TRAFFIC & TRANSPORT ASSESSMENT

Residential Development
Bessboro
Blackrock
Cork

January 2022

Document Control Sheet

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1.0 INTRODUCTION

1.1 INTRODUCTION

1.1.1 MHL Consulting Engineers has been instructed by Estuary View Ent 2022 Ltd. to prepare a Traffic & Transport Assessment (TTA) in support of a Strategic Housing Development planning application to An Bord Pleanala for the development of their lands at Bessborough, Blackrock, Cork.

1.1.2 A developed masterplan for the site proposes three phases of development, as per the following figure, **Fig 1.1.1**.

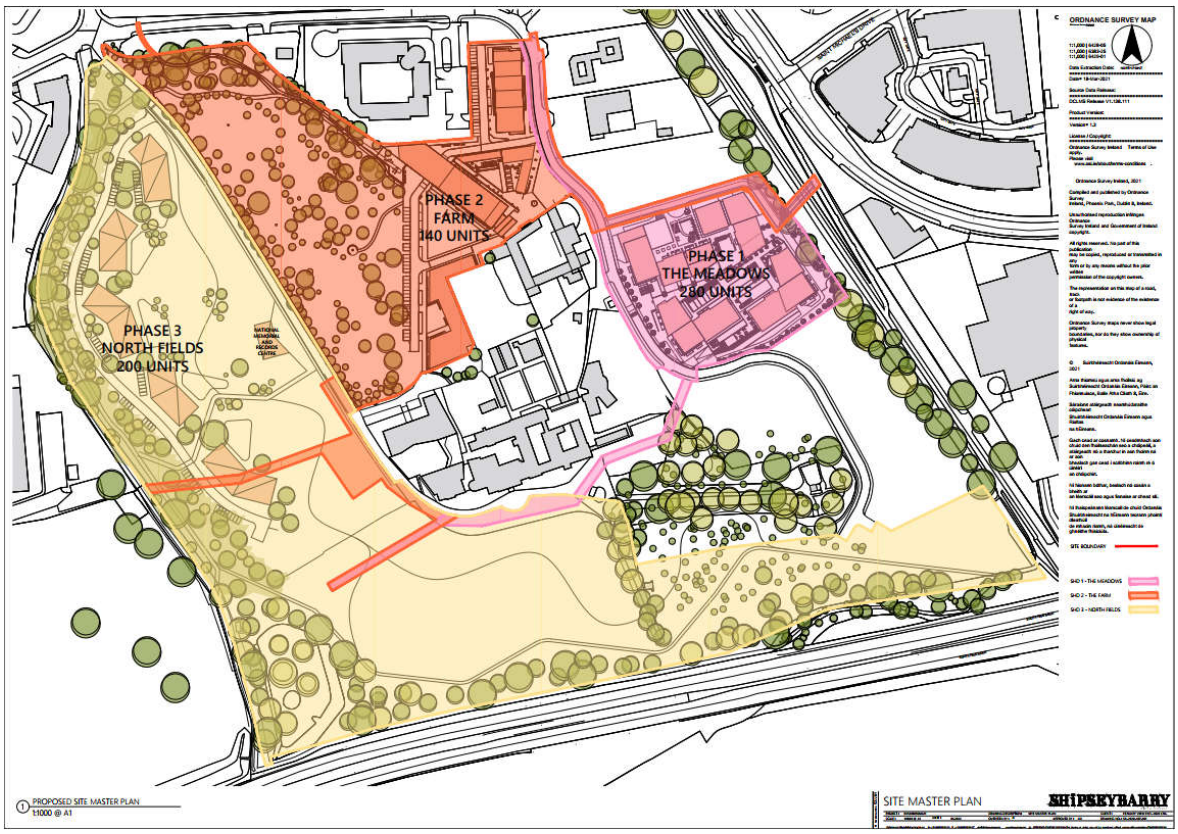

Fig 1.1.1: Proposed Phased Development of Site

Phase 1: The Meadows comprises 280 residential units with associated creche and café. This phase is to include 101 car parking spaces, 10 motorbike spaces and 604 bicycle parking spaces.

Phase 2: The Farm comprises 140 residential apartments an associated creche and is to include 58 no. car parking spaces, 5 no. motorbike spaces and 330 bicycle parking spaces.

Phase 3: The North Fields, which is subject to receiving the appropriate zoning, would comprise an additional 200 residential units with parking provision similar to that of the other phases.

Phases 1 and 2 are the subject of this SHD application whereas Phase 3 will be progressed in future years.

1.1.3 This TTA examines the cumulative effect of the proposed Bessborough Development in its entirety, considering each of the proposed phases with the following development years:

Phase 1: The Meadows – 2024-2026
Phase 2: The Farm – 2026-2028
Phase 3: The North Fields – 2028-2030

1.1.4 This TTA will assess how the proposed development will impact the surrounding roads network. It will consider appropriate access arrangements and the transport choices available to future users of the application site and how the existing/proposed transport infrastructure surrounding the site will influence that choice. The impact of traffic demand generated by the proposals will be considered and quantified for future year traffic models.

1.1.5 The scope of this study has been agreed with Cork City Council's Traffic & Transportation Department. Technical Notes have been produced to agree the key parameters relating to the traffic modelling carried out including, junctions to be assessed, trip generation, modal shift targets, trip distribution, assessment years and the presentation of results in terms of Key Performance Indicators (KPI's).

1.1.6 The key junctions in the area surrounding the proposed development are shown in **Fig 1.1.2** and are as follows:

- Junction 1: Traffic Signal Controlled cross-roads junction serving R852 Skehard Rd., Church Rd. & Scally's Supervalu.
- Junction 2. Traffic Signal Controlled T-junction where Bessborough Rd. joins R852 Skehard Rd.
- Junction 3: Traffic Signal Controlled cross-roads junction serving R852, Blackrock Ave. & Skehard Rd.
- Junction 4: Mini roundabout on the junction of Bessboro Rd. and the site access road.

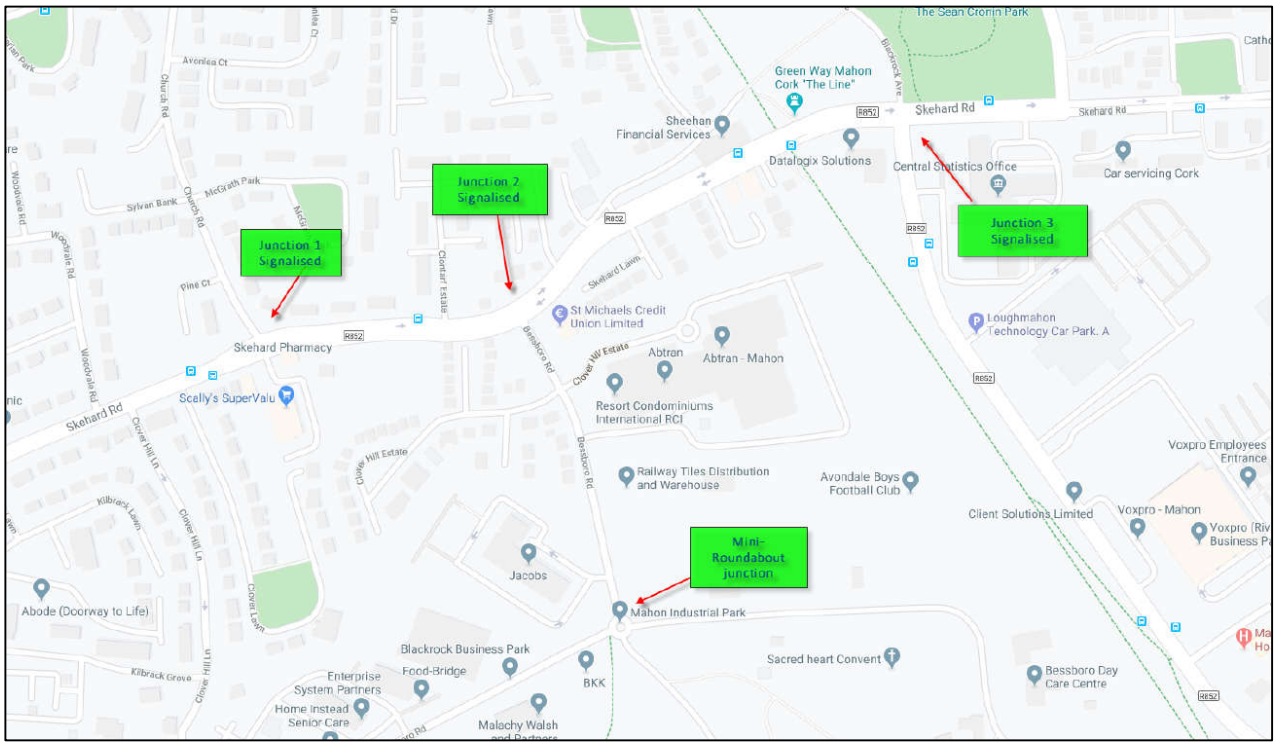

Fig 1.1.2: Junction Locations

1.2 PLANNING BACKGROUND

1.2.1 The development lands are encompassed within the proposed Bessborough Residential Neighbourhood with the transformation of the area viewed as essential for the future development of Mahon.

1.2.2 The lands are zoned for development in the current Mahon Local Area Plan 2014 under Sub-Area 3 Bessboro House & Grounds for medium density housing.

1.2.3 The proposed development of these lands for residential use is in accordance with the Strategic Goals of the Cork City Development Plan which seeks to increase population and households within Cork City via development of the greater city area. Inline with recent expenditure on public transport within the broader area this scheme will avail of sustainable transport solutions thereby reducing car dependence.

1.2.4 The lands are being actively promoted for significant residential development at local and regional planning policy levels. On this basis the proposed development in this planning application is a plan led development that is entirely suitable at this location.

1.3 STATUTORY CONSULTEE CONSULTATION

1.3.1 Notwithstanding ongoing consultation with the Traffic & Transportation Department of Cork City Council, the Design Team, have engaged with various departments within Cork City Council and with Traffic Infrastructure Ireland (TII) with a view to considering the respective issues raised as part of the design process of the scheme.

1.3.2 These engagements have informed the final layout of the scheme including access arrangements for vehicular, pedestrian and cycle modes of transport.

1.4 DOCUMENT STRUCTURE

1.4.1 A TTA is an appropriate form of assessment for the scale of the proposed development and the scope has been agreed with the Local Authority. The structure of this TTA is in accordance with TII (Transport Infrastructure Ireland) Document, Traffic and Transport Assessment Guidelines, 2014.

The aim of this TTA is to identify the characteristics of the application site and surrounding area, examine the likely transport implications, ensure sustainable accessibility is maximised and appropriate infrastructure provided.

The key issues that need to be addressed within this TTA, with reference to the size and location of the development proposal, are as follows:

- Review of the site location, composition and local roads network.
- Analysis of Road Safety data for the most recent five-year period available.
- Accessibility critique reviewing pedestrian, cycle and public transport access to the site, plus any infrastructure currently available to promote travel by sustainable means.
- A review of the relevant planning and transport policy.
- Description and justification for the proposed access arrangement, internal layout, parking provision, public transport provision, fire tender/service/delivery access, including all necessary swept-path assessments and visibility splays.
- Forecast multi-modal trip rates and trip generation as agreed with the Local Authority.
- Modal split assumptions used in the trip generation process.
- The use of appropriate and agreed traffic modelling software for the assessment of individual junctions.
- Provide With/Without Development assessment for each of the critical junctions.
- Assess significance of development generated traffic upon the surrounding transport infrastructure and identify any necessary mitigation.

2.0 NON-TECHNICAL SUMMARY

2.1 A TTA has been prepared in support of an application to An Bord Pleanala for the development of 620 no. residential units and 2 on-site creche facilities in the Bessborough Housing Development.

2.2 The TTA methodology including the scope and means of assessment of the identified key junctions has been agreed with the Local Authority as part of the pre-application process.

2.3 The TTA has demonstrated the following:

(i) The proposed residential development is in accordance with the principles of the Cork Metropolitan Area Transport Strategy and in line with the Mahon Local Area Plan (now lapsed) and forms an important continuation in the delivery of planned growth in the area. The traffic modelling carried out included for 'Granted Schemes' in the area currently under construction as well as applying TII Project Appraisal traffic growth rates on recorded traffic flows in 2020. The traffic counts were undertaken simultaneously at each of the 4 junctions in February 2020 prior to covid restrictions being put in place.

(ii) A review of the existing roads network and collision data in the vicinity of the site indicates that there are no significant problems in relation to the current safety of the Roads Network.

(iii) The following Key Performance Indicators (KPI's) were examined for the network:

a. **Journey Time Comparison:** Average journey times on specific routes in respective traffic models in seconds. A comparison of the four designated routes for the various time periods shows a steady increase in journey time both with/without development traffic. This is reflective of the application of TII Project Appraisal growth rates on background traffic flows without mitigation measures being implemented. The development of the Bessborough site will lead to an increase in traffic on the Bessborough Road primarily against the predominant direction of flow in the AM peak. It has its greatest impact in the PM peak with an approximate 3-fold increase in journey time on the Mahon Link to Skehard West route from 214 secs (2020) to 658 secs (2039). It should be noted that with no development on the site this figure jumps to 500 secs reflective of a route that will need mitigation measures to maintain its capacity in the future. Mitigation measures such as a change in signal timing at specific junctions and the elongation of right turn lanes is shown to improve this situation.

b. **Average Network Speed:** Average speed for vehicles on the modelled network in metres per second (m/s). The average network speed can be seen to decrease over the years with the introduction of additional traffic from the development and the application of TII's growth factors. In the AM the network presently operates at 9.4 m/s and this decreases to 7.4 m/s in 2039 with the development in place. Without the development the network speed decreases to 7.6 m/s in 2039. There is a greater decrease in the PM due to the larger number of vehicles in the network in the evening peak. Presently the network operates at 9.2 m/s and this decreases to 4.6 m/s in 2039 with the full development in place.

c. **Latent Demand:** Latent demand is defined as the number of vehicles still on the network at the end of a simulation period. A high latent demand can be indicative of a traffic network reaching or operating above the available capacity. The traffic modelling shows that at present there is no latent demand (2020-2024). Evident is that in the AM the latent demand begins to increase steadily from 2024 to a high of 560 vehicles remaining on the network in 2039 with the full development in place. The PM peak manages to have zero latent demand up to 2028 when phase 2 is completed. Following this there is a significant increase to 386 vehicles remaining on the network in

2039 with the full development in place. These future latent demand figures signify that without any form of mitigation the road network begins to operate over capacity.

d. **Average Queue Length:** Average length of queuing in metres on defined routes. The average queue lengths follow the trend of journey times. Presently in the AM queues are reaching a maximum of 75.3m on the Mahon Link approach to junction 3. In the PM the queue is reaching 85.2m on the same approach. It is clear from the modelling that there is a steady increase in queue length both with/without development. Mitigation measures in future years are effective in reducing the length of queues at all 5 locations assessed.

(iv) The KPI's have identified that the modelled road network will need varying levels of mitigation in future years. These mitigation measures would include varying the cycle time at individual junctions to accommodate expected changes to the predominant direction of flow, elongation of certain right turn lanes to accommodate the increase in traffic volumes and continued investment in public transport and sustainable transport solutions to encourage alternatives to the private car. If successful an increase in sustainable transport use would negate the assumed growth rates being applied to future years, implying that 2026 results with/without development would more represent future year scenarios.

(v) The proposed site layout is permeable to the roads network and is well connected to existing pedestrian linkages to public transport offerings, schools, retail and amenity destinations.

(vi) The proposed new access arrangements are safe and suitable and are in accordance with the Design Manual for Roads & Bridges (DMRB) and the Design Manual for Urban Roads & Streets (DMURS).

(vii) The site benefits from being in close proximity to regular transport provision, within walking distance of the site, which enables journeys throughout Cork City. Car parking provision within the site is at the lower end of the scale in order to encourage the use of sustainable transport modes.

(viii) The site is situated adjacent to the Blackrock railway greenway and includes provisions for two new links to the greenway from the development. Access to the greenway provides residents with excellent connectivity using sustainable transport options to the surrounding area and Cork City. Existing links from the greenway allow efficient access to local destinations such as the Mater Private Hospital, Mahon Point Shopping Centre, Mahon Retain Park, Voxpro, and the Central Statistics Office.

2.4 Road improvement works completed in 2021 as a part of the Skehard Road Improvement Scheme will positively impact on modal shift targets. Improved pedestrian and cyclist facilities in addition to the extension of bus lane facilities will have the effect of reducing journey times and encouraging an increase in use.

A modal shift of 45% (implying an anticipated increase in public transport or active travel in the immediate area of 21%) for future year models is deemed to be reasonable. This modal shift increase of 21% was applied to proposed development traffic from the opening year (when the development is fully completed) 2024, up to the design year 2039. It was not applied to background traffic flows.

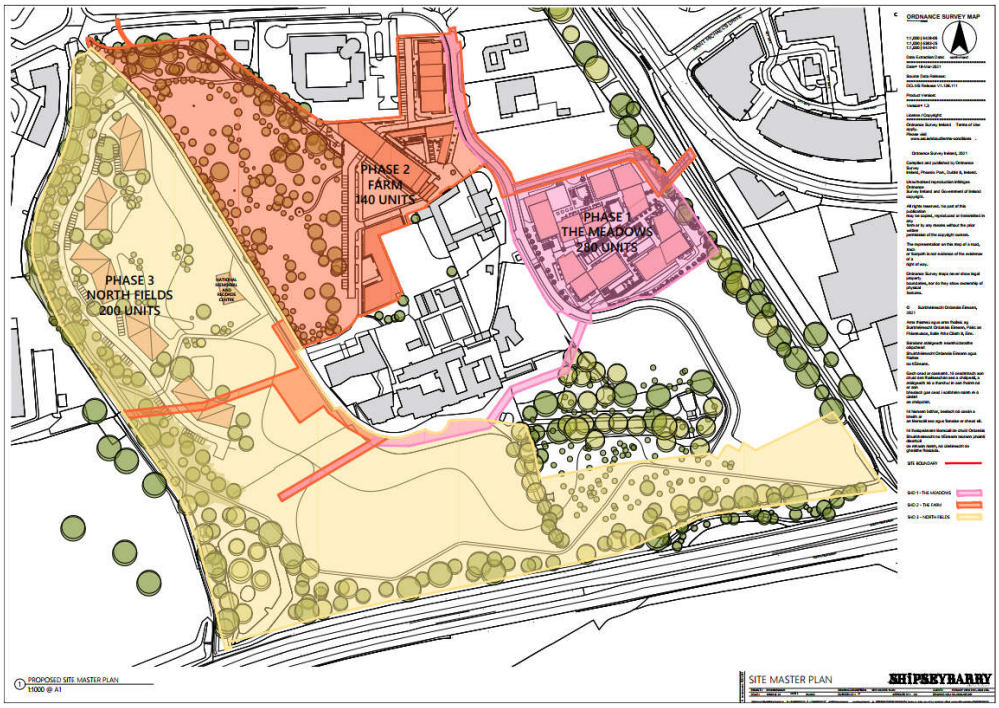

Fig 2.4.1: Combined Gateway View Proposed Development

3.0 EXISTING CONDITIONS

3.1 INTRODUCTION

3.1.1 This section describes the base data used to develop the junction models, the critical links and junctions as agreed with the Local Authority, committed transport proposals to the area and other surrounding proposed development.

3.2 BASELINE TRAFFIC CONDITIONS

3.2.1 As part of the pre-application process the extent of data collection and the critical links and junctions was agreed with the Local Authority.

3.2.2 A variety of different data sources have been used, including:

- 12-hour classified turning counts (4 sites, refer **Fig 3.2.1** below);
- Background OS Mapping and aerial photography;
- On-site junction measurements including saturation flows, link speeds, queue length measurements, pedestrian movements at signalled crossings and geometric data for each of the modelled junctions;

3.2.3 A total of 4 turning count surveys were undertaken as part of the study on Thursday 6th February 2020 prior to Covid restrictions being put in place. These surveys were carried out simultaneously using video cameras at each of the junctions for a 12-hour period. Queue length and pedestrian surveys were also conducted for the 12-hour period.

3.2.4 On-site measurements including lane widths, junction turning radii, lane lengths and saturation flows were undertaken by MHL and were incorporated in the constructed models.

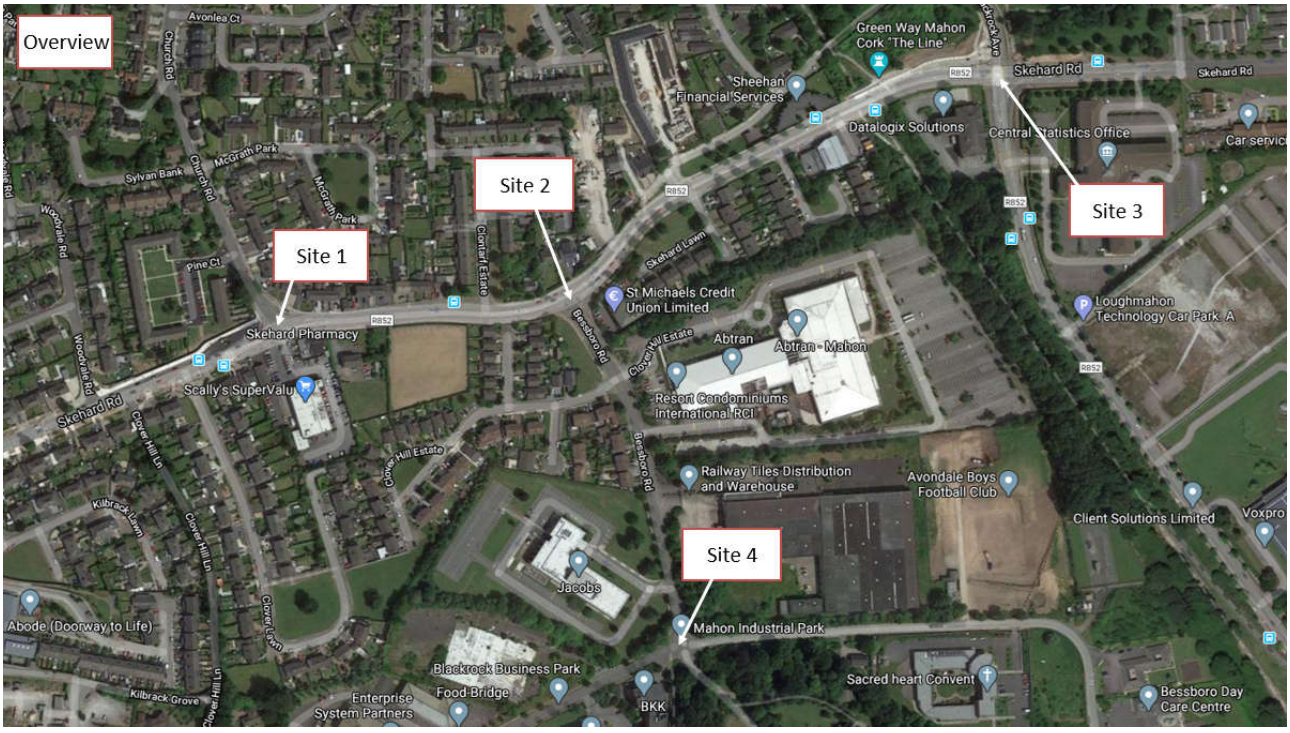

Fig 3.2.1: Traffic Count Survey Locations

3.2.5 The following figures present the recorded 12-hour traffic profile, percentage of classified vehicles and turning movements for each of the modelled junctions carried out on Thursday 6th of February 2020:

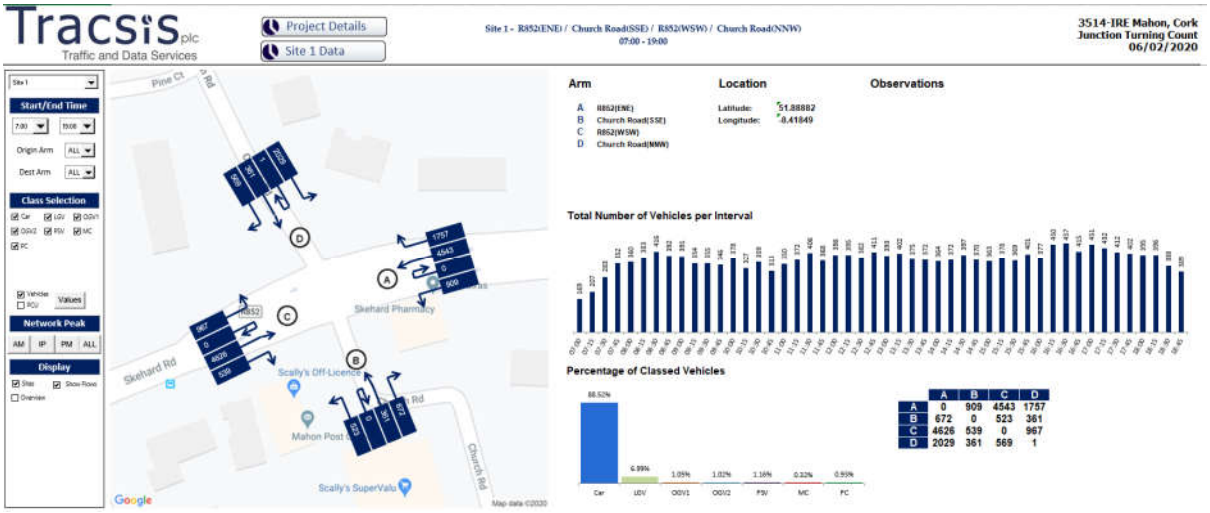

Fig 3.2.2: Junction 1: R852 Skehard Rd./Church Rd.

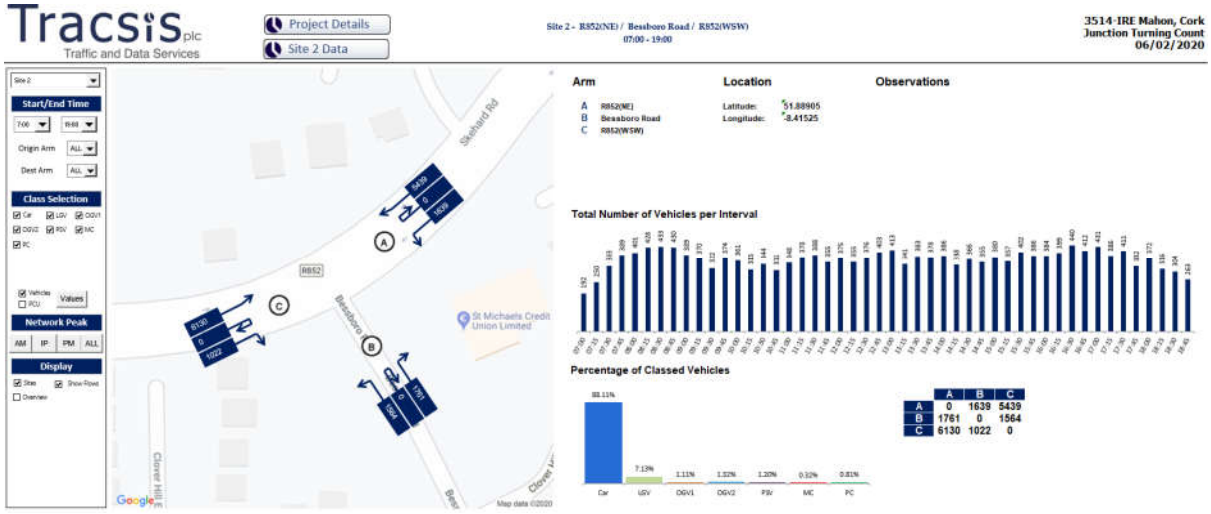

Fig 3.2.3: Junction 2: Bessboro Road/R852

Fig 3.2.4: Junction 3: R852/Skehard Road/Blackrock Ave.

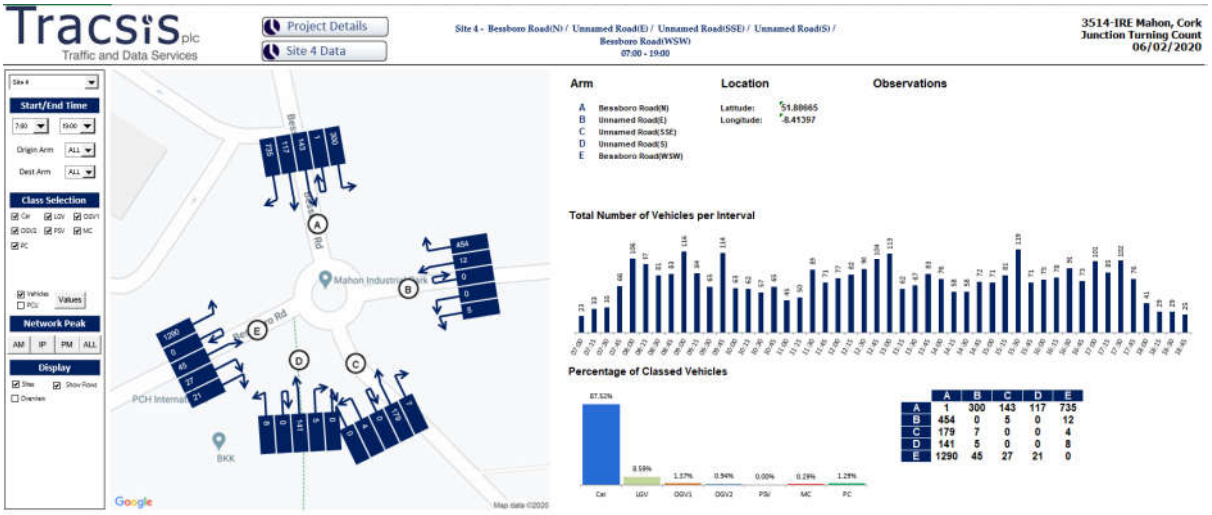

Fig 3.2.5: Junction 4: Bessboro Road mini-roundabout

3.2.6 The data presented in the above figures shows the peak hour traffic periods for both morning and evening respectively at each junction as follows:

- Junction 1: 08:15 – 09:15 and 16:15 – 17:15
- Junction 2: 08:00 – 09:00 and 16:15 – 17:15
- Junction 3: 08:30 – 09:30 and 16:00 – 17:00
- Junction 4: 09:00 – 10:00 and 17:00 – 18:00

For the purpose of the modelling analysis, each of the above peak hour traffic periods are included in the constructed Paramics Discovery Traffic Model which will run from 07:30-09:30 and 16:30-18:30. This ensures a robust analysis of the road network is carried out.

3.2.7 The percentage of classified vehicles was used within the generated traffic models to accurately reflect existing conditions.

3.3 SITE LOCATION AND COMPOSITION

3.3.1 The application site is located in Bessboro, Blackrock, considered within the South Eastern Suburbs of Cork City as defined by the Cork City Development Plan 2015-2021. Access to the site is by means of an existing access road which currently accesses the site.

3.4 LOCAL ROADS NETWORK

3.4.1 *Junction 1: Traffic Signal Controlled cross-roads junction serving R852 Skehard Rd., Church Rd. & Scally's Supervalu*

This cross-roads junction serves as an important vehicular access between Mahon Point and the greater Cork City urban area. It also provides a link for the surrounding residential areas to the wider roads network.
The measured two-way AADT (Annual Average Daily Traffic) at the cross-roads junction is 20,390.

