:00 – 18:00) Flow (vehs/hr)					
				DM	DS L7	DS J7	DS L1	DS L4	DS EPS	DM	DS L7	DS J7	DS L1	DS L4	DS EPS
M50	16 - 17	Cherrywood - M11	2	3406	3406	3406	3403	3406	3376	1902	1901	1901	1902	1901	1847
M11	3 - 4	Loughlinstown - M50	2	2043	2042	2050	2038	2044	2078	1017	1017	1017	1014	1018	1022
	4 - 5	M50/M11 - Bray North	3+1	5449	5448	5457	5440	5449	5454	2918	2918	2919	2916	2920	2869
	5 - 6	Bray North - Bray Central	3	5147	5167	5172	5136	5148	5162	2477	2496	2517	2585	2483	2591
N11	6 - 6a	Bray Central - Herbert Rd/R117	3	4969	4480	5186	4773	4991	4467	2693	2362	2703	2504	2625	2172
	6a - 7	Herbert Rd/R117 - Bray South	3	5066	4480	5346	4886	5094	4467	2579	2362	2615	2390	2512	2172
	7 - 8	Bray South - Kilmacanogue	3	4177	4079	3717	3943	3994	3749	1891	1889	1904	1898	1771	1909
	8 - 9	Kilmacanogue - Glen of the Downs	2	3264	3288	3142	3196	3248	3173	1676	1680	1688	1682	1686	1693
	9 - 10	Glen of the Downs - Delgany	2	3227	3250	3105	3158	3211	3136	1634	1640	1646	1641	1644	1652
	10 - 11	Delgany - Greystones (Kilpedder)	2	2828	2834	2829	2834	2826	2837	1471	1472	1474	1474	1474	1479
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	2663	2666	2661	2663	2661	2667	1637	1637	1638	1638	1638	1640
	12 - 13	Newtown MK - Newcastle	2	2056	2056	2057	2056	2056	2058	1211	1211	1211	1211	1211	1213
	13 - 14	Newcastle - Coynes Cross	2	2176	2176	2179	2176	2176	2179	1225	1225	1225	1225	1225	1225
M11	14 - 15	Coynes Cross - Ashford	2	2240	2240	2241	2240	2240	2241	1233	1233	1233	1233	1233	1233

ANNEX C: IMPACT OF DO-SOMETHING SCENARIOS ON MAINLINE FlOWS - 2030

Table C.6: 2030 Do-Something Scenarios (Junctions and Regional/Local Road Options) M11/N11 Southbound Peak Hour Flows (vehicles)

Road	Junction No.	Junction Name	No. of Lanes (With Widening)	AM Peak (08:00 – 09:00) Flow (vehs/hr)						PM Peak (17:00 – 18:00) Flow (vehs/hr)					
				DM	DS L7	DS J7	DS L1	DS L4	DS EPS	DM	DS L7	DS J7	DS L1	DS L4	DS EPS
M50	16 - 17	Cherrywood - M11	2	1828	1828	1828	1826	1828	1740	2996	2996	2996	2996	2996	2926
M11	3 - 4	Loughlinstown - M50	2	913	910	931	919	915	973	1625	1624	1624	1625	1624	1646
	4 - 5	M50/M11 - Bray North	3+1	2741	2738	2759	2745	2743	2714	4621	4621	4621	4621	4621	4572
	5 - 6	Bray North - Bray Central	3	2261	2230	2289	2283	2264	2295	4284	4296	4332	4402	4297	4423
N11	6 - 6a	Bray Central - Herbert Rd/R117	3	2445	2453	2518	2262	2456	2316	4703	4901	4700	4381	4649	4387
	6a - 7	Herbert Rd/R117 - Bray South	3	2448	2084	2560	2294	2398	2159	4464	4117	4312	4345	4257	3985
	7 - 8	Bray South - Kilmacanogue	3	2029	1887	1701	1874	1838	1701	3583	3489	3652	3590	3257	3660
	8 - 9	Kilmacanogue - Glen of the Downs	2	1520	1499	1529	1530	1532	1529	3117	3028	3185	3124	3183	3194
	9 - 10	Glen of the Downs - Delgany	2	1484	1463	1494	1494	1496	1493	3082	2995	3150	3089	3148	3159
	10 - 11	Delgany - Greystones (Kilpedder)	2	1339	1330	1350	1344	1341	1353	2900	2879	2904	2903	2904	2907
	11 - 12	Greystones (Kilpedder) - Newtown MK	2	1402	1400	1403	1404	1404	1404	2682	2677	2685	2682	2685	2686
	12 - 13	Newtown MK - Newcastle	2	1079	1077	1080	1080	1081	1080	2163	2162	2167	2164	2167	2168
	13 - 14	Newcastle - Coynes Cross	2	1101	1101	1101	1101	1101	1101	2375	2375	2375	2375	2375	2375
M11	14 - 15	Coynes Cross - Ashford	2	1146	1146	1146	1146	1146	1146	2474	2474	2474	2474	2474	2474

