Maudlins Traffic Modelling and Access Strategy

Kildare County Council

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Prepared for:

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1 Introduction

1.1 Overview

Kildare County Council (KCC) commissioned AECOM to provide transport planning services to develop the Maudlins Traffic Modelling & Access Strategy (TMAS), which is a requirement of the adopted Naas Local Area Plan 2021-2027. This report is the last step summarising the work undertaken as part of the development of the Strategy.

1.2 Background

The Naas Local Area Plan (LAP) 2021 – 2027 was adopted by the Elected Members in October 2021. Under the LAP the area referred to as 'Junction 9 (Maudlins Interchange)' was identified as a Key Development Area (KDA). The KDA includes the former Donnelly Mirrors and Cemex Concrete sites. The Naas LAP sets out two specific objectives in relation to this KDA:

- **Economic Development Objective (EDO 1.4)** – "*Facilitate the regeneration and redevelopment of the lands to the east of the Dublin Road roundabout, in particular the Key Development Area at Junction 9 (Maudlins) (the former Donnelly Mirrors and Cemex Concrete sites), through a joint approach for the overall landholding through the preparation of a comprehensive masterplan comprising of an overall high-quality design in recognition of its location as a key gateway site. Adherence to the Design Framework set out in Chapter 10 is required in the preparation of any masterplan for these lands which will be informed by the Traffic Modelling and Access Strategy (Objective URD 1.13, refers)*".

- ***Urban Regeneration and Development (URD 1.13)*** *- Prepare a* ***Traffic Modelling and Access Strategy (TMAS)*** *for lands zoned mixed-use at the Junction 9 (Maudlins) Key Development Area within 12 months of the adoption of the local area plan, in consultation with relevant stakeholders including Transport Infrastructure Ireland (TII), the National Transport Authority (NTA) and the owners of the KDA lands.*

  (i) This Strategy will identify the use, quantum and intensity of development that can be facilitated at the location complementary to safeguarding the strategic function and safety of the national road network, in accordance with the provisions of official policy outlined in the Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012).

  (ii) The Strategy will also identify any improvements required to the local transport network to facilitate development at this KDA.

  (iii) The masterplan required under URD 1.14 shall not be finalised until such time as the Council has completed and agreed the traffic modelling with the stakeholders identified above.

The methodology to develop the Maudlins Traffic Modelling and Access Strategy (TMAS) is shown below, with the deliverables as agreed:

Methodology		Deliverable
Step 1	Data Collection	Technical Note 1 – Traffic Survey Analysis
Step 2	Baselining (2022)	Technical Note 2 – Base Year Model Development
Step 3	Future Year Do-Minimum	Technical Note 3 – Future Year Model Development
Step 4	Stakeholder engagement Phase 1 (NTA, TII)	
Step 5	Scenario Testing	Technical Note 4 – Future Year DS Modelling[1]
Step 6	Stakeholder engagement Phase 2 (KCC discussions with Developers)	
Step 7	Reporting	Summary Report (this report)

This report presents a summary of previous technical notes prepared as part of the TMAS at steps 1, 2, 3 and 5.

1.3 Approach

To fulfil the requirements of the Naas Local Area Plan (LAP) 2021-2027 under URD 1.13 Kildare County Council appointed AECOM to prepare Traffic Modelling and Access Strategy (TMAS) for the Key Development Area.

AECOM developed a micro-simulation VISSIM model of the N7/M7 Junction 9 (Maudlins) and the local road network, referred to in this report as the TMAS Model. The TMAS Model was developed to assess and quantify the overall level of vehicular traffic that the existing Junction 9 (Maudlins) and local road network could effectively support during both peak and off-peak traffic periods. This Strategy focuses mainly on identifying the quantum and intensity of development that can be facilitated at the KDA site without compromising the strategic function and safety of the National Road network. The modelling undertaken identifies and guides the recommendation of the types of land-uses and quantum of development that may potentially be accommodated within the KDA.

Four technical notes that were developed previous to this report are summarised below:

- A Traffic Survey Analysis Report which discussed the traffic surveys undertaken, the subsequent analysis and the key findings. This data was used to develop the micro-simulation model.
- A Model Development Report which outlined the methodology adopted to produce the Baseline TMAS micro-simulation model; including a comparison between the modelled and observed traffic along with the objectives for the development of the model.
- Two Future Year Model Development reports which presented the methodology used in developing the future year Do Minimum (DM) and Do Something (DS) TMAS micro-simulation models. These notes provided the detail of the process applied to progress from the Baseline 2022 model version to the future year 2027 Do Minimum and Do Something models.

1.4 Purpose of this Report

The purpose of this report is to provide a summary of the analysis related to future traffic demand levels at the KDA site and present the proposed access strategy.

[1] Technical Note 4 was updated in Nov 2023 to include a review of and commentary on a modelling report undertaken by Systra on behalf of the developers of the Maudlins KDA site. This modelling report assessed the impact of alternative access arrangements and modifications to the existing road network to cater for an additional quantum of development with the Maudlins KDA site.

1.5 Report Structure

After this introduction, the report contains five sections as follows:

1. Summary of existing road network conditions
2. Development of base year model
3. Development of future year model
4. KDA site testing
5. Summary and Conclusions

2 Baseline Conditions

2.1 Introduction

The M/N7 traverses the north and west of Naas and has three junctions to access Naas – Junction 9 (Naas North), 9a (Naas Central) and 10 (Naas South) (anticlockwise from the north). The KDA site is located adjacent to Junction 9 on the N7, to the northeast of Naas town centre. The site is currently accessed from the Dublin Road roundabout (known also as Maudlins Roundabout) which connects the Dublin Road, Monread Road, Junction 9 NB offramp and the Johnstown Road, which includes the N7 WB offramp traffic.

The N7/M7 serves the corridor between Dublin and entire South West of Ireland. The M7 itself connects Dublin with Limerick via Naas, Newbridge, Kildare, Portlaoise and Nenagh. South of Naas the M7 splits into both the M9, which carries traffic to Waterford and the M8, which connects the M7 with Cork.

The Dublin Road (R445) links Junction 9 (Naas North) to Junction 12 (Newbridge) on the M7 and also crosses and connects to the M7 at Junction 10 (Naas South). The Dublin Road is a divided road (central bollards) for approximately 1km from its connection at Junction 9 heading SB.

The Monread Road provides connection to the National Road network for the commercial area located along its length and also access for residents and workers to the businesses.

The Johnstown Road serves to connect residents of Johnstown to Naas in the west and Kill in the east. It also carries traffic from Junction 8 and 9 WB of the N7 onto the Dublin Road Roundabout.

In order to understand the existing conditions on the local road network a variety of traffic surveys were carried out. The full process documenting the data collection and analysis undertaken to assess the road network conditions is detailed in *Technical Note 1 – Traffic Survey Analysis* and is attached to this report in Appendix A.

The traffic surveys conducted included Automatic Traffic Counts (ATC), Junction Turning Counts (JTC), Journey Time analysis and Queue length surveys.

The KDA site is a brownfield site consisting of the former Donnelly Mirrors and Cemex Concrete sites, currently vacant. The land is zoned T (Mixed Uses) – To provide for general commercial / industrial / enterprise use. Figure 2.1 shows the location of the KDA site

Figure 2.1 - Location of the KDA

2.2 Traffic Surveys

Traffic Surveys were undertaken in March/April 2022. At this time all travel restrictions due to Covid-19 travel restrictions had been lifted and TII traffic monitoring units in the area show traffic had returned to the levels seen in 2019, before the pandemic.

The development was assessed during the PM and Inter Peaks due to concerns that the operation of the National Road Network at these times could be negatively impacted by congestion on the local road network caused by the development of the sites.

Automatic Traffic Counts

The ATC determined the PM peak as between the hours of 16:00 and 17:00. The PM peak was identified as the critical peak for all sites. The Interpeak (IP) was found to be between 10:00 and 16:00. These surveys were carried out at the sites shown in Figure 2.2, for 24hrs continuously for a period of 2 weeks between Thursday 31st March – Thursday 14th April 2022, midweek days were picked for analysis to be representative of typical conditions.

Figure 2.2 - Location of ATC surveys

Junction Turning Counts

JTC surveys were carried out at three junctions, shown in Figure 2.3, on Thursday 31st March 2022 between 07:00 and 19:00. The JTC survey did not highlight any particular issues.

JTC data for Junction 02 (Maudlins Roundabout) was compared against September 2018 data, overall there has been about a 7% reduction in car and light vehicle traffic at the junction in the recent counts and 21% reduction in heavy vehicle traffic through this junction during evening peak hour. The reduction can be seen mainly in the traffic entering the roundabout from R445 through the N7 westbound off slip. This can be largely attributed to the new Junction 9a on the M7 providing an alternative route for these vehicles.

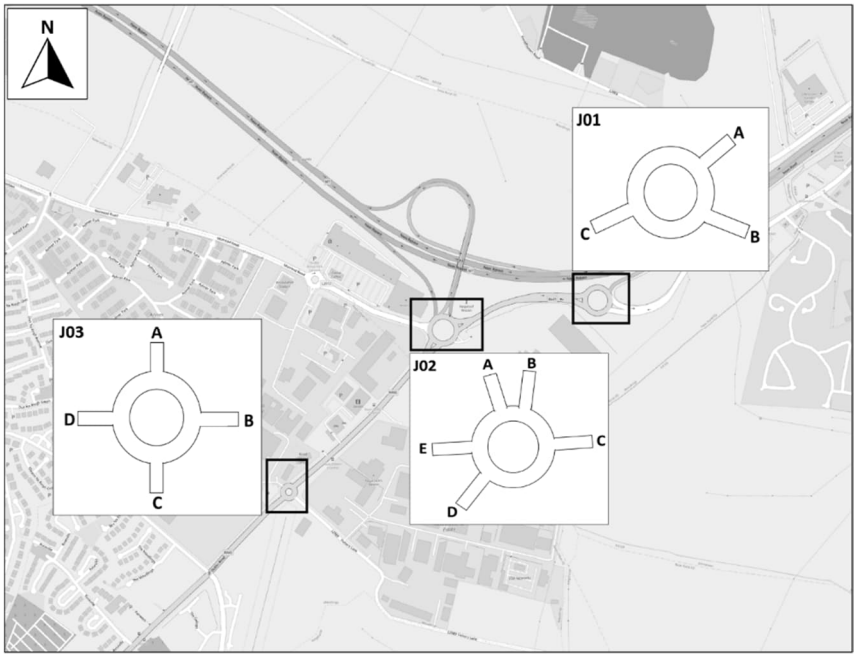

Figure 2.3 - Location of JTC counts

Journey Time Analysis

Google journey time data was collected on the 25th May 2022 and used to conduct the analysis and the routes included are shown in Figure 2.4. The journey time analysis demonstrated little variation between

the Interpeak and PM peak journey times, suggesting low delay variation on the road network throughout the day and limited congestion present on the local road network. Table 2.1 shows and example of the Google journey times for site 1 to site 9 between 10am and 7pm.

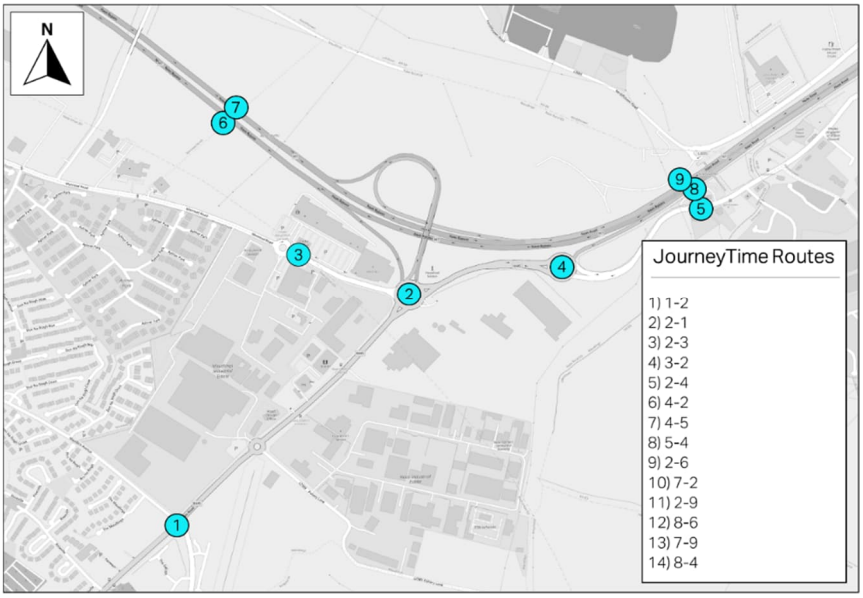

Figure 2.4 - Journey Time Routes

Table 2.1 - Journey Time Example Between Sites 1 and 9

	Site			Site	
30min Time Period	1 to 9	9 to 1	30min Time Period	1 to 9	9 to 1
10:00	02:28	01:53	15:00	02:31	01:57
10:30	02:26	01:53	15:30	02:35	01:57
11:00	02:28	01:53	16:00	02:35	01:58
11:30	02:32	01:55	16:30	02:36	02:00
12:00	02:31	01:55	17:00	02:30	01:57
12:30	02:28	01:55	17:30	02:24	01:55
13:00	02:31	01:56	18:00	02:25	01:52
13:30	02:31	01:55	18:30	02:27	01:53
14:00	02:31	01:56	19:00	02:29	01:59
14:30	02:29	01:59			

Queue Length Survey

Queue length surveys were undertaken at each JTC site shown in Figure 2.3 and measured total vehicles and vehicle type on each entry arm. The queue length surveys showed little difference between average and maximum queue lengths, which when combined with the journey time results, suggests low delays and only operational queues on the road network. They also demonstrated that the maximum queue recorded did not block any surrounding junction and was not continually present throughout the day. Data was provided for average and maximum queue length.

2.3 Summary of Traffic Conditions

Overall, the traffic surveys did not identify any local traffic issues and identified the PM peak as the busiest time on the network and the critical period for all survey sites. Journey times indicated minimal

delay and congestion on the network and queue lengths were shown to not interfere with junction operation.

The busiest and most complex junction in the area is the Dublin Road Roundabout, which is directly adjacent to the KDA site. The Dublin Road Roundabout is a large 5 arm roundabout, which is catering for all traffic accessing/egressing the N7/M7 on and off ramps feeding traffic via the Junction 9 interchange to and from Naas and also catering for local traffic.

3 Tool Development

Base Year Model Development

The full process undertaken to develop the Base year TMAS model is detailed in *Technical Note 2 – Base Year Model Development* and is included in Appendix B of this report. This section gives an overview of the process and provides some detail on the important points of the model development process.

3.1 Use of Existing Data

Existing information/models were consulted before the Maudlins TMAS models were developed. The Naas Development Plan Local Area Model (LAM) was cordoned to provide the base 2018 demand for the TMAS model.

3.2 Network Development

The 2022 road network and signal timings were coded in VISSIM based on timing data for the Dublin Road / The Gallops junction provided by the traffic control section in Kildare County Council. All the traffic survey data analysis detailed in Technical Note 1 was used in the development of the base year (2022) Maudlins TMAS Model to reflect the local traffic conditions. In addition to the traffic survey data information such as bus timetables and frequencies, bus stop locations, speed limits, number of lanes and lane markings and pedestrian crossing locations was used in the network development process.

Junction models were also developed for each of the below junctions to help determine the baseline junction capacity. These models indicated that the existing roundabouts are operating within capacity in the IP and PM peak periods.

- Junction 1 – R445 Dublin Road Roundabout
- Junction 2 – M7 Junction 9 Off-slip at R445 Roundabout
- Junction 3 – R445 Fishery Lane Roundabout

Figure 3.1 shows the extent of the model, which includes the following junctions and road sections:

- M7 section around Junction 9
- M7 J9 Off-slip at R445 Roundabout and Johnstown Road
- R445 Dublin Road Roundabout connecting to Monread Road and the M7 Southbound on-slip
- R445 at Fishery Lane Roundabout
- Signalised Junction at Dublin Road / The Gallops / Maudlins Avenue

The model contains 13 zones -12 are active in the base model and the 13th is located at the proposed development site and will be used for development testing.

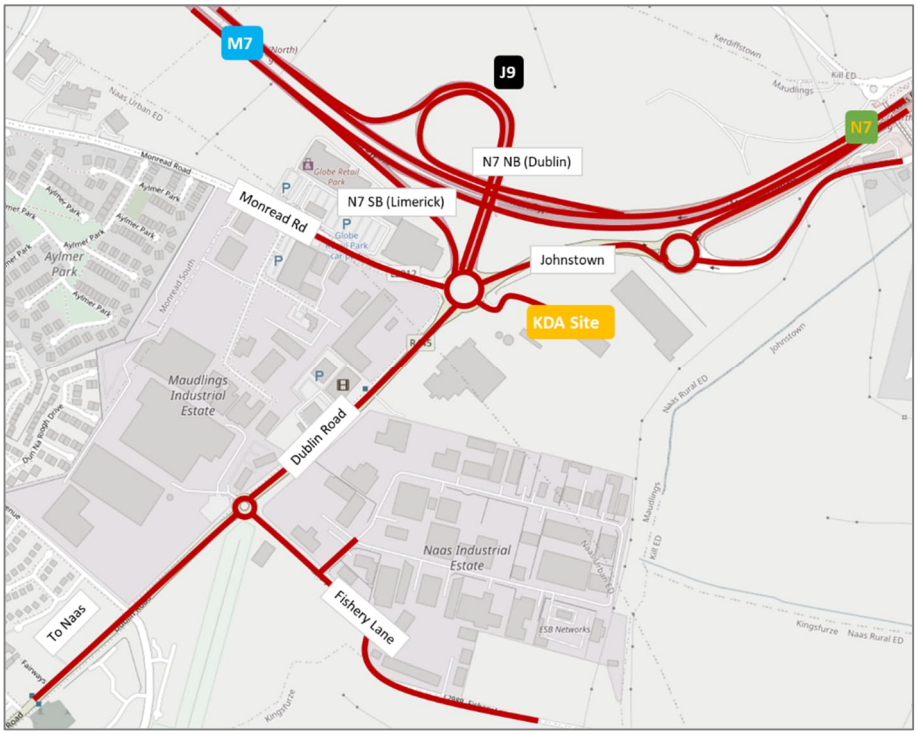

Figure 3.1 - Overview of the Modelled Area

The model was developed for the PM peak of 16:00 to 17:00 and IP of 10:00 to 16:00 and was built using a dynamic assignment process. Two vehicle types were used within this model, Cars/LGVs combined and HGVs. The proportional split between the two was determined from the traffic survey data.

3.3 Demand Development

The 2018 demand was updated to 2022 demand using the JTC data from April 2022. Demand data from the cordoned Naas Development Plan LAM model was used where no 2022 JTC data was available to assign the proportional splits. ATC data was given a higher level of confidence than JTC data given it is based on a number of days, therefore all JTC data was factored to the corresponding ATC totals for directly comparable sites.

The PM hour was calculated in 4 separate 15-min segments to provide a higher level of detail. As the IP hour is an average, an hourly total was calculated.

3.4 Model Calibration and Validation

For link flow and turning movement calibration, the measures used are:

- The absolute and percentage differences between modelled flows and counts
- The GEH statistic[2], which is a form of the Chi-squared statistic that incorporates both relative and absolute differences, and is defined as follows

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

**where M is the modelled flow and C is the observed flow.*

For journey time validation, a maximum difference of 15% between modelled and observed journey times has been used.

[2] Named after Geoffrey E. Havers who invented the statistic in the 1970's

The convergence criteria implemented for this model were:

- Journey Time - 15% of all journeys within 95%
- Turning Volume - 15% of all turns within 95% vehicles

The model was run until the convergence criteria were met; the IP and PM peak reached convergence on iteration 20 and 10 respectively. Calibration and validation achieved for all flow counts and journey times in the IP and PM peak periods exceeded the Project Appraisal Guidelines (PAG) standards. The model was deemed acceptable and replicated the existing operational performance of vehicular traffic at the M7 Junction 9 (Maudlins) and the surrounding local road network.

3.5 Conclusions

The base year micro-simulation model fulfilled all the calibration and validation criteria and was deemed suitable for use to understand the impacts of a number of future scenarios on network performance.

Future Year Model Development

3.6 Calculation of Future Growth

The process undertaken to develop the Future Year Do Minimum (DM) Model is fully detailed in *Technical Note 3 – Do Minimum Model Development* in Appendix C. The model includes future growth and committed schemes within the local area as detailed in the Naas Local Area Plan 2021-2027. However, the future model does not include any network change at Junction 9 on the M7 or development at the KDA site.

During the development of the Naas LAP, KCC developed the Naas Local Area Model (LAM). To develop future year growth factors for the TMAS micro-simulation model outputs from the future year LAM runs were used. A future year scenario with the full build out the of Naas LAP in 2027 was used, trips to and from the KDA site were removed from the LAM, as they will be applied separately in TMAS micro-simulation model. The growth calculated from the LAM was applied to the base year TMAS model.

The growth applied to the Baseline demand (2022 to 2027 growth) is detailed in Table 3.1**Error! Reference source not found.**, the growth below relates to zones in Maudlins area and excludes any motorway growth.

Table 3.1 - Growth Excluding the Motorway

Model Period	Vehicle type	Local Network Growth
PM	Car/LV	14%
	HGV	22%
IP	Car/LV	23%
	HGV	13%

3.7 Future Year Network Performance

The DM model demonstrated that once growth to 2027 is accounted for, queuing is projected to increase in the PM peak on the Dublin Road roundabout NB approach and on the WB approach at the end of the PM peak hour. Queuing not previously present in the Base scenario is observed in the DM model on the Fishery Lane approach to the roundabout in the second half of the PM peak hour. Figure 3.2 and Figure 3.3 show the DM road network and queuing present in the DM scenario at 16:45 (snapshots of the queuing at each 15-minute intervals during the PM peak are available in the *Technical Note 3 – 3.3 DM Model runs*).

Figure 3.2 - DM Scenario PM Peak 16:45

Figure 3.3 - DM Scenario PM Peak 16:45

Demand on the Dublin Road will increase under future year conditions, operational queuing is projected in the north-east direction on the approach to the signalised junction at Dublin Road/the Gallops and on the approach to the Dublin Road Roundabout.

Important to note that queuing was only permitted to extend to the next junction upstream and therefore won't impact that junction, for example from Maudlins roundabout on the Dublin Road, the queue could extend to Fishery Lane roundabout or on the R445 the queue could extend to the roundabout with the N7 off-slip but not spill onto the off-slip itself.

4 Demand Testing

4.1 KDA Site Access

The following was assumed in relation to access and egress from the KDA site:

- One-way access has been provided off the Maudlins Roundabout,
- Exit onto the Dublin Road has been provided via existing left-in, left-out junction located on Dublin Road between Maudlins roundabout and Fishery Lane roundabout, this existing junction was serving a local development on current KDA site, which is now closed, and
- Exit onto Fishery Lane through Naas Industrial Estate.

Figure 4.1 shows the KDA site in blue and the assumed access and egress routes to and from the site.

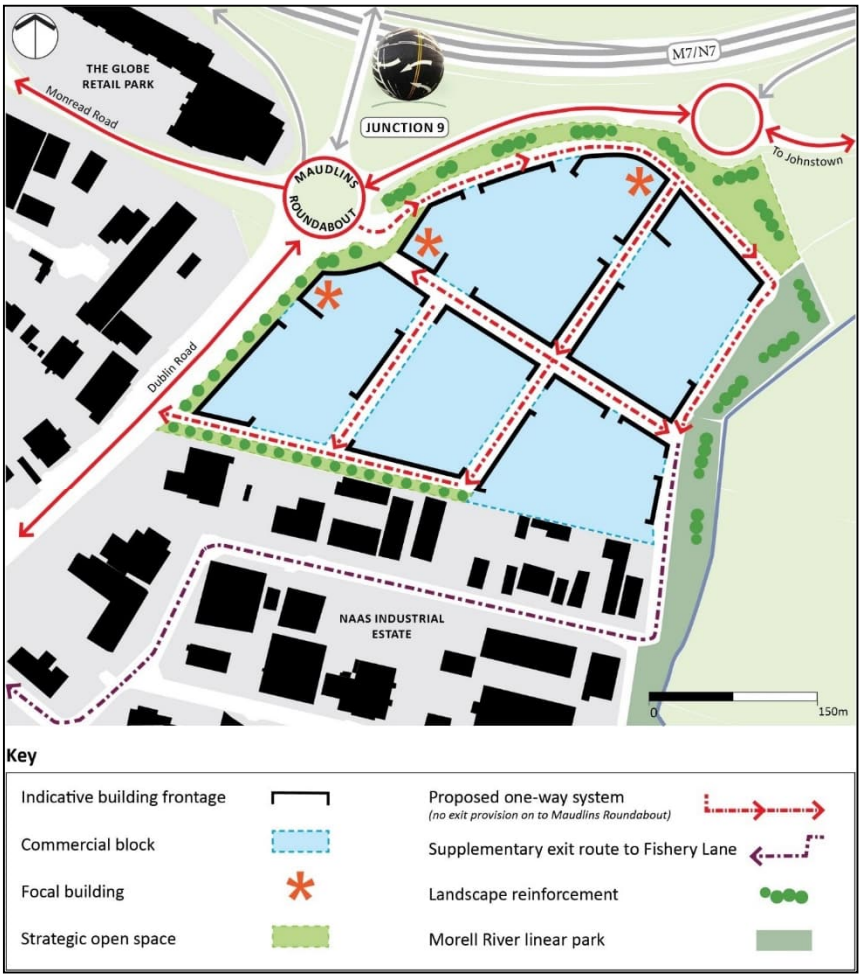

Figure 4.1 - KDA Site Access

The access to the KDA site is via the Maudlins Roundabout (referred to earlier as Dublin Road Roundabout). Traffic accessing the site from Naas must do so via Dublin Road and Maudlins Roundabout.

There are two proposed exits[3] from the development site, one onto Dublin Road, via a currently unused left-out junction and a second onto Fishery Lane, provided as a supplementary exit route through the existing Naas Industrial Estate as shown in Figure 4.2.

[3] Other access options can be proposed by developers however these are subject to assessment to ensure compliance with the access strategy.

The Dublin Road between Maudlins Roundabout and Fishery Lane roundabout is a centrally divided road with one lane in the south-west direction and two-lanes in the north-east direction on the approach to the Maudlins roundabout. The two-lanes approaching Maudlins roundabout split traffic depending on the destination, the nearside lane caters for traffic heading to Sallins and M7 southbound (Limerick / Cork direction) and the outside lane caters for traffic heading to Johnstown and N7 North (Dublin direction).

Figure 4.2 shows exit routes from the KDA site via the existing left-out junction located on the Dublin Road between Maudlins Roundabout and Fishery Lane roundabout.

Figure 4.2 - Dublin Road left-out Exit route from KDA site

Traffic exiting the KDA site via the existing left-out junction can only travel in the south-west direction on the Dublin Road regardless of its destination. In order to exit to Sallins, via Monread Rd and N7 in both directions all traffic is required to do U-turn at the Fishery Lane roundabout and travel in the north-east direction on Dublin Road to make the appropriate turn, 64% of traffic exiting the KDA site has a destination in those areas (Sallins/Monread Rd, and N7 in both directions). Current traffic conditions at the Fishery Lane roundabout show operational queuing developing on the Fishery Lane approach to the roundabout during evening peak hours due to high volumes of traffic on the Dublin Road, which reduces the gap time for traffic approaching the roundabout from Fishery Lane.

4.2 Maximum Traffic Levels

The testing undertaken focused solely on identifying the use, quantum and intensity of development that can be facilitated at the KDA site location complementary to safeguarding the function and safety of the National Road network under future year traffic conditions, with the full build out of the Naas LAP. In order to determine the quantum of land use that can be accommodated, the maximum level of traffic that the road network can cater for was determined first. The detailed process of developing the Do Something TMAS models was documented in *Technical Note 4 – Do Something Model Development*, which is included in Appendix D of this report.

For the KDA testing a Do Something (DS) model was developed based on the DM model to allow any specific KDA development demand to be added to the model, along with network changes that would be required to provide access to and from the site. Two demand distributions representing two different combinations of land uses were developed to test different levels of traffic in and out of the KDA site:

- **Demand Distribution 1 (Service Station)** - Represents the one **'permitted in principle'** land use and assumed 85% of development will be attracted to/from the motorway
- **Demand Distribution 2 (Mixed Use)** - Represents the mixed nature of the **'open for consideration'** land uses and was developed based on trip generation rate/patterns from the nearby Naas Industrial Estate

PM peak model was used to test the maximum traffic flow to and from the KDA site due to the proximity of the developments to the N7/M7 and the possibility of queuing caused by local congestion spilling onto the N7 off-ramps.

Tests of the DS model demonstrated that under **Demand Distribution 1 - Service Station** the maximum traffic demand that could be accommodated by the existing road network was estimated to be around **545 vehicles** (270 entering and 275 exiting) during the PM peak hour.

Under **Demand Distribution 2 - Mixed Use** the maximum traffic demand that could be accommodated by the existing road network was estimated to be around **450 vehicles** (175 entering and 275 exiting) during the PM peak hour. This scale of additional demand under both demand distributions caused a significant level of congestion for a short period during the peak hour.

As mentioned in Section 3.7 - Future Year Network Performance, queuing was only permitted to extend to the next junction upstream and therefore won't impact that junction, for example on the R445 the queue could extend to the roundabout with the N7 off-slip but not spill onto the off-slip itself (snapshots of the queuing resulting from the Do Something model runs are available in *Technical Note 4 – 3.2 Do Something Model runs*).

4.3 Quantum and Intensity of Development

To understand how trip demand might translate into land use, the Trip Rate Information Computer System (TRICS) was used. TRICS is a database of trip rates for developments used in the United Kingdom and Ireland for transport planning purposes, specifically to quantify the trip generation of new developments. Based on traffic surveys for developments of known quantum and type of location, TRICS provided estimates of trip rates for each land use of the proposed development. The trip rates are based on surveys undertaken on existing developments, therefore do not take into account changing patterns of work, such as increased rates of working from home.

Some potential land use combinations have been used to estimate total vehicular demand to show potential land use combinations and level of quantum for those land uses that could be accommodated on the KDA site. These are shown in Table 4.1.

Table 4.1 – Potential Land Use Combinations and Quantum

No	Land Use	Quantum
1	Petrol Filling Station	30 Bays
2	Petrol Filling Station	20 Bays
	Warehousing	24,500 Sqm
3	Petrol Filling Station	20 Bays
	Warehousing	9,500 Sqm
	Office	7,000 Sqm
4	Petrol Filling Station	20 Bays
	Warehousing	6,000 Sqm
	Office	3,041 Sqm
	Drive Through Coffee Shop	160 Sqm
5	Petrol Filling Station	12 Bays
	Warehousing	13,000 Sqm
	Office	12,250 Sqm
	Creche	500 Sqm
6	Petrol Filling Station	12 Bays
	Warehousing	10,000 Sqm
	Office	11,000 Sqm
	Creche	500 Sqm
	Drive Through Coffee Shop	200 Sqm

The overall arrivals and departures to/from the KDA site with various potential combinations of land uses amount to between 163 - 270 vehicles entering the site and between 250 - 280 vehicular trips exiting the site in the evening peak.

The potential combinations of land use and quantum of the proposed land use presented above could be accommodated on the KDA site without any modifications to the existing road network.

4.4 Possible Capacity Improvements

Given that both of the future demand distributions described caused significant levels of congestion for short periods during the peak hour, three local road network improvements were proposed and tested to mitigate these negative impacts. These improvements were tested individually and in combination. It must be noted that these tests were carried out at a conceptual level, future design work would be required to confirm the viability and deliverability of the potential physical modifications. These options were developed in consultation with KCC.

The local capacity improvements considered were as follows:

- Modify signal timings at Dublin Rd / Maudlins Av junction to optimise queuing,
- Increase capacity at the Dublin Rd / Fishery Ln junction by providing two lanes from Fishery Ln at the stop line and/or provide a two-lane exit NB on Dublin Rd,
- Increase capacity at Maudlins Roundabout for movements from Dublin Rd to N7 through a two-lane approach to the N7 with an additional left turn lane to Monread Rd.

Each intervention on its own was found to solve a single area of congestion; however, to improve the whole area, a combination of interventions would be required.

A subsequent stress test was carried out which **increased the development demand by 10%** alongside all potential road network modifications. The test found that this increased level of demand could be supported by the modified network.

5 Summary and Conclusions

5.1 Summary

To fulfil the requirements of the Naas Local Area Plan (LAP) 2021-2027 under URD 1.13 Kildare County Council appointed AECOM to prepare a Traffic Modelling and Access Strategy (TMAS) for the Key Development Area (KDA).

AECOM developed a micro-simulation TMAS model of the N7/M7 Junction 9 (Maudlins) and the local road network, to assess and quantify the overall level of vehicular traffic that the local road network could effectively support during both peak and off-peak traffic periods. The PM peak period was identified as being the critical period for the site where, due to congestion on the local road network, some occasional queuing might spill onto the N7 off ramps. The PM peak model was used to identify the maximum traffic flow to and from the KDA site that can be accommodated on the road network in order to determine the ultimate scale of proposed development.

This strategy focused mainly on identifying the quantum and intensity of development that can be facilitated at the KDA site without compromising the function and safety of the National Road network. The modelling undertaken enabled the quantification of the permitted and permitted in principle land-uses to be defined. This report gives examples of quantum and combinations of land uses that may potentially be accommodated within the KDA.

The key in establishing the maximum quantum of any development type is the maximum level of traffic the local road network could accommodate. Tests of the DS model demonstrated that under **Demand Distribution 1**, which considered land uses **permitted in principle** such as a Service Station, the maximum traffic demand that could be accommodated by the existing road network was estimated to be around **545 vehicles** during the PM peak hour.

Under **Demand Distribution 2**, which considered **open for consideration** land uses the maximum traffic demand that could be accommodated by the existing road network was estimated to be around **450 vehicles** during the PM peak hour. This scale of additional demand under both demand distributions caused a significant level of congestion for a short period during the peak hour.

5.2 Conclusions of AECOM Assessment

The TMAS model was calibrated and validated to 2022 traffic conditions and was deemed fit for purpose for assessing the proposed development traffic impact. The future year demand was projected in consultation with KCC in line with development expectations up to 2027 as per the Naas LAP.

The testing for the KDA site was undertaken with the primary objective of protecting the function and safety of the National Road network and minimising any impact on the overall congestion of the key roads within modelled area.

The impact of the KDA traffic on the local road network changes with the type of proposed land use due to changing travel patterns/distribution. The heaviest traffic on the local road network during the evening peak period is on the Dublin Road in the north-east direction, therefore traffic flow on Dublin Road and the operation of its junctions was deemed the critical element in determining the maximum flow to and from the KDA site, but also the potential for traffic queuing back onto the N7.

The TMAS modelling tests shows maximum two-way traffic flows associated with the development of the KDA site as between 450 and 545 vehicles in PM peak hour for two types of land uses: open for consideration (mixed use) and for permitted in principle (service station). The tested maximum two-way flows did not allow for an upgrade or changes to the Maudlins roundabout and as such these results are only valid for the access arrangements as tested.

Local road network improvements were assessed and tested and proved to help in managing congestion, however they did not allow for a significant increase in the scale of traffic to/from the KDA

site, only an increase of 10% in both demand distribution tests. Junction 9 Maudlins roundabout was not altered as part of these network improvements., which is the busiest and most congested junction within the vicinity of the KDA site. Its performance is critical to ensuring the function and safety of the national road network.

The proposed egress strategy from the KDA was shown to cause the N7/M7 bound traffic to route via the Dublin Road and necessitated U-turns if the Dublin Road left-out junction was used when exiting the KDA site, however this exit route ensures that the function of the national road network can be protected. Further consultation may be needed to identify the optimum balance for the KDA site.

5.3 Developers Proposed Access Strategy

As outlined in Section 4.1, AECOM considered 2 access arrangements for the Maudlins KDA site as part of this assessment, however other access arrangement can be considered. In line with this, the developers of the site, Fagan Group and Petrogas Group Limited, commissioned SYSTRA Limited to provide transport planning services in relation to a proposed access strategy for the Maudlins KDA.

This work supplemented the Transport Appraisal of the site undertaken by AECOM on behalf of Kildare County Council (KCC) as presented in this report. Details and results from this assessment are provided in the SYSTRA report titled 'Maudlins KDA, Developers Proposed Access Strategy – Transport Appraisal' (Included within Appendix D of this report).

The assessment undertaken by Systra on behalf of the developers of the Maudlins KDA site utilised AECOM's micro-simulation model but made changes in relation to the following:

- Demand – The developer's assessment has increased the quantum of development within the site and subsequently the level of PM peak hour trips
- Site Access - Modifications have made in terms of access/egress to the site

The developer's revision to the KDA access arrangement as shown in **Error! Reference source not found.** adds an additional arm to the Maudlins roundabout, thereby increasing the traffic flow at the circulatory carriageway east of the Dublin Road arm and reducing the available gap/capacity to the remaining arms, mainly the Dublin and Monread Roads.

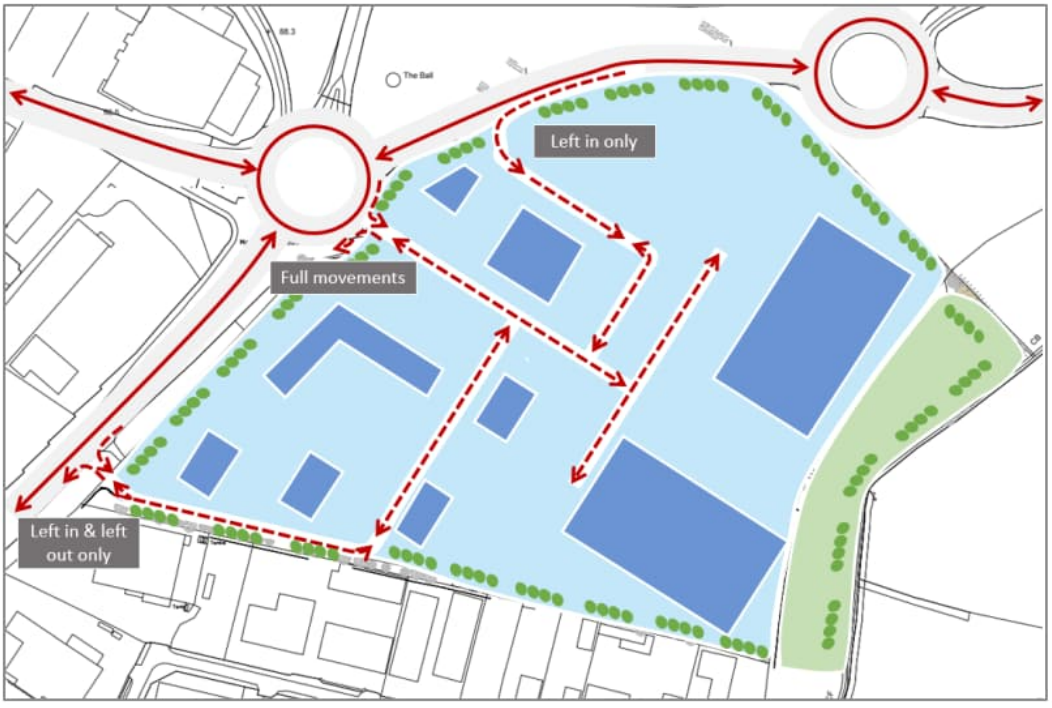

Figure 5.1 - Developer Proposal – Alternative Access Strategy for the Maudlins KDA

The developer's proposal increases the development quantum and the resulting traffic generation to and from the Maudlins KDA site over what was assessed by AECOM as the maximum traffic flow with the pre-defined access arrangement.

In addition to the proposed site assess arrangements put forward by the developers, several road network mitigation measures are also proposed to the existing road network. These modifications are required to help mitigate against the impacts associated with the higher quantum of development in the KDA site and also the increase in traffic directly onto the Maudlins Roundabout.

The proposed road network modification measures are reported by Systra to reduce delays on the Dublin Road, however the assessment shows significant queuing will occur within the KDA site and along the Monread Road (eastbound). It should be noted that right turning traffic (i.e. towards the M7/N7) exiting the KDA site at the Maudlins roundabout in the PM will have priority over the Dublin Road and Monread Road arms. High volumes of traffic exiting the KDA site at this location has the potential to significantly impact on the operation of the Maudlins roundabout and Dublin Road approach arm.

The assessment highlights the importance of assessing the overall operation of the wider road network and including modifications/upgrades to the existing network where required in order to minimise the impact of any development within the KDA site. The Systra assessment of the developers proposed access strategy indicates that with the proposed modifications in place a higher quantum of growth could potentially be provided in the KDA site without directly impacting on the operation of the M7/N7 mainline and its associated ramps.

Appendix A Technical Note 1 – Traffic Survey Analysis

Technical Note 1
Traffic Survey Analysis

Kildare County Council

Project reference: Maudlins Transport Modelling and Access Strategy

26th May 2022

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Figures

Tables

1. Introduction

This report summarises the Traffic survey analysis and the key findings for the Maudlins Traffic Modelling and Access Strategy project. The traffic survey data will be used to develop a micro-simulation model of the study area. An overview of the traffic surveys conducted is provided below.

DESCRIPTION: Technical Note - Traffic Survey Analysis

SURVEY TYPE: Automatic Traffic Counts (ATC), Junction Traffic Counts (JTC), Queue Lengths and Journey Time.

LOCATION: The M7 Junction 9 (Maudlins) and surrounding road network in Naas.

SURVEY PERIOD: The surveys have been undertaken during the following periods:

- **ATC Surveys:** 24hrs continuously for 2 weeks between 31st March – 14th April 2022.
- **JTC Surveys:** Thursday 31st March 2022 between 07:00 – 19:00.
- **Journey Time:** 25th May 2022 using Google API for IP and PM peaks.

Appendix A shows the geo locations of the survey sites.

2. Automatic Traffic Counts

2.1 Overview of ATC Surveys

Five Automatic Traffic Count (ATC) surveys were conducted at locations shown in **Figure 1** and listed in Error! Reference source not found. along with the site number, road and location. The data has been collected for 24hrs continuously for a period of 2 weeks between Thursday 31st March – Thursday 14th April 2022. The geo locations are provided in **Appendix A**.

Figure 1: Map of Automatic Traffic Counts Locations

Table 1. ATC Surveys Site Locations

ATC Site Ref	Road	Location
ATC1	R445	R445 south of Dublin Road Roundabout
ATC2	Monread Road	Monread Road west of Dublin Road Roundabout
ATC3	N7	N7 Junction 9 Westbound On-Slip
ATC4	N7	N7 Junction 9 Eastbound On / Off Slip
ATC5	R445	R445 East of Dublin Road Roundabout

2.2 ATC Data Summary

ATC Data was plotted for a 24-hour period to assess the hourly flow patterns for two-way flow at each site. Average Daily Traffic (ATC) was calculated for a typical workday (Tues-Thurs.) from the collected ATC data and **Figure 4** identifies the ADT over a 24-hour period. The PM peak is observed to be critical for all sites and the PM peak hour is identified as 16:00 to 17:00. The Interpeak (IP) period was identified between 10:00 and 16:00, the IP average hourly flow was calculated for average flow within that period.

Figure 2: ADT Distribution (averaged from two-week survey)

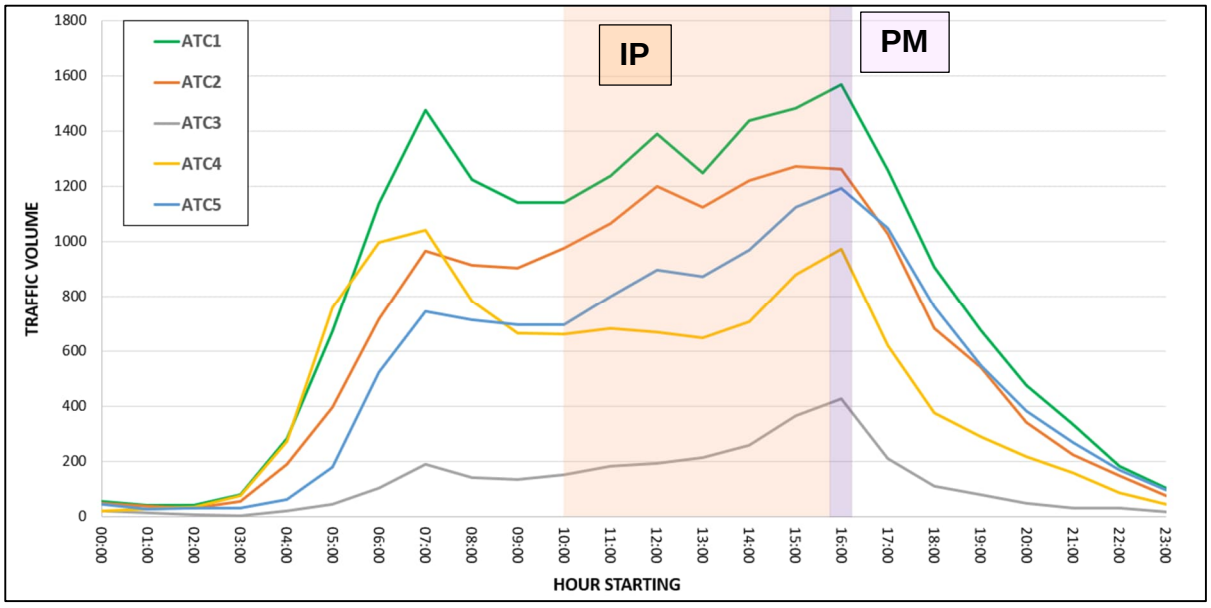


Table 2 shows the average hourly flow observed for each period.

Table 2. ATC Hourly Data

ATC Site Ref	IP hourly average (10:00-16:00)	PM Hour Average (16:00-17:00)
ATC1 Northbound	634	786
ATC1 Southbound	696	858
ATC2 Westbound	590	669
ATC2 Eastbound	552	658
ATC3 Northbound	227	447
ATC3 Southbound	Single direction slip road	
ATC4 Northbound	497	581
ATC4 Southbound	181	180
ATC5 Eastbound	155	185
ATC5 Westbound	732	1017

3. Junction Traffic Counts

3.1 Overview

Junction Turning Count (JTC) surveys and Queue length surveys were conducted at 3 locations as shown in **Figure 3** and listed in **Table 3** alongside the details of the site number and location. The site geo locations are provided in Appendix A .

The JTC data for all the 3 sites has been collected on the same day, Thursday 31st March between 07:00 – 19:00.

Figure 3: Map of Junction Turning Counts and Q length Survey Locations

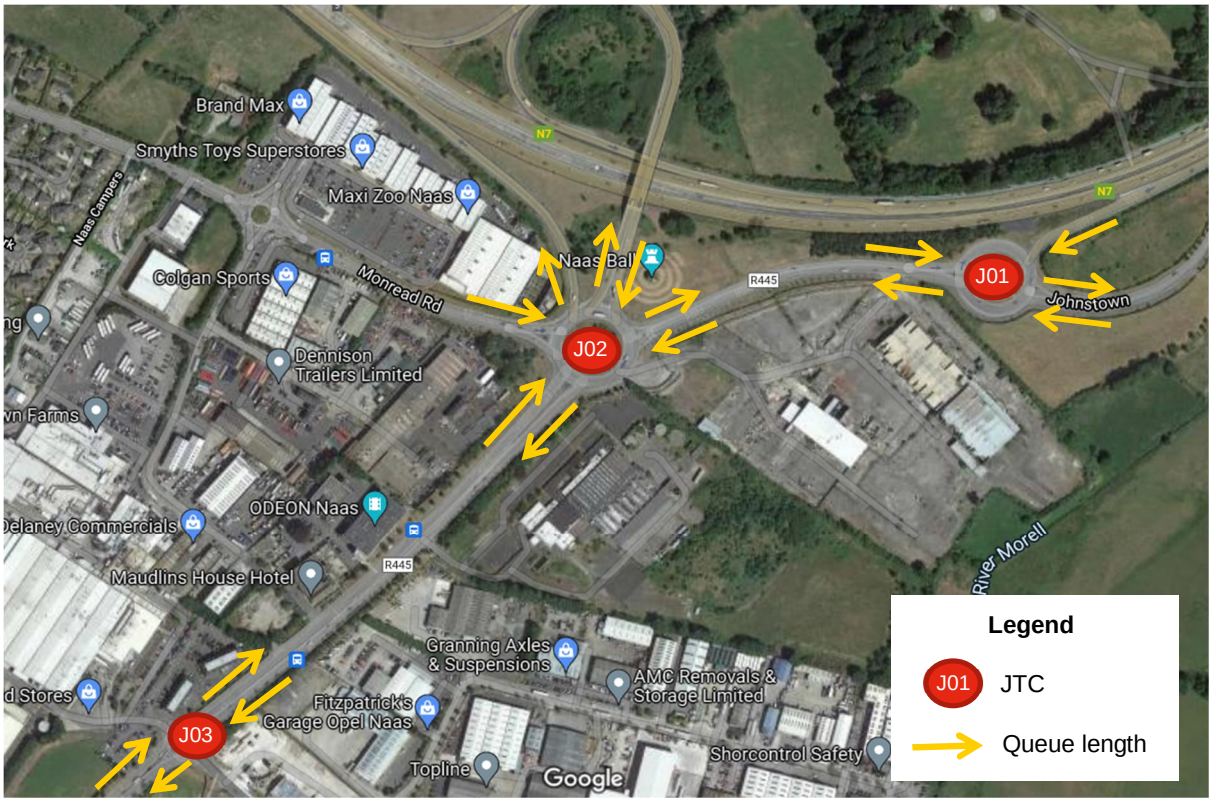


Table 3. JTC Surveys Site Locations

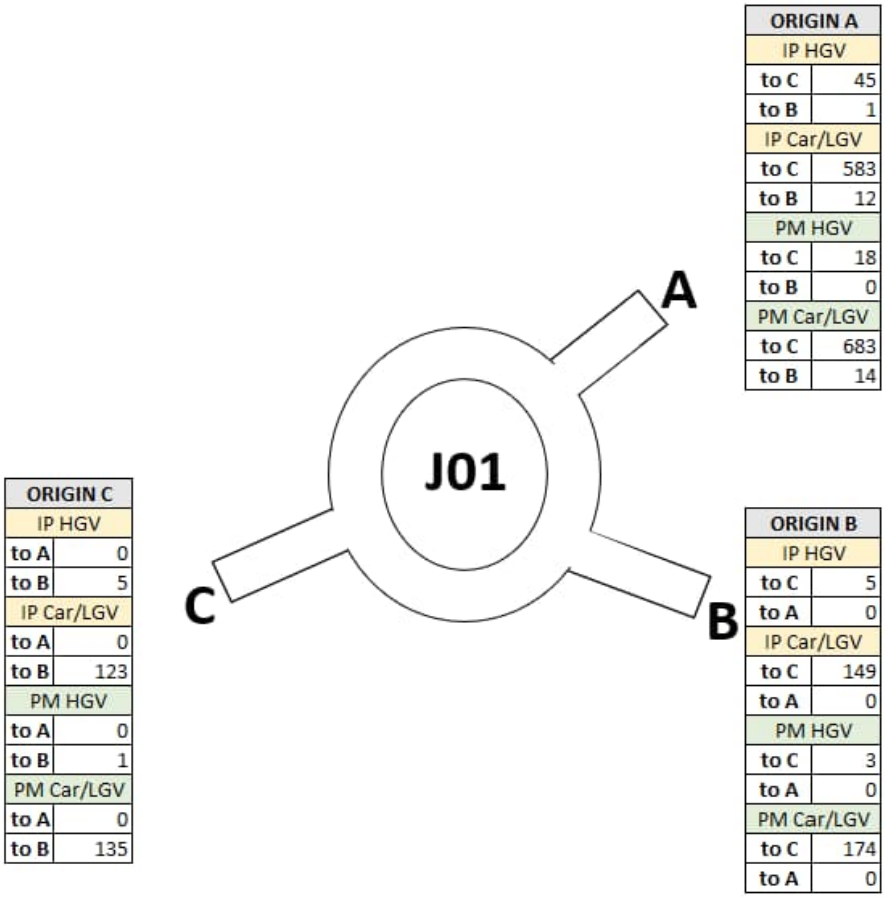
JTC Site Ref	Location
J01(JTC1)	N7 Junction 9 Off-Slip at R445 Roundabout
J02 (JTC2)	R445 Dublin Road Roundabout
J03 (JTC3)	R445 at Fishery Lane Roundabout

3.2 JTC Data Analysis

J01 (JTC1) - N7 Junction 9 Off-Slip at R445 Roundabout

JTCs were analysed to understand the movement of traffic at each junction during the average IP (10:00-16:00) and PM peak (16:00 – 17:00) periods. **Figure 4** shows the IP and PM hourly turning movements at J01 (JTC1) by vehicle type.