Image 3.4.1: Image of R852 Skehard Rd./Church Rd. cross-roads

Fig 3.4.1: R852 Skehard Rd./Church Rd. cross-roads – AM Peak Hour Flows

Fig 3.4.2: R852 Skehard Rd./Church Rd. cross-roads – PM Peak Hour Flows

3.4.2 *Junction 2: Traffic Signal Controlled T-Junction at which Bessboro Rd. joins R852 Skehard Rd.*

This signalised T-junction forms a part of the primary route serving the Mahon Industrial Estate and the Blackrock Business Park in addition to various commercial enterprises in the surrounding area. The junction also facilitates access to the Bessborough Centre and the Bessboro Day Care Centre.
The measured AADT (Annual Average Daily Traffic) at the T-junction is, 20,050.

Image 3.4.2: Image of Junction 2: R852 Skehard Rd./Bessboro Rd.

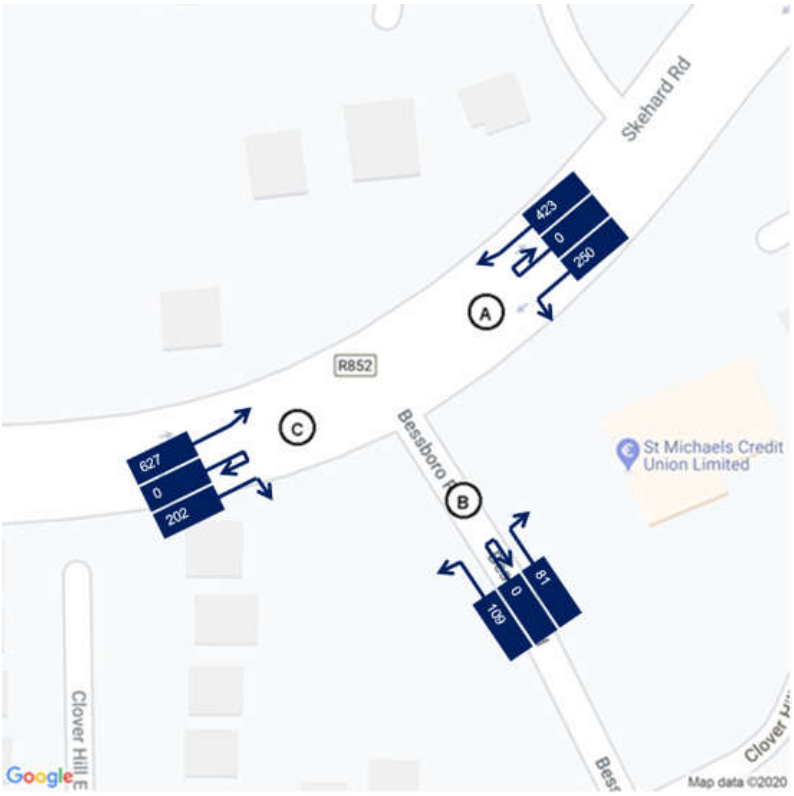

Fig 3.4.3: R852 Skehard Rd./Bessboro Rd.– AM Peak Hour Flows

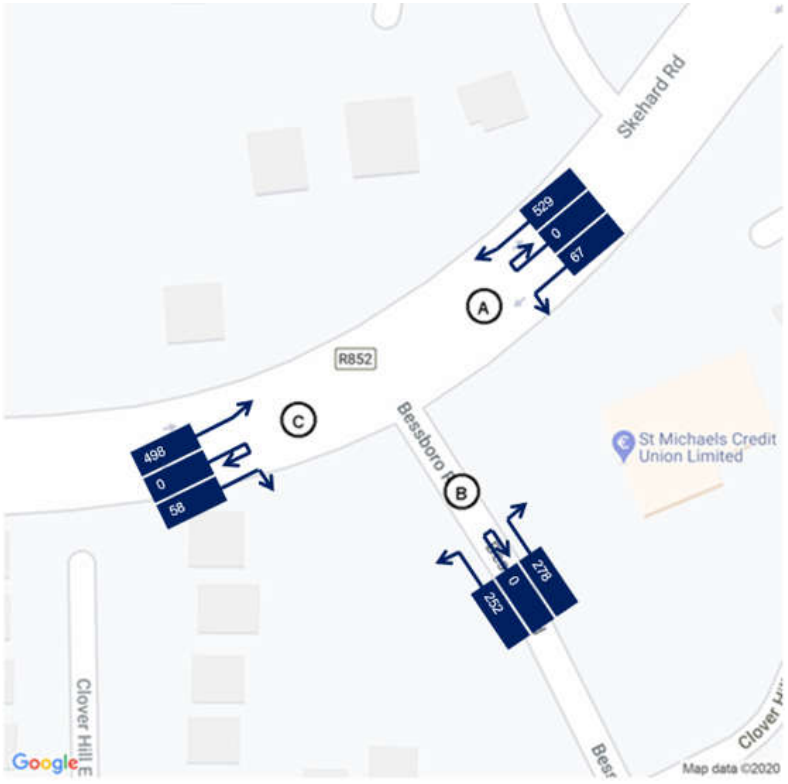

Fig 3.4.4: R852 Skehard Rd./Bessboro Rd.– PM Peak Hour Flows

3.4.3 *Junction 3*: *Traffic Signal Controlled cross-roads junction serving R852, Blackrock Ave., & Skehard Rd.*:

This signalised junction serves as an important vehicular access to the Mahon Retail Complex and the South Ring Road. Traffic flows through the junction are significant with a measured AADT (Annual Average Daily Traffic) of 23,900.

Image 3.4.3: R852/Blackrock Ave./Skehard Rd. junction

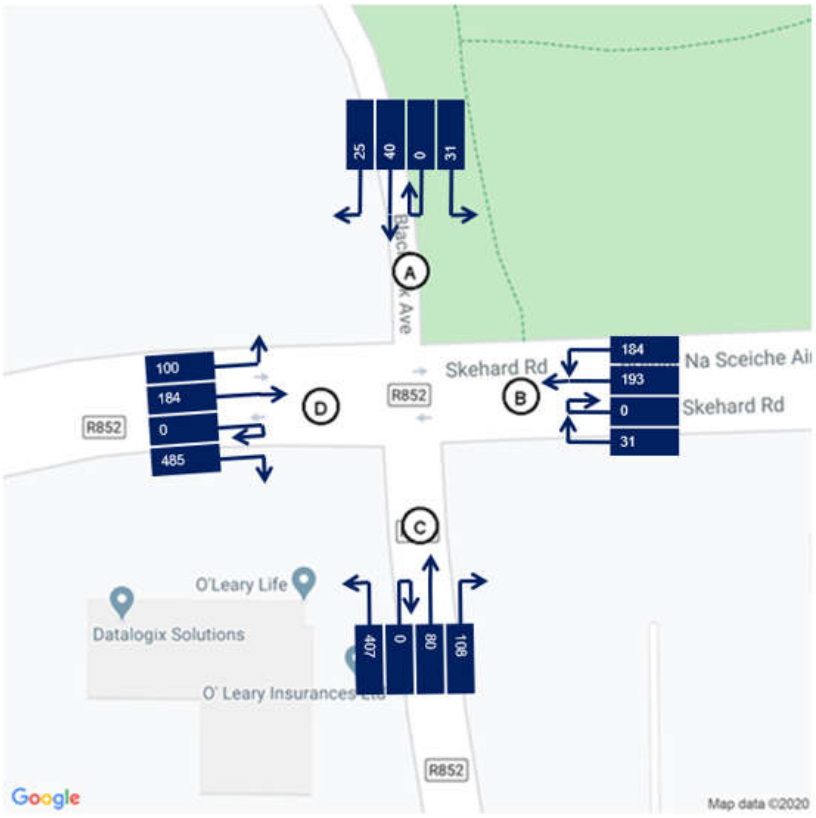

Fig 3.4.5: R852/Blackrock Ave./Skehard Rd. – AM Peak Hour Flows

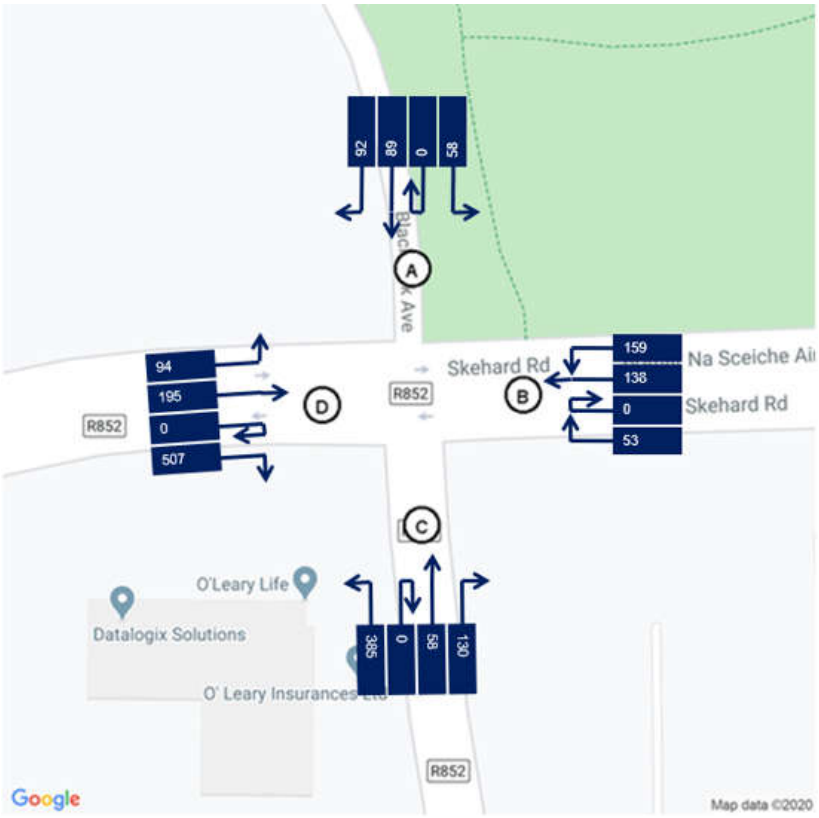

Fig 3.4.6: R852/Blackrock Ave./Skehard Rd. – PM Peak Hour Flows

3.4.4 *Junction 4: Mini roundabout on the junction of Bessboro Rd. and the site access road:*

This mini roundabout serves as a part of the primary route to the Mahon Industrial Estate as well as forming the primary access to the proposed 620 unit development. Direct access to the Bessborough Centre is also provided for.
The measured AADT (Annual Average Daily Traffic) at the roundabout junction is 4,000.

Image 3.4.4: Image of Bessboro Rd. mini-roundabout

Fig 3.4.7: Bessboro Rd. mini-roundabout – AM Peak Hour Flows

Fig 3.4.8: Bessboro Rd. mini-roundabout – PM Peak Hour Flows

3.5 COMMITTED TRANSPORT PROPOSALS

3.5.1 The publication of the CMATS (Cork Metropolitan Area Transport Study) document as well as BusConnects Cork proposes major upgrades to public transport provision in the Mahon/ Bessboro area to include high frequency bus services and a Light Rail Transit route (LRT). These measures will contribute to an expected increase in modal shift towards sustainable travel resulting in a reduction in traffic generation from residential developments. As part of this assessment allowance was made for a modal shift of 40% (current sustainable travel usage in the area as per 2016 census was 23%). This represents a 17% increase in modal shift over current levels and has been applied to 'new development traffic'. It has not been applied to background traffic flows, refer to Chapter 6.0 of this report for further details.

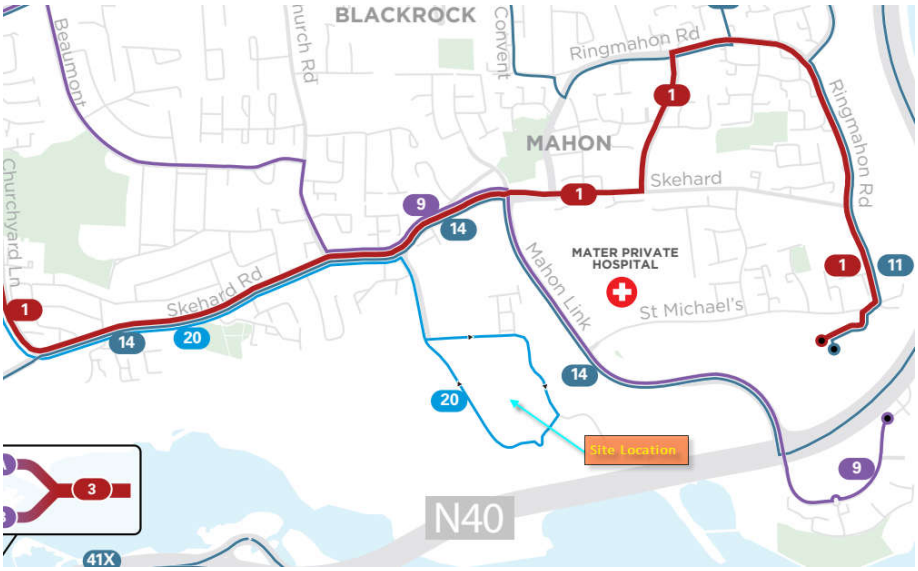

Fig 3.5.1: Extract from BusConnects Public Consultation Document

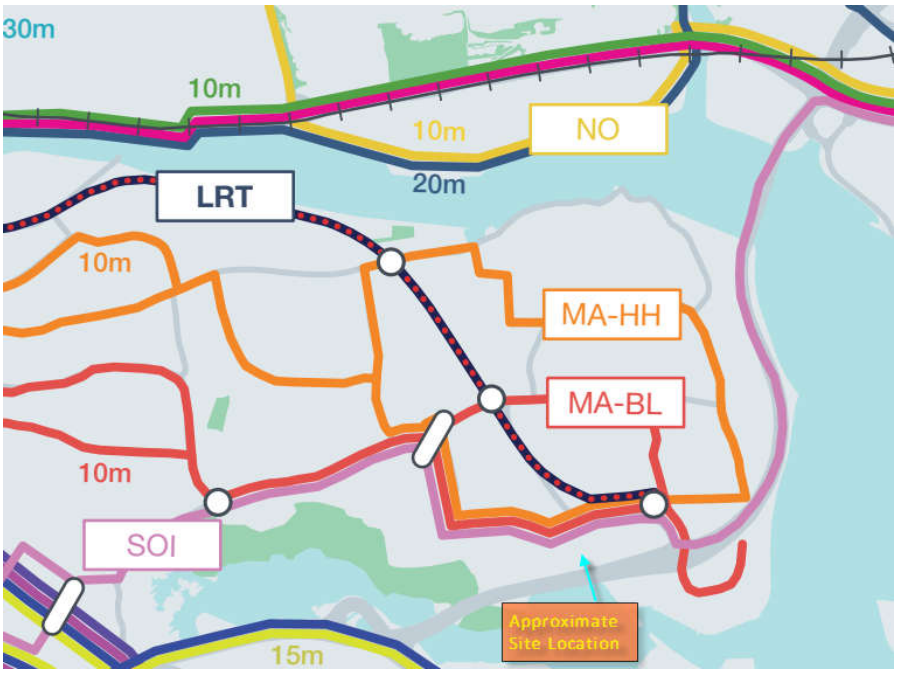

Fig 3.5.2: Extract from CMATS

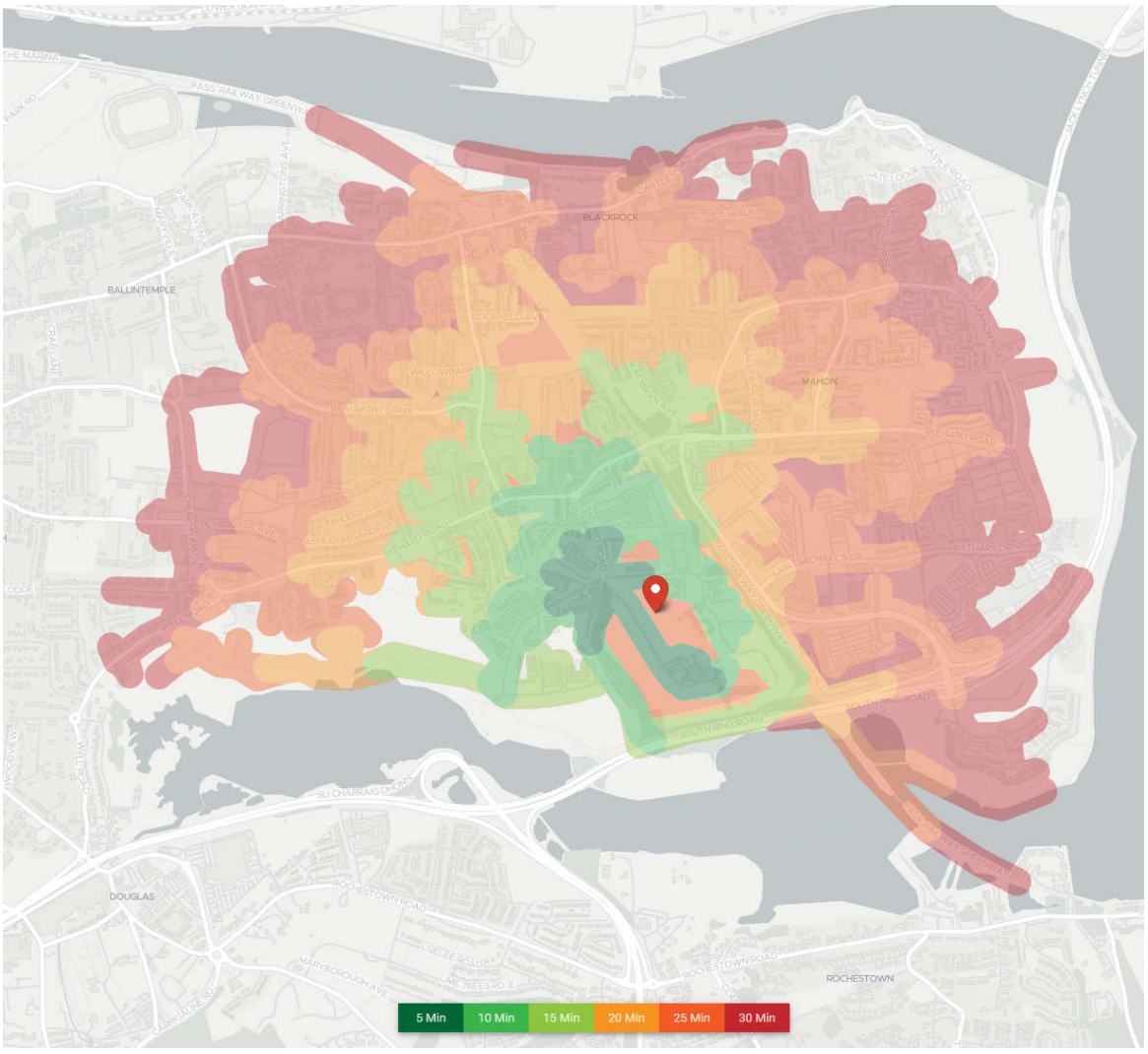

Fig 3.5.3: Walking Connectivity (Current)

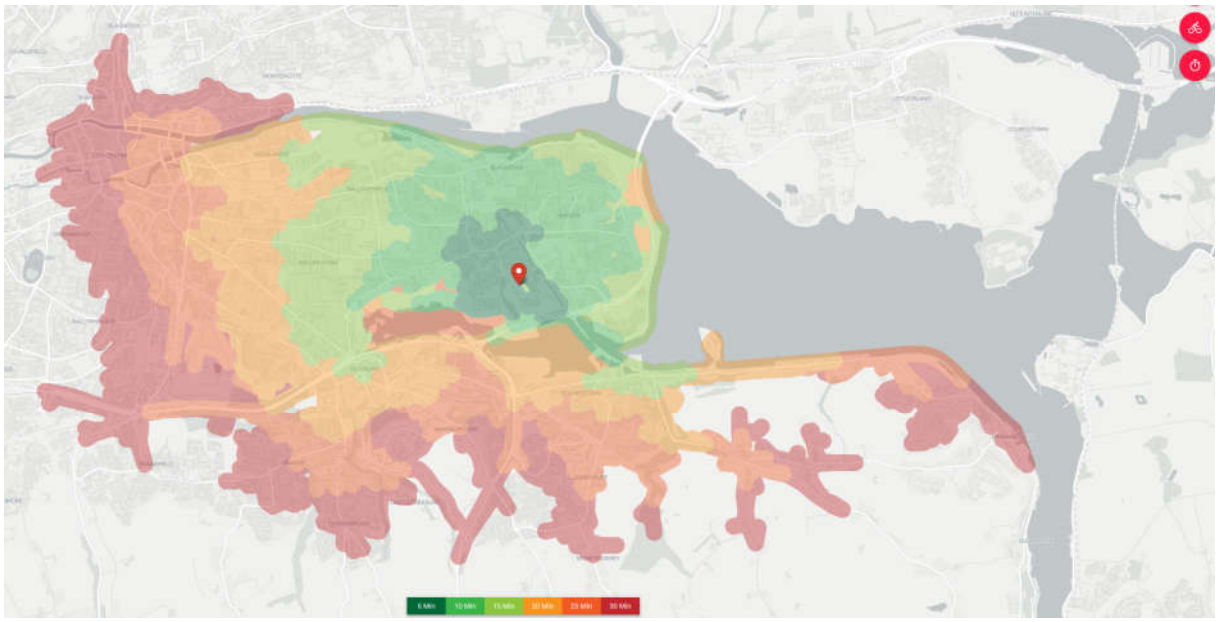

Fig 3.5.3: Cycle Connectivity (Current)

4.0 PROPOSED DEVELOPMENT

4.1 INTRODUCTION

4.1.1 The proposed development is consistent with the zoning in the local area plan for medium density housing and a creche.

4.1.2 The proposed scheme the subject of this application consists of two separate phases of development, The Meadows and The Farm with a third phase proposed in the future, The North Fields. In total this would deliver 620 residential units on the site with associated creche facilities, café and Remembrance Centre.

4.1.3 The proposed primary access to the site is from Bessboro Rd. via a local access road which currently accesses the site.

4.1.4 The proposed development includes a new pedestrian/cycle bridge crossing the Blackrock Greenway, which runs along the eastern boundary of the site.

4.1.5 The scheme proposes limited residential parking at 0.36 spaces per unit in Phase 1 and 0.41 spaces per unit in Phase 2 which is compatible with the Strategic Housing Development and Cork City Council Housing scheme recommendations encouraging residents to adopt more sustainable transport options.

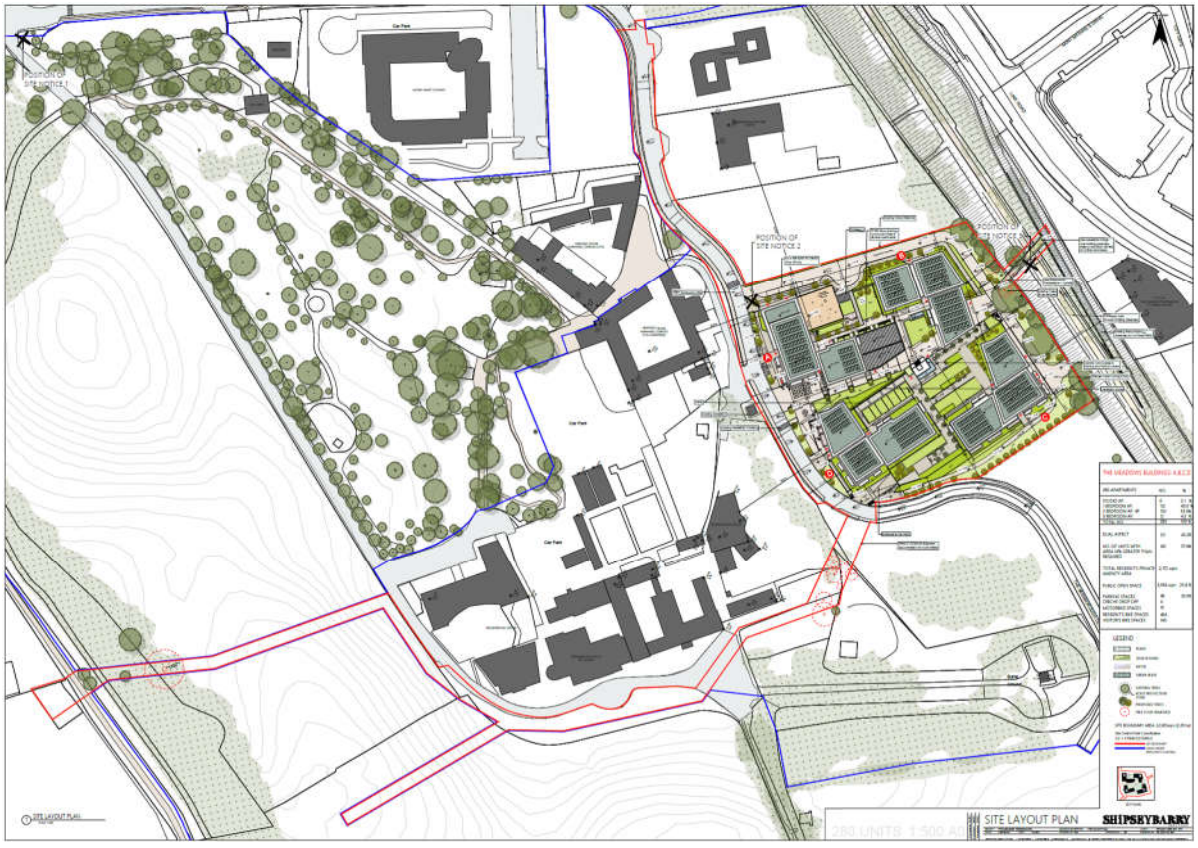

Fig 4.1.1: Proposed Site Layout – The Meadows

Fig 4.1.2: Proposed Site Layout – The Farm

4.2 PHASING

4.2.1 The scheme of six hundred and twenty units (620) residential units, and a sixty (60) child creche, would be completed in a number of phases starting in 2024 and finishing in 2030. To demonstrate the gradual impact on the local road network as the separate phases are complete, the Traffic Impact Assessment includes the proposed construction years of 2024, 2026, and 2028, in addition to the base year (2022), the design year +5 (2029), and the design year +15 (2039).

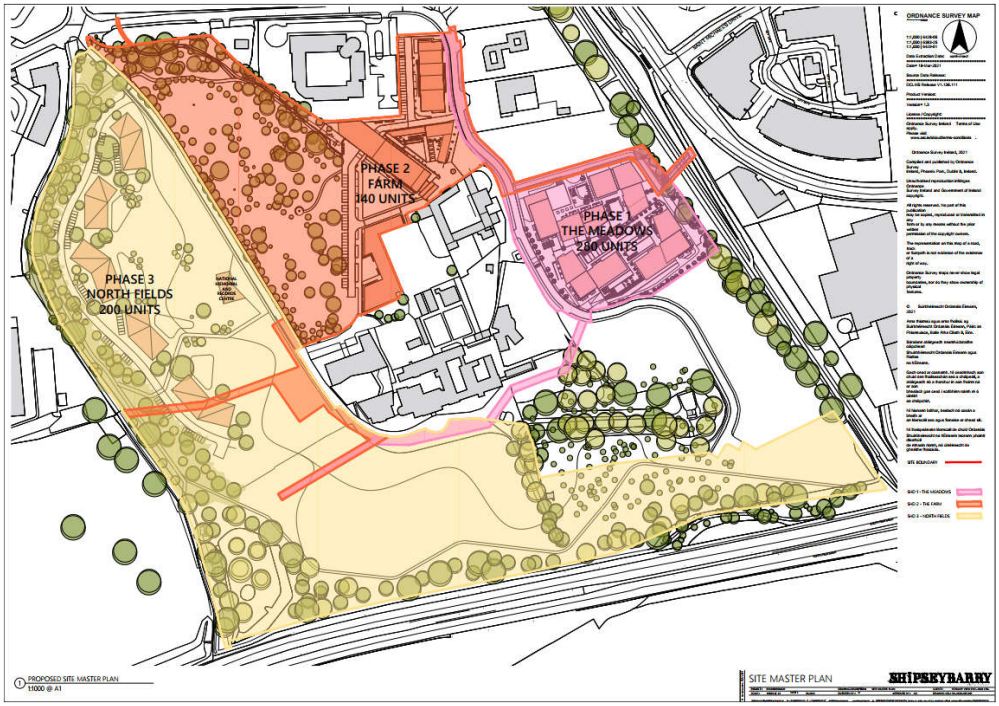

Fig 4.2.1: Proposed Phasing Plan

4.2.2 The proposed development will be phased as follows:

- 2024-2026 – Phase 1 280 residential units & creche
- 2026-2028 – Phase 2: 140 residential units & creche
- 2028-2030 – Phase 3: 200 residential units

4.3 CONSTRUCTION STAGE TRAFFIC IMPACT

4.3.1 The construction stage of the proposed development will be phased as described above in section 4.2.2.

It is envisaged that working hours will be from 07.00 to 18:00, Monday to Friday (08:00 to 14:00 Saturday) for construction personnel through each phase of the development. Generally, construction workers will travel to site before the measured peak hour of 08:00 – 09:00, to be on site for a 07:00 start-time. A very limited number of construction employees are likely to travel to the site during peak hours.

It is anticipated that heavy goods vehicles, HGV's, will be restricted to movements on the local road network during the off-peak periods. It is estimated that truck movements and general deliveries would arrive/leave at a steady rate during the course of the day. Over the course of the construction period an estimated 15 HGV's will deliver to the site on a daily basis. A number of mitigation measures are proposed to minimise the impact of this increase in HGV traffic on the existing roads network.

- The re-use of excavated materials generated on-site to reduce the total volume of imported material.
- Defining delivery times to site to avoid background traffic peak periods.
- Construction stage site staff starting before the morning peak and finishing after the evening peak.
- Site staff encouraged to car-pool and to use public transport.
- Road cleaning and wheel-wash systems put in place.

In general, the impact of construction traffic will be temporary in nature and less significant than the final development operational stage.

4.3.4 The successful Contractor will develop a Construction Traffic Management Plan including identified haulage routes in compliance with the Preliminary Temporary Traffic Management Plan developed in consultation with Cork City Council Roads & Transportation Department.

The surrounding road network is suitable to accommodate the construction traffic associated with the proposed development and the Construction Traffic Management Plan will include a range of mitigating measures to ensure the safety of the workforce on the site and accessing the site, and the public on the surrounding roads and to minimise construction traffic generation and disruption on the surrounding road network.

5.0 TRAFFIC GENERATION

5.1.1 Trip generation from the proposed 620 residential units was garnered via the TRICS database. MHL are a licence holder for the TRICS database and employ it for traffic studies. TRICS is a well-established UK and Irish national database which holds in excess of 2,100 site locations and 7,000 survey counts with over 98 separate land use sub-categories. MHL & Associates Ltd. are one of over 300 worldwide licensed TRICS member organisations. The TRICS program was utilised for the land-use sub-category associated with the development proposal. The "Guidelines for Traffic and Transportation Assessments" state that for residential use the busiest hours are between 08:00-09:00 and 17:00-18:00. Traffic counts conducted on the 6th February 2020 by Tracsis were utilised to establish the actual AM & PM Peak traffic hours for the local road network for the purposes of this assessment. The use of these counts was agreed with the Local Authority.

5.1.2 Sites from Greater Dublin Area, Galway, Louth, Waterford, Antrim and Monaghan were included from the TRICS database to determine the trip rates as shown in Table 5.1 below.