Appendix E

Phasing Options

Phasing Options

E.1 Proposed Measures

The various proposed measures along the M11/N11 corridor between Junction 4 (M50/M11) and Junction 8 (Kilmacanogue) are illustrated indicatively in Figures E1 to E5.

E.2 Phasing Implementation

Two phased plans to implement the various measures along the M11/N11 corridor between Junction 5 (M50/M11) and Junction 8 (Kilmacanogue) have been identified as part of this study and are discussed in the following sections.

The final measure of both phasing options considered would see the closure/reconfiguration of direct accesses and left on / left off junctions where possible, along with amendments to existing merges and diverges to comply with the appropriate standard on the section of N11 between Junction 8 (Kilmacanogue) and Junction 14 (Coynes Cross).

E2.1 Phasing Option 1 (M50 to Kilmacanogue)

Phasing Option 1 which is illustrated in Figure E.6 can be delivered in three phases as follows:

Phase 1

Phase 1 would see the introduction of services road on a section of the N11 between Junction 7 (Bray South) and Junction 8 (Kilmacanogue). At Junction 8, the southbound lane drop diverge would act as both a diverge lane and southbound service road. In the northbound direction, with a single lane gain closer to Junction 7 which acts as the Junction 8 merge and service road. This means that the mainline speed limit can be raised back to 100km/hr.

Phase 2

Phase 2 would see the M11 corridor widened to 3 lanes in each direction to Junction 6 Bray South (Fassaroe). Alongside this, Junction 6 would be upgraded by increasing the capacity of the existing roundabouts and bringing the existing merges/diverges up to standard. The upgrading of Junction 6 would allow for the additional demand through the junction to be catered for as a result of the new bridge across the River Dargle linking Upper Dargle Road to Herbert Road.

Phase 3

The next Phase would see the extension of 3 lanes to Junction 8 (Kilmacanogue). With Phase 2 completed the level of traffic through Junction 6a (east and west of the N11) would reduce as a result of the new bridge across the River Dargle. With the introduction of parallel service roads between Junctions 6 and 7, direct access between Junction 6a and the N11 could be closed thereby improving the capacity and operation of the N11 between Junctions 6 and 7.

The major upgrade to Junction 7 itself would be included as part of this Phase. Also included in this Phase would be the local link road improvements for local movements and network resilience. These include the connection between the M50 J16 (Cherrywood) to Rathmichael/Ballycorus Road Ballycorus Road, and the Ferndale Road improvements.

E.3 Phasing Implementation Option 2 (M50 to Kilmacanogue)

Phasing Option 2 which is illustrated in Figure E.7 can be delivered in three phases as follows:

Phase 1

Phase 1 would see the M11 corridor widened to 3 lanes in each direction to Junction 6 Bray South (Fassaroe). Alongside this, the N11 between Junction 6 and Junction 8 would be upgraded to 3 lanes in the southbound direction only (this would also include the southbound services roads between Junction 6a and 7) as no land acquisition is required on the western side of the N11. Phase 1 would also see the introduction of services road on a section of the N11 between Junction 7 (Bray South) and Junction 8 (Kilmacanogue).

Phase 2

The next Phase would see the N11 upgraded to 3 lanes in the northbound direction between Junction 6 and 8 (this would also include the northbound services roads between Junction 6 and 7) and the upgrading of Junctions 6 and 7. The Dargle River crossing would be included as part of this phase.