Figure 4: JTC average IP and PM peak hourly flow by vehicle split at J01



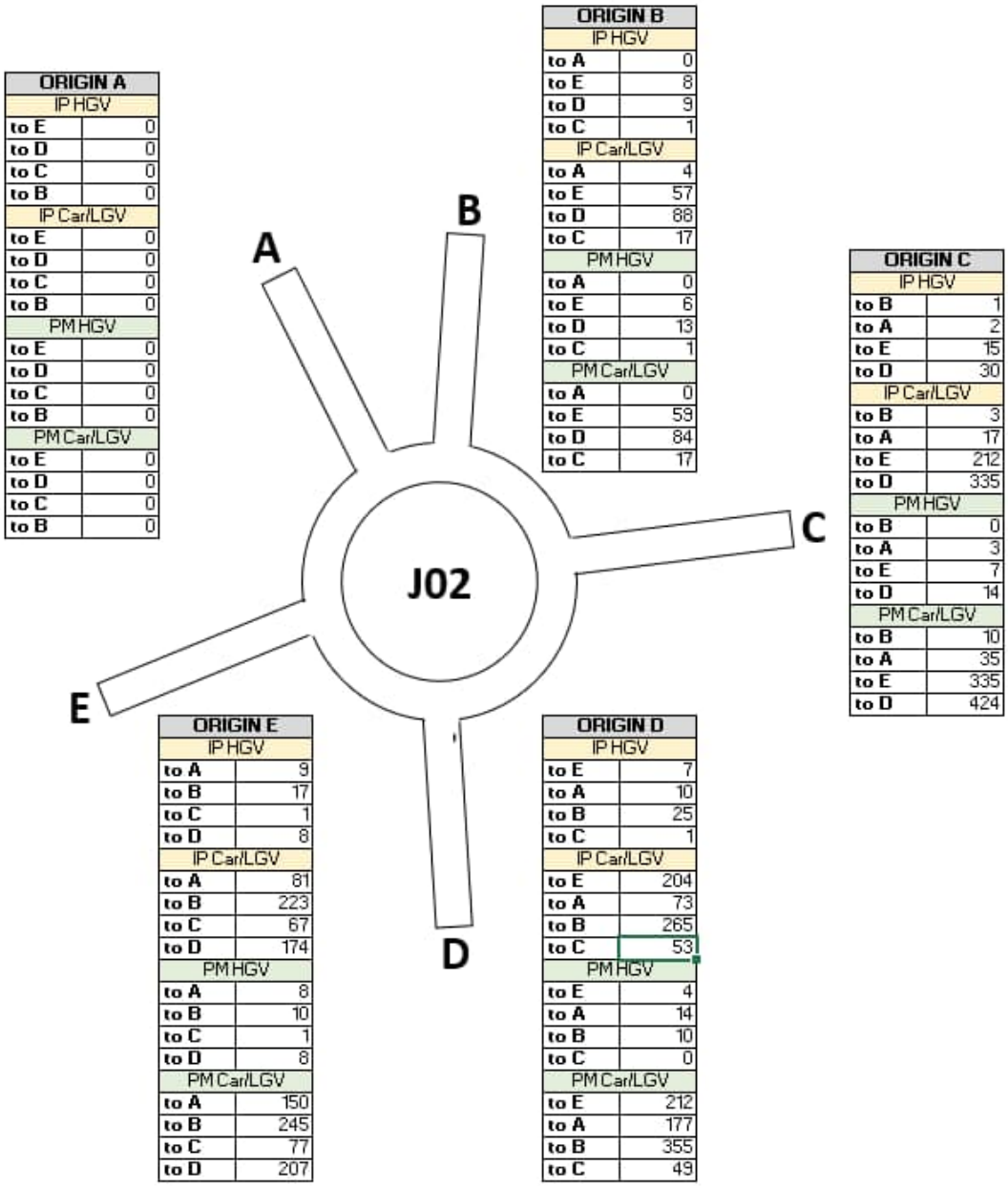
Arm A – N7 Off Slip; Arm B -Johnstown Road; Arm C – R445

Dominant turning movement at the roundabout is from N7 Off slip to R445 (From Arm A to Arm C)

J02 (JTC2) – R445 Dublin Road Roundabout

Figure 5 shows the IP and PM hourly JTC at J02 (JTC2) by vehicle type.

Figure 5: JTC average IP and PM peak hourly flow by vehicle split at J02



ORIGIN A	
IP HGV	
to E	0
to D	0
to C	0
to B	0
IP Car/LGV	
to E	0
to D	0
to C	0
to B	0
PM HGV	
to E	0
to D	0
to C	0
to B	0
PM Car/LGV	
to E	0
to D	0
to C	0
to B	0

ORIGIN B	
IP HGV	
to A	0
to E	8
to D	9
to C	1
IP Car/LGV	
to A	4
to E	57
to D	88
to C	17
PM HGV	
to A	0
to E	6
to D	13
to C	1
PM Car/LGV	
to A	0
to E	59
to D	84
to C	17

ORIGIN C	
IP HGV	
to B	1
to A	2
to E	15
to D	30
IP Car/LGV	
to B	3
to A	17
to E	212
to D	335
PM HGV	
to B	0
to A	3
to E	7
to D	14
PM Car/LGV	
to B	10
to A	35
to E	335
to D	424

ORIGIN E	
IP HGV	
to A	9
to B	17
to C	1
to D	8
IP Car/LGV	
to A	81
to B	223
to C	67
to D	174
PM HGV	
to A	8
to B	10
to C	1
to D	8
PM Car/LGV	
to A	150
to B	245
to C	77
to D	207

ORIGIN D	
IP HGV	
to E	7
to A	10
to B	25
to C	1
IP Car/LGV	
to E	204
to A	73
to B	265
to C	53
PM HGV	
to E	4
to A	14
to B	10
to C	0
PM Car/LGV	
to E	212
to A	177
to B	355
to C	49

Arm A – M7 (westbound) on slip; Arm B -M7 (eastbound) on/off slip; Arm C – R445(N); Arm D- R445(S); Arm E- Monread Road

The major movements at the roundabout are from R445(N) towards the R445(S) (Arm C to Arm D) and Monread road (Arm C to Arm E). R445 (S) to M7 eastbound (Arm D to Arm B) movement also carries significant peak hour flows.

The **Table 4** below compares the above presented JTC Site 02 data with previously collected data in September 2018. Overall, there has been about 7% reduction in CAR/LGV traffic at the junction in the recent counts and 21% reduction in HGVs. The reduction can be seen mainly in the traffic entering the roundabout from R445 (N) through the N7 Westbound off slip (From Arm C). The recently opened M7 Junction 9a provides shorter access to the R407 north of Naas, diverting the traffic otherwise accessing the R407 through N7 Westbound off slip and Monread road.

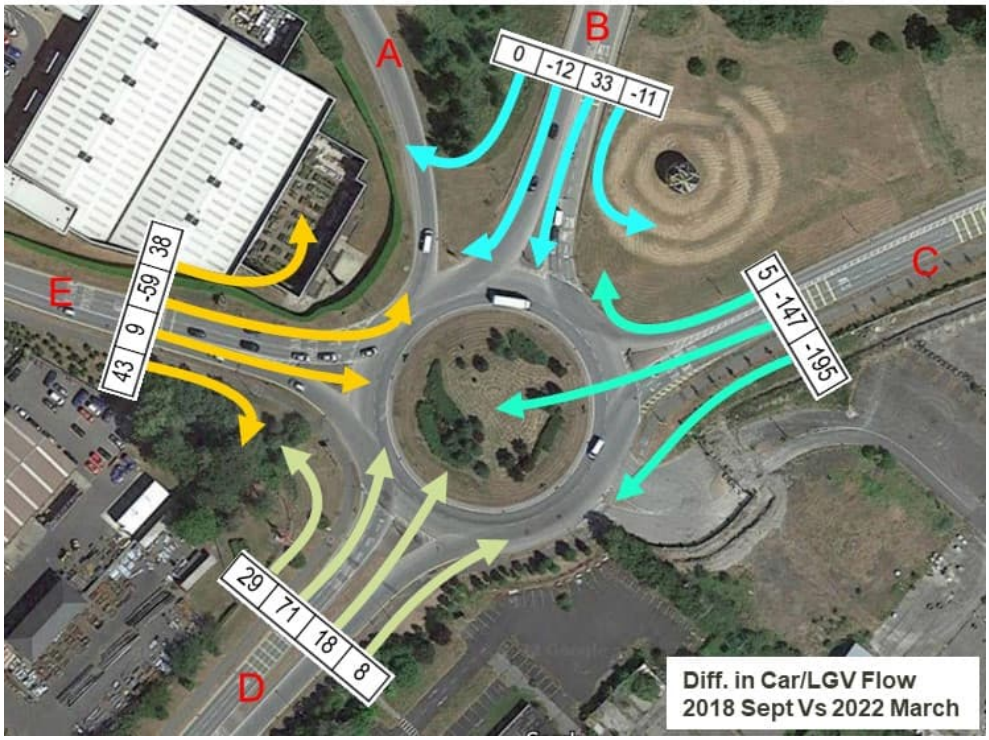
The turning movement from R445(N) to the M7 Westbound On slip (Arm C to Arm A) has been excluded from the comparison as this movement was unrealistically high in data collected in 2018 due to construction delays present at that time on the M7.

Table 4. J 02 Comparison with the 2018 September Data

JTC Site J02 (JTC2)	2022 Data 16:00-17:00		Sept 2018 Data 16:00-17:00		Actual Difference		Percentage Difference	
	Car/LGV	HGV	Car/LGV	HGV	Car/LGV	HGV	Car/LGV	HGV
JTC2AE	0	0	0	0	0	0	-	-
JTC2AD	0	0	0	0	0	0	-	-
JTC2AC	0	0	0	0	0	0	-	-
JTC2AB	0	0	0	0	0	0	-	-
From Arm A	**0**	**0**	**0**	**0**	**0**	**0**	**-**	**-**
JTC2BA	0	0	0	0	0	0	-	-
JTC2BE	59	6	71	7	-12	-1	-17%	-14%
JTC2BD	84	13	51	4	33	9	65%	225%
JTC2BC	17	1	28	0	-11	1	-39%	-
From Arm B	**160**	**20**	**150**	**11**	**10**	**9**	**7%**	**82%**
JTC2CB	10	0	5	0	5	0	100%	-
JTC2CE	335	7	482	25	-147	-18	-30%	-72%
JTC2CD	424	14	619	24	-195	-10	-32%	-42%
From Arm C	**769**	**21**	**1106**	**49**	**-337**	**-28**	**-30%**	**-57%**
JTC2DE	212	4	183	10	29	-6	16%	-60%
JTC2DA	177	14	106	2	71	12	67%	600%
JCT2DB	355	10	337	20	18	-10	5%	-50%
JTC2DC	49	0	41	0	8	0	20%	-
From Arm D	**793**	**28**	**667**	**32**	**126**	**-4**	**19%**	**-13%**
JTC2EA	150	8	112	4	38	4	34%	100%
JTC2EB	245	10	304	20	-59	-10	-19%	-50%
JTC2EC	77	1	68	2	9	-1	13%	-50%
JTC2ED	207	8	164	4	43	4	26%	100%
From Arm E	**679**	**27**	**648**	**30**	**31**	**-3**	**5%**	**-10%**
Total	**2401**	**96**	**2571**	**122**	**-170**	**-26**	**-7%**	**-21%**

Figure 6 shows the total vehicle difference in flow between the recent March 2022 and the 2018 September data at JTC 02.

Figure 6: J02 PM Peak Car/LGV flow comparison between 2018 Sept and 2022 March Data



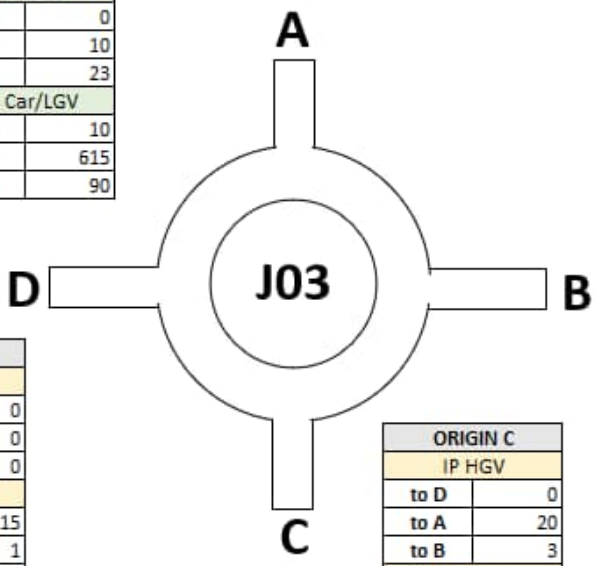
J03 (JTC3) R445 Fishery Lane Roundabout

Figure 7 shows the IP and PM hourly JTC at J03 (JTC3) by vehicle split. The highest volumes turning movements at the roundabout are between R445(N) and R445(S) (Arm A to Arm C/Arm C to Arm A).

Figure 7: JTC average IP and PM peak hourly flow by vehicle split at J03

ORIGIN A	
IP HGV	
to D	0
to C	22
to B	24
IP Car/LGV	
to D	10
to C	526
to B	98
PM HGV	
to D	0
to C	10
to B	23
PM Car/LGV	
to D	10
to C	615
to B	90

ORIGIN B	
IP HGV	
to A	22
to D	0
to C	4
IP Car/LGV	
to A	98
to D	1
to C	45
PM HGV	
to A	22
to D	0
to C	1
PM Car/LGV	
to A	146
to D	0
to C	74



ORIGIN D	
IP HGV	
to A	0
to B	0
to C	0
IP Car/LGV	
to A	15
to B	1
to C	6
PM HGV	
to A	0
to B	0
to C	0
PM Car/LGV	
to A	39
to B	4
to C	9

ORIGIN C	
IP HGV	
to D	0
to A	20
to B	3
IP Car/LGV	
to D	8
to A	476
to B	32
PM HGV	
to D	0
to A	7
to B	1
PM Car/LGV	
to D	4
to A	579
to B	37

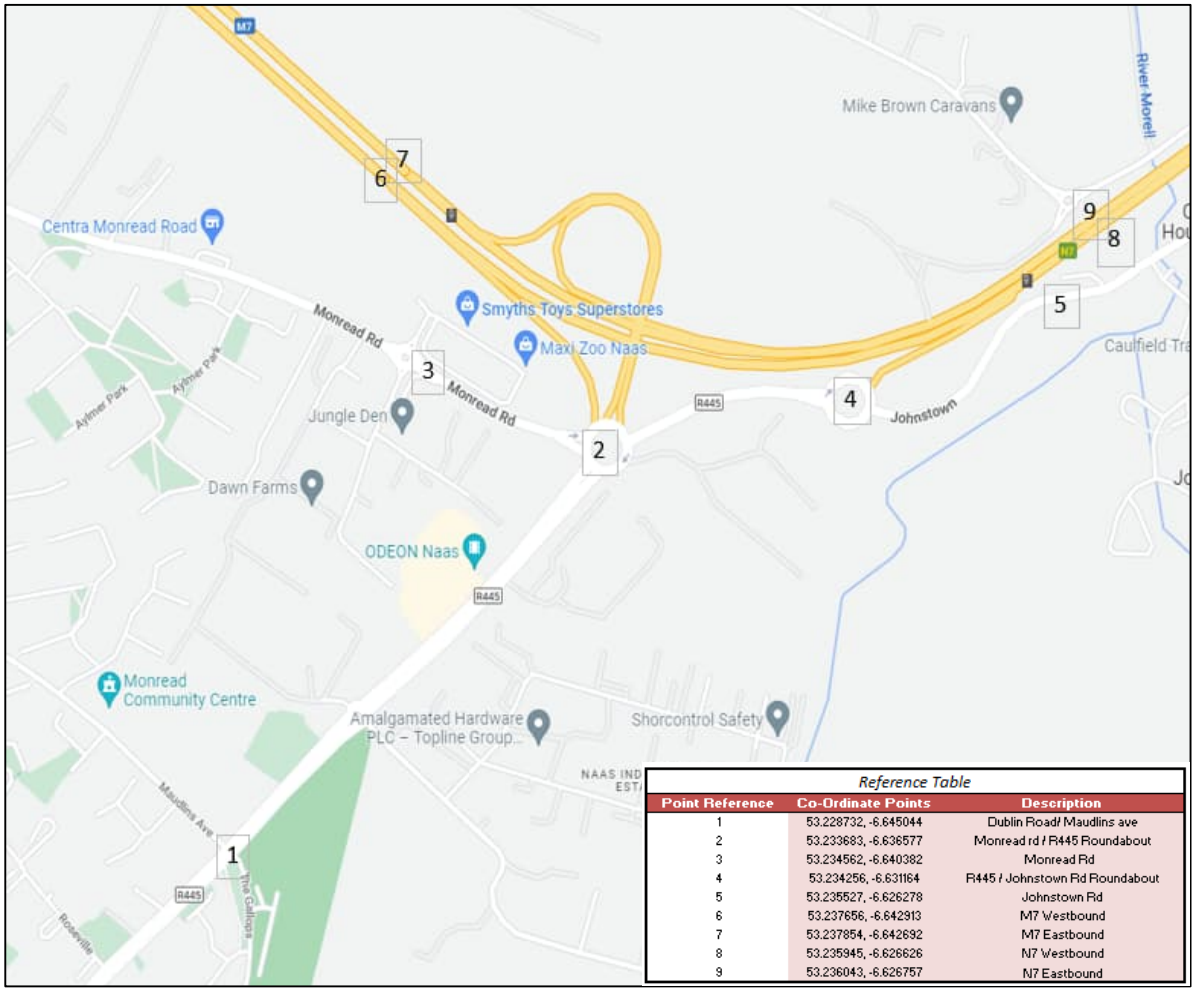
Arm A – R445(N); Arm B -Fishery Lane; Arm C – R445(S); Arm D- Industrial Area

4. Journey Time Data

4.1 Overview

Journey Time data was also collected using Goggle API. Fourteen routes were chosen across the network to present average journey times over the IP and PM peaks. Data was provided in fifteen-minute intervals. The average hourly journey times between the set locations are displayed in **Table 5**. The results were produced from a forecast journey time for Wednesday, 25th May 2022. **Figure 8** shows the set locations of the Journey time data points.

Figure 8: Journey Time Data Collection – Set Points



Reference Table

Point Reference	Co-Ordinate Points	Description
1	53.228732, -6.645044	Dublin Road/ Maudlins ave
2	53.233683, -6.636577	Monread rd / R445 Roundabout
3	53.234562, -6.640382	Monread Rd
4	53.234256, -6.631164	R445 / Johnstown Rd Roundabout
5	53.235527, -6.626278	Johnstown Rd
6	53.237656, -6.642913	M7 Westbound
7	53.237854, -6.642692	M7 Eastbound
8	53.235945, -6.626626	N7 Westbound
9	53.236043, -6.626757	N7 Eastbound

Table 5. Observed journey times for the IP and PM peaks

Route Path	Journey Time IP hour (MM:SS)	Journey Time PM Peak (MM:SS)
1-2	01:15	01:20
2-1	01:16	01:20
2-3	00:25	00:23
3-2	00:27	00:26
2-4	00:24	00:26
4-2	00:26	00:26
4-5	00:32	00:33
5-4	00:37	00:36
2-6	00:33	00:32
7-2	00:55	00:55
2-9	01:15	01:16
8-6	00:45	00:46
7-9	00:43	00:43
8-4	00:14	00:14

Journey times observed are similar across the average IP hour and the PM peak, which suggests low variation of delays throughout the day and limited congestion present on the road network.

5. Queue Data

5.1 Overview

Queue data was collected at each JTC site, on each entry arm, measured by vehicle type. The average queue was observed from the data and is shown in **Table 6**. **Table 7** presents the maximum queue observed during the PM peak.

Table 6. Average Queue Length Observed during the PM Peak

Gyratory Arm	16:00-16:15		16:15-16:30		16:30-16:45		16:45-17:00	
	Cars/LGVs	HGVs	Cars/LGVs	HGVs	Cars/LGVs	HGVs	Cars/LGVs	HGVs
JTC1A	0	0	0	0	0	0	0	0
JTC1B	3	0	2	0	2	0	3	0
JTC1C	0	0	0	0	0	0	0	0
JTC2A								
JTC2B	1	0	1	0	1	0	1	0
JTC2C	0	1	0	0	0	0	1	1
JTC2D	6	1	6	1	5	0	5	0
JTC2E	5	0	6	0	9	0	6	0
JTC3A	1	0	2	0	3	0	1	0
JTC3B	5	0	7	0	6	2	7	0
JTC3C	2	0	10	0	6	0	5	0
JTC3D	3	0	4	0	2	0	1	0

Table 7. Maximum Queue Length Observed during the PM Peak

Gyratory Arm	16:00-16:15		16:15-16:30		16:30-16:45		16:45-17:00	
	Cars/LGVs	HGVs	Cars/LGVs	HGVs	Cars/LGVs	HGVs	Cars/LGVs	HGVs
JTC1A	0	0	0	0	0	0	0	0
JTC1B	3	0	4	0	6	0	4	0
JTC1C	0	0	0	0	0	0	0	0
JTC2A								
JTC2B	1	0	4	0	1	0	4	1
JTC2C	0	1	0	0	0	0	2	1
JTC2D	7	1	9	1	8	1	4	0
JTC2E	6	0	6	1	11	0	11	0
JTC3A	4	0	5	0	5	0	2	0
JTC3B	6	0	11	1	13	4	10	0
JTC3C	5	1	**15**	0	8	0	6	0
JTC3D	5	0	9	0	3	0	2	0

The differences between maximum and average queue lengths show little variation. The reasonably short queue lengths together with journey times analysis suggest low delays and operational queues present on the road network.

The maximum queue length shows 15 vehicles on southern approach to Junction 3 R445 Fishery Lane Roundabout. The approximate length of the queue of 15 vehicles is 120m, which is a little over half the distance between the roundabout and the next junction upstream (Maudlins Ave and The Gallops), which means the queue does not blocks back the junction upstream. The variation of queue length throughout the hour suggests no persistent queuing was present.

6. Summary

The ATC data has provided the total traffic flows at each of the ATC sites in both traffic directions to assess the volume of traffic throughout the day for a period of two weeks. The PM peak is observed to be critical for all sites and the PM peak hour is identified as 16:00 to 17:00.

The Junction Turning Counts, journey times and queue lengths showed detailed information about the local road network. Data gathered suggests highest flows during the evening peak hour, however little variation is shown in journey times or queue lengths which suggest the road network operates efficiently with minimal delays.

The traffic survey data described in this report will be used to develop a micro-simulation model of the area. Journey time data and queue length data will be used to validate the model to ensure that vehicles are travelling through the model network with the observed delay.

Appendix A Geo location of Survey Sites

Table 8. Surveys Sites Geo Locations

Site Ref	Geo Location	
	Latitude	Longitude
ATC1	53.231569	-6.639836
ATC2	53.234038	-6.638666
ATC3	53.234461	-6.636948
ATC4	53.234664	-6.636102
ATC5	53.234295	-6.633968
J01(JTC1)	53.234263	-6.631123
J02 (JTC2)	53.233688	-6.636550
J03 (JTC3)	53.230434	-6.642081

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Appendix B Technical Note 2 – Base Year Model Development

Technical Note 2 – Base Year Model Development

Kildare County Council

Project reference: Maudlins Transport Modelling and Access Strategy

July 2022

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Contents

Figures

Tables

1. Introduction

1.1 Overview

Kildare County Council (KCC) has commissioned AECOM to provide Consulting Engineering services in relation to the Maudlins Traffic Modelling & Access Strategy (TMAS).

1.2 Background

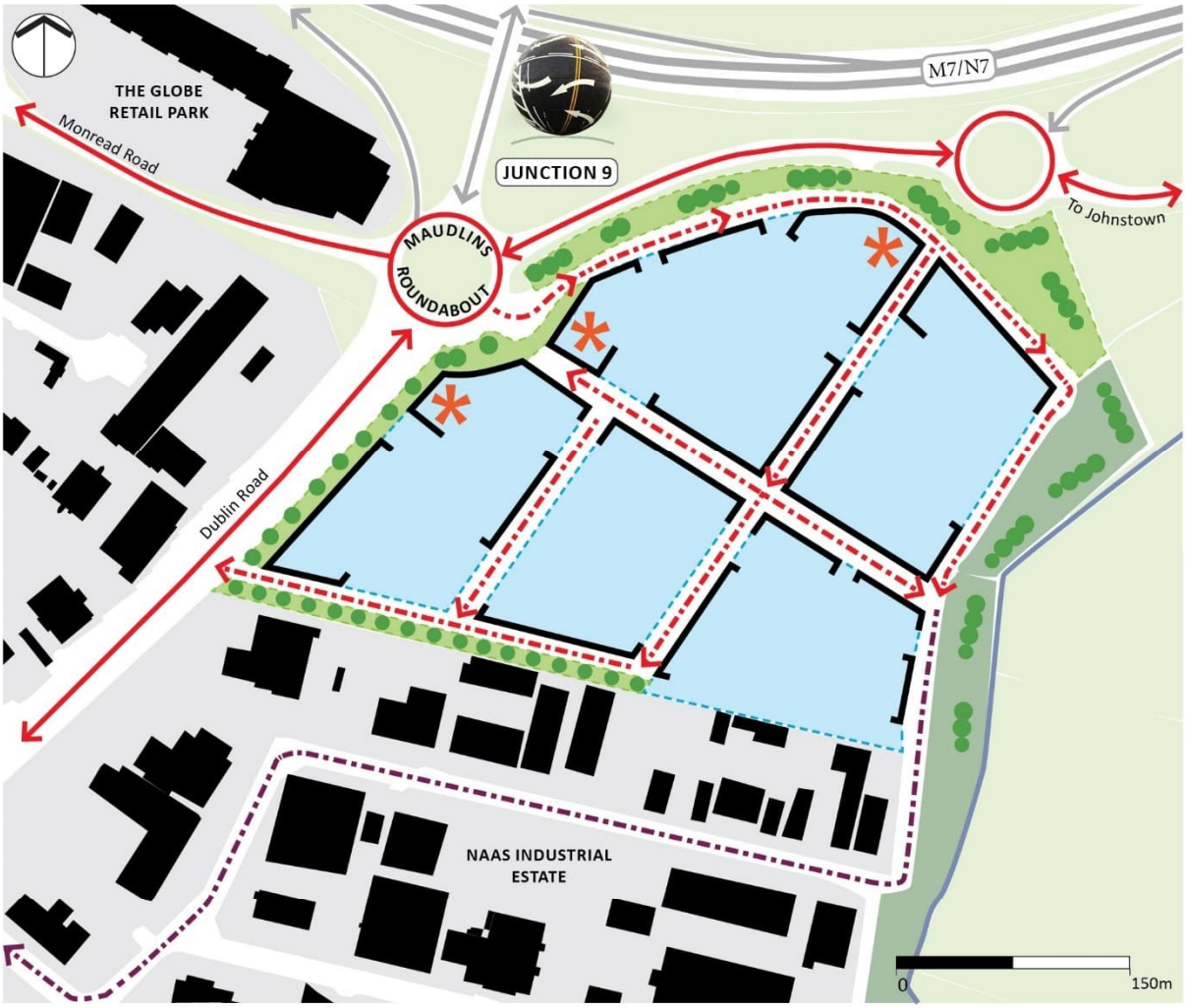
The Naas Local Area Plan (LAP) 2021 – 2027 was adopted by the Elected Members in October 2021. Under the LAP the area referred to as 'Junction 9 (Maudlins Interchange)' was identified as a Key Development Area (KDA). The specific development area lands associated with the Key Development Area (illustrated in **Figure 1.1**:) include the former Donnelly Mirrors and Cemex Concrete sites. Under the Naas LAP these lands have been zoned T (Mixed Uses) – To provide for general commercial / industrial / enterprise use[1].

The Naas LAP sets out two specific objectives in relation to this Key Development Area:

- **Economic Development Objective (EDO 1.4)** – *"Facilitate the regeneration and redevelopment of the lands to the east of the Dublin Road roundabout, in particular the Key Development Area at Junction 9 (Maudlins) (the former Donnelly Mirrors and Cemex Concrete sites), through a joint approach for the overall landholding through the preparation of a comprehensive masterplan comprising of an overall high-quality design in recognition of its location as a key gateway site. Adherence to the Design Framework set out in Chapter 10 is required in the preparation of any masterplan for these lands which will be informed by the Traffic Modelling and Access Strategy (Objective URD 1.13, refers)".*
- **Urban Regeneration and Development (URD 1.13**) - *Prepare a Traffic Modelling and Access Strategy for lands zoned Mixed-use at the Junction 9 (Maudlins) Key Development Area within 12 months of the adoption of the local area plan, in consultation with relevant stakeholders including Transport Infrastructure Ireland (TII), the National Transport Authority (NTA) and the owners of the KDA lands.*
    - *(i) This Strategy will identify the use, quantum and intensity of development that can be facilitated at the location complementary to safeguarding the strategic function and safety of the national road network, in accordance with the provisions of official policy outlined in the Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012).*
    - *(ii) The Strategy will also identify any improvements required to the local transport network to facilitate development at this KDA.*
    - *(iii) The masterplan required under URD 1.14 shall not be finalised until such time as the Council has completed and agreed the traffic modelling with the stakeholders identified above.*

[1] Specific Objective – The owner/developer of the subject lands is required to prepare a masterplan for the overall parcel of land.

Figure 1.1: Maudlins Site Location



Key

Indicative building frontage		Proposed one-way system *(no exit provision on to Maudlins Roundabout)*	
Commercial block		Supplementary exit route to Fishery Lane	
Focal building		Landscape reinforcement	
Strategic open space		Morell River linear park	

1.3 Context

AECOM has developed a Microsimulation VISSIM model of the M7 Junction 9 (Maudlins) and local road network to assess and quantify the overall level of vehicular traffic that network can efficiently and safely support during both peak and off-peak traffic periods.

The model will identify and guide the recommendation of the types of land-uses that may be potentially accommodated within the key development area and potential scale of these land-uses, in line with the Naas Local Area Plan (LAP).

This Model Development Report outlines the methodology adopted to produce a Vissim micro-simulation model of the M7 Junction 9 and local road network. This document describes the comparison between the modelled and observed data which has been undertaken to realistically replicate on-site traffic behaviour and conditions.

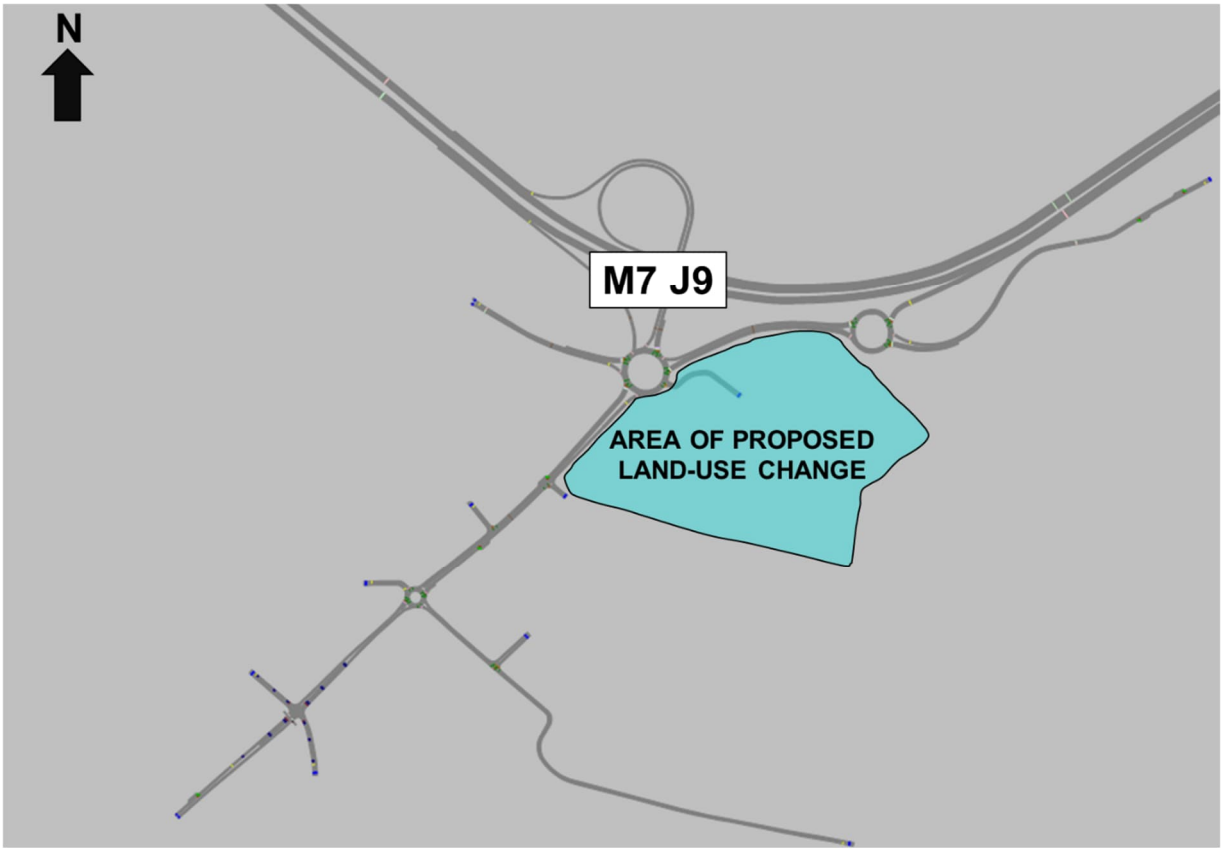
The objective of the study is primarily to help KCC understand the existing (2022) operational performance of Junction 9 (Maudlins) and the local road network and the anticipated 'background' traffic growth that may occur related to committed / planned development and general population / employment growth in Naas. Using this information, the study will establish the 'spare' capacity at Junction 9 (Maudlins) and the local road network considering the requirement to protect the safe and efficient operation of the National Road Network. Possible changes to the local road network and/or the junctions will be considered in order to improve the performance of the existing infrastructure.

In addition, alternative vehicular access proposals to the development lands will be considered which seek to minimise impacts on both the local road and National Road Network.

The study area is set out in **Figure 1.2**. The model extent includes:

- M7 J9 (Maudlins) with eastbound and westbound on/off-slips;
- The local network including four junctions along the R445 between M7 J9 and Naas Town Centre. These include Johnstown / R445 / N7 SB off, Dublin Rd / Monread Rd / N7 NB on/off, Dublin Rd / Fishery Ln and the signalised junction Dublin Rd / Maudlins Av / The Gallops; and
- The area of proposed land-use.

Figure 1.2: Model Extent



In support to the Vissim model three separate junction 9 models have also been developed to determine the baseline capacity of the three junctions.

1.4 Modelling Versions

The local model has been developed using the microsimulation software Vissim which allows for the simulation of traffic patterns with a great level of detail, displaying all road users and their interactions in one single model.

The Vissim software version used for developing the model is 2021 Service Pack 11.

The Junctions 9 software version used for developing the baseline models is Version 9.0.1.4646.

1.5 Report Structure

After this introduction, the structure of the report is as follows:

- Section 2 – Observed data and existing baseline capacities;
- Section 3 – Model Description;
- Section 4 – Network Development;
- Section 5 – OD Matrix Development;
- Section 6 – Model Standards: the criteria for assessing the suitability of the model;
- Section 7 – Model Convergence;
- Section 8 – Calibration and Validation; and
- Section 9 – Summary and Recommendations

2. Observed Data

2.1 Overview

This chapter describes the different data sources of observed data that have been used to calibrate and validate the base model.

2.2 Existing Data

2.2.1 Existing Model

In September 2020 AECOM developed a VISUM Local Area Model (LAM) with base year 2018, as part of the Naas/Sallins Transport Strategy. This model covered Naas town centre and the surrounding local network, including the N7 J9 and the R445. This model has been cordoned to the extent of the Maudlins study area to provide the base network and demand for the Vissim model. Where JTC data is available this has been used rather than the Visum model cordon.

2.2.2 Signal Specifications

Signal timing data was provided for the Dublin Road / The Gallops junction (location shown in **Figure 2.1**). This information was used to define the minimum and maximum signal timings and intergreens for input into the model. VAP signal coding has been used within the Vissim model allowing for variable cycle timings based on demand.

Figure 2.1: Signalised Junction Dublin Road / The Gallops

2.3 Survey Data

AECOM commissioned a traffic survey to collect data in Spring 2022. The data collection was undertaken by Irish Traffic Surveys Ltd between 31 March 2022 and 14 April 2022. Data included:

- ATC Data, 24hrs continuously for 2 weeks between 31 March and 14 April 2022.;
- JTC Data, recorded Thursday 31 March 2022 for a 12-hour period at 3 junction locations; and

- Queue Data, recorded Thursday 31 March 2022 for a 12-hour period at each approach to the 3 JTC locations.
- Journey Time Data, 25th May 2022 using Google API for IP and PM peaks.

Traffic survey analysis results and the key findings have been reported in the Technical Note 1. Due to time scales, no formal site investigations were undertaken, however a remote site investigation was undertaken and supplemented with local area knowledge.

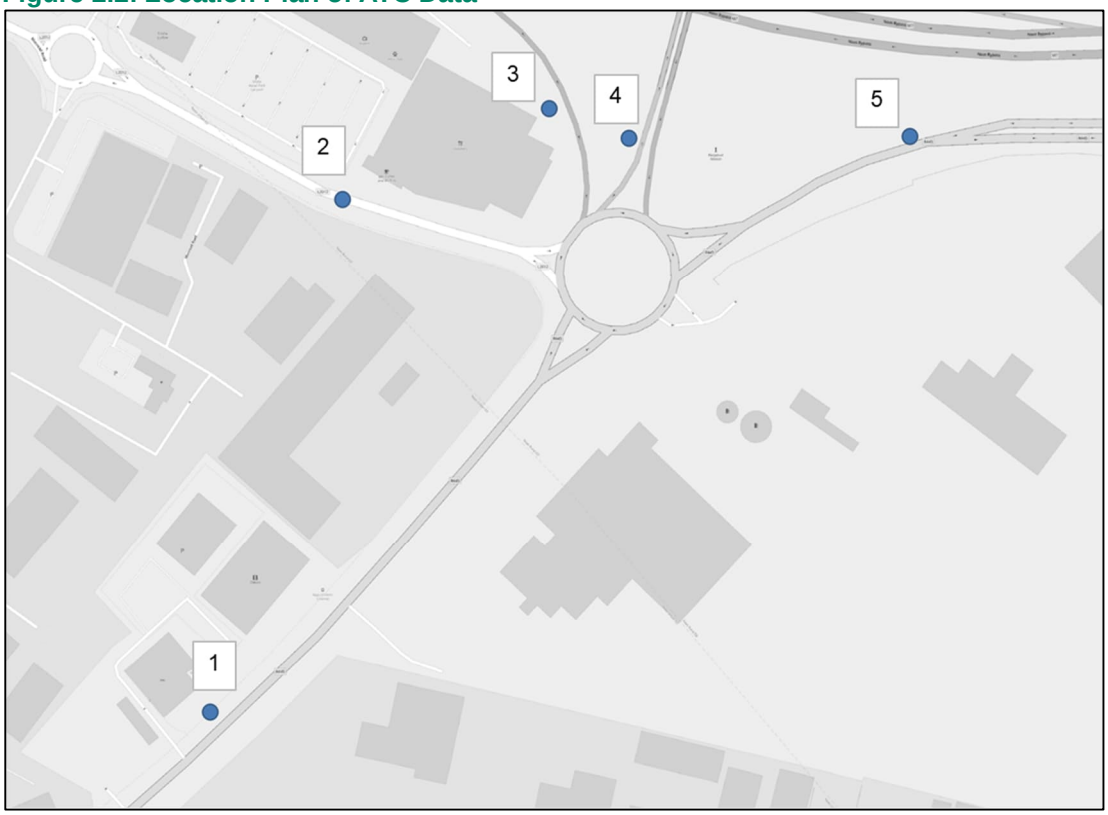
2.3.1 Automatic Traffic Count Data (ATC)

Five Automatic Traffic Count (ATC) surveys were conducted at locations shown in **Figure 2.2**. The data has been collected for 24hrs continuously for a period of 2 weeks between Thursday 31st March – Thursday 14th April 2022. To represent an average weekday, data was assessed for Tuesday, Wednesday and Thursday, representative of typical conditions. Average hourly flow observed at the ATC sites is provided in Appendix A.

The following site data was available:

1) ATC1: R445 south of Dublin Road Roundabout
2) ATC2: Monread Road west of Dublin Road Roundabout
3) ATC3: M7 Junction 9 Westbound On-slip
4) ATC4: M7 Junction 9 Eastbound On / Off-slip
5) ATC5: R445 East of Dublin Road Roundabout

Figure 2.2: Location Plan of ATC Data



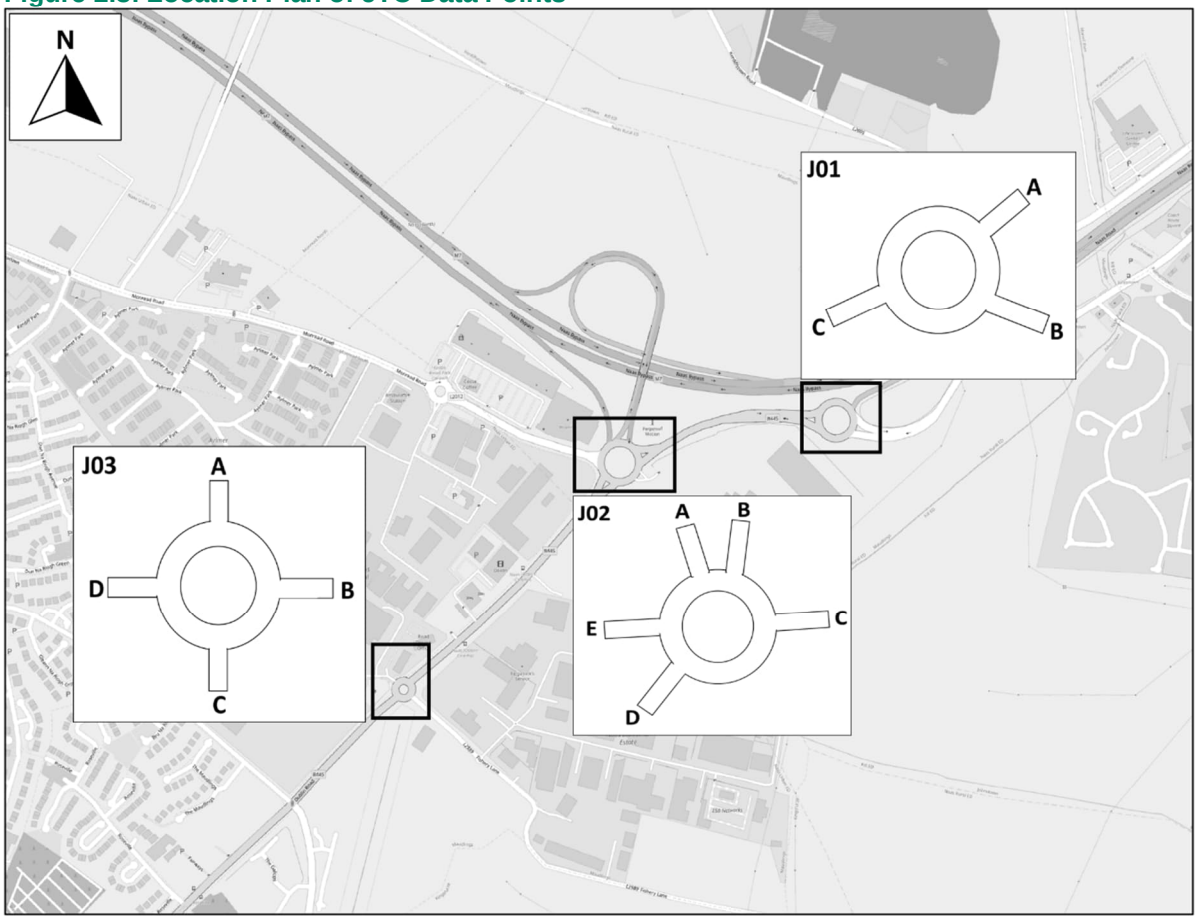
2.3.2 Junction Turning Count (JTC)

JTC surveys were conducted at three locations on Thursday 31st March 2022 between 07:00 and 19:00, the locations are shown in **Figure 2.3**. JTCs were used to understand the movement of traffic at each junction. Figures showing the IP and the PM hourly turning movements are provided in Appendix A.

The following site data was available:

1) J01 (JTC1): M7 Junction 9 Off-slip at R445 Roundabout
2) J02 (JTC 2): R445 Dublin Road Roundabout
3) J03 (JTC 3): R445 at Fishery Lane Roundabout

Figure 2.3: Location Plan of JTC Data Points



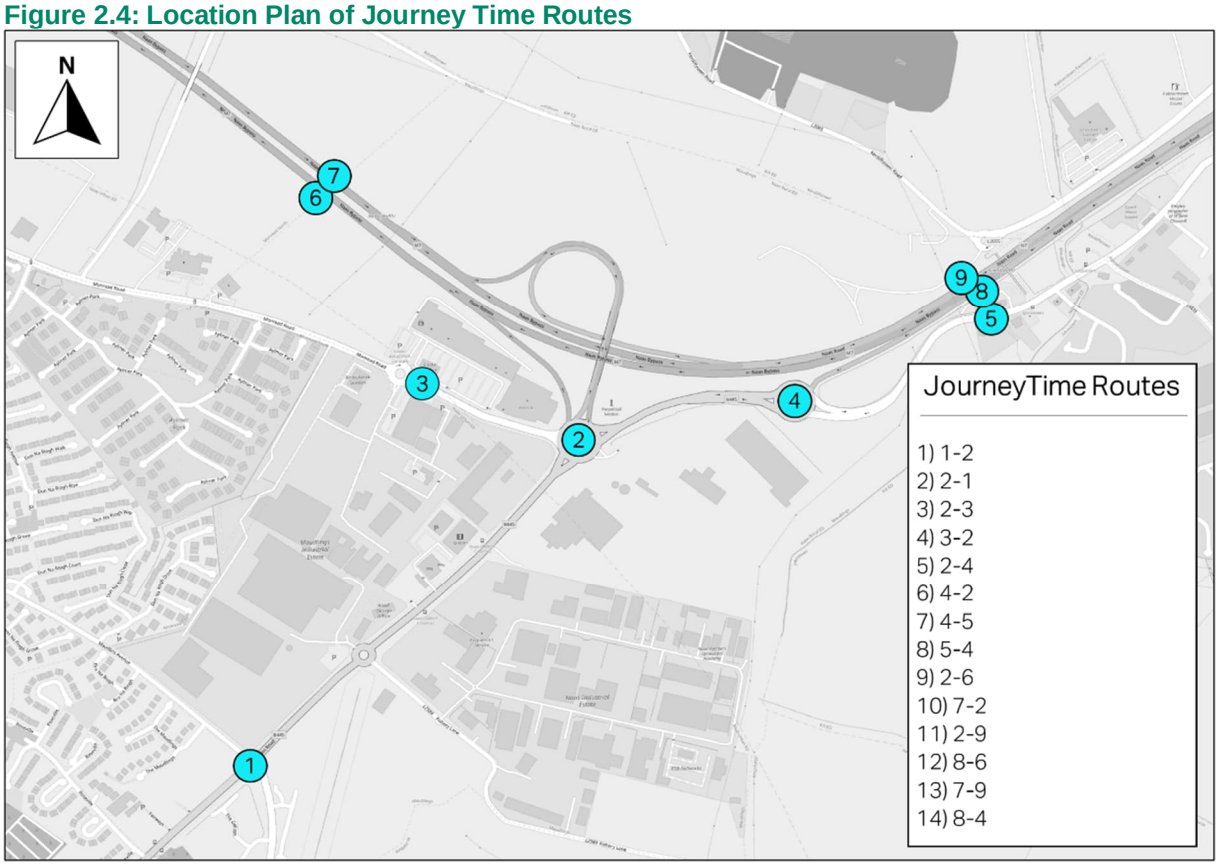
2.3.3 Queue Length Data

Queue length was recorded at each JTC site on each junction entry arm. Queue data was measured by total vehicles, stating vehicle type. Data was provided for average and maximum queue length.

2.4 Journey Time Data

Journey Time data was collected using Goggle Traffic. Fourteen routes were chosen across the network to present average journey times. The location of these is presented in **Figure 2.4**. The results were produced from a forecast journey time for Wednesday 25 May 2022.

Figure 2.4: Location Plan of Journey Time Routes



It should be noted that the journey time segments are short, ranging 0.24km to 1.24km. However due to availability of data this is deemed suitable to be used as a guide in the development of the base model.