	ARRIVALS				DEPARTURES				TOTALS			
Time Range	No. Days	Ave. DWELLS	Trip Rate	Estimated Trip Rate	No. Days	Ave. DWELLS	Trip Rate	Estimated Trip Rate	No. Days	Ave. DWELLS	Trip Rate	Estimated Trip Rate
00:00 - 01:00												
01:00 - 02:00												
02:00 - 03:00												
03:00 - 04:00												
04:00 - 05:00												
05:00 - 06:00												
06:00 - 07:00												
07:00 - 08:00	13	48	0.045	0.000	13	48	0.216	0.000	13	48	0.261	0.000
08:00 - 09:00	13	48	0.061	0.000	**13**	**48**	**0.236**	**0.000**	13	48	0.297	0.000
09:00 - 10:00	13	48	0.061	0.000	13	48	0.107	0.000	13	48	0.168	0.000
10:00 - 11:00	13	48	0.029	0.000	13	48	0.067	0.000	13	48	0.096	0.000
11:00 - 12:00	13	48	0.053	0.000	13	48	0.061	0.000	13	48	0.114	0.000
12:00 - 13:00	13	48	0.072	0.000	13	48	0.091	0.000	13	48	0.163	0.000
13:00 - 14:00	13	48	0.077	0.000	13	48	0.059	0.000	13	48	0.136	0.000
14:00 - 15:00	13	48	0.093	0.000	13	48	0.058	0.000	13	48	0.151	0.000
15:00 - 16:00	13	48	0.091	0.000	13	48	0.062	0.000	13	48	0.153	0.000
16:00 - 17:00	13	48	0.099	0.000	13	48	0.073	0.000	13	48	0.172	0.000
17:00 - 18:00	13	48	0.203	0.000	13	48	0.062	0.000	13	48	0.265	0.000
18:00 - 19:00	**13**	**48**	**0.214**	**0.000**	13	48	0.096	0.000	**13**	**48**	**0.310**	**0.000**
19:00 - 20:00												
20:00 - 21:00												
21:00 - 22:00												
22:00 - 23:00												
23:00 - 24:00												
Total Rates:			1.098	0.000			1.188	0.000			2.286	0.000

Table 5.1 Trip Generation Per Residential Unit (TRICS)

5.1.4 In the following chapter reference is made to the current (2016) Modal Shift by means of travel to work, school or college and is based on 2016 Census Data. The site is located in the Electoral Division of 'Mahon B, ref. **Table 6.1**, which 2016-year figures show 32% of persons in the area use sustainable means of travel.

The modal split of the more residential surrounding Electoral Divisions of 'Mahon A', 'Mahon C', and 'Browningstown', ref. **Table 6.2**, **Table 6.3**, and **Table 6.4** respectively, were also determined to provide a comparison with the results of 'Mahon B'. An existing modal split of 23% was selected as an average of the three areas implying that 23% of the persons in the area currently use sustainable means of travel. This was viewed as a closer representation of the proposed development based on the 2016 census.

5.1.5 Trip Generation from the proposed creche facilities was derived using the TRICS database. The following table presents the peak hour trip rates for a standalone creche.

In this instance it is assumed that the creche will primarily serve the proposed schemes with a limited volume of traffic being generated from the wider area. It is estimated that the creche facilities will add 20% of traffic from a stand-alone creche to traffic entering and exiting the development during the morning/evening peak hours.

Time Range	ARRIVALS				DEPARTURES				TOTALS			
	No. Days	Ave. PUPILS	Trip Rate	Estimated Trip Rate	No. Days	Ave. PUPILS	Trip Rate	Estimated Trip Rate	No. Days	Ave. PUPILS	Trip Rate	Estimated Trip Rate
00:00 - 01:00												
01:00 - 02:00												
02:00 - 03:00												
03:00 - 04:00												
04:00 - 05:00												
05:00 - 06:00												
06:00 - 07:00												
07:00 - 08:00	2	79	0.032	0.000	2	79	0.019	0.000	2	79	0.051	0.000
08:00 - 09:00	**2**	**79**	**0.380**	**0.000**	2	79	0.209	0.000	2	79	0.589	0.000
09:00 - 10:00	2	79	0.361	0.000	**2**	**79**	**0.399**	**0.000**	**2**	**79**	**0.760**	**0.000**
10:00 - 11:00	2	79	0.025	0.000	2	79	0.051	0.000	2	79	0.076	0.000
11:00 - 12:00	2	79	0.101	0.000	2	79	0.025	0.000	2	79	0.126	0.000
12:00 - 13:00	2	79	0.209	0.000	2	79	0.285	0.000	2	79	0.494	0.000
13:00 - 14:00	2	79	0.127	0.000	2	79	0.127	0.000	2	79	0.254	0.000
14:00 - 15:00	2	79	0.146	0.000	2	79	0.082	0.000	2	79	0.228	0.000
15:00 - 16:00	2	79	0.057	0.000	2	79	0.127	0.000	2	79	0.184	0.000
16:00 - 17:00	2	79	0.127	0.000	2	79	0.133	0.000	2	79	0.260	0.000
17:00 - 18:00	2	79	0.241	0.000	2	79	0.323	0.000	2	79	0.564	0.000
18:00 - 19:00	2	79	0.000	0.000	2	79	0.051	0.000	2	79	0.051	0.000
19:00 - 20:00												
20:00 - 21:00												
21:00 - 22:00												
22:00 - 23:00												
23:00 - 24:00												
Total Rates:			1.806	0.000			1.831	0.000			3.637	0.000

Table 5.2 Trip Generation Per Pupil – Creche (TRICS)

6.0 MODAL SPLIT

6.1.1 This section describes the current level of modal shift (the use of sustainable modes of travel) based on available data and compares these to national targets.

6.1.2 The 2016 Census online SAP data was used to assess current modal shift patterns in the Mahon area, specifically the electoral division of Mahon B which encompasses the site. 32% of people in this area said they were commuting on foot, bike or using public transport.

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Population aged 5 years and over by means of travel to work, school or college

Means of Travel	Work	School or College	Total
On foot	276	305	581
Bicycle	54	20	74
Bus, minibus or coach	185	143	328
Train, DART or LUAS	6	0	6
Motorcycle or scooter	12	2	14
Car driver	1,212	32	1,244
Car passenger	111	546	657
Van	73	0	73
Other (incl. lorry)	2	0	2
Work mainly at or from home	33	0	33
Not stated	86	52	138
Total	2,050	1,100	3,150

Table 6.1: 2016 Modal Shift by means of travel to work, school or college. (Electoral Division of Mahon B)

6.1.3 The electoral divisions of 'Mahon A', 'Mahon C', and 'Browningstown' were also analysed to ascertain their existing modal shift, ref. **Table 6.2**, **Table 6.3**, and **Table 6.4** respectively. **Table 6.5** provides a summary of the analysis results and indicates an average modal shift of 23% for the surrounding area. This figure more closely represents the anticipated modal shift of the proposed development due to the greater percentage of residential land use in these electoral divisions over 'Mahon B'.

PDF Excel Print

Population aged 5 years and over by means of travel to work, school or college

Means of Travel	Work	School or College	Total
On foot	158	194	352
Bicycle	68	17	85
Bus, minibus or coach	161	168	329
Train, DART or LUAS	2	1	3
Motorcycle or scooter	12	1	13
Car driver	1,395	50	1,445
Car passenger	107	650	757
Van	77	2	79
Other (incl. lorry)	8	0	8
Work mainly at or from home	47	3	50
Not stated	33	24	57
Total	2,068	1,110	3,178

Table 6.2: 2016 Modal Shift by means of travel to work, school or college. (Electoral Division of Mahon A)

PDF Excel Print

Population aged 5 years and over by means of travel to work, school or college

Means of Travel	Work	School or College	Total
On foot	70	132	202
Bicycle	50	18	68
Bus, minibus or coach	76	86	162
Train, DART or LUAS	2	2	4
Motorcycle or scooter	8	6	14
Car driver	924	63	987
Car passenger	69	331	400
Van	42	3	45
Other (incl. lorry)	4	0	4
Work mainly at or from home	45	3	48
Not stated	28	9	37
Total	1,318	653	1,971

Table 6.3: 2016 Modal Shift by means of travel to work, school or college. (Electoral Division of Mahon C)

PDF Excel Print

Population aged 5 years and over by means of travel to work, school or college

Means of Travel	Work	School or College	Total
On foot	24	71	95
Bicycle	16	5	21
Bus, minibus or coach	8	16	24
Train, DART or LUAS	0	0	0
Motorcycle or scooter	3	0	3
Car driver	286	17	303
Car passenger	16	133	149
Van	19	1	20
Other (incl. lorry)	2	1	3
Work mainly at or from home	15	0	15
Not stated	6	2	8
Total	395	246	641

Table 6.4: 2016 Modal Shift by means of travel to work, school or college. (Electoral Division of Browningstown)

Electorial Division	No. Commuters	No. Sustainable Commuters	Modal Split %
Mahon B	3117	989	***32***
Mahon A	3128	769	***25***
Mahon C	1923	436	***23***
Browningstown	626	140	***22***

Table 6.5: Summary of Modal Split for adjacent Electoral Divisions

6.1.4 Road improvement works completed in 2021 as a part of the Skehard Road Improvement Scheme will have led to continued progress of the Mahon Modal Shift towards national targets of 45%. Improved pedestrian and cyclist facilities in addition to the extension of bus lane facilities will have the effect of reducing journey times and encouraging an increase in use.

6.1.5 A modal shift of 45% (implying an anticipated increase in public transport or active travel in the immediate area of 21%) for future year models is deemed to be reasonable. This modal shift increase of 21% will be applied to proposed development traffic from the opening year (when the development is fully completed) 2024, up to the design year 2039. It will not be applied to background traffic flows.

7.0 TRAFFIC GENERATION / FORECASTING

7.1.1 This section describes the traffic generation from the development as outlined in Section 5 and accounts for future modal shift targets as described in Section 6. Traffic from granted planning's in the area is also included and presented in Table 7.4.

7.1.2 Based on trip generation rates the following table presents residential development traffic and creche generated traffic for future years. This traffic has been added to existing background flows and distributed through the network to model each of the identified junctions. The results are presented in Section 9 of this report.

Phase 1: The Meadows		AM PEAK (07:30-09:30)		PM PEAK (16:30-18:30)	
		Arrivals	Departures	Arrivals	Departures
New Residential Trip Generation - based on TRICs database					
280	Peak Trics Trip Rates Per Unit	0.122	0.343	0.417	0.158
	Peak Trips No. Units	34	96	117	44
	TOTAL	130		161	
New Creche Trip Generation - based on TRICs database					
35	Peak Trics Trip Rates Per unit	0.412	0.418	0.368	0.456
	Peak Trips No. Units	14	15	13	16
	TOTAL	29		29	
New Residential Trip Generation - allowing for 21% modal shift increase					
	TOTAL New Residential Trips	28	79	97	36
	Total New Creche Trips (20% new trips)	3	3	3	3
	Total 2 hour peak trips	31	82	100	39

Table 7.1 Proposed Development Traffic in 2024, The Meadows

Phase 2: The Farm		AM PEAK (07:30-09:30)		PM PEAK (16:30-18:30)	
		Arrivals	Departures	Arrivals	Departures
New Residential Trip Generation - based on TRICs database (Unit)					
140	Peak Trics Trip Rates Per Unit	0.122	0.343	0.417	0.158
	Peak Trips No. Units	17	48	58	22
	TOTAL	65		81	
New Creche Trip Generation - based on TRICs database (Pupils)					
25	Peak Trics Trip Rates Per unit	0.412	0.418	0.368	0.456
	Peak Trips No. Units	10	10	9	11
	TOTAL	21		21	
New Residential Trip Generation - allowing for 21% modal shift increase					
	TOTAL New Residential Trips	14	40	48	18
	Total New Creche Trips (20% new trips)	2	2	2	2
	Total 2 hour peak trips	16	42	50	21

Table 7.2 Proposed Additional Development Traffic in 2028, The Farm

Phase 3: The North Fields		AM PEAK (07:30-09:30)		PM PEAK (16:30-18:30)	
		Arrivals	Departures	Arrivals	Departures
New Residential Trip Generation - based on TRICs database (Unit)					
200	Peak Trics Trip Rates Per Unit	0.122	0.343	0.417	0.158
	Peak Trips No. Units	24	69	83	32
	TOTAL	93		115	
New Creche Trip Generation - based on TRICs database (Pupils)					
0	Peak Trics Trip Rates Per unit	0.412	0.418	0.368	0.456
	Peak Trips No. Units	0	0	0	0
	TOTAL	0		0	
New Residential Trip Generation - allowing for 21% modal shift increase					
	TOTAL New Residential Trips	20	57	69	26
	Total New Creche Trips (20% new trips)	0	0	0	0
	Total 2 hour peak trips	20	57	69	26

Table 7.3 Proposed Additional Development Traffic in 2030, The North Fields (full scheme)

7.1.3 As the proposed development site currently generates little or no traffic no reduction has been applied to account for pass-by trips, transfer trips or combined trips from the residential element of the scheme.

7.1.4 It is assumed that a significant portion of the Creche will be used for the proposed development, however in order to carry out a robust assessment of the roads network it has been agreed with the Local Authority that 20% of traffic that would be generated by a standalone creche will be attracted to the proposed development.

7.1.5 Traffic from granted schemes in the area (planning ref 17/37565 and 18/37820) are included as per the following table. The distribution of this additional traffic is dependent on the scheme's location.

Granted Schemes		AM PEAK (07:30-09:30)		PM PEAK (16:30-18:30)	
		Arrivals	Departures	Arrivals	Departures
New Residential Trip Generation - based on TRICs database (Unit)					
201	Peak Trics Trip Rates Per Unit	0.122	0.343	0.417	0.158
	Peak Trips No. Units	25	69	84	32
	TOTAL	93		116	
New Creche Trip Generation - based on TRICs database (Pupils)					
0	Peak Trics Trip Rates Per unit	0.412	0.418	0.368	0.456
	Peak Trips No. Units	0	0	0	0
	TOTAL	0		0	
New Residential Trip Generation - allowing for 21% modal shift increase					
	TOTAL New Residential Trips	20	57	69	26
	Total New Creche Trips (20% new trips)	0	0	0	0
	Total 2 hour peak trips	20	57	69	26

Table 7.4 Expected Traffic Generation from granted schemes in the area

7.1.6 In addition to development traffic, recorded background traffic was factored using TII (Transport Infrastructure Ireland) Project Appraisal Guidelines (PE-PAG-02017) for use in future year scenarios. The following table presents the factors used on recorded vehicle counts based on Link Based Growth Rates (Central Growth) for the Cork Metropolitan Area.

			Cars/LGV	HGV	Combined
Count %			97%	3%	100%
2020	to	2021	1.017	1.029	1.017
2020	to	2023	1.052	1.091	1.053
2020	to	2024	1.069	1.123	1.071
2020	to	2029	1.163	1.298	1.167
2020	to	2039	1.266	1.478	1.273

TII Project Appraisal Guidelines for National Roads Unit 5.3
Travel Demand Projections (PE-PAG-0217-02)

Table 7.5 Background Traffic Growth Rates Per Annum

8.0 TRIP ATTRACTION AND DISTRIBUTION

8.1.1 This section describes the methodology used in the distribution of development specific traffic onto the modelled network. **Fig 3.1** outlines the location of each of the junctions where turning count movements were recorded over a 12-hour timeframe. This 'snapshot' of existing traffic movements provides a basis for determining desire lines which can be used to assign development traffic at each of the modelled junctions.

8.1.2 Traffic flow matrices have been developed for each Junction for the following scenarios:

- 2020 Current Year Flows AM/PM
- 2024 AM/PM With/Without Dev (The Meadows – 280 residential units)
- 2028 AM/PM With/Without Dev (The Farm – 140 residential units)
- 2030 AM/PM With/Without Dev (The North Fields – 200 residential units)
- 2039 AM/PM With/Without Dev (Design Year)

8.1.3 *Junction 1: R852 Skehard Rd./Church Rd. Crossroads*

Fig 8.1.3: Junction 1 Arm Designation

AM

Origin \ Destination	A	B	C	D	Tot
A	0	50	376	111	537
B	34	0	22	15	71
C	553	26	0	30	609
D	269	27	69	0	365
Total	856	103	467	156	1582

PM

Origin \ Destination	A	B	C	D	Tot
A	0	94	527	191	812
B	62	0	65	58	185
C	381	49	0	120	550
D	141	46	38	1	226
Total	584	189	630	370	1773

Table 8.1 Junction 1: Existing AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	55	410	121	586
B	35	0	23	16	73
C	577	27	0	31	635
D	280	28	71	0	380
Total	893	110	504	167	1674

PM

Origin \ Destination	A	B	C	D	Tot
A	0	99	554	201	854
B	66	0	67	60	193
C	406	51	0	124	581
D	151	48	39	1	239
Total	623	198	661	386	1867

Table 8.2 Junction 1: 2022 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	55	413	122	590
B	35	0	23	16	73
C	578	27	0	31	636
D	280	28	71	0	380
Total	894	110	507	168	1679

PM

Origin \ Destination	A	B	C	D	Tot
A	0	99	555	201	855
B	66	0	67	60	193
C	408	51	0	124	583
D	152	48	39	1	240
Total	626	198	662	386	1871

Table 8.3 Junction 1: 2022 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	56	417	123	595
B	36	0	23	16	75
C	587	27	0	32	646
D	285	28	73	0	386
Total	908	111	512	170	1702

PM

Origin \ Destination	A	B	C	D	Tot
A	0	101	564	204	869
B	67	0	68	61	197
C	413	52	0	126	591
D	153	48	40	1	243
Total	634	201	672	392	1899

Table 8.4 Junction 1: 2023 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	57	430	127	613
B	36	0	23	16	75
C	590	27	0	32	649
D	286	28	73	0	387
Total	912	112	525	174	1724

PM

Origin \ Destination	A	B	C	D	Tot
A	0	102	568	205	875
B	68	0	68	61	198
C	420	52	0	126	598
D	156	48	40	1	246
Total	645	202	676	393	1916

Table 8.5 Junction 1: 2023 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	57	423	125	605
B	36	0	24	16	76
C	597	28	0	32	657
D	290	29	74	0	393
Total	923	113	521	173	1730

PM

Origin \ Destination	A	B	C	D	Tot
A	0	103	573	207	883
B	68	0	70	62	200
C	420	52	0	128	601
D	156	49	41	1	247
Total	644	204	683	399	1931

Table 8.6 Junction 1: 2024 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	60	445	131	636
B	36	0	24	16	76
C	603	28	0	32	663
D	293	29	74	0	396
Total	932	116	543	179	1770

PM

Origin \ Destination	A	B	C	D	Tot
A	0	105	582	210	897
B	70	0	70	62	202
C	432	52	0	128	613
D	160	49	41	1	251
Total	662	206	692	402	1963

Table 8.7 Junction 1: 2024 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	61	459	135	656
B	40	0	26	17	83
C	650	30	0	35	715
D	316	31	80	0	427
Total	1005	123	565	188	1881

PM

Origin \ Destination	A	B	C	D	Tot
A	0	112	623	226	960
B	74	0	76	68	218
C	456	57	0	140	653
D	169	54	44	1	268
Total	700	222	743	434	2099

Table 8.8 Junction 1: 2029 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	64	481	141	687
B	40	0	26	17	83
C	656	30	0	35	721
D	319	31	80	0	430
Total	1014	126	587	194	1921

PM

Origin \ Destination	A	B	C	D	Tot
A	0	114	632	229	974
B	76	0	76	68	220
C	468	57	0	140	665
D	173	54	44	1	272
Total	718	224	752	437	2131

Table 8.9 Junction 1: 2029 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	67	499	147	712
B	43	0	28	19	90
C	708	33	0	38	779
D	344	34	88	0	466
Total	1095	134	614	204	2047

PM

Origin \ Destination	A	B	C	D	Tot
A	0	121	679	246	1046
B	81	0	83	74	237
C	496	62	0	152	711
D	184	58	48	1	292
Total	761	242	810	473	2286

Table 8.10 Junction 1: 2039 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	70	521	153	743
B	43	0	28	19	90
C	714	33	0	38	785
D	347	34	88	0	469
Total	1104	137	636	210	2087

PM

Origin \ Destination	A	B	C	D	Tot
A	0	123	688	249	1060
B	83	0	83	74	239
C	508	62	0	152	723
D	188	58	48	1	296
Total	779	244	819	476	2318

Table 8.11 Junction 1: 2039 With Development AM/PM Peak Hour Traffic Movements

8.1.4 *Junction 2: Bessboro Rd./R852 T-Junction*

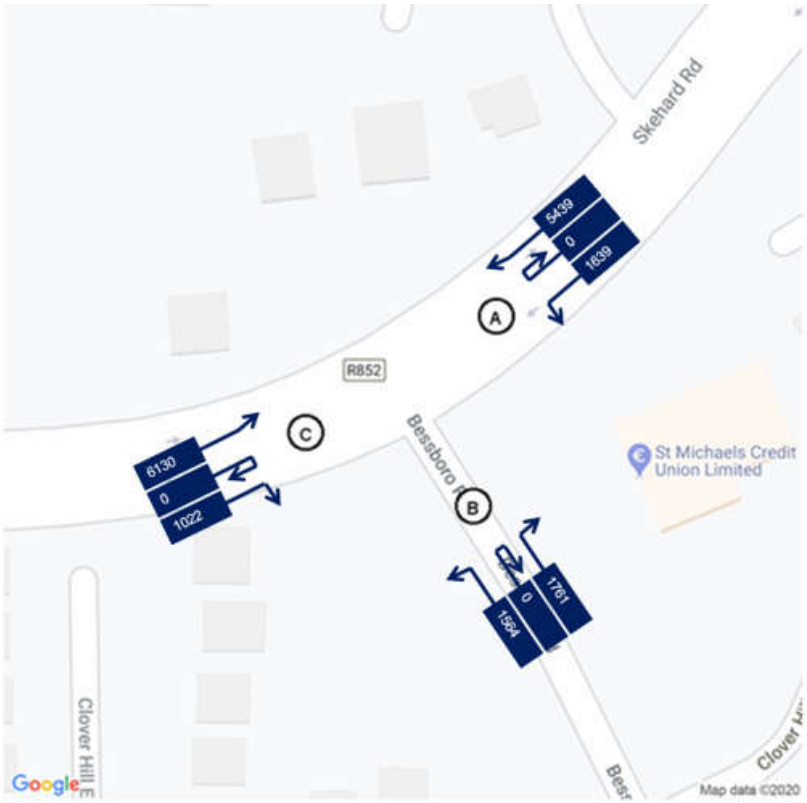


Fig 8.1.4: Junction 2 Arm Designation

AM

Origin \ Destination	A	B	C		Tot
A	0	250	423		673
B	81	0	109		190
C	627	202	0		829
Total	708	452	532		1692

PM

Origin \ Destination	A	B	C		Tot
A	0	67	529		596
B	278	0	252		530
C	498	58	0		556
Total	776	125	781		1682

Table 8.12 Junction 2: Existing AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	268	438		705
B	107	0	143		250
C	649	216	0		865
Total	755	484	580		1820

PM

Origin \ Destination	A	B	C		Tot
A	0	91	547		639
B	303	0	275		577
C	515	79	0		594
Total	818	170	822		1810

Table 8.13 Junction 2: 2022 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	269	438		706
B	110	0	147		257
C	649	217	0		866
Total	758	486	584		1829

PM

Origin \ Destination	A	B	C		Tot
A	0	95	547		643
B	305	0	276		580
C	515	82	0		597
Total	820	177	823		1820

Table 8.14 Junction 2: 2022 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	272	445		717
B	108	0	145		253
C	660	220	0		879
Total	768	492	590		1850

PM

Origin \ Destination	A	B	C		Tot
A	0	93	557		649
B	308	0	279		587
C	524	80	0		604
Total	832	173	836		1840

Table 8.15 Junction 2: 2023 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	276	445		721
B	121	0	163		284
C	660	224	0		883
Total	781	500	608		1889

PM

Origin \ Destination	A	B	C		Tot
A	0	107	557		663
B	315	0	285		600
C	524	91	0		615
Total	839	198	842		1878

Table 8.16 Junction 2: 2023 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	277	453		729
B	110	0	147		256
C	671	223	0		894
Total	781	500	599		1880

PM

Origin \ Destination	A	B	C		Tot
A	0	94	566		660
B	313	0	284		596
C	533	81	0		614
Total	846	175	850		1870

Table 8.17 Junction 2: 2024 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	289	453		741
B	134	0	178		311
C	671	232	0		903
Total	805	521	630		1956

PM

Origin \ Destination	A	B	C		Tot
A	0	116	566		682
B	328	0	298		625
C	533	99	0		632
Total	861	215	864		1939

Table 8.18 Junction 2: 2024 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	300	493		793
B	117	0	157		274
C	731	242	0		973
Total	848	543	650		2041

PM

Origin \ Destination	A	B	C		Tot
A	0	100	617		717
B	339	0	308		647
C	580	87	0		667
Total	919	187	924		2030

Table 8.19 Junction 2: 2029 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	312	493		805
B	141	0	188		329
C	731	251	0		982
Total	872	564	681		2117

PM

Origin \ Destination	A	B	C		Tot
A	0	122	617		739
B	354	0	322		676
C	580	105	0		685
Total	934	227	938		2099

Table 8.20 Junction 2: 2029 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	327	537		864
B	126	0	169		294
C	797	264	0		1060
Total	923	590	706		2219

PM

Origin \ Destination	A	B	C		Tot
A	0	107	672		779
B	368	0	334		702
C	633	93	0		725
Total	1001	200	1006		2207

Table 8.21 Junction 2: 2039 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C		Tot
A	0	339	537		876
B	150	0	200		349
C	797	273	0		1069
Total	947	611	737		2295

PM

Origin \ Destination	A	B	C		Tot
A	0	129	672		801
B	383	0	348		731
C	633	111	0		743
Total	1016	240	1020		2276

Table 8.22 Junction 2: 2039 With Development AM/PM Peak Hour Traffic Movements

8.1.5 *Junction 3: R852/ Skehard Rd./ Blackrock Ave. Crossroads*

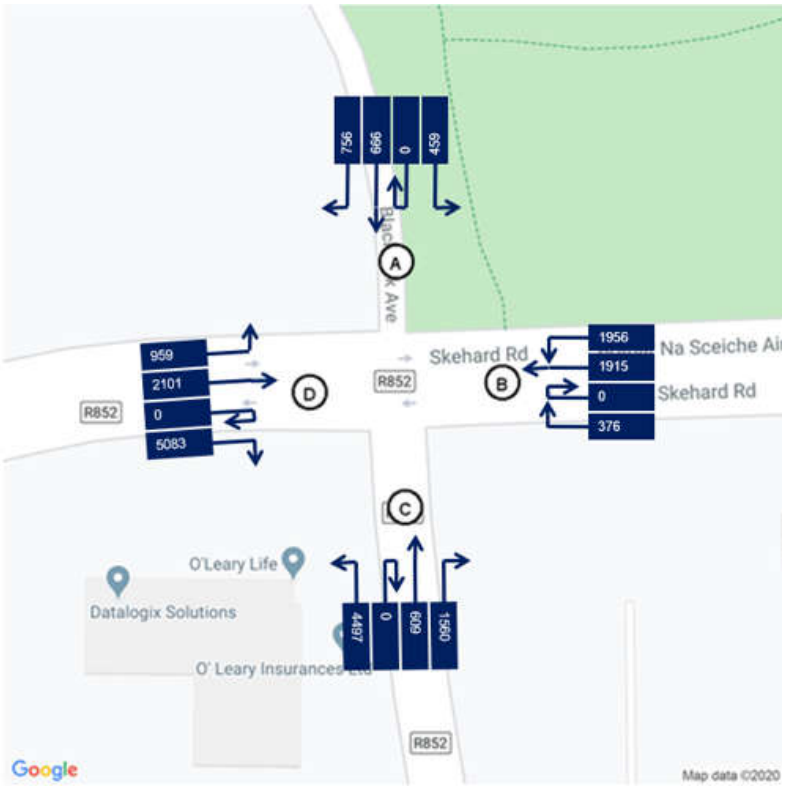


Fig 8.1.5: Junction 3 Arm Designation

AM

Origin \ Destination	A	B	C	D	Tot
A	0	31	40	25	96
B	31	0	184	193	408
C	80	108	0	407	595
D	100	184	485	0	769
Total	211	323	709	625	1868

PM

Origin \ Destination	A	B	C	D	Tot
A	0	58	89	92	239
B	53	0	159	138	350
C	58	130	0	385	573
D	94	195	507	0	796
Total	205	383	755	615	1958

Table 8.23 Junction 3: Existing AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	32	41	26	99
B	32	0	190	203	425
C	83	112	0	427	622
D	106	196	516	0	819
Total	221	340	748	656	1965

PM

Origin \ Destination	A	B	C	D	Tot
A	0	60	92	98	250
B	55	0	165	148	367
C	60	134	0	412	607
D	99	205	535	0	839
Total	214	399	791	658	2063

Table 8.24 Junction 3: 2022 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	32	41	26	99
B	32	0	190	203	425
C	83	112	0	428	623
D	106	197	518	0	822
Total	221	341	750	657	1969

PM

Origin \ Destination	A	B	C	D	Tot
A	0	60	92	98	250
B	55	0	165	149	368
C	60	134	0	415	610
D	99	206	536	0	841
Total	214	400	792	662	2069

Table 8.25 Junction 3: 2022 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	33	42	26	101
B	33	0	194	206	432
C	84	114	0	434	632
D	108	200	524	0	832
Total	225	346	760	667	1998

PM

Origin \ Destination	A	B	C	D	Tot
A	0	61	94	100	255
B	56	0	167	150	373
C	61	137	0	419	617
D	101	208	544	0	853
Total	218	406	805	669	2097

Table 8.26 Junction 3: 2023 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	33	42	26	101
B	33	0	194	207	433
C	84	114	0	437	635
D	110	203	532	0	845
Total	227	349	768	671	2015

PM

Origin \ Destination	A	B	C	D	Tot
A	0	61	94	102	257
B	56	0	167	153	376
C	61	137	0	428	626
D	102	210	548	0	860
Total	219	408	809	683	2118

Table 8.27 Junction 3: 2023 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	33	43	27	103
B	33	0	197	210	440
C	86	116	0	442	643
D	110	203	533	0	846
Total	229	352	773	678	2032

PM

Origin \ Destination	A	B	C	D	Tot
A	0	62	95	101	259
B	57	0	170	153	380
C	62	139	0	426	627
D	103	212	553	0	867
Total	221	413	818	680	2133

Table 8.28 Junction 3: 2024 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	33	43	27	103
B	33	0	197	214	444
C	86	116	0	450	651
D	113	209	548	0	870
Total	232	358	788	690	2068

PM

Origin \ Destination	A	B	C	D	Tot
A	0	62	95	104	262
B	57	0	170	158	385
C	62	139	0	440	641
D	105	216	562	0	882
Total	223	417	827	702	2170

Table 8.29 Junction 3: 2024 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	36	47	29	112
B	36	0	214	228	479
C	93	126	0	480	699
D	120	220	579	0	919
Total	249	382	840	737	2209

PM

Origin \ Destination	A	B	C	D	Tot
A	0	68	104	110	282
B	62	0	185	166	413
C	68	152	0	463	682
D	112	230	601	0	943
Total	241	449	890	739	2319

Table 8.30 Junction 3: 2029 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	36	47	29	112
B	36	0	214	232	483
C	93	126	0	488	707
D	123	226	594	0	943
Total	252	388	855	749	2245

PM

Origin \ Destination	A	B	C	D	Tot
A	0	68	104	113	285
B	62	0	185	171	418
C	68	152	0	477	696
D	114	234	610	0	958
Total	243	453	899	761	2356

Table 8.31 Junction 3: 2029 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	39	51	32	122
B	39	0	234	248	521
C	102	137	0	523	762
D	130	240	630	0	1000
Total	271	416	915	803	2406

PM

Origin \ Destination	A	B	C	D	Tot
A	0	74	113	120	307
B	67	0	202	180	450
C	74	165	0	503	742
D	121	251	654	0	1026
Total	262	490	969	803	2525