Phase 3

This Phase would include the local link road improvements for local movements and network resilience. These include the connection between the M50 J16 (Cherrywood) to Rathmichael/Ballycorus Road Ballycorus Road, and the Ferndale Road improvements.

Figure E.1 Summary J4 M50 to J8 Kilmacanogue

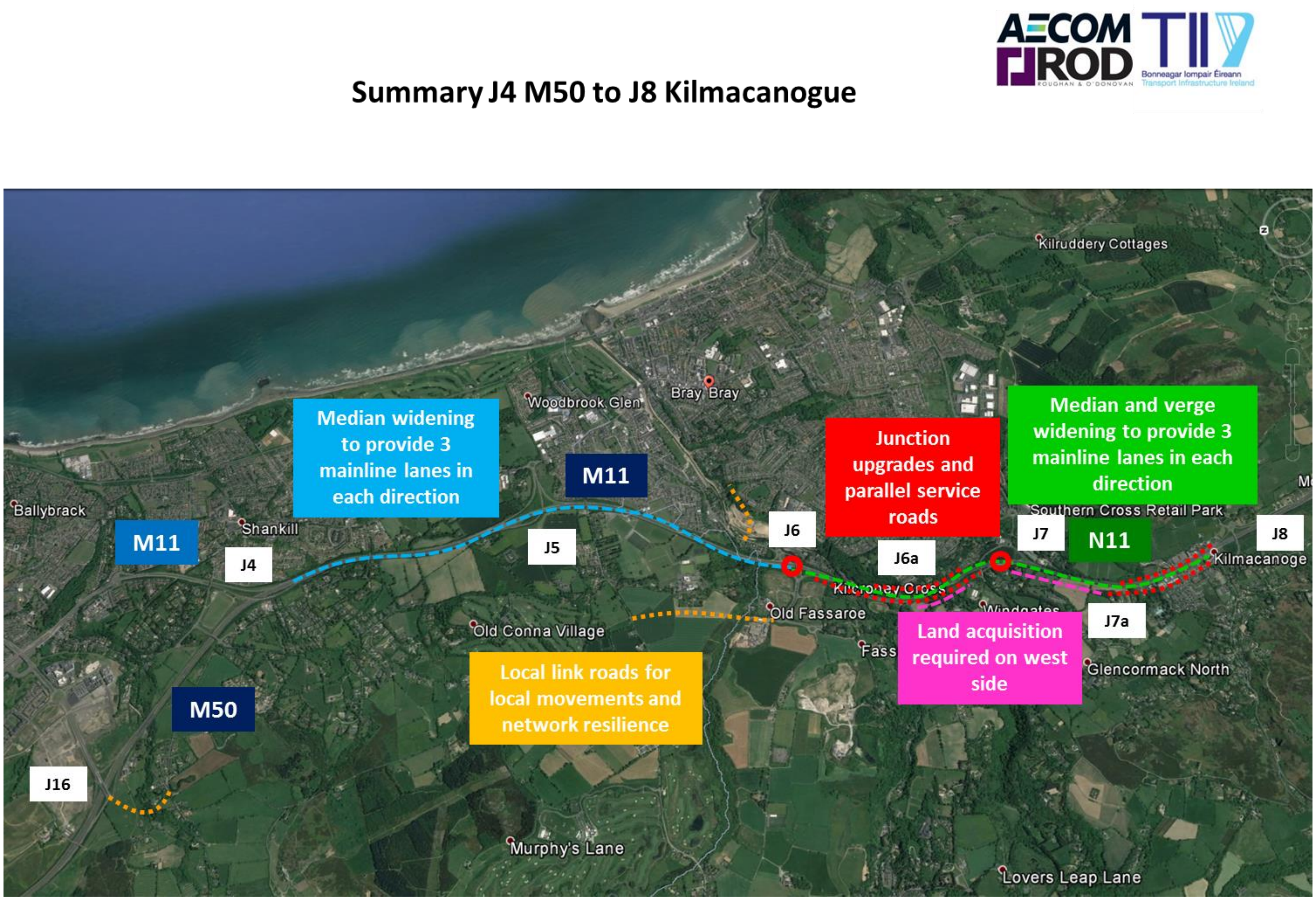


Figure E.2 Junction 4 M50 to Junction 5 Bray North

Junction 4 M50 to Junction 5 Bray North