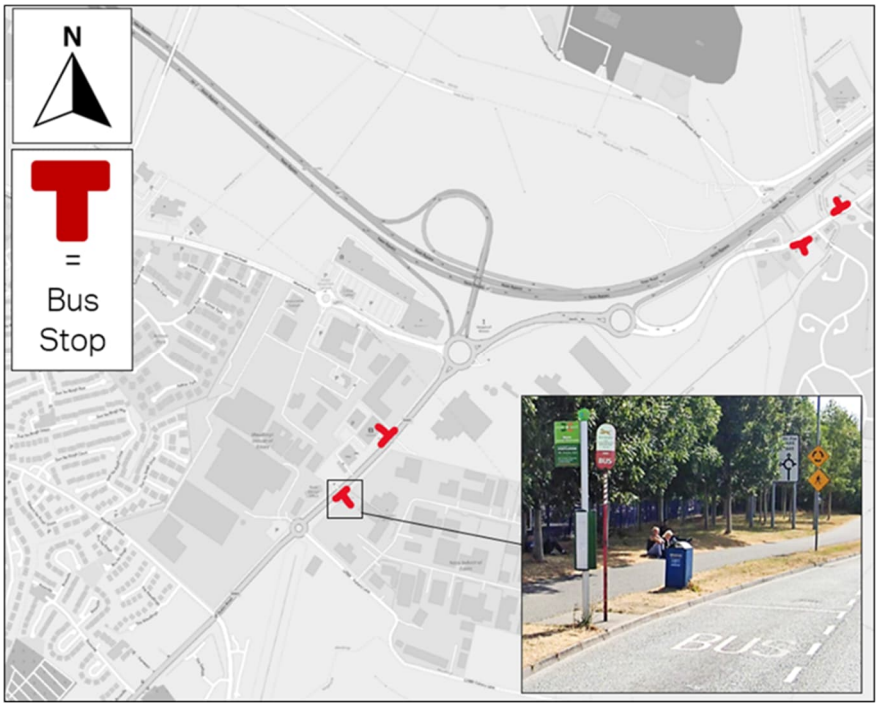
2.5 Site Investigation

The site investigation followed a virtual desk-top study. Bus timetables and frequencies were collected from Bustimes.org as shown in **Table 2.1.** Bus stop locations were observed and are shown in **Figure 2-5**.

Table 2.1: Bus Routes and Frequencies within the Modelled Area

Bus Route	Bus Frequencies within modelled time period
125 NB	0
125 SB	0
126 NB	2
126 SB	3
130 NB	0
130 SB	0
726 NB	1
726 SB	2
736 NB	0
737 NB	2
826 SB	0

Figure 2-5: The Distribution of Bus Stops within the Modelled Area

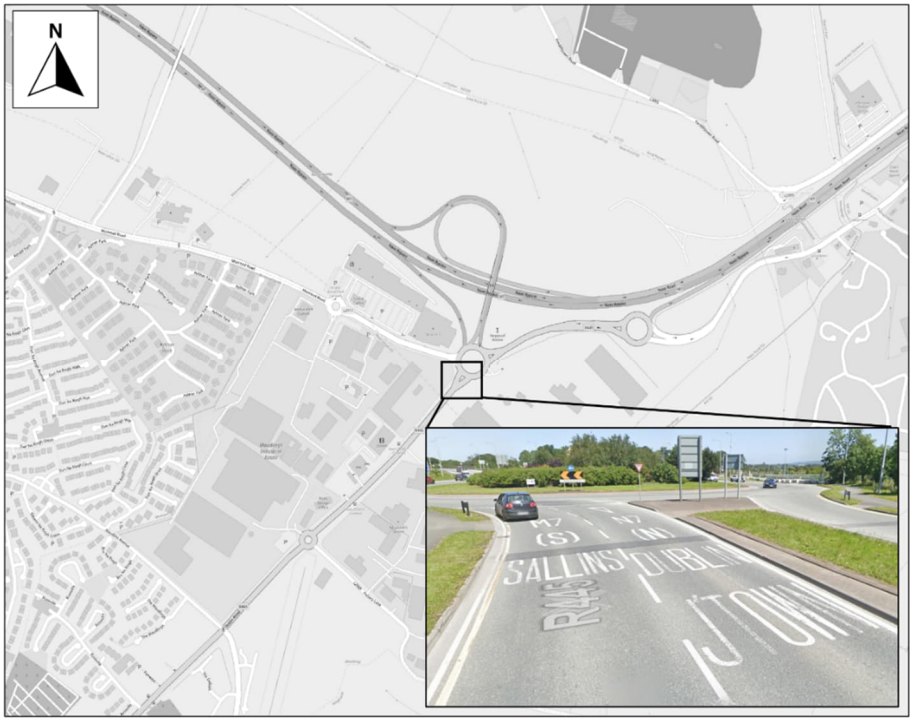


Desired speeds (speed limits) were taken from road traffic sign. The distribution of desired speed in the modelled network is shown in **Figure 2-6.**

Figure 2-6: Desired Speed Distributions of the Modelled Network

The number of lanes was observed across the modelled network. Where there was lane choice (notably at the approach to a junction), road arrows and signage were used to determine which lane a vehicle should be in. **Figure 2-7** provides an example.

Figure 2-7: Lane Choice on the Approach to a Roundabout



Pedestrian crossings were observed at The Gallops / R445 signalised junction to determine the potential movement of pedestrians in the model. **Figure 2-8** Shows where the pedestrian crossing points were observed in the model.

Figure 2-8: Location of Pedestrian Crossings in the Modelled Area

2.6 Existing Junction Capacity

AECOM have completed a Junctions 9 model of the following junctions:

- Junction 1 – R445 Dublin Road Roundabout
- Junction 2 – M7 Junction 9 Off-slip at R445 Roundabout

- Junction 3 – R445 Fishery Lane Roundabout

These models have helped determine the baseline junction capacity.

2.6.1 Junction Analysis

The operational assessment of the local road network has been undertaken using TRL Junctions 9 for non-signalised junctions. When considering priority controlled junctions, a Ratio to Flow Capacity (RFC) of greater than 85% (0.85) would indicate a junction to be approaching capacity, as operation above this RFC value is poor and deteriorates quickly resulting in traffic congestion in the form of longer queues.

Junctions 9 is an industry standard software to model the capacity and queuing of non-signalised junctions (Priority controlled, intersections, roundabouts). The meaning of the acronyms used within the capacity assessment results are discussed below.

- RFC Ratio to Flow Capacity (for non-signalised junctions)
- Q Queue length (PCU's) i.e. 1 PCU equates to a 5.75m long car

It is generally accepted that RFC values of 0.85 (85%) and less are indicators that a junction is operating within capacity. Junctions are only identified as operating over capacity if these values are exceeded.

The models have been completed using the aforementioned traffic surveys to assess the baseline capacity during the inter-peak and evening peak periods at each of the junctions. A summary of the results is shown in Table 2.2 to Table 2.4

Table 2.2: R445 Dublin Road Roundabout Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	R445 (Eastern Arm)	0.6	0.36	0.7	0.40
	Site Access	0.0	0.00	0.0	0.00
	R445 (Southern Arm)	0.5	0.31	0.7	0.38
	Monread Road (Western Arm)	0.6	0.34	0.7	0.37
	N7 Onslip / Offslip (Eastbound)	0.1	0.1	0.1	0.09

Table 2.3: M7 Junction 9 Off-slip at R445 Roundabout Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	Johnstown Road (Eastern Arm)	0.1	0.10	0.1	0.10
	R445 (Western Arm)	0.1	0.10	0.1	0.10
	N7 Off-slip (North Eastern Arm)	0.5	0.30	0.5	0.29

Table 2.4: R445 Fishery Lane Roundabout Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	R445 (Northern Arm)	0.7	0.38	0.7	0.39
	Fishery lane (Eastern Arm)	0.3	0.22	0.4	0.28
	R445 (Southern Arm)	1.0	0.47	1.2	0.53
	Maudlins Industrial Estate (Western Arm)	0.1	0.05	0.1	0.09

Based on the analysis of the roundabouts, it is clear that the existing roundabouts all operate within capacity during the interpeak and evening peak periods.

3. Model Description

A micro-simulation model has been developed using Vissim 2021 Service Pack 11.

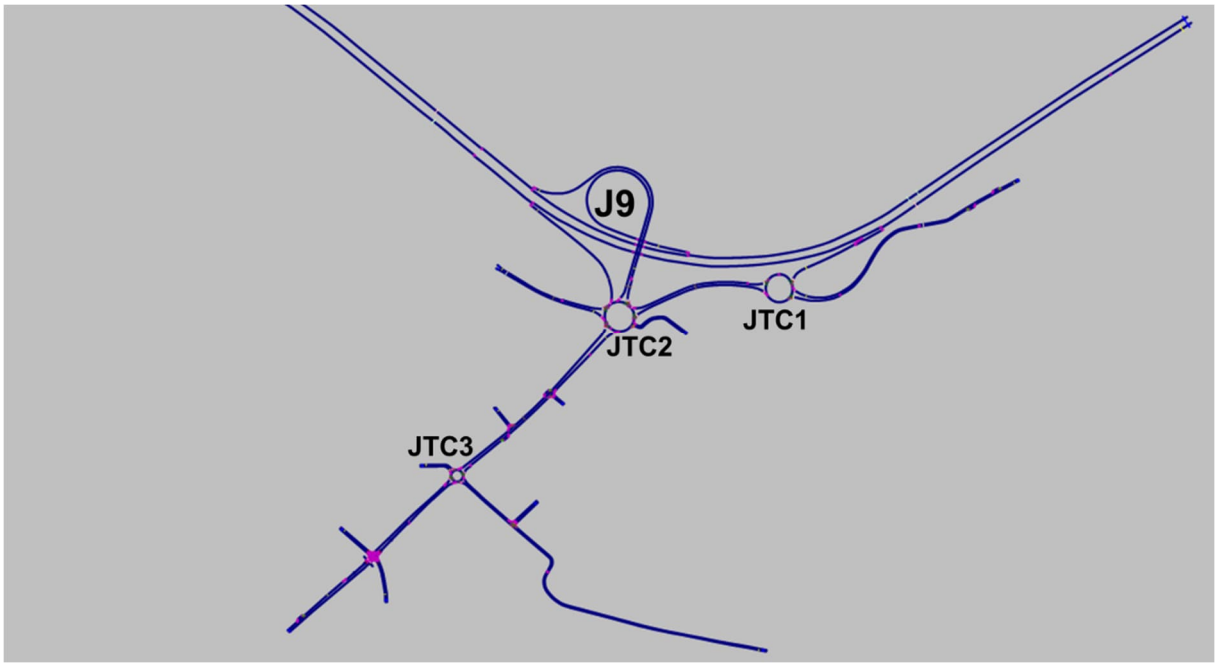
The following sections describe the model in more detail, including:

- Modelled area;
- Network structure;
- Time periods;
- User classes; and
- Traffic assignment methodology.

3.1 Modelled Area

The modelled area in Vissim relates to the area over which significant impacts of interventions are expected. This is also known as the Area of Detailed Modelling. **Figure 3.1** presents the screenshot of the modelled area.

Figure 3.1: Overview of the modelled area



This includes the following junctions and road network sections:

- M7 section around Junction 9
- M7 J9 Off-slip at R445 Roundabout and Johnstown Road
- R445 Dublin Road Roundabout connecting to Monread Road and the M7 Southbound On-slip
- R445 at Fishery Lane Roundabout
- Signalised Junction at Dublin Road / The Gallops / Maudlins Avenue

3.1.1 Justification of Model Coverage

The key to determining the boundaries of this area is to understand the nature and scale of the interventions to be tested using the model. In addition, local knowledge and professional judgement was applied in the definition of the areas.

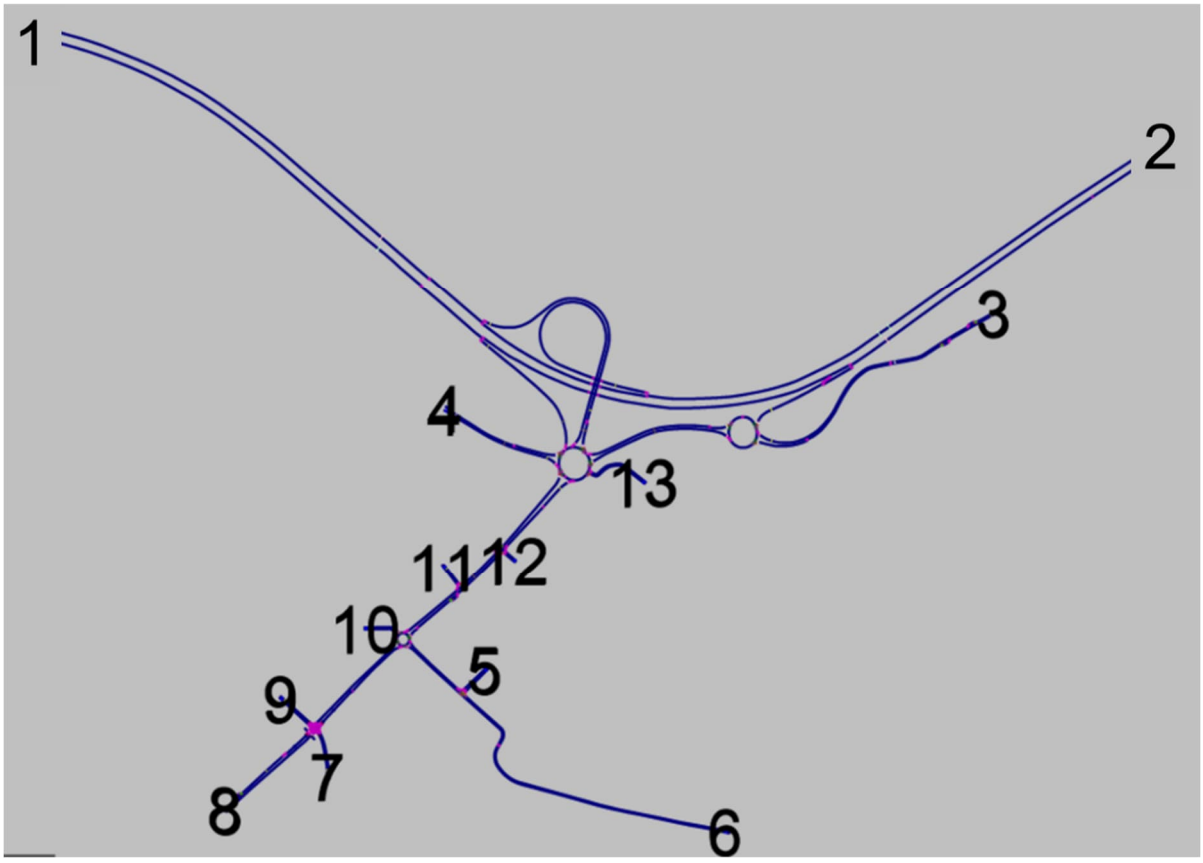
3.2 Network Structure

The network contains 13 zones: the point at which traffic enters and leaves the network via external points. 12 zones are active within the base model, the 13th zone is located at the proposed development site, to be used for development testing. **Table 3.1** and **Figure 3.2** show the zone locations.

Table 3.1: Zone Location Descriptions

Zone Number	Location Description
1	M7 Mainline Northbound
2	M7 Mainline Southbound
3	Johnstown
4	Monread Road
5	Naas Industrial Estate
6	Fishery Lane East
7	The Gallops
8	R445
9	Maudlins Avenue
10	Fishery Lane West
11	ODEAN Cinema Naas
12	Naas Industrial Estate
13	Proposed Development Site

Figure 3.2: Zone plan of the modelled network



3.3 Time Periods

The scope of this project was to develop a PM peak hour model and an average inter-peak hour model. Using the ATC data, the standard weekday PM peak hour is identified as 16:00 to 17:00. JTC data was recorded for a single 12-hour period, Thursday 31 March 2022, therefore the PM peak model is defined at this date.

An average hourly inter-peak model has been developed for an average hour during the inter-peak (between 10:00-16:00) on an average weekday (Tues – Thurs).

3.4 Vehicle Types / Classes

A vehicle type is a vehicle with a defined set of technical driving characteristics e.g. articulated HGV or rigid truck. These can be aggregated into a Class (e.g. HGV). This is used for a number of modelling features in Vissim, such as defining groups of vehicles with speed or acceleration behaviours.

The following vehicle types have been used within the models:

- Cars / LGVs; and
- HGVs.

3.4.1 Vehicle Classes / Vehicle Compositions

Origin and destination trip matrices are given in two compositions, Cars / LVs and HGVs.

Many elements of Vissim traffic control and data collection act on vehicle classes, providing the basis for speed data, evaluations, path selection behaviour and other network objects.

Vehicle composition splits have been taken from the traffic survey data for an average weekday. The proportional split between Car/LV and HGV is presented in **Table 3.2.**

Table 3.2: Vehicle Composition Split

Vehicle	IP % Split	PM % Split
Car / LV	93 %	96 %
HGV	7 %	4 %

3.5 Assignment Methodology – Dynamic Assignment

The model has been built using a dynamic (matrix-based) assignment in which vehicles choose their route through the network based on their interactions with the available road capacity.

3.5.1 Time Slices

In dynamic assignment, as opposed to static assignment process, traffic demand and infrastructure are not assumed to be constant over time. Therefore, the use of time slices has been taken into consideration for modelling the effects of varying traffic through the time period. These have been set to 15-minute time slices or evaluation intervals.

Costs are calculated for all possible paths (edges) within the network and each time interval.

3.6 Running the Model

Vissim is a microsimulation package in which individual runs of any given model, with no changes, will generate the same results. Multiple runs of the model with varying random seeds are required, and an average taken from across these runs. The average of 5 randomly seeded model runs generates the modelled data used in the calibration and validation processes. This ensures that the volume of data and analyses required is manageable whilst ensuring that the data reflects variation in the model runs.

The spread of results was checked to ensure there were no outliers.

4. Network Development

The basic element of a road network in Vissim is the link which can be defined as a unidirectional representation of a section of highway.

In addition, several elements are needed to model the flow/speed and flow/delay relationships at both link and junction levels.

4.1 Link and Connector Structure

For the flowing of traffic through the network, Vissim makes use of connectors for joining the highway links; in this way, the road network can be built.

A total of 71 links and 94 connectors have been used for replicating the existing layout.

4.2 Lane Change and Emergency Stop Distances

Lane change distance is the distance before the connector from which those vehicles, whose route or path leads across this connector, try to choose the lane in which they reach the connector without changing lanes[2].

The default value of 200 metres has been modified in 10 locations:

- R445 / Monread Rd - N7 J9 exit link from roundabout (25m);
- R445 / Monread Rd – EB exit to Johnstown (30m);
- Access to proposed development site (60m);
- R445 / Monread Rd – NB approach from Dublin Rd (440m)
- N7 J9 EB off-slip and mainline (850m)
- N7 J9 WB off-slip and mainline (850m)

These modifications have been made either due to the close proximity of vehicle movements, requiring a delayed lane change decision, or where signage enable an advanced lane change. All other lane changes remain unchanged.

Emergency stop distances have been kept to a default value of 5 metres.

4.3 Lane Restrictions

No lane restrictions were observed within the model area. Lane restriction have only been included within the model to limit bus stops to bus only.

4.4 Driving Behaviours

Two driving behaviours are used to model differing driving behaviours for each link. Two driving behaviours have been used within the model. They have been assigned to links and connectors across the modelled network based on the individual characteristics of the road section to be represented. These are:

- Freeway (Free Lane Selection); and
- Urban (Motorized)

4.4.1 Car-Following Model and Parameters Used

Two car-following models are available in Vissim: Wiedemann 74 and Wiedemann 99. These have been used for developing the available range of driving behaviours in the model.

The parameters used within the driving behaviours are summarised below in **Table 4.1**.

[2] PTV Vissim User Manual

Table 4.1: Driving Behaviours – Summary on Parameters Used

Parameter	Urban (Motorised)	Freeway (Free Lane Selection)
Obsrvdvehs	2	2
Standdistisfix	2.25	0.5
Standdist	1	1.5
Carfollowmodtype	W74	W99
W74bxadd	1	2
W74bxmult	1	3
Lnchgrule	Free Lane	Free Lane
Advmerg	0	1
Deslatpos	Middle	Middle
Ovtldef	0	0
Ovtrdef	0	0
Latdistdrivdef	1	1
Latdiststanddef	0.2	0.2
Cooplnchg	0	0

4.5 Speed Control

Speed control measures are required where vehicles move between different mandatory speed limits and whenever on-street road geometry causes drivers to decelerate as this is not directly captured within the car-following model.

Desired Speed Decisions (DSD) have been included in line with road speed limits and Reduced Speed Areas (RSA) have been assigned where required, as shown in **Figure 4.1**. Reduced Speed Areas (RSAs) have been used to address the following:

- To slow vehicles down before they reach a non-signalised junction to replicate the deceleration of vehicles stopping and waiting for their right of way.
- To replicate speeds dictated by geometry, such as on tight and wide bends.
- To replicate congestion outside of the modelled network.

Figure 4.1: Distribution of RSAs in the Modelled Network

5. OD Matrix Development

An OD matrix has been developed for 15-minute segments of each modelled hour.

5.1 Zoning System

The Vissim model is built using a dynamic demand assignment in which vehicles choose their route through the network based on calculated 'cost paths'. A dynamic assignment was chosen because of data availability and the suitability for updating a dynamic model to include the proposed development options.

The zoning system, on which dynamic assignments are based, provides a series of vehicular entry and exit points on the network. The inter-zonal movements, which are generated by the assignment process, provide a representation of the vehicle paths between the origins and destinations in the model network.

The zoning system for the Vissim model is shown in **Figure 3.2.**

5.2 Matrix Development

Each 15-minute segment matrix was developed using the JTC data, April 2022. The trip end total was calculated using the data and where data was available turning proportions where assigned. For movements where JTC data was not available a cordoned version of the Naas/Sallins Transport Strategy VISUM model developed by AECOM, 2018 was used to provide the proportion splits. All trip ends were fixed to JTC data.

There was variation between the JTC and ATC data recorded the same time period and day at corresponding locations. A higher level of confidence was placed in the ATC data totals, therefore all JTC data was factored to the ATC totals for the corresponding time for sites directly comparative.

The matrices then underwent a furnessing process to align the trip end totals with the turn proportions.

The PM hour was calculated in 4 separate 15-min segments to provide a higher level of detail. As the IP hour is an average, an hourly total was calculated.

5.3 Demand Totals

The matrix totals for each time segment assigned within the model are provided within **Table 5.1**.

Table 5.1. Assigned Demand Totals

Level	M1 (Car / LV)	M2 (HGV)	Total
PM 16:00-16:15	1570	25	1595
PM 16:15-16:30	1600	24	1624
PM 16:30-16:45	1617	19	1636
PM 16:45-16:45	1640	33	1673
IP Interval 1 - 4	1518	36	1554

6. Model Standards

It is important to clearly define calibration and validation.

Calibration describes the process of placing verifiable data into a traffic model to replicate observed street conditions. Calibration may require the adjustment of model parameters to recreate observed conditions.

Validation is the process of comparing model output against independently measured data that was not used during the calibration process.

Generally, microsimulation models use traffic count data for calibration and Journey times / queue lengths for validation.

The differences between modelled and observed data should be quantified and then assessed using specific criteria.

The purpose of validation is to verify that a model has been correctly calibrated and is therefore capable of producing valid predictions for proposed scenarios.

6.1 Link / Turning Movement Calibration

For link flow calibration, the measures used are:

- The absolute and percentage differences between modelled flows and counts; and
- The GEH statistic, which is a form of the Chi-squared statistic that incorporates both relative and absolute differences, and is defined as follows:

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

where M is the modelled flow and C is the observed flow.

6.2 Journey Time Validation

For journey time validation, a maximum difference of within 15% has been used.

6.3 Convergence Criteria

Before the results of any traffic model are used to influence decisions, the stability (or degree of convergence) of the model must be confirmed at the appropriate level. The importance of achieving convergence, at an appropriate level, is related to the need to provide stable, consistent and robust model results.

Table 6.1: Convergence Criteria

Criteria 1 Journey Time	Criteria 2 Turning Volume
15% of all journeys within 95%	15% of all turns within 95% vehicles

7. Model Convergence

As the Vissim model has been run using the Dynamic Assignment module, in which a series of iterated simulations are used to determine the route of a vehicle through the network based on a total travel cost, there is a need to assess the convergence of the model. This is required to establish a point where the travel times and volumes do not change significantly from one iteration to the next, enabling the model to be deemed stable and results to be analysed in confidence.

7.1 Convergence Results

The PM and IP models were initially run using a random seed and assigning travel demand matrices in batch mode. This was done to establish the initial costs (BEW files) and paths (WEG files) within the network.

An incremental vehicle volume loading approach has been used to identify all the suitable paths and a reasonable level of volume on those routes prior to convergence. The simulation started with only 50% of the total O-D demand which was gradually increased by a 10% step each run until reaching 100%.

Using the path and cost files from the previous process, a batch run of each model was then undertaken, using a single seed and running the model until the criteria stated above in section 6.3 were fulfilled. For each of the simulation runs, a cost file, a Network Performance Evaluation (NPE) file and a Convergence Evaluation (CVA) file were output. The tables below identify the convergence results.

For the Maudlins traffic model the following criterion was used to converge the model:

Table 7.1: Convergence Criteria and Summary

Peak	Criteria 1 Journey Time	Criteria 2 Turning Volume	Iteration	Volume (%) Results	Travel Time (%) Results
PM	15% of all journeys within 95%	15% of all turns within 95% vehicles	10	95%	95%
IP	15% of all journeys within 95%	15% of all turns within 95% vehicles	20	95%	95%

8. Calibration and Validation

In addition to evidence of network and route choice validation, evidence of the validation of the assignment has been included in the following primary terms:

- Data Collection Points;
- Journey Time Routes;
- Queue Lengths; and
- Node Evaluation

The following section includes calibration and validation summaries.

8.1 Flow Calibration

The below comparison is between the modelled flow and observed flows in the model.

Table 8.1: Calibration

	Differences		Criteria Fulfilled?	
Peak	**<5GEH Criteria**	**Individual Flow criteria**	**Both?**	**>85%?**
PM	100 %	Y	Y	Y
IP	100 %	Y	Y	Y

Calibration has been achieved for all counts during both the PM peak and IP periods. A summary is shown in **Table 8.2** and

Table 8.3. Please refer to **Appendix C** for more detail.

Table 8.2: Model Calibration of the PM

PM 16:00-17:00	Location	Survey	Model-Survey (Diff)	GEH
ATC1_NB	Dublin Road - Maudlins House Hotel	939	0	0.0
ATC1_SB	Dublin Road - Maudlins House Hotel	838	114	3.8
ATC2_EB	Monread Rd	668	63	2.4
ATC2_WB	Monread Rd	657	93	3.5
ATC3_NB	N7 SB On-slip	520	1	0.0
ATC4_NB	N7 NB On/Off-Slip	644	2	0.1
ATC4_SB	N7 NB On/Off-Slip	192	9	0.6
ATC5_NB	R445	211	-3	0.2
ATC5_SB	R445	993	-28	0.9

Table 8.3: Model Calibration of the IP

IP Avg Hour	Location	Survey	Model-Survey (Diff)	GEH
ATC1_NB	Dublin Road - Maudlins House Hotel	634	22	0.9
ATC1_SB	Dublin Road - Maudlins House Hotel	696	31	1.1
ATC2_EB	Monread Rd	590	34	1.4
ATC2_WB	Monread Rd	552	46	1.9
ATC3_NB	N7 SB On-slip	227	8	0.6
ATC4_NB	N7 NB On/Off-Slip	497	25	1.1
ATC4_SB	N7 NB On/Off-Slip	181	39	2.7
ATC5_NB	R445	155	10	0.8
ATC5_SB	R445	732	16	0.6

8.2 Journey Time Validation

In total 14 journey time routes have been assessed to ensure appropriate levels of delay are achieved, a summary of the JT routes is provided in **Table 7.1. Table 8.4** and **Table 8.5** provide a summary of the journey time validation.

Table 8.4: Journey Time Validation PM

JT Path	Route	Observed Time	Modelled Time	% Diff
1-2	Dublin Road NB	0:01:20	0:01:30	13%
2-1	Dublin Road SB	0:01:20	0:01:23	4%
2-3	Monread Rd WB	0:00:23	0:00:24	1%
3-2	Monread Rd EB	0:00:26	0:00:25	2%
2-4	R445 EB	0:00:26	0:00:26	1%
4-2	R445 WB	0:00:26	0:00:28	10%
4-5	Johnstown Rd EB	0:00:33	0:00:35	5%
5-4	Johnstown Rd WB	0:00:36	0:00:33	8%
2-6	J9 WB on-slip	0:00:32	0:00:34	9%
7-2	J9 EB off-slip	0:00:55	0:01:00	8%
2-9	J9 EB on-slip	0:01:16	0:01:08	11%
8-6	N7 J9 WB	0:00:46	0:00:38	18%
7-9	N7 J9 EB	0:00:43	0:00:40	6%
8-4	J9 WB off-slip	0:00:14	0:00:15	8%

Table 8.5: Journey Time Validation IP

JT Path	Route	Observed Time	Modelled Time	% Diff
1-2	Dublin Road NB	0:01:15	0:01:12	4%
2-1	Dublin Road SB	0:01:16	0:01:22	8%
2-3	Monread Rd WB	0:00:25	0:00:23	9%
3-2	Monread Rd EB	0:00:27	0:00:22	17%
2-4	R445 EB	0:00:24	0:00:25	4%
4-2	R445 WB	0:00:26	0:00:27	3%
4-5	Johnstown Rd EB	0:00:32	0:00:34	7%
5-4	Johnstown Rd WB	0:00:37	0:00:32	13%
2-6	J9 WB on-slip	0:00:33	0:00:33	2%
7-2	J9 EB off-slip	0:00:55	0:01:00	8%
2-9	J9 EB on-slip	0:01:15	0:01:08	10%
8-6	N7 J9 WB	0:00:45	0:00:37	17%
7-9	N7 J9 EB	0:00:43	0:00:41	5%
8-4	J9 WB off-slip	0:00:14	0:00:14	5%

For PM model, 13 of 14 routes fall within 15%. The N7 mainline westbound is slightly fast however this does not directly impact the study area. For the IP model 12 of 14 routes are within 15% of observed with again the N7 mainline westbound slightly fast and Monread Road eastbound slightly fast. As all journey time segments are within 20% of observed and within 10 seconds of observed.

Figure 8.1 and **Figure 8.2** display the journey time validation of observed verse modelled times by segment for each model period.

Figure 8.1: Journey Time Validation for the PM

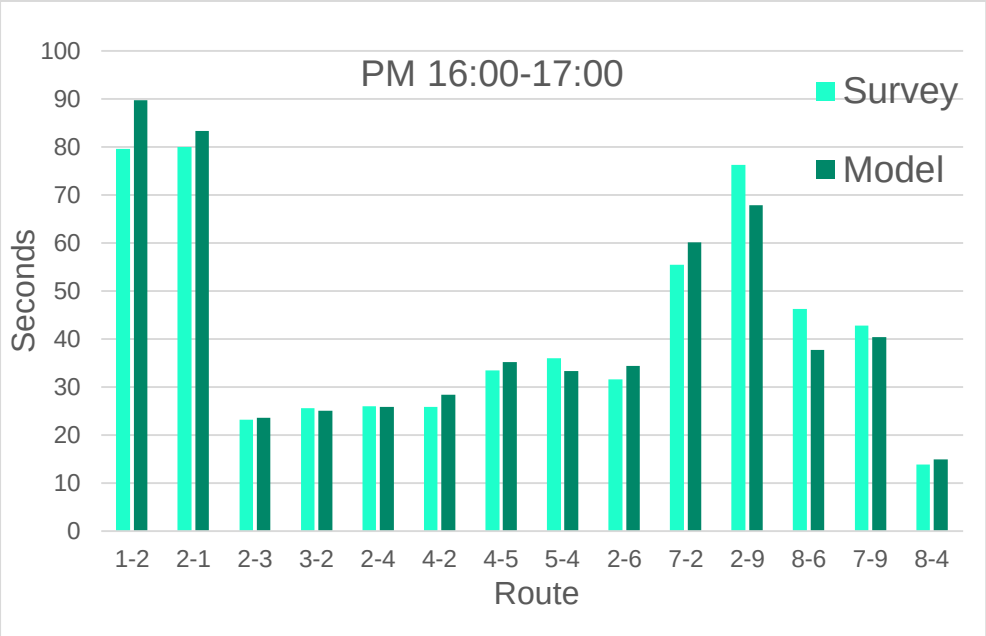
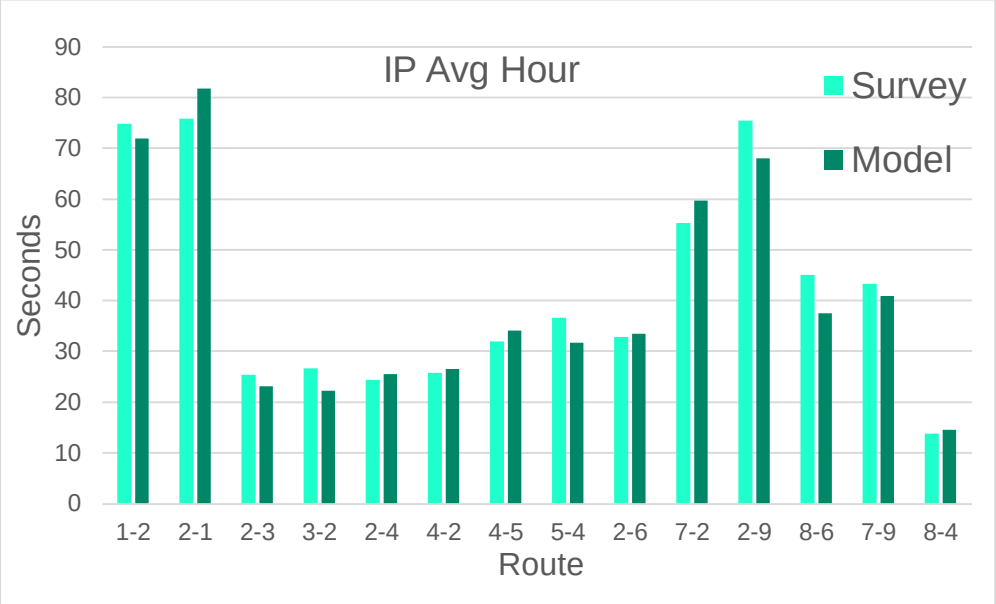


Figure 8.2: Journey Time Validation for the IP



9. Summary and Conclusions

9.1 Base Model Development Summary

A micro-simulation Vissim model of the M7 Junction 9 (Maudlins) and adjoining local road network has been developed. A PM model models the midweek PM peak hour, 16:00 – 17:00, with an average midweek IP hour modelled also.

The base model has been newly developed by AECOM for the purpose of this study in June 2022.

In terms of Calibration and Validation, the model is deemed acceptable and replicates the existing operational performance of vehicular traffic at the M7 Junction 9 (Maudlins) and the surrounding local road network.

9.2 Assessment of Fitness for Purpose

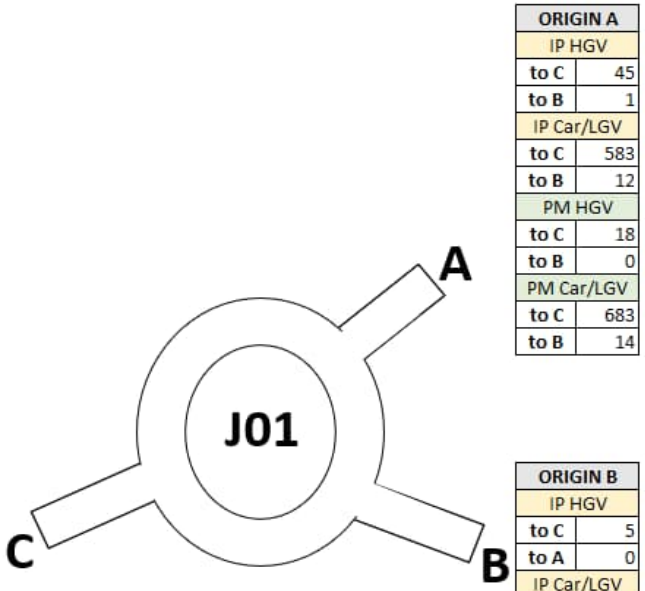
Taking the achieved validation levels into account, it is considered that the model is fit for the following purposes:

- Identification and quantification of existing issues
- Assessment of future issues
- Assessment of the construction and operational traffic impact on the highway network
- Scheme design
- Planning and development control.

Appendix A - Traffic Survey Data

A.1 JTC Data

JTC Data at J01

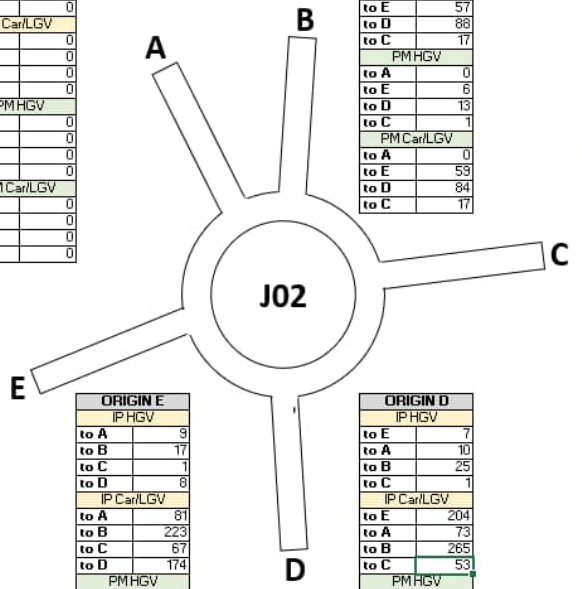


ORIGIN A	
IP HGV	
to C	45
to B	1
IP Car/LGV	
to C	583
to B	12
PM HGV	
to C	18
to B	0
PM Car/LGV	
to C	683
to B	14

ORIGIN B	
IP HGV	
to C	5
to A	0
IP Car/LGV	
to C	149
to A	0
PM HGV	
to C	3
to A	0
PM Car/LGV	
to C	174
to A	0

ORIGIN C	
IP HGV	
to A	0
to B	5
IP Car/LGV	
to A	0
to B	123
PM HGV	
to A	0
to B	1
PM Car/LGV	
to A	0
to B	135

JTC Data at J02



ORIGIN A	
IP HGV	
to E	0
to D	0
to C	0
to B	0
IP Car/LGV	
to E	0
to D	0
to C	0
to B	0
PM HGV	
to E	0
to D	0
to C	0
to B	0
PM Car/LGV	
to E	0
to D	0
to C	0
to B	0

ORIGIN B	
IP HGV	
to A	0
to E	8
to D	9
to C	1
IP Car/LGV	
to A	4
to E	57
to D	88
to C	17
PM HGV	
to A	0
to E	6
to D	13
to C	1
PM Car/LGV	
to A	0
to E	59
to D	84
to C	17

ORIGIN C	
IP HGV	
to B	1
to A	2
to E	15
to D	30
IP Car/LGV	
to B	3
to A	17
to E	212
to D	335
PM HGV	
to B	0
to A	3
to E	7
to D	14
PM Car/LGV	
to B	10
to A	35
to E	335
to D	424

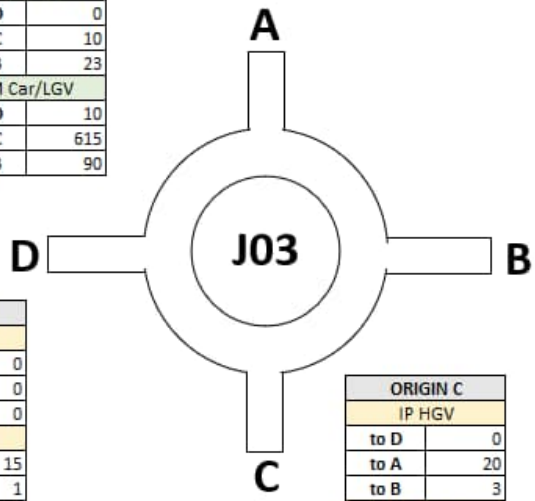
ORIGIN E	
IP HGV	
to A	9
to B	17
to C	1
to D	8
IP Car/LGV	
to A	81
to B	223
to C	67
to D	174
PM HGV	
to A	8
to B	10
to C	1
to D	8
PM Car/LGV	
to A	150
to B	245
to C	77
to D	207

ORIGIN D	
IP HGV	
to E	7
to A	10
to B	25
to C	1
IP Car/LGV	
to E	204
to A	73
to B	265
to C	53
PM HGV	
to E	4
to A	14
to B	10
to C	0
PM Car/LGV	
to E	212
to A	177
to B	355
to C	49

JTC Data at J03

ORIGIN A	
IP HGV	
to D	0
to C	22
to B	24
IP Car/LGV	
to D	10
to C	526
to B	98
PM HGV	
to D	0
to C	10
to B	23
PM Car/LGV	
to D	10
to C	615
to B	90

ORIGIN B	
IP HGV	
to A	22
to D	0
to C	4
IP Car/LGV	
to A	98
to D	1
to C	45
PM HGV	
to A	22
to D	0
to C	1
PM Car/LGV	
to A	146
to D	0
to C	74



ORIGIN D	
IP HGV	
to A	0
to B	0
to C	0
IP Car/LGV	
to A	15
to B	1
to C	6
PM HGV	
to A	0
to B	0
to C	0
PM Car/LGV	
to A	39
to B	4
to C	9

ORIGIN C	
IP HGV	
to D	0
to A	20
to B	3
IP Car/LGV	
to D	8
to A	476
to B	32
PM HGV	
to D	0
to A	7
to B	1
PM Car/LGV	
to D	4
to A	579
to B	37

A.2 ATC Data – Hourly Totals PM and IP

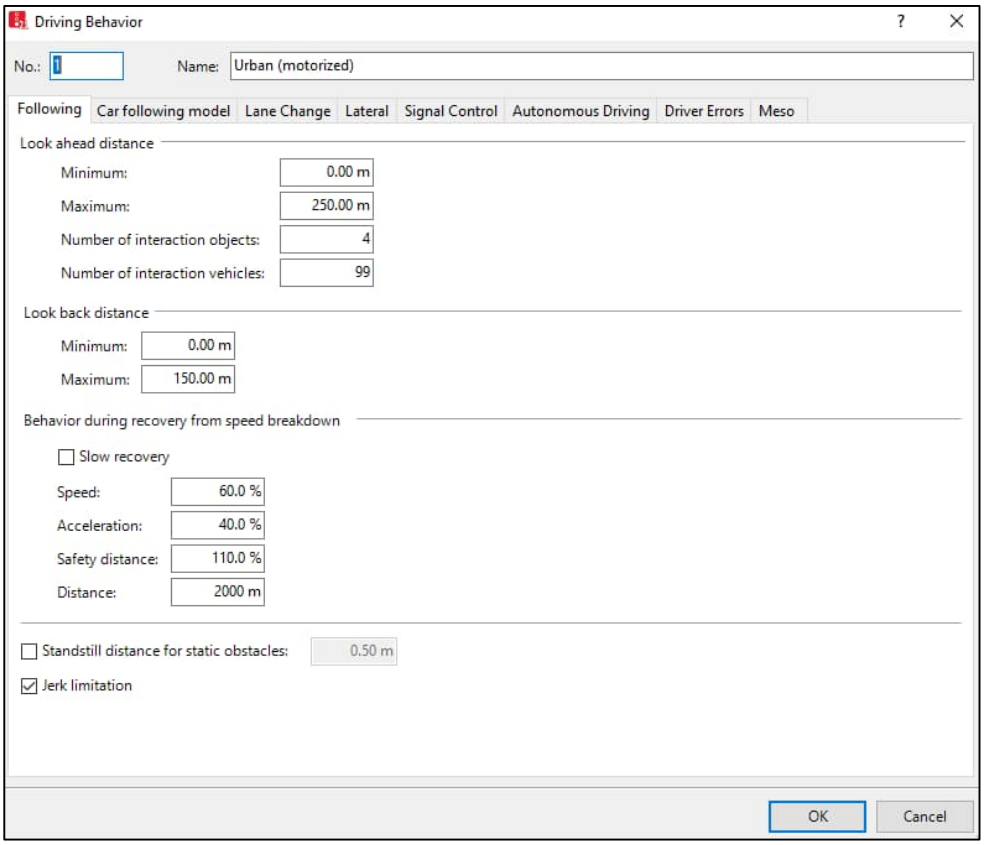
ATC Site Ref	IP hourly average (10:00-16:00)	PM Hourly Average (16:00-17:00)
ATC1 Northbound	634	786
ATC1 Southbound	696	858
ATC2 Westbound	590	669
ATC2 Eastbound	552	658
ATC3 Northbound	227	447
ATC3 Southbound	Single direction slip road	
ATC4 Northbound	497	581
ATC4 Southbound	181	180
ATC5 Eastbound	155	185
ATC5 Westbound	732	1017

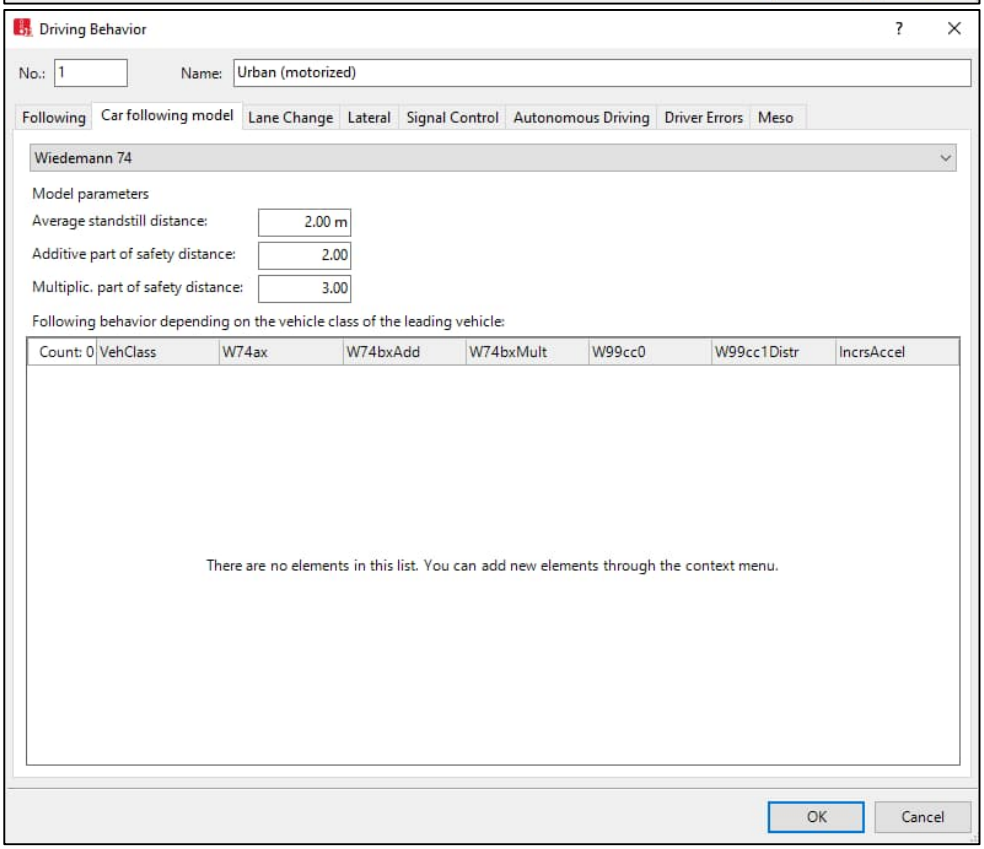
A.3 ATC Data – 15 Minute Interval Data (PM)

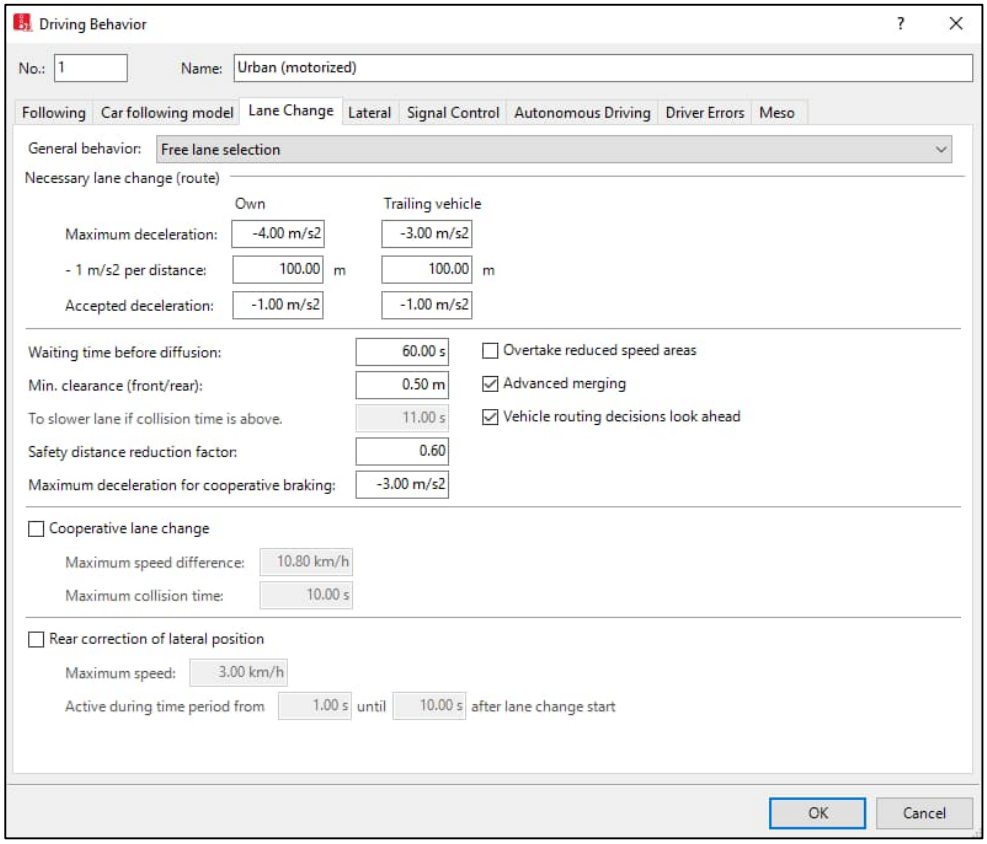
ATC Site Ref	16:00-16:15	16:15-16:30	16:30-16:45	16:45-17:00
ATC1 Northbound	225	179	201	155
ATC1 Southbound	206	207	211	211
ATC2 Westbound	169	170	162	152
ATC2 Eastbound	175	157	166	138
ATC3 Northbound	131	97	117	83
ATC3 Southbound	Single direction slip road			
ATC4 Northbound	153	132	151	120
ATC4 Southbound	41	43	45	43
ATC5 Eastbound	45	41	48	48
ATC5 Westbound	240	245	248	254