Table 8.32 Junction 3: 2039 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	Tot
A	0	39	51	32	122
B	39	0	234	252	525
C	102	137	0	531	770
D	133	246	645	0	1024
Total	274	422	930	815	2442

PM

Origin \ Destination	A	B	C	D	Tot
A	0	74	113	123	310
B	67	0	202	185	455
C	74	165	0	517	756
D	123	255	663	0	1041
Total	264	494	978	825	2562

Table 8.33 Junction 3: 2039 With Development AM/PM Peak Hour Traffic Movements

8.1.6 *Junction 4: Bessboro Rd. Mini-Roundabout*

Fig 8.1.6: Junction 4 Arm Designation

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	41	64	18	100	223
B	43	0	2	0	1	46
C	8	0	0	0	0	8
D	2	0	0	0	0	2
E	83	6	8	3	0	100
Total	136	47	74	21	101	379

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	28	1	1	30	60
B	46	0	0	0	1	47
C	22	2	0	0	1	25
D	23	0	0	0	0	23
E	205	4	0	0	0	209
Total	296	34	1	1	32	364

Table 8.34 Junction 4: Existing AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	52	66	19	103	241
B	76	0	3	0	2	82
C	8	0	0	0	0	8
D	2	0	0	0	0	2
E	87	8	8	3	0	106
Total	174	61	78	22	105	439

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	54	1	1	31	87
B	66	0	0	0	1	67
C	23	4	0	0	1	28
D	24	0	0	0	0	24
E	216	8	0	0	0	224
Total	328	66	1	1	33	430

Table 8.35 Junction 4: 2022 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	54	66	19	103	243
B	83	0	4	0	2	90
C	8	0	0	0	0	8
D	2	0	0	0	0	2
E	87	8	8	3	0	106
Total	181	63	79	22	105	449

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	61	1	1	31	94
B	69	0	0	0	1	70
C	23	4	0	0	1	28
D	24	0	0	0	0	24
E	216	9	0	0	0	225
Total	331	74	1	1	33	441

Table 8.36 Junction 4: 2022 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	53	67	19	105	245
B	77	0	3	0	2	82
C	8	0	0	0	0	8
D	2	0	0	0	0	2
E	88	8	8	3	0	108
Total	176	61	79	22	107	446

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	54	1	1	32	88
B	66	0	0	0	1	67
C	23	4	0	0	1	28
D	24	0	0	0	0	24
E	220	8	0	0	0	228
Total	333	67	1	1	34	436

Table 8.37 Junction 4: 2023 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	61	67	19	105	253
B	108	0	4	0	3	115
C	8	0	0	0	0	8
D	2	0	0	0	0	2
E	88	9	8	3	0	109
Total	207	70	80	22	108	488

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	79	1	1	32	113
B	79	0	0	0	1	80
C	23	5	0	0	1	29
D	24	0	0	0	0	24
E	220	12	0	0	0	232
Total	346	97	1	1	34	479

Table 8.38 Junction 4: 2023 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	54	69	19	107	249
B	78	0	3	0	2	83
C	9	0	0	0	0	9
D	2	0	0	0	0	2
E	90	8	9	3	0	110
Total	179	62	80	22	109	453

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	55	1	1	32	89
B	67	0	0	0	1	68
C	24	4	0	0	1	29
D	25	0	0	0	0	25
E	223	8	0	0	0	232
Total	339	67	1	1	34	443

Table 8.39 Junction 4: 2024 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	75	69	19	107	270
B	133	0	5	0	4	142
C	9	0	0	0	0	9
D	2	0	0	0	0	2
E	90	11	9	3	0	113
Total	234	86	82	22	111	536

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	95	1	1	32	129
B	96	0	0	0	2	98
C	24	7	0	0	1	32
D	25	0	0	0	0	25
E	223	14	0	0	0	238
Total	368	116	1	1	35	522

Table 8.40 Junction 4: 2024 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	58	75	21	117	270
B	82	0	3	0	2	88
C	9	0	0	0	0	9
D	2	0	0	0	0	2
E	98	9	9	3	0	120
Total	192	67	87	24	119	489

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	58	1	1	35	95
B	72	0	0	0	1	73
C	26	4	0	0	1	31
D	27	0	0	0	0	27
E	243	9	0	0	0	252
Total	367	71	1	1	37	477

Table 8.41 Junction 4: 2029 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	79	75	21	117	291
B	137	0	5	0	4	147
C	9	0	0	0	0	9
D	2	0	0	0	0	2
E	98	12	9	3	0	123
Total	247	91	89	24	121	572

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	98	1	1	35	135
B	101	0	0	0	2	103
C	26	7	0	0	1	34
D	27	0	0	0	0	27
E	243	15	0	0	0	258
Total	396	120	1	1	38	556

Table 8.42 Junction 4: 2029 With Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	62	81	23	127	293
B	87	0	4	0	2	92
C	10	0	0	0	0	10
D	3	0	0	0	0	3
E	106	10	10	4	0	130
Total	206	72	95	27	129	529

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	61	1	1	38	101
B	76	0	0	0	1	78
C	28	5	0	0	1	34
D	29	0	0	0	0	29
E	264	9	0	0	0	274
Total	398	74	1	1	41	516

Table 8.43 Junction 4: 2039 Without Development AM/PM Peak Hour Traffic Movements

AM

Origin \ Destination	A	B	C	D	E	Tot
A	0	83	81	23	127	314
B	142	0	6	0	4	151
C	10	0	0	0	0	10
D	3	0	0	0	0	3
E	106	13	10	4	0	133
Total	261	96	97	27	131	612

PM

Origin \ Destination	A	B	C	D	E	Tot
A	0	101	1	1	38	141
B	105	0	0	0	2	108
C	28	8	0	0	1	37
D	29	0	0	0	0	29
E	264	15	0	0	0	280
Total	427	123	1	1	42	595

Table 8.44 Junction 4: 2039 With Development AM/PM Peak Hour Traffic Movements

9.0 NETWORK MODELLING RESULTS

9.1 BASE MODEL DEVELOPMENT

Paramics Discovery models were built for the Existing, 2020, scenario AM and PM time periods. These models represent the AM and PM 2-hour peak periods, from 07:30 to 09:30 and 16:30 to 18:30.

Traffic count information was collected by 'Tracsis plc' in February 2020 prior to the impact of Covid. In addition to junction turning counts, queue length surveys and pedestrian crossing surveys were carried out simultaneously on all approaches to the 4 Junctions included in the study area, refer to Figure 1.2. This information was used to build the prior matrix and construct the preliminary base model which was calibrated using the recorded information.

The flow chart shown in Figure 9.1 illustrates the stages of the modelling process undertaken to build each of the base year Paramics models. This is the standard system of developing such large-scale Microsimulation models.

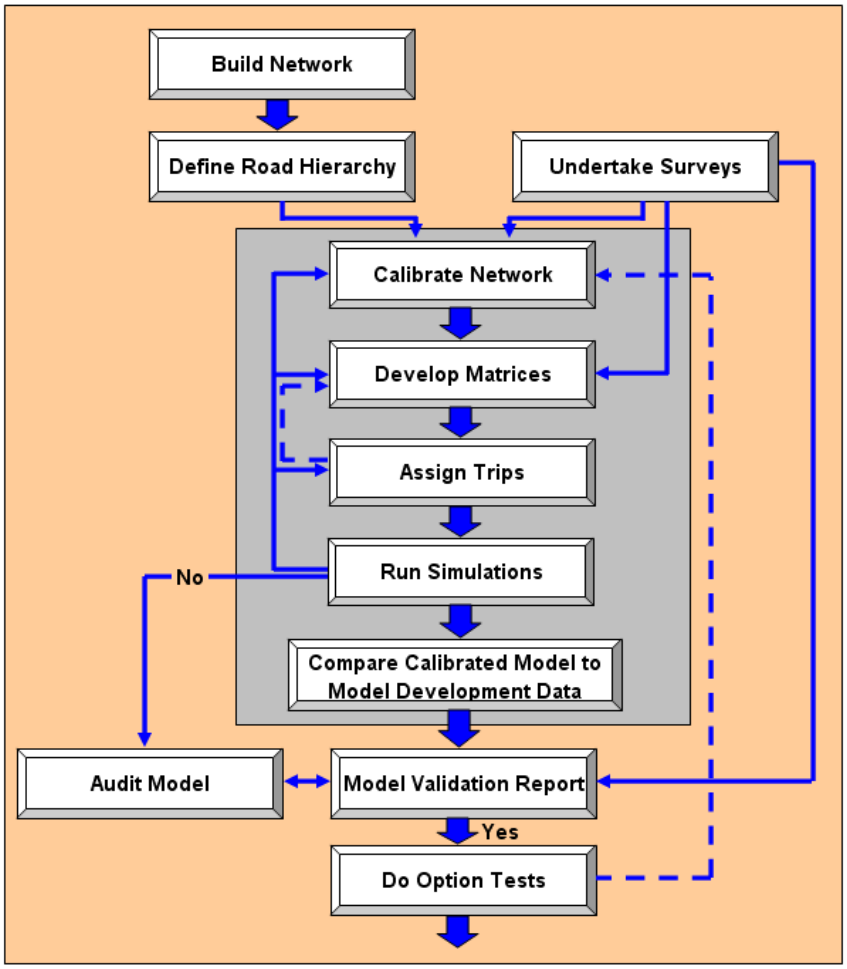


Fig 9.1: Stages of the Paramics Modelling Process

9.1.1 Data Collection

Traffic Survey data was provided to the traffic modelling team by Tracsis to inform this study. The data included coordinated classified vehicular turning counts, pedestrian counts and queue length data.
In addition, traffic signal timings including stages and phasing were recorded during on-site visits. Bus timetables for the routes using the modelled network were used and confirmed by on-site observation.

9.1.2 Digital Mapping

This process involved the coordination of digital Ordnance Survey mapping to provide a working AutoCAD template for the Paramics traffic analysis. The historic mapping was adjusted to reflect as-built drawings for the Skehard Road Improvement works carried out by Cork City Council.

9.1.3 Site Visits

As part of the model development a number of site visits were undertaken by MHL. Data required in the model build process as well as the calibration and validation process were collected. This information included:

- Road Geometry Details
- Junction Traffic Counts spot checks
- Queue Length Survey spot checks
- Junction Operation Characteristics including phasing of signal-controlled junctions

9.1.4 Traffic Surveys

MHL commissioned Tracsis plc. to collect coordinated classified traffic surveys counts for a 12-hour period for each of the major junctions encompassed in this study. These traffic counts were undertaken from 07:00 to 19:00 on Thursday 6th February 2020 prior to the impact of Covid. Detail of the traffic count locations undertaken by Tracsis are shown in Appendix A of this report.

A graphic showing the daily traffic profile for the overall study area is shown below. The graphic shows the volume of traffic recorded in any given 15-minute interval on the network during the 12-hour period. The graph shows the morning and evening peaks.
The busiest peak hour traffic flows were recorded at 07.30- 08:30 & 16:30-17:30.

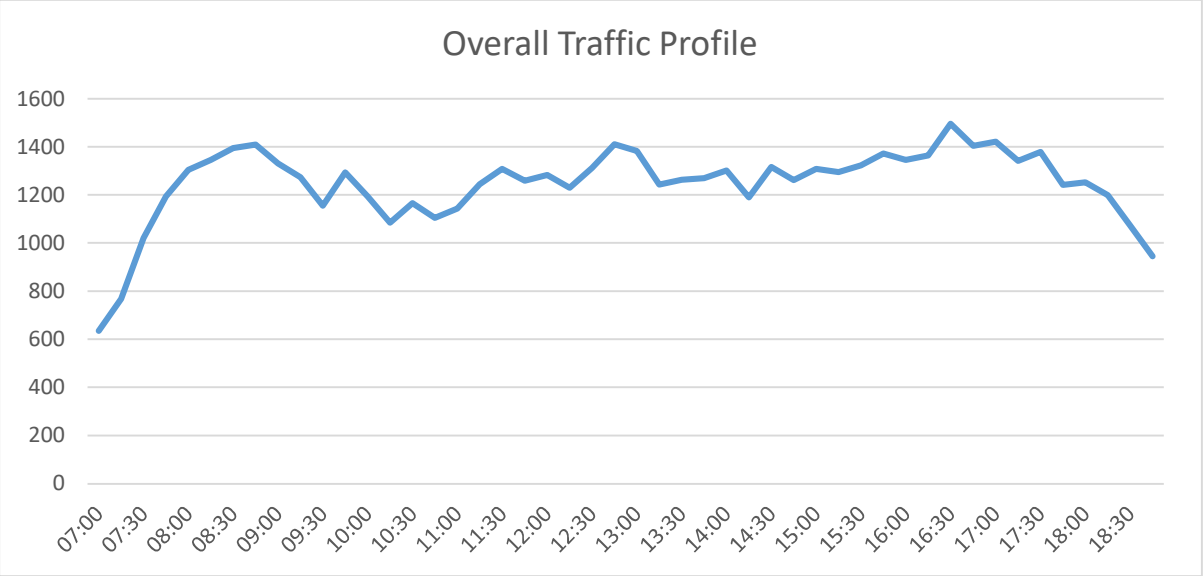


Fig 9.2: Recorded 12-hour traffic profile

9.1.5 Queue Length Surveys

Tracsis plc also carried out queue length surveys on all junction approaches. The queue length results were used to calibrate the traffic models for the peak hours in the base year 2020.

As outlined above spot-checks were carried out in the current year 2022 when traffic flows were returning to normal after covid restrictions were eased. These spot checks indicated that 2020 traffic flows and queue levels remain higher than current levels, reflecting what is assumed to be a percentage of people still working from home. The constructed models using 2020 data therefore represents worst-case scenarios.

9.1.6 Model Calibration

Following the construction of the network from digital mapping and survey data, derivation of traffic demands and assignment of the demands, the model was examined for inaccuracies and inappropriate model parameters.

The Bessborough Model was calibrated by employing an iterative design process along with Matrix Estimation methods. Several input factors were observed and/or adjusted until the model performed in a way that was consistent with existing traffic conditions thus ensuring the integrity of the simulation. Aspects of the modelling inputs, important to achieve a well calibrated model, that were carefully adjusted include:

- Junction capacity and performance.
- Peak Hour traffic profiles
- Route choice (no route choice parameter).
- Road hierarchy.
- Vehicle speeds.
- Perturbation.

Calibrating the model in this way meant that it was being designed to take into account variables that could accurately establish whether the model was a true representation of actual network conditions.

9.1.7 Model Validation

Traffic Count Validation

Design Standards and good practice requires that there should be two sets of observed data used in the development of the model; the first is in the network calibration process, the second to validate the model. For the purposes of this model the Tracsis collected traffic data was used to set up and calibrate the base model with spot checks carried out in 2022 at the key Junctions 1,2 and 3 for specific time periods during the peak periods used to validate the base model findings.

Statistical Flow Validation

The model was validated by comparing the traffic count information to the modelled flows from Paramics. This involved running the Paramics Matrix Estimation mode through thousands of iterations to ensure that the flows are representative of actual measured flows. The GEH statistic is used to assess the accuracy of modelled flows and is the standard by which Traffic Model Assignment is validated. The reason for using the GEH statistic, rather than an absolute or relative flow difference, is that it can cope with a wide range of traffic flows. Whereas an absolute difference of 100pcu/hr can be important in a flow of 200pcu/hr it is largely irrelevant in a flow of several thousand pcu/hr. In this report the GEH statistics have been presented on a junction-by-junction basis. Individual link flow movements have also been considered.

The following tables present the Link flow approaches to each junction for both AM and PM peaks comparing recorded traffic flows to the developed matrices. TII Standards recommend that a GEH value of less than 5 is a very good match, less than 10 is acceptable whereas more than 10 may warrant further investigation. When viewing the tables Junctions 1, 2 & 3 are identifiable with J4: Unnamed Junction representing traffic to and from the Blackrock Business Park, Jacob's Engineering and Clover Hill Estate and J5: Housing Scheme, representing traffic from granted schemes using the Bessborough Road. The inclusion of these schemes ensures a robust assessment of future year scenarios.

The results of the comparative flow analysis for the Bessborough models were exceptionally good and indicate that the simulated congestion and interaction reflects the 2020 situation with an average of 100% of modelled flows achieving a GEH value under 5. As there is no route choice on the developed model these results are expected. The highest deviation from recorded flows occurs in the evening peak and is associated with a partially completed new housing development accessed adjacent to the site access road for Phases 1 & Phase 2. The GEH associated with this zone is 2.5.

Matrix Estimation View

Flow Group: 2020 AM (Current Scenario) | Import counts... | Export counts... | Select the modelled flows to compare: Traffic Routes

Traffic Counts

Ref	Junction	Arms	Count	Modelled Flow (*)	Balancing Factor	% Diff	Diff	GEH
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:6	217	218	1.00	0.5	1	0.1
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:7	643	643	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:8	84	82	1.02	-2.4	-2	0.2
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:5	72	72	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:6	30	30	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:7	44	44	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:5	1100	1099	1.00	-0.1	-1	0.0
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:6	73	73	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:8	54	54	1.00	0.0	0	0.0
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:5	517	515	1.00	-0.4	-2	0.1
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:7	106	107	0.99	0.9	1	0.1
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:8	43	43	1.00	0.0	0	0.0
	J2:Beesboro/R852	J2:1 -> J2:5	495	499	0.99	0.8	4	0.2
	J2:Beesboro/R852	J2:1 -> J2:6	725	749	0.97	3.3	24	0.9
	J2:Beesboro/R852	J2:2 -> J2:4	150	152	0.99	1.3	2	0.2
	J2:Beesboro/R852	J2:2 -> J2:6	196	194	1.01	-1.0	-2	0.1
	J2:Beesboro/R852	J2:3 -> J2:4	1244	1276	0.97	2.6	32	0.9
	J2:Beesboro/R852	J2:3 -> J2:5	417	410	1.02	-1.7	-7	0.3
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:6	39	39	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:7	76	76	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:8	57	56	1.02	-1.8	-1	0.1
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:5	37	37	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:7	387	388	1.00	0.3	1	0.1
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:8	373	372	1.00	-0.3	-1	0.1
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:5	108	108	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:6	231	231	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:8	821	820	1.00	-0.1	-1	0.0
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:5	136	135	1.01	-0.7	-1	0.1
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:6	319	319	1.00	0.0	0	0.0
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:7	975	974	1.00	-0.1	-1	0.0
	J4:Unnamed Junction	J4:1 -> J4:6	119	119	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:1 -> J4:7	18	18	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:1 -> J4:8	243	241	1.01	-0.8	-2	0.1
	J4:Unnamed Junction	J4:2 -> J4:5	118	118	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:2 -> J4:7	0	0	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:2 -> J4:8	4	4	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:3 -> J4:5	9	9	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:3 -> J4:6	0	0	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:3 -> J4:8	0	0	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:4 -> J4:5	122	122	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:4 -> J4:6	22	22	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:4 -> J4:7	12	12	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:1 -> J5:3	97	97	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:1 -> J5:6	0	0	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:4 -> J5:2	532	531	1.00	-0.2	-1	0.0
	J5:Housing Scheme	J5:4 -> J5:6	380	378	1.01	-0.5	-2	0.1
	J5:Housing Scheme	J5:5 -> J5:2	0	0	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:5 -> J5:3	249	249	1.00	0.0	0	0.0

Table 9.1 GEH Statistical 2020 AM Output

The surveyed traffic counts and the simulated traffic counts are compared using the GEH Statistic. In accordance with the TII "Project Appraisal Guidelines for National Roads Unit 5.1 -Construction of Transport Models" (PE-PAG-02015) 85% of Turning Counts should have a GEH value of less than 5. This compares favourably to the results of the Matrix Estimation procedure carried out as part of the validation process. For each of the current year models AM and PM the GEH values were found to be well within the requirement.

Matrix Estimation View

Flow Group: 2020 PM (Current Scenario) | Import counts... | Export counts... | Select the modelled flows to compare: Traffic Routes

Traffic Counts

Ref	Junction	Arms	Count	Modelled Flow (*)	Balancing Factor	% Diff	Diff	GEH
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:6	384	393	0.98	2.3	9	0.5
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:7	1012	1018	0.99	0.6	6	0.2
	J1:Junction 1: Skehard Roa...	J1:1 -> J1:8	155	160	0.97	3.2	5	0.4
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:5	99	115	0.86	16.2	16	1.5
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:6	123	124	0.99	0.8	1	0.1
	J1:Junction 1: Skehard Roa...	J1:2 -> J1:7	105	104	1.01	-1.0	-1	0.1
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:5	738	807	0.91	9.3	69	2.5
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:6	247	236	1.05	-4.5	-11	0.7
	J1:Junction 1: Skehard Roa...	J1:3 -> J1:8	98	94	1.04	-4.1	-4	0.4
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:5	281	312	0.90	11.0	31	1.8
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:7	97	92	1.05	-5.2	-5	0.5
	J1:Junction 1: Skehard Roa...	J1:4 -> J1:8	90	88	1.02	-2.2	-2	0.2
	J2:Beesboro/R852	J2:1 -> J2:5	108	126	0.86	16.7	18	1.7
	J2:Beesboro/R852	J2:1 -> J2:6	1042	1110	0.94	6.5	68	2.1
	J2:Beesboro/R852	J2:2 -> J2:4	492	527	0.93	7.1	35	1.6
	J2:Beesboro/R852	J2:2 -> J2:6	452	461	0.98	2.0	9	0.4
	J2:Beesboro/R852	J2:3 -> J2:4	978	976	1.00	-0.2	-2	0.1
	J2:Beesboro/R852	J2:3 -> J2:5	248	258	0.96	4.0	10	0.6
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:6	119	124	0.96	4.2	5	0.5
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:7	144	151	0.95	4.9	7	0.6
	J3:Junction 3: R582/Blackr...	J3:1 -> J3:8	164	173	0.95	5.5	9	0.7
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:5	94	97	0.97	3.2	3	0.3
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:7	295	309	0.95	4.7	14	0.8
	J3:Junction 3: R582/Blackr...	J3:2 -> J3:8	267	281	0.95	5.2	14	0.8
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:5	79	82	0.96	3.8	3	0.3
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:6	278	288	0.97	3.6	10	0.6
	J3:Junction 3: R582/Blackr...	J3:3 -> J3:8	740	782	0.95	5.7	42	1.5
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:5	166	160	1.04	-3.6	-6	0.5
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:6	438	424	1.03	-3.2	-14	0.7
	J3:Junction 3: R582/Blackr...	J3:4 -> J3:7	939	919	1.02	-2.1	-20	0.7
	J4:Unnamed Junction	J4:1 -> J4:6	82	77	1.06	-6.1	-5	0.6
	J4:Unnamed Junction	J4:1 -> J4:7	5	4	1.25	-20.0	-1	0.5
	J4:Unnamed Junction	J4:1 -> J4:8	53	52	1.02	-1.9	-1	0.1
	J4:Unnamed Junction	J4:2 -> J4:5	81	84	0.96	3.7	3	0.3
	J4:Unnamed Junction	J4:2 -> J4:7	0	0	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:2 -> J4:8	3	4	0.75	33.3	1	0.5
	J4:Unnamed Junction	J4:3 -> J4:5	81	84	0.96	3.7	3	0.3
	J4:Unnamed Junction	J4:3 -> J4:6	3	4	0.75	33.3	1	0.5
	J4:Unnamed Junction	J4:3 -> J4:8	0	0	1.00	0.0	0	0.0
	J4:Unnamed Junction	J4:4 -> J4:5	329	342	0.96	4.0	13	0.7
	J4:Unnamed Junction	J4:4 -> J4:6	9	12	0.75	33.3	3	0.9
	J4:Unnamed Junction	J4:4 -> J4:7	1	1	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:1 -> J5:3	455	478	0.95	5.1	23	1.1
	J5:Housing Scheme	J5:1 -> J5:6	0	0	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:4 -> J5:2	250	251	1.00	0.4	1	0.1
	J5:Housing Scheme	J5:4 -> J5:6	106	133	0.80	25.5	27	2.5
	J5:Housing Scheme	J5:5 -> J5:2	0	0	1.00	0.0	0	0.0
	J5:Housing Scheme	J5:5 -> J5:3	489	510	0.96	4.3	21	0.9

Table 9.2 GEH Statistical 2020 PM Output

The following tables present the resulting Demand Matrix for both the AM and PM peaks. The 2-hour matrices indicate a flow of 4,635 vehs for the AM peak and 5,268 vehs for the PM peak. The recorded traffic flows at Junction 2 on the main Skehard Road were used to develop an AM and PM peak hour traffic profile for use in the modelling software. The profiles applied are shown in Figures x,y and are used in the Paramics software to proportion the introduction of vehicles onto the network. This ensures that the modelling picks up inter-peak peaks, for example in the AM profile peak traffic flow is at 08:30-09:00 falling back thereafter. The evening profile shows a peak approaching 17:00 and a second peak around 18:00. The use of these profiles within the model is part of the calibration process.

Zone	1	2	3	4	5	6	7	8	9	10	Total
1		78.000	90.000	206.000	583.000	41.000	6.000	80.000	171.000	58.000	**1313.000**
2	107.000		38.000	89.000	271.000	15.000	2.000	31.000	69.000	43.000	**665.000**
3	25.000	8.000		39.000	76.000	2.000	0.000	5.000	13.000	3.000	**171.000**
4	153.000	53.000	37.000		388.000	18.000	3.000	38.000	87.000	20.000	**797.000**
5	320.000	119.000	108.000	231.000		44.000	7.000	89.000	193.000	48.000	**1159.000**
6	49.000	13.000	3.000	9.000	40.000		0.000	4.000	0.000	4.000	**122.000**
7	4.000	1.000	0.000	1.000	3.000	0.000		0.000	0.000	0.000	**9.000**
8	51.000	14.000	3.000	9.000	41.000	22.000	12.000		0.000	4.000	**156.000**
9	41.000	10.000	2.000	7.000	34.000	0.000	0.000	0.000		3.000	**97.000**
10	44.000	30.000	5.000	12.000	41.000	2.000	0.000	3.000	9.000		**146.000**
Total	**794.000**	**326.000**	**286.000**	**603.000**	**1477.000**	**144.000**	**30.000**	**250.000**	**542.000**	**183.000**	**4635.000**

Table 9.3 2020 AM 07:30-09:30 Demand Matrix.

Zone	1	2	3	4	5	6	7	8	9	10	Total
1		236.000	72.000	181.000	370.000	38.000	2.000	26.000	118.000	94.000	**1137.000**
2	92.000		27.000	72.000	156.000	11.000	1.000	7.000	38.000	88.000	**492.000**
3	105.000	40.000		124.000	151.000	2.000	0.000	1.000	9.000	16.000	**448.000**
4	168.000	64.000	97.000		309.000	4.000	0.000	3.000	16.000	26.000	**687.000**
5	435.000	180.000	82.000	288.000		19.000	1.000	13.000	58.000	76.000	**1152.000**
6	27.000	9.000	4.000	12.000	29.000		0.000	4.000	0.000	3.000	**88.000**
7	27.000	9.000	4.000	12.000	29.000	4.000		0.000	0.000	3.000	**88.000**
8	107.000	38.000	18.000	50.000	114.000	12.000	1.000		0.000	15.000	**355.000**
9	149.000	53.000	25.000	70.000	160.000	0.000	0.000	0.000		21.000	**478.000**
10	104.000	124.000	10.000	27.000	61.000	3.000	0.000	2.000	12.000		**343.000**
Total	**1214.000**	**753.000**	**339.000**	**836.000**	**1379.000**	**93.000**	**5.000**	**56.000**	**251.000**	**342.000**	**5268.000**

Table 9.3 2020 PM 16:30-18:30 Demand Matrix.

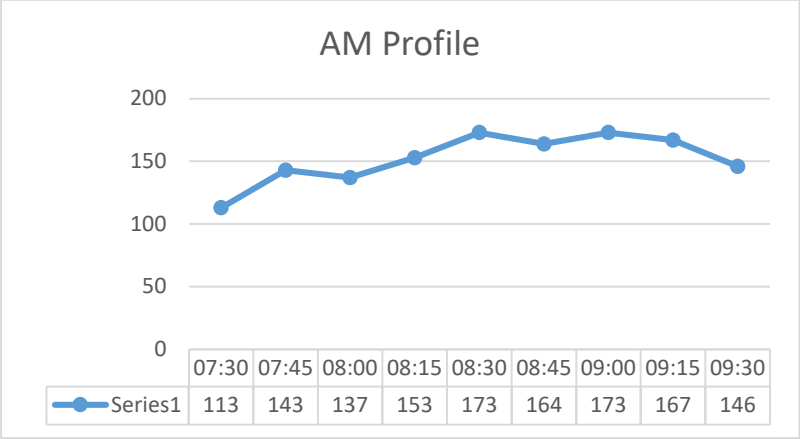


Fig 9.3: Recorded AM Peak traffic profile

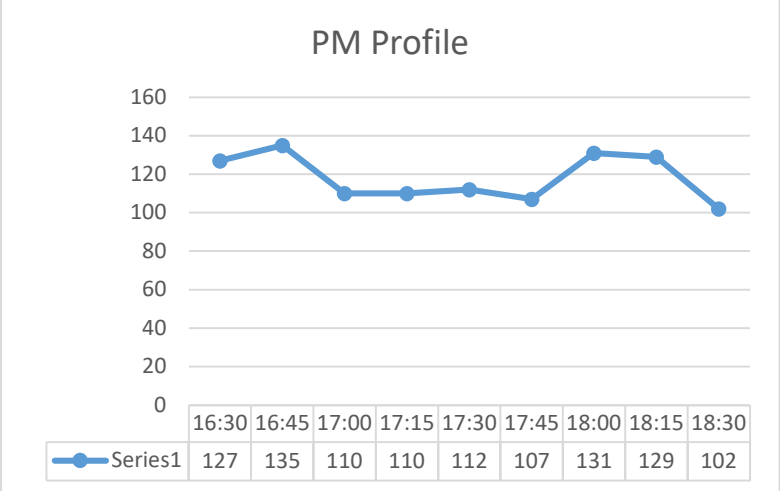
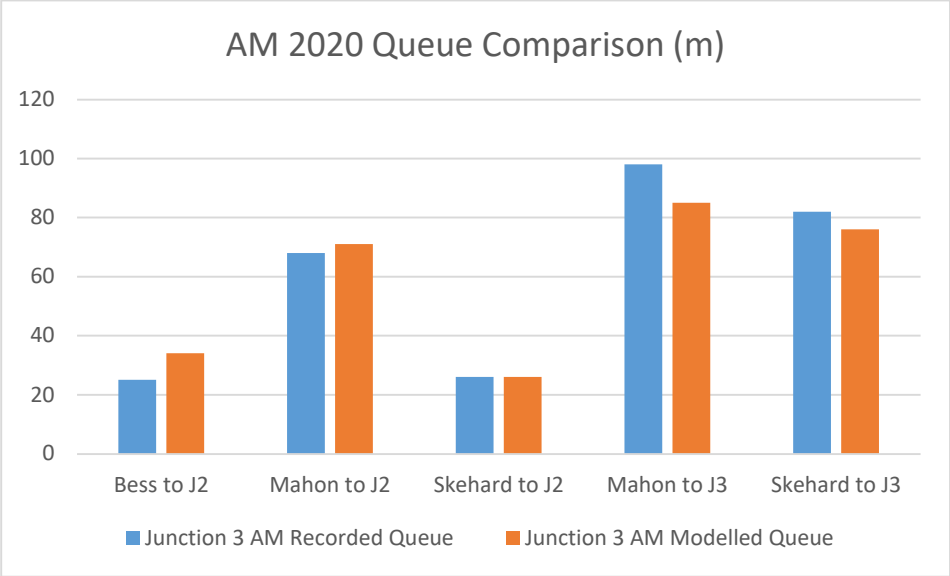


Fig 9.4: Recorded PM Peak traffic profile

9.1.7 Queue Length Validation

The base model was validated by comparing the queue lengths, as recorded on-site, with those in the Paramics model to ensure the integrity of the simulation. Validating the model in this way meant that it was being constructed to take into account actual real time traffic and road conditions as observed on the ground. This comparison showed that the level of queuing shown in the model accurately represents on site conditions. The following graphs present a comparison between recorded 2020 traffic queues forming at the critical junctions during peak periods and the modelled queues for the same time-period.