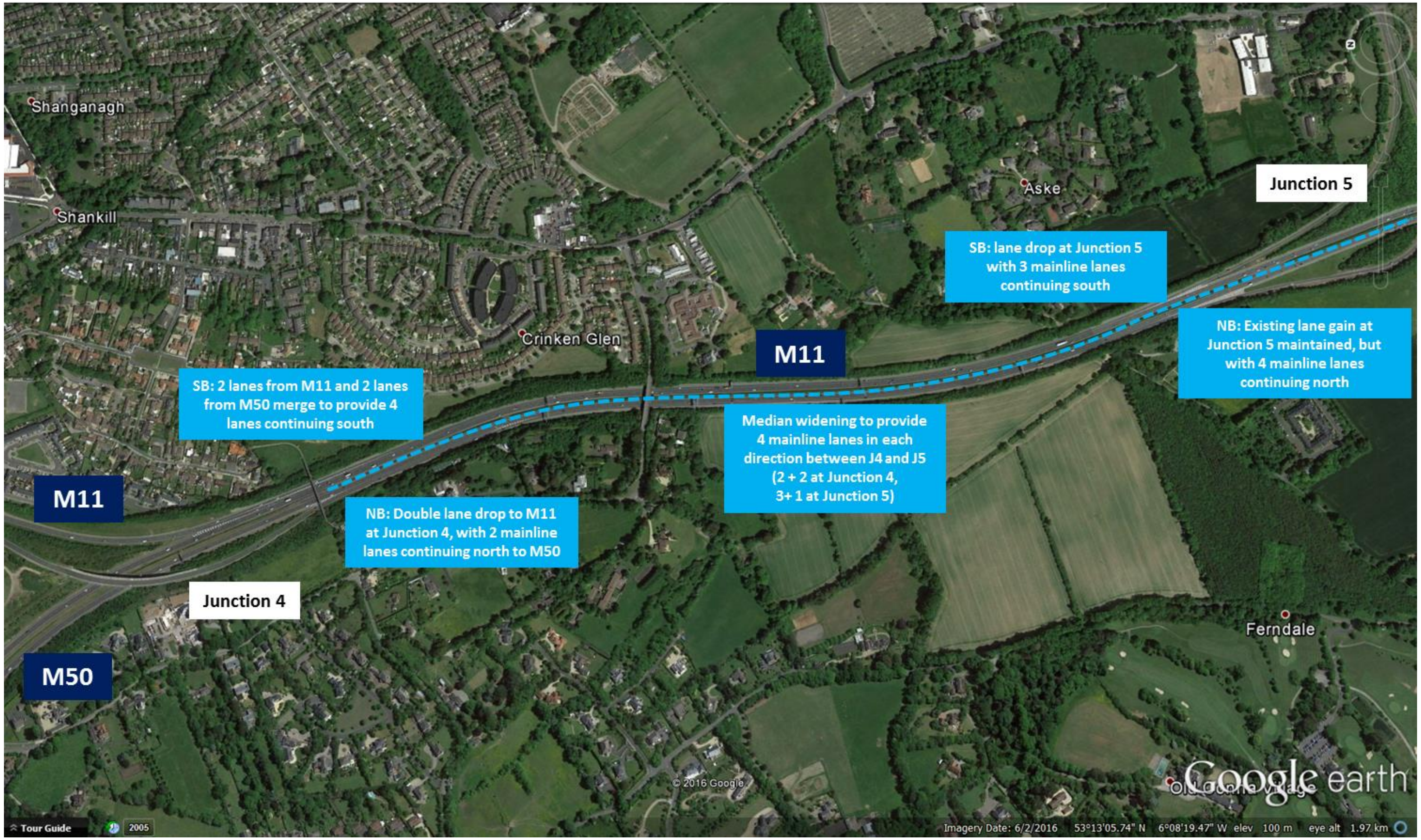


Figure E.3 Junction 5 Bray North to Junction 6 Bray Central

Junction 5 Bray North to Junction 6 Bray Central

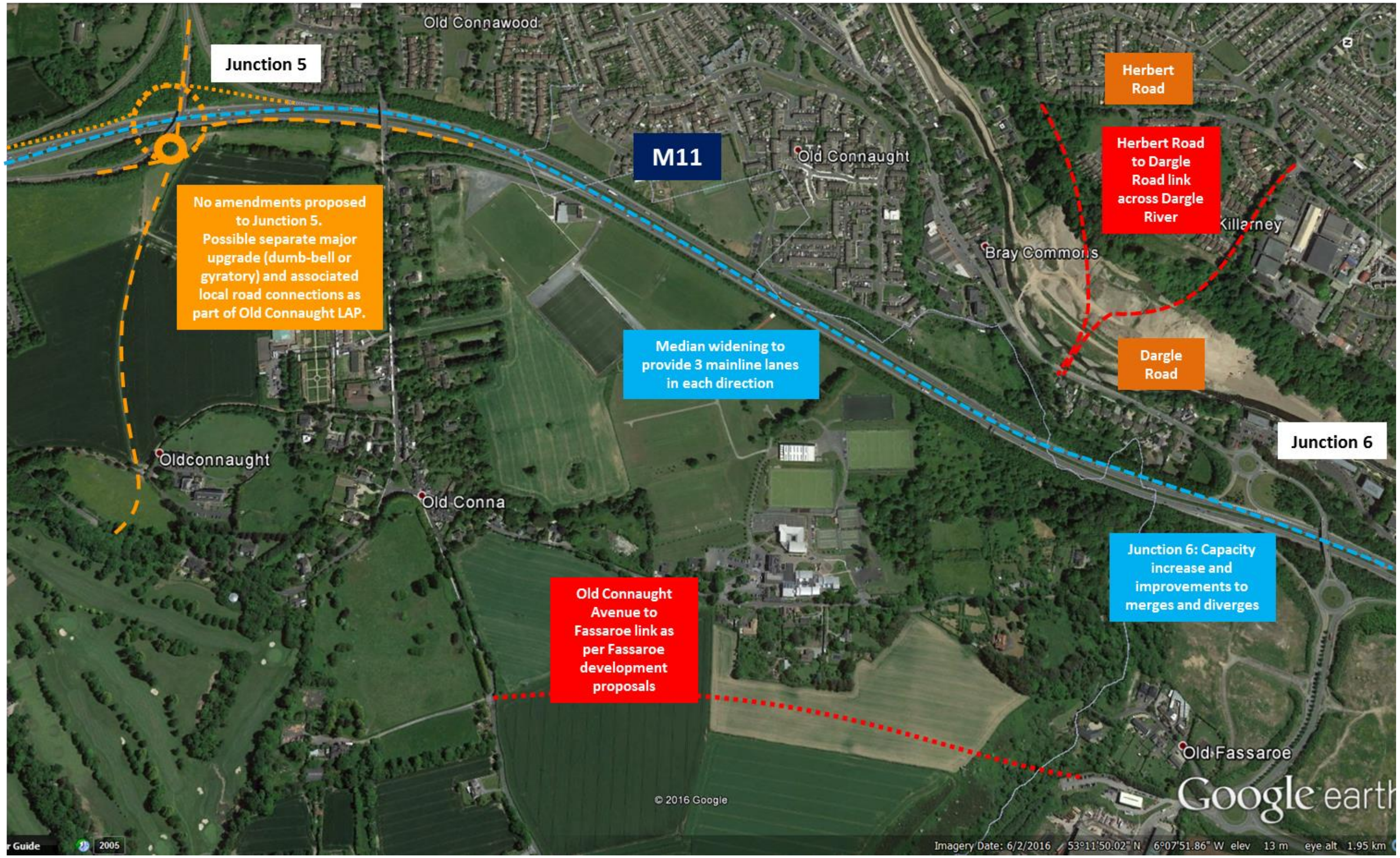