Appendix B - Driving Behaviour Parameters

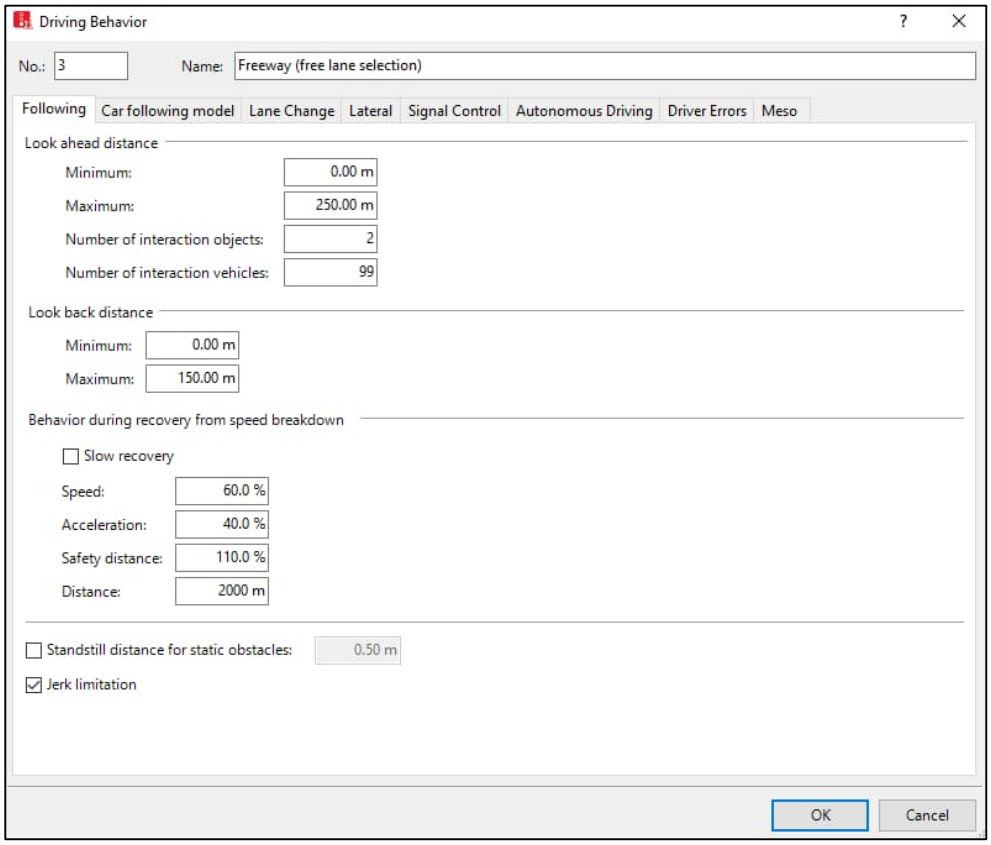
B.1 - Urban (Motorized)

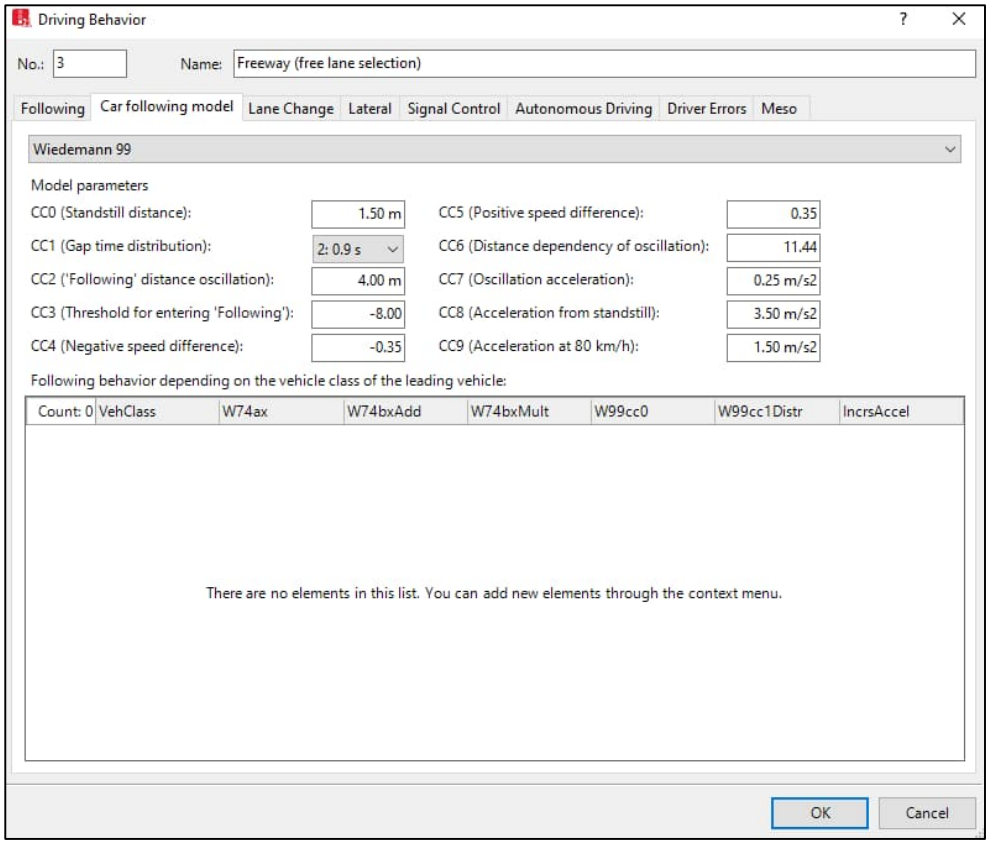


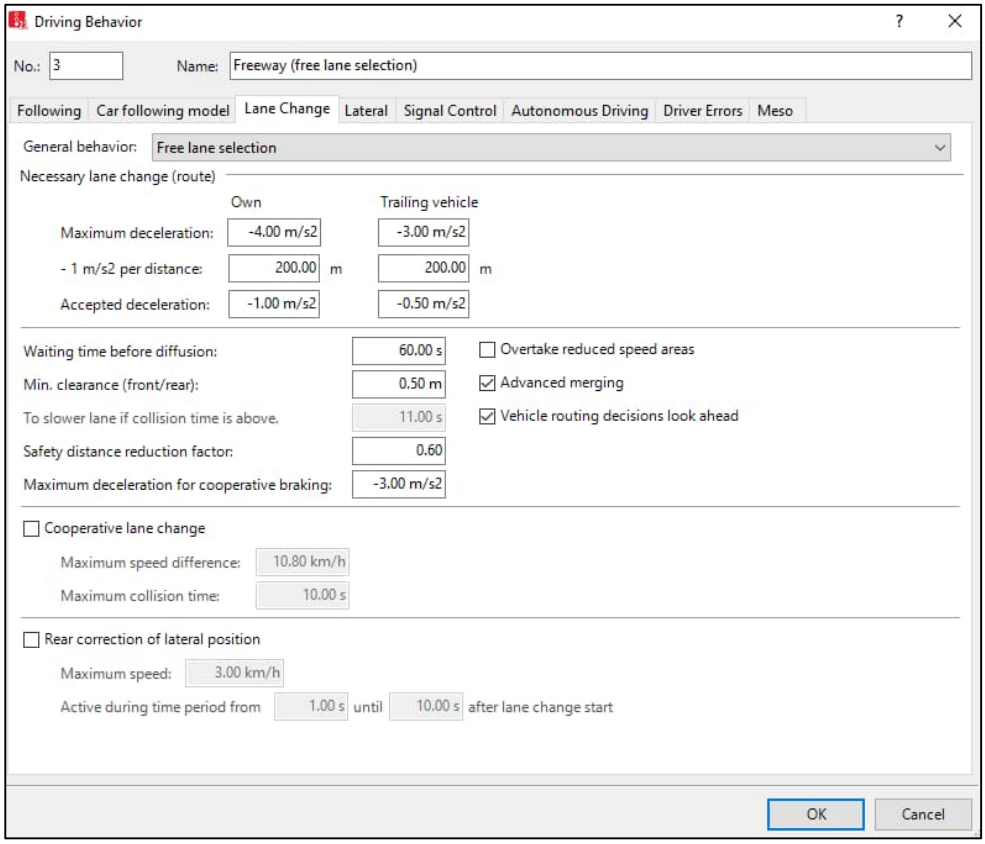



Driving Behavior
No.: 1
Name: Urban (motorized)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
General behavior: Free lane selection
Necessary lane change (route)
Own
Trailing vehicle
Maximum deceleration: -4.00 m/s2 -3.00 m/s2
- 1 m/s2 per distance: 100.00 m 100.00 m
Accepted deceleration: -1.00 m/s2 -1.00 m/s2
Waiting time before diffusion: 60.00 s
Min. clearance (front/rear): 0.50 m
To slower lane if collision time is above: 11.00 s
Safety distance reduction factor: 0.60
Maximum deceleration for cooperative braking: -3.00 m/s2
Overtake reduced speed areas
Advanced merging
Vehicle routing decisions look ahead
Cooperative lane change
Maximum speed difference: 10.80 km/h
Maximum collision time: 10.00 s
Rear correction of lateral position
Maximum speed: 3.00 km/h
Active during time period from 1.00 s until 10.00 s after lane change start
OK
Cancel

B.2 Freeway (Free Lane Selection)






Driving Behavior
No.: 3
Name: Freeway (free lane selection)
Following
Car following model
Lane Change
Lateral
Signal Control
Autonomous Driving
Driver Errors
Meso
General behavior: Free lane selection
Necessary lane change (route)
Own
Trailing vehicle
Maximum deceleration: -4.00 m/s2 -3.00 m/s2
- 1 m/s2 per distance: 200.00 m 200.00 m
Accepted deceleration: -1.00 m/s2 -0.50 m/s2
Waiting time before diffusion: 60.00 s
Min. clearance (front/rear): 0.50 m
To slower lane if collision time is above: 11.00 s
Safety distance reduction factor: 0.60
Maximum deceleration for cooperative braking: -3.00 m/s2
Overtake reduced speed areas
Advanced merging
Vehicle routing decisions look ahead
Cooperative lane change
Maximum speed difference: 10.80 km/h
Maximum collision time: 10.00 s
Rear correction of lateral position
Maximum speed: 3.00 km/h
Active during time period from 1.00 s until 10.00 s after lane change start
OK
Cancel

Appendix C - Model Calibration

C.1 PM Calibration Counts – 15 min intervals

	Location	16:00 - 16:15					
		Observed PM	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
ATC1_NB	Dublin Road - Maudlins House Hotel	249	210	-39	-16%	2.6	Pass
ATC1_SB	Dublin Road - Maudlins House Hotel	198	218	20	10%	1.4	Pass
ATC2_WB	Monread Rd	164	160	-4	-2%	0.3	Pass
ATC2_EB	Monread Rd	191	216	25	13%	1.8	Pass
ATC3_NB	N7 SB On-slip	143	134	-9	-6%	0.8	Pass
ATC4_NB	N7 NB On/Off-Slip	165	158	-7	-4%	0.6	Pass
ATC4_SB	N7 NB On/Off-Slip	38	40	2	5%	0.3	Pass
ATC5_NB	R445	46	45	-1	-2%	0.1	Pass
ATC5_SB	R445	216	219	3	1%	0.2	Pass

	Location	16:15 - 16:30					
		Observed PM	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
ATC1_NB	Dublin Road - Maudlins House Hotel	237	226	-11	-5%	0.7	Pass
ATC1_SB	Dublin Road - Maudlins House Hotel	197	239	42	21%	2.8	Pass
ATC2_WB	Monread Rd	163	160	-3	-2%	0.2	Pass
ATC2_EB	Monread Rd	165	211	46	28%	3.4	Pass
ATC3_NB	N7 SB On-slip	112	126	14	13%	1.3	Pass
ATC4_NB	N7 NB On/Off-Slip	178	195	17	10%	1.2	Pass
ATC4_SB	N7 NB On/Off-Slip	43	46	3	7%	0.4	Pass
ATC5_NB	R445	47	52	5	11%	0.7	Pass
ATC5_SB	R445	235	224	-11	-5%	0.7	Pass

	Location	16:30 - 16:45					
		Observed PM	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
ATC1_NB	Dublin Road - Maudlins House Hotel	246	252	6	2%	0.4	Pass
ATC1_SB	Dublin Road - Maudlins House Hotel	217	219	2	1%	0.1	Pass
ATC2_WB	Monread Rd	157	189	32	20%	2.4	Pass
ATC2_EB	Monread Rd	154	156	2	1%	0.2	Pass
ATC3_NB	N7 SB On-slip	146	138	-8	-5%	0.7	Pass
ATC4_NB	N7 NB On/Off-Slip	164	149	-15	-9%	1.2	Pass
ATC4_SB	N7 NB On/Off-Slip	50	51	1	2%	0.1	Pass
ATC5_NB	R445	52	43	-9	-17%	1.3	Pass
ATC5_SB	R445	254	258	4	2%	0.3	Pass

	Location	16:45 - 17:00					
		Observed PM	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
ATC1_NB	Dublin Road - Maudlins House Hotel	207	251	44	21%	2.9	**Pass**
ATC1_SB	Dublin Road - Maudlins House Hotel	226	276	50	22%	3.2	**Pass**
ATC2_WB	Monread Rd	184	222	38	21%	2.7	**Pass**
ATC2_EB	Monread Rd	147	167	20	14%	1.6	**Pass**
ATC3_NB	N7 SB On-slip	119	123	4	3%	0.4	**Pass**
ATC4_NB	N7 NB On/Off-Slip	137	144	7	5%	0.6	**Pass**
ATC4_SB	N7 NB On/Off-Slip	61	64	3	5%	0.4	**Pass**
ATC5_NB	R445	66	68	2	3%	0.2	**Pass**
ATC5_SB	R445	288	264	-24	-8%	1.4	**Pass**

C.2 IP Calibration Counts – 15 min intervals

	Location	15-min Interval 1									
		Observed PM	Modelled PM	Diff	Diff (%)	GEH	GEH Pass	Combine Performance	Flow < 700. diff <100 veh	Flow >=700 <=2700	Flow>2700 diff<400 veh
ATC1_NB	Dublin Road - Maudlins House Hotel	159	165	6	4%	0.5	Pass	PASS	Pass	N/A	N/A
ATC1_SB	Dublin Road - Maudlins House Hotel	174	179	5	3%	0.4	Pass	PASS	Pass	N/A	N/A
ATC2_WB	Monread Rd	147	153	6	4%	0.5	Pass	PASS	Pass	N/A	N/A
ATC2_EB	Monread Rd	138	150	12	9%	1.0	Pass	PASS	Pass	N/A	N/A
ATC3_NB	N7 SB On-slip	57	59	2	4%	0.3	Pass	PASS	Pass	N/A	N/A
ATC4_NB	N7 NB On/Off-Slip	124	133	9	7%	0.8	Pass	PASS	Pass	N/A	N/A
ATC4_SB	N7 NB On/Off-Slip	45	54	9	19%	1.2	Pass	PASS	Pass	N/A	N/A
ATC5_NB	R445	39	43	4	11%	0.6	Pass	PASS	Pass	N/A	N/A
ATC5_SB	R445	183	185	2	1%	0.1	Pass	PASS	Pass	N/A	N/A

	Location	15-min Interval 2									
		Observed PM	Modelled PM	Diff	Diff (%)	GEH	GEH Pass	Combine Performance	Flow < 700. diff <100 veh	Flow >=700 <=2700	Flow>2700 diff<400 veh
ATC1_NB	Dublin Road - Maudlins House Hotel	159	166	7	5%	0.6	Pass	PASS	Pass	N/A	N/A
ATC1_SB	Dublin Road - Maudlins House Hotel	174	183	9	5%	0.7	Pass	PASS	Pass	N/A	N/A
ATC2_WB	Monread Rd	147	158	11	7%	0.9	Pass	PASS	Pass	N/A	N/A
ATC2_EB	Monread Rd	138	149	11	8%	0.9	Pass	PASS	Pass	N/A	N/A
ATC3_NB	N7 SB On-slip	57	59	2	4%	0.3	Pass	PASS	Pass	N/A	N/A
ATC4_NB	N7 NB On/Off-Slip	124	129	5	4%	0.4	Pass	PASS	Pass	N/A	N/A
ATC4_SB	N7 NB On/Off-Slip	45	56	11	23%	1.5	Pass	PASS	Pass	N/A	N/A
ATC5_NB	R445	39	41	2	6%	0.3	Pass	PASS	Pass	N/A	N/A
ATC5_SB	R445	183	185	2	1%	0.1	Pass	PASS	Pass	N/A	N/A

	Location	15-min Interval 3									
		Observed PM	Modelled PM	Diff	Diff (%)	GEH	GEH Pass	Combine Performance	Flow < 700. diff <100 veh	Flow >=700 <=2700	Flow>2700 diff<400 veh
ATC1_NB	Dublin Road - Maudlins House Hotel	159	161	2	2%	0.2	Pass	PASS	Pass	N/A	N/A
ATC1_SB	Dublin Road - Maudlins House Hotel	174	185	11	6%	0.8	Pass	PASS	Pass	N/A	N/A
ATC2_WB	Monread Rd	147	160	13	9%	1.0	Pass	PASS	Pass	N/A	N/A
ATC2_EB	Monread Rd	138	150	12	9%	1.0	Pass	PASS	Pass	N/A	N/A
ATC3_NB	N7 SB On-slip	57	57	0	1%	0.0	Pass	PASS	Pass	N/A	N/A
ATC4_NB	N7 NB On/Off-Slip	124	130	6	5%	0.5	Pass	PASS	Pass	N/A	N/A
ATC4_SB	N7 NB On/Off-Slip	45	55	10	21%	1.4	Pass	PASS	Pass	N/A	N/A
ATC5_NB	R445	39	40	1	3%	0.2	Pass	PASS	Pass	N/A	N/A
ATC5_SB	R445	183	194	11	6%	0.8	Pass	PASS	Pass	N/A	N/A

	Location	15-min Interval 4									
		Observed PM	Modelled PM	Diff	Diff (%)	GEH	GEH Pass	Combine Performance	Flow < 700. diff <100 veh	Flow >=700 <=2700	Flow>2700 diff<400 veh
ATC1_NB	Dublin Road - Maudlins House Hotel	159	164	5	3%	0.4	Pass	PASS	Pass	N/A	N/A
ATC1_SB	Dublin Road - Maudlins House Hotel	174	180	6	3%	0.4	Pass	PASS	Pass	N/A	N/A
ATC2_WB	Monread Rd	147	153	6	4%	0.5	Pass	PASS	Pass	N/A	N/A
ATC2_EB	Monread Rd	138	149	11	8%	0.9	Pass	PASS	Pass	N/A	N/A
ATC3_NB	N7 SB On-slip	57	60	3	6%	0.4	Pass	PASS	Pass	N/A	N/A
ATC4_NB	N7 NB On/Off-Slip	124	130	6	5%	0.5	Pass	PASS	Pass	N/A	N/A
ATC4_SB	N7 NB On/Off-Slip	45	55	10	21%	1.4	Pass	PASS	Pass	N/A	N/A
ATC5_NB	R445	39	41	2	6%	0.3	Pass	PASS	Pass	N/A	N/A
ATC5_SB	R445	183	184	1	1%	0.1	Pass	PASS	Pass	N/A	N/A

Appendix D – Model Journey Time Validation

D.1 PM Turning Movement Validation

	PM Peak						
	Observed PM	Observed Corrected	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
JTC1AC	701	895	769	-126	10%	4.7	PASS
JTC1AB	14	18	23	9	64%	2.1	PASS
JTC1CA	0	0	0	0	0%	0.0	PASS
JTC1CB	136	174	209	73	54%	5.6	FAIL
JTC1BC	177	226	197	20	11%	1.5	PASS
JTC1BA	0	0	0	0	0%	0.0	PASS
JTC2AE	0	0	0	0	0%	0.0	PASS
JTC2AD	0	0	0	0	0%	0.0	PASS
JTC2AC	0	0	0	0	0%	0.0	PASS
JTC2AB	0	0	0	0	0%	0.0	PASS
JTC2BA	0	0	0	0	0%	0.0	PASS
JTC2BE	65	74	72	7	11%	0.8	PASS
JTC2BD	97	110	102	5	5%	0.5	PASS
JTC2BC	18	21	27	9	50%	1.9	PASS
JTC2CB	10	11	11	1	10%	0.3	PASS
JTC2CA	38	43	47	9	24%	1.4	PASS
JTC2CE	342	390	454	112	33%	5.6	FAIL
JTC2CD	438	499	449	11	3%	0.5	PASS
JTC2DE	216	246	204	-12	-6%	0.8	PASS
JTC2DA	191	218	261	70	37%	4.7	PASS
JTC2DB	365	416	363	-2	-1%	0.1	PASS
JTC2DC	49	56	81	32	65%	4.0	PASS
JTC2EA	158	180	214	56	35%	4.1	PASS
JTC2EB	255	290	271	16	6%	1.0	PASS
JTC2EC	78	89	100	22	28%	2.3	PASS
JTC2ED	215	245	166	-49	-23%	3.6	PASS
JTC3AD	10	10	8	-2	-20%	0.7	PASS
JTC3AC	625	625	617	-8	-1%	0.3	PASS
JTC3AB	113	113	123	10	9%	0.9	PASS
JTC3BA	168	168	168	0	0%	0.0	PASS
JTC3BD	0	0	0	0	0%	0.0	PASS
JTC3BC	75	75	59	-16	-21%	2.0	PASS
JTC3CD	4	4	3	-1	-25%	0.5	PASS
JTC3CA	586	586	533	-53	-9%	2.2	PASS
JTC3CB	38	38	38	0	0%	0.0	PASS
JTC3DA	39	39	38	-1	-3%	0.2	PASS
JTC3DB	4	4	5	1	25%	0.5	PASS
JTC3DC	9	9	8	-1	-11%	0.3	PASS

D.2 IP Turning Movement Validation

	Inter Peak						
	Observed PM	Observed Corrected	Modelled PM	Difference	Difference (%)	GEH	GEH Pass
JTC1AC	583	634	587	-47	1%	1.9	PASS
JTC1AB	13	14	16	2	22%	0.4	PASS
JTC1CA	0	0	0	0	0%	0.0	PASS
JTC1CB	127	138	165	28	30%	2.3	PASS
JTC1BC	153	167	160	-7	4%	0.5	PASS
JTC1BA	0	0	0	0	0%	0.0	PASS
JTC2AE	0	0	0	0	0%	0.0	PASS
JTC2AD	0	0	0	0	0%	0.0	PASS
JTC2AC	0	0	0	0	0%	0.0	PASS
JTC2AB	0	0	0	0	0%	0.0	PASS
JTC2BA	4	4	0	-4	-100%	2.9	PASS
JTC2BE	64	70	72	2	12%	0.3	PASS
JTC2BD	97	105	124	19	28%	1.8	PASS
JTC2BC	18	20	25	5	39%	1.2	PASS
JTC2CB	3	4	4	0	20%	0.2	PASS
JTC2CA	19	20	24	4	27%	0.8	PASS
JTC2CE	228	247	343	96	51%	5.7	FAIL
JTC2CD	364	396	374	-22	3%	1.1	PASS
JTC2DE	211	230	209	-21	-1%	1.4	PASS
JTC2DA	83	90	105	15	27%	1.5	PASS
JTC2DB	290	315	263	-52	-9%	3.1	PASS
JTC2DC	54	59	60	1	11%	0.2	PASS
JTC2EA	89	97	107	10	20%	1.0	PASS
JTC2EB	240	261	256	-5	7%	0.3	PASS
JTC2EC	68	73	80	7	19%	0.8	PASS
JTC2ED	182	198	156	-42	-14%	3.2	PASS
JTC3AD	10	11	8	-3	-23%	1.1	PASS
JTC3AC	548	595	514	-81	-6%	3.5	PASS
JTC3AB	122	133	124	-9	2%	0.8	PASS
JTC3BA	121	131	114	-17	-6%	1.6	PASS
JTC3BD	1	1	0	-1	-100%	1.4	PASS
JTC3BC	48	52	48	-4	0%	0.6	PASS
JTC3CD	9	9	8	-1	-6%	0.4	PASS
JTC3CA	496	539	441	-98	-11%	4.5	PASS
JTC3CB	34	37	28	-9	-18%	1.7	PASS
JTC3DA	15	16	20	4	33%	0.9	PASS
JTC3DB	1	1	0	-1	-100%	1.5	PASS
JTC3DC	6	7	4	-3	-35%	1.2	PASS

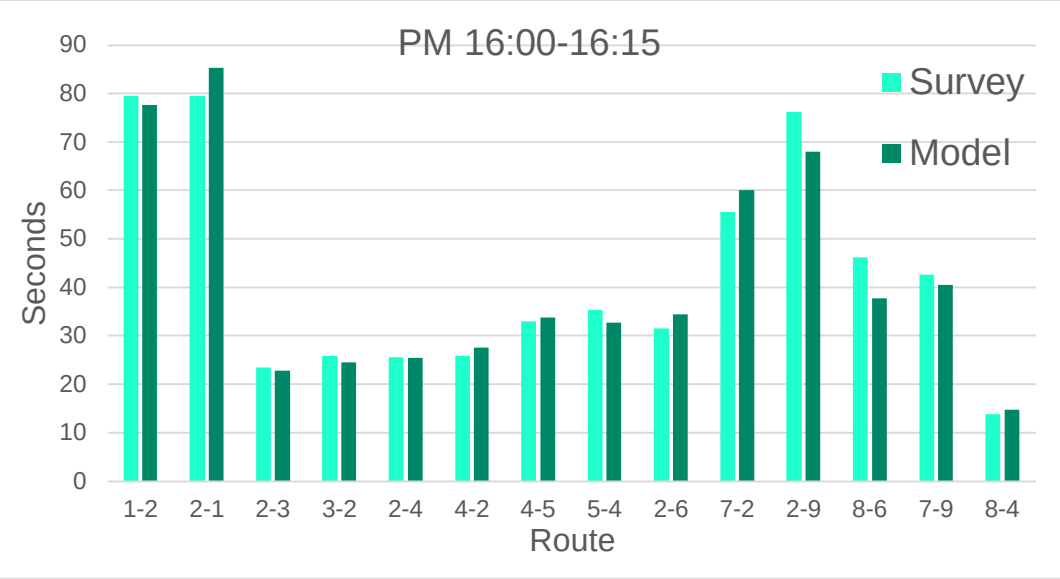
D.3 Journey Times Hourly Totals PM

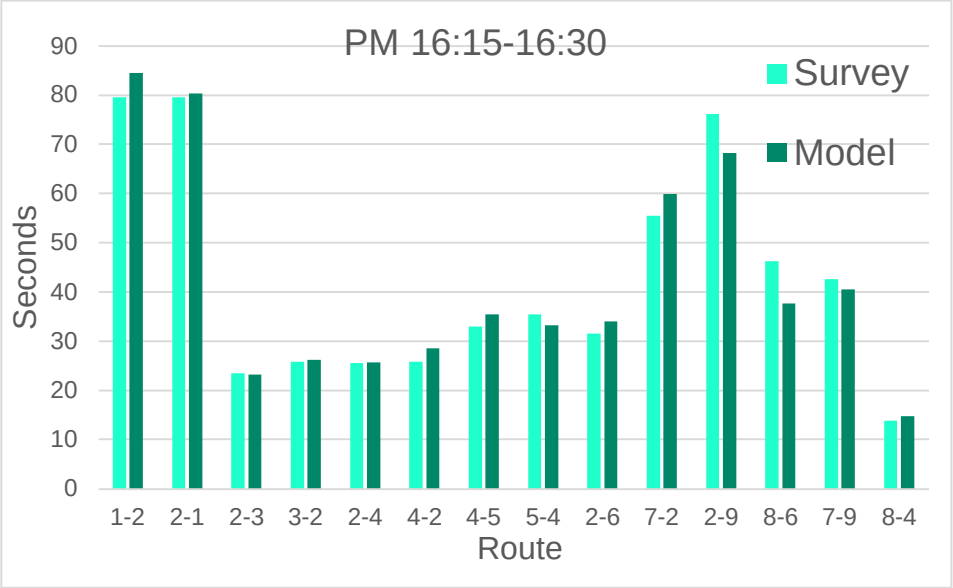
Traffic TT - PM				
Route path	Observed Time (MM:SS)	Modelled Time (MM:SS)	Difference (S)	Difference %
1-2	0:01:20	0:01:30	0:00:10	13%
2-1	0:01:20	0:01:23	0:00:03	4%
2-3	0:00:23	0:00:24	0:00:00	1%
3-2	0:00:26	0:00:25	-0:00:01	2%
2-4	0:00:26	0:00:26	-0:00:00	1%
4-2	0:00:26	0:00:28	0:00:03	10%
4-5	0:00:33	0:00:35	0:00:02	5%
5-4	0:00:36	0:00:33	-0:00:03	8%
2-6	0:00:32	0:00:34	0:00:03	9%
7-2	0:00:55	0:01:00	0:00:05	8%
2-9	0:01:16	0:01:08	-0:00:08	11%
8-6	0:00:46	0:00:38	-0:00:09	18%
7-9	0:00:43	0:00:40	-0:00:02	6%
8-4	0:00:14	0:00:15	0:00:01	8%

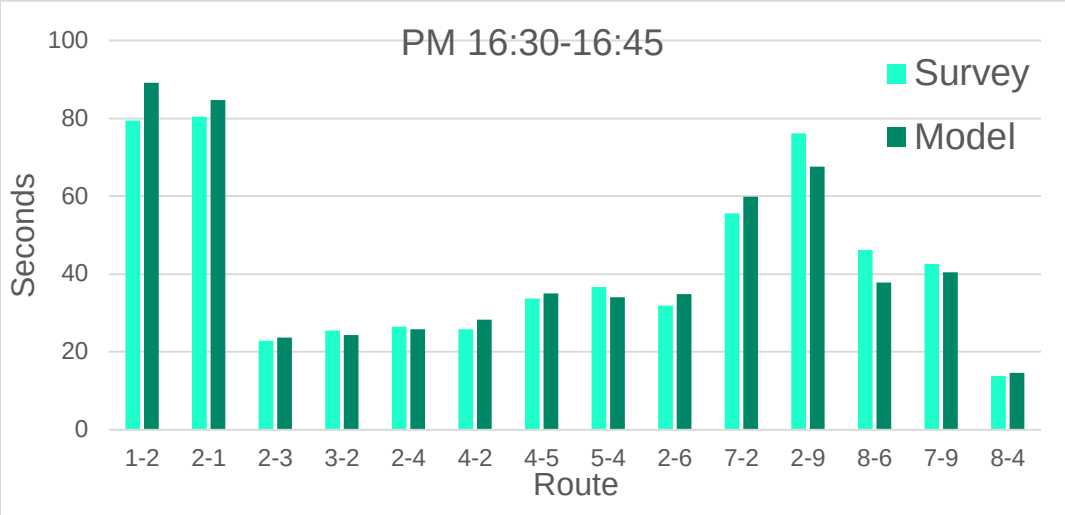
D.4 Journey Times Hourly Totals IP

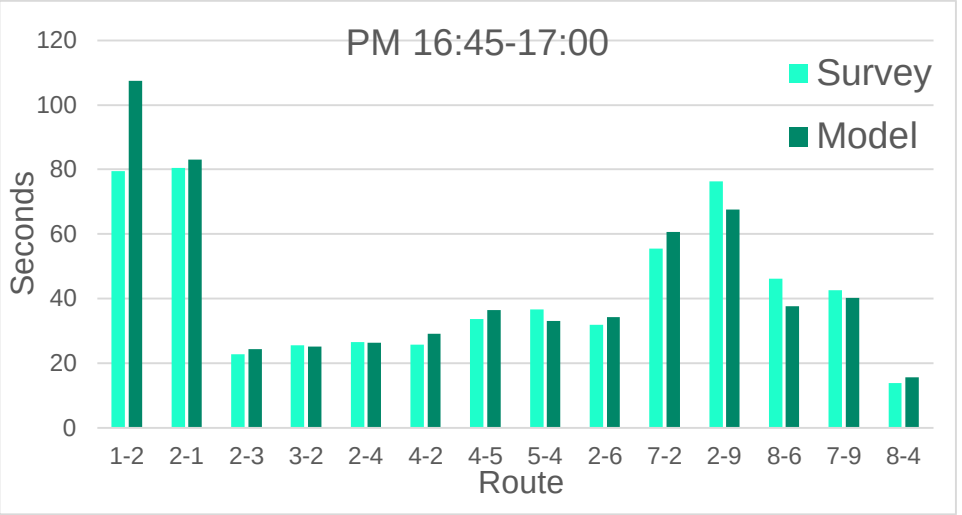
Traffic TT - IP				
Route path	Observed Time (MM:SS)	Modelled Time (MM:SS)	Difference (S)	Difference %
1-2	0:01:15	0:01:12	-0:00:03	4%
2-1	0:01:16	0:01:22	0:00:06	8%
2-3	0:00:25	0:00:23	-0:00:02	9%
3-2	0:00:27	0:00:22	-0:00:04	17%
2-4	0:00:24	0:00:25	0:00:01	4%
4-2	0:00:26	0:00:27	0:00:01	3%
4-5	0:00:32	0:00:34	0:00:02	7%
5-4	0:00:37	0:00:32	-0:00:05	13%
2-6	0:00:33	0:00:33	0:00:01	2%
7-2	0:00:55	0:01:00	0:00:04	8%
2-9	0:01:15	0:01:08	-0:00:07	10%
8-6	0:00:45	0:00:37	-0:00:08	17%
7-9	0:00:43	0:00:41	-0:00:02	5%
8-4	0:00:14	0:00:14	0:00:01	5%

D.5 Journey Time Graph PM 15-minute intervals









Appendix C Technical Note 3 – Future Year Model Development

Technical Note 3
Future Year Model Development

Kildare County Council

Project reference: Maudlins Transport Modelling and Access Strategy

05th April 2023

Delivering a better world

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Contents

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Tables

1. Introduction

1.1 Overview

Kildare County Council (KCC) has commissioned AECOM to provide Consulting Engineering services in relation to the Maudlins Traffic Modelling & Access Strategy (TMTS).

1.2 Background

The Naas Local Area Plan (LAP) 2021 – 2027 was adopted by the Elected Members in October 2021. Under the LAP the area referred to as 'Junction 9 (Maudlins Interchange)' was identified as a Key Development Area. The Key Development Area includes the former Donnelly Mirrors and Cemex Concrete sites.

1.3 Context

AECOM have developed a micro-simulation VISSIM model of the M7 Junction 9 (Maudlins) and the local road network to assess and quantify the overall level of vehicular traffic that Junction 9 (Maudlins) and the local road network can efficiently and safely support during both peak and off-peak traffic periods.

The model will identify and guide the recommendation of the types of land-uses that may be potentially accommodated within the key development area and potential scale of these land-uses, in line with the Naas Local Area Plan (LAP).

A Model Development Report[1] has been developed which outlines the methodology adopted to produce a Baseline VISSIM micro-simulation model and Junction 9 models; including a comparison between the modelled and observed traffic along with the objectives of the model.

1.4 Do Minimum Technical Note

The purpose of this note is to provide details of the process applied to progress from the Baseline 2022 model version to the Do Minimum (DM) future year model version. The DM model includes future growth and schemes within the local area as detailed in the Naas Local Area Plan 2021-2027 but does not include development at the specific development site or any network changes.

This note provides an outline of the process followed to calculate the future demand, along with impacts on the network due to calculated demand growth from the 2022 to 2027 on both Maudlins LAM and Junction 9 models.

The DM model will be used to test the level of demand that can be accommodated on the existing highway network from the proposed development site.

[1] Technical Note 2 – Maudlins Base Year Model Development Report rev1, issued 6th July 2022

2. Future Year Demand

2.1 Overview

A future year 2027 demand has been developed to allow for testing at the former Donnelly Mirrors and Cemex Concrete sites to the south of M7. The demand growth applied to the 2022 baseline model has been calculated using the Naas Local Area Model (LAM) VISUM model. Total vehicle increase has been applied as the LAM includes committed network changes and developments within the local vicinity to the proposed development site.

2.2 Naas LAM

In the Naas LAM, future year demands were developed and informed the Draft Naas Local Area Plan (LAP) 2021-2027. Population and jobs targets for Naas were incorporated into a planning sheet provided to AECOM by KCC which projected the additional number of persons and jobs for each zone in the Naas Local Area Model for 2027 (final year of draft LAP).

In order to convert the additional population and jobs projections into vehicular trips, a tool called TRICS (Trip Rate Information Computer System) was utilised. TRICS is a database of trip rates for developments used in the United Kingdom and Ireland for transport planning purposes, specifically to quantify the trip generation of new developments. As each model zone was based on a specific land-use type, each zone containing additional population/jobs was assigned land-use type and accessibility within TRICS.

The resultant additional trips generated were then added to base year traffic data for Naas in order to develop future year origin and destination trip ends. Future year demand for external zones was assumed to be the same as that given by TII's NTpM. External zone growth between 2018 and 2030 was 39.6% for the PM peak period. Future year trip distribution was then undertaken utilising the furnessing distribution method. The future year Naas LAM model was utilised to estimate future year growth for the Maudlins LAM.

2.3 2022 to 2027 demand growth assumptions

The following assumptions have been applied:

- Any movements with a negative growth assumed no growth.
- Growth between 2018 LAM to 2027 LAM VISUM Models has been applied. Due to the covid-19 pandemic causing a temporary reduction in traffic flows, 2022 flows were assumed to be comparable with 2018, no growth was applied to account for 2018-2022 growth.
- Any future LAM trips to the development site have been removed, this will be applied during the testing phase;
- Any origin-destination with zero in base have total 2027 volume applied;

2.4 2027 Demand

The growth applied to the Baseline demand is detailed in **Table 2.1**, the growth below relates to zones in Maudlins area and exclude any Motorway growth.

Table 2.1: Growth excluding Motorway

Model Period	Vehicle type	Local Network Growth
PM	Car/LV	14%
	HGV	22%
IP	Car/LV	23%
	HGV	13%

3. 2027 VISSIM Model

3.1 Overview

The 2027 DM model has been developed for the corresponding time periods as the Baseline model. PM peak, 16:00 to 17:00 and an average weekday interpeak hour.

3.2 Model Convergence

3.2.1 Convergence Results

The PM and IP DM models were converged following the same criterion as with the Baseline model.

Table 3.1: Convergence Criteria and Summary

Peak Period	Criteria 1 Journey Time	Criteria 2 Turning Volume	Iteration	Volume (%) Results	Travel Time (%) Results
PM	15% of all journeys within 95%	15% of all turns within 95% vehicles	19	95%	95%
IP	15% of all journeys within 95%	15% of all turns within 95% vehicles	16	95%	95%

3.3 DM Model runs

This section provides a summary along with screen shots of the DM model with the corresponding time in the base model to show demand growth impacts.

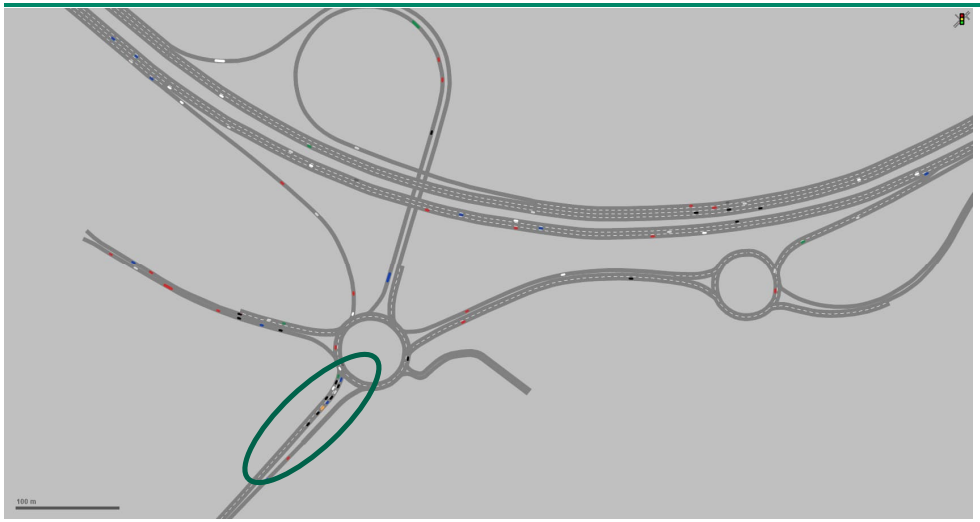
As shown in **Figure 3-1** to **Figure 3-4**, there is queuing on the Dublin Road roundabout NB approach throughout the peak hour, the queue length is increasing in 2027. Queueing is also noted on the WB approach to the roundabout during the DM occurring at the end of the peak (1700).

There is no queueing on Fishery Lane during the Base scenario however into the 2027 DM queuing is occurring on the Fishery Lane approach to the roundabout at 1645 and 1700.

As expected, the IP model performs with less congestion than the PM peak. It is worth nothing some minor queueing that occurs on the Monread Rd approach to the junction 9 roundabout during the IP.

Figure 3-1: PM 1615

Base



DM

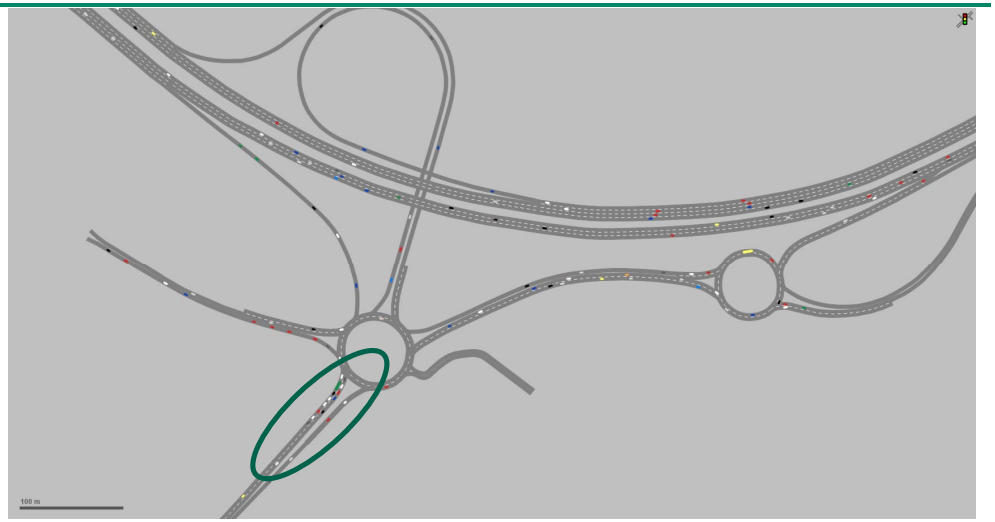


Figure 3-2: PM 1630

Base

DM

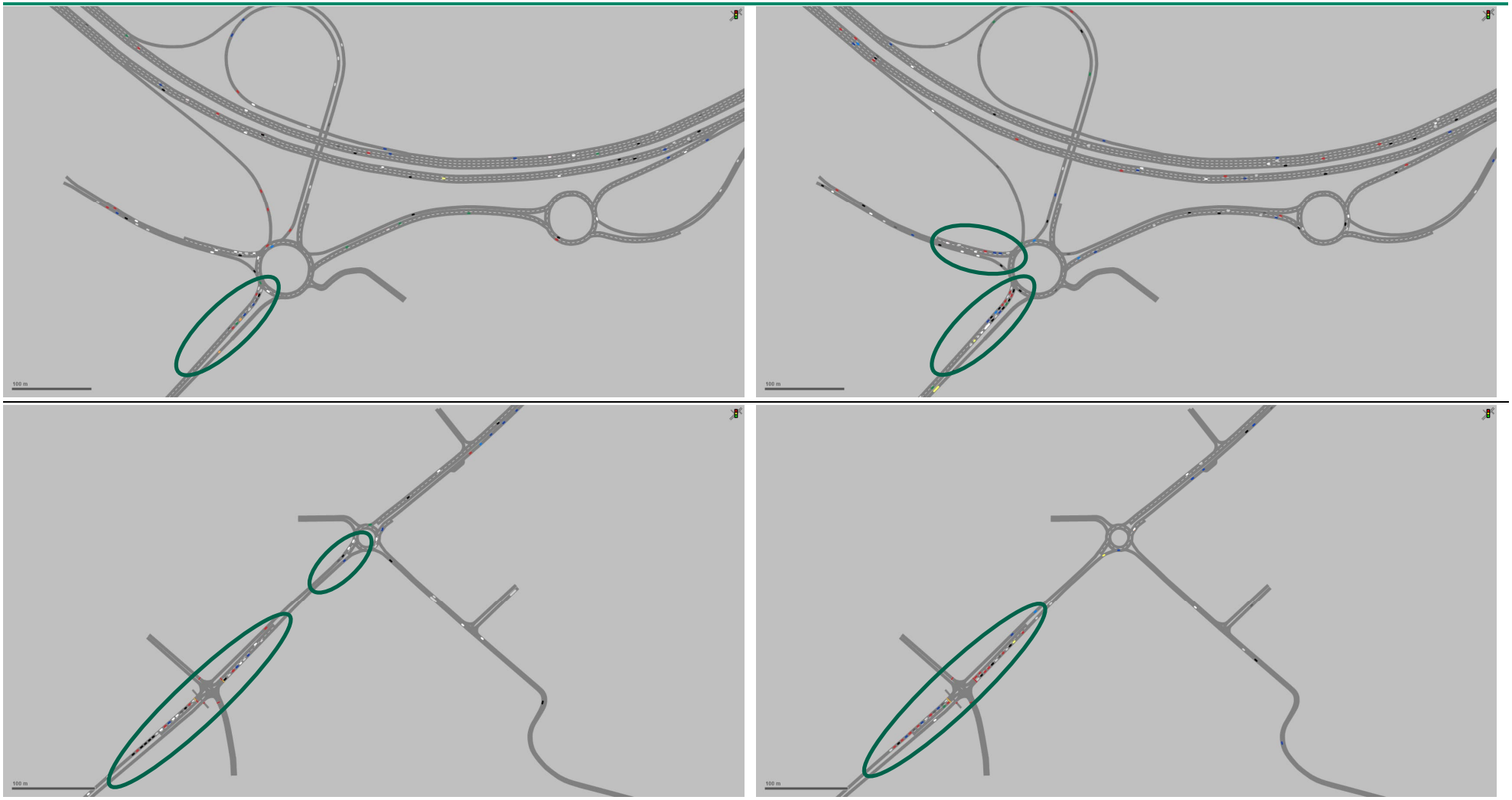
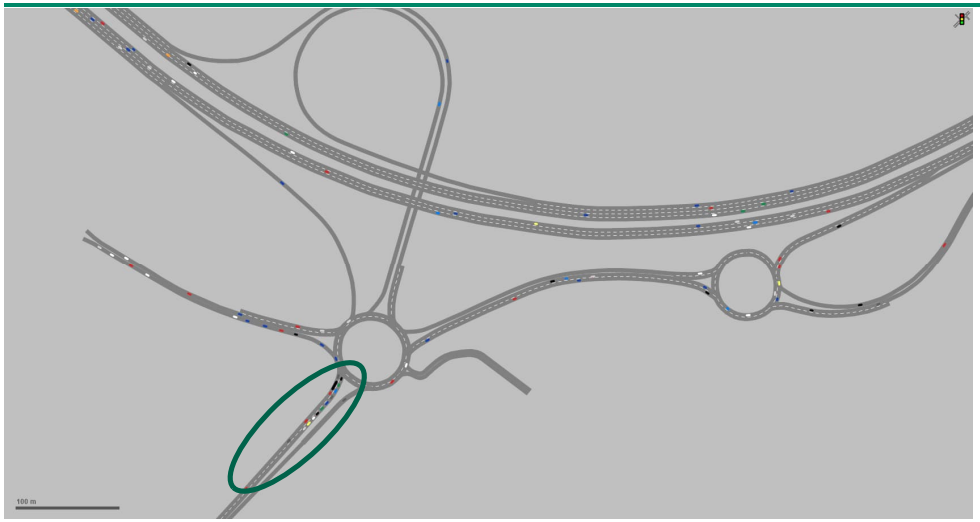


Figure 3-3: PM 1645

Base



DM

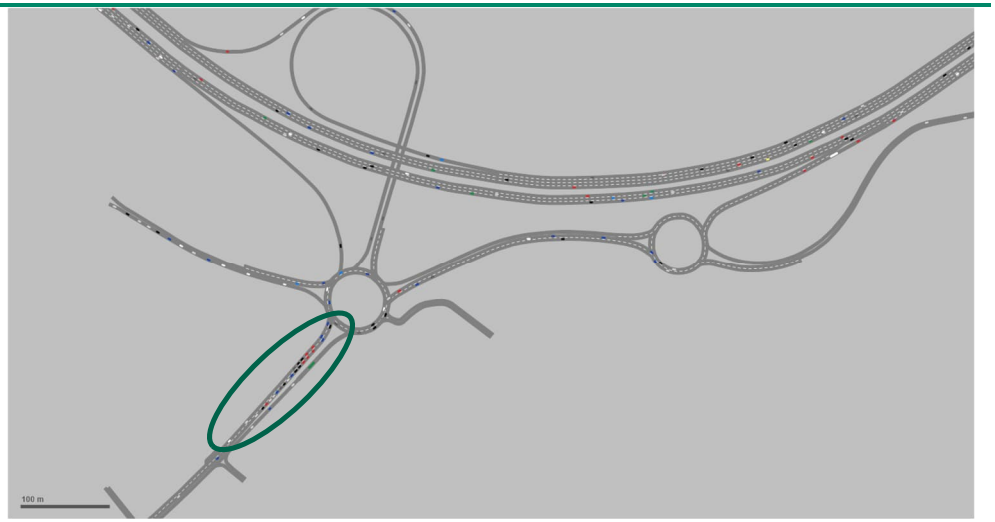
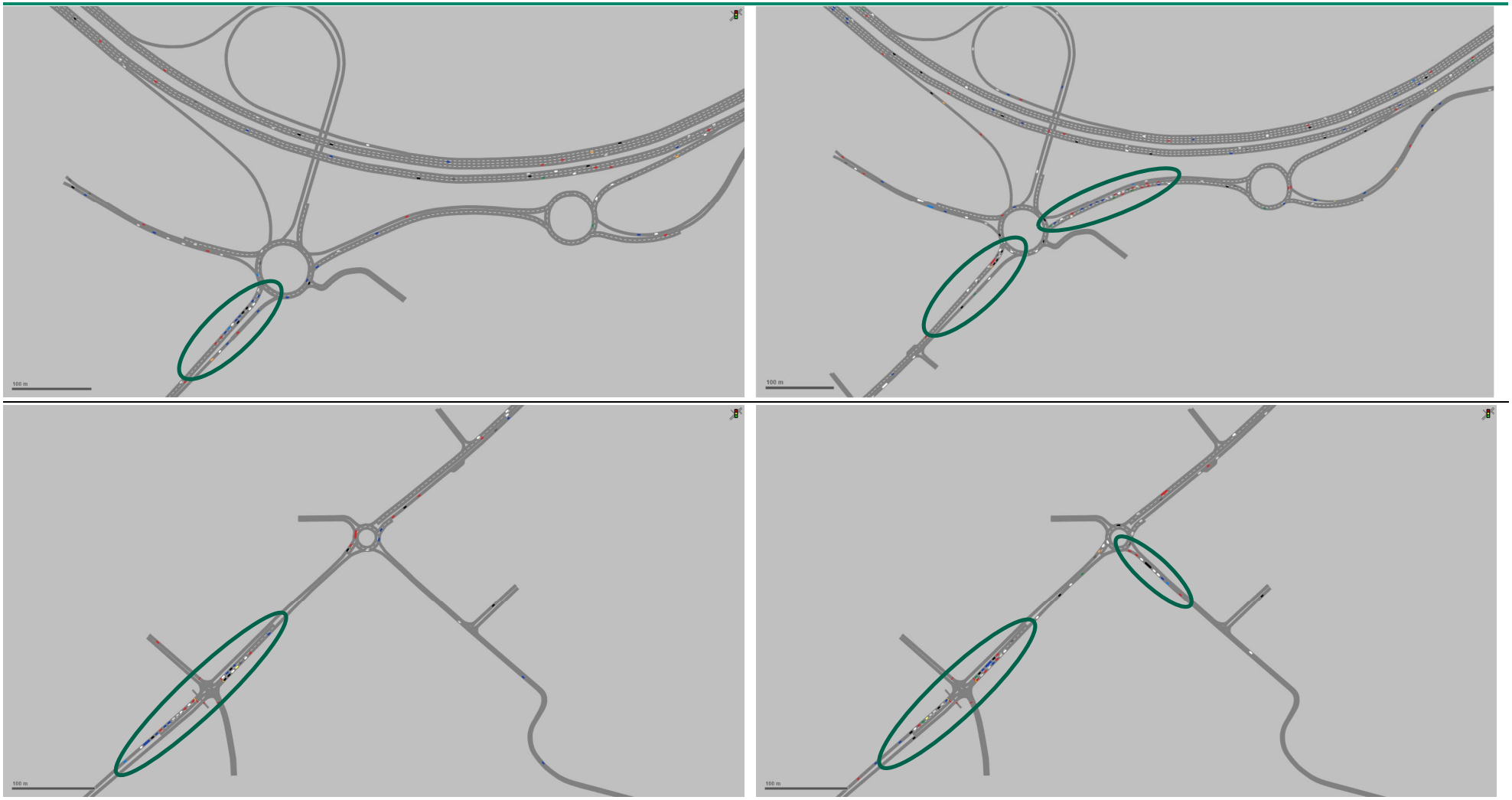


Figure 3-4: PM 1700

Base

DM



4. 2027 Junctions 9 Model

4.1 Overview

The 2027 DM model has been developed for the corresponding time periods as the Baseline model which was an average weekday interpeak hour and the evening peak hour, 16:00 to 17:00. AECOM have completed Junctions 9 models of the following junctions:

- Junction 1 – R445 Dublin Road Roundabout;
- Junction 2 – M7 Junction 9 Off-slip at R445 Roundabout; and
- Junction 3 – R445 Fishery Lane Roundabout.