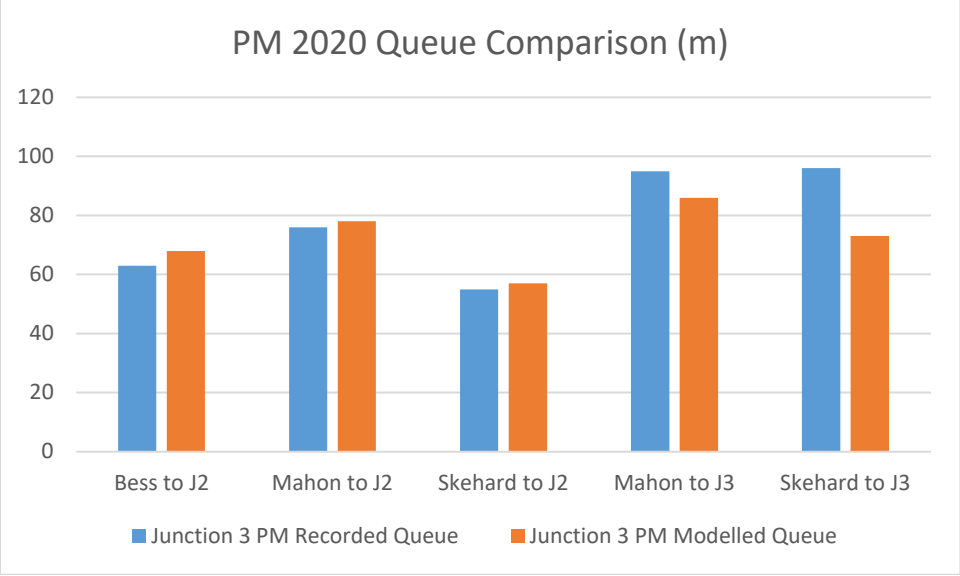


Fig 9.5: 2020 AM/PM Queue Length Comparison

Evident is that the modelled queues broadly reflect the recorded 2020 situation. As previously outlined current year spot checks indicate a drop in overall traffic volumes on the network which results in reduced queues forming at the junctions. In addition, the constructed model reflects the current 'improved' layout which has seen the introduction of Bus Corridors and the use of Bus-Gates at the junctions. Signal timings and phases used in the model are based on the current observed situation. These modifications to the Base Year 2020 collected data will account for the minor discrepancies observed in the constructed model.

The constructed base year models for both peak periods are deemed to be suitable for analysing future year scenarios.

9.2 TRAFFIC MICROSIMULATION RESULTS

The study encompassed the road network as agreed with the Local Authority which is shown in the following extract from the model.

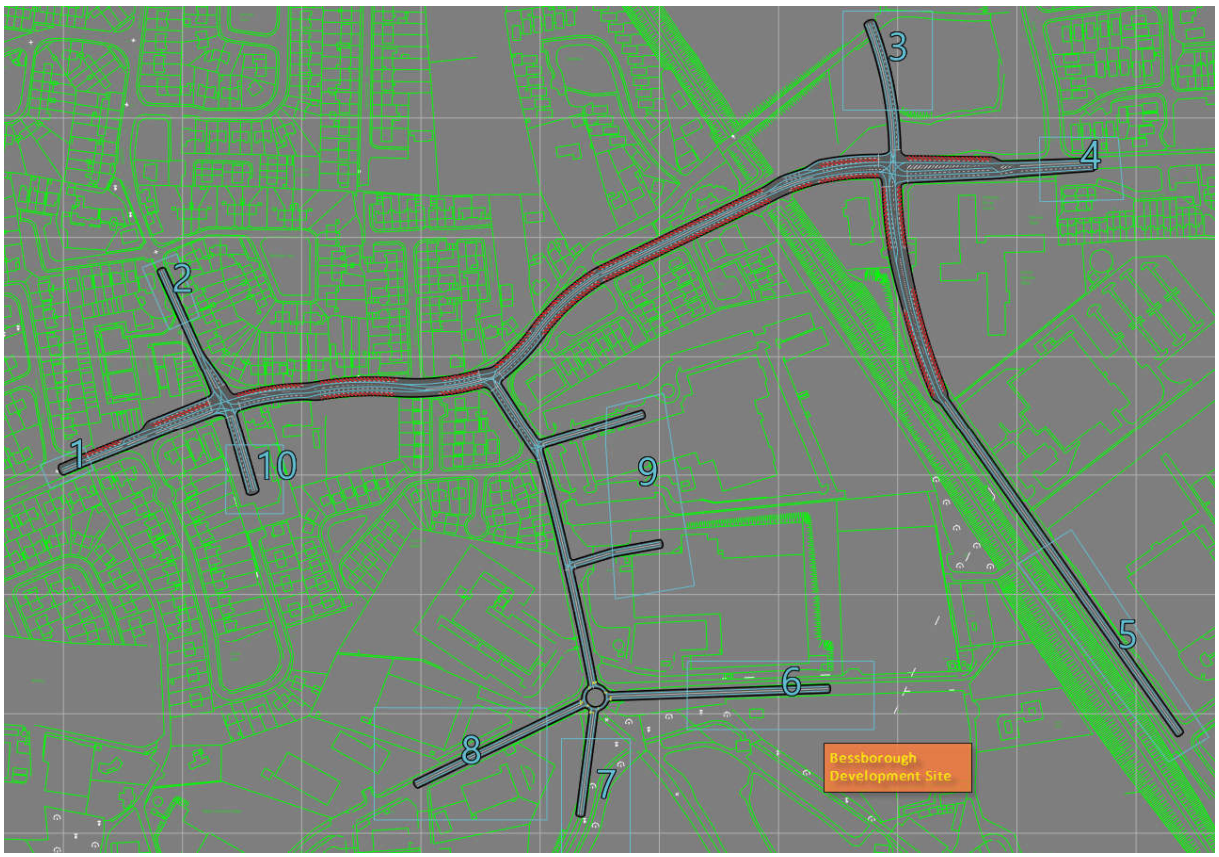


Fig 9.6: Extent of Modelled Network

The Base Year for the model is 2020 as agreed with the Local Authority. The following scenarios have been developed to assess the impact of the proposed phased development:

Scenario 1: 2020 AM/PM Base Year Models
Scenario 2: 2024 AM/PM Models with previously granted schemes (no development)
Scenario 3: 2026 AM/PM with/without Phase 1 (assuming a commencement date in 2024)
Scenario 4: 2028 AM/PM with/without Phase 2 (assuming Phase 1 completed)
Scenario 5: 2030 AM/PM with/without Phase 3 (assuming Phase 1,2 completed)
Scenario 6: 2039 AM/PM Design Year Models with/without (without assumes no new development on the site)

The effects of traffic growth on the existing road network plus the additional traffic generated by the proposed development, have been compiled to generate likely traffic volumes for the different scenarios. The resultant model outputs are estimated values for journey times, traffic queues and delays.

9.2.1 Microsimulation Model Key Performance Indicators

In order to compare various model scenarios from a statistical point of view a comparison of specific 'Key Performance Indicators' (KPI's) is carried out. This comparison of such KPI's provides a quantifiable, relative evaluation of various modelled scenarios. These KPIs include:

- **Journey Time Comparison**: Average journey times on specific routes in respective traffic models in seconds.

- **Average Network Speed**: Average speed for vehicles on the modelled network in metres per second (m/s)

- **Latent Demand**: Latent demand is defined as the number of vehicles still on the network at the end of a simulation period. A high latent demand can be indicative of a traffic network reaching or operating above the available capacity.

- **Average Queue Length**: Average length of queuing in metres on defined routes.

9.2.1.1 Journey Time Comparison

Specific journey paths through the network were modelled to provide a means of comparing the impact of the proposed developments on the Skehard Road, Mahon Link Road and the Bessborough Road. The following Extracts from the model show these individual routes:

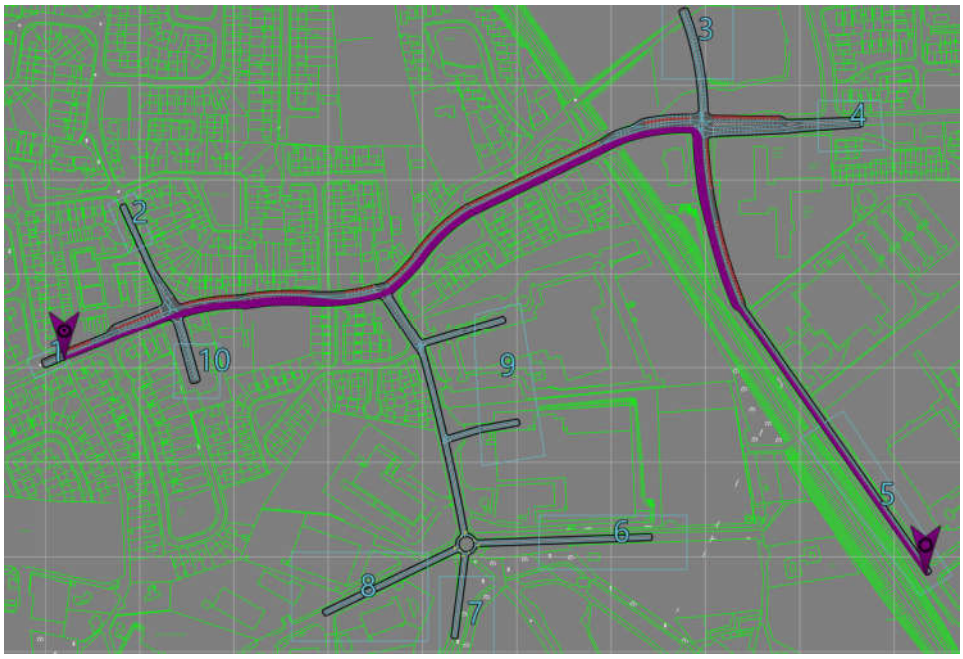


Fig 9.7: Mahon Link to Skehard Road West.

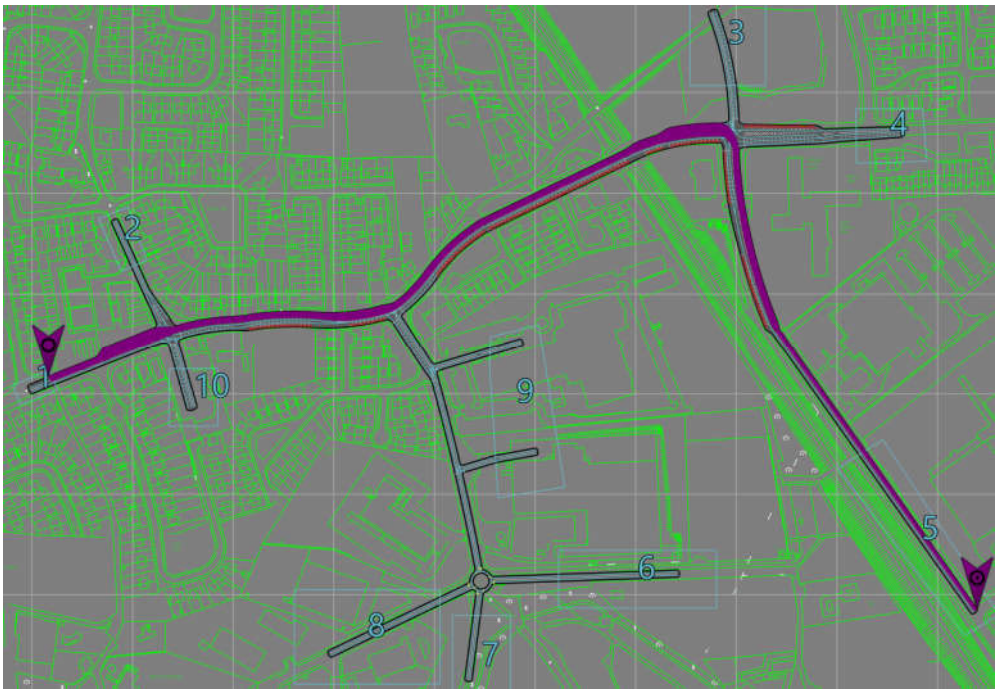


Fig 9.8 Skehard Road West to Mahon Link.

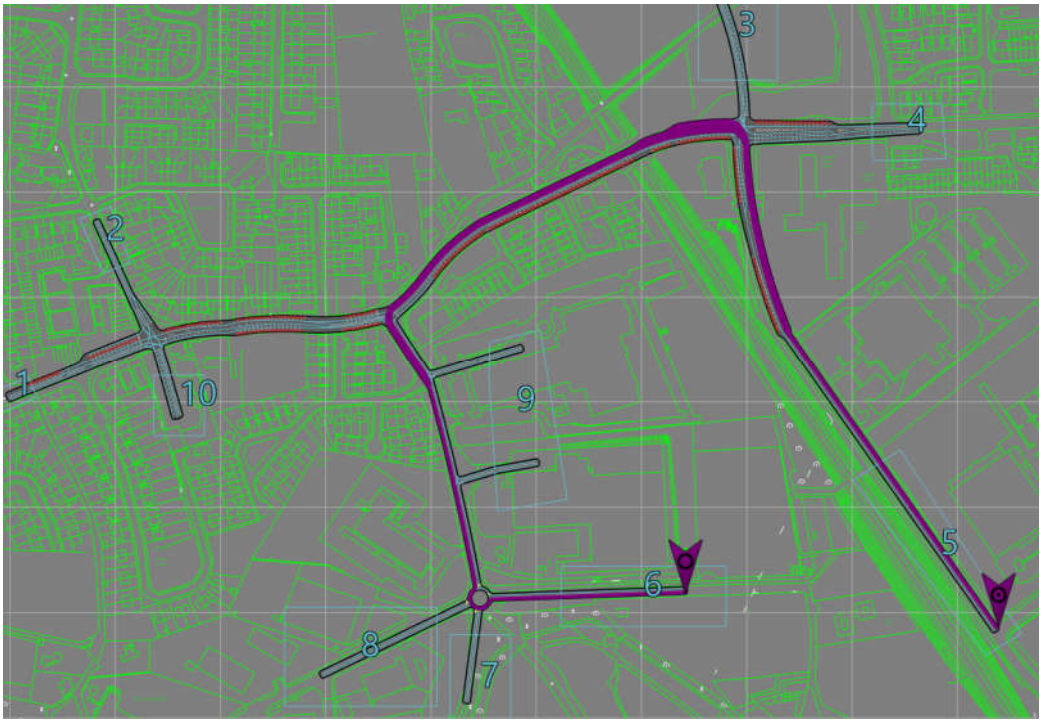


Fig 9.9 Bessborough to Mahon Link

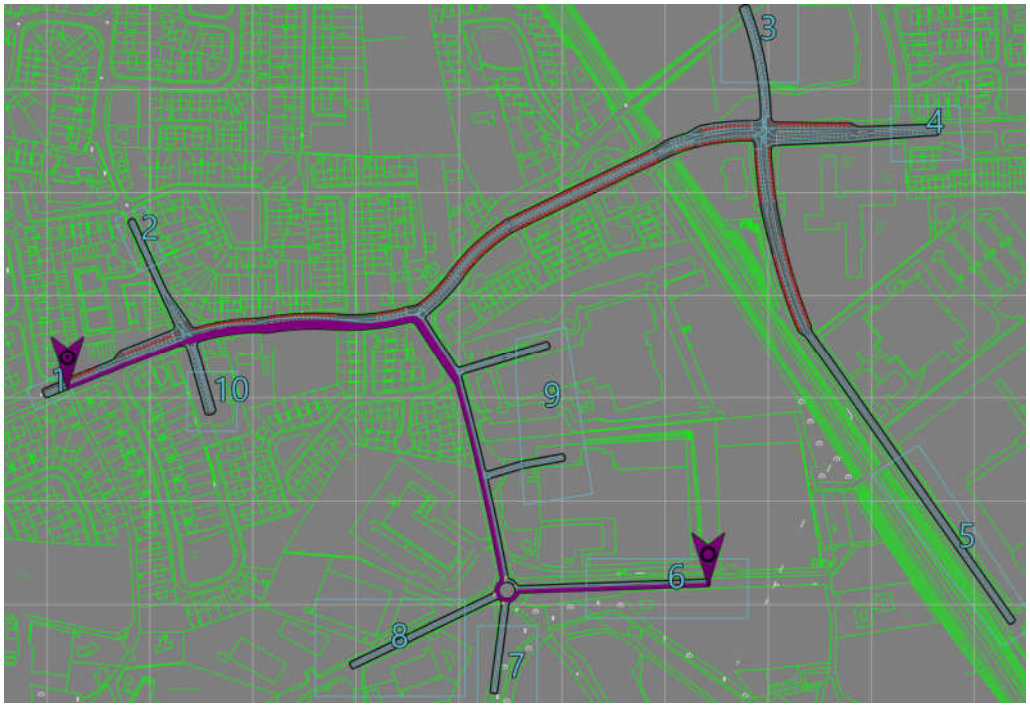


Fig 9.10 Bessborough to Skehard Road West

The developed models are run through 10 iterations and analysed using the Paramics Discovery Software to provide Average Journey Times in seconds along these routes. The resulting data is presented in graphical format for each of the developed scenarios. In this phase of the modelling no adjustments to traffic signal timings or stages are made to improve future year scenarios implying the results are a like-for-like comparison.

The journey times along each of the routes are seen to increase overtime both with/without development traffic. The largest increase relates to the Bessborough Road accessing onto the Skehard Road. As part of the mitigation section of the Traffic Impact Assessment report changes to signal timings will be made to improve the operational characteristics of the network.

Figures 9.13 and 9.14 present the with/without scenarios for 2039 AM and PM. Unlike the other scenarios assessed, the without development in this instance is assuming no development on the Bessborough Site. Background traffic has been increased as per the TII Project Appraisal Guidelines

and permitted developments have been included. The with development includes the 3-phases of the Bessborough Scheme. Evident is that there is an approximate 70% increase in journey times for traffic using the Bessborough Road in the AM peak, reflecting the large volume of traffic turning east towards Mahon on the Skehard Road. The PM peak shows a 49% increase in journey time for traffic on Bessborough Road. An adjustment to the traffic signal timings will mitigate some of this impact when individual phases of the scheme are occupied.
The impact of the proposed Bessborough Scheme on Skehard Road/Mahon Link Road journey times is approximately 26% in the Design Year 2039.

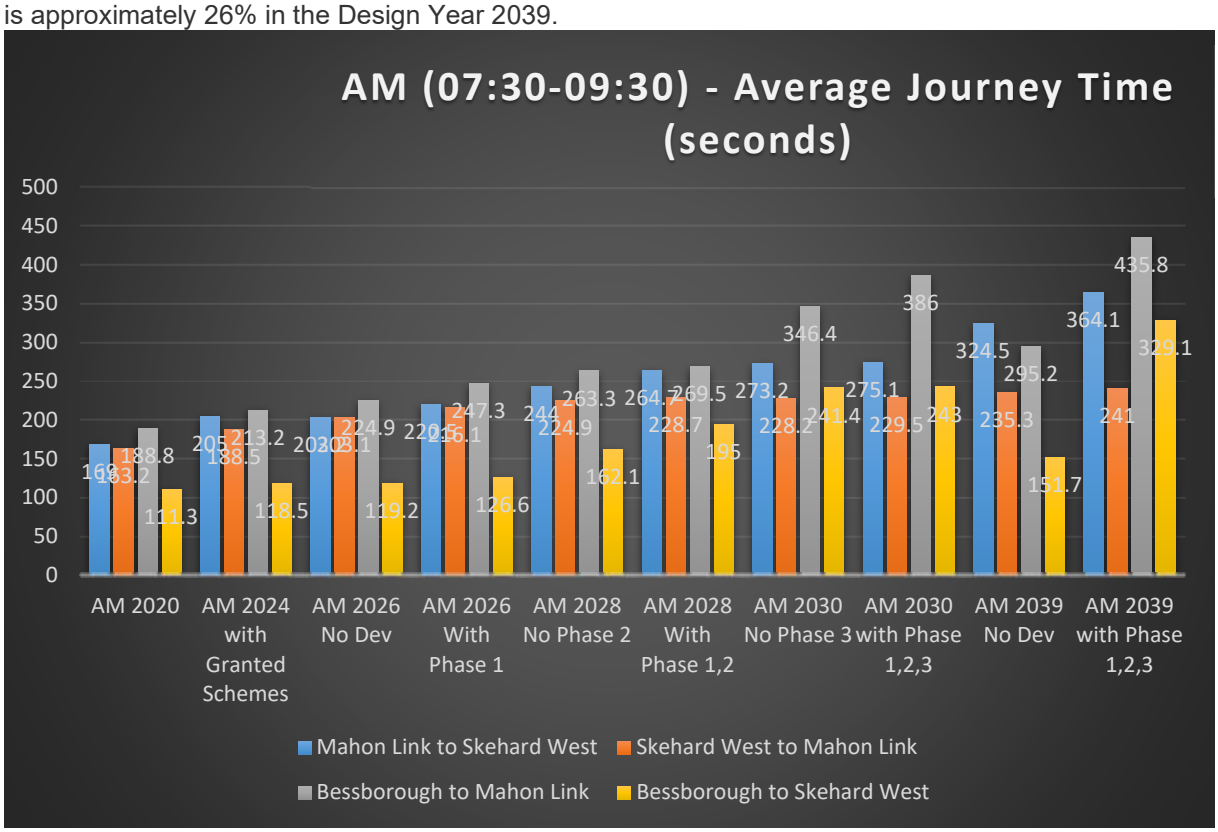


Fig 9.11 AM (07:30-09:30) Average Journey Time Comparison (secs)

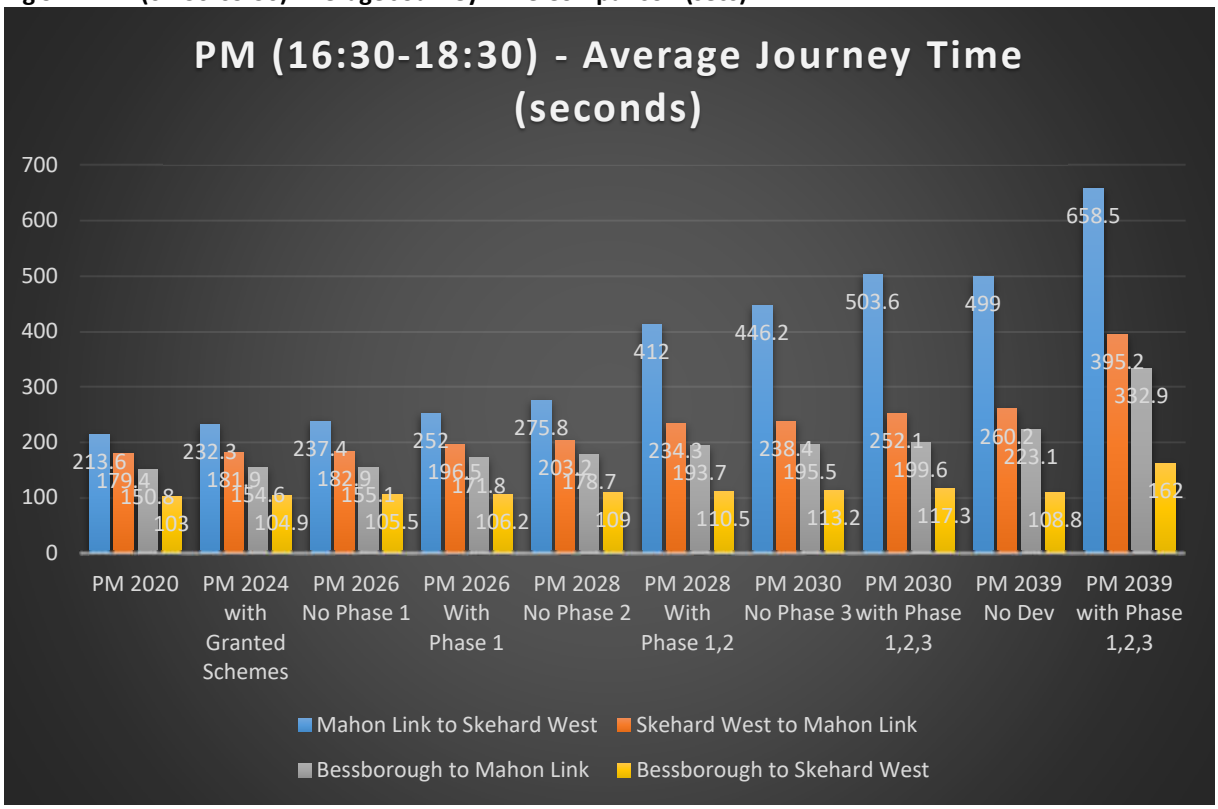


Fig 9.12 PM (07:30-09:30) Average Journey Time Comparison (secs)

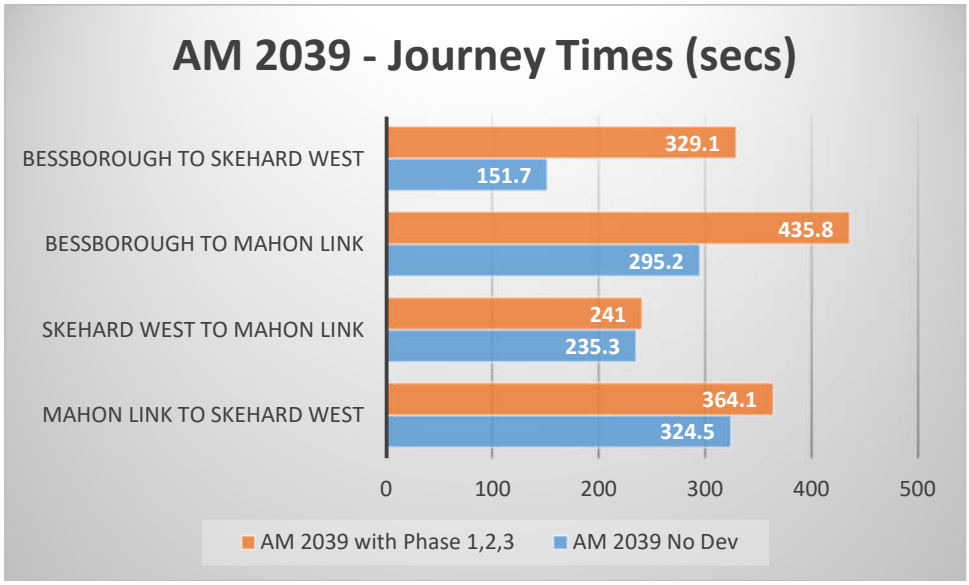


Fig 9.13 AM 2039 (07:30-09:30)

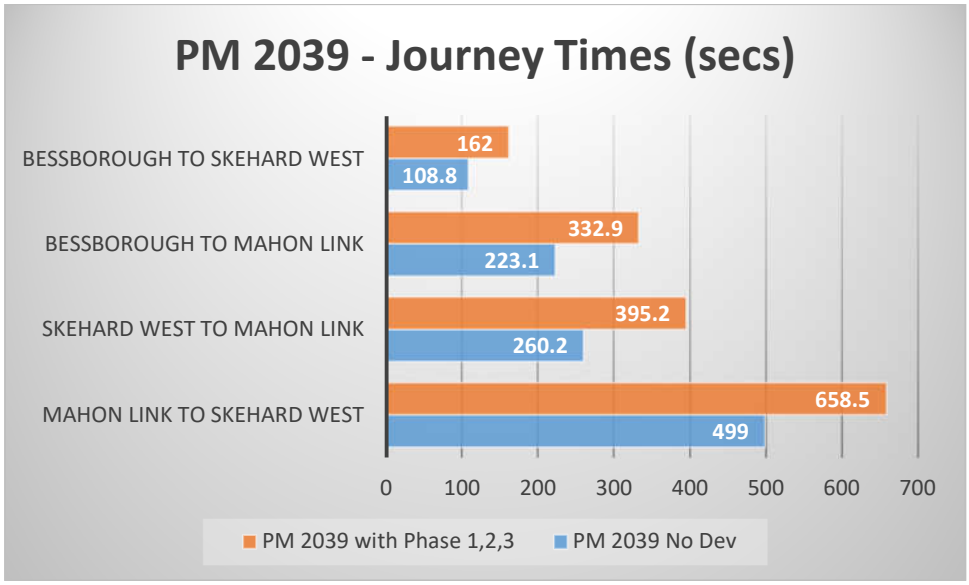


Fig 9.14 PM 2039 (16:30-18:30)

9.2.1.2 Average Network Speed

An assessment of the average network speed for the various data sets is presented in the following graphs. There is a steady decline in vehicular speed through the network going from There is a steady decline in vehicular speed through the network going from 9.4425m/s to 7.4225m/s during the AM peak and 9.1625m/s to 4.6275m/s during the PM peak over the modelled time-period This decline is reflective of the increase in traffic volumes on the network from both the development and background traffic growth. Evident is that this decline is present both with/without development.

A decrease in network speed relates directly to journey times which will encourage the use of sustainable transport modes. In this instance where significant public transport infrastructure (dedicated bus lanes) and off-road greenways exist adjacent to the site, an increase in journey time for the car should result in a positive shift towards these modes. Future year traffic models account for an annual increase in background traffic based on TII guidelines but do not include for a reduction due to anticipated increases in modal shift. It should also be noted when interpreting these results that the difference in future year with/without models reduces as the overall network begins to reach capacity. The following KPI, Latent Demand, reflects the number of vehicles left on the network after the modelled time-period has complete (vehicles that have not completed their journey). An increase in

latent demand implies the modelled network is approaching capacity and modifications to signal timings will be needed to increase the throughflow of traffic at junctions. It should be noted that changes to signal timings will improve the capacity of junctions within the modelled area but may have a knock-on effect on the operation of junctions outside this zone.