Figure E.4 Junction 6 Bray Central to Junction 7 Bray South

Junction 6 Bray Central to Junction 7 Bray South

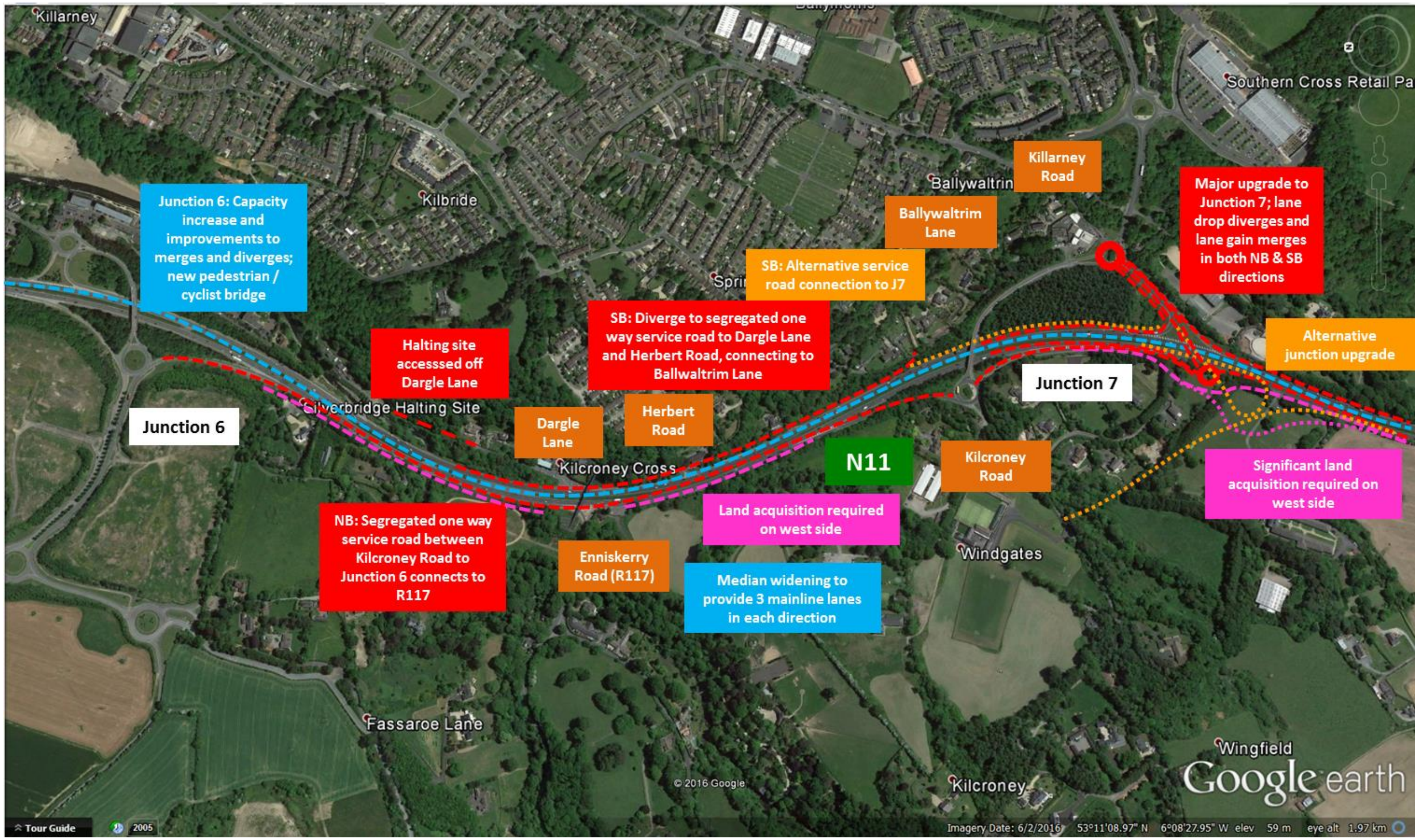


Figure E.5 Junction 7 Bray South to Junction 8 Kilmacanogue

Junction 7 Bray South to Junction 8 Kilmacanogue