4.2 Junction Analysis

The operational assessment of the local road network has been undertaken using TRL Junctions 9 for non-signalised junctions. When considering roundabouts, a Ratio to Flow Capacity (RFC) of greater than 85% (0.85) would indicate a junction to be approaching capacity, as operation above this RFC value is poor and deteriorates quickly resulting in traffic congestion in the form of longer queues.

Junctions 9 is an industry standard software to model the capacity and queuing of non-signalised junctions (priority controlled, intersections, roundabouts). The meaning of the acronyms used within the capacity assessment results are discussed below.

- RFC Ratio to Flow Capacity (for non-signalised junctions)
- Q Queue length (PCU[2]'s) i.e. 1 PCU equates to a 5.75m long car

It is generally accepted that RFC values of 0.85 (85%) and less are indicators that a junction is operating within capacity. Junctions are only identified as operating over capacity if these values are exceeded. The models and their result for the Baseline and the DM are set out in the following subheadings.

4.2.1 R445 Dublin Road Roundabout

A model was completed using the traffic flows from the VISSIM models to assess the traffic volumes for the inter peak and evening peak period for the 2022 baseline and 2027 DM assessment years at the R445 Dublin Road Roundabout. A summary of the results are shown in Table 4.1.

Table 4.1: R445 Dublin Road Roundabout Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	R445 (Eastern Arm)	0.7	0.37	1.0	0.48
	Site Access	0.0	0.00	0.0	0.00
	R445 (Southern Arm)	0.5	0.30	0.8	0.42
	Monread Road (Western Arm)	0.5	0.31	0.8	0.43
	N7 Onslip / Offslip (Eastbound)	0.1	0.11	0.1	0.11
2027 Do Minimum	R445 (Eastern Arm)	1.1	0.50	1.7	0.61
	Site Access	0.0	0.00	0.0	0.00
	R445 (Southern Arm)	0.5	0.33	1.0	0.47
	Monread Road (Western Arm)	0.5	0.33	1.0	0.47
	N7 Onslip / Offslip (Eastbound)	0.2	0.15	0.2	0.13

[2] PCU = Passenger Car Unit

The maximum recorded RFC is on the R445 (Eastern Arm) for both the inter peak and evening peak periods of the 2027 DM assessment year. The inter peak RFC was 0.50 RFC with a corresponding queue of 1.1 PCU and the evening peak RFC was 0.61 with a corresponding queue of 1.7 PCU.

When comparing the 2027 DM assessment year with the baseline, it is anticipated that there would be an increase of 0.13 (13%) RFC with a corresponding increase to queuing of 0.4 PCU during the inter peak period on the R445 (Eastern Arm) of the roundabout. During the evening peak period, it is anticipated that the RFC would increase by 0.13 (13%) with an anticipated increase of 0.7 PCU on the R445 (Eastern Arm) of the roundabout. The roundabout is anticipated to continue to operate within capacity through to the 2027 Do Minimum assessment year.

4.2.2 N7 Junction 9 Off-slip R445 Roundabout

A model was completed using the traffic flows from the VISSIM models to assess the traffic volumes for the inter peak and evening peak period for the 2022 baseline and 2027 DM assessment years at the N7 Junction 9 Off-slip R445 Roundabout. A summary of the results are shown in Table 4.2.

Table 4.2: M7 Junction 9 Off-slip Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	Johnstown Road (Eastern Arm)	0.1	0.08	0.1	0.11
	R445 (Western Arm)	0.1	0.10	0.2	0.13
	N7 Off-slip (North Eastern Arm)	0.4	0.26	0.6	0.34
2027 Do Minimum	Johnstown Road (Eastern Arm)	0.2	0.13	0.2	0.17
	R445 (Western Arm)	0.2	0.15	0.2	0.17
	N7 Off-slip (North Eastern Arm)	0.6	0.35	0.8	0.44

The maximum recorded RFC is on the N7 Off-slip arm for both the inter peak and evening peak periods of the 2027 DM assessment year. The inter peak RFC was 0.35 RFC with a corresponding queue of 0.6 PCU and the evening peak RFC was 0.44 with a corresponding queue of 0.8 PCU.

When comparing the 2027 DM assessment year with the baseline, it is anticipated that there would be an increase of 0.09 (9%) RFC with a corresponding increase to queuing of 0.2 PCU during the inter peak period on the N7 Off-slip arm of the roundabout. During the evening peak period it is anticipated that the RFC would increase by 0.10 (10%) with an anticipated increase of 0.2 PCU on the N7 Off-slip arm of the roundabout. The roundabout is anticipated to continue to operate within capacity through to the 2027 Do Minimum assessment year.

4.2.3 R445 Fishery Lane Roundabout

A model was completed using the traffic flows from the VISSIM models to assess the traffic volumes for the inter peak and evening peak period for the 2022 baseline and 2027 DM assessment years at the R445 Fishery Lane Roundabout. A summary of the results are shown in Table 4.3.

Table 4.3: R445 Fishery Lane Outputs

Assessment Year	Arm	Inter Peak		PM Peak	
		Queue (PCU)	RFC	Queue (PCU)	RFC
2022 Baseline	R445 (Northern Arm)	0.6	0.35	0.8	0.41
	Fishery lane (Eastern Arm)	0.3	0.20	0.5	0.32
	R445 (Southern Arm)	0.8	0.43	1.4	0.56
	Maudlins Industrial Estate (Western Arm)	0.0	0.03	0.1	0.11
2027 Do Minimum	R445 (Northern Arm)	0.6	0.37	0.9	0.46
	Fishery lane (Eastern Arm)	0.3	0.21	0.6	0.37
	R445 (Southern Arm)	0.9	0.45	1.6	0.59
	Maudlins Industrial Estate (Western Arm)	0.0	0.04	0.2	0.12

The maximum recorded RFC is on the R445 (Southern Arm) for both the inter peak and evening peak periods of the 2027 DM assessment year. The inter peak RFC was 0.45 RFC with a corresponding queue of 0.9 PCU and the evening peak RFC was 0.59 with a corresponding queue of 1.6 PCU.

When comparing the 2027 DM assessment year with the baseline, it is anticipated that there would be an increase of 0.02 (2%) RFC with a corresponding increase to queuing of 0.1 PCU during the inter peak period on the R445 (Southern Arm) of the roundabout. During the evening peak period it is anticipated that the RFC would increase by 0.05 (5%) with an anticipated increase of 0.1 PCU on both the Fishery Lane and R445 (Northern Arm) of the roundabout. The roundabout is anticipated to continue to operate within capacity through to the 2027 Do Minimum assessment year.

5. Summary and Conclusions

5.1 Future Year Model Development Summary

A micro-simulation Vissim model of the M7 Junction 9 (Maudlins) and adjoining local road network has been developed. Two time periods within the model have been developed; a midweek PM peak hour, 16:00 – 17:00, and an average midweek IP hour.

The model has been newly developed by AECOM for the purpose of this study in June 2022. The model will be used to assess and quantify the overall level of vehicular traffic that Junction 9 (Maudlins) and the existing local road network can efficiently and safely support during both peak and off-peak traffic periods.

The Model Development Report includes details of the model Calibration and Validation, the base model is deemed acceptable and replicates the existing operational performance of vehicular traffic at the M7 Junction 9 (Maudlins) and the surrounding local road network. This Do Minimum Model Development Technical Note 3 details the process followed to develop the Do Minimum 2027 model version which will be used to test trips due to a development at the former Donnelly Mirrors and Cemex Concrete sites.

5.2 Conclusions

The model can now be used to identify and guide the recommendation of the types of land-uses that may be potentially accommodated within the key development area and potential scale of these land-uses, in line with the Naas Local Area Plan (LAP).

Appendix D Technical Note 4 – Future Year Do-Something Modelling

Technical Note 4
Future Year Do Something Modelling

Kildare County Council

Project reference: Maudlins Transport Modelling and Access Strategy

07th November 2023

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1. Introduction

1.1 Overview

Kildare County Council (KCC) has commissioned AECOM to provide transport planning services as part of a wider commission to develop a Maudlins Traffic Modelling & Access Strategy (TMAS).

1.2 Background

The Naas Local Area Plan (LAP) 2021 – 2027 was adopted by the Elected Members in October 2021. Under the LAP the area referred to as 'Junction 9 (Maudlins Interchange)' was identified as a Key Development Area. The Key Development Area includes the former Donnelly Mirrors and Cemex Concrete sites. The Naas LAP sets out two specific objectives in relation to this Key Development Area:

- **Economic Development Objective (EDO 1.4)** – *"Facilitate the regeneration and redevelopment of the lands to the east of the Dublin Road roundabout, in particular the Key Development Area at Junction 9 (Maudlins) (the former Donnelly Mirrors and Cemex Concrete sites), through a joint approach for the overall landholding through the preparation of a comprehensive masterplan comprising of an overall high-quality design in recognition of its location as a key gateway site. Adherence to the Design Framework set out in Chapter 10 is required in the preparation of any masterplan for these lands which will be informed by the Traffic Modelling and Access Strategy (Objective URD 1.13, refers)".*
- **Urban Regeneration and Development (URD 1.13**) - *Prepare a Traffic Modelling and Access Strategy for lands zoned Mixed-use at the Junction 9 (Maudlins) Key Development Area within 12 months of the adoption of the local area plan, in consultation with relevant stakeholders including Transport Infrastructure Ireland (TII), the National Transport Authority (NTA) and the owners of the KDA lands.*
    - *(i) This Strategy will identify the use, quantum and intensity of development that can be facilitated at the location complementary to safeguarding the strategic function and safety of the national road network, in accordance with the provisions of official policy outlined in the Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012).*
    - *(ii) The Strategy will also identify any improvements required to the local transport network to facilitate development at this KDA.*
    - *(iii) The masterplan required under URD 1.14 shall not be finalised until such time as the Council has completed and agreed the traffic modelling with the stakeholders identified above.*

The methodology to develop the Maudlins Traffic Modelling and Access Strategy (TMAS) was developed and is shown below, with the deliverables as agreed:

1. Data Collection – Deliverable: Technical Note 1 – Traffic Survey Analysis
2. Baselining (2022) – Deliverable: Technical Note 2 – Base Year Model Development
3. Future Year Do-Minimum – Deliverable: Technical Note 3 – Future Year Model Development
4. Stakeholder engagement Phase 1 (NTA, TII)
5. Scenario Testing – Deliverable: Technical Note 4 – Future Year DS Modelling (this note)
6. Stakeholder engagement Phase 2 (Developer)
7. Reporting

This report presents details of the Step 5 Scenario Testing task.

1.3 Context

AECOM have developed a micro-simulation VISSIM model of the M7/N7 Junction 9 (Maudlins) and the local road network to assess and quantify the overall level of vehicular traffic that Junction 9 (Maudlins) and the local road network could effectively support during both peak and off-peak traffic periods.

The model will identify and guide the recommendation of the types of land-uses that may be potentially accommodated within the Key Development Area (KDA) and potential scale of these land-uses, in line with the Naas Local Area Plan (LAP).

A Model Development Report[1] has been developed which outlines the methodology adopted to produce a Baseline VISSIM micro-simulation model; including a comparison between the modelled and observed traffic along with the objectives for the development of the model.

In addition to the Model Development Report a separate Technical Note 3 Future Year Model Development was also developed which details the methodology used in developing a future year Do Minimum (DM) VISSIM micro-simulation model. This note provides the detail of the process applied to progress from the Baseline 2022 model version to the future year 2027 Do Minimum model.

1.4 Do Something Technical Note

The purpose of this note is to provide details on the development of the Do Something (DS) future year 2027 model. The Do Something model allows for any specific KDA development demand to be added to the model along with any network changes that would be required to provide access to and from the KDA site.

The Do Something model has been used to test the level of traffic demand, associated with the KDA site, which could potentially be supported by the existing local road network.

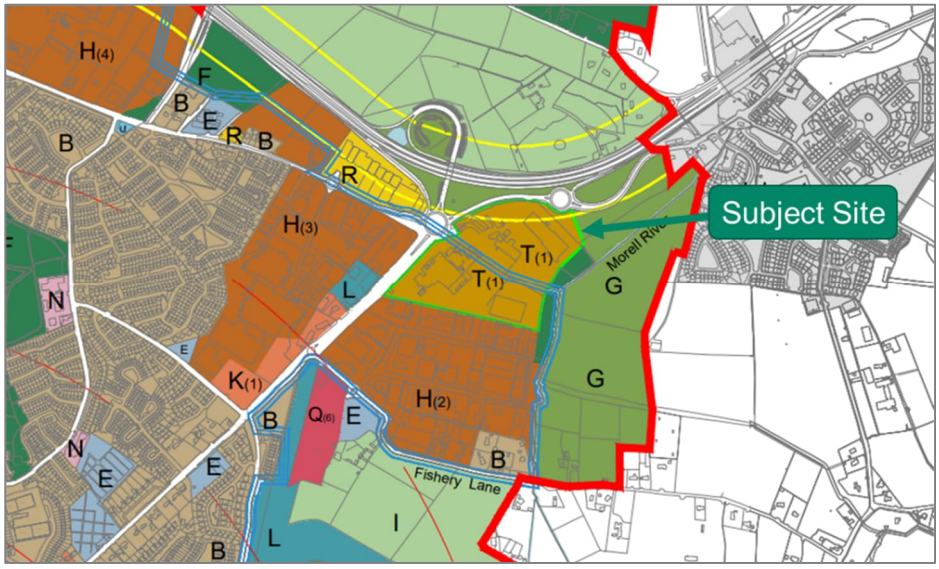
[1] *Technical Note 2 – Maudlins Base Year Model Development Report rev1, issued 6th July 2022*

2. Development Assumptions

2.1 Overview

The KDA site is currently zoned in the Naas Local Area Plan (LAP) 2021-2027 as 'Mixed-Use' and identified as 'Regeneration Lands'. The zoning map showing the development area is shown in **Figure 2-1.**

Figure 2-1: Maudlins Key Development Area (KDA) Zoning



Within the Naas LAP Land Use Zoning Matrix there is one land use 'Permitted in Principle' and 25 'Open For Consideration' for the site. The land use 'Permitted in Principle' is a service station. The 25 land uses 'Open for Consideration' cover a wide range from light industry, offices, restaurant to data centre and schools. Full list of uses 'Open for Consideration' (O) is shown in Appendix A.

2.2 Demand Distribution

In order to test different levels of traffic in and out of the development site an origin / destination demand distribution had to be defined. Given that there is only one permitted in principle land use it was considered appropriate to create demand distribution specifically for that land use and another one for the mixed nature of the open for consideration land uses. The service station demand distribution is based on assumption that 85% of development will be attracted to/from the Motorway which would be common for a development of this nature in this location adjacent to a Motorway. The mixed development land use distribution was developed from the nearby Naas Industrial Estate located off the Fishery Lane.

The two origin/destination distributions for the KDA site are detailed in **Table 2-1** and **Table 2-2** below, which show distribution for Service Station and distribution for mixed use respectively.

Table 2-1: Demand Distribution 1 – Service Station

Location	Entry to KDA site		Exit from KDA site	
N7 South	36%	78%	38%	86%
N7 North	42%		48%	
Johnstown	2%		0%	
Monread Rd	10%		5%	
Fishery Ln	5%		3%	
Naas Direction	5%		6%	

Table 2-2: Demand Distribution 2 – Mixed Use

Location	Entry to KDA site		Exit from KDA site	
N7 South	18%	44%	25%	54%
N7 North	26%		29%	
Johnstown	6%		0%	
Monread Rd	16%		14%	
Fishery Ln	16%		11%	
Naas Direction	18%		21%	

The Vissim model has been used to test varying levels of demand to ascertain the scale of demand that could be accommodated on the existing local road network. Due to the KDA site being located in a close proximity to the M7/N7 it was considered appropriate to focus on the PM peak, which is the critical period for the site where due to congestion on the local road network some occasional queuing might spill onto the N7 off ramps. The PM peak model was used to test the maximum flow to and from the KDA site in order to determine the ultimate scale of proposed development.

2.3 Access / Exit Assumptions

The following was assumed in relation to access and egress from the KDA site:

- One-way access has been provided off the Maudlins Roundabout,
- Exit onto the Dublin Road has been provided via existing left-in, left-out junction located on Dublin Road between Maudlins roundabout and Fishery Lane roundabout, this existing junction was serving a local development on current KDA site, which is now closed, and
- Exit onto Fishery Lane through Naas Industrial Estate.

Figure 2-2 shows the KDA site with assumed access and egress routes to and from the site.

Figure 2-2: Maudlins Access Assumptions

The access to the KDA site is via the Maudlins Roundabout. Traffic accessing the site from Naas must do so via Dublin Road, Maudlins Roundabout and take the roundabout exit for the KDA site.

There are two proposed exits from the development site, one onto Dublin Road, via a currently unused left-out junction and second onto Fishery Lane, provided as a supplementary exit route through the existing Naas Industrial Estate as shown in **Figure 2-2**.

The Dublin Road between Maudlins Roundabout and Fishery Lane roundabout is a centrally divided road with one lane in the south-west direction and two-lanes in the north-east direction on the approach to the Maudlins roundabout. The two-lanes approaching Maudlins roundabout split traffic depending on the destination, the nearside lane caters for traffic heading to Sallins and M7 southbound (Limerick / Cork direction) and the outside lane caters for traffic heading to Johnstown and N7 North (Dublin direction).

Figure 2-3 shows exit routes from the KDA site via the existing left-out junction located on the Dublin Road between Maudlins Roundabout and Fishery Lane roundabout.

Figure 2-3: Maudlins Dublin Road left-out Exit route from KDA site

Traffic exiting the KDA site via the existing left-out junction can only travel in the south-west direction on the Dublin Road regardless of its destination. In order to exit to Sallins, via Monread Rd and N7 in both directions all traffic is required to do U-turn at the Fishery Lane roundabout and travel in the north-east direction on Dublin Road to make the appropriate turn, 64% of traffic exiting the KDA site has a destination in those areas (Sallins/Monread Rd, and N7 in both directions). Current traffic conditions at the Fishery Lane roundabout show operational queuing developing on the Fishery Lane approach to the roundabout during evening peak hours due to high volumes of traffic on the Dublin Road, which reduces the gap time for traffic approaching the roundabout from Fishery Lane.

Due to some queuing present in the model during the evening peak period on Fishery Lane approaching the roundabout free choice was given to KDA traffic exiting the site in relation to which exit route the traffic can take. The equilibrium assignment in the model will try and balance the cost for each exit allowing for overall demand. By iteratively running the simulation, the model will build costs and paths files and re-distribute the traffic between the two available exit routes in order to reach balanced convergence. The final proportional split of exit used will be provided as part of model outputs.

3. Microsimulation Testing

3.1 Overview

The model tests have been carried out in the PM peak scenario to test the impact of development trips during the busiest period of the day.

The model does not make allowances for the potential for trips to reroute out of the model area due to the impact of the additional development trips, all Do Minimum trips stay constant. Also all trips to and from the KDA site are assumed as additional, no pass-by trip rate was applied for the purposes of these tests.

3.2 DS Model runs

The following total demand levels were tested:

- 270 vehicles entering within the peak hour,
- 175 vehicles entering within the peak hour,
- 400 vehicles exiting within the peak hour,
- 330 vehicles exiting within the peak hour,
- 275 vehicles exiting within the peak hour, and
- 220 vehicles exiting within the peak hour,

The tests conclude that the maximum additional traffic demand that could be accommodated by the existing road network using demand distribution 1 (service station) was estimated to be around 270 entering vehicles and 275 exiting vehicles during the PM peak hour. When using the demand distribution 2 (mixed development) the maximum demand that could be accommodated using the existing road network was estimated to be around 175 entering vehicles and 275 exiting vehicles during the PM peak hour. Within the VISSIM model this scale of additional demand does cause a significant level of congestion for a short period during the peak.

Tests with the demand distribution 1 were undertaken first. **Figure 3-1** and **Figure 3-2**, provide images of the VISSIM Do Something 1 model during a run (Random seed 40). As can be seen, queuing begins at 16:30, with queuing building on the northbound Dublin Road approach to the Maudlins roundabout and on the Dublin Road northbound approach to the Fishery Lane roundabout. All queues extend further into the period, and by 17:00 there are queues forming on both exits from the development test site.

Figure 3-1: PM Do Something 1 16:00 to 16:45

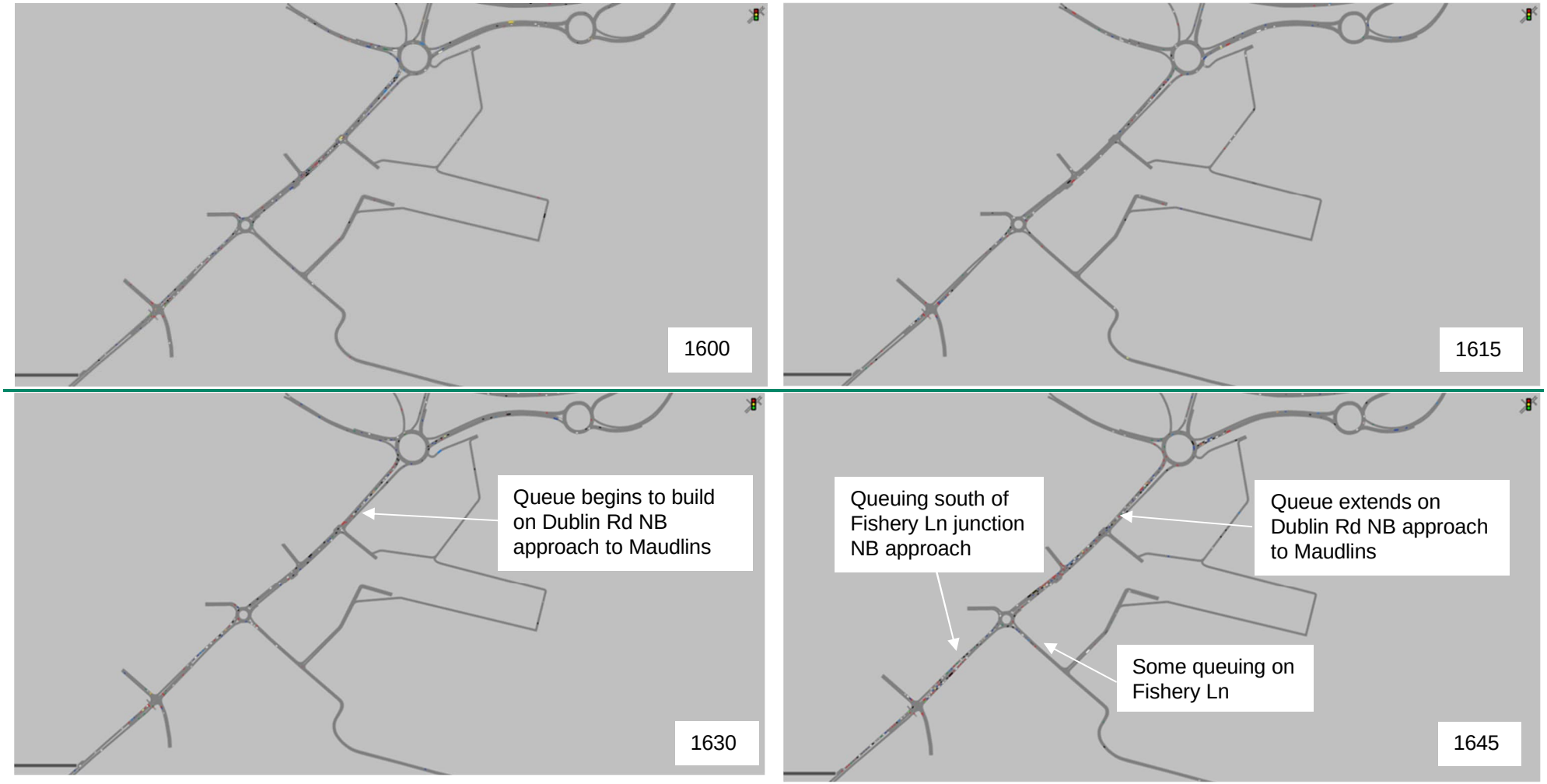
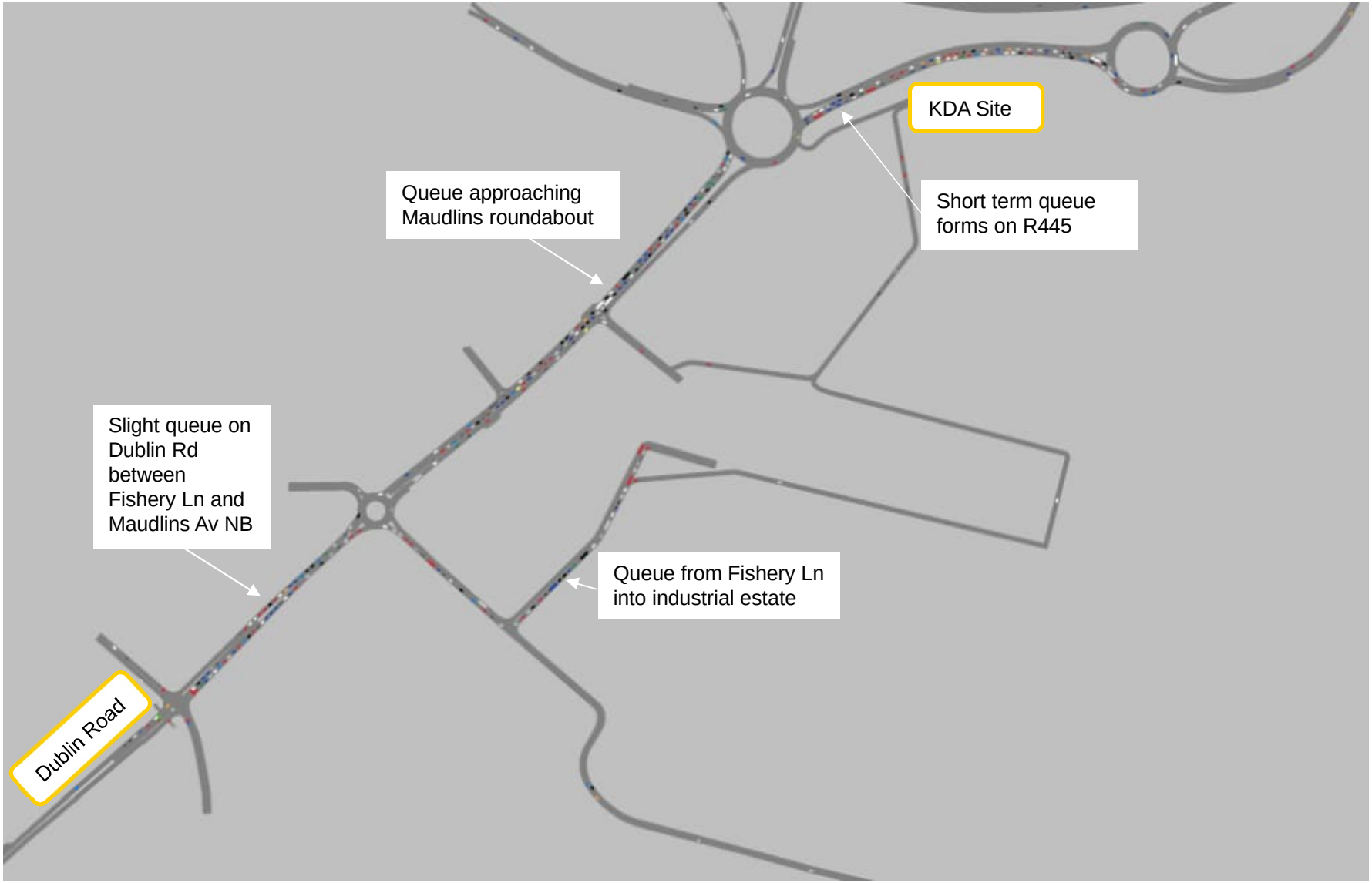


Figure 3-2: PM Do Something 1 17:00



Although the model operates reasonably well with a demand of 275 exiting vehicle and 270 entering vehicles during the evening peak hour there is still a level of congestion that builds throughout the peak, most notability in the period from 16:45 to 17:00. In order to mitigate the negative impacts some local recommendations have been included in the section below.

Figure 3-3 and **Figure 3-4** provide images of the VISSIM Do Something 2 model using Demand Distribution 2 during a run (Random seed 40). Queuing is forecast to begin at 16:30, with queuing building on the northbound Dublin Road approach to the Maudlins roundabout, on Fishery Lane approach to Dublin Rd and on Dublin Road northbound approach to the Fishery Lane roundabout. All queues extend further into the peak, and by 17:00 there are queues forming on both exits from the KDA development site.

As explained earlier the exit route from the KDA site is decided iteratively by the model. **Table 3-1** provides the percentage of trips predicted to use each exit. There is only one access point to the development zone.

Table 3-1: Development Exit Split Proportions

Location	Percentage of Exit Trips
Dublin Road	82%
Fishery Lane	18%

Figure 3-3: PM Do Something 2 16:00 to 16:45

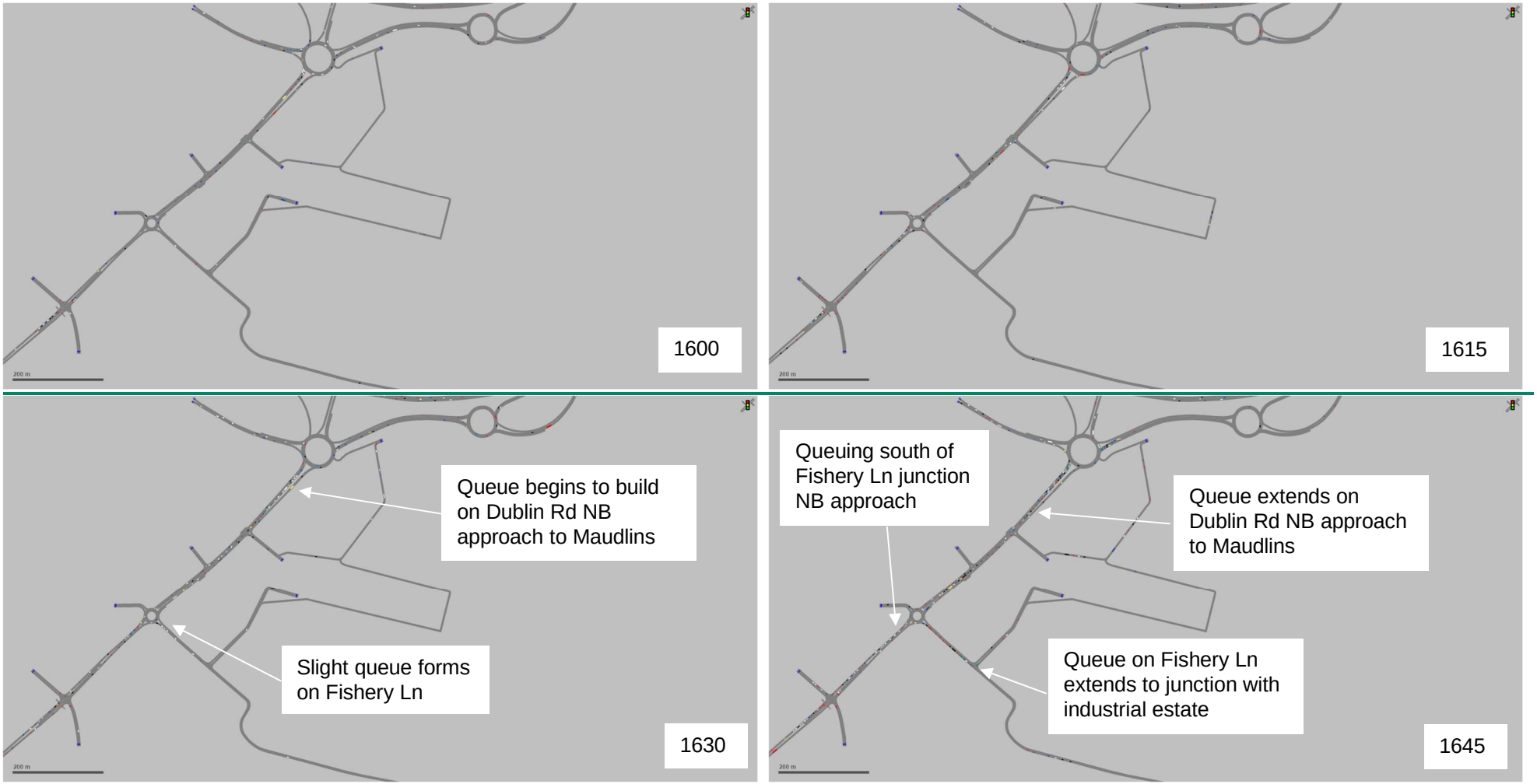
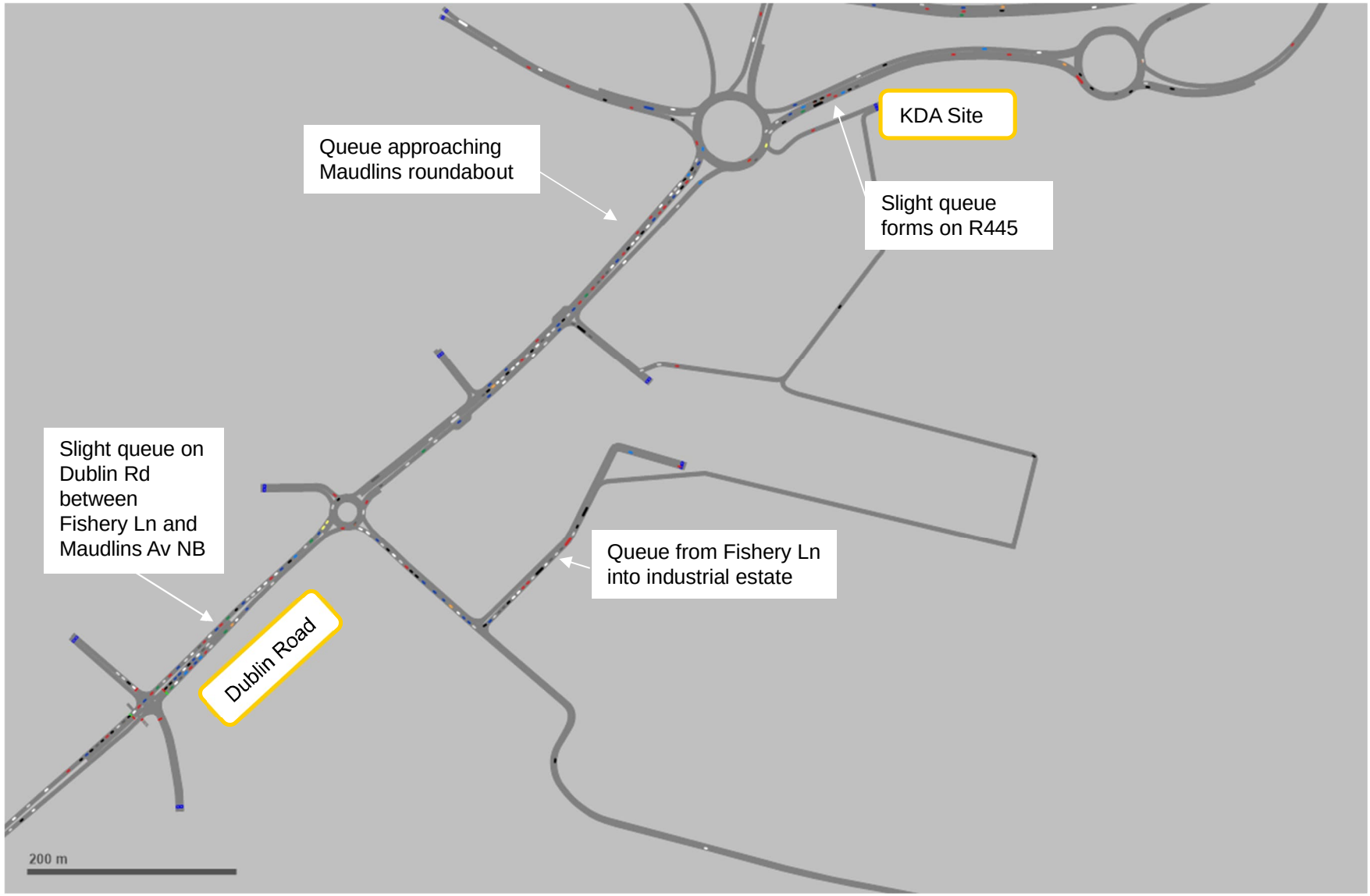


Figure 3-4: PM Do Something 2 17:00



Although the model operates reasonably well with the addition of 275 exiting vehicles and 175 entering vehicles during the evening peak hour there is still a level of congestion that builds throughout the peak, most notability in the period from 16:45 to 17:00. In order to mitigate the negative impacts of both tests (Do Something 1 and Do Something 2) some local recommendations were proposed as set out in the section below.

3.3 Recommendations

To improve the performance of the local road network and potentially allow for additional development traffic a number of network modifications were identified as below:

- Modify signal timings at Dublin Rd / Maudlins Av junction to optimise queuing
- Increase capacity at the Dublin Rd / Fishery Ln junction by providing two lanes from Fishery Ln at the stop line and/or provide a two lane exit NB on Dublin Rd
- Increase capacity at Maudlins Roundabout for movements from Dublin Rd to N7 through a two lane approach to the N7 with an additional left turn lane to Monread Rd.

To assess the impacts of these network modifications each has been tested both individually and in combination.

3.4 Proposed Network Modifications

It must be noted that these tests have been carried out at a conceptual level, future design work would be required to confirm the viability and deliverability of the potential physical modifications however they have been developed in consultation with KCC.

The network modifications assumed for each test are as follows:

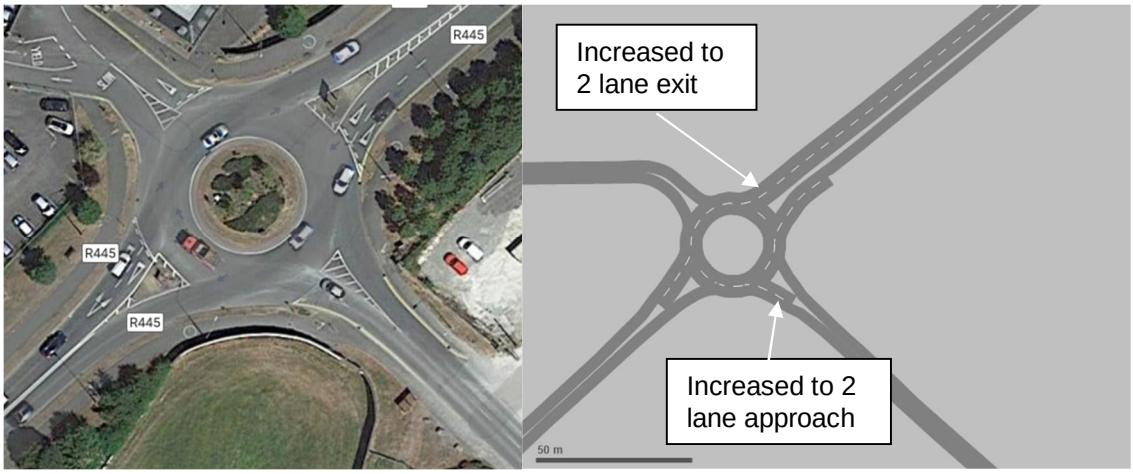
<u>Signal Modifications at Dublin Road</u>

An additional 10 seconds have been allocated to green time for signal phase 1 (Dublin Rd N/S movement) at the junction of Dublin Road with Maudlins Avenue and The Gallops.

<u>Fishery Lane two lane approach and Dublin Road two lane exit at roundabout junction</u>

Increased capacity at Fishery Lane roundabout would be achieved by extending the two lane section of the Dublin Road all the way to the roundabout to allow for a two-lane exit from the roundabout, two-lane operation of the roundabout and additional short stacking lane on the Fishery Lane approach to allow right turning traffic to wait and look for a gap in traffic to enter the roundabout.

Figure 3-5: Fishery Lane Roundabout Existing Layout and Proposed Modifications



Maudlins Roundabout three lane approach from South

Localised increased capacity at Maudlins Roundabout could be achieved by increasing the number of lanes on the approach to the roundabout from the Dublin Road direction from two to three. In addition, localised widening of the circulatory carriageway between southern Dublin Road arm and Monread Road to three lanes would allow the traffic from Dublin Road heading in the direction of Monread Road to do so in tandem with the traffic heading to the N7 westbound.

Figure 3-6: Maudlins Roundabout Existing Layout and Proposed Modifications

3.5 Network Modifications Testing Results

Four network modification scenarios were tested within the model:

- Modification A with Signal Modifications at Dublin Road
- Modification B with Fishery Lane two lane approach and Dublin Road two lane exit at roundabout junction
- Modification C with Maudlins Roundabout three lane approach
- Modification D will all modifications listed above (A, B and C)

All models were run to convergence to allow for the model to calculate appropriate proportions of vehicles exiting via each exit (Dublin Road or Fishery Lane). The models used demand distribution 2 (mixed use). The exiting proportions for each test are included in **Table 3-2.**

Table 3-2: Development Exit Split Proportions

Scenario	Dublin Rd	Fishery Ln
DS 1 and DS 2	82%	18%
DS 2A with Signal Modifications at Dublin Road	84%	16%
DS 2B with Fishery Lane two lane approach and Dublin Road two lane exit at roundabout junction	73%	27%
DS 2C with Maudlins Roundabout three lane approach	83%	17%
DS 2D with all modifications	74%	26%

The proportion of vehicles exiting the KDA site via Fishery Lane increases only in scenarios with the modifications proposed to the Fishery Lane roundabout. These modifications increase the capacity for Fishery Lane traffic entering the roundabout, but also help traffic that is already using the roundabout to exit more efficiently at Dublin Road northbound.

Images for each test run are presented in **Figure 3-7** to **Figure 3-10**. Each modification alone solves a single area of congestion however to improve the area a combination of interventions would be required.