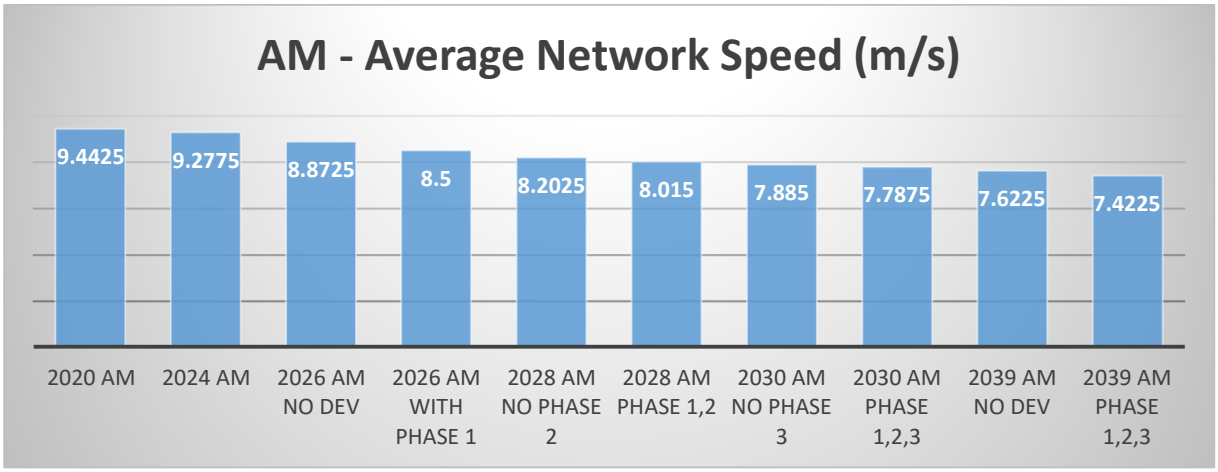


Fig 9.15 AM – Comparison of Average Network Speed

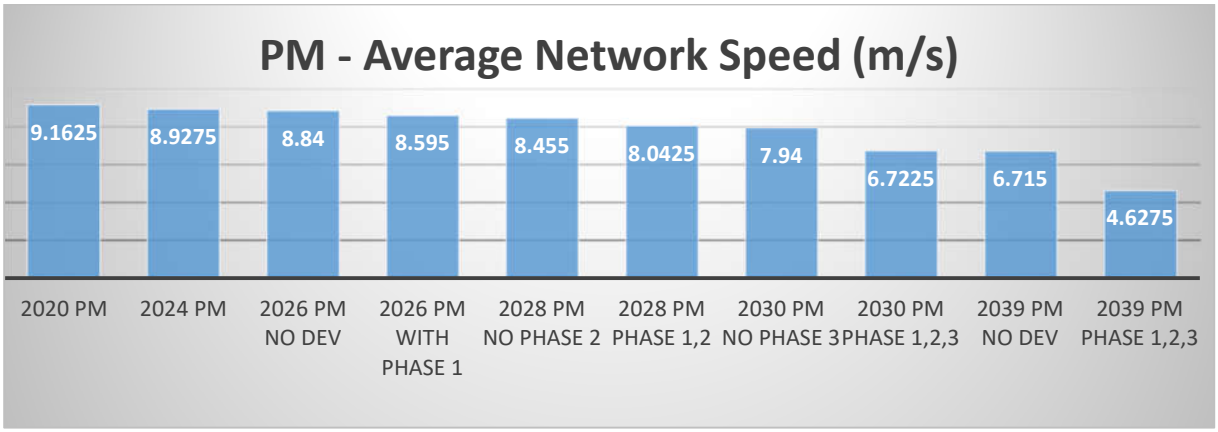


Fig 9.16 PM – Comparison of Average Network Speed

9.2.1.3 Latent Demand

The following graphs indicate the number of vehicles remaining on the network on completion of the modelled time-period. There is a significant jump in 2028 AM (Phase 2 in place) between the with/without which steadily increases thereafter. This jump is related to the increase in traffic accessing onto Skehard Road from the Bessborough Road without a change to the signal timings. The AM peak, at present, favours traffic entering into the Bessborough Employment Area over and above traffic exiting onto Skehard Road. A re-balance of signal timings would mitigate the delay experienced on the minor arm (Bessborough Road).

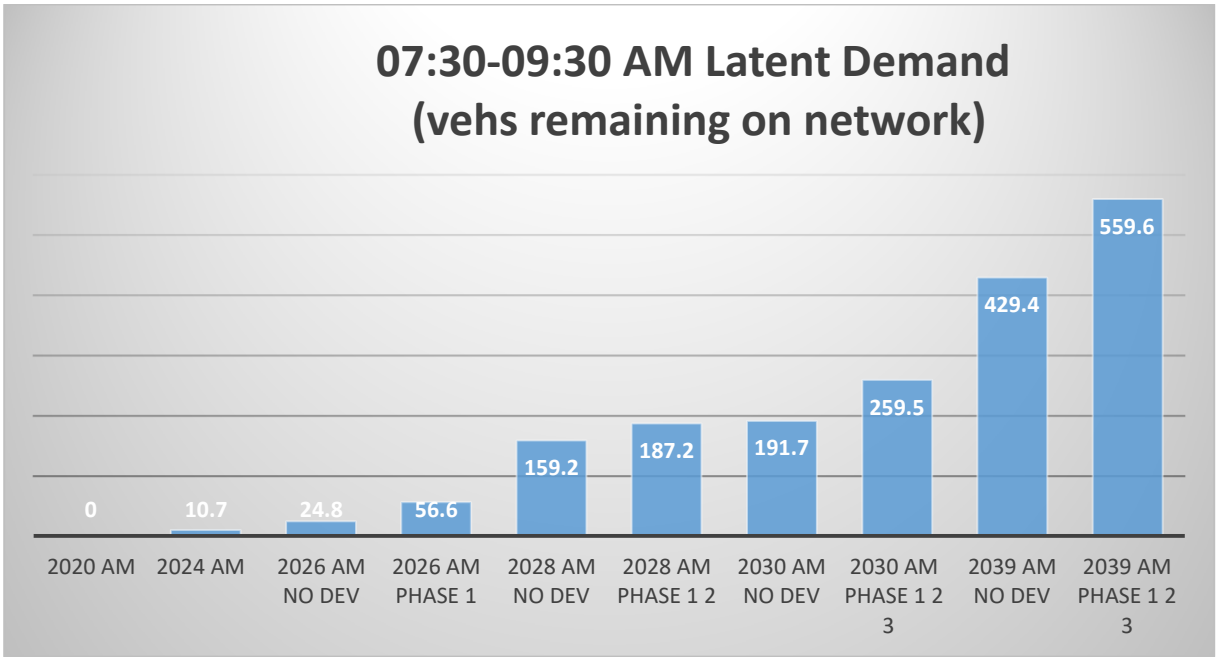


Fig 9.17 AM Comparison of Latent Demand

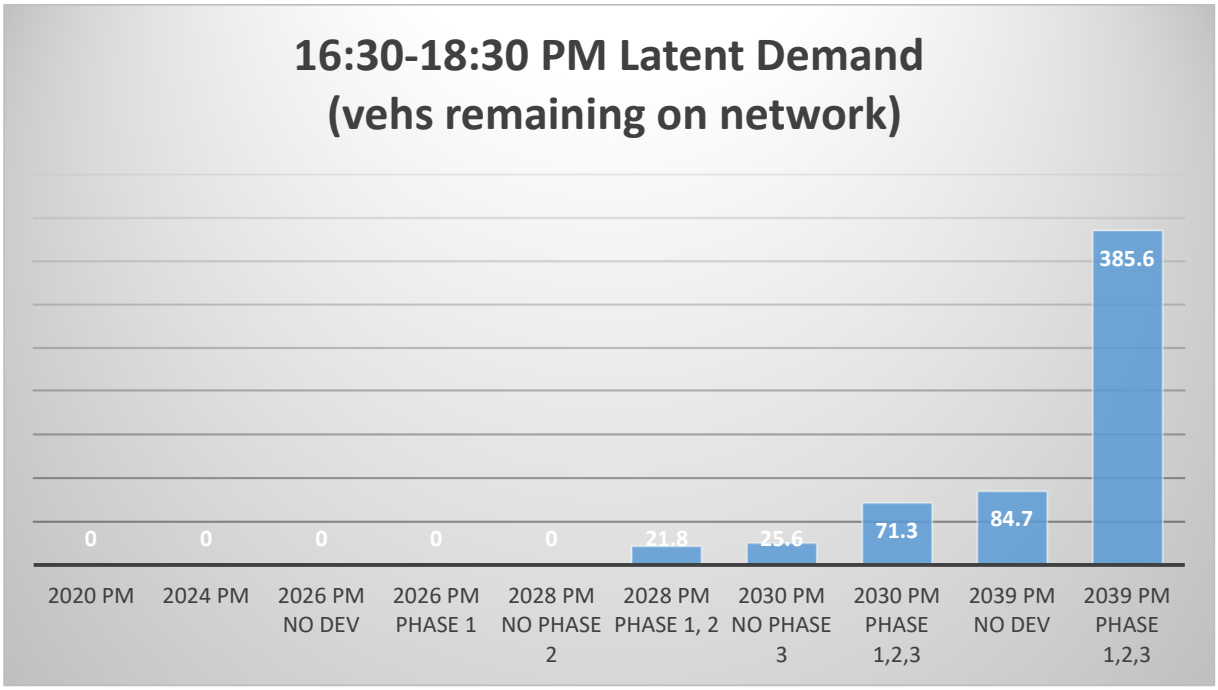


Fig 9.18 PM Comparison of Latent Demand

The AM and PM peaks at present are operating within capacity with 100% of vehicles being able to complete their journey within the modelled time-period.

9.2.1.3 Average Queue Length

Specific queue paths through the network were modelled to provide a means of comparing the impact of the proposed developments on the Skehard Road, Mahon Link Road and the Bessborough Road. The following Extracts from the model show these individual queue paths.

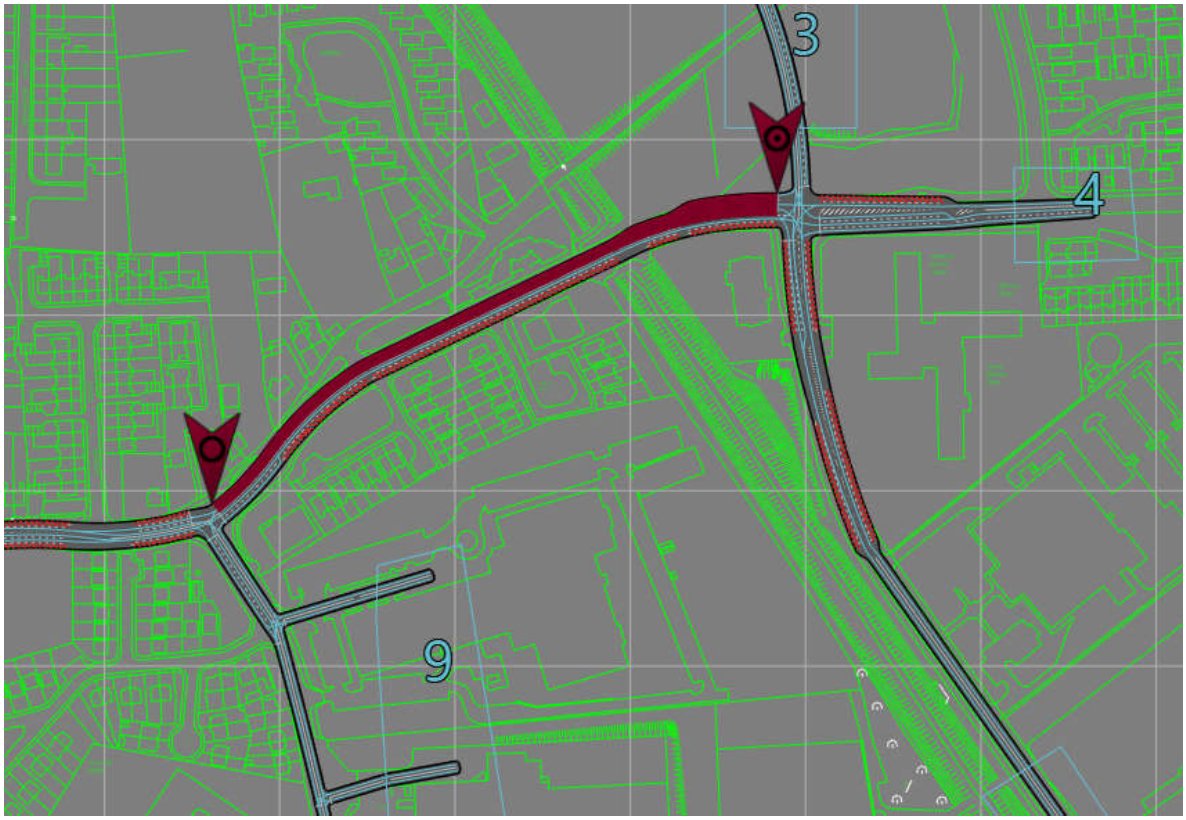


Fig 9.19 Skehard Road to Junction 3

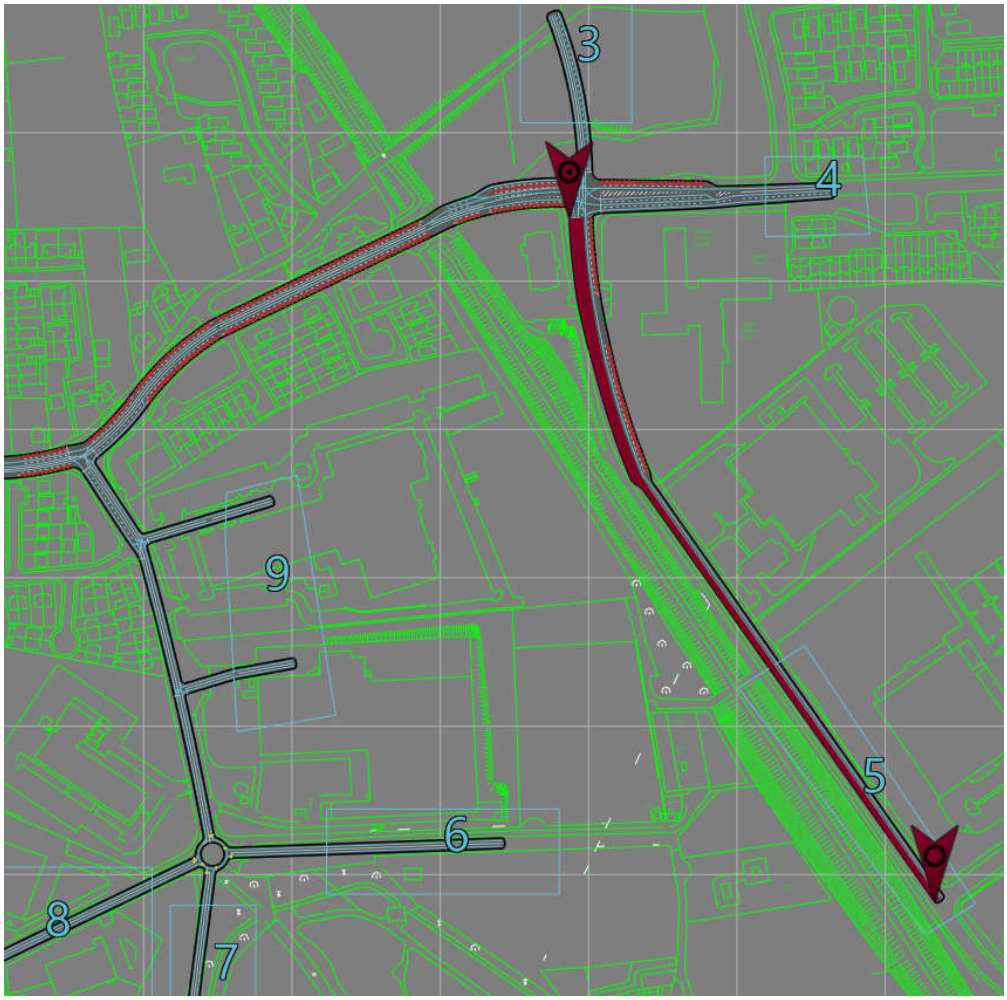


Fig 9.20 Mahon Link Road to Junction 3

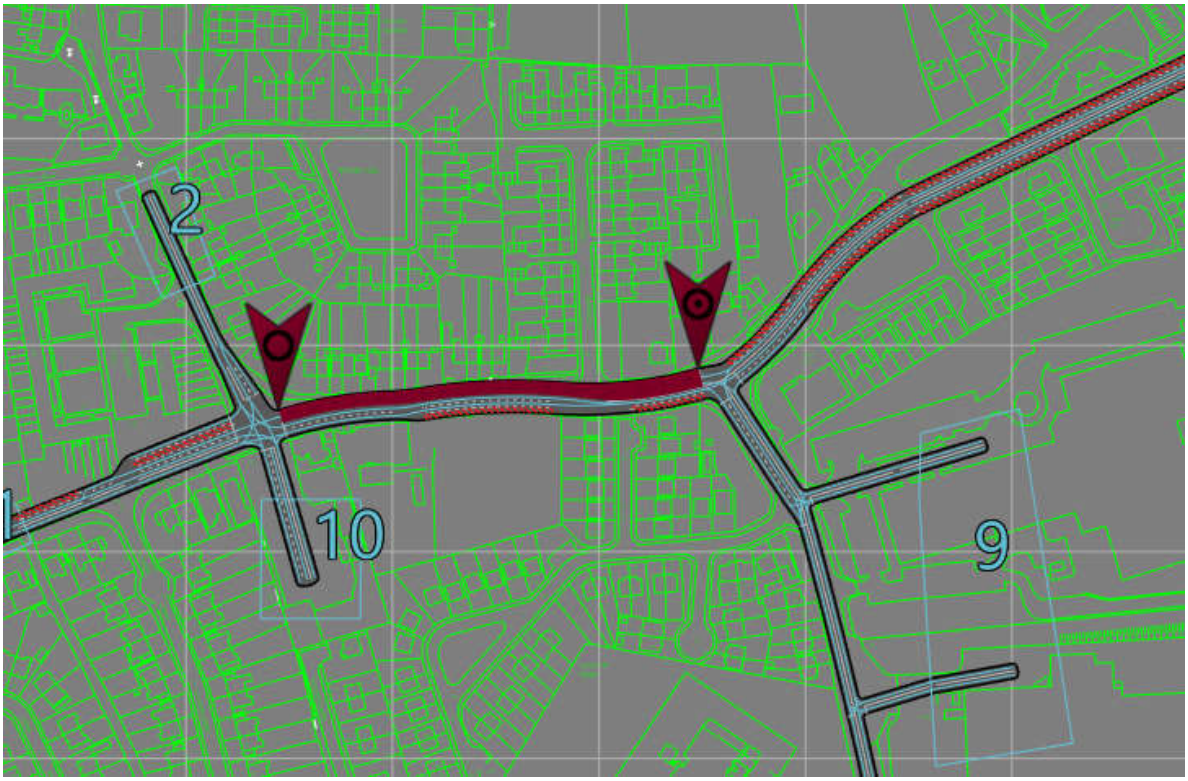


Fig 9.21 Skehard Road West to Junction 2

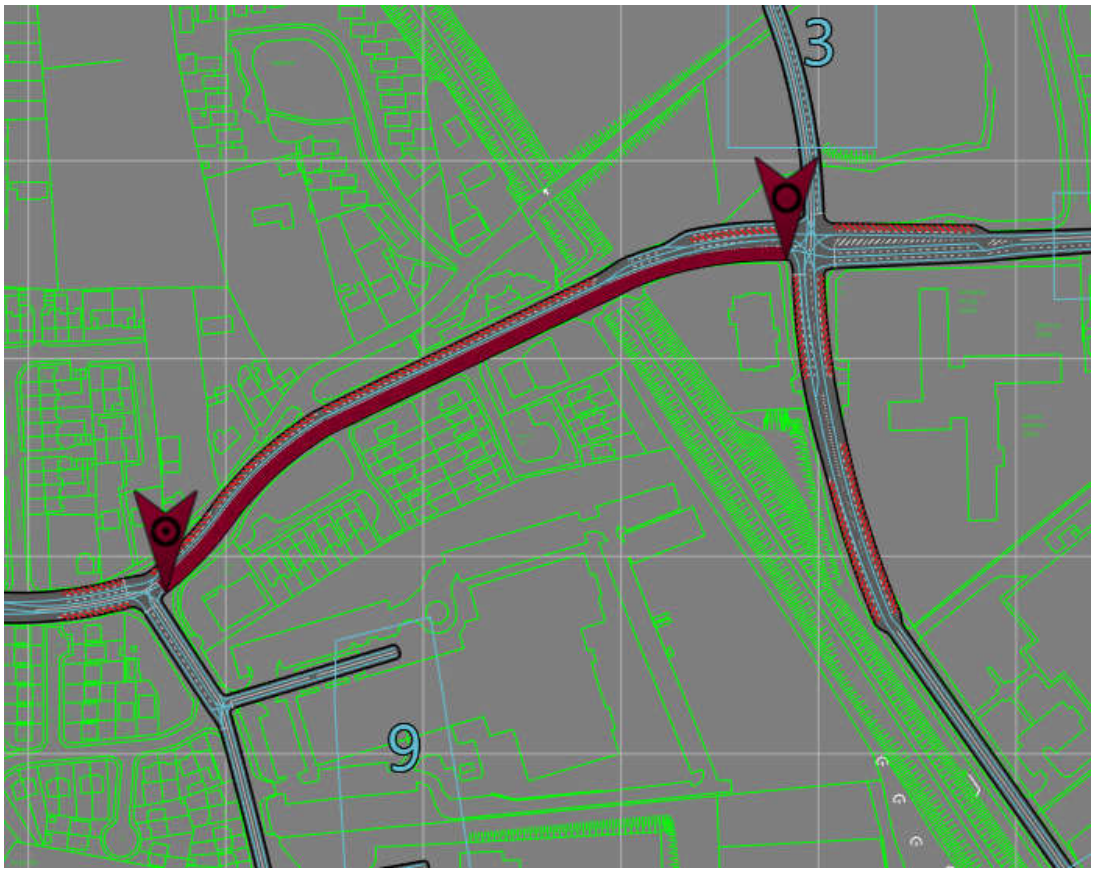


Fig 9.22 Mahon Approach to Junction 2

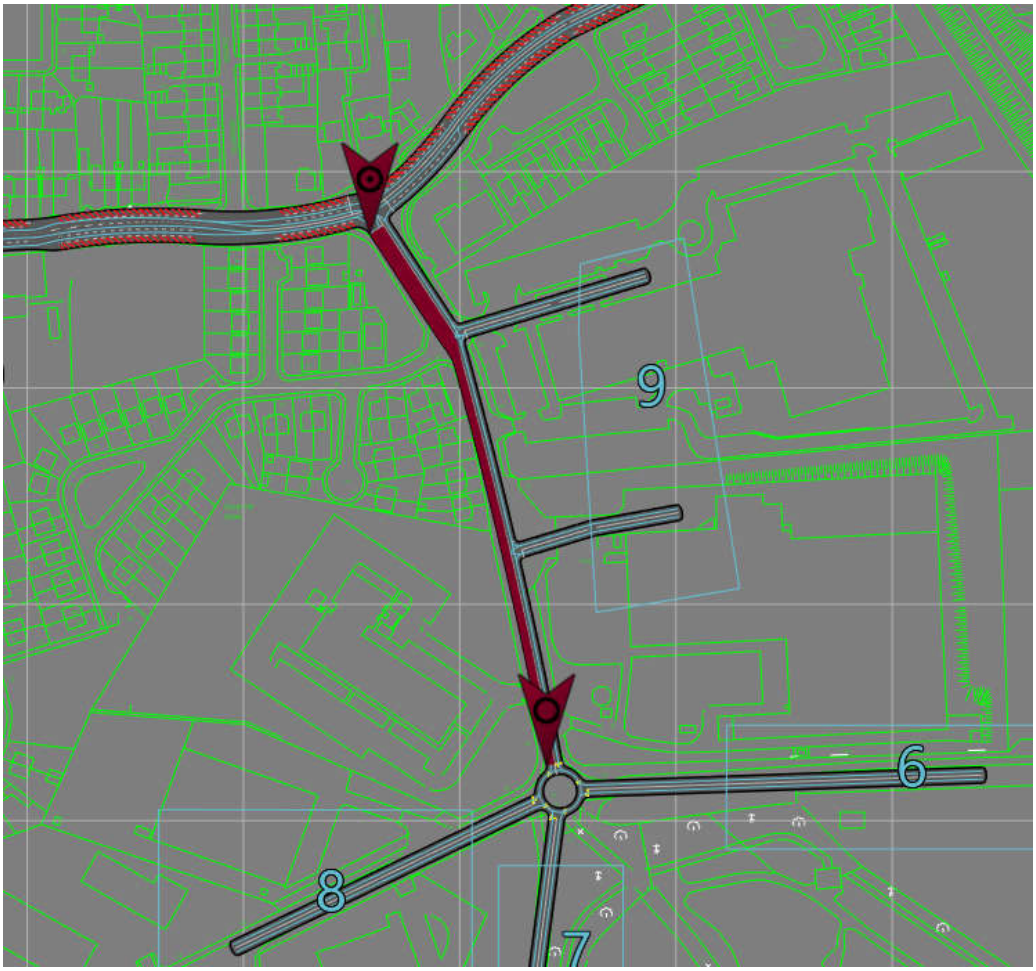


Fig 9.23 Bessborough Road Approach to Junction 2

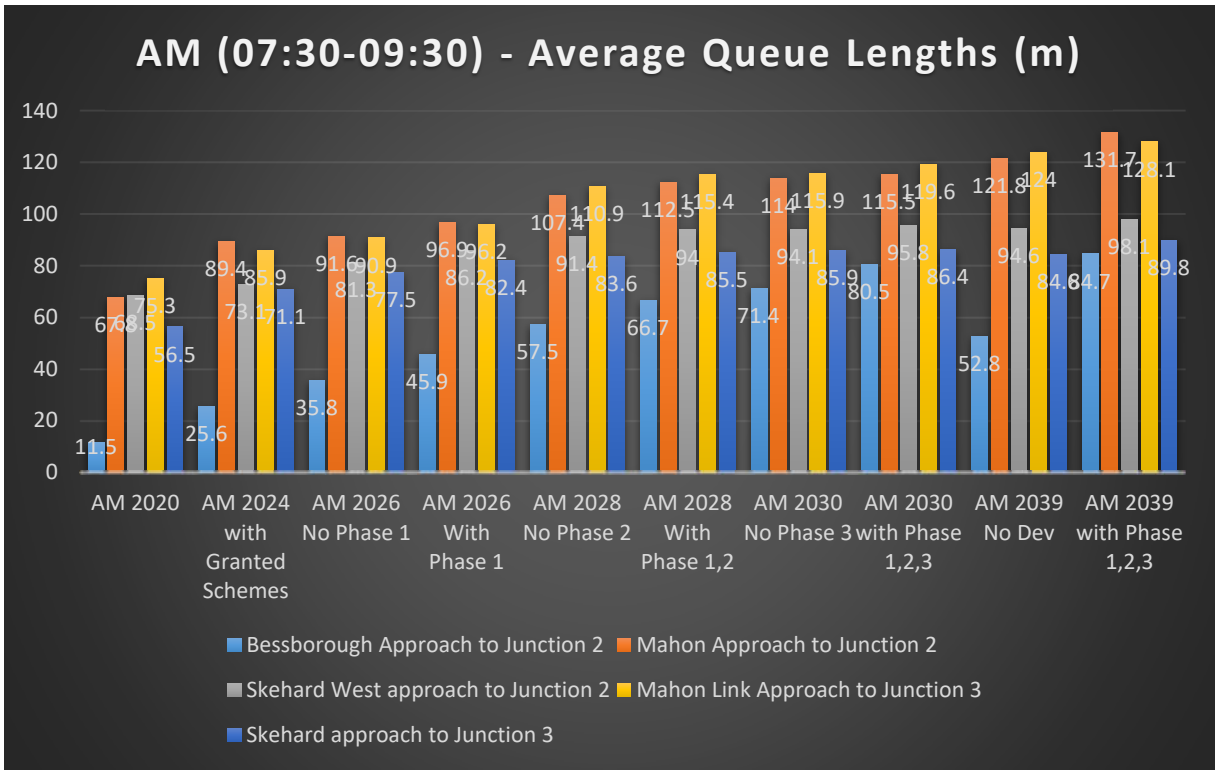


Fig 9.24 AM Average Queue Lengths

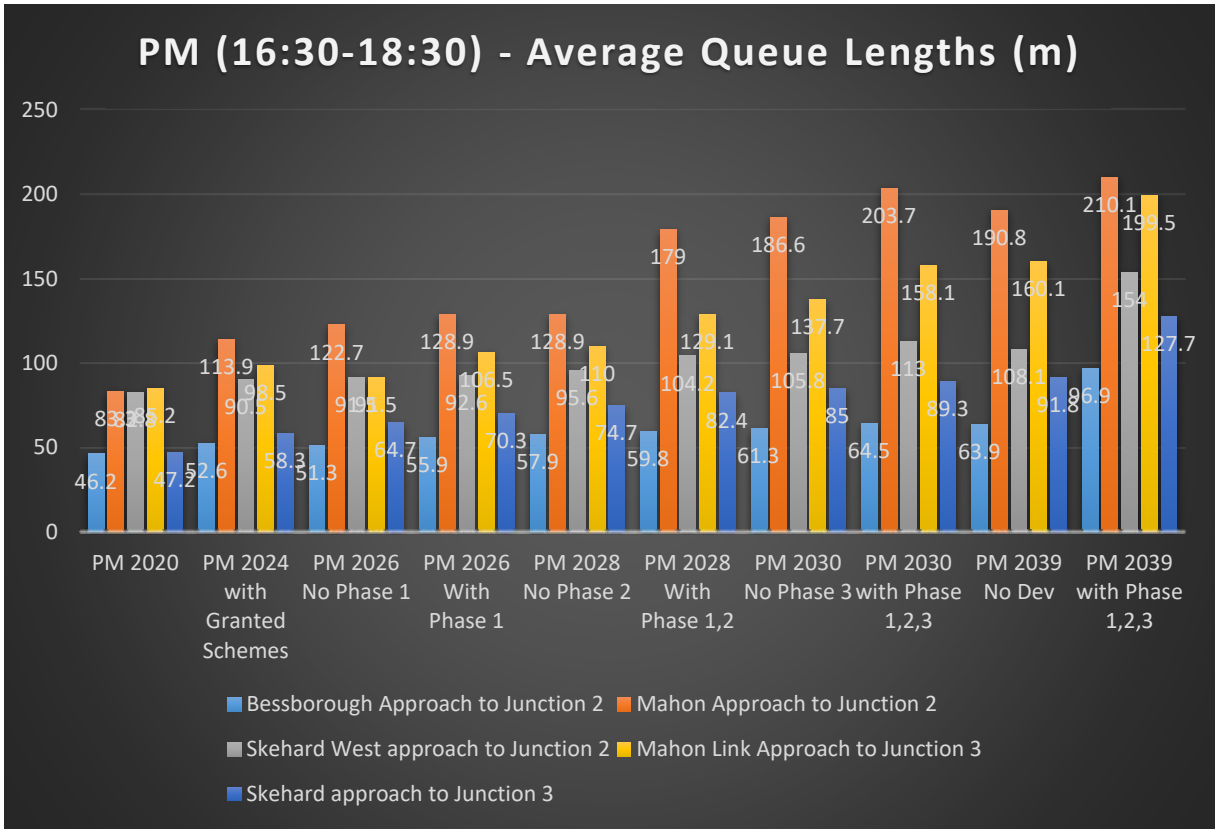


Fig 9.25 PM Average Queue Lengths

The queue length results for each data set shows a gradual increase in queue lengths both with/without development in place. Bessborough approach to Junction 2 is the most impacted which corresponds with the other KPI's. The following two graphs present the Design Year, 2039, impacts on queue lengths comparing with/without for both peak periods. Evident is that the impact of the development is in the region of a 21% increase over and above the annual growth rate coupled with granted schemes. This level of impact in an area set for continued investment in public transport and sustainable modes of travel is appropriate.