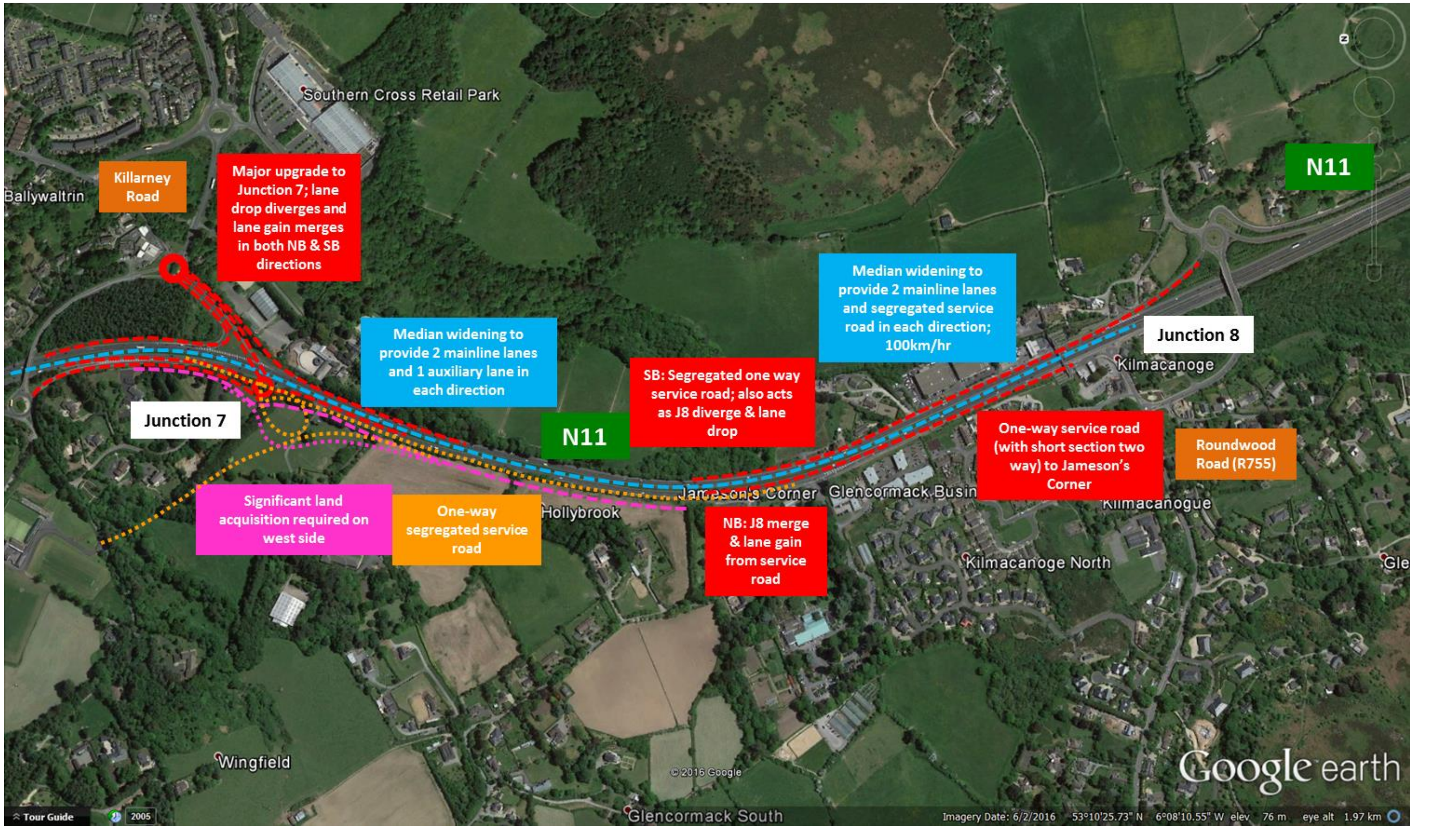


Figure E.6 Phasing Option 1 J4 (M50) to J8 (Kilmacanogue)

Phasing Option 1
J4 (M50) to J8 (Kilmacanogue)

Figure E.7 Phasing Option 2 J4 (M50) to J8 (Kilmacanogue)