Figure 3-7: PM Do Something 2A with Signal modifications at Dublin Rd

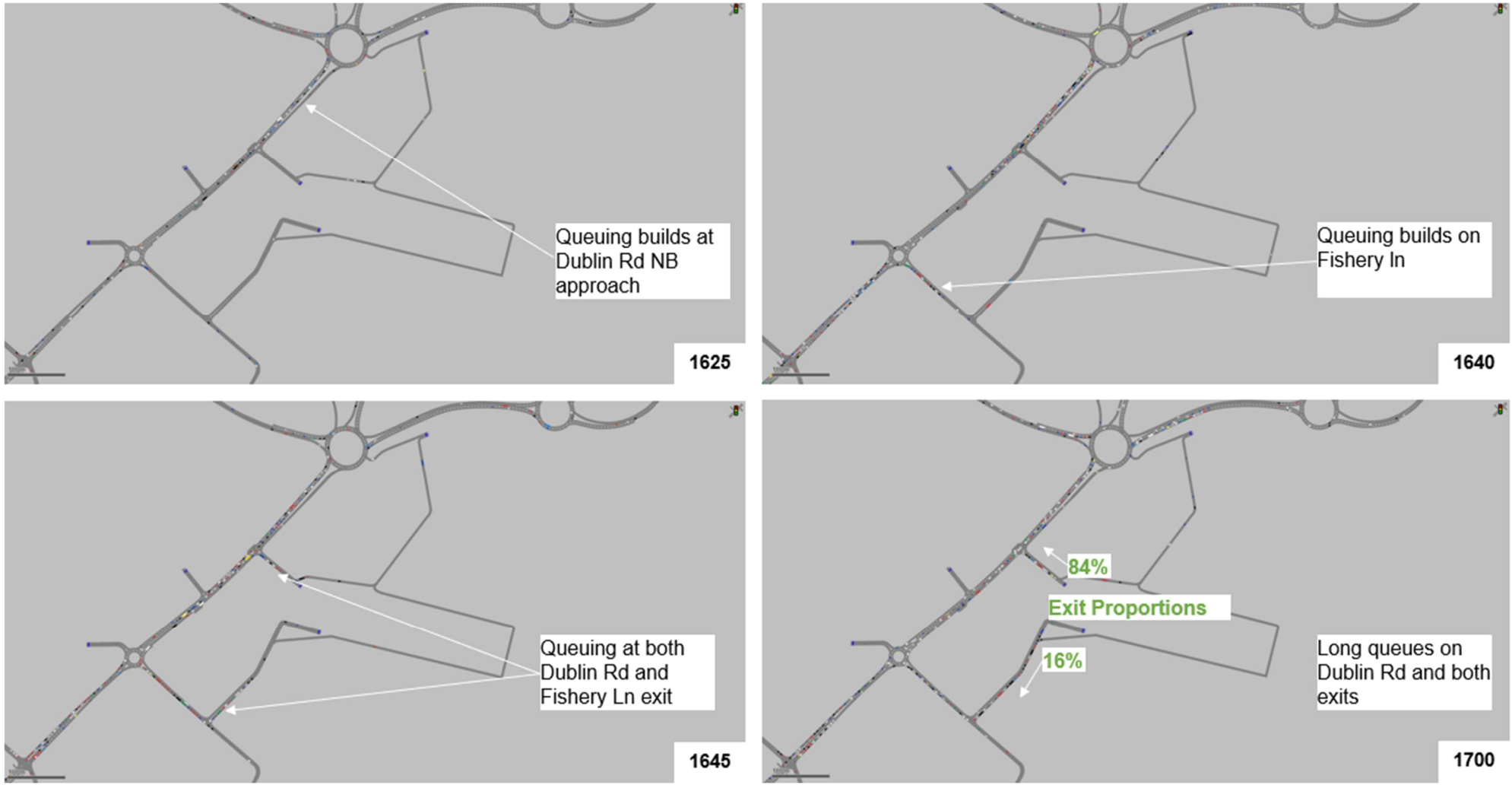


Figure 3-8: PM Do Something 2B with Fishery Ln two lane approach, two lane exit

Figure 3-9: PM Do Something 2C with Maudlins Roundabout three lane approach

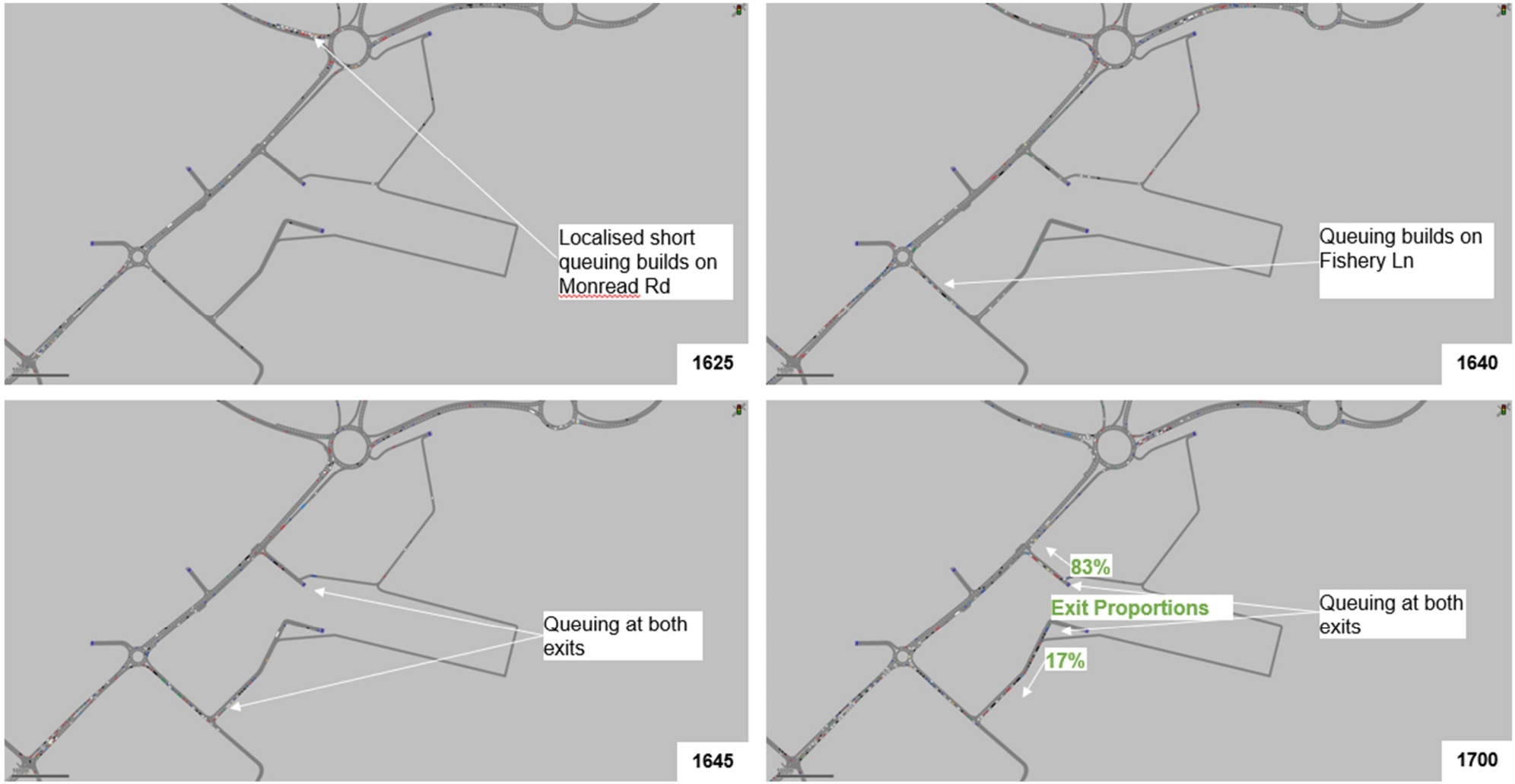
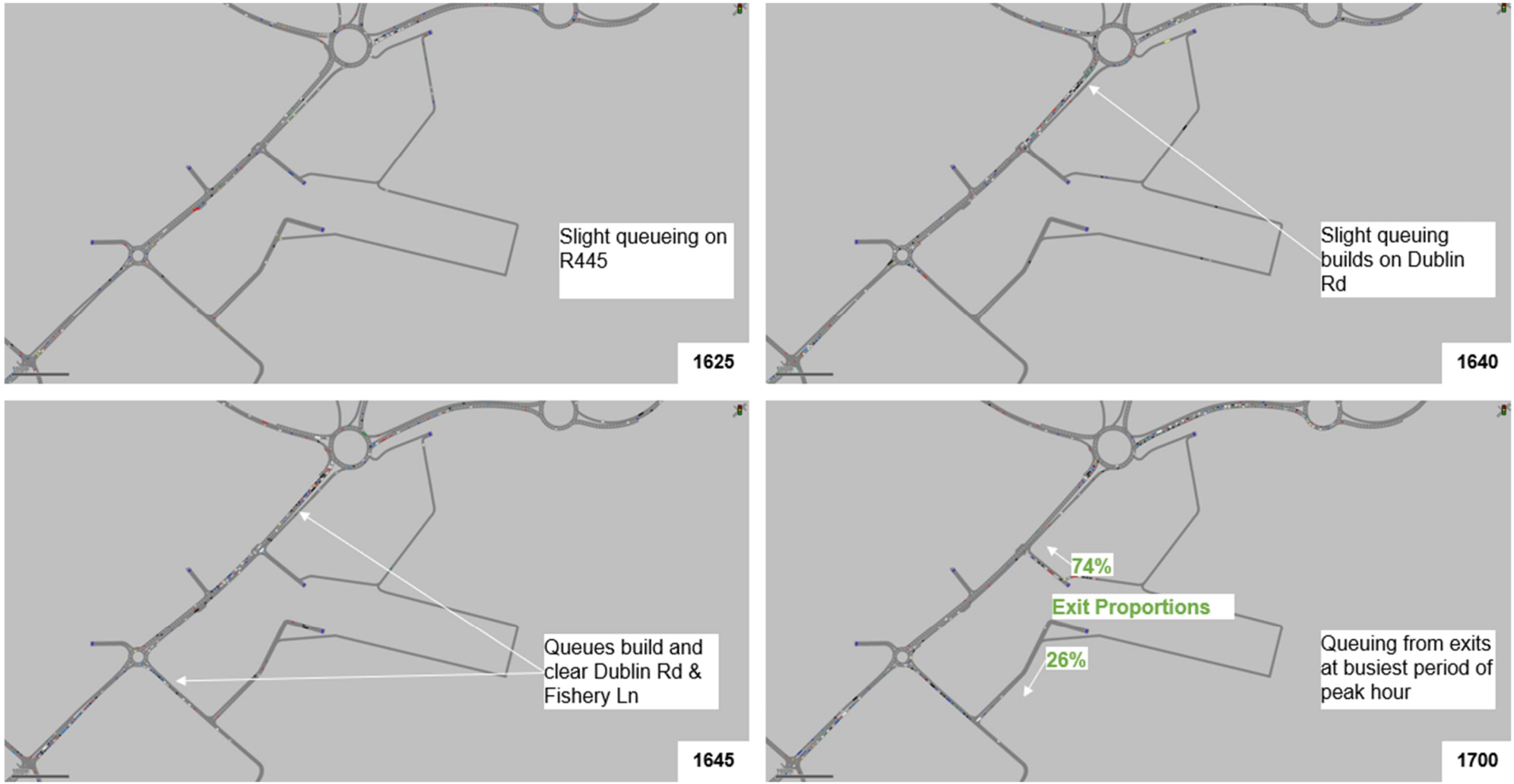


Figure 3-10: PM Do Something 2D with all test recommendation modifications



A summary of the findings for each scenario is provided below:

DS 2A with Signal Modifications at Dublin Road

In this option, adjusted signals at Dublin Road, Maudlins Avenue and The Gallops increased the efficiency of traffic travelling in northbound direction on Dublin Road. Due to the high traffic flows outbound in northbound direction this caused Dublin Road to be filled with traffic on the approach to Fishery Lane roundabout and subsequently Maudlins roundabout. The improved flow of traffic caused queuing initially at the Maudlins roundabout and eventually extending to Fishery Lane. This queuing is predicted to impact traffic exiting from the KDA site on both exits. The change to the traffic signals would be most suited with some supplementary modifications to Maudlins roundabout to address the excessive queuing on Dublin Road approach to that roundabout.

DS 2B with Fishery Lane two lane approach and Dublin Road two lane exit at roundabout junction

This modification improved the operation of the Fishery Lane roundabout, which resulted in reduction in queuing on both exits from the KDA site. However, the improvement increased the efficiency of traffic flow on the Dublin Road approach to Maudlins roundabout and once the Dublin road became congested the queuing caused blocking back of traffic on both exits from the KDA site and Fishery Lane. These modifications should be complemented by modifications to Maudlins roundabout southern approach arm to make the most out of the improvement.

DS 2C with Maudlins Roundabout three lane approach

This modification on its own improved the queuing on the Dublin Road approach to Maudlins roundabout, however the constraint in this scenario is the Fishery Lane roundabout. Due to capacity constraints at this junction the queuing extended on all approaches to this roundabout starting on Fishery Lane, and Dublin Road south and north approaches. The performance of Maudlins roundabout was improved however the full extent of the improvements could not be tested as the efficiency of traffic flows arriving at Maudlins roundabout were not improved.

DS 2D with all modifications

With all modifications in place the traffic congestion on the local road network still develops but clears quickly and if not predicted to block back to any junctions. The model estimates that 74% of traffic exiting the KDA site will do so via the Dublin Road left-out exit and 26% will use exit onto Fishery Lane via existing Naas Industrial Estate.

A subsequent test was carried out which increased the development demand by 10% (total exiting vehicles 300) alongside all potential modifications, this test found that this increased level of demand could be supported by the modified network.

It should be noted that the high level of congestion in the model only occurs between 16:45 and 17:00. The profile for exiting vehicles is based on the 2022 observed data used for the calibration of the base model which sees this 15-minute time period experience an influx of departing demand. If the exiting demand profile could be smoothed further over the hour it is likely the model could accommodate further demand increases however, to provide some resilience to the performance of the existing road network it was not tested further.

The above modifications were included and tested in the models with Demand Distribution 2 (mixed use), however they can be implemented within the local road network irrespective of the type of the land uses proposed for the KDA. The results (screenshots) from the additional test scenario (all modifications included and Demand Distribution 1 – DS 1D are included in Appendix B. The results for this test show no impact on queuing along the R445.

4. TRICS Analysis

4.1 Introduction

Trip Rate Information Computer System (TRICS) is a database of trip rates for developments used in the United Kingdom and Ireland for transport Planning Purposes, specifically to quantify the trip generation of new developments. Based on traffic surveys for known development quantum and type of location TRICS estimates trip rates for each land use of the proposed development.

4.2 Trip Rate Calculations

Some potential land use combinations have been used to estimate total vehicular demand to show potential land use combinations and level of quantum for those land uses that could be accommodated on the KDA site. Full details on the potential land use combinations and trip rates and development details from TRICS are included in Appendix C.

The overall arrivals and departures to/from the KDA site with the potential combinations of land uses amount to between 163 - 270 vehicles entering the site and between 250 - 280 vehicular trips exiting the site in the evening peak.

The potential combinations of land use and quantum of the proposed land use could be accommodated on the KDA site without any modifications to the existing road network.

5. Summary and Conclusions

5.1 Summary

AECOM have developed a micro-simulation VISSIM model of the M7/N7 Junction 9 (Maudlins) and the local road network to assess and quantify the overall level of vehicular traffic that Junction 9 (Maudlins) that the local road network can efficiently support. Naas bound PM Peak traffic flows through Junction 9 (Maudlins) have the most potential to negatively impact on the operation/safety of the National Road Network (e.g. queuing on the westbound off-ramp of the N7) as such it was proposed to assess the PM peak and not the AM Peak for the purposes of this assessment.

Two types of demand distribution scenarios were considered, one for land use permitted in principle (Demand Distribution 1), and the other for more mixed land use (Demand Distribution 2) considered for the KDA site.

The maximum demand that could be accommodated using the existing road network under Demand Distribution 1 was estimated to be around 270 entering vehicles and 275 exiting vehicles during the PM peak hour. This did not cause significant queuing on R445 and the queues did not spill onto the N7 off-ramps. Under Demand Distribution 2 the maximum demand for KDA site was estimated to be around 175 vehicles entering and 275 exiting vehicles during the PM peak hour. However it was found that this does cause a significant level of congestion for a short period during the peak hour.

To mitigate some of the queuing a list of modifications/improvements was developed, and the model has been tested using the Do Something demand. The overall visual improvements in queuing were noted, however all improvements identified should be implemented in tandem as the sum of the parts is greater than the individual impact and together, they represent a more holistic network.

The modified road network was tested again with increased traffic flow from the KDA site and it was concluded that exit flows could be increased to 300 vehicles during PM peak with the modifications in place. Queuing was observed during the modelling of the evening peak hour, however it was short in duration and dissipated quickly. Simple smoothing of demand profile for traffic exiting the site would significantly reduce the impact on the road network.

Based on the estimated level of traffic exiting the KDA site in the evening peak a combination of land uses and their quantum's have been worked out. These were reported on in Appendix C.

5.2 Conclusions

The report shows that the impact of the KDA traffic on the local road network changes with the type of proposed land use due to changing travel patterns/distribution. The traffic on the local road network is heaviest during the evening peak period on the Dublin Road north-east direction, therefore traffic flow on Dublin Road and the operation of its junctions was deemed the critical element to determining the maximum flow to and from the KDA site.

When more traffic is attracted to the site from the N7/M7, like in the service station scenario, the Dublin Road is mostly impacted by traffic exiting the KDA site and small proportion of traffic entering, therefore the total inbound trips to the KDA site is higher in that example (270 in and 275 out).

When more mixed-use development is assessed at the KDA site (a more even balance in the attraction of trips from N7 and local roads) a higher proportion of traffic accessing the site and lower proportion of traffic egressing the site is impacting on the Dublin Road congestion build up resulting in maximum flow to and from the KDA site in the region of 175 in and 275 out.

It should also be noted that land uses such as a service stations have a high trip generation, but this usually includes a high proportion of pass-by trips rather than new trips to the area. This is not the case for mixed-use land such as office, drive-through or creche which generates a higher proportion of additional trips to the area. Given the absence of data all trips tested in this note are additional, no pass-by proportions were applied.

Local road improvements were tested and proved beneficial in addressing localised congestion and inefficient use of road space, however they should always be considered holistically and in a wider context to make sure interventions do not indirectly negatively impact on other locations.

6. Developers Revised Access Strategy

6.1 Overview

Developers Fagan Group and Petrogas Group Limited, have commissioned SYSTRA Limited to provide further transport planning services in relation to the access strategy for the Maudlins Key Development Area (KDA). This further work supplements the Transport Appraisal of the site undertaken by AECOM on behalf of Kildare County Council (KCC). Details and results from this assessment are provided in the SYSTRA report titled 'Maudlins KDA, Developers Proposed Access Strategy – Transport Appraisal' (Included within Appendix D of this report).

For SYSTRA to test the proposed access strategy, KCC provided SYSTRA with a copy of the VISSIM microsimulation model, developed by AECOM as previously detailed within this report. SYSTRA have used this model to test network modifications to the KDA site access strategy put forward by the developers.

6.2 Developers Assessment

The assessment undertaken by Systra on behalf of the developers of the Maudlins KDA site utilised AECOM's model but made changes in relation to the following:

- Demand – The developer's assessment has increased the quantum of development within the site and subsequently the level of peak hour trips
- Site Access - Modifications have made in terms of access/egress to the site

Details of these changes are provided in the following sections.

Increased Quantum of Development

The trip generation for the Maudlins KDA site assumed as part of the AECOM assessment and the trip generation in the developer's assessment is presented in **Table 6-1.** The maximum trip generation tests for the Maudlins KDA site were developed using two demand distribution profiles, hence the range provided in the PM Peak Arrivals under the AECOM assessment. The developer's proposal included a mix of the demand distribution profiles; therefore an average value was used to calculate the proportional change. The table shows that overall the developers have assumed an addition 36% in PM Peak Hour trips as part of this assessment.

Table 6-1: Combined Trip Generation of KDA site for the PM Peak Hour with Mitigation Measures

Scenario	AECOM Test	Developers Proposal	% Change
PM Peak Arrivals	175-270	263	18%
PM Peak Departures	300	449	+50%
PM Peak Totals	475-570	712	+36%

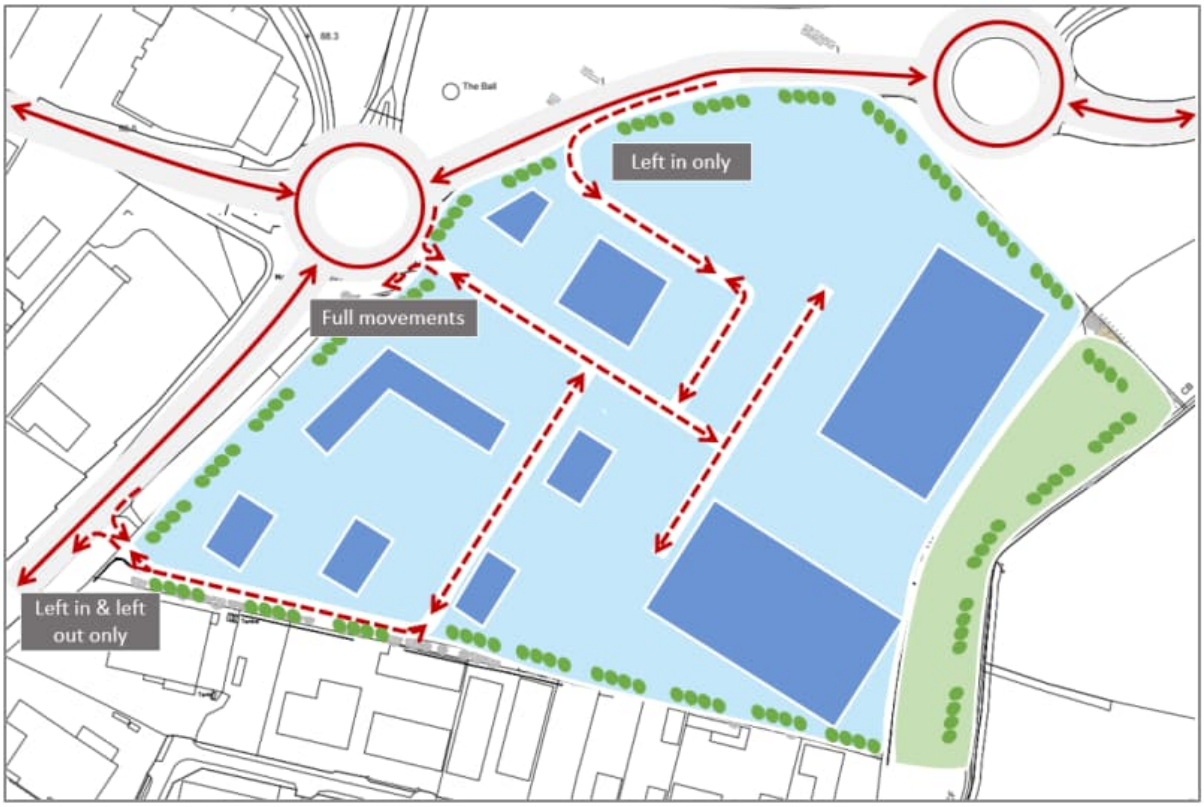
Site Access Modifications

The developer's proposal evaluated by Systra includes revised access/egress arrangements for the Maudlins KDA site, as follows:

- Left slip only entry from the Johnstown Road
- Entry and exit to the KDA site via the Maudlins roundabout
- Retention of a left-in, left-out arrangement located south of the Maudlins Road roundabout

The revised arrangements are shown in **Figure 6-1**.

Figure 6-1: Developer Proposal – Alternative Access Strategy for the Maudlins KDA



The proposed access arrangements put forward by the developers allow for KDA vehicular traffic travelling to and from the N7/M7 to be accommodated via a two-way arm directly off the Maudlins roundabout, eliminating the need to access the N7/M7 via the Dublin Road / Fishery Lane Roundabout.

The new network configuration, together with the increased overall number of vehicular journeys associated with the developer's intended development, will put additional strain on the Maudlins roundabout, which is part of the existing N7/M7 interchange.

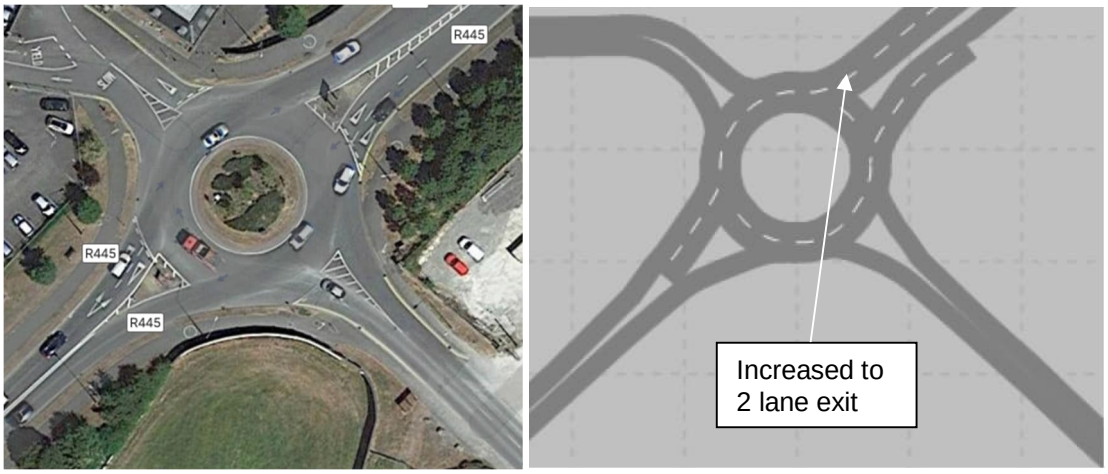
Traffic heading south along the Dublin Road will use the existing left-out exit, therefore traffic exiting the KDA site in all other directions (e.g. Monread Road, the M7/N7 on-ramps, or Johnstown Road) will use the Maudlins Roundabout reducing the available capacity/gaps available to the Dublin Road and Monread Road arms, therefore having a potential negative impact on the capacity/operation of the roundabout.

AECOM have reviewed the report produced by SYSTRA (the associated VISSIM micro-simulation models were not reviewed). In summary, under the proposed access arrangement (without any mitigation measures) significant increases in journey time on the Dublin Road (circa additional 7 min per vehicle in the northbound direction) during the PM peak hour would occur. Significant queuing would also occur on the Dublin Road northbound and on the exit from the Maudlins KDA site.

To improve the performance of the network, the developers propose several road network mitigation measures. The mitigation measures associated with increased capacity at the Maudlins Roundabout and Fishery Lane Roundabout identified in Section 3.4 of this note were further refined by the developer and are summarised below for reference. **Figure 6-2** shows mitigation measures proposed to the Maudlins Roundabout, while **Figure 6-3** shows mitigation measures proposed to the Fishery Lane Roundabout.

Figure 6-2: Maudlins Roundabout Existing Layout and Proposed Modifications

Figure 6-3: Fishery Lane Roundabout Existing Layout and Proposed Modifications



With the addition of the road network mitigation measures, the journey time on Dublin Road (northbound) up to the Maudlins Roundabout is reduced back to a Do-Minimum level (i.e. without the proposed development). The N/7M7 mainline and associated ramps would experience no increase in journey time. There would however be an increase to journey time eastbound on Monread Road. Further analysis by SYSTRA determines that the effects are experienced towards the end of the peak hour, most notably during the period 16:45 – 17:00.

6.3 Summary

The developer's proposal increases the development quantum and the resulting traffic generation to and from the Maudlins KDA site over what was assessed in this note as the maximum traffic flow with the pre-defined access arrangement. The developer's revision to the KDA access arrangement is adding an additional arm to the Maudlins roundabout, thereby increasing the traffic flow at the circulatory carriageway east of the Dublin Road arm and reducing the available gap/capacity to the remaining arms, mainly the Dublin and Monread Roads.

The proposed road network modification measures are reported to reduce delay on the Dublin Road, however the modelling results show significant queuing is present within the KDA site and queuing along the Monread Road. It should be noted that right turning traffic (i.e. towards the M7/N7) exiting the KDA site at the Maudlins roundabout in the PM will have priority over the Dublin Road and Monread Road arms. High volumes of traffic exiting the KDA site at this location has the potential to significantly impact on the operation of the Maudlins roundabout and Dublin Road approach arm.

Appendix A

A.1 Naas LAP 2021-2027 Land Use Zoning Matrix

LAND USE	A: Town Centre	B: Existing Residential	C: New Residential	R: Retail/Commercial	T: Mixed-use	U: Utilities/Services
Amusement Arcade	O	N	N	N	N	N
Agricultural Buildings	N	N	N	N	N	N
Car Park (other than ancillary)	Y	N	N	O	O	O
Betting Office	O	N	N	N	N	N
Cemetery	N	N	N	N	N	N
Cinema	O	N	N	O	O	N
Community / Recreational / Sports buildings	Y	O	O	O	O	N
Crèche/ Playschool	Y	O	Y	O	O	N
Cultural Uses/Library	Y	O	O	N	O	N
Dancehall/ Disco	O	N	N	N	N	N
Data Centre	N	N	N	N	O[67]	N
Dwelling	Y	Y	Y	N	N	N
Emergency Residential Accommodation	Y	O	O	N	O	N
Funeral Homes	Y	N	N	N	O	N

LAND USE	A: Town Centre	B: Existing Residential	C: New Residential	R: Retail/Commercial	T: Mixed-use	U: Utilities/Services
Garage/Car Repairs	N	N	N	O	N	N
Group/Special Needs Housing	Y	Y	Y	N	N	N
Guest House/ Hotel/Hostel	Y	O	O	N	O	N
Heavy Commercial Vehicle Park	N	N	N	N	O[76]	O
Hot food take-away	O	N	N	O	O	N
Industry (light)	O	N	N	O	O	N
Industry (general)	N	N	N	N	N	O
Medical Consultant/ Health Centre	Y	O	O	O	O	N
Motor Sales	O	N	N	O	O	N
Nursing Home	Y	Y	Y	N	O	N
Offices	Y	O[77]	O[78]	O	O	N
Park /Playground	Y	Y	Y	N	O	N
Service Station	N	N	O	O	Y[80]	O
Place of Worship	Y	O	O	N	O	N
Playing Fields	O	O	O	N	N	N

LAND USE	A: Town Centre	B: Existing Residential	C: New Residential	R: Retail/Commercial	T: Mixed-use	U: Utilities/Services
Pub	Y	N	O	O	O	N
Restaurant	Y	O	O	O	O	N
School	Y	O	O	N	O	N
Shop (Comparison)	Y	N	N	O	N	N
Shop (Convenience)	Y	O[B1]	O[B2]	Y	O[B6]	N
Retail Warehousing	Y	N	N	O	N	N
Stable Yard	N	N	N	N	N	N
Tourist Related Facilities	Y	O	O	O	O	N
Utility Structures	O	O	O	O	O	Y
Warehouse (wholesale) /Logistics /Store/Depot	O	N	N	N	O	N

Appendix B

B.1 Screenshots from test DS 1D – 16:30

B.2 Screenshot from test DS 1 D – 16:45

B.3 Screenshot from test DS 1D – 17:00

Appendix C

C.1 Potential land use combinations and level of development quantum

No	Land Use	Quantum	Trip Rate Arrival / Departure		Trip Generation Arrivals/Departures		Total	
1	Petrol Filling Station	30 Bays	9	9	270	270	270	270
2	Petrol Filling Station	20 Bays	9	9	180	180	235	280
	Warehousing	24,500 Sqm	0.223	0.407	55	100		
3	Petrol Filling Station	20 Bays	9	9	180	180	211	280
	Warehousing	9,500 Sqm	0.223	0.407	21	39		
	Office	7,000 Sqm	0.144	0.875	10	61		
4	Petrol Filling Station	20 Bays	9	9	180	180	217	252
	Warehousing	6,000 Sqm	0.223	0.407	13	24		
	Office	3,041 Sqm	0.144	0.875	4	27		
	Drive Through Coffee Shop	160 Sqm	11.715	13.017	19	21		
5	Petrol Filling Station	12 Bays	9	9	108	108	163	278
	Warehousing	13,000 Sqm	0.223	0.407	29	53		
	Office	12,250 Sqm	0.144	0.875	18	107		
	Creche	500 Sqm	1.615	1.916	8	10		
6	Petrol Filling Station	12 Bays	9	9	108	108	178	281
	Warehousing	10,000 Sqm	0.223	0.407	22	41		
	Office	11,000 Sqm	0.144	0.875	16	96		
	Creche	500 Sqm	1.615	1.916	8	10		
	Drive Through Coffee Shop	200 Sqm	11.715	13.017	23	26		

C.2 Trip Rates for Service Station

To determine the potential trip rate and associated trip generation for the Petrol Filling Station land use, AECOM undertook a TRICS assessment and a first principles analysis. For the TRICS assessment the arrival rate was determined to be 7.574 and the departure rate was 7.840. It should be noted that the TRICS database does not include any Motorway Service Areas (MSAs) within Ireland. The first principles approach adopted an average stay of 6 minutes from when a customer pulls into the petrol pump, fills up, pays and leaves the pump. This results in a trip rate of 10.000 for arrivals and departures which would suggest that the petrol pump is 100% utilised throughout the peak hour period.

For the purposes of this assessment, an average was taken between the TRICS value and the first principles value to determine a suitable arrival and departure rate for the Petrol Filling Station land use which was 9.000 for the arrival and departure rate. This number of 9.000 would equate to an approximate stay of 6 minutes and 40 seconds per vehicle.

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	1
Development Zone	1
Residential Zone	11
Retail Zone	1
No Sub Category	3

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

Sui Generis	17 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:

All Surveys Included

Population within 1 mile:

1,001 to 5,000	2 days
5,001 to 10,000	2 days
10,001 to 15,000	5 days
15,001 to 20,000	2 days
20,001 to 25,000	3 days
25,001 to 50,000	3 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
50,001 to 75,000	2 days
75,001 to 100,000	2 days
100,001 to 125,000	1 days
125,001 to 250,000	5 days
250,001 to 500,000	6 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	7 days
1.1 to 1.5	8 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	17 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	17 days

This data displays the number of selected surveys with PTAL Ratings.

Covid-19 Restrictions	Yes	At least one survey within the selected data set was undertaken at a time of Covid-19 restrictions

LIST OF SITES relevant to selection parameters

1 BR-13-B-02 TESCO EXTRA PFS BRISTOL CITY
EASTGATE ROAD
BRISTOL

Suburban Area (PPS6 Out of Centre)
Retail Zone
Total Filling bays: 12
Survey date: TUESDAY *09/11/21* *Survey Type: MANUAL*

2 DC-13-B-01 ESSO & TESCO EXPRESS DORSET
271 BARRACK ROAD
CHRISTCHURCH

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 6
Survey date: MONDAY *24/03/14* *Survey Type: MANUAL*

3 DC-13-B-02 M&S & BP DORSET
71-75 SOMERFORD ROAD
CHRISTCHURCH

Suburban Area (PPS6 Out of Centre)
No Sub Category
Total Filling bays: 8
Survey date: FRIDAY *21/03/14* *Survey Type: MANUAL*

4 DS-13-B-01 ESSO & TESCO EXPRESS DERBYSHIRE
NOTTINGHAM ROAD
DERBY
CHADDESDEN
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 8
Survey date: FRIDAY *26/06/15* *Survey Type: MANUAL*

5 DV-13-B-01 BP & COSTCUTTER DEVON
TORBAY ROAD
PAIGNTON

Edge of Town
Residential Zone
Total Filling bays: 8
Survey date: TUESDAY *18/07/17* *Survey Type: MANUAL*

6 EB-13-B-02 BP CONNECT & M&S SIMPLY FOOD CITY OF EDINBURGH
BULLYEON ROAD
QUEENSFERRY

Edge of Town
Residential Zone
Total Filling bays: 15
Survey date: THURSDAY *26/06/14* *Survey Type: MANUAL*

7 FI-13-B-01 BP & M&S SIMPLY FOOD FIFE
HARBOUR DRIVE
DALGETY BAY

Edge of Town
No Sub Category
Total Filling bays: 13
Survey date: WEDNESDAY *23/03/16* *Survey Type: MANUAL*

8 GA-13-B-01 CIRCLE K & SPAR GALWAY
BRACKERNAGH
BALLINASLOE

Edge of Town
Residential Zone
Total Filling bays: 10
Survey date: TUESDAY *14/09/21* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

9 GM-13-B-01 BP & SPAR GREATER MANCHESTER
NEW STREET
ROCHDALE
MILNROW
Edge of Town
Residential Zone
Total Filling bays: 8
Survey date: WEDNESDAY 21/10/15 Survey Type: MANUAL

10 LC-13-B-03 TEXACO & MORRISONS DAILY LANCASHIRE
GARSTANG ROAD
PRESTON
FULWOOD
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 8
Survey date: TUESDAY 06/11/18 Survey Type: MANUAL

11 LE-13-B-02 TESCO EXPRESS & ESSO LEICESTERSHIRE
FOSSE ROAD NORTH
LEICESTER

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 8
Survey date: TUESDAY 28/10/14 Survey Type: MANUAL

12 LN-13-B-01 GULF & CO-OP LINCOLNSHIRE
CARHOLME ROAD
LINCOLN

Edge of Town
Residential Zone
Total Filling bays: 8
Survey date: WEDNESDAY 04/10/17 Survey Type: MANUAL

13 NT-13-B-03 SAINSBURY'S PFS NOTTINGHAMSHIRE
CASTLE BRIDGE ROAD
NOTTINGHAM

Suburban Area (PPS6 Out of Centre)
Development Zone
Total Filling bays: 16
Survey date: FRIDAY 25/11/16 Survey Type: MANUAL

14 NY-13-B-03 ESSO & CO-OP NORTH YORKSHIRE
WETHERBY ROAD NORTH
KNARESBOROUGH

Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Filling bays: 8
Survey date: FRIDAY 30/09/16 Survey Type: MANUAL

15 TW-13-B-05 SHELL & SPAR TYNE & WEAR
THE BROADWAY
SUNDERLAND

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 6
Survey date: FRIDAY 24/05/19 Survey Type: MANUAL

16 WA-13-B-01 TOPAZ WATERFORD
DUNMORE ROAD
WATERFORD
COVE LANE
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Filling bays: 8
Survey date: TUESDAY 12/05/15 Survey Type: MANUAL

LIST OF SITES relevant to selection parameters (Cont.)

17 WO-13-B-02 MORRISONS PFS WORCESTERSHIRE
CLEARWELL ROAD
REDDITCH
WINYATES WEST
Suburban Area (PPS6 Out of Centre)
No Sub Category
Total Filling bays: 12
Survey date: MONDAY *05/10/20* *Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 13 - PETROL FILLING STATIONS/B - PFS - WITH RETAIL
TOTAL VEHICLES
Calculation factor: 1 BAYS
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. BAYS	Trip Rate	No. Days	Ave. BAYS	Trip Rate	No. Days	Ave. BAYS	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	1	10	0.300	1	10	0.100	1	10	0.400
06:00 - 07:00	17	10	4.654	17	10	4.340	17	10	8.994
07:00 - 08:00	17	10	7.222	17	10	7.019	17	10	14.241
08:00 - 09:00	17	10	7.469	17	10	7.222	17	10	14.691
09:00 - 10:00	17	10	7.420	17	10	7.444	17	10	14.864
10:00 - 11:00	17	10	6.772	17	10	6.833	17	10	13.605
11:00 - 12:00	17	10	6.562	17	10	6.605	17	10	13.167
12:00 - 13:00	17	10	8.049	17	10	7.963	17	10	16.012
13:00 - 14:00	17	10	8.136	17	10	8.105	17	10	16.241
14:00 - 15:00	17	10	7.500	17	10	7.370	17	10	14.870
15:00 - 16:00	17	10	7.222	17	10	7.426	17	10	14.648
16:00 - 17:00	17	10	7.574	17	10	7.840	17	10	15.414
17:00 - 18:00	17	10	8.093	17	10	7.932	17	10	16.025
18:00 - 19:00	17	10	7.426	17	10	7.623	17	10	15.049
19:00 - 20:00	17	10	6.654	17	10	6.698	17	10	13.352
20:00 - 21:00	17	10	4.852	17	10	4.895	17	10	9.747
21:00 - 22:00	17	10	3.414	17	10	3.475	17	10	6.889
22:00 - 23:00	4	11	1.238	4	11	1.452	4	11	2.690
23:00 - 24:00	2	10	0.450	2	10	0.650	2	10	1.100
Total Rates:			111.007			110.992			221.999

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	6 - 16 (units:)
Survey date date range:	01/01/14 - 19/11/21
Number of weekdays (Monday-Friday):	17
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

C.3 Trip Rates for Warehousing

Calculation Reference: AUDIT-204602-220721-0758

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : D - INDUSTRIAL ESTATE
TOTAL VEHICLES

Selected regions and areas:

01	GREATER LONDON		
	HV	HAVERING	1 days
02	SOUTH EAST		
	EX	ESSEX	1 days
03	SOUTH WEST		
	WL	WILTSHIRE	1 days
05	EAST MIDLANDS		
	LN	LINCOLNSHIRE	1 days
	NR	NORTHAMPTONSHIRE	2 days
06	WEST MIDLANDS		
	WK	WARWICKSHIRE	2 days
07	YORKSHIRE & NORTH LINCOLNSHIRE		
	NY	NORTH YORKSHIRE	1 days
	WY	WEST YORKSHIRE	2 days
10	WALES		
	VG	VALE OF GLAMORGAN	1 days
12	CONNAUGHT		
	CS	SLIGO	1 days
13	MUNSTER		
	CR	CORK	1 days
	TI	TIPPERARY	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter:	Gross floor area
Actual Range:	10000 to 40229 (units: sqm)
Range Selected by User:	10000 to 50000 (units: sqm)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/14 to 21/10/20

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	2 days
Tuesday	4 days
Wednesday	2 days
Thursday	4 days
Friday	3 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	15 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	1
Edge of Town	14

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

Not Known	15 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Filter by Site Operations Breakdown:
All Surveys Included

Population within 500m Range:
All Surveys Included

Population within 1 mile:

1,001 to 5,000	1 days
5,001 to 10,000	3 days
10,001 to 15,000	4 days
20,001 to 25,000	5 days
25,001 to 50,000	2 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
25,001 to 50,000	2 days
50,001 to 75,000	2 days
75,001 to 100,000	1 days
100,001 to 125,000	2 days
125,001 to 250,000	6 days
250,001 to 500,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	4 days
1.1 to 1.5	11 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	15 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	14 days
2 Poor	1 days

This data displays the number of selected surveys with PTAL Ratings.

Covid-19 Restrictions	Yes	At least one survey within the selected data set was undertaken at a time of Covid-19 restrictions

LIST OF SITES relevant to selection parameters

1 CR-02-D-03 INDUSTRIAL ESTATE CORK
R623
CORK
LITTLE ISLAND
Edge of Town
Industrial Zone
Total Gross floor area: 40229 sqm
Survey date: TUESDAY 15/10/19 Survey Type: MANUAL

2 CS-02-D-01 INDUSTRIAL ESTATE SLIGO
THE BACK AVENUE
SLIGO
CLEVERAGH
Edge of Town
No Sub Category
Total Gross floor area: 12008 sqm
Survey date: MONDAY 27/05/19 Survey Type: MANUAL

3 EX-02-D-04 INDUSTRIAL ESTATE ESSEX
PASTURE ROAD
WITHAM

Edge of Town
Industrial Zone
Total Gross floor area: 37130 sqm
Survey date: THURSDAY 10/05/18 Survey Type: MANUAL

4 HV-02-D-01 INDUSTRIAL ESTATE HAVERING
CHURCH ROAD
ROMFORD
HAROLD WOOD
Edge of Town
Residential Zone
Total Gross floor area: 13000 sqm
Survey date: TUESDAY 07/10/14 Survey Type: MANUAL

5 LN-02-D-03 INDUSTRIAL ESTATE LINCOLNSHIRE
DEACON ROAD
LINCOLN

Edge of Town
Industrial Zone
Total Gross floor area: 11265 sqm
Survey date: FRIDAY 28/06/19 Survey Type: MANUAL

6 NR-02-D-01 INDUSTRIAL ESTATE NORTHAMPTONSHIRE
ROBINSON WAY
KETTERING

Edge of Town
Industrial Zone
Total Gross floor area: 12900 sqm
Survey date: THURSDAY 23/10/14 Survey Type: MANUAL

7 NR-02-D-02 INDUSTRIAL ESTATE NORTHAMPTONSHIRE
CORNHILL CLOSE
NORTHAMPTON
LODGE FARM IND. ESTATE
Edge of Town
Industrial Zone
Total Gross floor area: 12670 sqm
Survey date: WEDNESDAY 21/10/20 Survey Type: MANUAL

8 NY-02-D-02 INDUSTRIAL ESTATE NORTH YORKSHIRE
RACECOURSE ROAD
RICHMOND

Edge of Town
Out of Town
Total Gross floor area: 35183 sqm
Survey date: TUESDAY 12/03/19 Survey Type: MANUAL

LIST OF SITES relevant to selection parameters (Cont.)

9 TI-02-D-01 INDUSTRIAL ESTATE TIPPERARY
LIMERICK ROAD
NENAGH

Edge of Town
No Sub Category
Total Gross floor area: 33000 sqm
Survey date: FRIDAY *27/05/16* *Survey Type: MANUAL*

10 VG-02-D-01 INDUSTRIAL ESTATE VALE OF GLAMORGAN
ARTHUR STREET
BARRY

Edge of Town
No Sub Category
Total Gross floor area: 13091 sqm
Survey date: MONDAY *08/05/17* *Survey Type: MANUAL*

11 WK-02-D-03 INDUSTRIAL ESTATE WARWICKSHIRE
EASTBORO WAY
NUNEATON

Edge of Town
Industrial Zone
Total Gross floor area: 20860 sqm
Survey date: THURSDAY *26/09/19* *Survey Type: MANUAL*

12 WK-02-D-04 INDUSTRIAL ESTATE WARWICKSHIRE
ABELES WAY
ATHERSTONE

Edge of Town
No Sub Category
Total Gross floor area: 17500 sqm
Survey date: FRIDAY *27/09/19* *Survey Type: MANUAL*

13 WL-02-D-02 INDUSTRIAL ESTATE WILTSHIRE
HEADLANDS GROVE
SWINDON

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 10000 sqm
Survey date: TUESDAY *20/09/16* *Survey Type: MANUAL*

14 WY-02-D-04 INDUSTRIAL ESTATE WEST YORKSHIRE
LAW STREET
CLECKHEATON

Edge of Town
Industrial Zone
Total Gross floor area: 23226 sqm
Survey date: THURSDAY *15/09/16* *Survey Type: MANUAL*

15 WY-02-D-08 INDUSTRIAL ESTATE WEST YORKSHIRE
MILL LANE
HALIFAX

Edge of Town
No Sub Category
Total Gross floor area: 11305 sqm
Survey date: WEDNESDAY *17/10/18* *Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 02 - EMPLOYMENT/D - INDUSTRIAL ESTATE
TOTAL VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	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	4	22815	0.050	4	22815	0.009	4	22815	0.059
06:00 - 07:00	5	20505	0.173	5	20505	0.023	5	20505	0.196
07:00 - 08:00	15	20224	0.387	15	20224	0.098	15	20224	0.485
08:00 - 09:00	15	20224	0.481	15	20224	0.192	15	20224	0.673
09:00 - 10:00	15	20224	0.314	15	20224	0.224	15	20224	0.538
10:00 - 11:00	15	20224	0.246	15	20224	0.231	15	20224	0.477
11:00 - 12:00	15	20224	0.233	15	20224	0.232	15	20224	0.465
12:00 - 13:00	15	20224	0.232	15	20224	0.280	15	20224	0.512
13:00 - 14:00	15	20224	0.266	15	20224	0.263	15	20224	0.529
14:00 - 15:00	15	20224	0.240	15	20224	0.273	15	20224	0.513
15:00 - 16:00	15	20224	0.193	15	20224	0.276	15	20224	0.469
16:00 - 17:00	15	20224	0.223	15	20224	0.407	15	20224	0.630
17:00 - 18:00	15	20224	0.152	15	20224	0.457	15	20224	0.609
18:00 - 19:00	15	20224	0.081	15	20224	0.171	15	20224	0.252
19:00 - 20:00	5	20505	0.074	5	20505	0.090	5	20505	0.164
20:00 - 21:00	5	20505	0.016	5	20505	0.035	5	20505	0.051
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			3.361			3.261			6.622

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	10000 - 40229 (units: sqm)
Survey date date range:	01/01/14 - 21/10/20
Number of weekdays (Monday-Friday):	15
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

C.4 Trip Rates for Office

Calculation Reference: AUDIT-204602-220721-0706

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 02 - EMPLOYMENT
Category : A - OFFICE
TOTAL VEHICLES

Selected regions and areas:

02	SOUTH EAST		
	HC	HAMPSHIRE	1 days
03	SOUTH WEST		
	WL	WILTSHIRE	1 days
04	EAST ANGLIA		
	CA	CAMBRIDGESHIRE	1 days
	SF	SUFFOLK	1 days
05	EAST MIDLANDS		
	NR	NORTHAMPTONSHIRE	1 days
06	WEST MIDLANDS		
	WO	WORCESTERSHIRE	1 days
07	YORKSHIRE & NORTH LINCOLNSHIRE		
	WY	WEST YORKSHIRE	1 days
08	NORTH WEST		
	CH	CHESHIRE	1 days
	MS	MERSEYSIDE	1 days
09	NORTH		
	DH	DURHAM	1 days
10	WALES		
	CO	CONWY	1 days
13	MUNSTER		
	CR	CORK	1 days
14	LEINSTER		
	LU	LOUTH	1 days
15	GREATER DUBLIN		
	DL	DUBLIN	1 days
16	ULSTER (REPUBLIC OF IRELAND)		
	MG	MONAGHAN	1 days
17	ULSTER (NORTHERN IRELAND)		
	AN	ANTRIM	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter:	Gross floor area
Actual Range:	1200 to 10100 (units: sqm)
Range Selected by User:	1000 to 15000 (units: sqm)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/14 to 11/11/21

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	3 days
Tuesday	6 days
Wednesday	4 days
Thursday	3 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	16 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	2
Edge of Town	14

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	2
Commercial Zone	5
Development Zone	2
Residential Zone	1
Out of Town	1
No Sub Category	5

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

Not Known	16 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Filter by Site Operations Breakdown:
All Surveys Included

Population within 500m Range:
All Surveys Included

Secondary Filtering selection (Cont.):

Population within 1 mile:

1,000 or Less	1 days
1,001 to 5,000	3 days
5,001 to 10,000	4 days
10,001 to 15,000	6 days
15,001 to 20,000	1 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
25,001 to 50,000	2 days
50,001 to 75,000	2 days
100,001 to 125,000	2 days
125,001 to 250,000	5 days
250,001 to 500,000	4 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	8 days
1.1 to 1.5	6 days
1.6 to 2.0	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	16 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	16 days

This data displays the number of selected surveys with PTAL Ratings.

Covid-19 Restrictions	Yes	At least one survey within the selected data set was undertaken at a time of Covid-19 restrictions

LIST OF SITES relevant to selection parameters

1 AN-02-A-06 SPORTS ADMINISTRATION ANTRIM
UPPER MALONE ROAD
BELFAST

Edge of Town
Residential Zone
Total Gross floor area: 2217 sqm
Survey date: TUESDAY 20/11/18 *Survey Type: MANUAL*

2 CA-02-A-06 OFFICES CAMBRIDGESHIRE
LYNCH WOOD
PETERBOROUGH

Edge of Town
Commercial Zone
Total Gross floor area: 4040 sqm
Survey date: WEDNESDAY 19/10/16 *Survey Type: MANUAL*

3 CH-02-A-04 OFFICES CHESHIRE
WINTERTON WAY
MACCLESFIELD
LYME GREEN BUSINESS PK
Edge of Town
Commercial Zone
Total Gross floor area: 3000 sqm
Survey date: TUESDAY 04/05/21 *Survey Type: MANUAL*

4 CO-02-A-01 GOVERNMENT OFFICES CONWY
NARROW LANE
LLANDUDNO JUNCTION

Edge of Town
Commercial Zone
Total Gross floor area: 6186 sqm
Survey date: WEDNESDAY 28/03/18 *Survey Type: MANUAL*

5 CR-02-A-01 STATISTICS OFFICES CORK
MAHON CRESCENT
CORK

Edge of Town
No Sub Category
Total Gross floor area: 8600 sqm
Survey date: MONDAY 23/06/14 *Survey Type: MANUAL*

6 DH-02-A-03 ENGINEERING COMPANY DURHAM
ALDERMAN BEST WAY
DARLINGTON

Edge of Town
No Sub Category
Total Gross floor area: 3530 sqm
Survey date: THURSDAY 18/10/18 *Survey Type: MANUAL*

7 DL-02-A-08 OFFICES DUBLIN
NORTHWOOD AVENUE
DUBLIN
NORTHWOOD
Edge of Town
Development Zone
Total Gross floor area: 3800 sqm
Survey date: WEDNESDAY 19/05/21 *Survey Type: MANUAL*

8 HC-02-A-12 HMRC HAMPSHIRE
NORTHERN ROAD
PORTSMOUTH
COSHAM
Suburban Area (PPS6 Out of Centre)
No Sub Category
Total Gross floor area: 10100 sqm
Survey date: MONDAY 23/11/15 *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

9 LU-02-A-01 BETTING HEADQUARTERS LOUTH
INNER RELIEF ROAD
DUNDALK

Edge of Town
Commercial Zone
Total Gross floor area: 2052 sqm
Survey date: MONDAY *09/11/20* *Survey Type: MANUAL*

10 MG-02-A-02 OFFICES MONAGHAN
ARMAGH ROAD
MONAGHAN

Edge of Town
Out of Town
Total Gross floor area: 3205 sqm
Survey date: WEDNESDAY *16/11/16* *Survey Type: MANUAL*

11 MS-02-A-03 HOMES DEVELOPER MERSEYSIDE
ALDERMAN ROAD
LIVERPOOL

Suburban Area (PPS6 Out of Centre)
No Sub Category
Total Gross floor area: 1200 sqm
Survey date: TUESDAY *20/04/21* *Survey Type: MANUAL*

12 NR-02-A-01 OFFICES NORTHAMPTONSHIRE
THE LAKES
NORTHAMPTON

Edge of Town
Commercial Zone
Total Gross floor area: 9225 sqm
Survey date: THURSDAY *22/10/20* *Survey Type: MANUAL*

13 SF-02-A-03 OFFICES SUFFOLK
WHITE HOUSE ROAD
IPSWICH

Edge of Town
Industrial Zone
Total Gross floor area: 2800 sqm
Survey date: THURSDAY *24/09/20* *Survey Type: MANUAL*

14 WL-02-A-01 PET INSURANCE COMPANY WILTSHIRE
THE CRESCENT
AMESBURY
SUNRISE WAY
Edge of Town
Development Zone
Total Gross floor area: 2500 sqm
Survey date: TUESDAY *18/09/18* *Survey Type: MANUAL*

15 WO-02-A-03 IT SERVICES WORCESTERSHIRE
STOURPORT ROAD
KIDDERMINSTER

Edge of Town
Industrial Zone
Total Gross floor area: 5945 sqm
Survey date: TUESDAY *13/10/20* *Survey Type: MANUAL*

16 WY-02-A-05 OFFICES WEST YORKSHIRE
PIONEER WAY
CASTLEFORD
WHITWOOD
Edge of Town
No Sub Category
Total Gross floor area: 1230 sqm
Survey date: TUESDAY *23/05/17* *Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 02 - EMPLOYMENT/A - OFFICE
TOTAL VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	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	1	10100	1.109	1	10100	0.168	1	10100	1.277
07:00 - 08:00	15	4246	0.589	15	4246	0.069	15	4246	0.658
08:00 - 09:00	16	4352	1.271	16	4352	0.101	16	4352	1.372
09:00 - 10:00	16	4352	0.922	16	4352	0.138	16	4352	1.060
10:00 - 11:00	16	4352	0.247	16	4352	0.109	16	4352	0.356
11:00 - 12:00	16	4352	0.154	16	4352	0.135	16	4352	0.289
12:00 - 13:00	16	4352	0.195	16	4352	0.388	16	4352	0.583
13:00 - 14:00	16	4352	0.355	16	4352	0.352	16	4352	0.707
14:00 - 15:00	16	4352	0.246	16	4352	0.283	16	4352	0.529
15:00 - 16:00	16	4352	0.126	16	4352	0.450	16	4352	0.576
16:00 - 17:00	16	4352	0.144	16	4352	0.875	16	4352	1.019
17:00 - 18:00	16	4352	0.089	16	4352	1.123	16	4352	1.212
18:00 - 19:00	15	4560	0.037	15	4560	0.447	15	4560	0.484
19:00 - 20:00									
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			5.484			4.638			10.122

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	1200 - 10100 (units: sqm)
Survey date date range:	01/01/14 - 11/11/21
Number of weekdays (Monday-Friday):	16
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

C.5 Trip Rates for Drive Through

Calculation Reference: AUDIT-204602-220721-0742

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 06 - HOTEL, FOOD & DRINK
Category : J - DRIVE THROUGH COFFEE SHOP
TOTAL VEHICLES

Selected regions and areas:

02	SOUTH EAST		
	HC	HAMPSHIRE	1 days
04	EAST ANGLIA		
	SF	SUFFOLK	1 days
05	EAST MIDLANDS		
	NR	NORTHAMPTONSHIRE	2 days
06	WEST MIDLANDS		
	HE	HEREFORDSHIRE	1 days
	WO	WORCESTERSHIRE	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Gross floor area
Actual Range: 140 to 305 (units: sqm)
Range Selected by User: 125 to 420 (units: sqm)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/14 to 16/10/21

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	1 days
Tuesday	1 days
Friday	4 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	6 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	3
Edge of Town	3

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and Not Known.