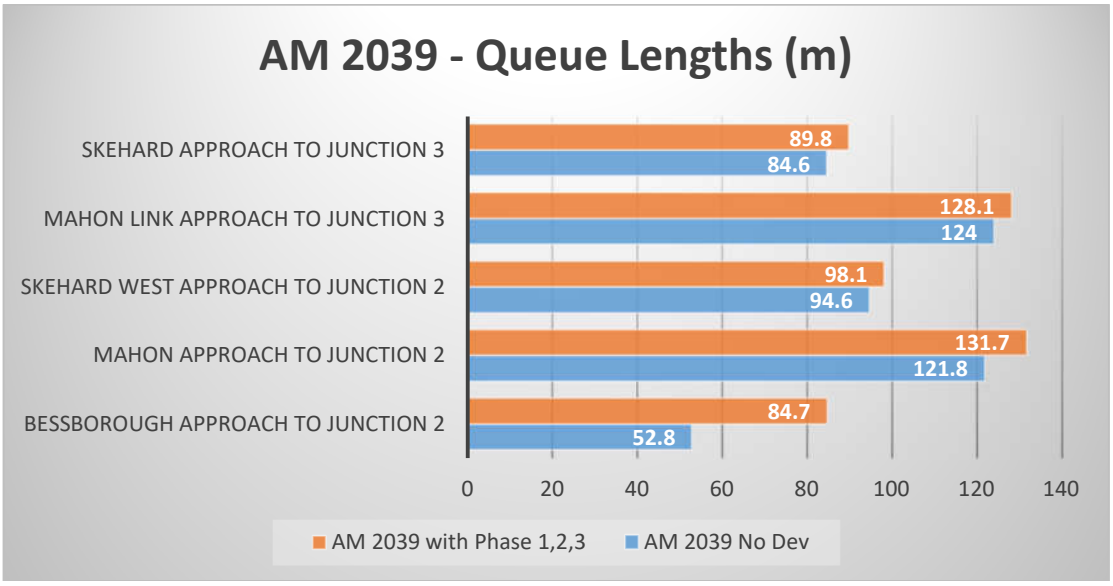


Fig 9.26 AM 2039 - Average Queue Lengths

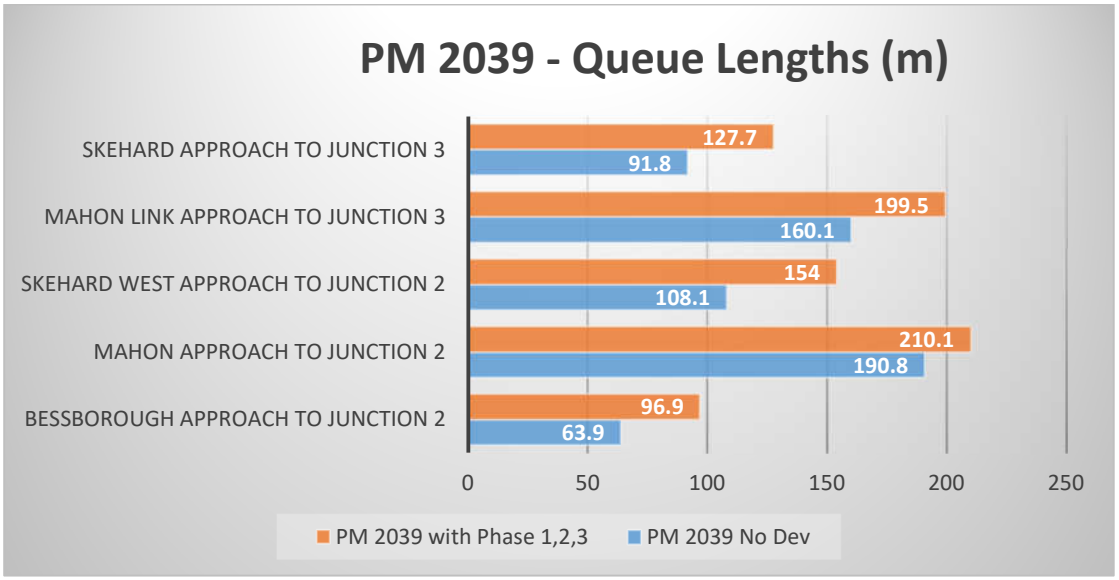


Fig 9.27 PM 2039 - Average Queue Lengths

9.3 TRAFFIC MICROSIMULATION RESULTS WITH MITIGATION

The proposed development constructed in a phased manner will add to existing traffic flows on what is already a busy network. Each of the key performance indicators shows a steady deterioration both with/without development traffic. The development is seen to have the greatest impact on the Bessborough/Skehard Road Junction, Junction 2 in the Design Year 2039 for traffic trying to access onto Skehard Road.
The Bessborough Road currently serves what is primarily an employment area implying that traffic is attracted to the area during the morning peak and leaves during the evening peak. When development traffic is added to these predominant flows the resulting queueing on Skehard Road, specifically from the west, is significant but is comparable to conditions experienced on the network prior to Covid.
The 2039 Design Year model results demonstrate the impact of the full development on the modelled network, providing a direct comparison of no development on the site with the full scheme. The 2039 results include granted schemes as well as TII annual growth rates applied to background traffic flows for both scenarios.

The latent Demand recorded in both, future year peak models, for all scenarios, indicates that the local road network is approaching capacity, particularly after 2026, Phase 1. These models do not represent possible mitigation measures that can be applied such as the following:

1. Traffic signal timings and phases should be modified to cater for a change in directional flow at each of the modelled junctions.
2. For the Design Year scenario (2039) an adjustment to the storage provided at right turn lanes would improve the capacity of the Junctions in question.
3. Continued funding in sustainable transport solutions should mitigate the growth in traffic volumes. If successful, then the future year modelled network would more resemble the 2024 model in terms of KPI's.

Future year models were constructed to determine the extent of signal timing adjustment that could be made to the modelled network and are show in the following table.

Junction Location	Signal Timing Cycle	Year
Junction1 Church Rd	110 seconds	2026
Junction 2 Bessborough	110 seconds	2026
Junction 3 Mahon Link	120 seconds	2028

Section 9.2.1 presents a comparison of KPI's with these mitigation measures put in place for all scenarios.

9.3.1 Microsimulation Model Key Performance Indicators

9.3.1.1 Journey Time Comparison

Following the introduction of the mitigation measures the journey times over almost all scenarios have dropped significantly. This is evident when comparing Figures 9.28 and 9.29 with 9.11and 9.12 respectively. Moreover figures 9.30 and 9.31 portray the dramatic effects the proposed mitigation measures can have.

Figures 9.30 and 9.31 present the with/without scenarios, both mitigated and unmitigated, for 2039 AM and PM Design Year. Unlike the other scenarios assessed, the without development in this instance is assuming no development on the Bessborough Site. Background traffic has been increased as per the TII Project Appraisal Guidelines and permitted developments have been included. The with development includes the 3-phases of the Bessborough Scheme.

From these figures it is evident that reductions in journey times can be achieved with the implementation of the proposed mitigation measures. In the AM there is a decrease of up to 40% of the journey time when comparing the fully completed development with the mitigated and unmitigated scenarios across the network. The PM scenarios also see a reduction in journey times achieving a decrease of 35% across the network. These reductions in journey times illustrate how effective the mitigation of adjusting the signal timings.

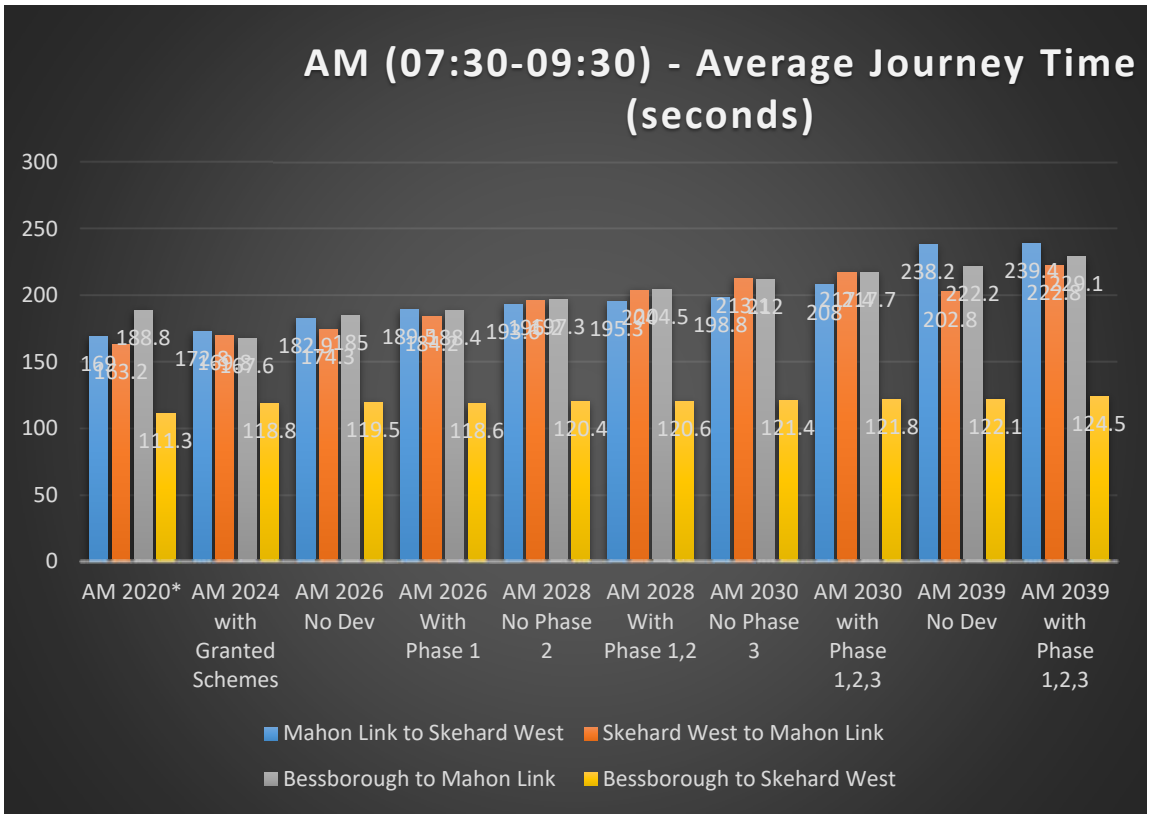


Fig 9.28: Mitigated AM (07:30-09:30) Average Journey Time Comparison (secs) (* - unmitigated)

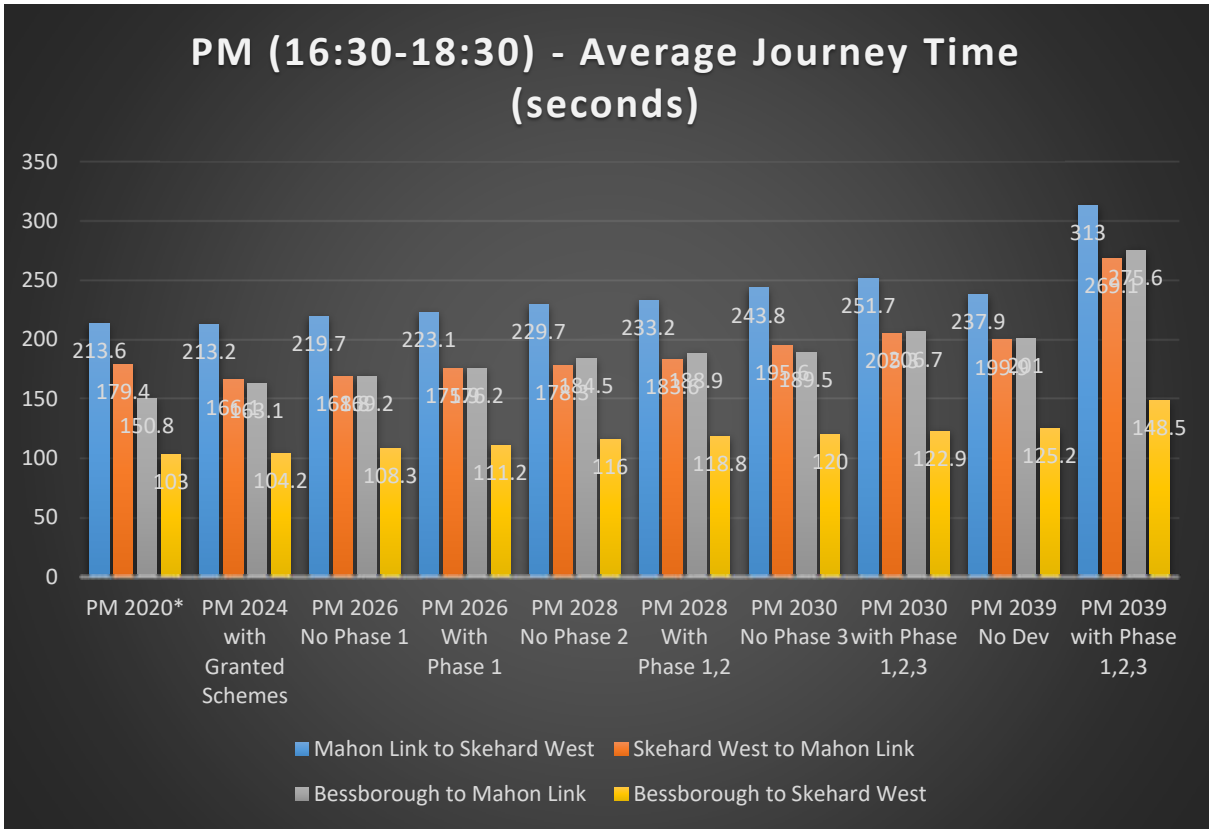


Fig 9.29: Mitigated PM (16:30-18:30) Average Journey Time Comparison (secs) (* - unmitigated)

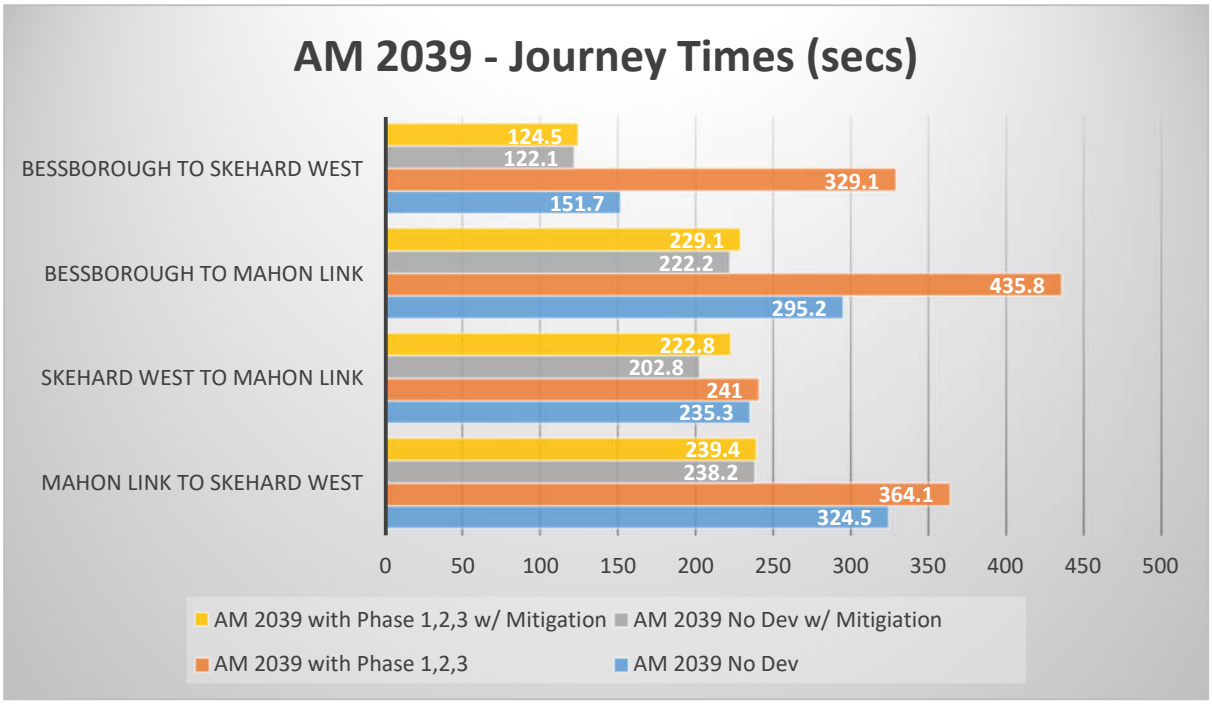


Fig 9.30: Mitigated comparison AM 2039 (07:30-09:30)

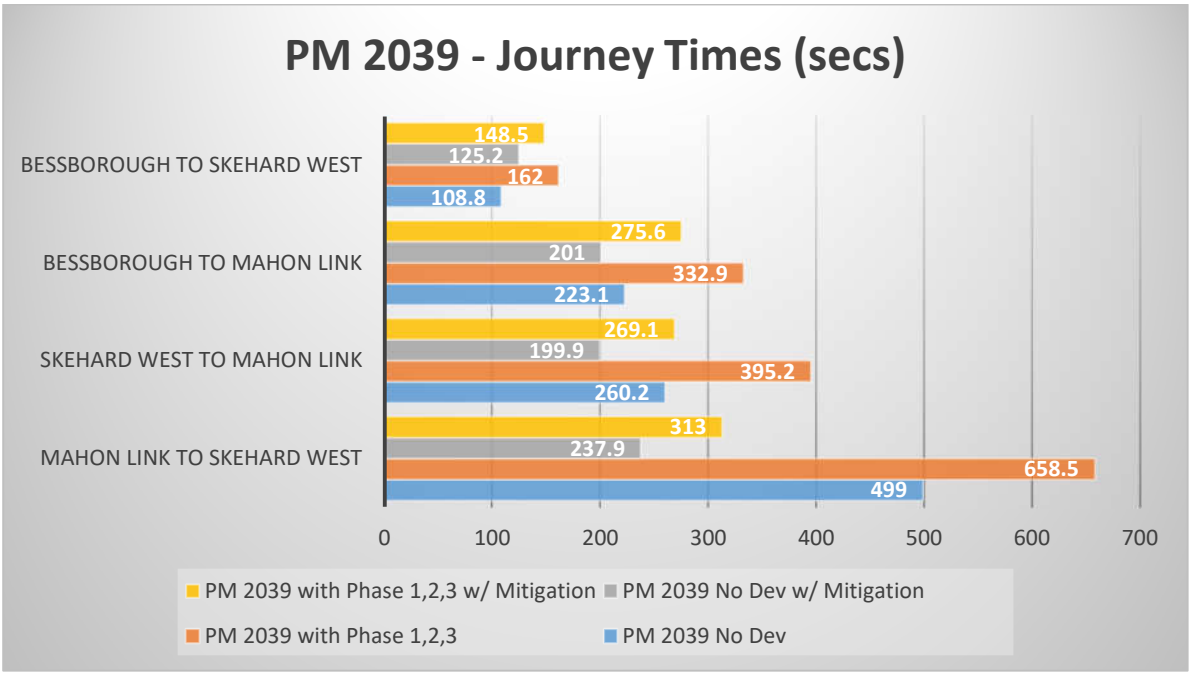


Fig 9.31: Mitigated comparison PM 2039 (16:30-18:30)

9.3.1.2 Average Network Speed

An assessment of the average network speed for the various mitigated data sets is presented in the following graphs. There is a steady decline in vehicular speed through the network going from 9.4425m/s to 8.365m/s and this is comparable with the unmitigated case as seen in Figure 9.32 the average network speed declined from 9.4425m/s to 7.4225m/s during the AM peak. The mitigated scenario shows a reduction in the extent of Network Speed reduction. Similarly for the PM period, with mitigated measures in place the speed declines from 9.1625m/s to 6.4475m/s and as shown in Figure 9.33 the unmitigated case was 9.1625m/s to 4.6275m/s during the PM peak over the modelled time-period. The increase in network speed as a result of the mitigation measures is clear.

It should be noted that in the PM there is little to no change in network speed both with and without mitigation until after 2026. Therefore, the altering of the traffic signals for this time-period will not be required until the completion of phase 1 in 2026. Following this milestone then the mitigation measures suggested in this report should be considered for implementation.

While the network speed has been increased it is still on a steady decline. This decrease in network speed relates directly to journey times which will encourage the use of sustainable transport modes. In this instance where significant public transport infrastructure (dedicated bus lanes) and off-road greenways exist adjacent to the site, an increase in journey time for the car should result in a positive shift towards these modes. Future year traffic models account for an annual increase in background traffic based on TII guidelines but do not include for a reduction due to anticipated increases in modal shift. It should also be noted when interpreting these results that the difference in future year with/without models reduces as the overall network begins to reach capacity.

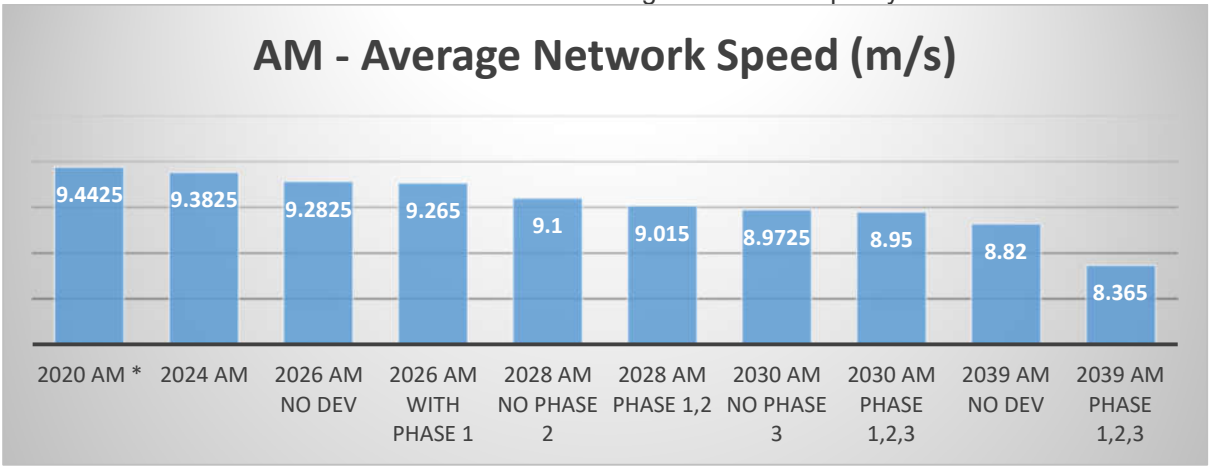


Fig 9.32: Mitigated AM – Comparison of Average Network Speed (m/s) (* - unmitigated)

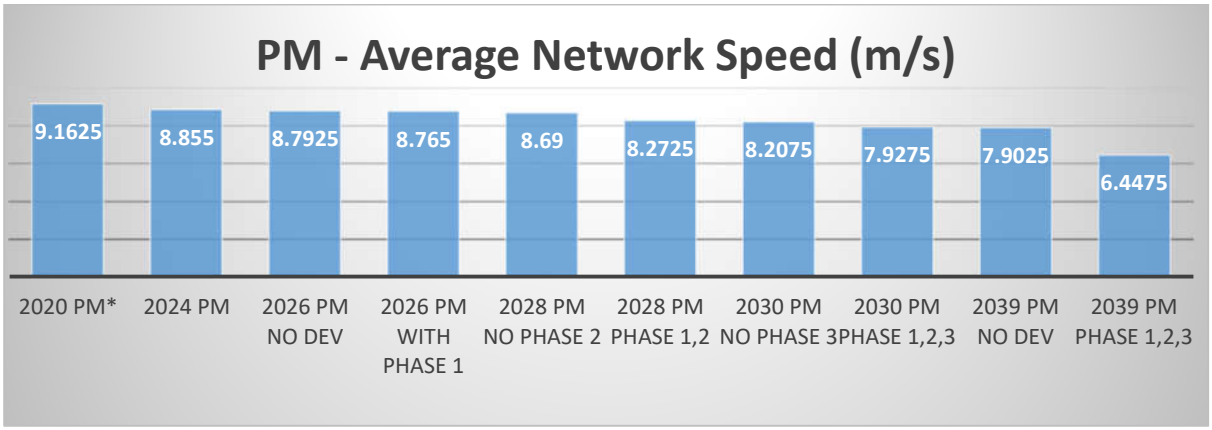


Fig 9.33: Mitigated PM – Comparison of Average Network Speed (m/s) (* - unmitigated)

9.3.1.3 Latent Demand

The Latent Demand reflects the number of vehicles left on the network after the modelled time-period has complete (vehicles that have not completed their journey). As shown in Figures 9.34 and 9.35 the latent demand in the network is greatly reduced when compared to the corresponding unmitigated values in figures 9.17 and 9.18. In the AM the latent demand for each corresponding scenario is almost halved. The latent demand in the PM has almost been significantly reduced with the proposed signal timing changes. There's a value of only 28 no. vehicles in the 2039 with Phase 1,2,3 PM scenario. This conveys that the network will be able to operate within its capacity in the PM up to and including 2039 with the full development in place.

In the AM scenario further mitigation measures should be undertaken as follows. Additional changes such as the lengthening of right turn lanes could be considered to provide additional storage on the approaches to the junctions thereby increasing junction capacity in the future. These physical changes to the network will only be required in future years if traffic growth rates continue to rise. An extension to the right-turn-lane approaching Junction 2 on Skehard Road serving Bessborough would resolve the issue of right turners blocking main through traffic observed in future year AM models (2028 onwards).

Bus-Connects proposes a significant increase in public transport provision serving this area. The Skehard Road Public Transport Route Improvement Scheme has now been completed. This scheme included the construction of bus lanes from Junction 1 through Junction 3 to Mahon Point implying that public transport users will avoid the queuing forecasted as part of the developed future year models. In addition, 'Bus-Gates' are included at each junction further prioritising public transport modes. These upgrades will encourage residents of the scheme to use sustainable transport modes and avoid the use of the private car. These measures should also result in a reduction in predicted growth rates being applied to background flows as it will be evident that travel by public transport on dedicated corridors is far more efficient than the use of the private car.

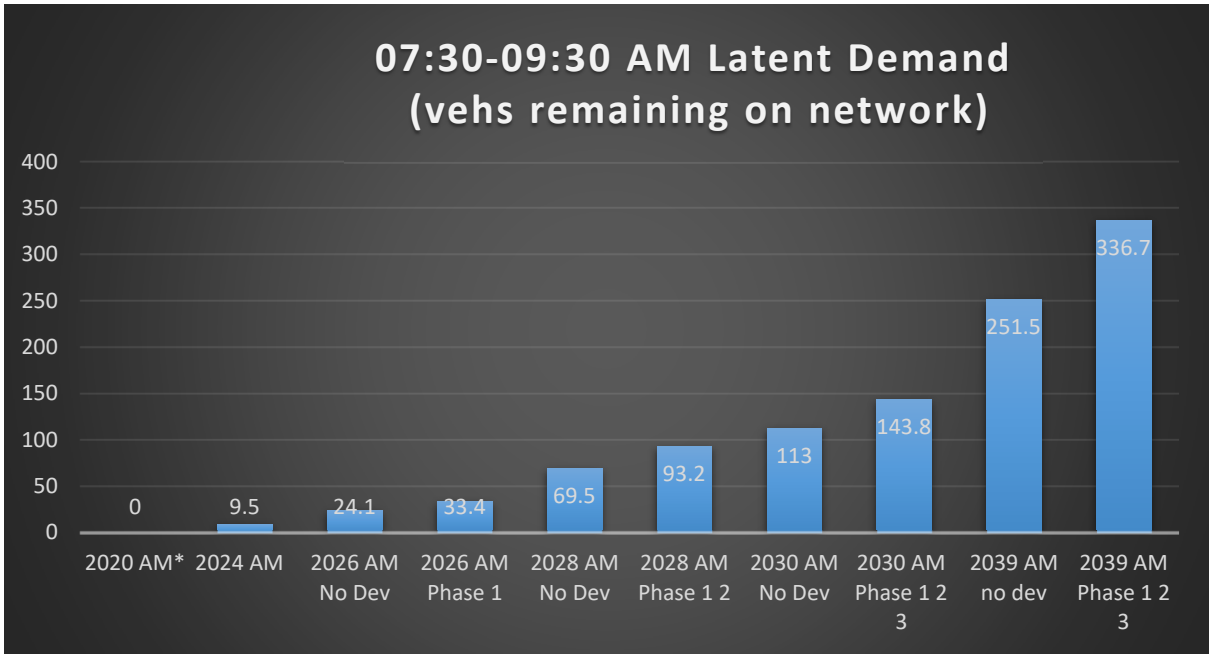


Fig 9.34: Mitigated AM Comparison of Latent Demand (* - unmitigated)

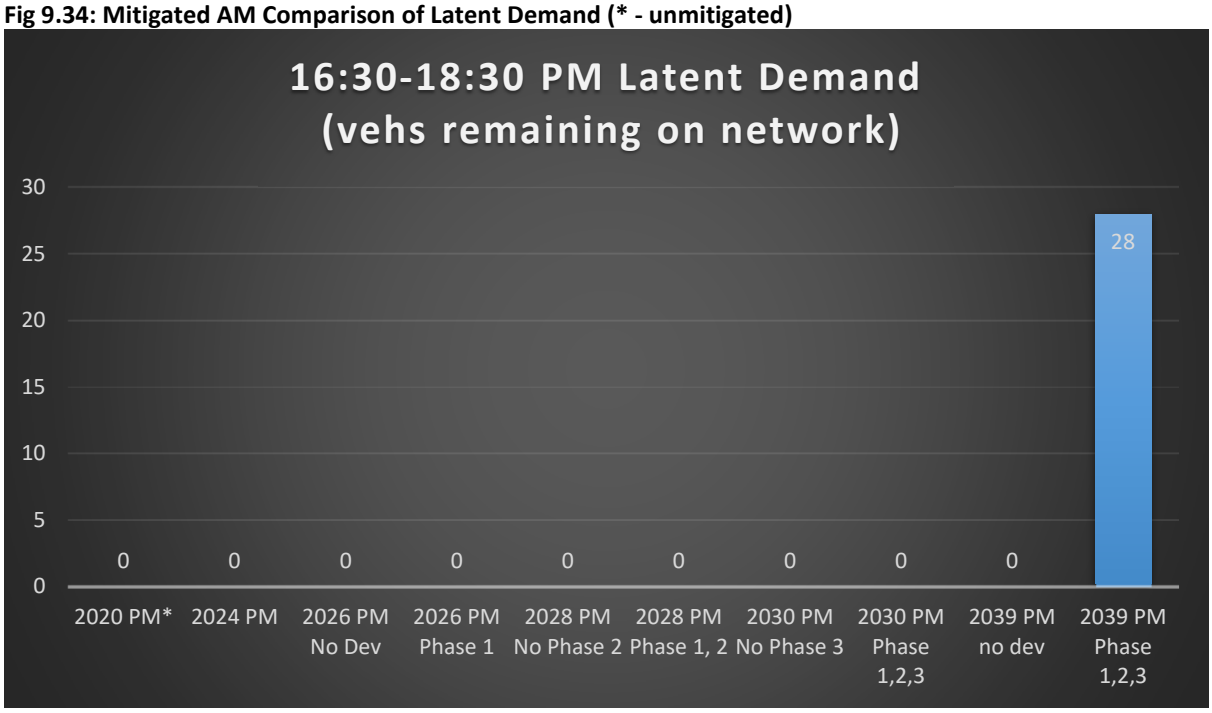


Fig 9.35: Mitigated PM – Comparison of Average Network Speed (m/s) (* - unmitigated)

9.3.1.4 Average Queue Length

As with the average journey times, the average queue lengths are also seen to decline following the introduction of the new signal times. The greatest reductions can be seen on the Mahon approach to junction 2. The following two graphs present the Design Year, 2039, impacts on queue lengths comparing with/without for both peak periods. Evident is that the impact of the mitigation measures is in the region of a 26% decrease from the unmitigated scenario. This level of reductions will greatly aid in alleviating the congestion in the area and the amount of queuing. The area will also be aided with the continued investment in public transport and other sustainable transport methods, combined with the proposed mitigation measures these queue lengths could be even further reduced. For this report it was agreed to consider the “worst case scenario” and not apply the modal shift to the existing traffic.