Selected Location Sub Categories:

Industrial Zone	2
Residential Zone	1
Retail Zone	2
No Sub Category	1

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

Not Known	6 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:

All Surveys Included

Population within 1 mile:

1,000 or Less	1 days
1,001 to 5,000	2 days
15,001 to 20,000	1 days
20,001 to 25,000	1 days
25,001 to 50,000	1 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	2 days
50,001 to 75,000	1 days
100,001 to 125,000	1 days
125,001 to 250,000	1 days
250,001 to 500,000	1 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.6 to 1.0	4 days
1.1 to 1.5	2 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	6 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	6 days

This data displays the number of selected surveys with PTAL Ratings.

Covid-19 Restrictions	Yes	At least one survey within the selected data set was undertaken at a time of Covid-19 restrictions

LIST OF SITES relevant to selection parameters

1 HC-06-J-01 COSTA COFFEE HAMPSHIRE
COTSWORTH ROAD
GOSPORT

Suburban Area (PPS6 Out of Centre)
Retail Zone
Total Gross floor area: 185 sqm
Survey date: MONDAY *27/09/21* *Survey Type: MANUAL*

2 HE-06-J-01 STARBUCKS HEREFORDSHIRE
LEDBURY ROAD
ROSS-ON-WYE

Edge of Town
Retail Zone
Total Gross floor area: 305 sqm
Survey date: TUESDAY *24/11/20* *Survey Type: MANUAL*

3 NR-06-J-01 STARBUCKS NORTHAMPTONSHIRE
CORBY ROAD
CORBY
WELDON
Suburban Area (PPS6 Out of Centre)
Industrial Zone
Total Gross floor area: 236 sqm
Survey date: FRIDAY *23/10/20* *Survey Type: MANUAL*

4 NR-06-J-02 BEWICHED COFFEE NORTHAMPTONSHIRE
DARNELL WAY
NORTHAMPTON

Edge of Town
Industrial Zone
Total Gross floor area: 140 sqm
Survey date: FRIDAY *15/10/21* *Survey Type: MANUAL*

5 SF-06-J-01 COSTA COFFEE SUFFOLK
THORNEY WAY
STOWMARKET

Edge of Town
No Sub Category
Total Gross floor area: 200 sqm
Survey date: FRIDAY *25/09/20* *Survey Type: MANUAL*

6 WO-06-J-01 STARBUCKS WORCESTERSHIRE
STOURPORT ROAD
KIDDERMINSTER

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 240 sqm
Survey date: FRIDAY *09/10/20* *Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 06 - HOTEL, FOOD & DRINK/J - DRIVE THROUGH COFFEE SHOP
TOTAL VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	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	3	192	0.694	3	192	0.000	3	192	0.694
06:00 - 07:00	5	213	4.597	5	213	4.221	5	213	8.818
07:00 - 08:00	6	218	15.237	6	218	13.783	6	218	29.020
08:00 - 09:00	6	218	18.760	6	218	17.228	6	218	35.988
09:00 - 10:00	6	218	21.975	6	218	19.832	6	218	41.807
10:00 - 11:00	6	218	16.233	6	218	16.692	6	218	32.925
11:00 - 12:00	6	218	15.391	6	218	15.773	6	218	31.164
12:00 - 13:00	6	218	18.070	6	218	17.688	6	218	35.758
13:00 - 14:00	6	218	16.616	6	218	17.381	6	218	33.997
14:00 - 15:00	6	218	13.093	6	218	13.706	6	218	26.799
15:00 - 16:00	6	218	11.945	6	218	11.409	6	218	23.354
16:00 - 17:00	6	218	11.715	6	218	13.017	6	218	24.732
17:00 - 18:00	6	218	8.882	6	218	10.260	6	218	19.142
18:00 - 19:00	6	218	6.049	6	218	6.815	6	218	12.864
19:00 - 20:00	5	213	4.128	5	213	4.597	5	213	8.725
20:00 - 21:00	5	213	1.876	5	213	2.720	5	213	4.596
21:00 - 22:00	2	163	0.923	2	163	1.231	2	163	2.154
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			186.184			186.353			372.537

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	140 - 305 (units: sqm)
Survey date date range:	01/01/14 - 16/10/21
Number of weekdays (Monday-Friday):	6
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

C.6 Trip Rates for Creche

Calculation Reference: AUDIT-204602-220721-0725

TRIP RATE CALCULATION SELECTION PARAMETERS:

Land Use : 04 - EDUCATION
Category : D - NURSERY
TOTAL VEHICLES

Selected regions and areas:

01	GREATER LONDON		
	RB	REDBRIDGE	1 days
03	SOUTH WEST		
	WL	WILTSHIRE	1 days
04	EAST ANGLIA		
	CA	CAMBRIDGESHIRE	1 days
05	EAST MIDLANDS		
	DS	DERBYSHIRE	1 days
	LE	LEICESTERSHIRE	1 days
	LN	LINCOLNSHIRE	1 days
06	WEST MIDLANDS		
	WK	WARWICKSHIRE	1 days
09	NORTH		
	TV	TEES VALLEY	1 days
	TW	TYNE & WEAR	1 days
10	WALES		
	BG	BRIDGEND	1 days
	MM	MONMOUTHSHIRE	1 days
11	SCOTLAND		
	DU	DUNDEE CITY	1 days
	SR	STIRLING	1 days
12	CONNAUGHT		
	RO	ROSCOMMON	1 days

This section displays the number of survey days per TRICS® sub-region in the selected set

Primary Filtering selection:

This data displays the chosen trip rate parameter and its selected range. Only sites that fall within the parameter range are included in the trip rate calculation.

Parameter: Gross floor area
Actual Range: 150 to 860 (units: sqm)
Range Selected by User: 109 to 2350 (units: sqm)

Parking Spaces Range: All Surveys Included

Public Transport Provision:
Selection by: Include all surveys

Date Range: 01/01/14 to 19/11/21

This data displays the range of survey dates selected. Only surveys that were conducted within this date range are included in the trip rate calculation.

Selected survey days:

Monday	3 days
Tuesday	3 days
Wednesday	1 days
Thursday	3 days
Friday	4 days

This data displays the number of selected surveys by day of the week.

Selected survey types:

Manual count	14 days
Directional ATC Count	0 days

This data displays the number of manual classified surveys and the number of unclassified ATC surveys, the total adding up to the overall number of surveys in the selected set. Manual surveys are undertaken using staff, whilst ATC surveys are undertaking using machines.

Selected Locations:

Suburban Area (PPS6 Out of Centre)	5
Edge of Town	9

This data displays the number of surveys per main location category within the selected set. The main location categories consist of Free Standing, Edge of Town, Suburban Area, Neighbourhood Centre, Edge of Town Centre, Town Centre and

This data displays the number of surveys per location sub-category within the selected set. The location sub-categories consist of Commercial Zone, Industrial Zone, Development Zone, Residential Zone, Retail Zone, Built-Up Zone, Village, Out of Town, High Street and No Sub Category.

Secondary Filtering selection:

Use Class:

E(f)	14 days

This data displays the number of surveys per Use Class classification within the selected set. The Use Classes Order 2005 has been used for this purpose, which can be found within the Library module of TRICS®.

Population within 500m Range:

All Surveys Included

Population within 1 mile:

1,001 to 5,000	2 days
5,001 to 10,000	2 days
10,001 to 15,000	1 days
15,001 to 20,000	3 days
20,001 to 25,000	1 days
25,001 to 50,000	5 days

This data displays the number of selected surveys within stated 1-mile radii of population.

Population within 5 miles:

5,001 to 25,000	1 days
50,001 to 75,000	1 days
75,001 to 100,000	3 days
125,001 to 250,000	5 days
250,001 to 500,000	4 days

This data displays the number of selected surveys within stated 5-mile radii of population.

Car ownership within 5 miles:

0.5 or Less	1 days
0.6 to 1.0	4 days
1.1 to 1.5	8 days
2.1 to 2.5	1 days

This data displays the number of selected surveys within stated ranges of average cars owned per residential dwelling, within a radius of 5-miles of selected survey sites.

Travel Plan:

No	14 days

This data displays the number of surveys within the selected set that were undertaken at sites with Travel Plans in place, and the number of surveys that were undertaken at sites without Travel Plans.

PTAL Rating:

No PTAL Present	13 days
1b Very poor	1 days

This data displays the number of selected surveys with PTAL Ratings.

LIST OF SITES relevant to selection parameters

1 BG-04-D-01 NURSERY BRIDGEND
GEORGE STREET
BRIDGEND
BRIDGEND IND. ESTATE
Edge of Town
Industrial Zone
Total Gross floor area: 210 sqm
Survey date: MONDAY *13/10/14* *Survey Type: MANUAL*

2 CA-04-D-02 NURSERY CAMBRIDGESHIRE
EASTFIELD ROAD
PETERBOROUGH

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 400 sqm
Survey date: TUESDAY *18/10/16* *Survey Type: MANUAL*

3 DS-04-D-02 NURSERY DERBYSHIRE
MAXWELL AVENUE
DERBY
DARLEY ABBEY
Edge of Town
Residential Zone
Total Gross floor area: 415 sqm
Survey date: THURSDAY *12/07/18* *Survey Type: MANUAL*

4 DU-04-D-01 NURSERY DUNDEE CITY
LONGTOWN TERRACE
DUNDEE

Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 325 sqm
Survey date: MONDAY *24/04/17* *Survey Type: MANUAL*

5 LE-04-D-01 NURSERY LEICESTERSHIRE
WIGSTON ROAD
LEICESTER
OADBY
Edge of Town
Residential Zone
Total Gross floor area: 375 sqm
Survey date: THURSDAY *30/10/14* *Survey Type: MANUAL*

6 LN-04-D-01 NURSERY LINCOLNSHIRE
NEWARK ROAD
LINCOLN
SWALLOW BECK
Suburban Area (PPS6 Out of Centre)
Residential Zone
Total Gross floor area: 600 sqm
Survey date: TUESDAY *31/10/17* *Survey Type: MANUAL*

7 MM-04-D-01 NURSERY MONMOUTHSHIRE
SPOONER CLOSE
NEWPORT
COEDKERNEW
Edge of Town
Commercial Zone
Total Gross floor area: 860 sqm
Survey date: FRIDAY *27/09/19* *Survey Type: MANUAL*

8 RB-04-D-02 NURSERY REDBRIDGE
RAY LODGE ROAD
WOODFORD GREEN

Edge of Town
Residential Zone
Total Gross floor area: 666 sqm
Survey date: WEDNESDAY *22/11/17* *Survey Type: MANUAL*

9 RO-04-D-01 NURSERY ROSCOMMON
PARK VIEW
ROSCOMMON
CRUBY HILL
Edge of Town
Residential Zone
Total Gross floor area: 500 sqm
Survey date: FRIDAY *26/09/14* *Survey Type: MANUAL*

LIST OF SITES relevant to selection parameters (Cont.)

10	SR-04-D-01	NURSERY		STIRLING
	HENDERSON STREET			
	STIRLING			
	BRIDGE OF ALLAN			
	Edge of Town			
	No Sub Category			
	Total Gross floor area:		250 sqm	
	Survey date: MONDAY		*16/06/14*	*Survey Type: MANUAL*
11	TV-04-D-01	NURSERY		TEES VALLEY
	COTSWOLD DRIVE			
	REDCAR			
	Edge of Town			
	Residential Zone			
	Total Gross floor area:		150 sqm	
	Survey date: FRIDAY		*19/05/17*	*Survey Type: MANUAL*
12	TW-04-D-03	NURSERY		TYNE & WEAR
	JUBILEE ROAD			
	NEWCASTLE UPON TYNE			
	GOSFORTH			
	Suburban Area (PPS6 Out of Centre)			
	Residential Zone			
	Total Gross floor area:		725 sqm	
	Survey date: TUESDAY		*21/05/19*	*Survey Type: MANUAL*
13	WK-04-D-01	NURSERY		WARWICKSHIRE
	THE RIDGEWAY			
	STRATFORD UPON AVON			
	Edge of Town			
	Residential Zone			
	Total Gross floor area:		340 sqm	
	Survey date: FRIDAY		*29/06/18*	*Survey Type: MANUAL*
14	WL-04-D-01	NURSERY		WILTSHIRE
	SHREWSBURY ROAD			
	SWINDON			
	WALCOT			
	Suburban Area (PPS6 Out of Centre)			
	Residential Zone			
	Total Gross floor area:		500 sqm	
	Survey date: THURSDAY		*22/09/16*	*Survey Type: MANUAL*

This section provides a list of all survey sites and days in the selected set. For each individual survey site, it displays a unique site reference code and site address, the selected trip rate calculation parameter and its value, the day of the week and date of each survey, and whether the survey was a manual classified count or an ATC count.

TRIP RATE for Land Use 04 - EDUCATION/D - NURSERY
TOTAL VEHICLES
Calculation factor: 100 sqm
BOLD print indicates peak (busiest) period

	ARRIVALS			DEPARTURES			TOTALS		
Time Range	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	Trip Rate	No. Days	Ave. GFA	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	1	400	0.000	1	400	0.000	1	400	0.000
07:00 - 08:00	14	451	2.137	14	451	0.823	14	451	2.960
08:00 - 09:00	14	451	3.879	14	451	2.945	14	451	6.824
09:00 - 10:00	14	451	1.710	14	451	1.504	14	451	3.214
10:00 - 11:00	14	451	0.665	14	451	0.427	14	451	1.092
11:00 - 12:00	14	451	0.665	14	451	0.538	14	451	1.203
12:00 - 13:00	14	451	1.821	14	451	1.852	14	451	3.673
13:00 - 14:00	14	451	1.061	14	451	1.678	14	451	2.739
14:00 - 15:00	14	451	0.855	14	451	0.744	14	451	1.599
15:00 - 16:00	14	451	0.792	14	451	1.235	14	451	2.027
16:00 - 17:00	14	451	1.615	14	451	1.916	14	451	3.531
17:00 - 18:00	14	451	2.201	14	451	3.072	14	451	5.273
18:00 - 19:00	13	474	0.130	13	474	0.762	13	474	0.892
19:00 - 20:00	1	400	0.000	1	400	0.000	1	400	0.000
20:00 - 21:00									
21:00 - 22:00									
22:00 - 23:00									
23:00 - 24:00									
Total Rates:			17.531			17.496			35.027

This section displays the trip rate results based on the selected set of surveys and the selected count type (shown just above the table). It is split by three main columns, representing arrivals trips, departures trips, and total trips (arrivals plus departures). Within each of these main columns are three sub-columns. These display the number of survey days where count data is included (per time period), the average value of the selected trip rate calculation parameter (per time period), and the trip rate result (per time period). Total trip rates (the sum of the column) are also displayed at the foot of the table.

*To obtain a trip rate, the average (mean) trip rate parameter value (TRP) is first calculated for all selected survey days that have count data available for the stated time period. The average (mean) number of arrivals, departures or totals (whichever applies) is also calculated (COUNT) for all selected survey days that have count data available for the stated time period. Then, the average count is divided by the average trip rate parameter value, and multiplied by the stated calculation factor (shown just above the table and abbreviated here as FACT). So, the method is: COUNT/TRP*FACT. Trip rates are then rounded to 3 decimal places.*

Parameter summary

Trip rate parameter range selected:	150 - 860 (units: sqm)
Survey date date range:	01/01/14 - 19/11/21
Number of weekdays (Monday-Friday):	14
Number of Saturdays:	0
Number of Sundays:	0
Surveys automatically removed from selection:	0
Surveys manually removed from selection:	0

This section displays a quick summary of some of the data filtering selections made by the TRICS® user. The trip rate calculation parameter range of all selected surveys is displayed first, followed by the range of minimum and maximum survey dates selected by the user. Then, the total number of selected weekdays and weekend days in the selected set of surveys are show. Finally, the number of survey days that have been manually removed from the selected set outside of the standard filtering procedure are displayed.

Appendix D

D.1 Developers Proposed Access Strategy – Transport Appraisal – Modelling Report Version 2

Maudlins KDA **03/10/2023**

Reference number IE01T22A36/001

DEVELOPERS PROPOSED ACCESS STRATEGY - TRANSPORT APPRAISAL

SYSTRA

MAUDLINS KDA

DEVELOPERS PROPOSED ACCESS STRATEGY - TRANSPORT APPRAISAL

IDENTIFICATION TABLE	
Client/Project owner	Fagan Group and Petrogas Group Ltd
Project	Maudlins KDA
Study	Developers Proposed Access Strategy - Transport Appraisal
Type of document	Modelling Report
Date	03/10/2023
File name	20230915 KDA Maudlins Transport Appraisal
Reference number	IE01T22A36/001
Number of pages	48

APPROVAL

Version	Name		Position	Date	Modifications
1	Author	Jolanta Otwinowska	Senior Consultant	13/09/2023	Minor Edits
	Checked by	Sandra Hill Smith/ Shaun Edwards	Associate / Associate Director	25/09/2023	
	Approved by	Andrew Archer	Director	26/09/2023	
2	Author	Jolanta Otwinowska	Senior Consultant	03/10/2023	Issued to KCC for Comment
	Checked by	Sandra Hill Smith/ Shaun Edwards	Associate / Associate Director	03/10/2023	
	Approved by	Andrew Archer	Director	03/10/2023	

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1. INTRODUCTION

1.1 Overview

1.1.1 Fagan Group and Petrogas Group Ltd have commissioned SYSTRA Limited to provide transport planning services in relation to the access strategy for the Maudlins Key Development Area (KDA) in Naas, County Kildare. This technical note supplements the transport appraisal of the site undertaken by AECOM on behalf of Kildare County Council (KCC). In this regard, this technical report should be read in conjunction with the *Maudlins Traffic Modelling & Access Strategy April 2023* (TMAS) Report.

1.2 Background

1.2.1 Situated next to Junction 9 of the N7, The Naas Local Area Plan (LAP) 2021-2027 identifies the former Donnelly Mirrors and Cemex Concrete site as a Key Development Area and important gateway site for Naas.

Figure 1. Maudlins KDA site Location

1.2.2 Economic Development Objective (EDO 1.4) and Urban Regeneration & Development Objective (URD 1.13) of the LAP requires the preparation of a comprehensive masterplan for the Maudlins KDA lands. As a key first step in the development of the Masterplan, URD 1.13 sets out the need for the preparation of a Traffic Modelling & Access Strategy (TMAS) within 12 months of the plan being adopted. To be undertaken in consultation with Transport Infrastructure Ireland (TII), the National Transport Authority (NTA) and the owners of the KDA lands; the purpose of the TMAS was to:

- Identify the use, quantum and intensity of development that could be accommodated at the KDA site, whilst safeguarding the strategic function of the adjoining national road in

accordance with Section 28 Ministerial Guidelines 'Spatial Planning and National Roads Guidelines for Planning Authorities' (DoECLG, 2012).

- Identify the need for any necessary improvements to the local transport network to facilitate the development of the KDA lands

1.2.3 To fulfil the requirements of URD 1.13 of the Naas LAP , KCC appointed Aecom to prepare the TMAS for the Maudlins KDA lands. As part of the preparation of the TMAS, AECOM developed a micro-simulation model to enable a detailed operational assessment of the proposed KDA on the local and national road network. This assessment was undertaken against the backdrop of the planned wider growth of Naas as set out in the LAP. The TMAS report concluded with a recommendation as to the type and quantum of development that could be accommodated at the Maudlins KDA, and made further recommendation as to potential mitigation measures which could be implemented on the local road network to facilitate its development.

1.2.4 Subsequent to completion of this work, KCC requested AECOM to undertake an additional modelling assessment of the Maudlins KDA with consideration to access proposals and development quantums proposed by Fagan Group and Petrogas Group Ltd (the 'Developers'). The outcome of this modelling assessment is contained in *Maudlins Developers Proposals Microsimulation Testing- March 2023*.

1.2.5 A meeting was held in April 2023 between KCC, the Developers and SYSTRA Ltd to review the outcome of the TMAS and supplementary Developers Proposal assessment. During the meeting, the Developer team presented a modification to the proposed Developer access strategy which included an entry only from the Johnstown Road. Discussion also took place during the meeting as to potential measures which could be implemented at the Maudlins KDA to support sustainable access to the development and reduce its impact on the adjacent road network.

1.2.6 It was agreed during the meeting that a further assessment of the Developers access strategy should be undertaken by SYSTRA utilising the micro-simulation model developed by AECOM for the TMAS.

1.3 Purpose of Report

1.3.1 Building upon the work undertaken in the TMAS, the purpose of this report is to provide a summary of the traffic analysis relating to the Developers modified access strategy and proposed mix and quantum of development. The analysis is presented for both the existing transport network and with consideration to the necessary improvements to the local transport network as set out in the TMAS. The report also explores potential sustainable transport measures which could be implemented at the site to encourage sustainable travel behaviours.

1.4 Model Approach

1.4.1 In order to assess the impacts of the proposed KDA development on the surrounding road network SYSTRA has used a Vissim microsimulation model. The model was previously commissioned by Kildare County Council and developed by AECOM for this purpose. The model covers the evening peak period of 16:00 to 17:00 with a 30-minute warm-up period from 15:30 to 16:00 which ensures that the network is fully "populated" with traffic by the

start of the peak hour. The base model was calibrated and validated by AECOM on behalf of KCC and has been used by SYSTRA without modification. The model has a future year of 2027.

1.4.2 Figure 2 shows the extents of the modelled road network, along with the zones where traffic enters and leaves the model.

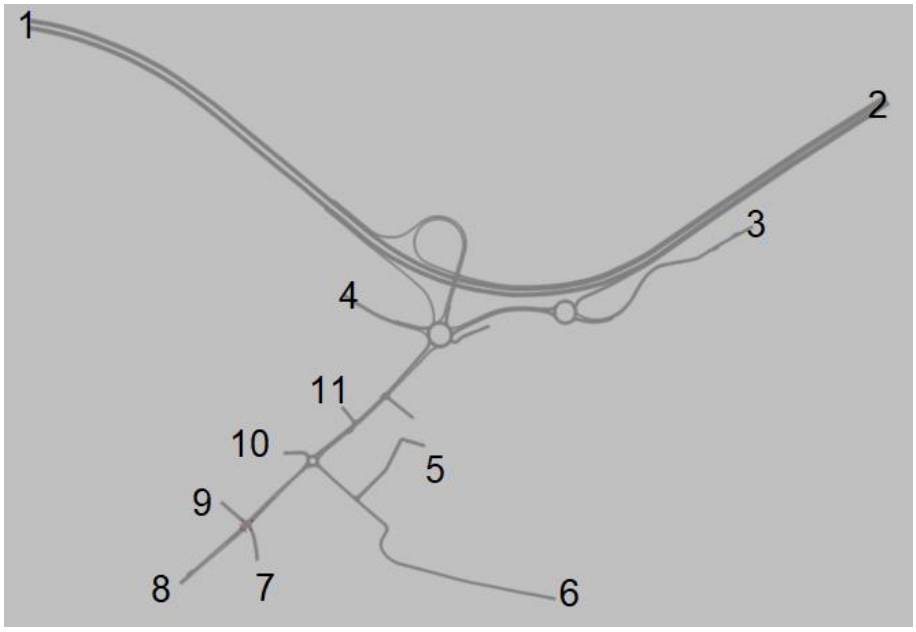


Figure 2. KDA area VISSIM model extent and zoning system

1.4.3 The following model zones were included:

1. M7 mainline south
2. N7 mainline north
3. Johnstown
4. Monread Road
5. Naas Industrial Estate
6. Fishery Lane East
7. The Gallops
8. R445 Dublin Road
9. Maudlins Avenue
10. Fishery Lane West
11. Odeon Cinema Naas

1.4.4 This model covers the evening peak only (as specified by Kildare County Council) and was used to undertake further tests of the development impact and potential mitigations.

1.5 Report Structure

1.5.1 Following this introduction, the report contains the following sections:

- **Section 2- Proposed Development**: provides a summary of the proposed land uses for the Cemex and Donnelly Mirrors site and the revised access strategy. The section also provides a more detailed review of the trip generation for the site based on the proposed

land uses, and presents the distribution of the proposed development traffic on the adjacent local and national road network.

- **Section 3- Scheme Assessment**: Utilising the micro-simulation model developed for the TMAS, this section presents the analysis for the future traffic demand levels at the KDA site, based on the revised access strategy. The analysis is presented for both the existing transport network and with consideration to the necessary improvements to the local transport network as set out in the TMAS.
- **Section 4- Sustainable Transport Measures**: this section identifies potential physical and behavioural change measures which could be implemented at the KDA site to help reduce carbon emissions from transport and encourage sustainable travel behaviours.
- **Section 5 Summary and Conclusions**: Presents a summary of the supplementary modelling analysis undertaken for the Maudlins KDA and concludes with recommended improvement measures which will need to be implemented to support its development.

2. PROPOSED DEVELOPMENT

2.1 Land Use

2.1.1 As noted in section 1, the Maudlins KDA site is formed by two key land development sites: the Cemex Site, which is now under the ownership of Petrogas Group Ltd and the Donnelly Mirrors site, which is now under the ownership of the Fagan Group.

2.1.2 A joint masterplan is currently under preparation for the site which considers the following land uses.

Cemex Site

2.1.3 The proposed development on the Cemex site currently considers the following:

- An Electric Vehicle Charging Hub (up to 40 bays)
- A general use Petrol Filling Station (PFS- up to 12 bays) with ancillary retail and food.
- A HGV fuel facility and HGV/Coach parking
- HGV EV charging facility
- A Drive Thru Coffee Kiosk
- A Distribution Centre
- Associated car parking, landscaping and SUDS features.

2.1.4 The figure below provides a summary of the distinct areas of the development, showing an overlay of the development proposals on background mapping.

CODE	LAND USE	AREA
	General PFS Service Area and Parking	14,000 sqm
	HGV Area and HGV/Coach Parking	7,180 sqm
	Distribution	9,000 sqm
	Drive Thru Coffee Kiosk	200 sqm

Figure 3. Cemex Site Land use breakdown

Donnelly Mirrors Site

2.1.5 Two development scenarios have been developed for the Donnelly Mirrors Site – Concept A and Concept B. Through meetings with The Fagan Group, it has been determined that Concept A is presently the merging preferred mix of development, consisting of:

- Car Showroom: 2700sqm
- Office: 9450sqm
- Aparthotel: 19200sqm

- Warehouse Retail: 5760sqm
- Warehouse Wholesale: 7040sqm
- Warehouse / Depot: 3960sqm

2.1.6 The alternative development concept for the Donnelly Mirrors Site (Concept Option B) replaces the office component of the site with Apartments. As contained in the *Maudlins Developers Proposals Microsimulation Testing- March 2023* Report, this alternative development option results in a lower trip generation for the combined site. In order to produce a robust modelling assessment, the higher trip generation scenario under Concept A has been assessed at this stage, however this may be revisited in the future if required.

2.2 Access Strategy

2.2.1 The TMAS adopted the access strategy set out in the Naas LAP 2021-2027, which assumed the following access and egress arrangements for the Maudlin KDA site:

- One-way entry only off the Maudlins Roundabout;
- Exit onto the Dublin Road via an existing left-in & left-out junction located to the north of the Fishery Lane roundabout, this existing junction; and
- Supplementary exit onto Fishery Lane through the Naas Industrial Estate.

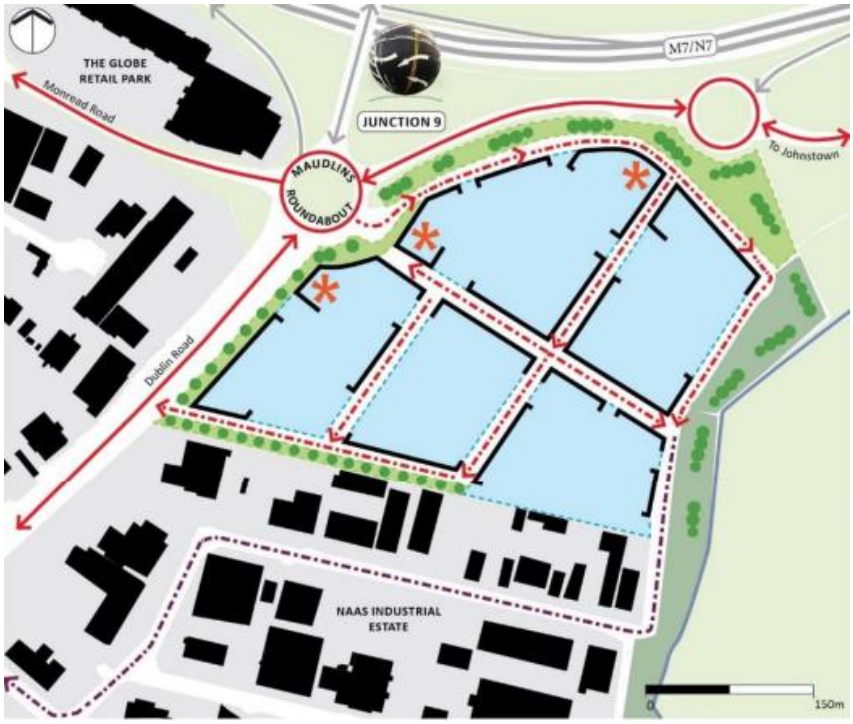


Figure 4. Naas LAP – Access Strategy for Maudlins KDA

2.2.2 Following discussions with KCC, the Developers proposed an alternative access strategy for assessment, , which assumed the following access and egress arrangements for the Maudlin KDA site:

- Left slip only entry into the site from the Johnstown Road;
- Entry and exit to the site via the Maudlins Roundabout; and

- Retention of a left in & Left out arrangement located to the north of the Fishery Lane roundabout

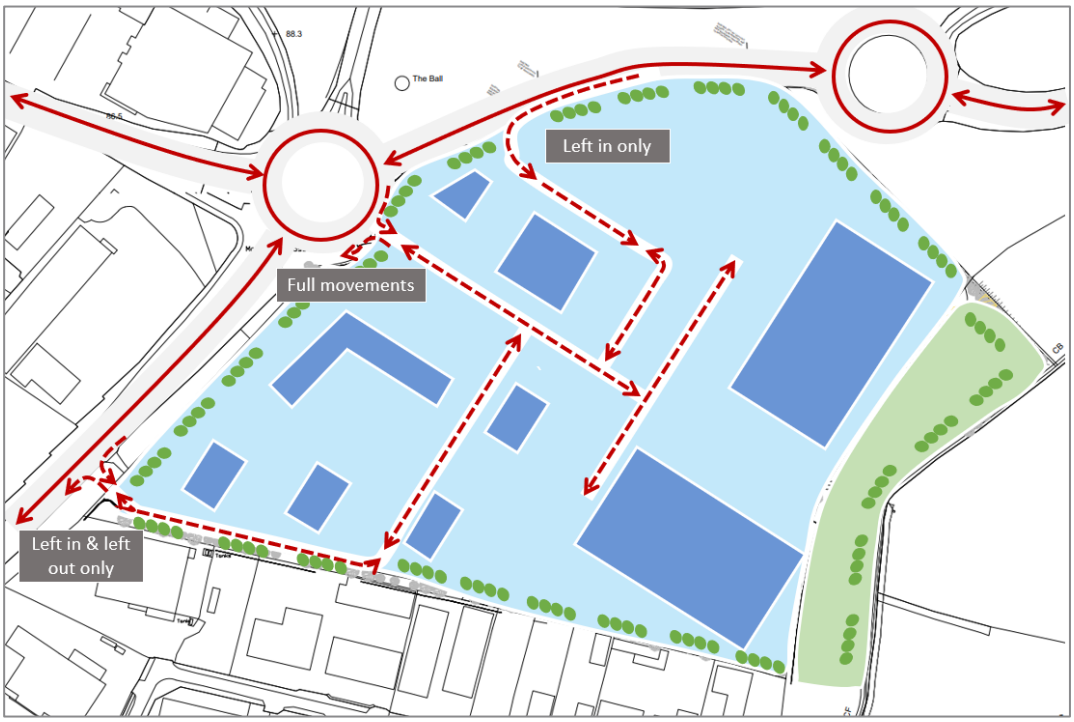


Figure 5. Developer Proposal – Access Strategy for the Maudlins KDA

2.2.3 The proposed Developer access strategy for the KDA site is examined in further detail in Section 3 of this report.

2.3 Trip Generation

2.3.1 A detailed assessment of the combined trip generation for the KDA site based on the development aspirations of Petrogas Group Ltd and The Fagan Group has been undertaken and is contained in Appendix A of this report. The trip generation assessment utilised TRIC[1]s information contained in the two modelling reports prepared by Aecom on behalf of KCC, supplemented with traffic survey information collated for existing comparable sites.

Cemex Site

2.3.2 Aligned with the Maudlins Traffic Modelling and Access Strategy, the technical report in Appendix A includes an additional estimation of the potential number of Electrical Vehicles utilising the charging bays. The report also estimates the likely proportion of Pass-By trips for the Petrol Filling Station (PFS) and Drive Thru-Coffee shop element of the site only.

2.3.3 The following table presents the trip generation estimation for the Cemex element of the KDA based on the forecast land uses:

[1] TRICS® is the system of trip generation analysis for the UK and Ireland. The system allows users to establish potential levels of trip generation for a development scenario using a series of database filtering processes

Table 1. Cemex Site Trip Generation - PM Peak

LAND USE	QUANTUM	ARRIVALS	DEPARTURES	TWO WAY
Fuel Pumps (No.)	8 Bays	108	108	216
HGV Fuelling	(*) 0.7 Ha	13	16	29
EV Charging Bays	40 Bays	27	27	54
Stand Alone Coffee (sqm)	198sqm	17	24	41
Distribution Centre (sqm)	9072sqm	11	20	31
TOTAL		**176**	**195**	**371**

Donnelly Mirrors Site

2.3.4 The following table extracted from the *Maudlins – Developers Proposals, Microsimulation Testing* Report, sets out the trip generation for the Donnelly Mirrors concept A Land use as follows:

Magna Concept A - Trip Gen

Land Use	Quantum	AM Peak		PM Peak	
		Arrival	Departure	Arrival	Departure
Car Showroom	2700 sqm	41	12	10	32
Office	9450 sqm	120	10	8	106
Aparthotel	19200 sqm	49	56	46	49
Warehouse Retail	5760 sqm	28	11	9	26
Warehouse Wholesale	7040 sqm	34	14	11	32
Warehouse / Depot	3960 sqm	8	4	4	8
Total 1 way		279	106	**87**	**254**
Total 2 way		386		**342**	

Table 2. Concept A Donnelly Mirrors Trip Generation

2.3.5 As note previously, an alternative development concept for the Donnelly Mirrors Site (Concept Option B) has been developed which replaces the office component of the site with Apartments. This alternative development option results in a lower trip generation for the combined site (342 combined PM peak hour trip generation in Concept A versus 254 in Concept B), however the higher trip generation scenario under Concept A has been assessed at this stage in order to produce a robust modelling assessment. This may be revisited in the future if required.

Combined KDA Site

2.3.6 The combined trip generation for the entire KDA site in the PM peak hour is estimated as follows:

SITE AREA	PM PEAK ARRIVAL	PM PEAK DEPARTURES	PM PEAK TOTALS
Cemex Site Development Proposals	176	195	**371**
Donnelly Mirrors Development Proposals	87	254	**341**
Totals	**263**	**449**	**712**

Table 3. Combined Generation of KDA site for the PM Peak Hour

2.4 Trip Distribution

2.4.1 SYSTRA adopted the same traffic distributions developed by AECOM and described in "Maudlins Traffic Modelling and Access Strategy" issued on 5th April 2023.

2.4.2 Demand distribution 1 was adopted for the development zone replicating the Cemex part of the KDA, while demand distribution 2 was used for the development zone replicating the Donnelley Mirrors part of the site.

2.4.3 A summary of entry and exit splits for each distribution is summarised in a Table 4 and Table 5 below.

Table 4. Demand Distribution 1

DEMAND DISTRIBUTION 1			
Zone	**Location**	**Entry to KDA**	**Exit**
1	M7 South	36%	38%
2	N7 North	42%	48%
3	Johnstown	2%	0%
4	Monread Road	10%	5%
6	Fishery Lane	5%	3%
8	Naas via Dublin Road	5%	6%

Table 5. Demand Distribution 2

DEMAND DISTRIBUTION 2			
Zone	**Location**	**Entry to KDA**	**Exit**
1	N7 South	18%	25%
2	N7 North	26%	29%
3	Johnstown	6%	0%
4	Monread Road	16%	14%
6	Fishery Lane	16%	11%
8	Naas via Dublin Road	18%	21%

3. SCHEME ASSESSMENT

3.1 Overview

3.1.1 To assess the impact of the proposed development and potential mitigation measures, standard network performance criteria were identified in order to provide a fair comparison between scenarios. These are listed below.

Journey Times

3.1.2 Route 1 for journey time assessment is Dublin Road – the northbound approach to Maudlin roundabout is as shown on the figure below.

Figure 6. Journey time route on Dublin Road – northbound approach to Maudlin Roundabout

3.1.3 Route 2 for journey time assessment is Monread Road – the eastbound approach to Maudlin roundabout is as shown on the figure below.

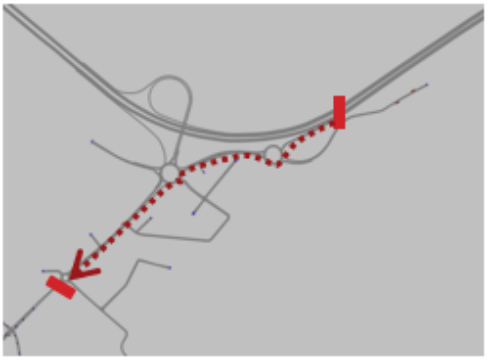
Figure 7. Journey time route on Monread Road – eastbound approach to Maudlin Roundabout

3.1.4 Route 3 for journey time assessment is the route from Johnstown is as shown on the figure below.

Figure 8. Journey time route on Johnstown – westbound approach to Maudlin Roundabout

3.1.5 Route 4 is Johnstown to Fishery Lane is as shown on the figure below.

Figure 9. Journey time route from Johnstown to Fishery Lane

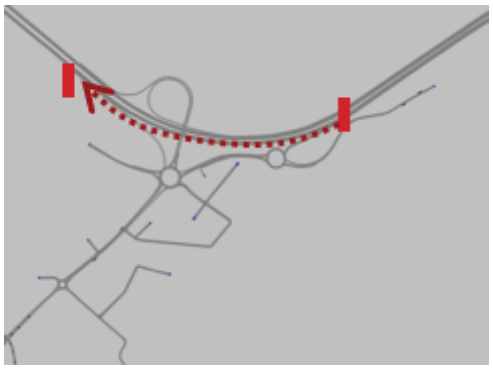


3.1.6 Route 5 is the M7 eastbound from exit to entry slip, is as shown on the figure below.

Figure 10. Journey time route on M7 eastbound

3.1.7 Route 6 is the M7 westbound from exit to entry slip, isas shown on the figure below.

Figure 11. Journey time route on M7 westbound



Network performance

3.1.8 The overall performance of the network is shown by the following metrics:

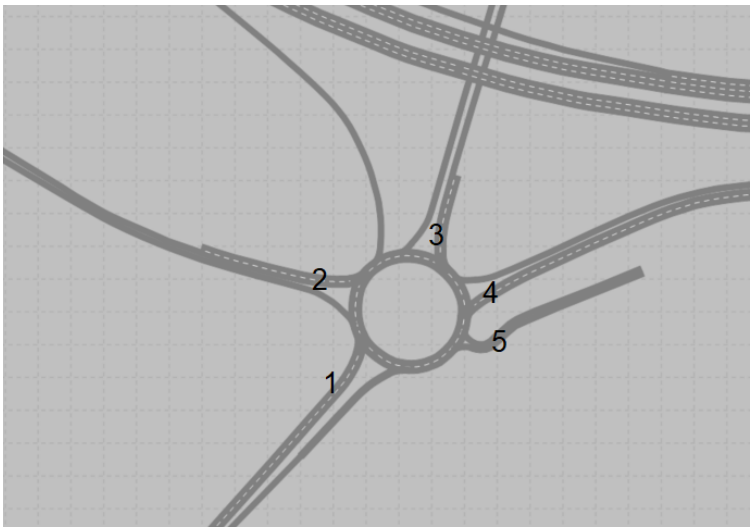
- Latent demand – number of vehicles which can't enter the network by the end of the simulation period
- Average speed (kph) – weighted average of speed of all vehicles
- Average delay (seconds per vehicle) – average delay per vehicle.

Queue lengths

3.1.9 Queue lengths were assessed at all approaches to Maudlin Roundabout as shown in Figure 12.

- 1 – Dublin Road
- 2 – Monread Road
- 3 – M7 off slip
- 4 – Johnstown
- 5 – KDA.

Figure 12. Queue counters used in assessment



3.1.10 These criteria were compared for each scenario tested.

3.2 Do Nothing Assessment

3.2.1 Initially a future year without development was tested, this is referred to as the Do Nothing or DN scenario and provides a reference case by which other scenarios can be compared. This scenario was developed by AECOM and shows the future traffic conditions based on the level of background growth forecast in the Naas Local Area Plan, but without the KDA development in place.

Journey Times

3.2.2 Journey time results in the Do Nothing scenario are summarised in Table 6 below.

Table 6. Journey time results for Do Nothing scenario

ROUTE NUMBER	ROUTE DESCRIPTION	DN JT [S]
1	**Dublin Road northbound**	**00:01:58**
2	**Monread Road**	**00:00:28**
3	**Johnstown**	**00:00:36**
4	**Johnstown to Fishery Lane**	**00:01:53**
5	**M7 eastbound**	**00:00:41**
6	**M7 westbound**	**00:00:38**

Network Performance

3.2.3 Network performance statistics are summarised in the table below.

Table 7. Network Statistics for Do Nothing scenario

MEASURE	DN
Latent Demand (veh)	**0**
Average speed (kph)	**72**
Average delay (s/veh)	**23**

Queue lengths

3.2.4 Maximum queue lengths are summarised in the table below.

Table 8. Maximum queue lengths for Do Nothing scenario

ARM	MAXIMUM QUEUE LENGTH [M]
1 – Dublin Road	**162**
2 – Monread Road	**56**
3 – M7 off slip	**10**
4 – Johnstown	**105**
5 – KDA	**0**

3.3 Do Something Assessment

3.3.1 The Do Something (DS) scenario represents the operation of the network ***with*** the proposed development in place, but ***without*** any mitigation measures. It includes traffic generation for the development as set out within this report, but with no network improvements. The only change in network is that required for the proposed KDA access arrangements. The only change to traffic flows is the addition of development traffic for the KDA.

Journey Times

3.3.2 Table 9 below shows comparison between this scenario and the Do Nothing (no development) scenario.

Table 9. Journey time results for Do Nothing and Do Something scenarios

ROUTE NUMBER	ROUTE DESCRIPTION	DN [S]	DS [S]
1	Dublin Road NB	00:01:58	00:08:55
2	Monread Road	00:00:28	00:00:33
3	Johnstown	00:00:36	00:00:36
4	Johnstown to Fishery Lane	00:01:53	00:01:55
5	M7 eastbound	00:00:41	00:00:41
6	M7 westbound	00:00:38	00:00:38

3.3.3 The journey time results above indicate that once development is built the main affected area of the network is forecast to be the Dublin Road where journey time is recorded to increase by a factor of four against the Do Nothing scenario. The development has no impact on journey times on the N7 National Road, or the Johnstown Road or Monread Road.

Network Performance

3.3.4 Network performance statistics are summarised in Table 10 below for this scenario and compared against the Do Nothing (no development) scenario.

Table 10. DS – Network Statistics results for Do Nothing and Do Something scenarios

MEASURE	DN	DS
Latent Demand (veh)	0	224
Average speed (kph)	72	47
Average delay (s/veh)	23	81

3.3.5 Network statistics indicate an overall deterioration of traffic conditions once development traffic is added to the network. Latent demand (the number of vehicles unable to enter the network during the modelled period) increases from 0 to 224 vehicles. This latent demand is primarily experience by vehicles queuing on the Dublin Road. Average speed is recorded to reduce from 72 to 47 kph and average delay is recorded to triple from 23 to 81 seconds per vehicle.

Queue lengths

3.3.6 Maximum queue lengths are summarised in the table below.

Table 11. Maximum queue lengths for Do Nothing and Do Something scenarios

ARM	DN [M]	DS [M]
1 – Dublin Road	**162**	**485**
2 – Monread Road	**56**	**76**
3 – M7 off slip	**10**	**14**
4 – Johnstown	**105**	**100**
5 – KDA	**0**	**291**

3.3.7 The highest increase in maximum queue lengths was recorded on the Dublin Road. This is due to traffic on the Dublin Road needing to give way to opposing traffic exiting the development. A level of queuing is also experienced internally within the development, as traffic exiting the employment centres wait to enter the external network.

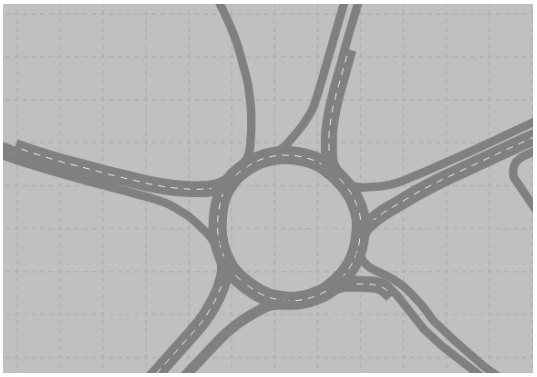
3.4 Mitigation

Overview

3.4.1 The external mitigation measures developed as part of the TMAS were utilised as part of the mitigation strategy set out below. Each change is shown below, against the current layout.

Figure 13. Additional lane on Dublin Road approach to Maudlin roundabout

Current situation



Mitigation

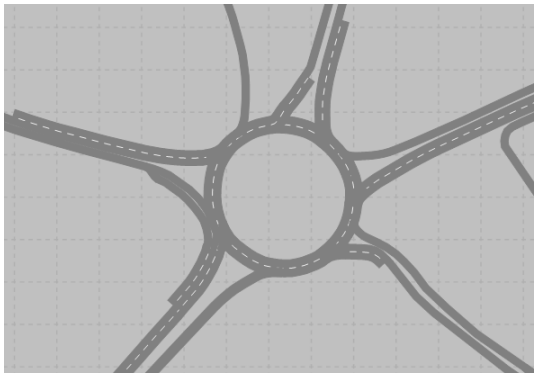
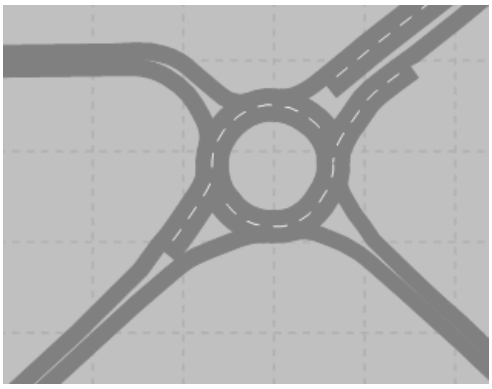
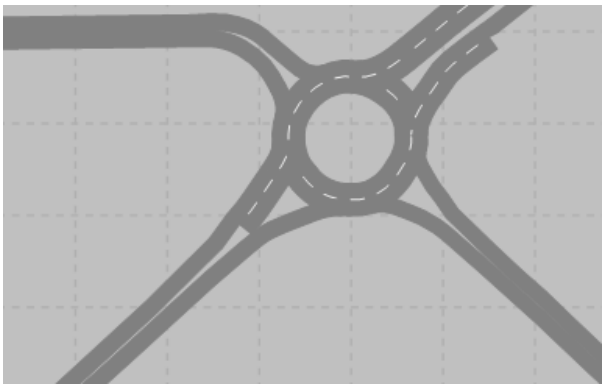


Figure 14. Two lanes ahead on Fishery Lane

Current situation

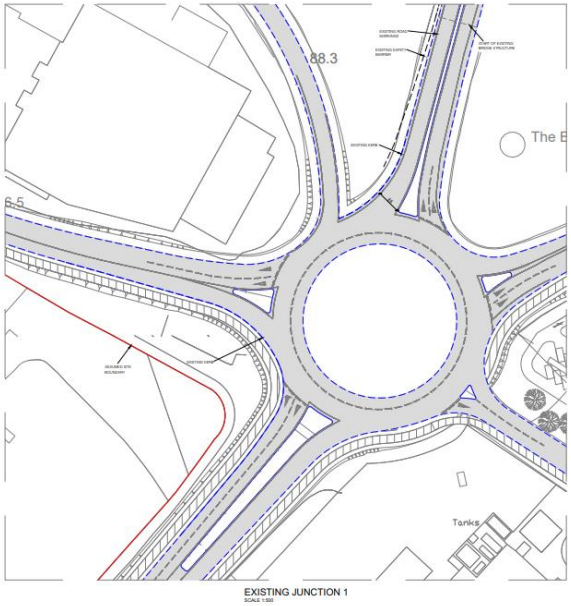


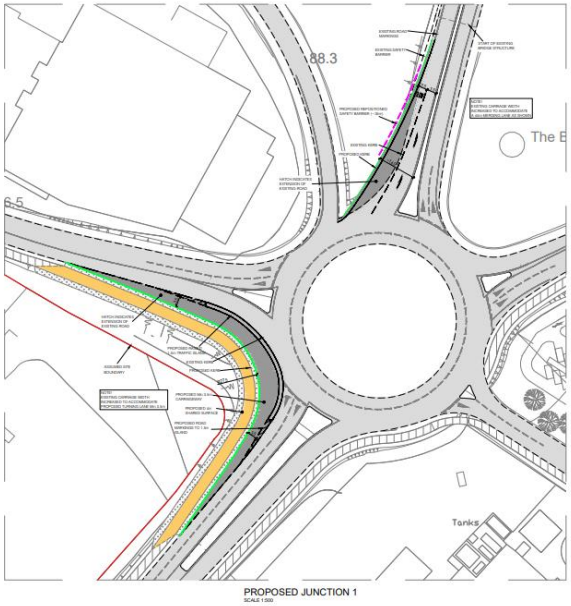
Mitigation



3.4.2 Additional mitigation was developed in order to reduce delays on Dublin Road. At present although there is a 2 lane entry to the roundabout from the south arm, traffic cannot make full use of this as the M7 exit (which has the highest flow) has a single lane. An additional lane was therefore added at the exit towards the M7, which then merges back to a single lane, to maximise capacity for this key movement from Dublin Road. This is shown in the figure below.

Figure 15. Mitigation measures at Maudlin Roundabout





3.5 Do Something With Mitigation Assessment

Scenario Description

3.5.1 The Do Something with mitigation (DSM) scenario contains the same traffic flows as the DS scenario. The mitigations described above and listed below were added in order to address the impact of the development:

- Additional lane on Dublin Road
- Two lanes ahead on Fishery Lane through the roundabout
- Two lanes exit from Dublin Road towards M7.

Journey Times

3.5.2 Table 12 below shows comparison between Do Nothing (DN – no development), Do Something (DS – with development) and Do Something with mitigation (DSM – with development and mitigation) scenarios.

Table 12. JT results for Do Nothing, Do Something and Do Something + Mitigation

ROUTE NUMBER	ROUTE DESCRIPTION	DN [S]	DS [S]	DSM [S]
1	Dublin Road NB	00:01:58	00:08:55	00:01:56
2	Monread Road	00:00:28	00:00:33	00:01:14
3	Johnstown	00:00:36	00:00:36	00:00:32
4	Johnstown to Fishery Lane	00:01:53	00:01:55	00:01:47
5	M7 eastbound	00:00:41	00:00:41	00:00:41
6	M7 westbound	00:00:38	00:00:38	00:00:39

3.5.3 The journey time results above indicate that the proposed mitigations will successfully mitigate the traffic delays experienced in the Do-Something Scenario. In particular:

- Journey times on the M7 remain unchanged, confirming no impact from the development on the Strategic Road Network.
- The Dublin Road journey time, which was significantly increased with the development included, drops back down to the same level as with no development.

3.5.4 The only route with a residual impact is the Monread Road where the journey time is recorded to increase by approximately 45 seconds. This is a result of providing increased capacity for the Dublin Road to M7 movement, since traffic on Monread Road needs to give way to this flow.

Network Performance

3.5.5 Network performance statistics are summarised in Table 13 below.

Table 13. Network Statistics for Do Nothing, Do Something and Do Something + Mitigation

MEASURE	DN	DS	DSM
Latent Demand (veh)	**0**	**224**	**37**
Average speed (kph)	**72**	**47**	**62**
Average delay (s/veh)	**23**	**81**	**39**

3.5.6 Network statistics indicate a substantial overall improvement of traffic conditions once mitigations are added to the network. Latent demand is recorded to decrease from 224 in the Do Something (with development) scenario to 37 vehicles in the DSM (with development and mitigation) scenario. Average speed is recorded to increase from 47 to 62 kph which is just slightly lower than the 72kph observed in the Do Nothing. scenario. Average delay is recorded to reduce by over half, from 81 to 39 seconds per vehicle.

Queue lengths

3.5.7 Maximum queue lengths are summarised in the table below.

Table 14. Max queue lengths for Do Nothing, Do Something and Do Something + Mitigation [m]

ARM	DN [M]	DS	DSM [M]
1 – Dublin Road	**162**	**485**	**134**
2 – Monread Road	**56**	**76**	**212**
3 – M7 off slip	**10**	**14**	**17**
4 – Johnstown	**105**	**100**	**83**
5 – KDA (Internal to site)	**0**	**291**	**345**

3.5.8 The proposed mitigation measures reduce queuing significantly particularly on the Dublin Road. With the development and mitigation both included, the queue length on Dublin Road is shorter than in the Do Nothing (no development). The only external approach which retains some impact is Monread Road (2) which is in line with described journey times. This is an effect of increased capacity for Dublin Road to M7 movement.

3.5.9 Similarly to the Do-something scenario, A level of queuing is also experienced internally within the development, as traffic exiting the employment centres wait to enter the external network during the evening peak hour. This level of internal queuing within the development is experienced for a short duration during the evening peak hour.

3.5.10 As the maximum queue on Monread Road is forecast to increase with the mitigation measures in place, a more detailed analysis was undertaken for this approach to understand the pattern and duration of queuing leading to the reported results. Table 15 below presents average queue lengths on Monread Road for each 15 minutes interval during the PM peak period.

Table 15. Average queue during PM peak period on Monread Road in Do Something + Mitigation [m]

	16:00-16:15	16:15-16:30	16:30-16:45	16:45-17:00
Average queue length	**54**	**46**	**90**	**140**

3.5.11 The average queue results in the PM peak period show much lower values than the 'worst case' maximum queue length. In all time intervals in the PM peak period, the average queue on the Monread Road approach is not recorded to reach the upstream junction (Globe Retail park entrance) which is situated 260 metres from the Maudlin Roundabout. The maximum queue represents a worst-case scenario which will occur for only a short period of time during the peak traffic period.

3.5.12 In conclusion, the results of the micro-simulation assessment demonstrate that the proposed development with mitigations in place, will have a minimal impact on the external road network, maintaining journey times on the M7 and local road network.

4. SUSTAINABLE TRANSPORT MEASURES

4.1 Overview

4.1.1 The following section identifies potential physical and behavioural change measures which could be implemented at the KDA site, aligned to local and national policy, which seek to reduce carbon emissions from transport and encourage sustainable travel behaviours. These have been addressed under the following headings:

- Electric Vehicles Charging on Ten-T Network
- Regional Bus Service interchange with local town Services
- Delivery of Active Travel Infrastructure
- Land Use Integration
- Behavioural Change Measures

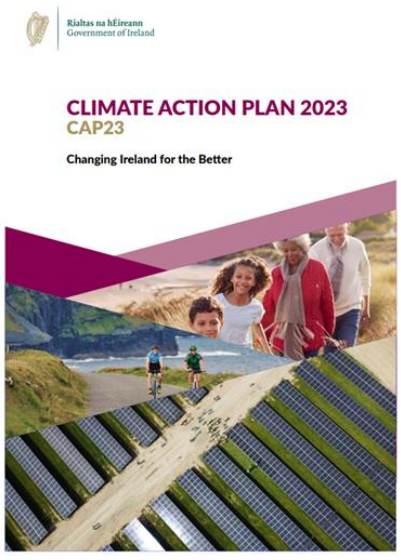
4.1.2 It is intended that the implementation of these measures will be explored further as the KDA Masterplan is prepared and the scheme progresses through the planning process.

4.2 Electric Vehicles Charging on Ten-T Network

Policy Direction

Climate Action Plan 2023 (CAP 23)

4.2.1 The government's Climate Action Plan seeks a 50% reduction in carbon emissions from the transport Sector by 2030 and a target of net zero carbon emissions by 2050. The plan sets outs three key themes for achieving the necessary reduction in carbon emissions as follows:



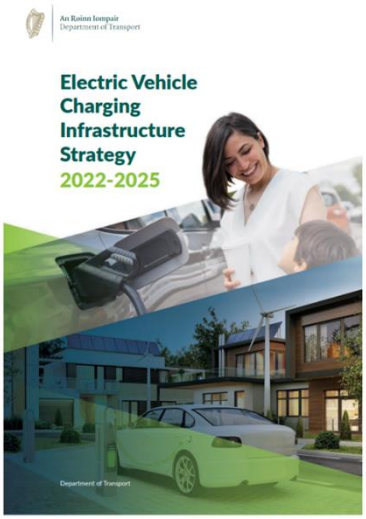
- **Avoid:** Reduce or avoid the need for travel through delivering enhanced Spatial and Land Use Planning. This can be achieved through integrating services and multi-use developments at transport nodes.
- **Shift:** Move to more environmentally modes of transport through delivery of safe and high-quality active travel infrastructure; improving the attractiveness, capacity and frequency of public transport services; and enhanced integration of services.
- **Improve:** Improve the energy efficiency of vehicle technology through transition of the vehicle fleet to clean fuels e.g. Electric Vehicles.

4.2.2 CAP 23 contains a series of short, medium and long term actions required to achieve the carbon emission reduction targets. Specific actions relating to the development proposals of this site include:

- **Undertake planning and enabling works for AFIR (alternative Fuels Infrastructure Regulation) high-power charging requirements on TEN-T network**
- **Roll out of en-route High-Powered Charging network**

Electric Vehicle Charging Infrastructure Strategy 2022-2025

4.2.3 Prepared by the Department of Transport, ZEVI (Zero Emission Vehicles Ireland) provides a strategic focus on delivering high powered public charge points in heavily-trafficked areas and along national road networks to reduce queuing time, reduce range and charger anxiety, and improve the EV driver experience.



4.2.4 Targets set out within the strategy include for deployment of comprehensive rapid charging throughout the full TEN-T network by 2025 with doubling of capacity by 2030.

4.2.5 Guided by European requirements, the strategy outlines a minimum provision of motorway charging infrastructure dedicated to HGVs by 2025. The strategy recognises that collaboration and engagement with the haulage sector and other key stakeholders (including ESBN and EirGrid) will be key to achieving these ambitious targets.

European Commission Regulation for the deployment of alternative fuels infrastructure

4.2.6 Electric heavy-duty vehicles need a distinctively different recharging infrastructure than light-duty vehicles. Publicly accessible infrastructure for electric heavy-duty vehicles is however currently almost nowhere available in the Union. A combined approach of distance-based targets along the TEN-T network, targets for overnight recharging infrastructure and targets at urban nodes should ensure that a sufficient publicly accessible infrastructure coverage for electric heavy-duty vehicles is established throughout the Union to support the expected market uptake of battery electric heavy-duty vehicles.

EUROPEAN COMMISSION

4.2.7 A sufficient number of publicly accessible fast recharging points dedicated to heavy duty vehicles should also be deployed along the TEN-T network to ensure full connectivity throughout the Union. That infrastructure should have sufficient power output to allow the recharge of the vehicle within the driver's legal break time. In addition to fast recharging points along the network, heavy-duty vehicles should also be able to use publicly accessible recharging infrastructure for overnight recharging along the main transport network to specifically support the electrification of the long-haul sector.

4.2.8 Member States should seek, to the extent possible and in compliance with Directive (EU) 2014/23 of the European Parliament and of the Council13, to competitively award new concessions specifically for recharging stations on or adjacent to existing highway rest areas in order to limit deployment cost and enable new market entrants.

Proposed Measures

4.2.9 As part of the redevelopment of the old Cemex site, it is proposed to deliver a service area, including provision for 40 Electric Vehicle charging points for use by member of the public. This will have the capacity to expand in number as the demand arises.

4.2.10 In addition, the site will provide motorway charging infrastructure dedicated to HGVs travelling on the N7.

4.2.11 The delivery of this high powered charging facility on the N7, meeting the needs of general and freight traffic, will support the delivery of alternative fuel policy initiatives as set out by the European Union and Government of Ireland, thereby contributing to the achievement of CAP carbon emission reduction goals.

Figure 16. Car and HGV charging infrastructure in proposed development

4.3 Regional Bus Service interchange with local town Services

Policy Direction

Greater Dublin Area Transport Strategy 2022-2042

4.3.1 Covering Dublin, Meath, Wicklow and Kildare; the National Transport Authority's Greater Dublin Area Transport Strategy contains a 20 year plan for the delivery of transport infrastructure across the region. The plan focusses on the delivery of sustainable transport infrastructure to serve the anticipated growth in population as set out in the National Planning Framework (Project Ireland 2040).

4.3.2 In relation to Naas and its environs, the plan includes for:

- **Active Travel:** Delivery of a robust and efficient walking and cycling network in Naas Town
- **Bus:** Support the delivery of new and enhanced public transport infrastructure in Naas and Sallins
- **Rail:** Extend the DART to deliver electrified rail services to Sallins / Naas
- **Freight:** Support for goods vehicle parking facilities at on-line motorway service areas and other appropriate locations within the GDA

NTA Connecting Ireland

4.3.3 Connecting Ireland is a public transport initiative developed by the NTA with the aim of increasing connectivity, particularly for people living outside our major cities and towns. The plan aims to provide better connections between villages and towns by linking these areas with an enhanced regional network connecting cities and regional centres nationwide.

4.3.4 Within the Kildare area, Naas is a key stop for Regional Services operating along the N7 from Cork, Limerick Carlow, Waterford, Kilkenny and Clonmel. Naas is also served by a number of local bus services operating to Clane, Johnstown, Blessington, Kilcullen etc.

Figure 17. Proposed Connecting Ireland Bus Services Operating to Naas

Naas Sallins Transportation Study

4.3.5 KCC commissioned a transport strategy for Naas to address the existing transport issues experienced within the town and support its sustainable growth in line with the population and employment forecast set out within the Local Area Plan. The plan contains a comprehensive set of transport measures addressing the needs of walking, cycling, public transport users and general traffic.

4.3.6 With respect to public transport, the plan makes recommendation in relation to the routing of potential local bus services operating in the town. These are:

- Option 1: Central Spine (Short Term) - connecting the school complex to the south of Naas at Pipers Hill with the town centre and north to the train station and the periphery of Sallins
- Option 3: Eastern Spine (Short Term) – links southern, central and northern Naas with the hospital, several schools, the town centre and the train station
- Option 2: Western Spine (Long Term) - connecting the school complex at Pipers Hill to the town centre and Millennium employment area before terminating at the train station.

4.3.7 The alignment of these routes in relation to the Maudlins KDA stie is illustrated in the figure below:

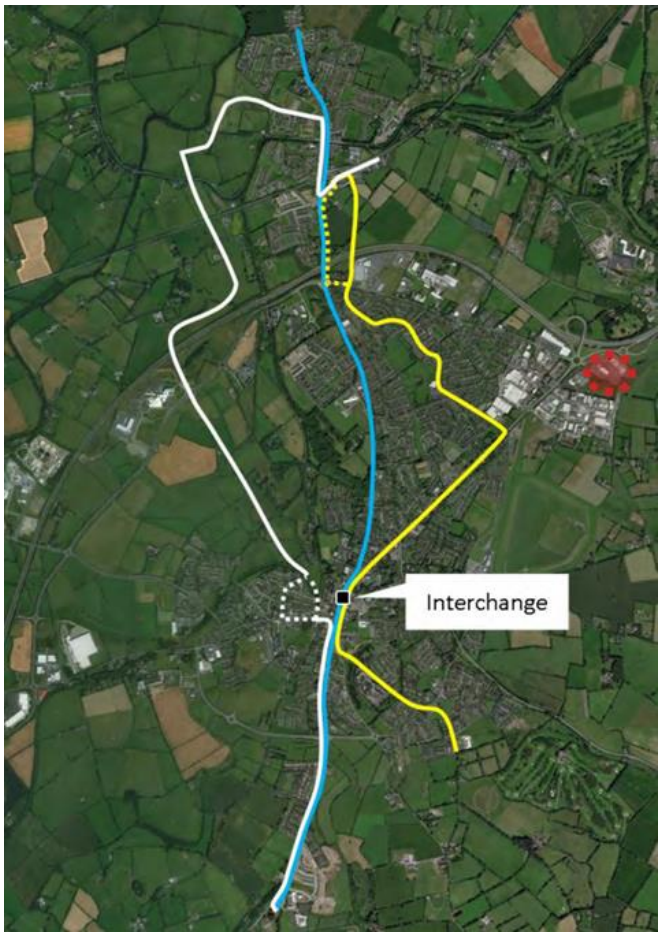


Figure 18. Naas Sallins Transportation Study – proposed local bus services

4.3.8 The delivery of the Maudlins KDA site adjacent to the M7 interchange provides an opportunity for future regional / inter-city bus services operating along the M7, as set out under Connecting Ireland, to interchange with proposed local bus services, as envisioned within the Naas Sallins Transportation Study. This could prove beneficial to visitors to the KDA site, as well as passengers travelling to Naas town or the wider region.

4.3.9 As illustrated in the below figure, it is noted that the provision of this facility would require a realignment of the currently proposed Eastern Spine local bus service, however demand for this realignment is likely to materialise as the Maudlins KDA site is fully developed.

4.3.10 As noted in the previous section, it is the intention of Petrogas Group Limited to implement separate EV facilities on the site capable of charging HGV's. Should the proposed local bus operate as an all-electric bus service (similar to the recently launched service in Athlone[2]) then there is an opportunity that the local bus could recharge at the Maudlins KDA, whilst interchanging with regional bus services. Should KCC and NTA be interested in exploring this public-private partnership approach, then Petrogas would welcome the opportunity to discuss further.

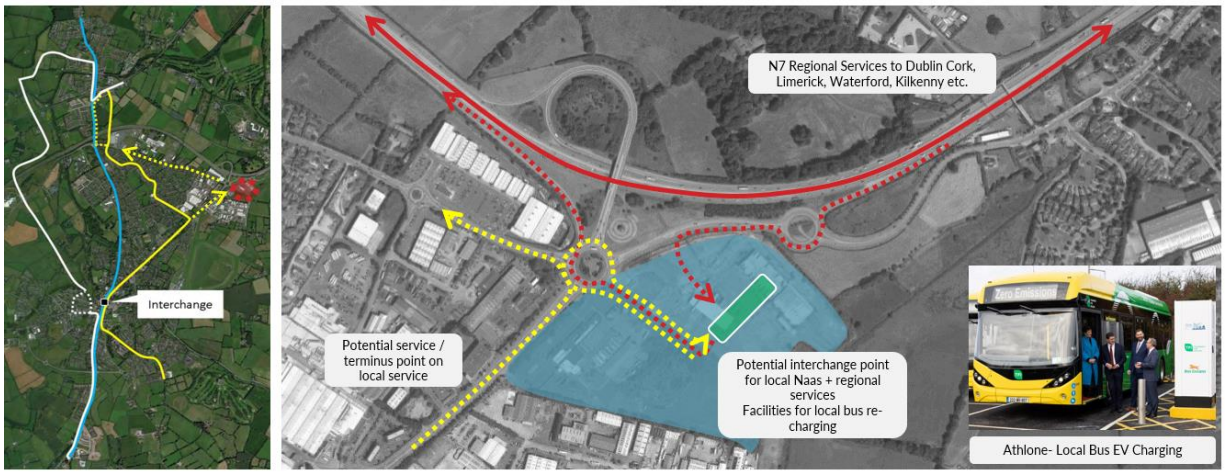


Figure 19. Potential local / regional bus interchange at Maudlins KDA site

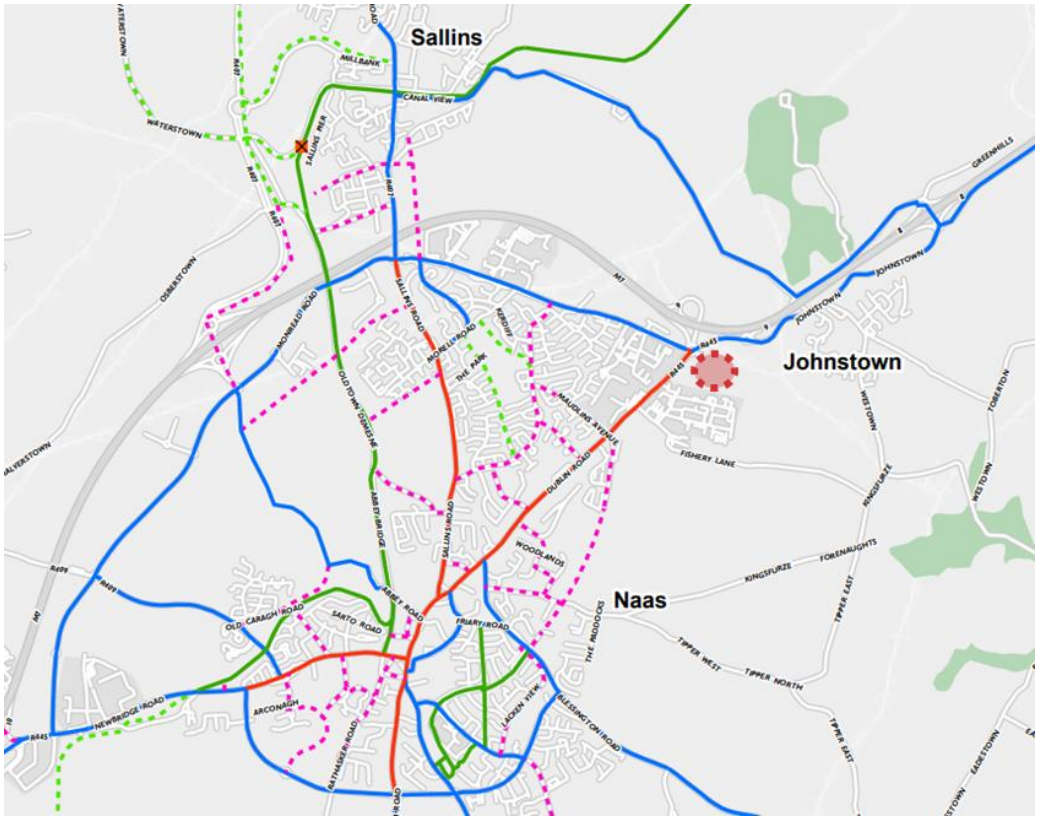
[2] Minister Ryan launches Ireland's first all-electric town bus service in Athlone - National Transport

4.4 Delivery of Active Travel Infrastructure

Policy Direction

2022 Greater Dublin Area Cycle Network Plan

4.4.1 The NTA's Greater Dublin Area Cycle Network Plan provides an urban, inter-urban and



greenway network for each of the 7 local authorities comprising the Greater Dublin Area. The plan provides as comprehensive and consistent network of routes linking key destinations/attractions and serving the needs of all user types. The following figure illustrated the planned network in Naas, indicating the location of the KDA Maudlins site. As can be seen from the figure, it is the intention that the KDA site will be directly served by planned cycle routes on the R445 Johnstown Road, the Monread Road and the Dublin Road.

Figure 20. Greater Dublin Area Cycle Network Plan in Naas

Naas Sallins Transportation Study

4.4.2 Building upon the recommendations contained in the NTA's Greater Dublin Area Cycle Network Plan, the Naas Sallins Transportation Study includes a comprehensive cycle network plan for Naas, with segregated cycle routes planned along Dublin Road and Maudlins Road. The planned delivery timeline for these routes as set out in the Naas Sallins Transportation Study is 3-5 years. Preliminary designs have been prepared for each of these routes and have been provided to the development team.

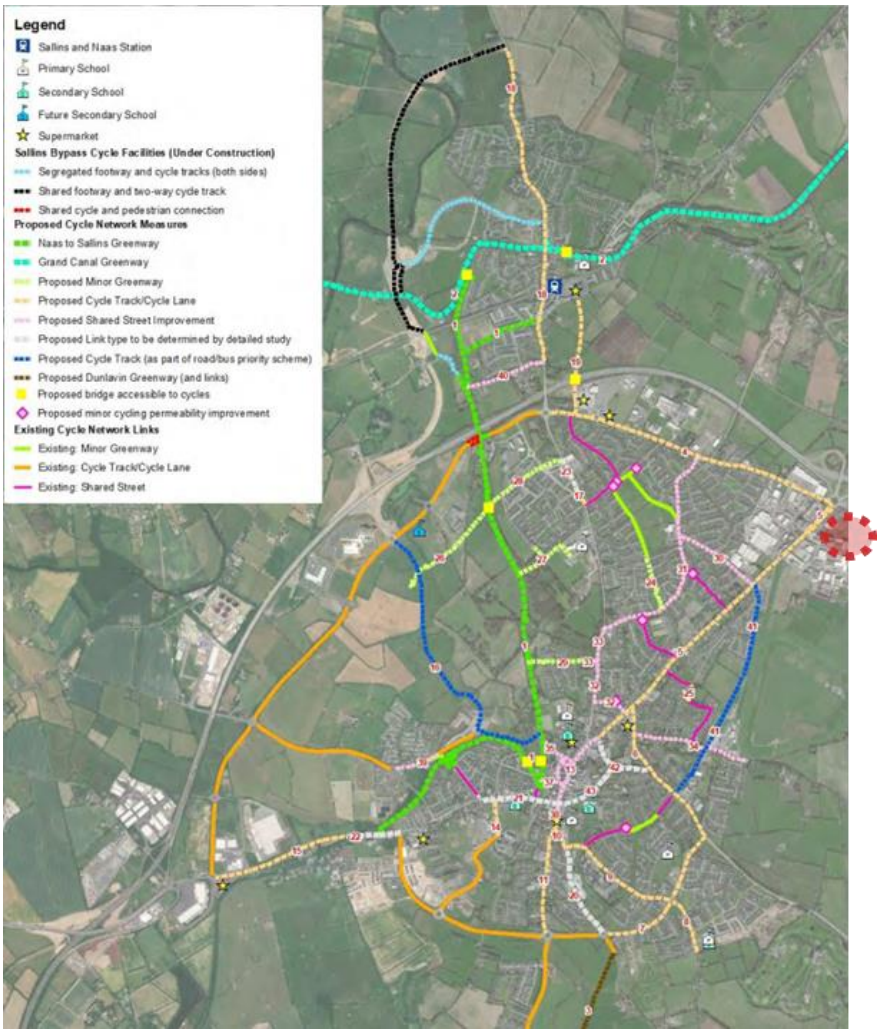


Figure 21. Naas Sallins Transportation Study- Cycle Network

Proposed Measures

4.4.3 Through development of the site, as well as delivery of external mitigation measures as set out in Section 3 of this report, opportunity exists for the development team to deliver active travel measures along parts of Johnstown Road, Dublin Road and Monread Road.

4.4.4 As part of the masterplanning process for the Maudlins KDA, the planned cycle routes will be integrated into the development, incorporating cycle parking and other complementary facilities (e.g. rest areas, wayfinding, lighting etc.) The following figure illustrates the proposed cycle routes which could be delivered at the site and on the adjoining road network.

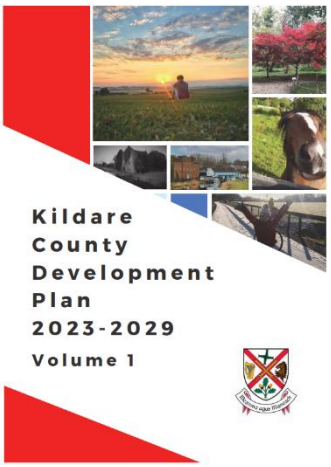
Figure 22. Cycle Network - KDA Maudlins site

4.5 Land Use Integration

Policy Direction

Kildare County Development Plan 2023- 2029

4.5.1 In accordance with national government policy, the Kildare County Development Plan recognises the importance of providing mixed use developments as a key mechanism for delivering a low carbon future. The delivery of complementary land uses in a compact urban form, can encourage travel by sustainable modes or even reduce the demand for travel at all.



4.5.2 In this regard, the overarching guiding principles of the County Development Plan, seeks to:

- To promote the sustainable development of communities by locating residential, employment, social and community facilities in close proximity to each other.

4.5.3 This objective is also recognised in the Draft Naas Local Area 2021- 2027 Plan, which identifies the need to deliver a coherent joint vision for the Maudlins Key Development Area, with a particular focus on delivering a mixed use development with a strong urban form.

Proposed Measures

4.5.4 Aligned with the recommendations of the Naas Local Area Plan, the joint masterplan developed for the site seeks to deliver a range of complementary land-uses which will support a level of internal trip making amongst commercial, living and recreational land uses (Office – Apartment Hotels – Restaurant).

4.5.5 The masterplan also seeks to shared internal facilities within the site, for example cycle and Car Parking. [Insert Land use Map for Masterplan – STW?]

4.6 Behavioural Change Measures

Policy Direction

Workplace Travel Plan: A Guide for Implementers

4.6.1 A Workplace Travel Plan is a package of measures aimed at supporting sustainable travel for work-related journeys. It comprises actions to promote walking, cycling, public transport, carsharing, the use of technology instead of travel, and flexible working practices.

4.6.2 Prepared by the NTA and TFI, a *Workplace Travel Plan: A Guide for Implementers* sets out the process for developing a workplace Travel Plan for a development; including:

- Review of existing travel pattens and policies
- Setting objectives for the travel plan
- Identifying and Implementing Actions
- Monitoring of the plan and adjusting

Proposed Measures

4.6.3 The Sustainable Transport Measures identified within this section will be supported by range of behavioural Change measures providing staff and visitors with a choice of transport modes to visit the Maudlins KDA.

4.6.4 Given the need to prepare an integrated vision for the KDA lands, it is recommended that a combined Framework Mobility Management Plan (FMMP) be developed for the site addressing:

- Personalised Travel Planning
- Public transport use incentives
- Active Travel facilities – secure parking, cycle repair facilities, changing rooms, wash areas etc.
- Carpooling

4.6.5 It is recommended that a FMMP Manager be identified with responsibility for Surveying, development, implementation and monitoring of the plan, with target setting and reporting to KCC.

5. SUMMARY AND CONCLUSIONS

5.1 Summary

5.1.1 SYSTRA Limited were commissioned by the Fagan Group and Petrogas Group Ltd to provide transport planning services for the Maudlins Key Development Area (KDA) in Naas, County Kildare. This report supplements a prior transport appraisal conducted by AECOM for Kildare County Council (KCC) and should be read alongside the April 2023 Maudlins Traffic Modelling & Access Strategy (TMAS) Report.

5.1.2 The Maudlins KDA, situated near N7's Junction 9, is identified as a Key Development Area in the Naas Local Area Plan (LAP) 2021-2027. The LAP mandates the creation of a comprehensive masterplan for the KDA, including a TMAS to assess development impacts and transportation requirements.

5.1.3 AECOM were appointed by KCC to prepare the TMAS, which included development of a micro-simulation model for evaluating the KDA's effects on the local and national road network. Subsequently, the Developers (Fagan Group and Petrogas Group Ltd) proposed modifications to the access strategy, necessitating additional modelling assessments.

5.1.4 This report extends the TMAS work, summarising traffic analysis for the Developers' revised access strategy and development plans. Utilising the micro-simulation model developed as part of the TMAS, it assesses impacts on the existing transport network and considers improvements outlined in the TMAS. Sustainable transport measures to promote sustainable travel behaviours are also explored.

5.1.5 The report concludes with recommendations for improvement measures to support the KDA's sustainable development.

5.2 Conclusions

5.2.1 The micro-simulation assessment reviewed the impact of the revised access strategy for the Maudlins KDA site, focusing on various criteria such as journey times, network performance, and queue lengths. A summary of the key points are as follows:

- **Do Nothing Assessment**: Serving as a baseline, this scenario examined the traffic conditions in the future without any development but with the anticipated growth in background traffic arising from the delivery of the land uses set out in the Naas Local Area Plan.
- **Do Something Assessment**: This scenario represents the network's operation with the proposed development and access strategy in place but without any mitigation measures. Whilst the N7 and Johnstown Road operate satisfactorily in this scenario with no delays, it indicates negative impacts on journey times and queue lengths on the Dublin Road.
- **Mitigation**: As set out in the TMAS, mitigation measures were introduced to address the negative impacts of the development. These include adding an additional lane on Dublin Road, providing two lanes on Fishery Lane through the roundabout, and having two lanes for exiting from Dublin Road toward M7.

- **Do Something With Mitigation Assessment:** This scenario assessed the impact of development with the added mitigation measures in place. It shows that these mitigations successfully address the traffic delays experienced in the without mitigation scenario, with substantial improvements in journey times and reduced queuing on the Dublin Road. As with all scenarios, the proposed development has no impact on queuing or journey times on the N7 National Road. There is a minor residual impact on queuing on the Monread Road as a result of the increased capacity provided on the Dublin Road, however delays experienced on this road during the peak hour are short in duration and do not impact on the operation of upstream junctions.

5.2.2 In conclusion, the results of the micro-simulation assessment demonstrate that the proposed development with mitigations in place, will have a minimal impact on the external road network, maintaining journey times on the M7 and local road network.

5.2.3 The document outlines a series of sustainable transport measures proposed for the KDA (Key Development Area) site. These measures are in alignment with local and national policies aimed at reducing carbon emissions from transportation and promoting sustainable travel behaviours. The key measures and policies are as follows:

- **Electric Vehicles Charging on Ten-T Network:** The government's Climate Action Plan seeks to reduce carbon emissions from the transport sector significantly. This includes transitioning to electric vehicles (EVs). The proposed measures within the KDA include the provision of 40 public EV charging points on the site and dedicated charging infrastructure for heavy goods vehicles (HGVs) travelling on the N7.
- **Regional Bus Service Interchange with Local Town Services:** The Greater Dublin Area Transport Strategy aims to enhance public transport infrastructure, including bus services. The KDA site offers an opportunity for regional and inter-city bus services to connect with local buses, benefiting both KDA visitors and regional travellers. Local bus services maybe able to avail of the EV charging infrastructure.
- **Delivery of Active Travel Infrastructure:** The plan includes the development of active travel infrastructure, including segregated cycle routes along Johnstown Road, Dublin Road, and Monread Road. These routes will be integrated into the development and include cycle parking and complementary facilities.
- **Land Use Integration:** The plan encourages mixed-use developments to reduce the need for travel and promote sustainable modes of transportation. The KDA site's masterplan aims to deliver mixed land uses, such as offices, apartments, hotels, and restaurants, promoting internal trips within the site.
- **Behavioural Change Measures:** Workplace Travel Plans are proposed to support sustainable travel for work-related journeys. These plans include actions to encourage walking, cycling, public transport use, carsharing, the use of technology to reduce travel, and flexible working practices. A Framework Mobility Management Plan (FMMP) is recommended for the KDA site to address personalized travel planning, public transport incentives, active travel facilities, carpooling, and more. An FMMP Manager will oversee its development, implementation, and monitoring.

In summary, these sustainable transport measures for the KDA site aim to align with government policies and reduce carbon emissions while promoting sustainable travel options and integrated land use planning. These measures are expected to be further explored as the KDA Masterplan is developed and the project progresses through the planning process.

Appendix A: Trip Generation Comparison Note

TRANSPORT NOTE

IDENTIFICATION TABLE				
Client	Petrogas Group Limited			
Project	Cemex site, Naas			
Study	Trip Generation Comparison			
Date	27/06/2023			
Document Author	Produced by:	A Hogg	Checked by:	A Archer

CEMEX SITE, NAAS

Introduction

Kildare County Council (KCC) commissioned AECOM in 2022 to provide transport planning services to develop the Maudlins Traffic Modelling & Access Strategy, which is a requirement of the adopted Naas Local Area Plan 2021-2027.
Under the LAP the area referred to as 'Junction 9 (Maudlins Interchange)' was identified as a Key Development Area (KDA). As illustrated in the attached figure, the KDA includes the former Donnelly Mirrors site which is under the ownership of The Fagan Group, and the Cemex Concrete sites which is under the ownership of Petrogas Group Ltd (Applegreen).

This Trip Generation Comparison Technical Note has been prepared by SYSTRA on behalf of Petrogas Group Ltd and The Fagan Group in order to determine the combined trip generation for the KDA site based on the development aspirations of both parties.

The technical note utilises trip generation information contained in two modelling reports prepared by Aecom on behalf of KCC:

- **Maudlins Traffic Modelling and Access Strategy - dated 05/04/23; and**
- **Maudlins – Developers Proposals, Microsimulation Testing - dated 28/03/23**

The note compares different methodologies for calculating the potential trip generation for the KDA site, based on an evaluation of TRICs data in addition to survey data collated from a similar site and presents the most accurate forecast of future traffic operations on the surrounding road network. Given the nature and location of the site, consideration will also be given to the amount of Pass by Trips generated by the development.
As the two elements of the site present different trip generation and distribution characteristics, they have been addressed separately before a combined trip generation is presented for the entire KDA site.

Proposed Development – Cemex Site

Whilst the masterplan for the site continues to evolve, it is understood that the proposed development on the Cemex site currently considers the following:

- **An Electric Vehicle Charging Hub (up to 40 bays)**
- **A general use Petrol Filling Station (PFS- up to 12 bays) with ancillary retail and food retail.**
- **A HGV fuel facility and HGV/Coach parking**
- **HGV EV charging facility**
- **A Drive Thru Coffee Kiosk**
- **A Distribution Centre**
- **Associated car parking, landscaping and SUDS features.**

The figure below provides a summary of the distinct areas of the development, showing an overlay of the development proposals on background mapping.

CODE	LAND USE	AREA
	General PFS Service Area and Parking	14,000 sqm
	HGV Area and HGV/Coach Parking	7,180 sqm
	Distribution	9,000 sqm
	Drive Thru Coffee Kiosk	200 sqm

TRICs Overview

TRICS is a database of trip rates for developments used in the United Kingdom and Ireland for transport planning purposes, specifically to quantify the trip generation of new developments. Based on traffic surveys for developments of known quantum and type of location, TRICS provided estimates of trip rates for each land use of the proposed development. The trip rates are based on surveys undertaken on existing developments, therefore do not take into account changing patterns of work, such as increased rates of working from home. TRICS works by filtering the database of served sites based on key characteristics of the proposed development so that sites of a similar nature are included in the trip rate calculation.
Examples of these characteristics include:

- **Site Area;**
- **Number of Bays;**
- **Number of Employees ;**
- **Gross Floor Area (GFA)**

When evaluating the trip generation of a site it is important to identify the most appropriate development characteristics (e.g. site area, number of bays etc.) and filter by the most appropriate location characteristics (e.g. urban setting, access to public transport etc.) from TRICs as this will greatly influence the trip rate generated by the database. Therefore, It is important that professional judgement is used to determine the most appropriate site characteristics in TRICs.

TRICS Methodology 1 (Overall Site Area)

The first methodology examines trip rates set out in the *Maudlins – Developers Proposals, Microsimulation Testing* report, dated 28/03/23. In this report, trip rates for the PFS have been determined by the 'Site Area' and a similar approach has been used in assessing the trip-making potential of the HGV filling station. For the Drive-Thru Coffee Kiosk and Distribution Centre, a GFA-based approach is proposed, as the building size will be a more determining factor.

As set out within the report, applying this methodology results in the following numbers of trips being calculated.

Table 1 – Proposed Trip Generation (Methodology 1 – Site Area)

		Trip Generation			
		AM Peak		PM Peak	
Use	AREA	Arrival (IN)	Departure (OUT)	Arrival (IN)	Departure (OUT)
Cars & LGVs Fuelling	1.4ha	355	307	415	330
HGV Fuelling	0.718ha	11	9	13	16
Coffee Drive Thru	200 sqm	33	30	17	24
Distribution Centre	9,000 sqm	16	9	11	20
Total 1 Way		415	355	456	390
Total 2 Way		770		846	

As shown above Methodology 1 results in circa **770 two-way trips in the AM peak and 846 in the PM peak**.

It should be noted that regardless of the chosen methodology up to 90% of the trips to the fuelling facilities are expected to be Pass-by Trips which are already on the network and will simply divert to use the facilities the development provides. Further information on this is provided later in this note.

TRICS Methodology 2 (No of Bays/First principles)

The second methodology examines trip rates set out in the *Maudlins – Developers Proposals, Microsimulation Testing* Report, dated 28/03/23. The following methodology has been extracted from Section C.2 'Trip Rates for Service Station' in Appendix C of that report:

"To determine the potential trip rate and associated trip generation for the Petrol Filling Station land use, AECOM undertook a TRICS assessment and a first principles analysis.

For the TRICS assessment the arrival rate was determined to be 7.574 and the departure rate was 7.840. It should be noted that the TRICS database does not include any Motorway Service Areas (MSAs) within Ireland. The first principles approach adopted an average stay of 6 minutes from when a customer pulls into the petrol pump, fills up, pays and leaves the pump. This results in a trip rate of 10.000 for arrivals and departures which would suggest that the petrol pump is 100% utilised throughout the peak hour period. For the purposes of this assessment, an average was taken between the TRICS value and the first principles value to determine a suitable arrival and departure rate for the Petrol Filling Station land use which was 9.000 for the arrival and departure rate. This number of 9.000 would equate to an approximate stay of 6 minutes and 40 seconds per vehicle."

It should be noted:

Naas bound PM Peak traffic flows through the Maudlins junction have the most potential to negatively impact on the operation/safety of the National Road Network (e.g. queuing on the westbound off-ramp of the N7) as such it was proposed to assess the PM peak and not the AM Peak for the purposes of this assessment.
The resulting trip generation is summarised in the Table2 below:

Table 2 – Proposed Trip Generation (Methodology 2 – No of Bays)

			PM PEAK		TOTAL	
			Arrivals	Departures	Arrivals	Departures
Petrol Filling Station	12 Bays	RATE	9	9	178	281
		TRIPS	108	108		
Warehousing	10,000sqm	RATE	0.223	0.407		
		TRIPS	22	41		
Office	11,000sqm	RATE	0.144	0.875		
		TRIPS	16	96		
Creche	500sqm	RATE	1.615	1.916		
		TRIPS	8	10		
Drive Through Coffee Shop	200sqm	RATE	11.715	13.017		
		TRIPS	23	26		

This table has been recreated from *Maudlins Traffic Modelling and Access Strategy* which was produced by AECOM on 05/04/23

Using this methodology, the overall arrivals and departures to/from the Cemex site equates to **178 vehicles entering the site and 281 vehicular trips exiting the site in the evening peak.**

Comparison

As shown there is a large discrepancy between the two trip rate methodologies:

- **Methodology 1 (Based on overall site area for the PFS) – 846 two-way traffic in the PM peak**
- **Methodology 2 (Based on number of Filling Pumps) – 459 two-way traffic in the PM peak**

In order to identify the most representative site characteristic for determining the trip generation of the PFS, traffic survey data was collated from an existing PFS site on the N7 at the Millennium Park at Naas.
A summary of the traffic survey and the resulting trip rates are included in Table 3.

Table 3 Millennium Park at Naas Site Survey Data

SITE	VEHICLE TYPE	DIRECTION	NO. OF BAYS	PEAK HOUR FLOW (16:00-17:00)	TRIP RATE PER BAY
Millennium Park Naas	Cars	Arriving	16	137	8.5625
	Cars	Departing		146	9.125
	HGVs	Arriving		5	0.3125
	HGVs	Departing		6	0.375
	Total	**Arriving**		**142**	**8.875**
		Departing		**152**	**9.500**

When these trip rates are applied to the 12 fuel bays proposed as part this development the following vehicle Trips are calculated for the PFS element of the site:

- **Total PFS Arrivals = 106 (12 x 8.5625)**
- **Total PFS Departures = 114 (12 x 9.125)**
- **Total PFS Two Way Trips = 220**

A Summary of the PFS trip generation rate for the two trip generation methodologies detailed above, compared to the surveyed site is presented in table 4 below:

Table 4 Summary of the PFS trip generation rate- (two trip generation methodologies and surveyed site)

METHODOLOGY	PM PEAK CAR ARRIVAL	PM PEAK CAR DEPARTURE	PM PEAK TOTAL TRIPS
Methodology 1: Based on overall site area for the PFS	415	330	**745**
Methodology 2: Based on number of Filling Pumps	108	108	**216**
Millennium Park Surveyed Site	106	114	**220**

The above exercise clearly demonstrates that the 'Number of Filling Pumps' is a much more accurate site characteristic for determining the trip generation of the PFS element of the site rather than the 'overall site area', therefore it is suggested that Methodology 2 (Number of Filling Pumps) is taken forward as the preferred method of trip generation.

Electric Vehicle Charging Bays

To date, no consideration has been given in the modelling reports to the trip generation associated with the proposed 40 Electric Vehicle (EV) charging bays.
The TRICS database does not currently include data for EV charging sites, however the developer has provided SYSTRA with EV charging data from three other Applegreen service stations which include EV charging facilities.

- **Lusk**
- **Castlebellingham**
- **Rathcoole**

Based on the data, the average number of charging sessions was calculated per charging bay and this factor was then applied to the 40 EV bays proposed at the site. This is summarised in Table 4 Below:

Table 5 EV survey data

SITE	CHARGING SESSIONS PER WEEK	NO. OF EV BAYS	CHARGING SESSIONS/ WEEK/ BAY	CHARGING SESSION/ DAY/ BAY	CHARGING SESSION/ PEAK HR/BAY (*)	CHARGING SESSIONS 40 BAYS/ PEAK HR
Lusk NB	64	4	16	2.3	0.23	**9.1**
Lusk SB	48	4	12	1.7	0.17	6.9
Castlebellingham NB	76	12	6	0.9	0.09	3.6
Castlebellingham SB	58	16	4	0.5	0.05	2.1
Rathcoole	27	4	7	1.0	0.10	3.9

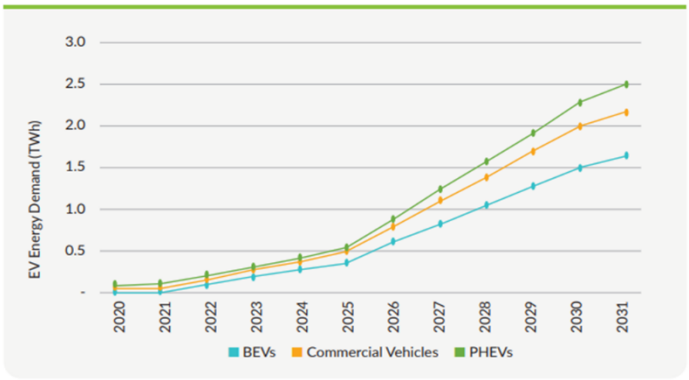
(*) It is assumed that 10% of the daily EV charging sessions will occur in the Peak hour

An examination of the above table reveals that Lusk has the highest rate of EV charging with 0.23 charging sessions in the peak hour.

To ensure a robust assessment the highest rate (based on Lusk) has been applied to the proposed development. This results in approximately 9 Arrivals and 9 Departures in the PM peak hour or 18 Two Way trips based on present day demand.

It is estimated that this number will increase substantially over the next ten years as the number of EVs on the road increases. EirGrid's latest All-Island Generation Capacity Statement 2022-2031 provides an EV energy demand forecast up to 2031 as illustrated in the attached figure. An examination of the graph indicates that forecast demand for EV charging across the various transport modes will increase by approximately 300% from 2023 to 2030. Applying this growth rate would result in a peak hour demand of approximately 27 Arrivals and 27 Departures in the PM peak hour or 54 Two Way trips.

Figure 2: *EV Energy Demand - Median Scenario*



Source: Department of Transport – Electric Vehicle Charging Infrastructure Strategy 2022-2025

It is also expected that the number of trips associated with the PFS will decrease at a similar rate over this time period as drivers move away from Internal Combustion Engines in favour of Electric Vehicles. Notwithstanding this, the trip rate associated with the PFS element of the site has not been amended in order to provide a robust assessment.

Pass-By Trips

A significant proportion of trips made to the proposed PFS, EV charging and Coffee Shop will already be travelling on the nearby highway network. Given that the site is located adjacent to the N7, it is reasonable to expect that a high proportion of trips will be Pass-by in nature.

Based on turn in rates captured from existing PFS, the developer expects that approximately 90% of trips to the PFS will be Pass-by trip from the N7. This proportion of Pass-by trips aligns with Section 2.2 of the *Maudlins Traffic Modelling and Access Strategy* which notes that:

> *The service station demand distribution is based on assumption that 85% of development will be attracted to/from the Motorway which would be common for a development of this nature in this location adjacent to a Motorway.*

It is also estimated that a large proportion of the trips generated by the Drive-Thru Coffee shop facilities will also be Pass-by from the N7. Therefore, when considering Pass-by trips it is suggested that a 90% pass-by rate is applied to the Drive-Thru Coffee shop trips as well.

Cemex Site- Overall Revised Trip Generation

Based on the foregoing assessments, the trip generation estimation for the Cemex element of the KDA has been updated to reflect the more accurate estimation of the trip generation using fuel pumps as the site characteristic and including for the forecast demand for EV charging. Table 6 provides an updated summary of the trip generation for the Cemex site based on the forecast land uses:

Table 6 – Revised Trip Generation Cemex Site

Land Use	QUANTUM	PM Peak		
		Arrivals	Departures	Two Way

Fuel Pumps (No.)	12 Bays	108	108	**216**
HGV Fuelling	(*) 0.7 Ha	13	16	**29**
EV Charging Bays	40 Bays	27	27	**54**
Stand Alone Coffee Building (sqm)	198sqm	17	24	**41**
Distribution Centre Building (sqm)	9072sqm	11	20	**31**
TOTAL		**176**	**195**	**371**

(*) Estimation for HGV fuelling / parking – taken from *Maudlins – Developers Proposals, Microsimulation Testing report, dated 28/03/23*

Proposed Development – Donnelly Mirrors Site

As set out in the *Maudlins – Developers Proposals, Microsimulation Testing* - dated 28/03/23, Two development scenarios have been developed for the Donnelly Mirrors Site. Through meetings with The Fagan Group, it has been determined that Concept A is presently the merging preferred mix of development, consisting of:

- **Car Showroom: 2700sqm**
- **Office: 9450sqm**
- **Aparthotel: 19200sqm**
- **Warehouse Retail: 5760sqm**
- **Warehouse Wholesale: 7040sqm**
- **Warehouse / Depot: 3960sqm**

Table 2.2 of the *Maudlins – Developers Proposals, Microsimulation Testing Report*, sets out the trip generation for the Concept Land use as follows:

Table 7 – Proposed Trip Generation Donnelly Mirrors Site (Concept A)

Magna Concept A - Trip Gen

Land Use	Quantum	AM Peak		PM Peak	
		Arrival	Departure	Arrival	Departure
Car Showroom	2700 sqm	41	12	10	32
Office	9450 sqm	120	10	8	106
Aparthotel	19200 sqm	49	56	46	49
Warehouse Retail	5760 sqm	28	11	9	26
Warehouse Wholesale	7040 sqm	34	14	11	32
Warehouse / Depot	3960 sqm	8	4	4	8
Total 1 way		279	106	**87**	**254**
Total 2 way		386		342	

Concept A generates a two-way total 342 trips in the PM peak.

Proposed KDA Development – Combined Trip Generation

Based on the information contained in this report, the combine trip generation for the entire KDA site in the PM peak hour is estimated as follows:

Table 8 – Proposed Trip Generation of KDA site for the PM Peak Hour.

SITE AREA	PM PEAK ARRIVAL	PM PEAK DEPARTURES	PM PEAK TOTALS
Cemex Site Development Proposals	176	195	**371**
Donnelly Mirrors Development Proposals	87	254	**341**
Totals	**263**	**449**	**712**

SYSTRA provides advice on transport, to central, regional and local government, agencies, developers, operators and financiers.

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