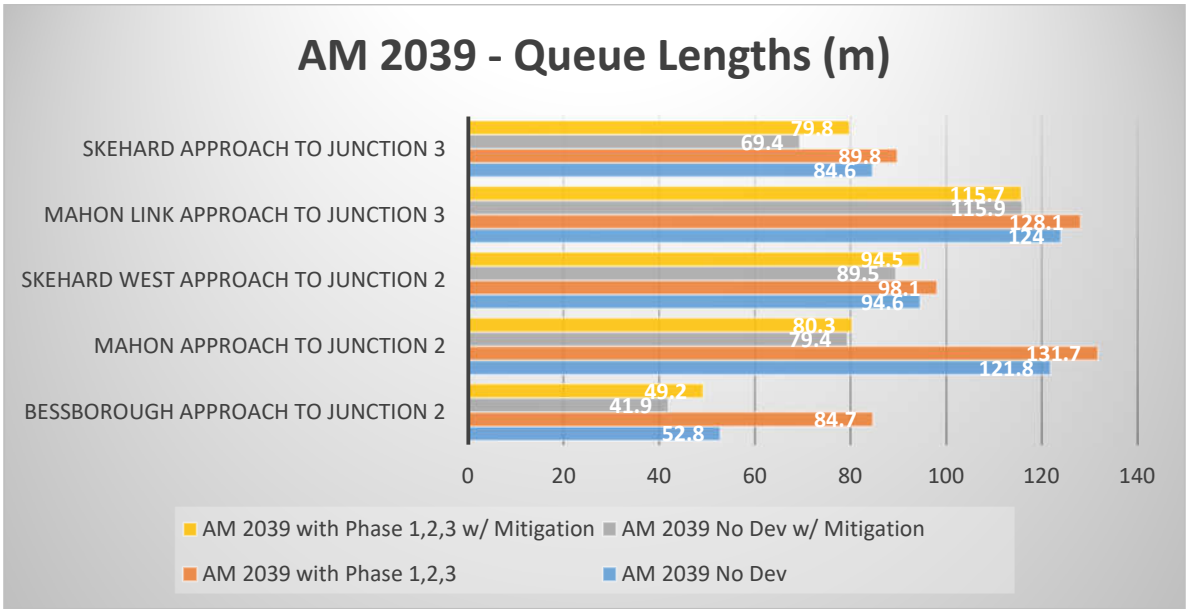


Fig 9.36: Mitigated comparison AM 2039 (07:30-09:30)

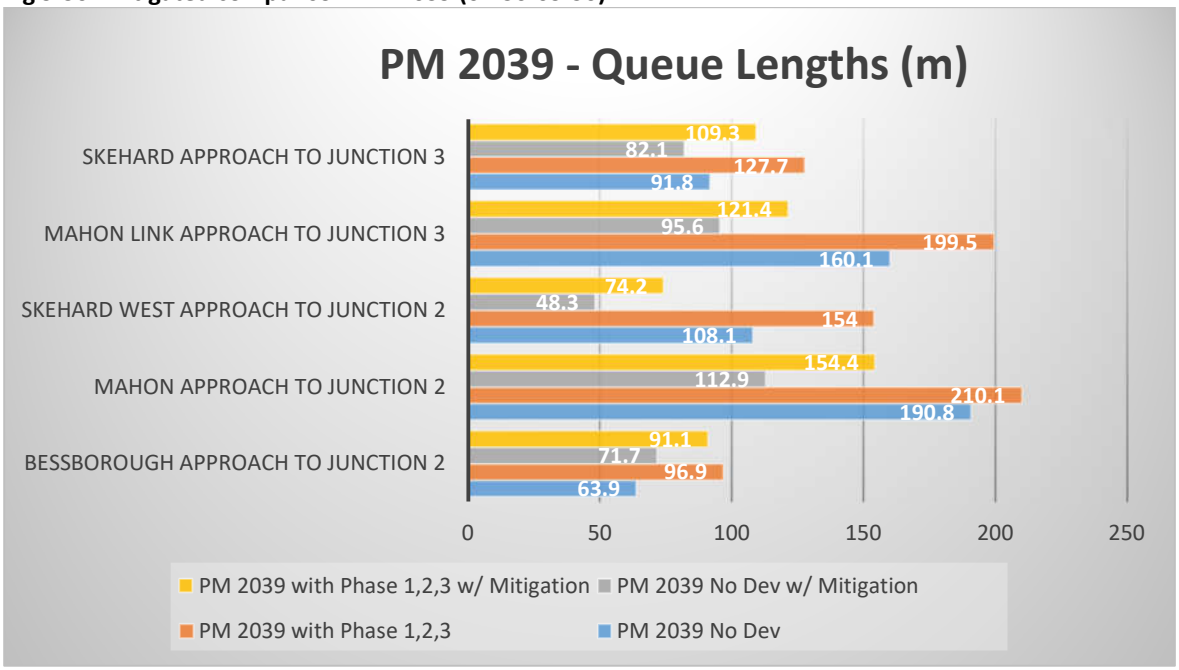


Fig 9.37: Mitigated comparison PM 2039 (16:30-18:30)

9.4 SUMMARY OF FINDINGS

The overall transportation modelling points to a number of key findings:

The proposed development in a phased manner will add to existing traffic flows on what is already a busy network. Each of the key performance indicators used shows a steady deterioration both with/without development traffic. The development is seen to have the greatest impact on the Bessborough/Skehard Road Junction, Junction 2.

The 2039 Design Year model results demonstrate the impact of the full development on the modelled network, providing a direct comparison of no development on the site with the full scheme. The 2039 results include granted schemes as well as TII annual growth rates applied to background traffic flows for both scenarios.

The latent Demand recorded in both, future year peak models, for all scenarios, indicates that the local road network is approaching capacity, particularly after 2026. As indicated these models do not represent possible mitigation measures that can be applied such as increasing signal timings or the likelihood that future year background flows will be positively impacted by an increase in modal shift. It is possible that a global shift to sustainable travel will negate the annual growth in traffic predicted by TII. If this situation was to arise then the future year models would resemble more the 2024 scenarios.

The overall model findings indicate that the road network is operating close to capacity during existing morning peak periods with the Bessborough Junction 2 operating close to capacity for recorded flows exiting onto Skehard Road east. With the completion of granted schemes and the addition of associated traffic by 2024 the right turn lane approach on Bessborough Road begins to block the left turning lane. An adjustment to the green time for the Bessborough approach will resolve this issue with an effect on through flow traffic on Skehard Road heading east. Future year models were constructed to determine the extent of signal timing adjustment that could be made to Junction 2 without having a knock-on effect to Junction 1 and Junction 3.

Following the introduction of the increased cycle times for traffic signals the impact in reduction in journey times, queues and latent demand is obvious. There's also an increase in the network speed when compared to the unmitigated case. As previously mentioned, these improvements to the network were achieved by only extending the signal timings. Further improvements could be achieved by an adjustment to the storage provided at right turn lanes would improve the capacity of the Junctions in question and continued funding in sustainable transport solutions should mitigate the growth in traffic volumes.

9.4.1 Report Summary

The traffic modelling assessment outlined in this report has employed the Bessborough Paramics model developed specifically for this project. The extents of the model and the parameters used in its construction were agreed with Cork City Council Traffic & Transport Department.

By employing this Paramics Microsimulation Model the impact of the subject application can be considered over a wide area network, and account for future planned infrastructure improvements in the area. These improvements would involve the adjustment of traffic signal timings to improve the capacity of junctions to accommodate all flows and scenarios. The future year 'adjusted' models provide a roadmap to the Local Authority on when likely changes to the signal-controlled junctions will be needed, to accommodate future year flows.

The current network operates a MOVA (Microprocessor Optimised Vehicle Actuation) control system which is designed to cater for the full range of traffic conditions, from very low off-peak flows to a junction that is overloaded. For a major part of the range MOVA operates in a delay minimising mode, capable of altering the phase timings to manage approaching flows. It also allows the redistribution of 'un-used' pedestrian phases. If the junction becomes overloaded the system switches to a capacity maximising procedure based on a maximum cycle time. The recorded maximum cycle times at the three signal-controlled junctions are as follows:

Location	Cycle Time
Junction 1	110 secs
Junction 2	90 secs
Junction 3	110 secs

The traffic modelling carried out to inform this report has been used to generate particular "Key Performance Indicators" (KPI's) which serve to provide an overview of traffic conditions for the various model scenarios, allowing the traffic impact of the respective models to be compared. The KPIs referenced in this assessment point to the following findings:

The 2020 Base Year models accurately reflect the recorded queues at each of the modelled junctions during the data gathering phase of the scheme and are fit for purpose to assess future year scenarios.

The Latent Demand results suggest that at present the modelled network operates within capacity but by 2024 it will approach capacity during peak hours. It should be noted that in 2024 the network

demand is based on granted schemes and TII Project Appraisal Guidelines growth rates on background flows. There is no development traffic being generated by the Bessborough Site. Future years after 2024 show the modelled network operating above capacity both with/without development. When compared to the mitigated scenarios while the same trend is happening in the AM the latent demand is about half of that for the unmitigated case. In the PM's case there is no latent demand until 2039 with a very low 28 vehicles when compared to the unmitigated over 300 vehicles.

Journey time comparisons on specified route paths show a steady increase both with/without development with an approximate 26% increase recorded in the Design Year 2039 between no development and with development. There is a decrease of 40% of the journey times in the AM and a decrease of 37% in the PM following the implementation of the longer cycle timings for the signals.

Comparably the modelled network speed reduces with an increase in traffic flows both with/without development. The 2020 average AM network speed is 9.4425 m/s with the 2039 speed reducing to 7.4225 m/s. The average PM network speed in 2020 is 9.1625 m/s and this decreases to 4.6275 in 2039 with the full development. Following the implementation of the mitigation measures these average speeds in 2039 increase to 8.365 in the AM and 6.4475 in the PM. These increases in network speeds enforces the claim that with the mitigation measures in place the journey times through the network can be decreased and in turn easing the traffic build-up in the area.

10.0 CUMULATIVE IMPACT

10.1.1 As outlined in **Section 7.0** of this report, industry standard growth rates have been applied to background traffic for future year assessments (to account for further development within the area). These growth rates make allowance for modal shift targets as set by national policy but do not take account of site-specific measures that may be implemented to mitigate against traffic generation from a particular development. In this instance the development of strategic transport corridors in-line with the CMATS study.

10.1.2 The Blackrock railway greenway runs along the eastern boundary of the proposed development. This scheme will provide two additional pedestrian/cycle connections to the greenway thereby greatly improving connectivity across the area.

11.0 ROAD SAFETY

11.1.1 Existing Road Network Safety

The access road to the proposed site operates at a 30kph speed limit and currently serves the Sacred Heart Convent, the Bessboro Day Care Centre, the Alzheimer Society of Ireland, the Bessborough Centre Creche, and a number of residential units. The existing footpath running along the length of the access road provides good connectivity to the wider pedestrian footpath network for new residents of the proposed scheme.

Several raised speed bumps present along the access road are currently being utilised as a means of traffic calming on the access road.

11.1.2 Road Collision Database

A review of the RSA Road Collision Statistics was undertaken for the area in the vicinity of the applicants' site.

One minor collision occurred in 2016 at a location on Bessboro Rd. approximately 110m west of the mini roundabout. The collision involved a car and a pedestrian resulting in one minor casualty.

A number of minor collisions occurred in the wider area over the available 11-year period as shown in **Figure 11.1**.

11.1.3 Proposed Road Safety Mitigation Measures

The proposed development will include a number of measures that are deemed necessary to improve road safety in the area. The development of a raised shared surface will reinforce the low-speed regime within the development.

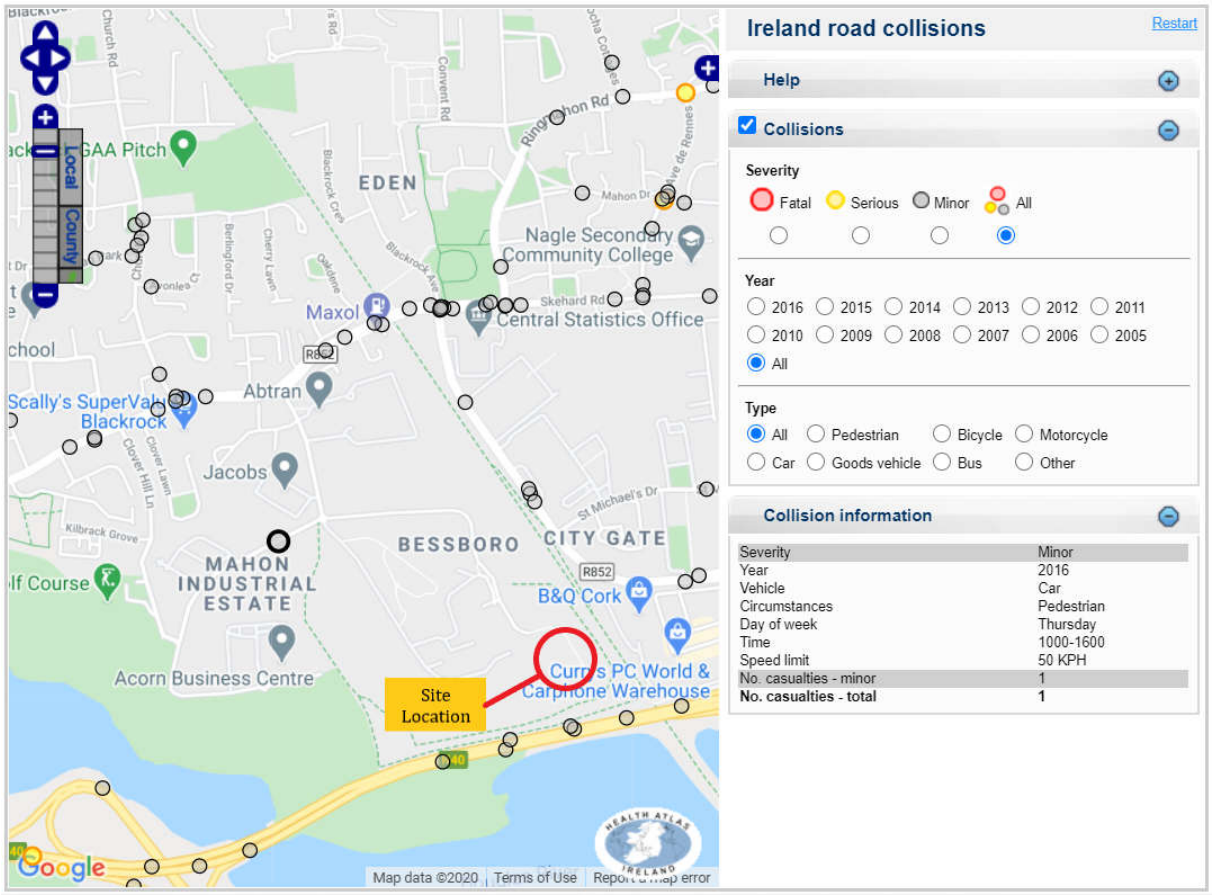


Fig 11.1: Collision statistics for Roads in the vicinity of the site

12.0 ENVIRONMENTAL IMPACT

12.1 The proposed development has been designed in accordance with the principles of DMURS (Design Manual for Urban Roads and Streets) with all internal roads having a gradient of not greater than 5% and good pedestrian connectivity throughout.

12.2 The close proximity to current public transport facilities, via connection to existing footpath network and via two proposed links to the Blackrock railway greenway, in conjunction with the continued development of the Strategic Transport Corridors, should result in the scheme approaching if not exceeding the target modal split as set out by Government (45%).

12.3 The construction stage of the scheme proposes to re-use / relocate the bulk of the excavation within the site implying that there will be a significant reduction in construction traffic generated to and from the site over and above a site where importation or exportation of earthworks is required. This will minimise the impact the development will have on the existing roads network during this period.

13.0 INTERNAL LAYOUT & PARKING PROVISION

13.1 **Figure 4.1.1** presents the proposed layout which includes the provision of on-street and sub level parking, shared cycle/footpaths, pedestrian/cycle permeability throughout the site on designated off-road routes, and a raised shared surface serving as a speed control measure.

13.2 Parking is provided in accordance with the LAP and is suitably located on site in shared on-street parking and in sub levels for apartment residents. Included in the sub level parking is the provision of two parking spaces reserved for mobility impaired users. With respect to cycle parking, dedicated cycle parking provision spaces are provided as part of the proposed development.

14.0 PUBLIC TRANSPORT

14.1 A number of public bus routes serve the site including the 202, 215, 215A, and 219 all of which avail of the recently upgraded facilities along Skehard Rd. These routes provide a high level of service and frequency to the site.

The 202 runs from Hollyhill to Mahon Point via the City Centre, the 215 links Cloghroe and Blarney to Mahon Point via the City Centre, the 215A runs from the City Centre to Mahon Point via Boreenmanna Rd., and the 219 links Mahon to UCC (via Pearse Rd.) and CIT.

14.2 The Cork Metropolitan Area Transport Strategy 2040 (CMATS) proposes significant improvements to the public transport facilities over and above what is currently available to the new proposed scheme. In addition to the introduction of a further 100km of bus lanes to the metropolitan area, CMATS proposes the introduction of a 17km Light Rail Network which is to include stations at Mahon Point and Blackrock. With the provision of these facilities and other incentives as part of national policy, it is anticipated that a shift to public transport will occur over the construction phase of this scheme. CMATS has provided more certainty for the delivery of these enhancements. The LAP states that is an objective of the plan to *Support the achievement of **high levels of modal shift** by collaborating with other agencies to improve public transport services and influence patterns of employment development to support use of sustainable modes and travel by public transport".*

14.3 The following isochrone map shows the areas currently accessible by public transport based on time of travel from the site.
Note: The distances include transfers to different services so are indicative only (delay may be experienced during transfer)

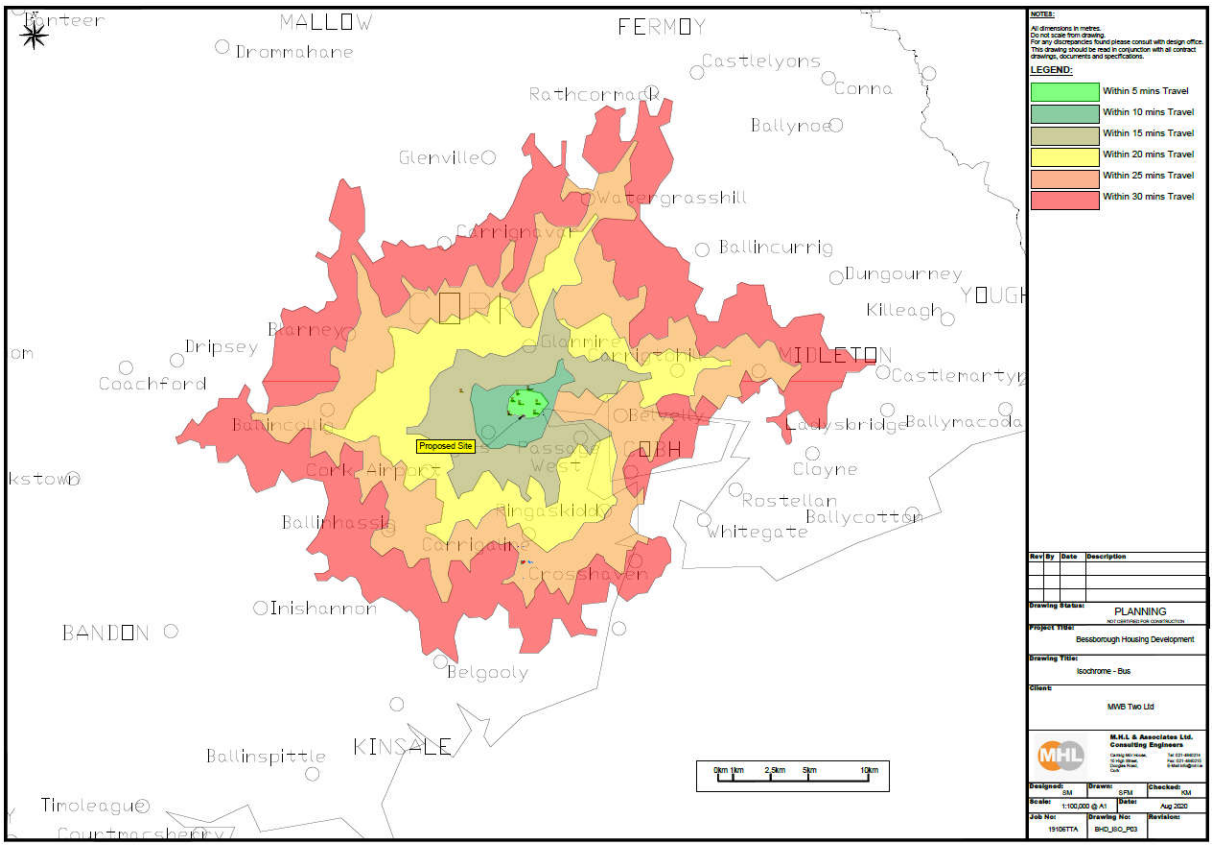


Fig 14.2: Time of travel by Public Transport Options

14.6 Evident from the above map is that current bus provision in the area allows travel to a wide area within 30 mins, with many of the main employment centres being within the 20 mins range. This is significantly shorter than CSO figures for other areas such as Dublin City 28.9 mins, South Dublin 30.6 mins, Waterford City & County 22.4 mins, Limerick City & County 24.2 mins.

A commute time by public transport in excess of 45 mins results in a change in behavioural preference away from public transport. It can be concluded that the proposed development site by its location will encourage the use of public transport in-line with national policy.

14.7 The aforementioned travel times are set to significantly improve as a result of CMATS which will include bus priority at junctions, additional on-road facilities such as covered shelters, real-time arrival departure boards and an increase in frequency of service. These measures, scheduled for delivery in 2023, will require the density of population in the area served, to justify this expenditure by the NTA.

15.0 ACCESSIBILITY AND INTEGRATION

15.1 A desktop assessment of permeability for cyclists and pedestrians from the site was carried out. Presented in the following isochrone maps are the range of distances, for both pedestrians and cyclists, based on travel time.

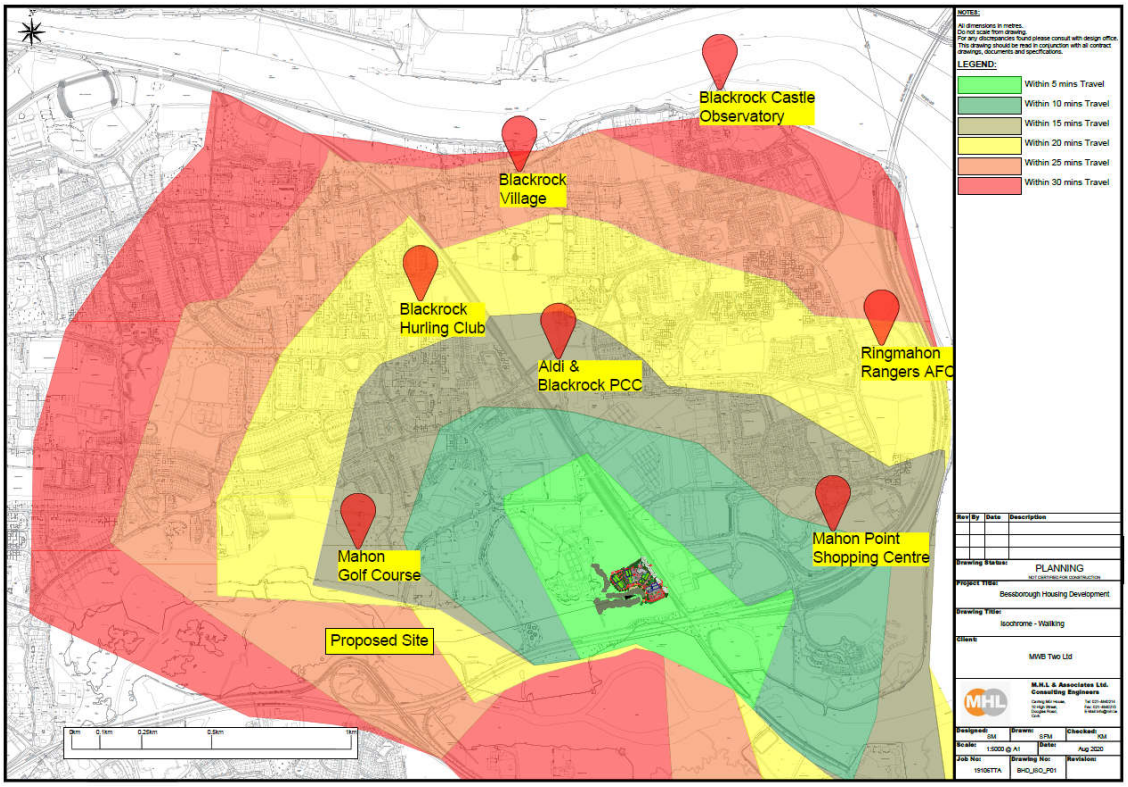


Fig 15.1: Proposed Development: Walking distance to local area

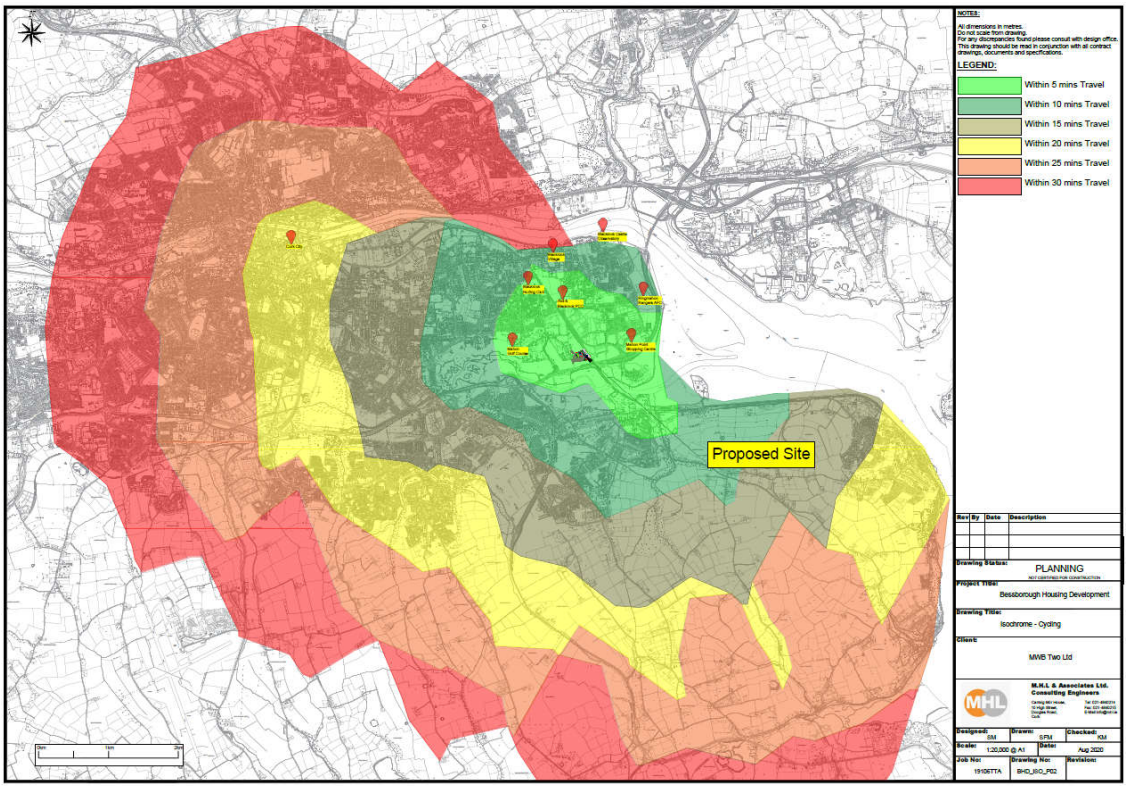


Fig 15.2: Proposed Development: Cycle distance to local area

15.2 Within 10 mins walk time from the site:

- Blackrock Business Park
- Mahon Industrial Estate
- Mahon Point Shopping Centre
- Mahon Retail Park
- Mater Private Hospital

- City Gate
- Bus Stop Clontarf Estate (Service 202, 215, 215A, and 219)
- Bus Stop City Gate (Service 215, 215A, and 219)

Within 15 mins walk time from the site:

- Mahon Golf Course
- Aldi
- Blackrock Hall Primary Care Centre
- Mahon Post Office
- Scally's Supervalu
- Bus Stop Clover Lawn (Service 215, 215A, and 219)
- Bus Stop Skehard Lawn (Service 215, 215A, and 219)

Within 20 mins walk time from the site:

- Blackrock National Hurling Club
- Dundanion Medical Centre
- Nagle Secondary Community College
- Scoil na Croise Naofa Primary School
- Ringmahon Rangers AFC
- Bus Stop Barnstead Drive (Service 202)
- Bus Stop Nagle Community College (Service 202)
- Bus Stop Ringmahon Rd. (Service 202 & 219)

Within 30 mins walk time from the site:

- Blackrock Village
- Blackrock Pier
- St. Michaels Catholic Church Blackrock
- The Marina Park
- Pairc Ui Rinn GAA
- Cork Constitution FC
- Ballinlough Pitch & Putt Club
- Beaumont Girls School
- Bus Stop Ardmahon Estate (Service 219)

15.3 The cycle range is presented in similar terms and relates to the average distance travelled in a specific time (16-19 kmh). Cork City Centre falls within the 20 min category based on unrestricted flow through junctions. The 30 mins range includes all of the city including the surrounding suburbs.

Note: The travel speed used is on the low side, an experienced cyclist would have a 26-30kph average speed, however the speed used is more reflective of the topography in and around Cork City. It should also be noted that as a result of the aforementioned topography the inbound from the site to, say the City Centre, would be considerably quicker than the outbound trip, so on average it is considered that the speed used is appropriate.

16.0 ACCESS FOR PEOPLE WITH DISABILITIES

16.1 The internal layout of the development is designed to accommodate all road users and will adhere to national guidelines regarding people with disabilities.

17.0 MOBILITY MANAGEMENT PLAN (SUSTAINABLE ACCESS STRATEGY)

17.1 As outlined previously, significant effort has been put in to delivering connectivity from the site to local services and public transport options. A 'Mobility Management Plan/Travel Plan' is a strategy for managing multi-modal access to a site or development, focusing on promoting

access by sustainable modes. The objective of national and local policy is to reduce reliance on the car for travel. Inducements and encouragement should be applied in order to influence change and this can be achieved through the delivery of 'Mobility Management Plans'.

17.2 A mobility management plan relating to a residential development would form part of the sales/promotion package presented to would-be purchasers and would highlight the proximity of local services, public transport provision, schools and walking/cycle distances to same. The proposed 'hard measures' that will facilitate safer pedestrian, cycle and public bus access will be provided as part of the application and will be further complimented by scheduled Local Authority Works (CMATS, BusConnects).

17.3 An overview of the sustainable infrastructure proposed is as follows:

- Two new combined pedestrian/cycling links to the Blackrock railway greenway.
- Connection to existing pedestrian footpath network provided linkages to public transport offerings, schools, retail, and amenity destinations.
- Car parking provision within the site is at the lower end of the scale in order to encourage the use of sustainable transport modes.
- Provision of indoor bicycle parking facilities allowing ease of access and protection against the weather.

18.0 REFERENCES

- National Roads Authority (May 2014) Traffic and Transport Assessment Guidelines NRA, Dublin
- Institution of Highways & Transportation (1994) Guidelines for Traffic Impact Assessment IHT, London
- National Roads Authority (2000) Road Geometry Handbook NRA, Dublin
- National Roads Authority (revised 2003) Design Manual For Roads and Bridges NRA, Dublin
- National Roads Authority (November 2004) Draft Traffic and Transport Assessment Guidelines NRA, Dublin
- RSA Ireland Road Collisions

  http://www.rsa.ie/RSA/Road-Safety/Our-Research/Ireland-Road-Collisions/